

**HOELLER**  
THE STACK COMPANY

**NEXT GENERATION  
PEM ELECTROLYZER STACKS**



# MADE IN GERMANY

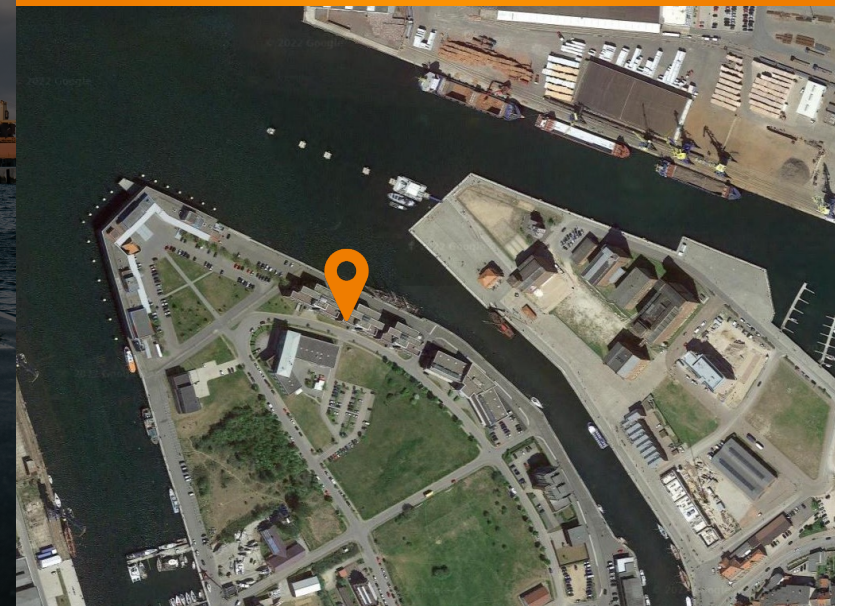
**HOELLER**  
THE STACK COMPANY



OUR GOAL:  
**GREEN HYDROGEN FOR  
LESS THAN EUR 4 / KG**



HOELLER  
ELECTROLYZER GMBH  
Alter Holzhafen 17b  
23966 Wismar, Germany



# OUR MISSION

## MANAGEMENT TEAM

A photograph of two men in business attire standing in front of an industrial facility, likely a port or refinery. The man on the left is wearing a dark suit jacket over a light blue shirt and a dark sweater. The man on the right is wearing a dark suit jacket over a light blue checkered shirt and glasses. The background shows a large industrial structure with a crane and a body of water.

WE DEVELOP THE NEXT  
GENERATION OF HYDROGEN  
ELECTROLYSIS STACKS,  
THE CORE COMPONENT OF  
ELECTROLYZERS

# A WEALTH OF EXPERIENCE IN ELECTROLYZERS

## MANAGEMENT TEAM



Dipl.-Ing. (FH)  
**Stefan Höller**

- + Founder, CEO and CTO
- + Hydrogen pioneer since 1991
- + Founder of H-TEC Systems

Lic.oec.HSG, MBA  
**Matthias Kramer**

- + CFO and COO
- + ex BCG, KPMG, Volkswagen

## KEY MILESTONES

**1997**

- + H-TEC Systems founded

**2000**

- + initial patent filings for improving fuel cells and electrolysis

**2007**

- + first H-TEC stack produced

**2011**

- + GP Joule  
Shareholder of H-TEC

**2016**

- + Hoeller Electrolyzer founded

**2017**

- + initial patent filings
- + Proof of concept @ Fraunhofer ISE

**2018**

- + Relocation to Wismar

**2020**

- + IT-PEM funding from 7th Energy Research Program BMWi
- + Selected as one of 32 start-ups for "Tech Tour Energy in Transition"

