Biologische Methanisierung –
von CO2 und Wasserstoff zu e-Methan

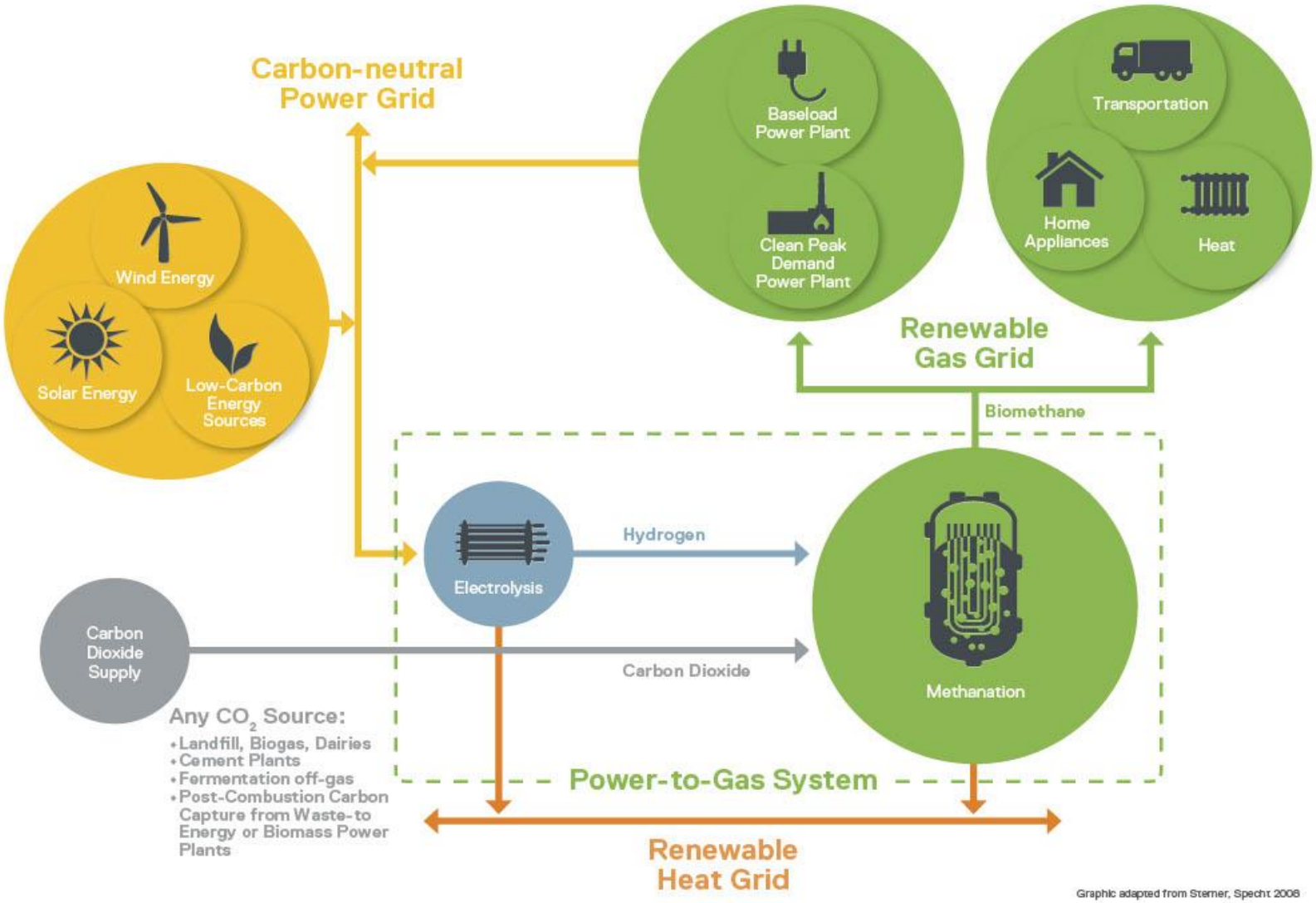
Electrochaea

WIVA P&G
Energy Model Region

Vortrag zum Seminar der WIVA P&G
06. July 2022
MSc. Theresa Ahrens
Development Engineer

