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HZI Biogas methanation plant in Gabersdorf, Austria

E. Moioli – 27.03.2023

The renewable gas field

HZI technology

Results from operation

Where is Gabersdorf?

Renewable Gasfield (P2G-Anlage Gabersdorf)

Manufacturer

Directions Save Nearby Send to phone Share

8435 Gabersdorf, Austria

QH3P+8F Gabersdorf, Austria

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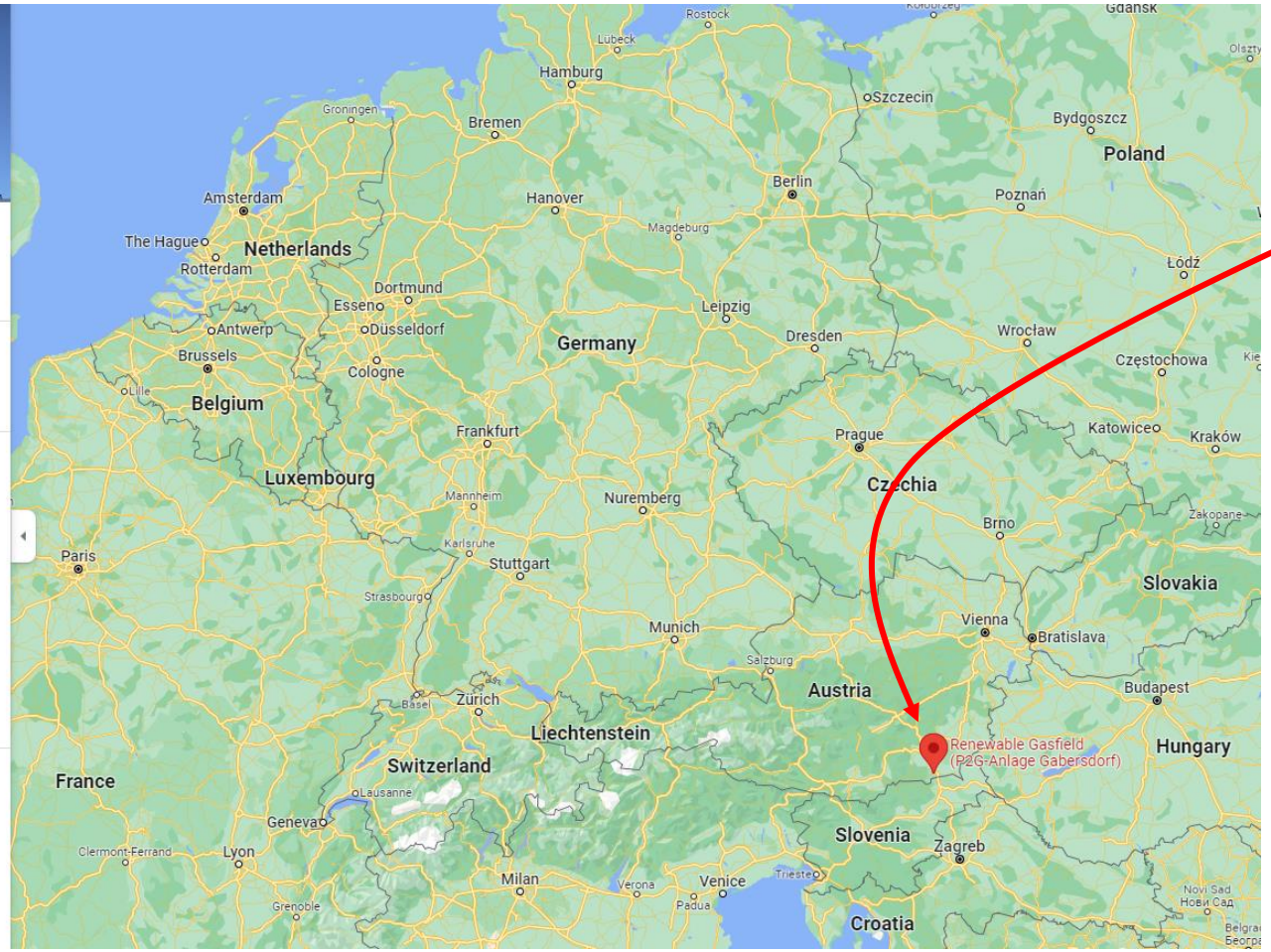


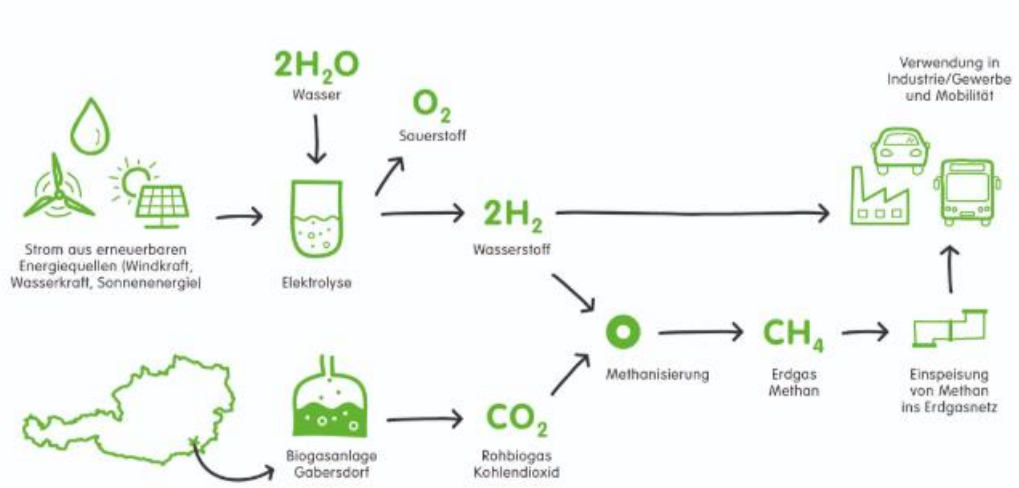
Check on Google maps!

Context of the plant

RENEWABLE GASFIELD

PROJECT DESCRIPTION

The decarbonization of the power supply and the shift from carbon-based energy sources to renewables lead to major changes in the energy economy to secure a long-term energy supply. Due to the high volatility of wind power and photovoltaics (PV) an increased energy storage demand is required. The existing Austrian natural gas grid offers an enormous storage potential. Green energy from wind power or PV is used in water electrolysis for hydrogen (H2) production and its following methanation of



Project to realize a renewable gas field

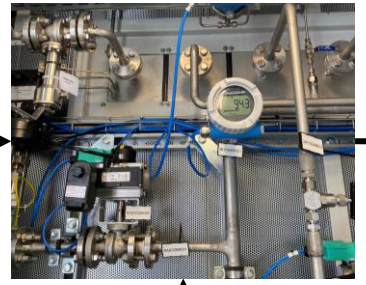
- Biogas upgrading via methanation
- Electrolyser
- HZI methanation reactor

WIVA P&G
Energy Model Region
RENEWABLE GASFIELD

ENERGIE STEIERMARK

Gabersdorf plant at a glance

Wet AD

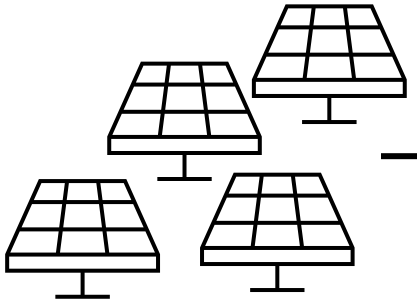


Mixing & Conditioning

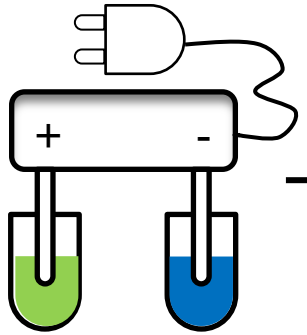
Methanation reactor

Grid injection

240 kW SNG



PV panels



Electrolyser

Intermediate storage

Compression & H_2 use

H_2 production side

Biogas production

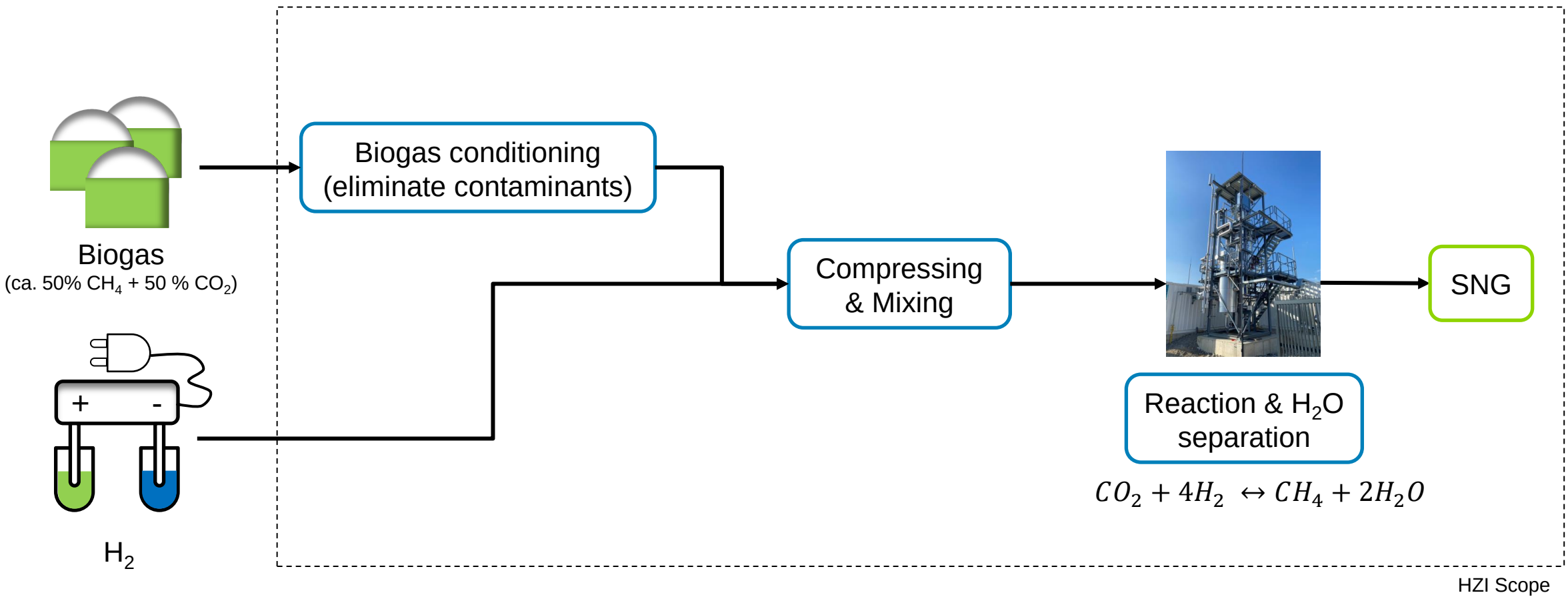
- Wet AD as source of CO_2
  - ca. 600-700 Nm^3/h biogas production
  - Small amount of total CO_2 available is converted into methane
  - Currently, biogas is burnt in a combined heat and power plant (CHP)

The renewable gas field

HZI technology

Results from operation

Scope of the plant



Ancillary units

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Biogas conditioning (eliminate contaminants)

- Removal of sulphur and tars:
  - Activated carbons
  - CuO

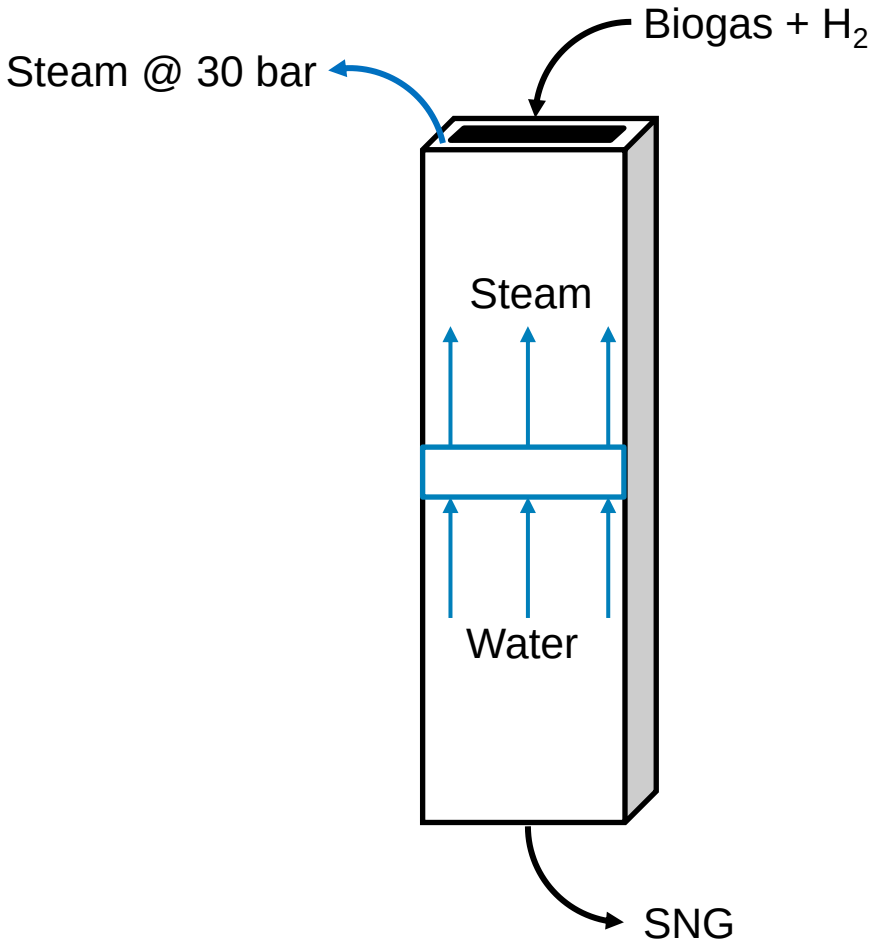
Compressing & Mixing

- Biogas is compressed to 10 bar
  - Oil free compressor
  - 1 dedicated container for biogas compression
- In container also installed:
  - Boiler feed water storage
  - Water circulation pump

Post-processing

- Biogas is compressed to 10 bar
  - Oil free compressor
  - 1 dedicated container for biogas compression
- In container also installed:
  - Boiler feed water storage
  - Water circulation pump

Reactor concept

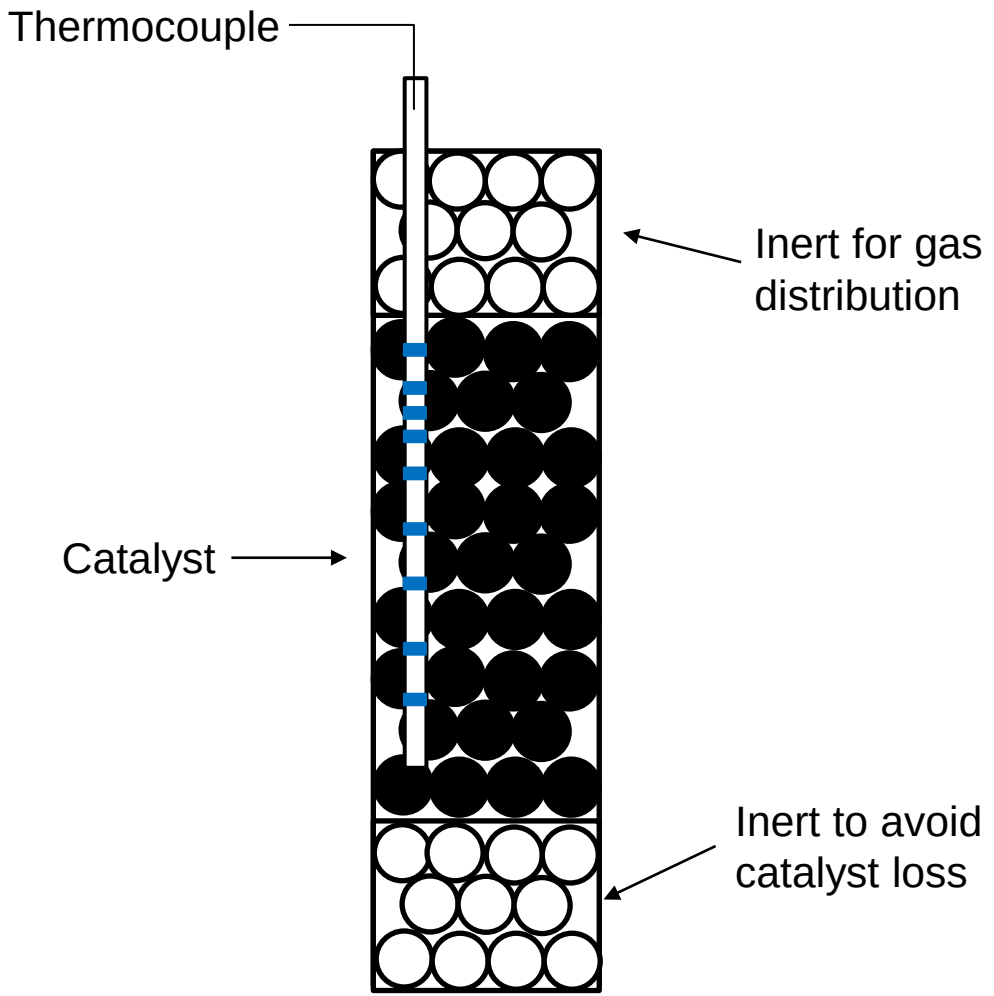


- Reactor is composed of a series of plate-type heat exchangers
- Internal side: gas passing over the catalyst
- External side: boiling water
- Heat exchange in counter-current
- Catalyst supplied by Hitachi Zosen Corporation (Japan)
  - Ni-based catalyst supported on ZrO_2

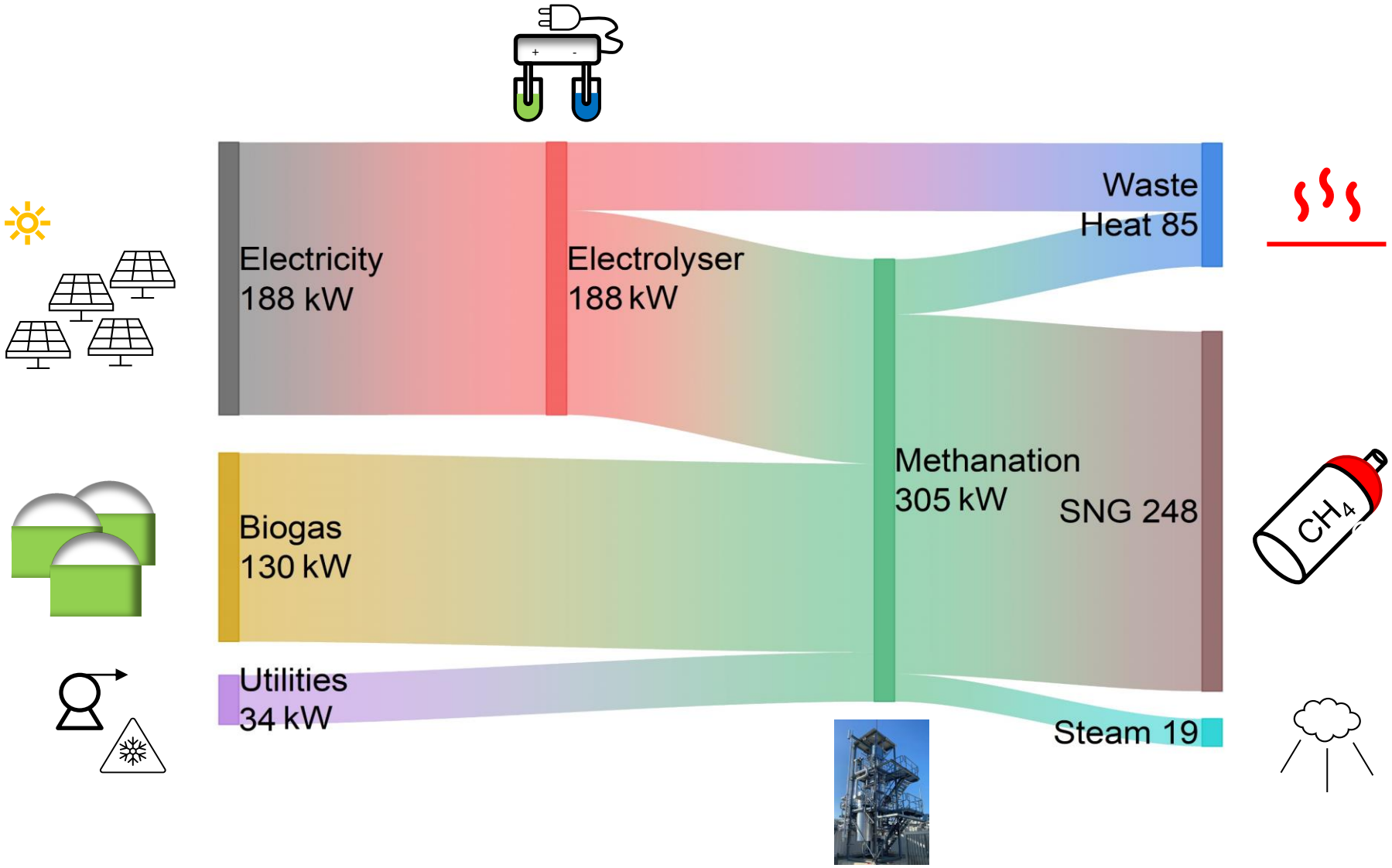
Methanation reactor

Inside the reactor

- Space between plates is filled with catalyst
- Inert layers are added to improve gas distribution and to stabilize the catalyst
- Multipoint thermocouple is inserted to monitor the temperature inside the catalyst bed



Energy balance

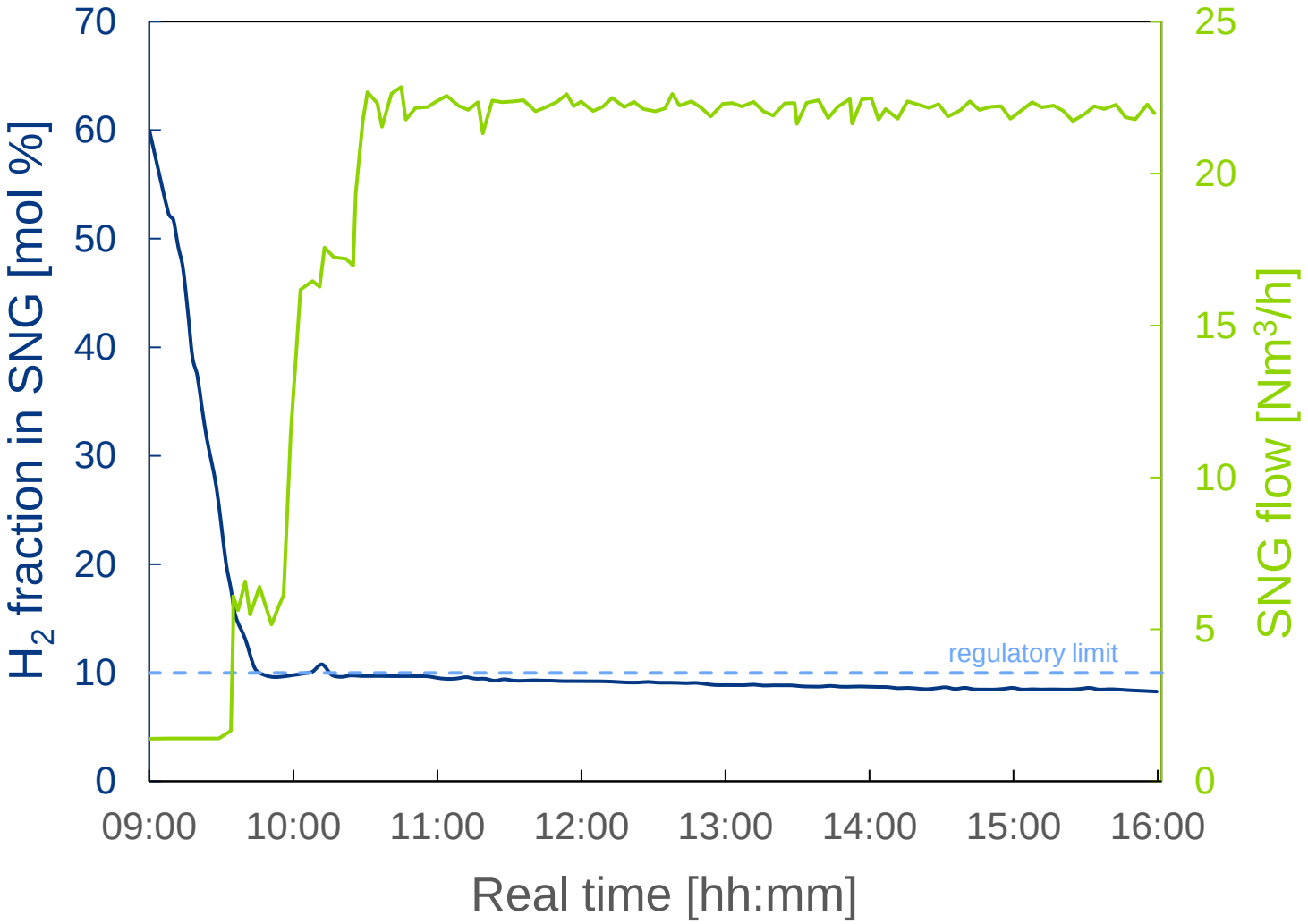


The renewable gas field

HZI technology

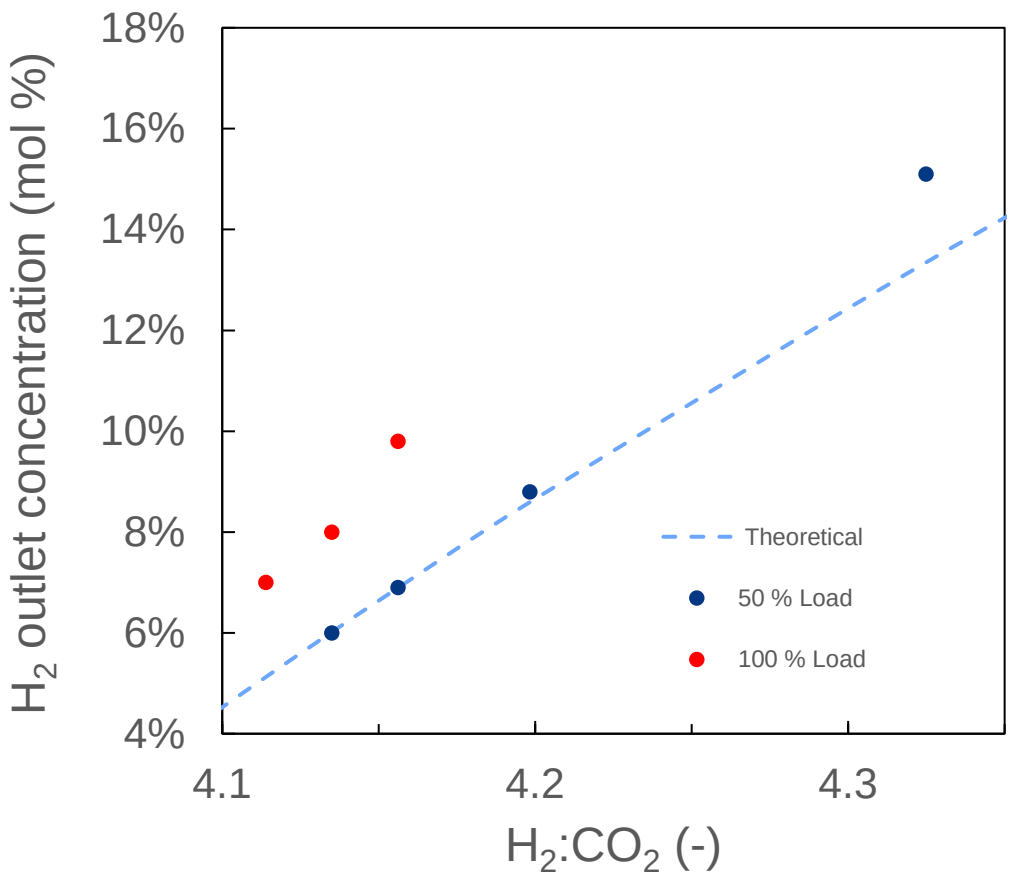
Results from operation

Long run results



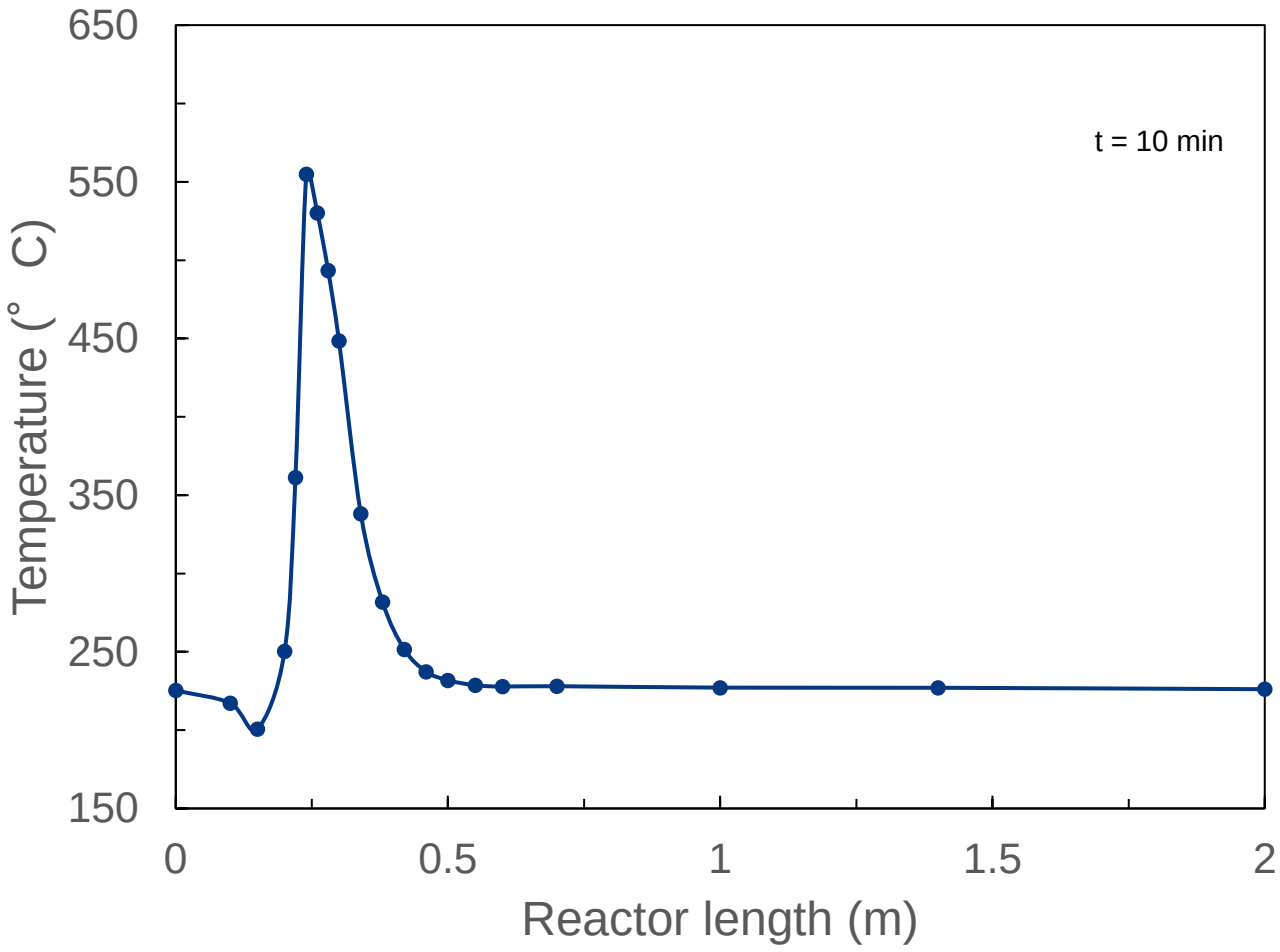
- Target: max. 10 vol. % H_2 in the product gas (Austrian regulatory limit)
- Reaction operated in excess H_2 to avoid catalyst coking
- CO_2 concentration is low (almost full conversion)
- Gas produced is constantly on spec
- Production of approx 22 Nm^3/h SNG

Effect of load/stoichiometry

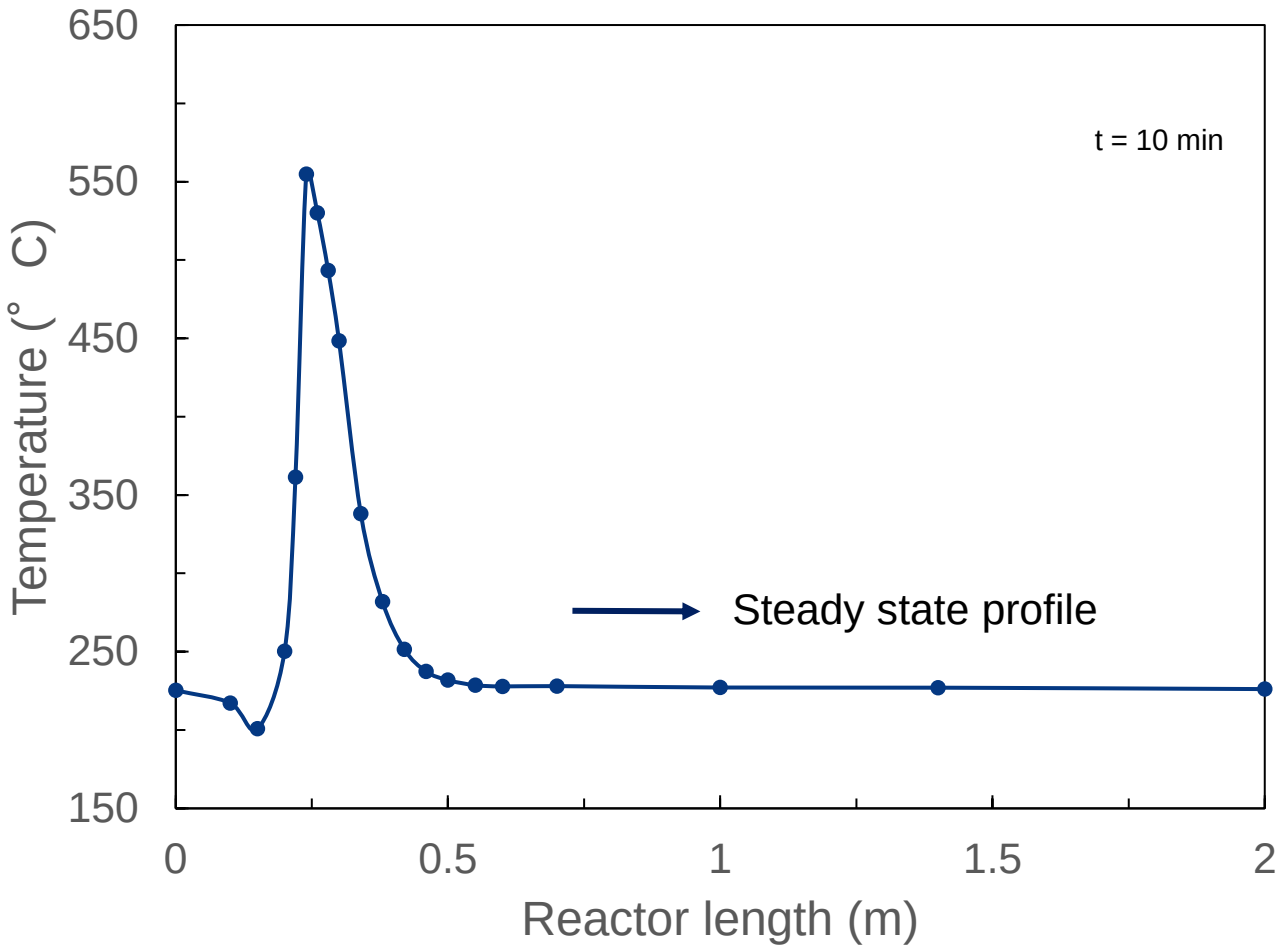


- At 50 % load, the results correspond to the stoichiometric limit
- At 100 % load, the measured value is ca. 2 % higher than theoretical limit
- The specification is achieved in practically all the points investigated
- If H_2 conversion should be increased, it is possible to decrease the excess H_2
- In practical cases H_2 excess should be tailored to ensure catalyst durability and fulfilment of the specifications

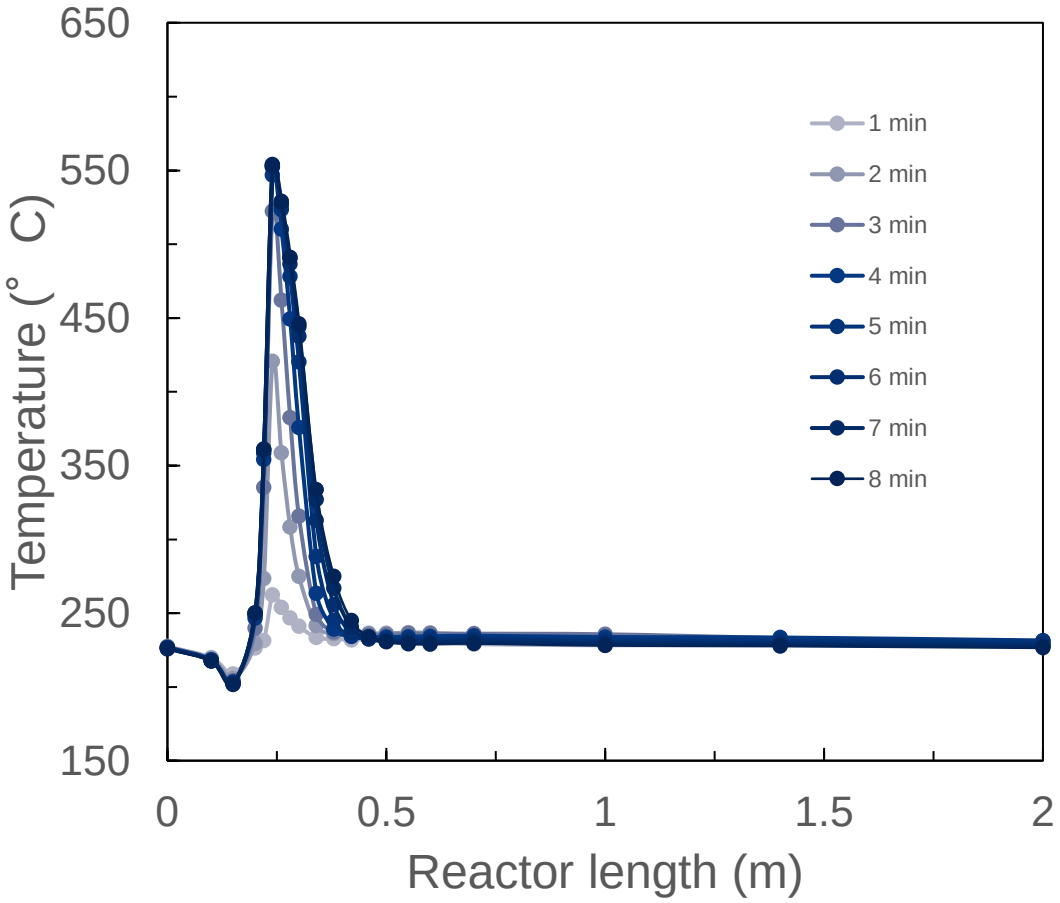
Reaction activation



Detailed analysis

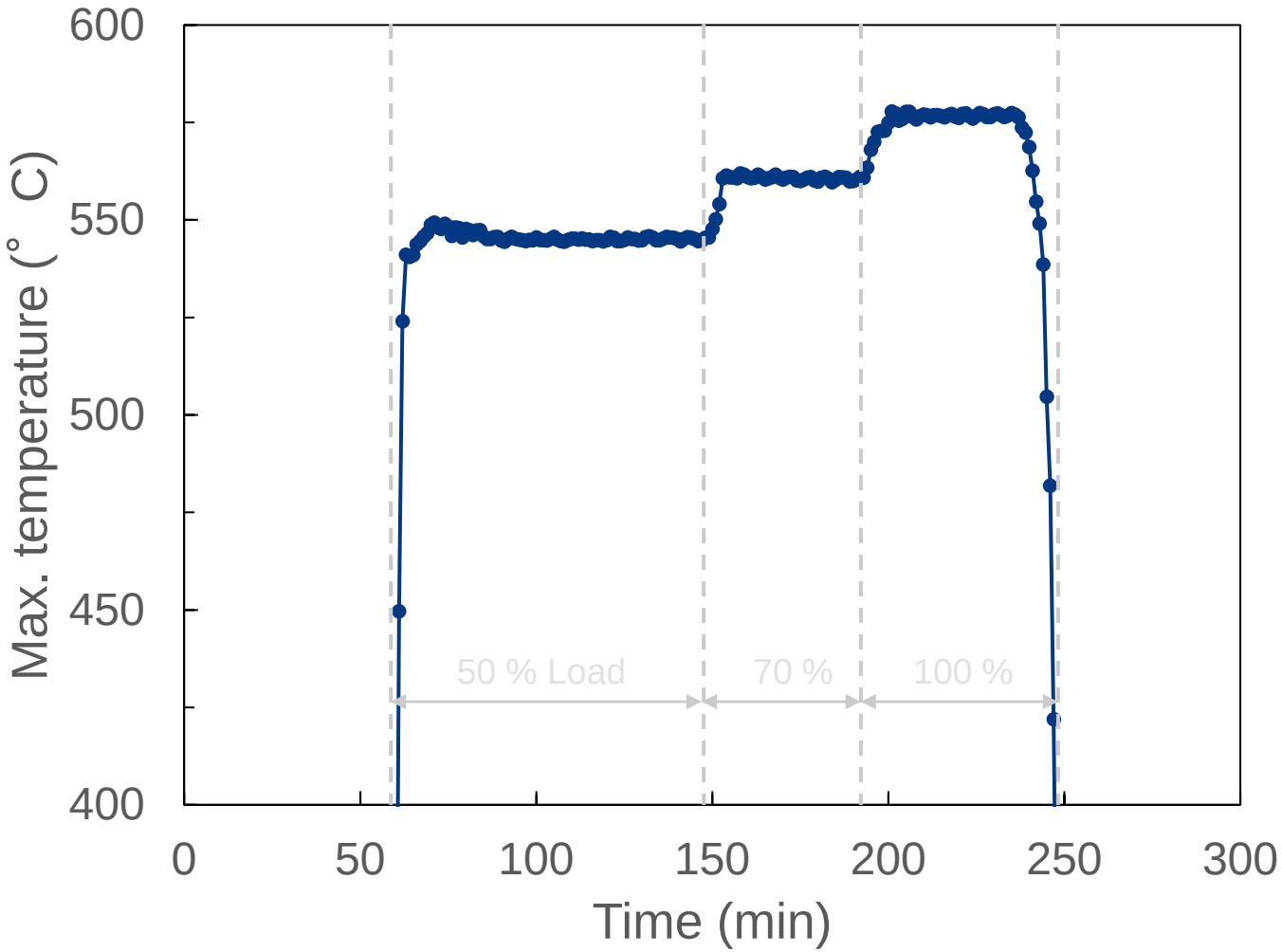


Reaction activation at a glance



- