

Hydrogen for a sustainable energy mobility ecosystem

791. WE-Heraeus-Seminar, Bad Honnef
Prof. Dr. Tim Hosenfeldt
SVP Central Technologies, Schaeffler AG
June 20, 2023

We pioneer motion

We are Schaeffler – A world-leading technology business

A photograph of a modern multi-story office building at night. The building has a glass facade with many windows, some of which are lit from within. On the top edge of the building, the word "SCHAEFFLER" is displayed in large, illuminated, green 3D letters. The sky is dark blue.

SCHAEFFLER

As a **leading global supplier to the automotive and industrial sectors**, the Schaeffler Group has been driving forward groundbreaking inventions and developments in the fields of motion and mobility for over 75 years. With **innovative technologies, products, and services** in the fields of electric mobility, CO₂-efficient drives, Industry 4.0, digitalization, and renewable energies, the company is a reliable partner for making **motion and mobility more efficient, intelligent, and sustainable**.

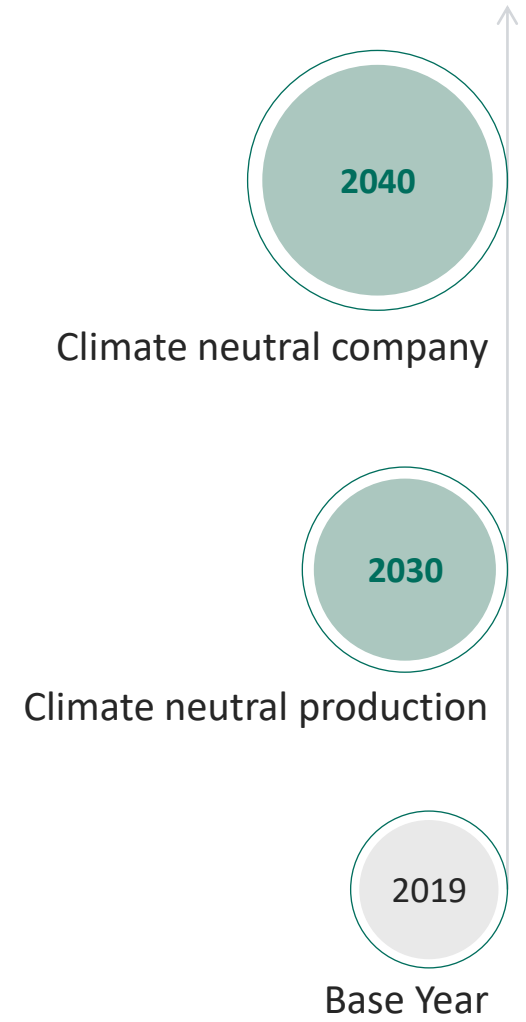
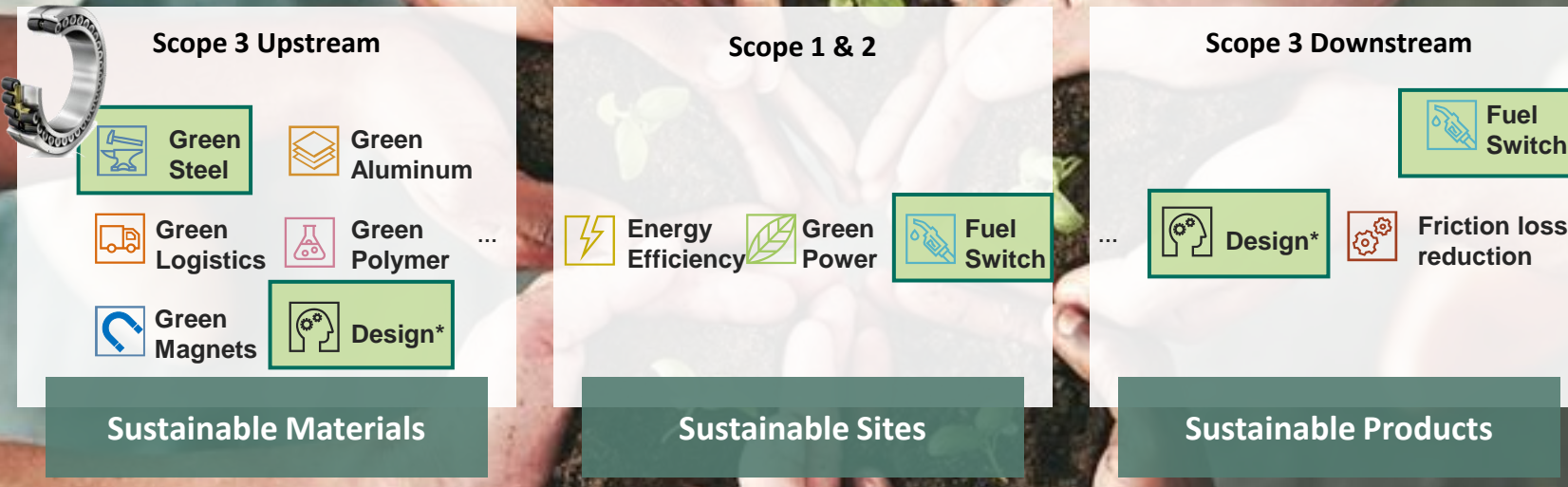
New eco-systems require holistic competences from energy generation to energy consumption