Renewable Gas Charges our Largest Battery: the Gas Grid

Electrochaea



Storing Renewable Energy as Methane in the Natural Gas Grid

Electrochaea

Electrochaea

Proprietary Biocatalytic System

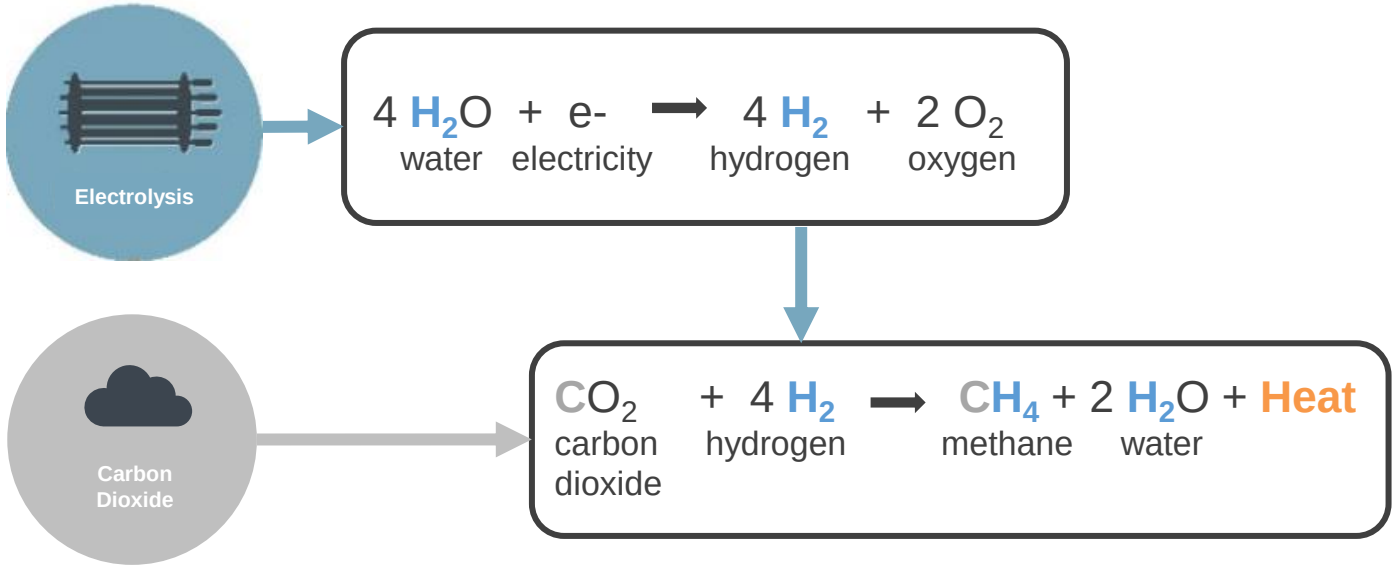
- Abundant renewable power
- Available CO_2 sources

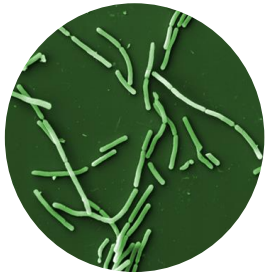
- Natural gas grid storage - distribution to all energy sectors
- Energy and CO_2 sequestration

The Archaea Transform Every Molecule of CO_2 into Molecule of CH_4 Without Using Fossil Fuels