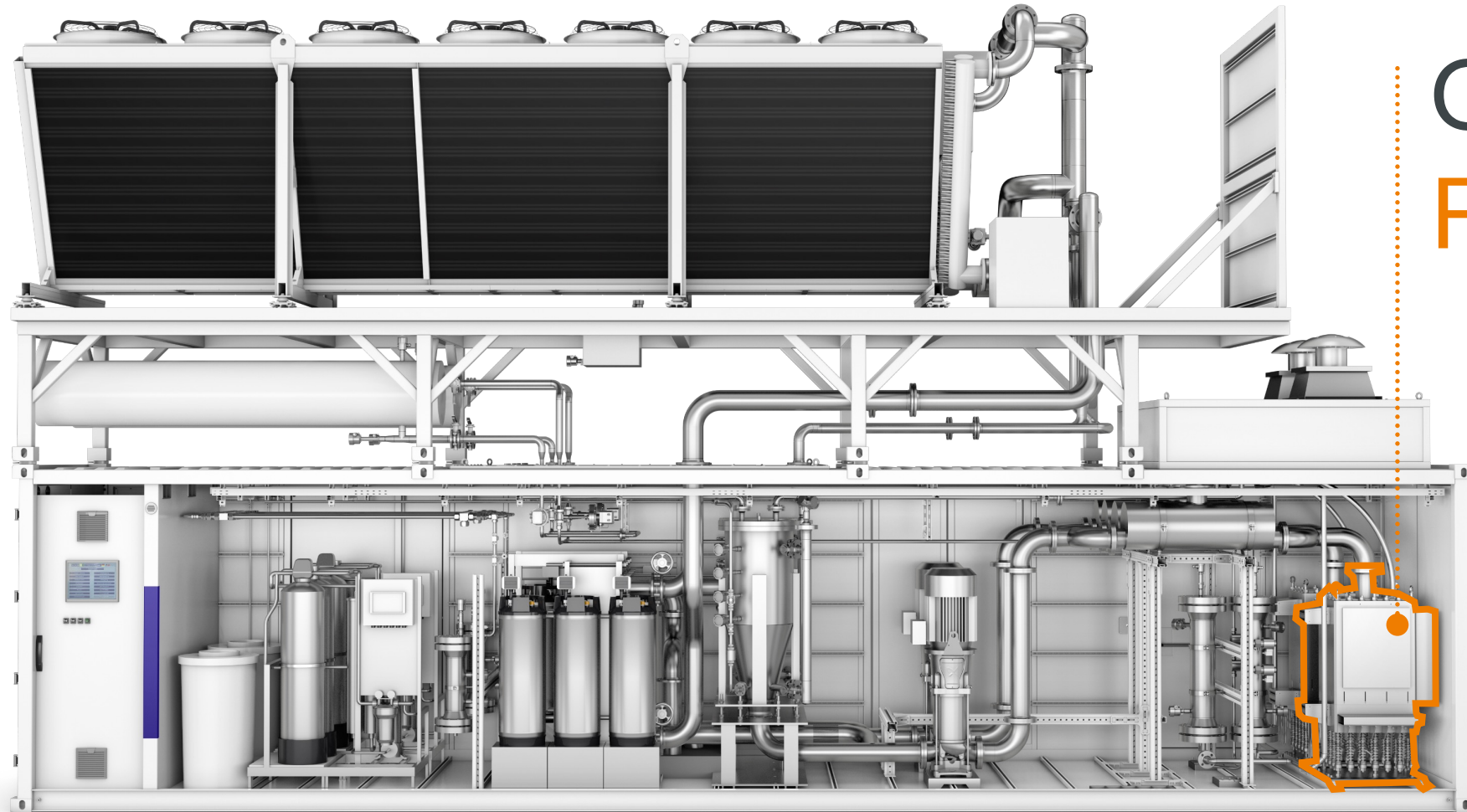
**2022**

- + Rolls-Royce Power Systems becomes investor and strategic partner
- + Winner of the Ludwig Bölkow Technology Award