Schaeffler has set itself ambitious pathway to climate neutrality

Managing climate impact is an integrative process along the entire value chain

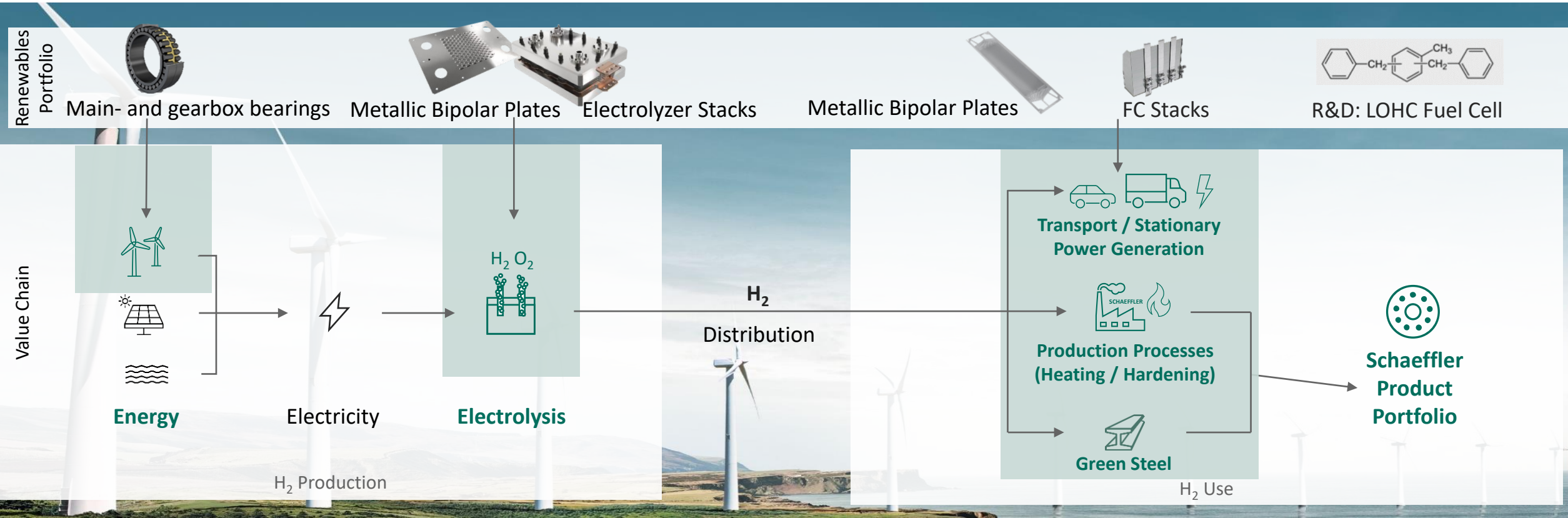
Climate Neutrality @ Schaeffler



H₂ as integrative part of Schaeffler's sustainability efforts.

* Design as cross-cutting and connecting element

The Hydrogen Chain and Schaeffler's involvement



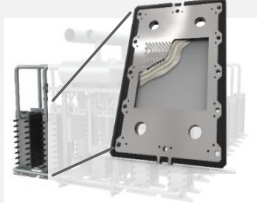
Hydrogen extends Schaeffler's renewables product portfolio and is a vital part of Schaeffler's sustainability efforts.

Integrated development approach enables tailored coating - base material system for bipolar plates


Requirements from pH regime and potential conditions	
Corrosion protection	Fuel Cell/Electrolysis
Electric Conductivity	Fuel Cell/Electrolysis
Mechanical stability	Stack assembly

Transfer to product

Electrolysis (PEMEL)



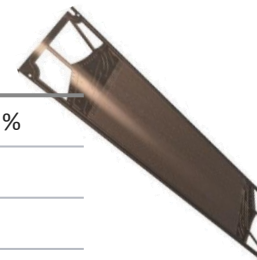
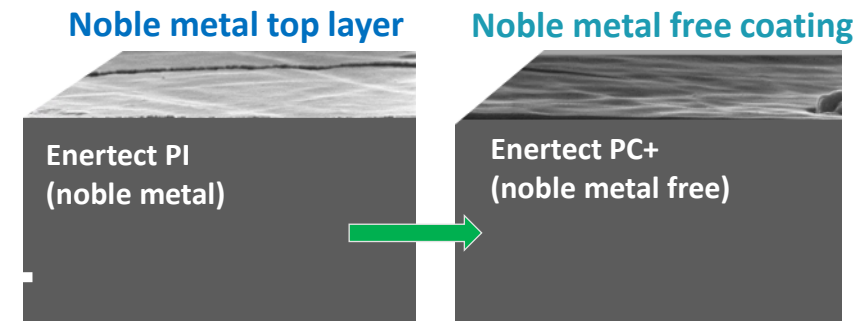
Fuel Cell (PEMFC)



Enerctec-coatings → Enabler for H₂ as energy carrier

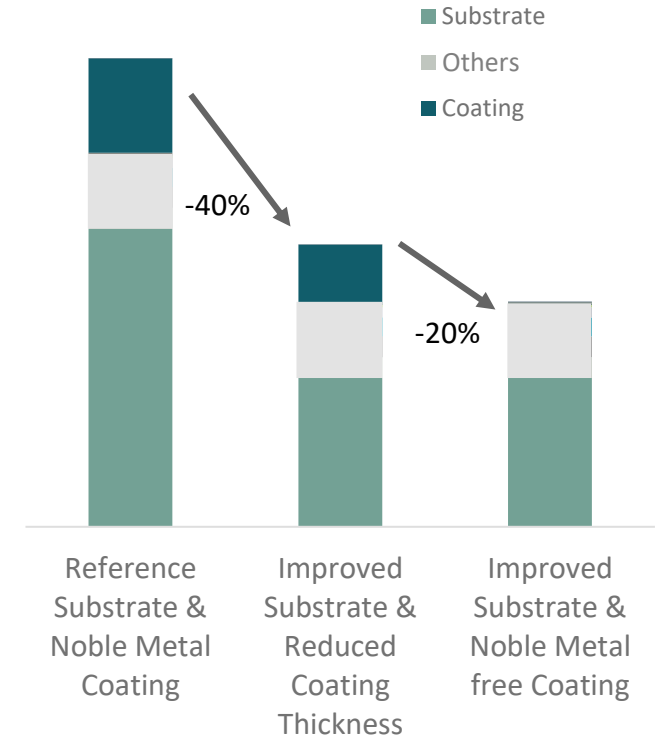
PEMEL: Polymer Electrolyte Membrane Electrolyser
 PEMFC: Proton Exchange Membrane Fuel Cell

Substrate	Steel	Formability	Stability ⁵⁾	CO ₂
	1.4404	✓	✓	100 %
	Steel 1	✓	✓	82%
	Steel 2	✓	✓	89%
	Steel 3	✗	✓	62%
Steel 4	✗ (v)	✓	50%	