Electrochaea

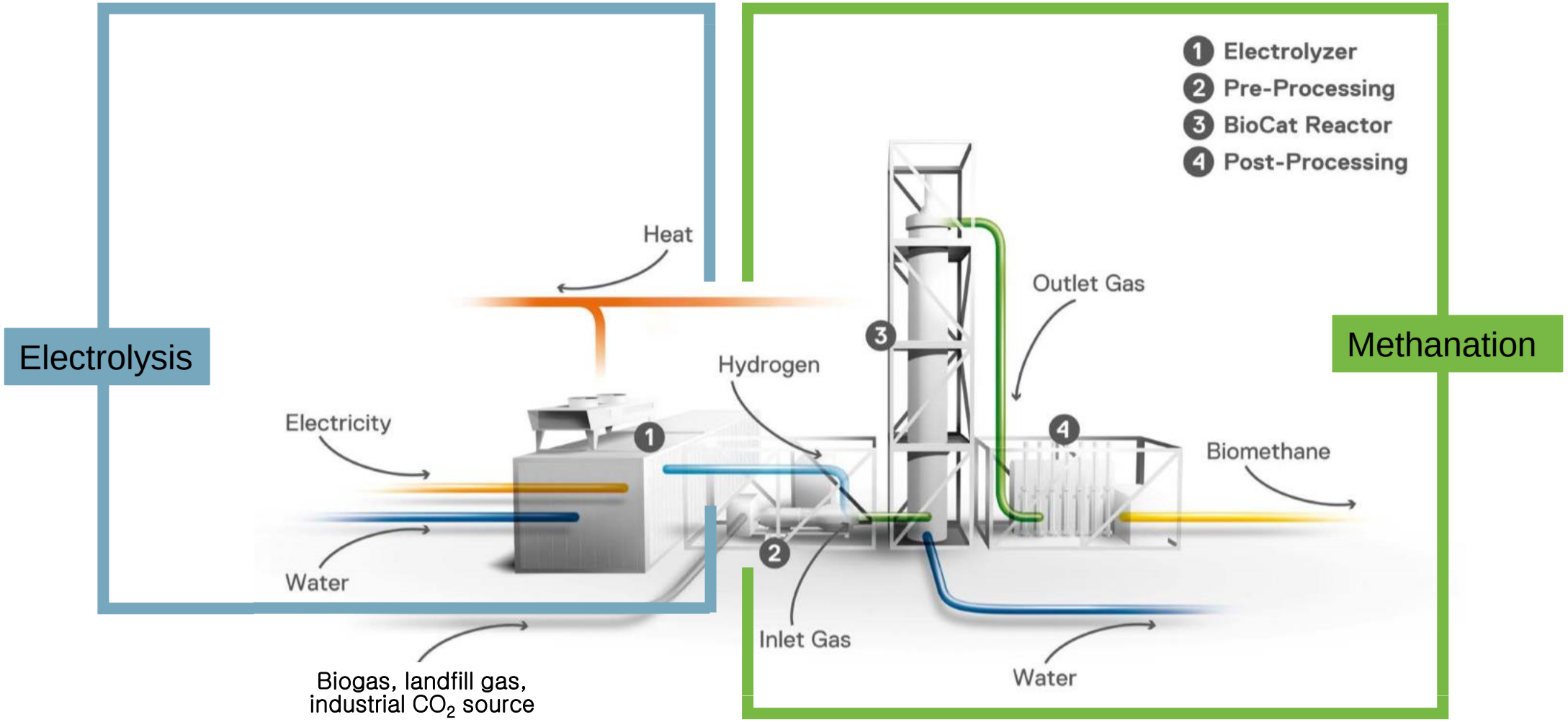
Electrolysis is the process that produces hydrogen.	Renewable hydrogen is synthesized in the electrolyzer from water and renewable electricity.



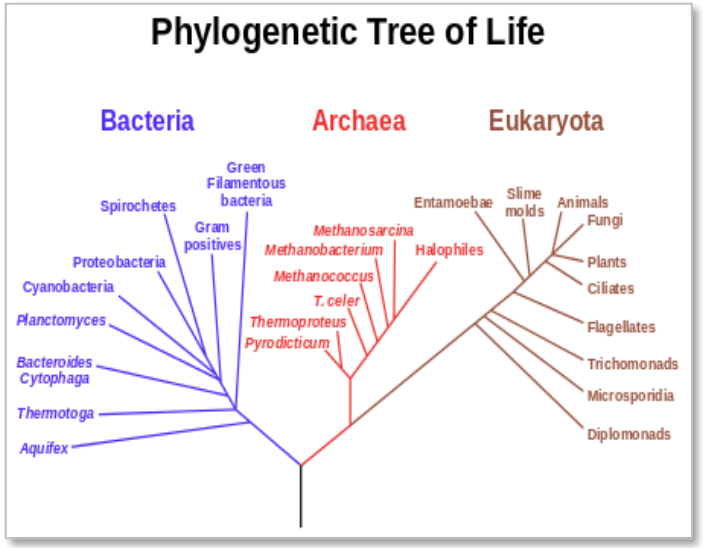


The methane is synthesized in each cell of the biocatalyst. There are trillions of cells working to produce methane in the reactor.	The biocatalyst is a single-celled microorganism that belongs to the domain of Archaea.	The cells are self-replicating in the reactor, as such, the system can sustain itself.