PRODUCT

THE STACK IS THE HEART OF THE ELECTROLYZER

HOELLER  
THE STACK COMPANY



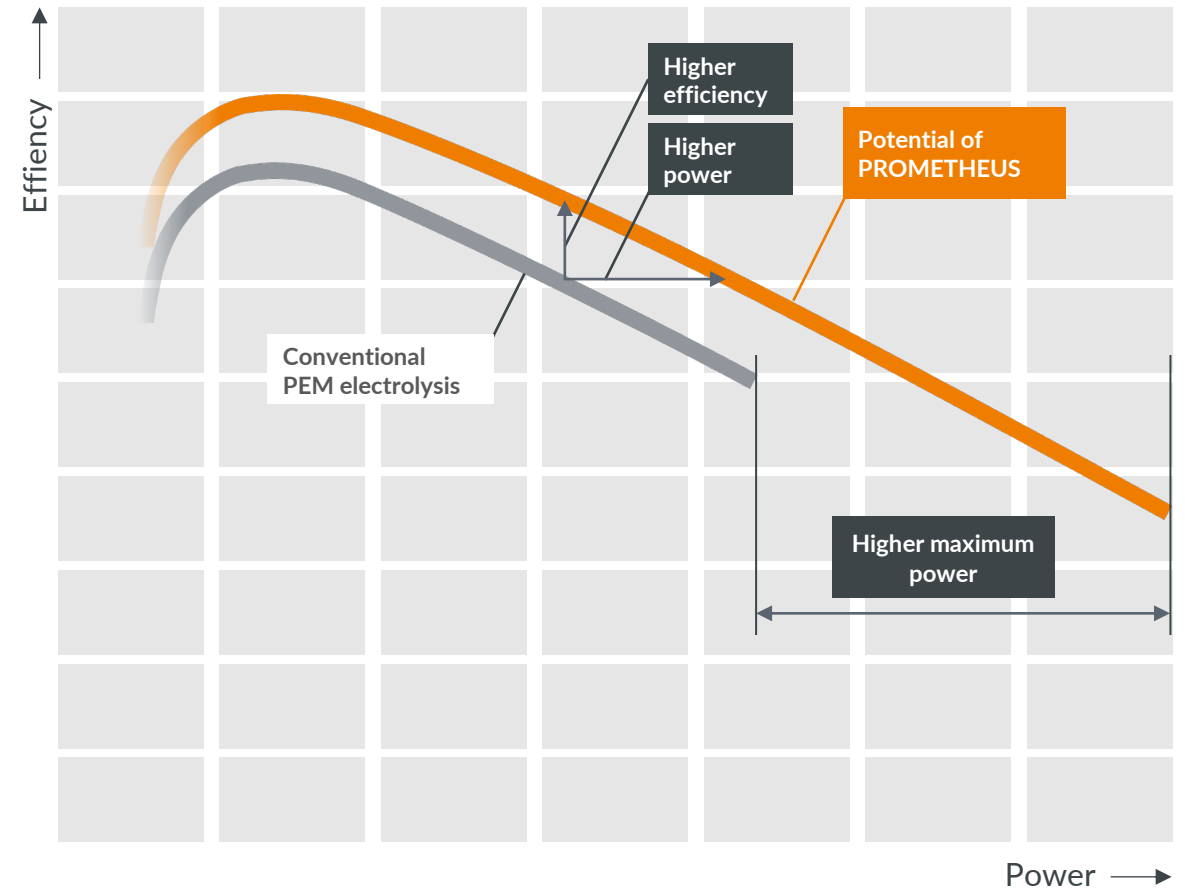
OUR  
FOCUS

# NEXT GENERATION PEM STACKS

## KEY IMPROVEMENT LEVRS

- + MEMBRANE ELECTRODE ASSEMBLY – Better connectivity to reduce catalyst need
- + END PLATE – Advanced design to optimize installation space
- + POROUS TRANSPORT LAYER – Lower resistance to increase power and efficiency
- + BIPOLAR PLATE – Optimization of the flow field to maximize power
- + HIGHER OUTPUT PRESSURE – Simplification of the system

## POTENTIAL OF THE HOELLER PEM ELECTROLYSIS



# PROMETHEUS

## OUR INNOVATIVE PEM STACKS

### FIRST GENERATION



#### Prometheus S

Dimension 61 x 56 x 93 cm  
Rated power 100 kW  
H2 production 21Nm<sup>3</sup> / h (47kg/d) @ 40 bar  
SOP 3Q2023