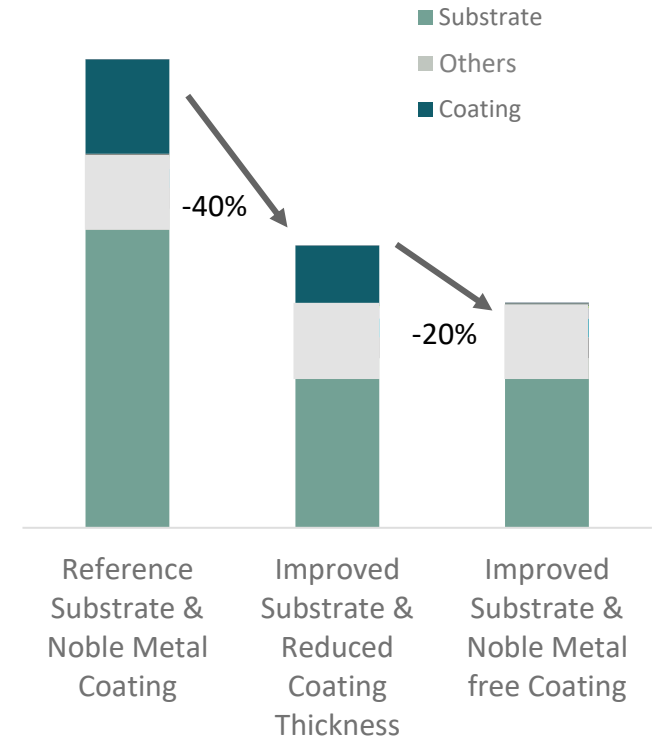
Coating	Coating	CO ₂
	Noble metal based	100 %
	Noble metal free	1%

➤ Up to 99% reduction of coating related CO₂-footprint



Material and Surface Technology Innovation with best performance to cost and sustainability ratio in product & process.

Integrated development approach enables tailored coating - base material system for bipolar plates



Material and Surface Technology Innovation with best performance to cost and sustainability ratio in product & process.

Leveraging the strength of an Industrial & Automotive group to create customer focused solutions

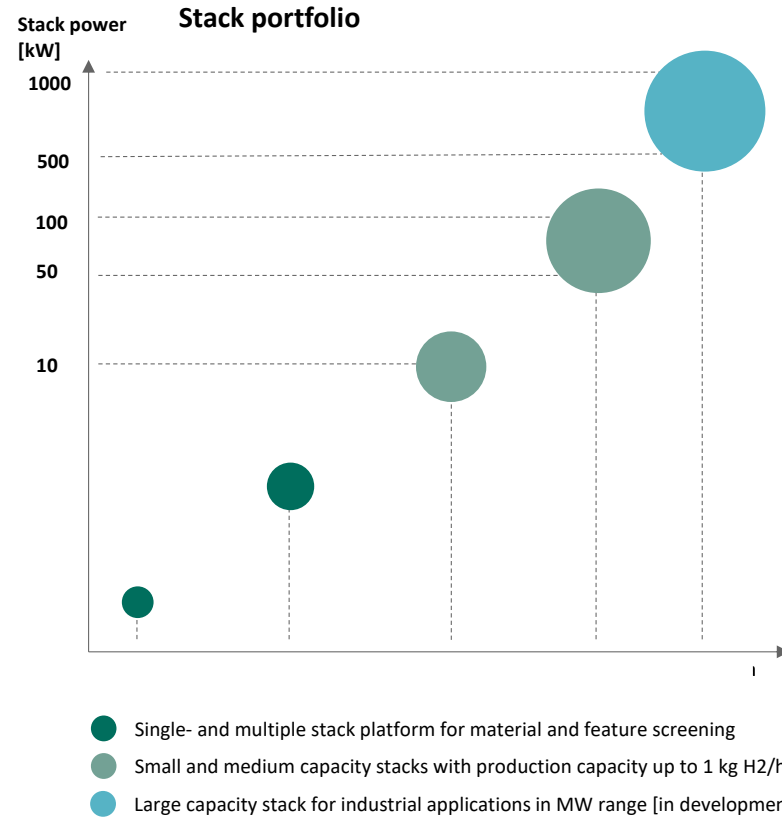
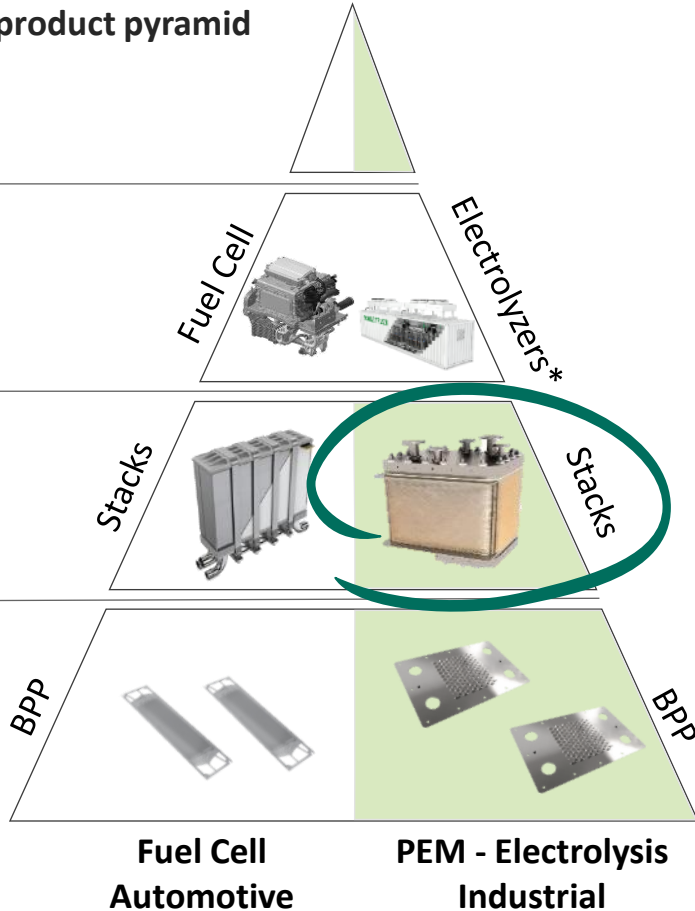
Schaeffler H2 product pyramid

Deployment

Systems

Modules

Components

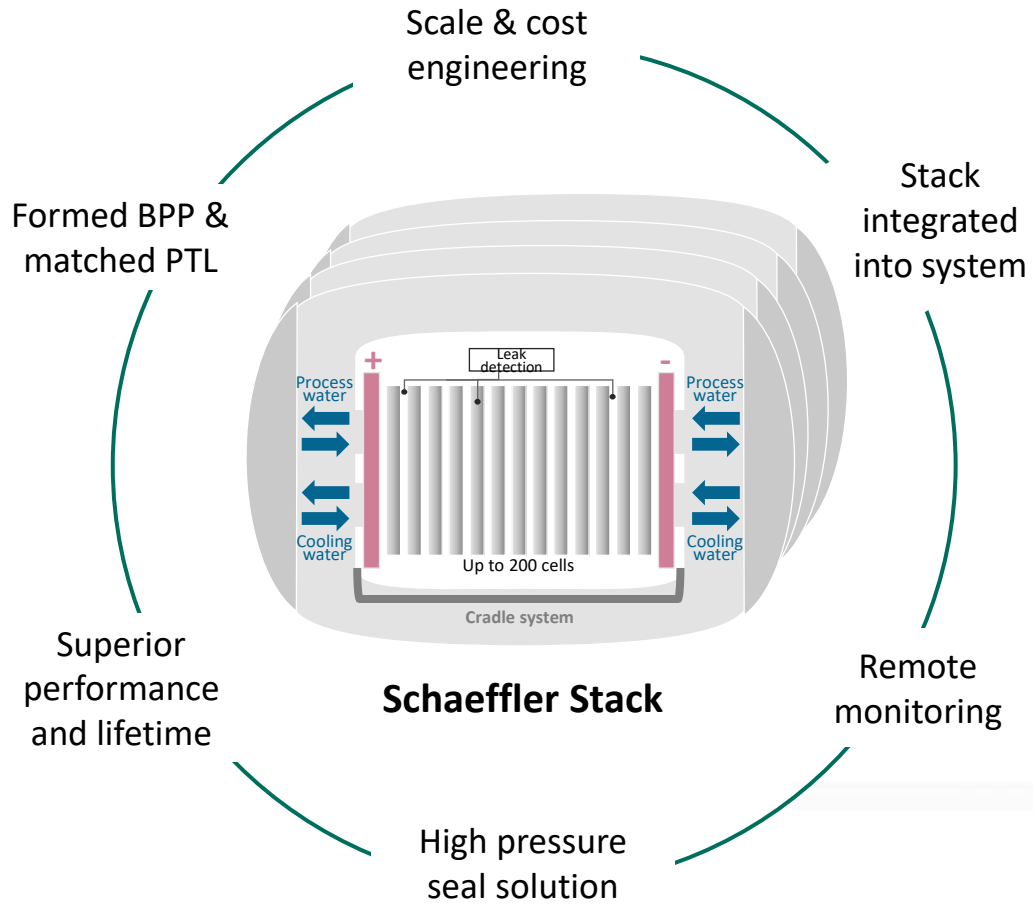


Key aspects

- **Joint Research, Component and Process Development** for high quality, mass production @ optimum 'Levelized Cost of H₂'
- Modules to leverage the strength of Schaeffler **Assembly Know-How** "Schaeffler Sondermaschinenbau – SMB"
- **Systems** to maximise the usage of Schaeffler components, but with external partners (EPCs)
- **Electrochemical and System** competence paired with **Industrialization Expertise**

¹ with System Integration Partner (e.g. EPCs)

Next generation: Schaeffler Stack → made for multi-MW systems



Evolutionary Stack development

Building on current commercial stack designs Schaeffler provides winning technical solutions leveraging advantages of PEM electrolyzers:

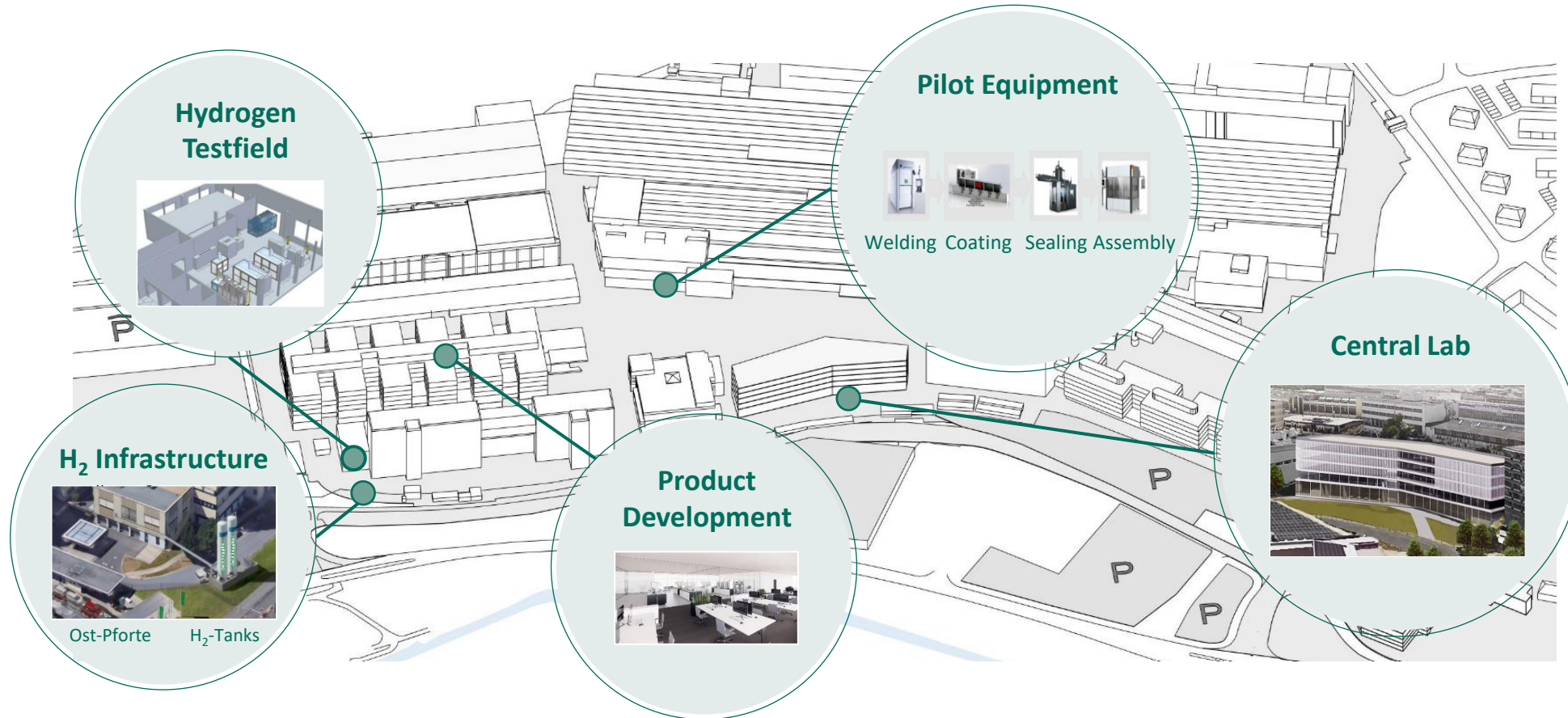
- Small footprint enabling containerized systems
- Dynamic operation capturing renewables
- Minimizing “Levelized Cost of Hydrogen”

Project timeline

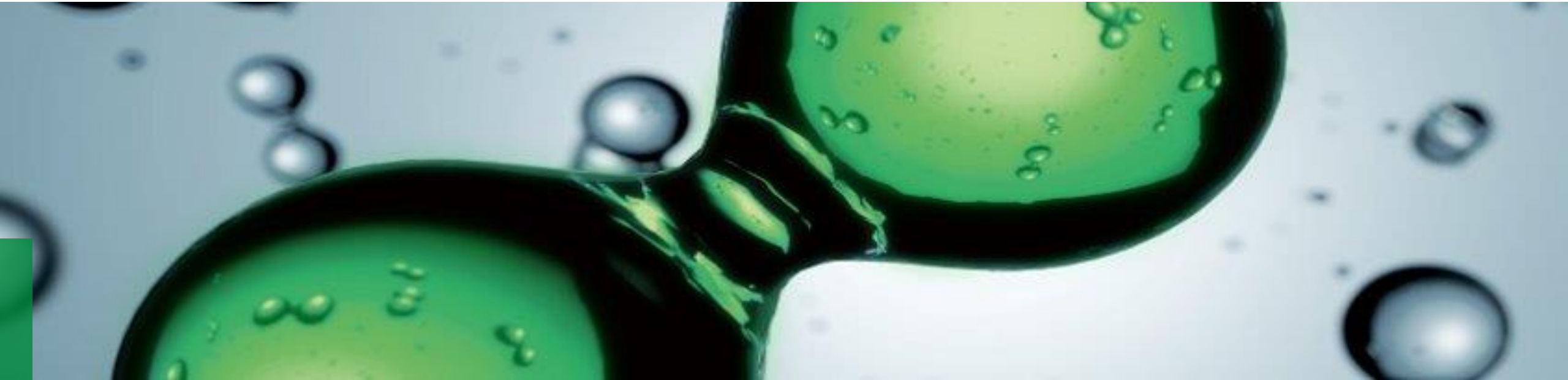


Activities in StacIE provide know-how build-up on components, design principles, and testing which leads to the next generation PEM stack platform.

Hydrogen Competence Center Herzogenaurach



- Schaeffler is **committed to hydrogen technology** and strongly working on related products. This product development is **bundled in Herzogenaurach**.
- It applies for products on **Hydrogen Production (Electrolyzers)** as well as for products on **Hydrogen Application (Fuel Cells)**.
- **Pilot Equipment** for Fuel Cell- & Electrolyser Stack Production **with a capacity of 720k Bipolar Plate Modules = 2000 Stacks/y.**
- **Hydrogen Test Field** for automotive and industry application currently being setup with **Short-Stack, Full-Stack, Component- and Full System test rigs.**



Energy storage for sustainable energy mobility ecosystem

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