A Scalable and Simple System Design



Our biocatalyst: methanogenic Archaea



- **Methanogenic Archaea:**
  - 3.5 billion year-old single-celled organisms
  - Described only 30 years ago by pioneers Prof Carl Woese (Illinois) and Prof Karl Stetter (Regensburg)
  - Specialized „tiny chemical plants“ pre-engineered by nature
  - „Archaeal diet“: CO_2 and H_2 (no other carbon source needed!), 65 ^oC

- **Electrochaea biocatalyst:** proprietary, selectively evolved, highly efficient, optimised Archaea

Electrochaea's Rapid Technology De-risking and Scale-up

75 MW

10 MW

1 MW

50 kW

1 kW

n/a
Power Input

75 MW Commercial-Scale

With support from strategic investors Electrochaea focuses on scale-up and integration for grid scale commercial projects

10 MW Commercial-Scale

Scale-up for first commercial biomethanation plant co-funded by EIC Accelerator program

Commercial-Scale Field Trial

Preparing for market entry with a commercial-scale demonstration unit, using an optimized reactor, Copenhagen, Denmark

Pre-Commercial Field Trial

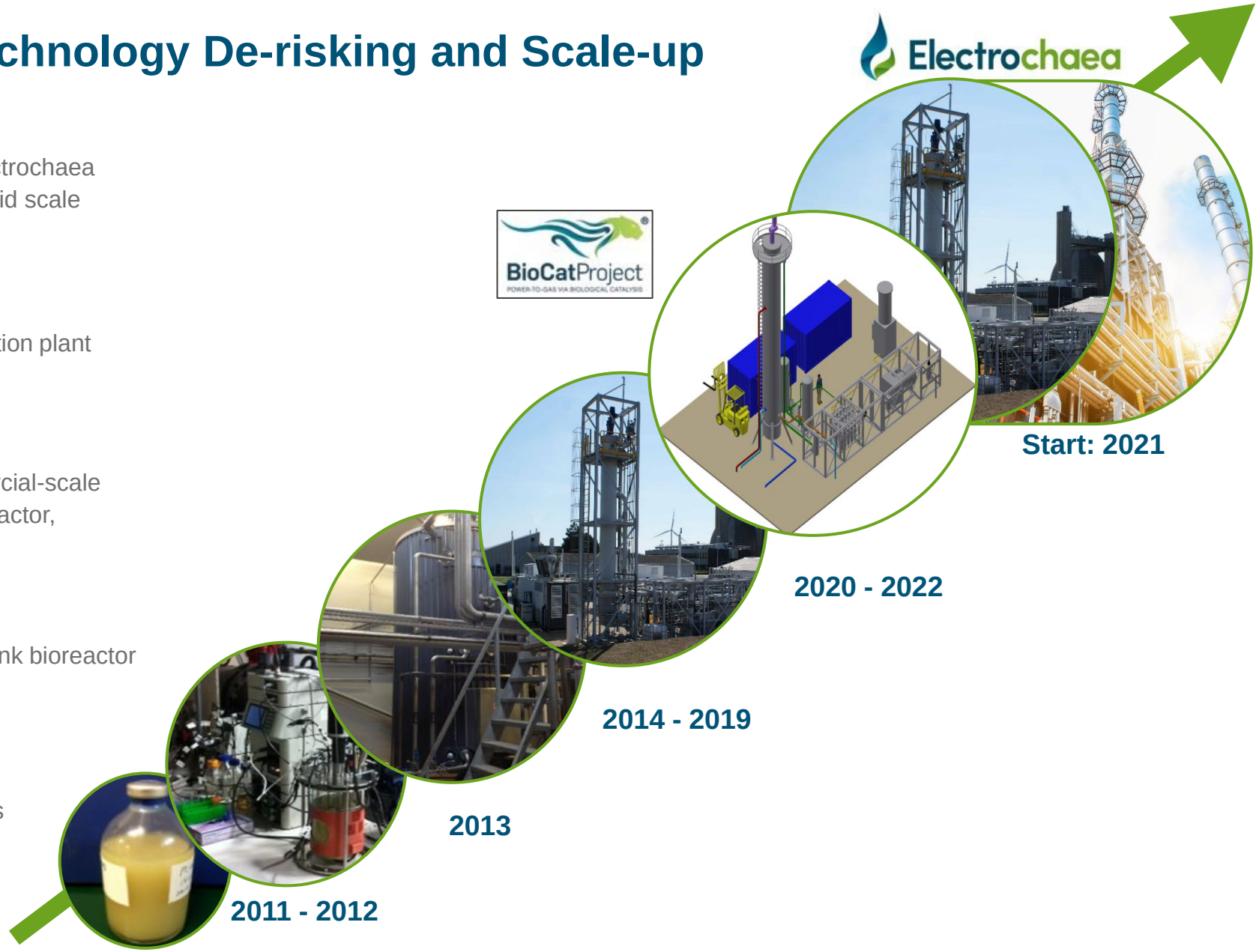
Process demonstration in a 5m³ stirred tank bioreactor using raw biogas, Foulum, Denmark

