



Electrochaea GmbH

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Sales Manager**

5th EUROPEAN CONFERENCE
BIOGAS POWER ON
BIOGAS & BIOGAS UPGRADING

FORTES

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Hamburg, Germany



28/09/2023

**An Industrial-Scale Application for CO₂ recycling
and production of Renewable Fuel**

Electrochaea Snapshot



- Cleantech 100 growth-stage power-to-gas company incorporated in 2010
- Technology combines CO₂ and green hydrogen to create BioCat Methane – pure renewable CH₄ – through a patented biochemical process
- Value creation through storage of renewable energy, recycling CO₂, and displacing fossil methane in the gas grid and for transportation
- Successful gas grid injection in DK and CH, demonstration in USA with NREL
- Over EUR 75mn raised to date from strategic and financial partners including Baker Hughes, ENGIE / Storengy, EIC, MVP, b-to-v Matterwave, Energie 360° and KfW and grants
- *Now scaling up to meet market needs with 10MWe and 75MWe Archetypes*

Baker Hughes 

storengy

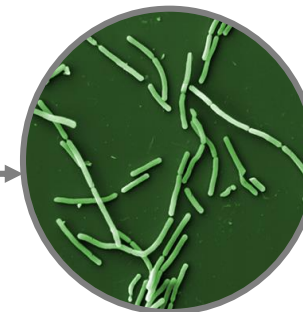
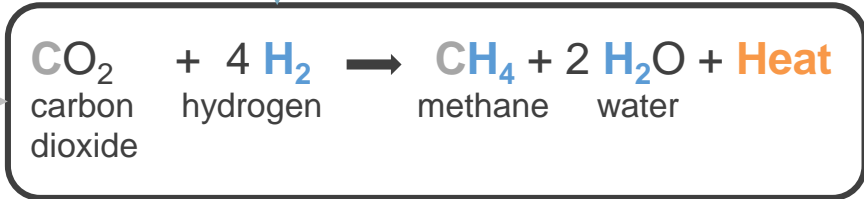
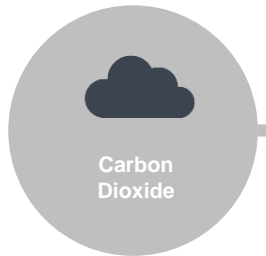
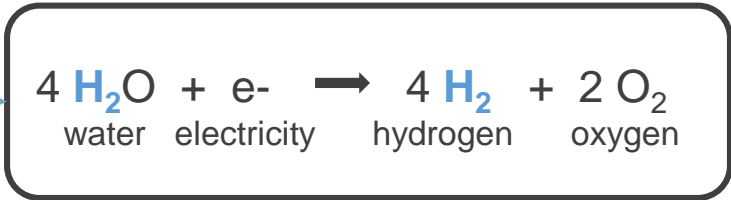
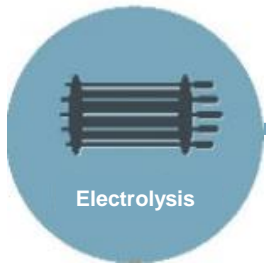


energie360°

The Archaea Transform Every Molecule of CO₂ into CH₄

Electrolysis is the process that produces hydrogen.

Renewable hydrogen is synthesized in the electrolyser from water and renewable electricity.