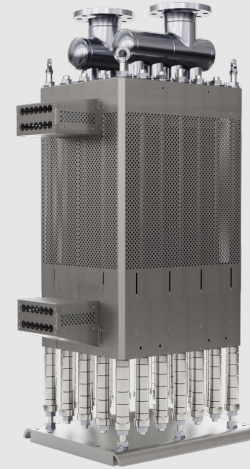
Dimension

Rated power

H2 production

SOP

### SECOND GENERATION



#### Prometheus L

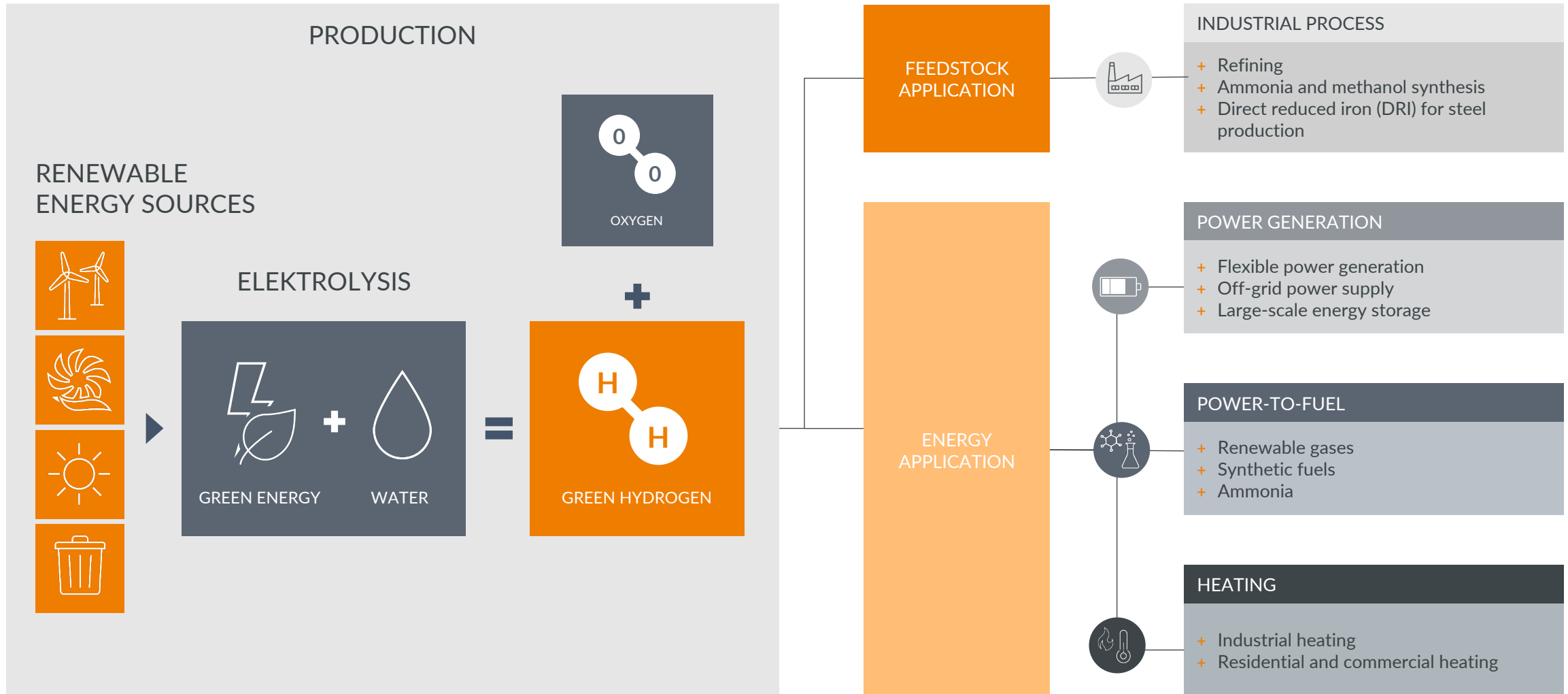
Dimension 103 x 86 x 226 cm  
Rated power 1.5 MW  
H2 production 316Nm<sup>3</sup> / h (680kg/d) @ 40 bar  
SOP 2Q2024

+ Higher Hydrogen Output Pressure (target: 80 bar)

+ Increased temperature (target: 110 degrees C)

# STACKS FOR MANY USE CASES

## WE HELP THE ENERGY TRANSITION

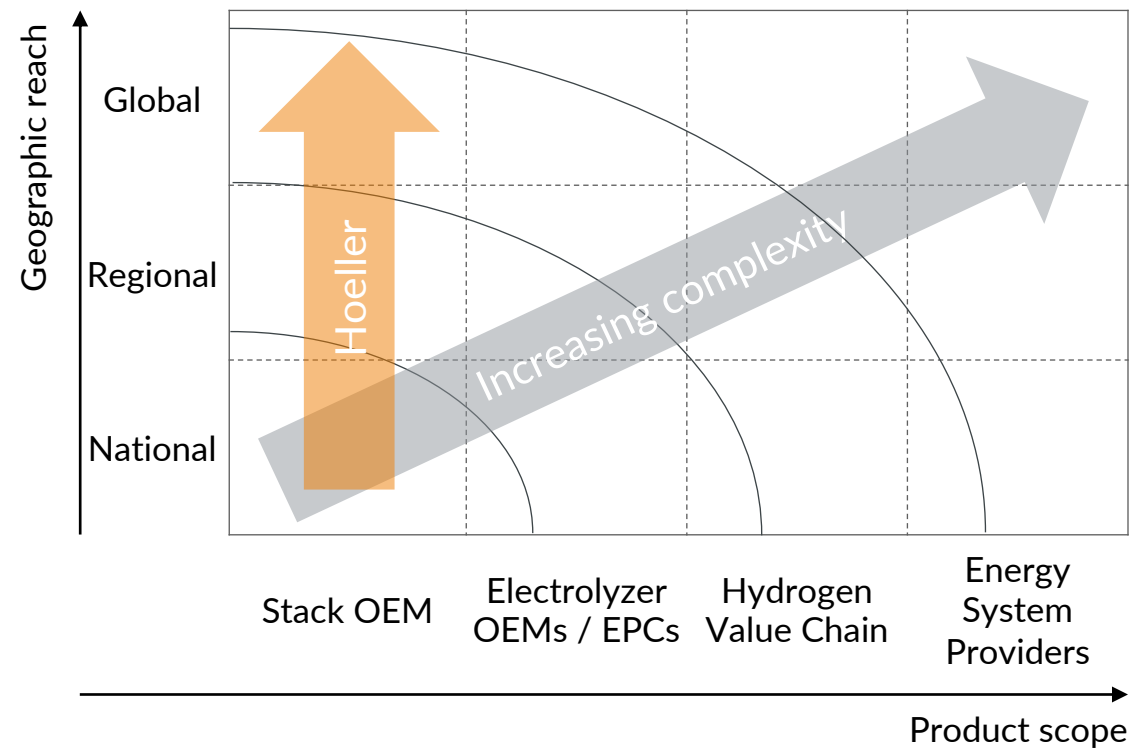




# OUR STRATEGIC DIRECTION

## FOCUS ON CORE COMPETENCIES

### Market Dynamics



#### Positioning as stack specialist / OEM-supplier

- + Focus on our core competence - the stack

#### In-house design, prototyping and testing

- + R&D partnerships
- + design for manufacturing

#### Licencing of the system patents to partners

- + No development or customization of complete systems

#### Industrialization of assembly and production

- + Insourcing from suppliers
- + Cost optimization

# THE GREEN HYDROGEN OPPORTUNITY

## AN EMERGING GLOBAL MARKET

### THE GLOBAL CLEAN HYDROGEN RACE

Goldman Sachs' Carbonomics study

- Predicts up to an **7-fold increase of global hydrogen demand** by 2050
- Estimates **investments of USD 1,7 tn** into electrolyzers
- Leading to a **200 fold increase of installed capacity** by 2030 to 130 GW
- Driven by rapidly **increasing overall project sizes**
- With **Europe leading** the short-term project pipeline followed by **Australia, LatAm and MENA**
- Resulting in a **40% cost deflation** for PEM electrolyzers
- Achieving hydrogen **cost parity with diesel** by 2030

Leading to a global  
stack market of  
USD 30 bn by 2030

+ 1% of market  
share equals  
USD 300 m of  
revenue in  
Hoeller stacks



## Rolls-Royce group

A world-class technology company, built on three strong and complimentary business units.

Power Systems is the group's 2<sup>nd</sup> largest business and frontrunner in electrification.



# Civil Aerospace



**35**  
types of commercial aircraft powered by us



**13,000**  
engines in service around the world



**19,000**  
total employees



**5.089bn**  
underlying revenue

# Defence



**150**  
customers in over 100 countries



**16,000**  
engines in service around the world



**9,000**  
total employees



**3.366bn**  
underlying revenue

# Power Systems



**>40,000**  
customers in 13 different industries



**20,000**  
reciprocating engines sold per year



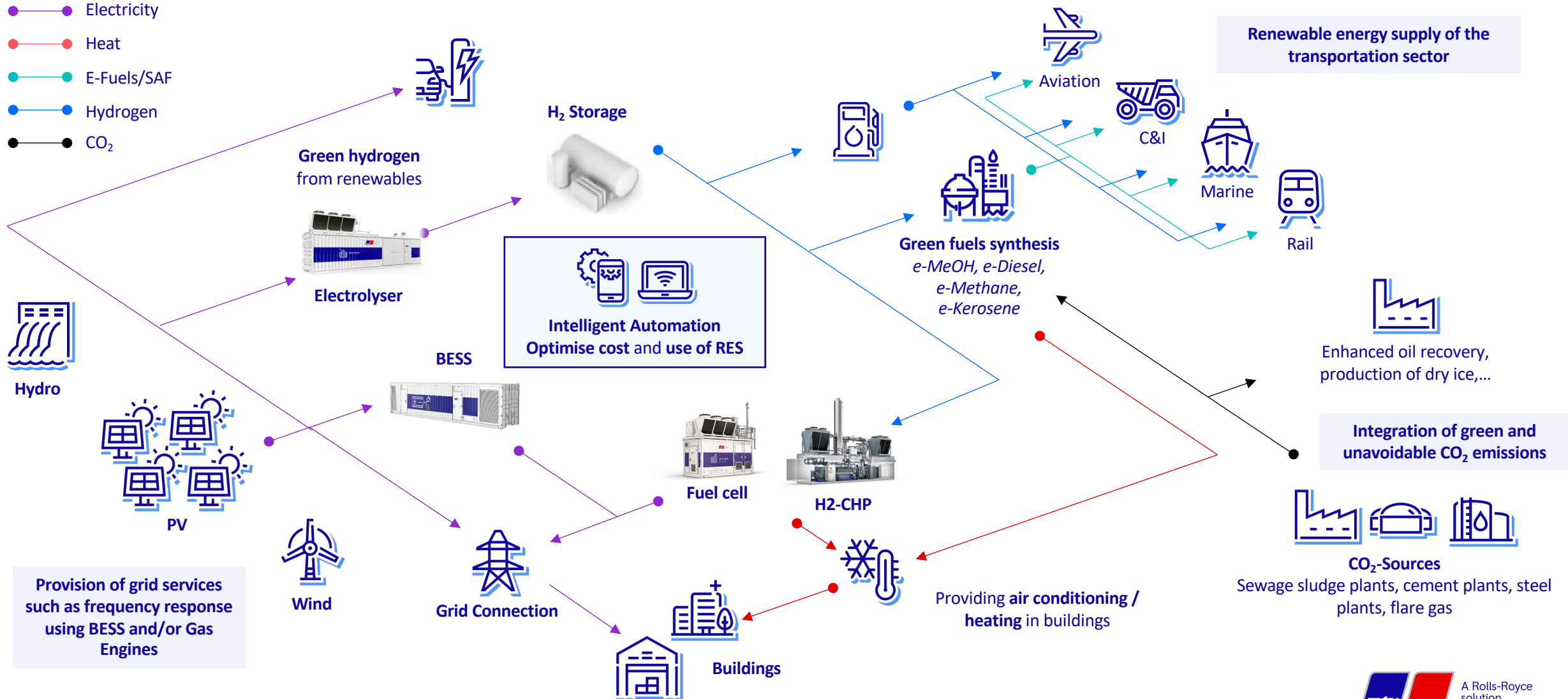
**≈ 9,000**  
total employees



**2.745bn**  
underlying revenue



# The Future of Green Transport and Energy: Renewable Cross-Sectoral Energy System





# MTU ELECTROLYZER SOLUTION

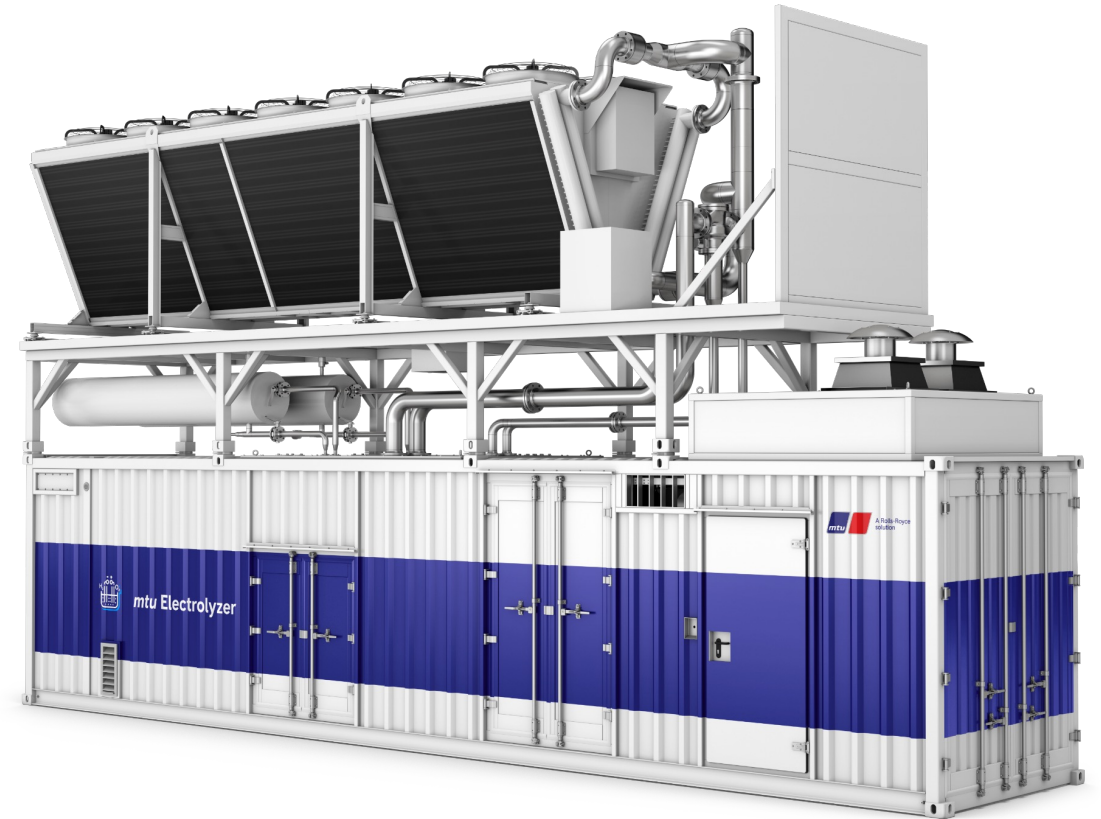
powered by Hoeller stack technology

## Electrical Skid



Cooling    Rectifiers    Transformer

## Process Container



## Performance

- 3.5 MW<sub>e</sub> electrical power demand.
- Scalable Multi-MW.
- PEM electrochemistry with flexible response time for RES combination.



Friedrichshafen, Germany

# Microgrid Validation Center

The Microgrid Validation Center in Friedrichshafen combines different energy generation assets with storage and load to enable validation of different stationary energy solutions.

In off grid mode, the assets and control algorithms' ability to maintain grid stability can be validated. In on grid mode, grid-forming functionality and the offering of grid services such as frequency response can be validated and further developed. The control system optimizes the energy management according to optimization goals such as cost or CO2 emissions. An integrated emulator acts as a programmable load to enable simulation of a wide variety of scenarios.

## Configuration



Offgrid + On grid



Solar PV



BESS



Diesel



Gas



Emulator



Fuel Cell



Electrolyser



H2 Engine

## Main Benefits

- Development and validation of new control algorithms & technologies
- Realistic show case for customers
- CO<sub>2</sub> and cost savings for factory

## Applications

- Integration of PV
- Regulation of Frequency and Voltage
- Load sharing
- Black start
- Island & Grid-parallel operation
- Peak Shaving / Energy Shifting
- Uninterruptible power supply (2021)

## Solution

- 12V4000 Diesel 1300kW
- 12V4000L64 Gas 1300kW
- EnergyPack 2000kVA / 1000kWh
- PV 80kW
- Fuel Cell 250kW
- Emulator (SMA) 2500kW
- mtu EnergetIQ



**HOELLER**  
THE STACK COMPANY

THANK YOU FOR  
**YOUR ATTENTION!**

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