Lab-Scale Field Trial

Biocatalytic capability test with raw biogas

Basic Research

In Dr. Mets' laboratory at the University of Chicago



Our Technology in Industrial-Scale Pilots

(0.25 MWe)
Golden, Colorado, US
July 2019

- ✓ Commissioning completed
- ✓ 1st US biological methanation
- ✓ High pressure (18 bar)
- ✓ Project support SoCal Gas, NREL (US DOE)
- ✓ **New DOE grant (9/2021) will relocate the plant to a Summit Utilities (Maine) dairy biogas site for gas grid RNG injection.**

(0.7 MWe)
Solothurn, Switzerland
May 2019

- ✓ Gas grid injection within 96h
- ✓ Operation >1200h, 17 216 Nm³ RNG injected
- ✓ Automated operation
- ✓ Commercial design
- ✓ Project support EC (H2020), RES
- ✓ *Click here for a virtual tour of Solothurn*

(1 MWe)
Avedøre, Denmark
April 2016

- ✓ WWTP site integration
- ✓ Flexible operation, load following
- ✓ 1st grid scale demonstration
- ✓ Project support EUDP, Energinet, HMN, AUDI, Insero, Hydrogenics, BioFos

1MWe Demonstration Plant Achievements

Electrochaea technology feedstock flexibility demonstrated by pilot facility

Electrochaea

CO_2 Operation

1 MW electrical power

200 Nm³/h H_2

50 Nm³/h CO_2

Heat 320 kW

Synthetic Biomethane 50 Nm³/h

grid

Biogas Upgrade

1 MW electrical power

Biogas

200 Nm³/h H_2

50 Nm³/h CO_2 (from Biogas)

75 Nm³/h CH_4 (from Biogas)

Heat 320 kW

Synthetic Biomethane 50 Nm³/h

Organic Biomethane 75 Nm³/h

grid

BioCatProject

HMN GASHANDEL

Audi Vorsprung durch Technik

FORSKEL

BIOFOS

HYDROGENICS SHIFT POWER | ENERGIZE YOUR WORLD

Impact of Electrochaea´s scalable technology

2,000GWh$_e$ + 185,000t CO_2	**250MW$_e$** BioCat® methanation system	12,500Nm^3/h RNG

energy of ~**625,000 households**

~**103,000 passengers** flying from London to NY

Renewable energy

CO_2

Renewable natural gas

CO_2 mitigation

Renewable thermal energy

yearly consumption of ~**10,000 CNG cars**

147mn km with 1 CNG car (~3660x around the world)

CO_2 Mitigation of ~**15mn trees**

Re-utilization of resources

Reduction of CO_2 footprint

*assumptions:
- Heat and electricity for one year 3,200 kWh in a household with 4 person in Germany (2013)
- Consumption average CNG car: 4.5kg CNG/100km, yearly distance: 15 000km/year
- 8,000 h/a of operation, electrolysis included
- One beech binds 12,5 kg CO_2/year
- CO_2 emissions calculator www.atmosfair.de

The Team – Multi-Disciplinary with Experienced Leadership

Mich Hein, PhD
CEO & Managing Director, USA

Co-founder and managing partner at Nidus Partners. Passionate entrepreneur. Raised €60 mn for start-ups

Doris Hafenbradl, PhD
CTO & Managing Director, EMEA

Over 20 years of experience in biotech, biofuels and pharmaceutical industries. Expert in hyperthermophilic archaea. Commercialized multiple technology ideas

Harald Beschid
Chief Operation Officer

15 years hands-on expertise in project management, project controls, operations and various cross-department consulting assignments. Managing budgets directly with over €320 million.

HIGHLY MOTIVATED, SKILLED AND MULTI-DISCIPLINARY TEAM

Vielen Dank!

Theresa Ahrens
Development Engineer

theresa.ahrens@electrochaea.com

Dr. Doris Hafenbradl
Managing Director,
CTO

doris.hafenbradl@electrochaea.com

Electrochaea GmbH
Semmelweisstrasse 3
Planegg – Steinkirchen 82152
Germany

www.electrochaea.com

Electrochaea´s Investors:

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36Mio EUR Series D closed in Dec21