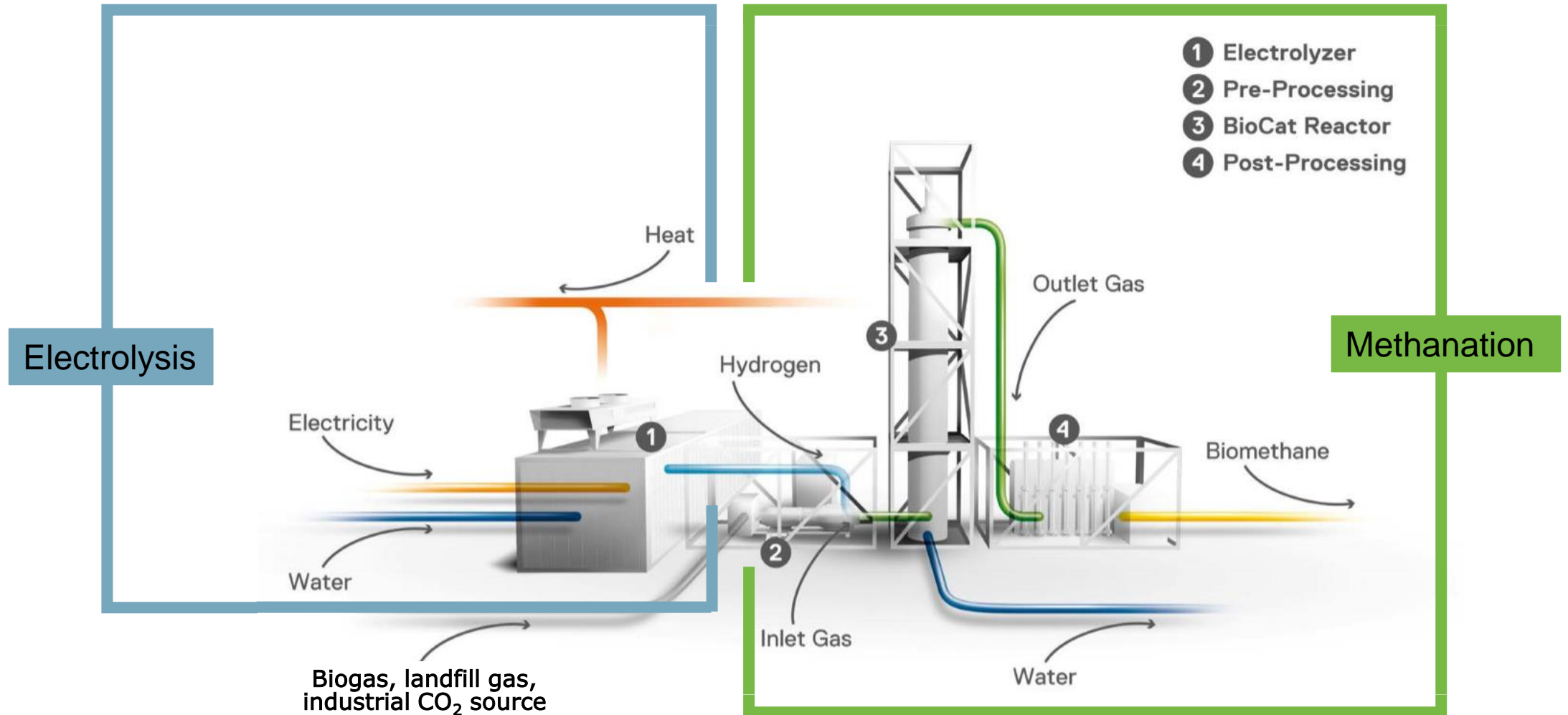


The methane is synthesized in each cell of the biocatalyst. There are trillions of cells working to produce methane in the reactor.

The biocatalyst is a single-celled microorganism called Archaea.

The cells are maintained in the reactor.

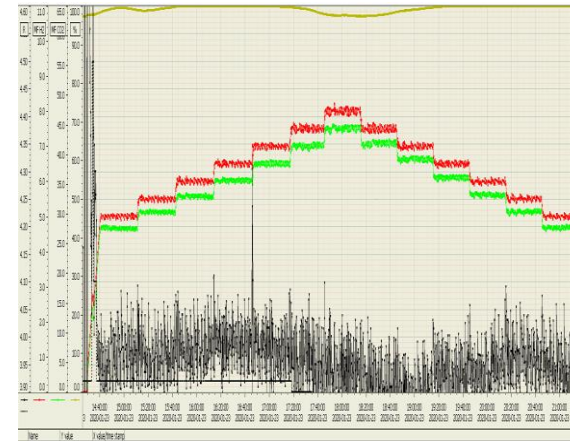
A Scalable and Simple System Design



Unique Features of Electrochaea's Technology

Unique Biocatalyst

- Patented strain
- Optimized methane productivity (20 x increase)
- Outstanding robustness
- Fast start/stop cycles



Productive	98.6% of carbon goes into methane
Effective	VVD* of 850, H ₂ mass-transfer limited
Responsive	Quick return to methane production within seconds/minutes
Selective	100% methane, no intermediates
Robust	Tolerant to oxygen, H ₂ S, CO, sulfate, ammonia, particulates
Simple	Moderate temperature range (60-65°C) and pressure (1-10 bar)
Proprietary	Patented biocatalyst developed by L. Mets is licensed exclusively to Electrochaea by the University of Chicago

*VVD = volumes of gas per volume of reactor per day (24-hr)

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.**

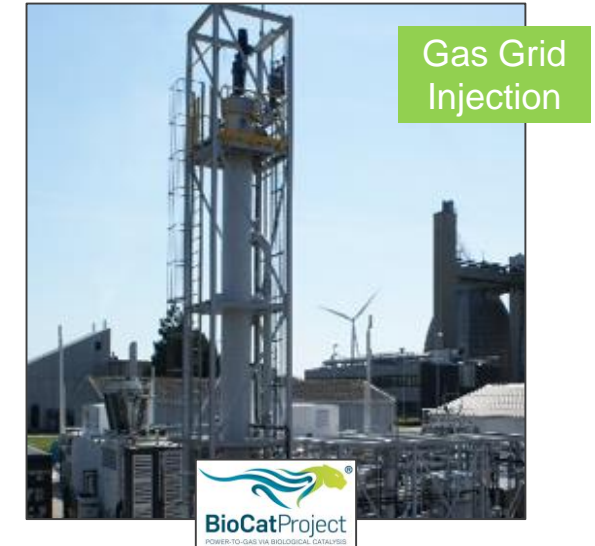
(0.7 MWe)
Solothurn, Switzerland
May 2019



- ✓ Gas grid injection within 96h
- ✓ Operation >1200h, 17 216 Nm³ RNG injected
- ✓ Automated operation
- ✓ Commercial design
- ✓ Project support EC (H2020), RES
- ✓ [Cliquez ici pour une visite virtuelle à Soleure](#)
- ✓ [Click here for a virtual tour of Solothurn](#)

confidential

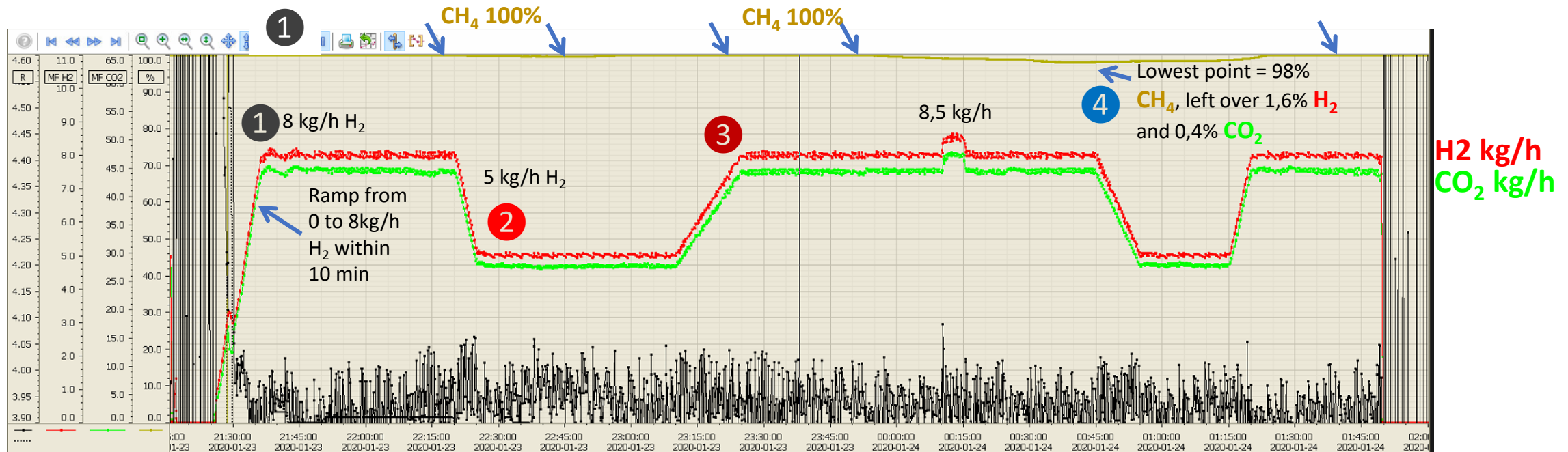
(1 MWe)
Avedøre, Denmark
April 2016



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

Highly Flexible System Operation ideal to match renewable electricity supply

Electrochaea's biocatalyst is robust and produces grid quality gas through start-up, turndown and turnup of the methanation process in minutes, without post-reactor gas purification



- 1 Start-up within minutes, CH₄ production achieves designed scale of the test performed
- 2 Ramping down H₂ and CO₂ flow, no change in product gas quality
- 3 Ramping up H₂ and CO₂ flows, no change in product gas quality
- 4 CO₂ conversion is not affected by change in input flows

Rapid Technology De-risking and Scale-up



75 MW Commercial-Scale

Baker Hughes and Electrochaea joint scale-up activity – Combination of biomethanation and post-combustion carbon-capture technologies

10 MW Commercial-Scale

Scale-up for first commercial biomethanation plant in Denmark, 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

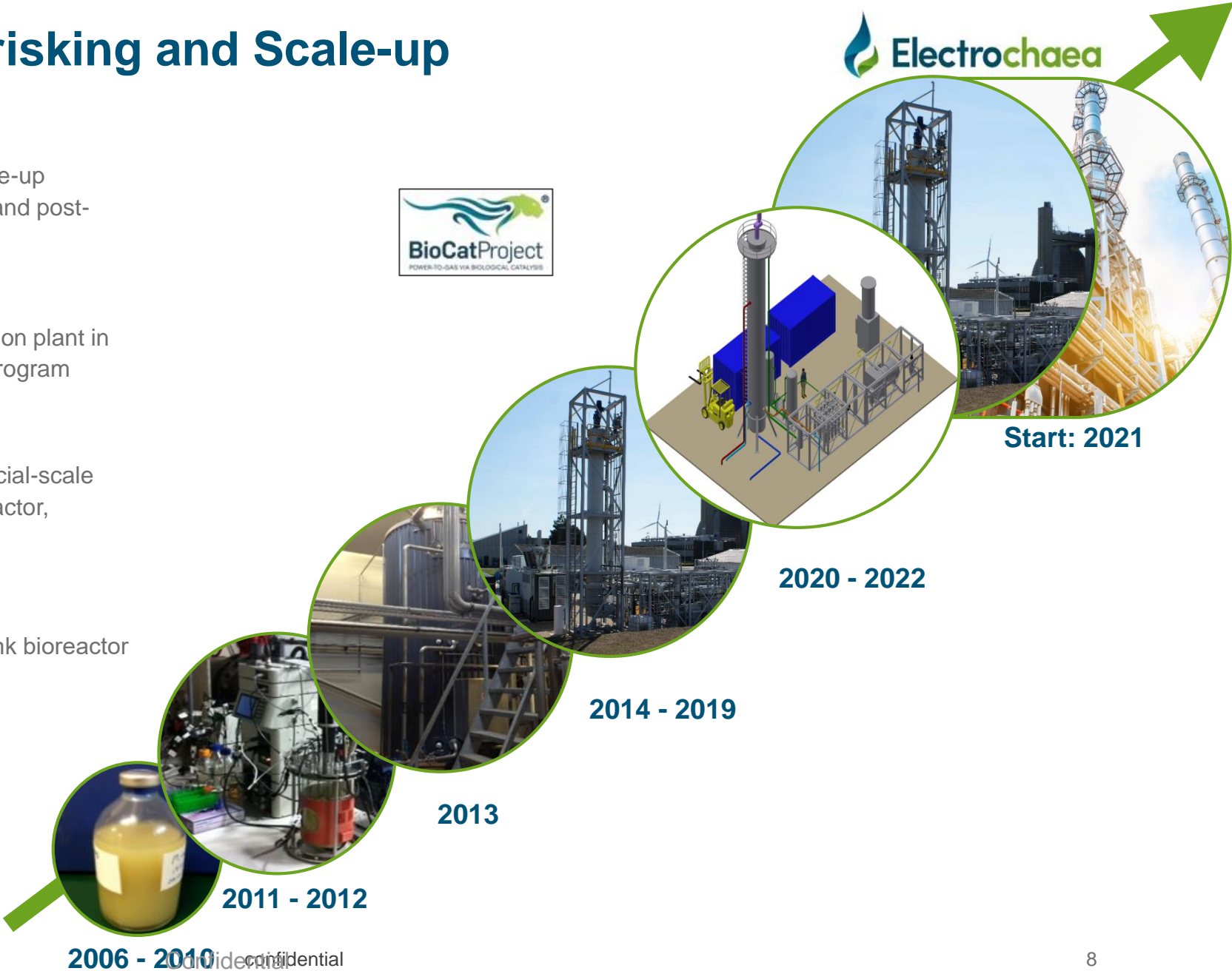
Process demonstration in a 5m³ stirred tank bioreactor using raw biogas, Foulum, Denmark

Lab-Scale Field Trial

Biocatalytic capability test with raw biogas

Basic Research

In Dr. Mets' laboratory at the University of Chicago



2006 - 2010 Confidential

10 MW project – “Biocat Roslev” Overview



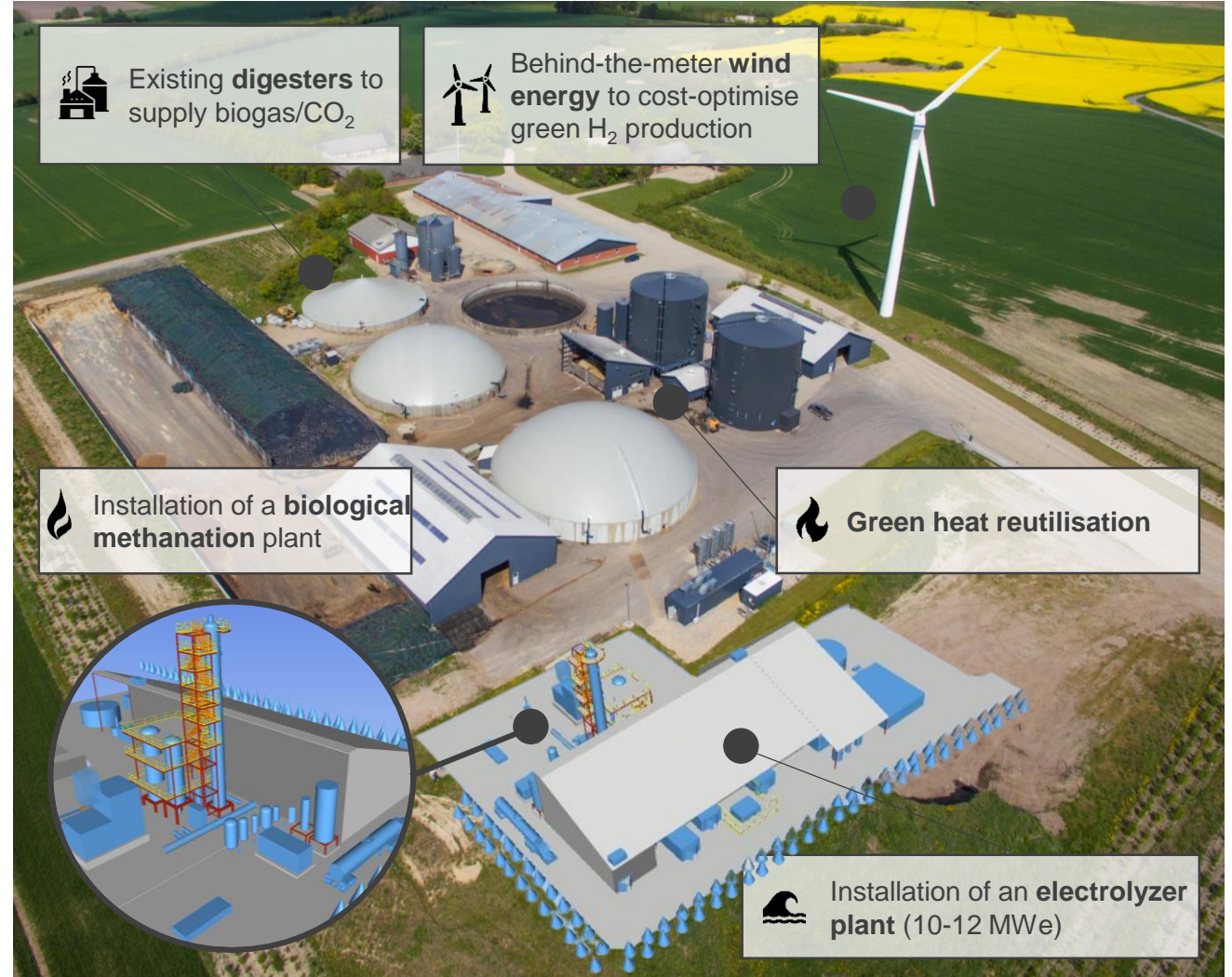
SITE: ROSLEV, DENMARK



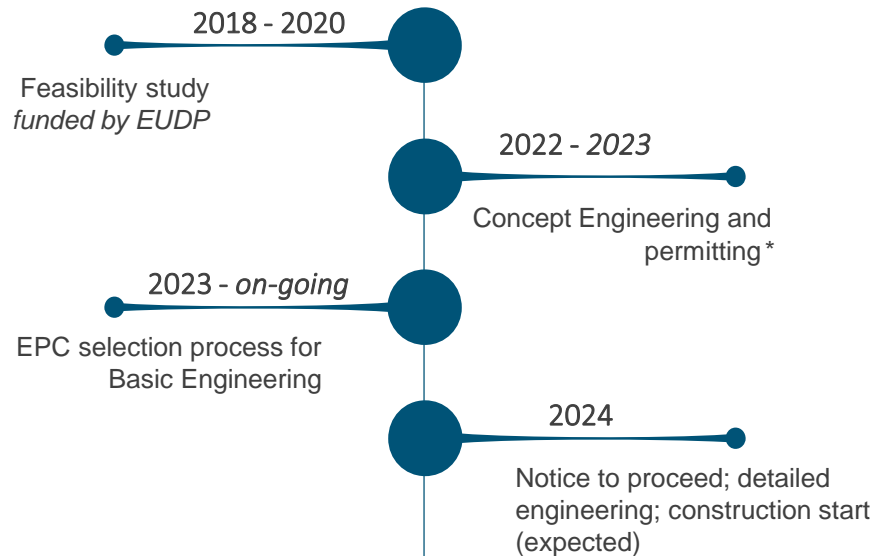
PROJECT PARTICIPANTS



PROJECT OVERVIEW



TIMELINE

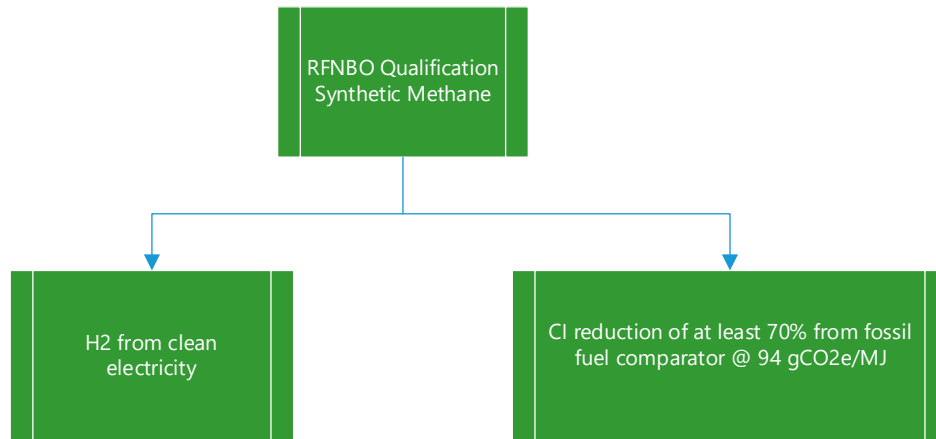


*Funded by the European Union's Horizon 2020 Research and Innovation Programme under grant agreement no. 101010276

Overview of a 10 MWe Plant: Operating Parameters



Synthetic Methane is an RFNBO and has a higher value for the maritime sector



- To qualify for RFNBO, a fuel must satisfy two conditions:
 - ✓ Hydrogen made from qualifying clean electricity
 - ✓ CI reduction of at least 70% from fossil fuel comparator @ 94 gCO₂e/MJ
- BioCat Methane production process qualifies for RFNBO on the hydrogen side when electricity is procured from a green PPA
- Qualifies on the CI side because of very low contributions from each stages of the process
 - ✓ Hydrogen: 0 gCO₂e/MJ (green electricity carries CI score of 0)
 - ✓ Methanation reactor: <2 gCO₂e/MJ to account for nutrient impact
- The maritime sector has RFNBO sub-targets that make eLNG attractive

Electrochaea Business Summary



- Electrochaea enables our customers and partners to provide a long-term renewable replacement for natural gas and long duration renewable energy storage with our best-in-class methanation technology
- We generate revenues from licensing, technology transfer and services
- We help preserve the existing infrastructure and markets to effect a transition to low carbon energy
- We support expansion of business models and regulatory policies that recognize the intrinsic value of low carbon methane

We share in the value created by our technology our renewable gas is used by our customers and partners





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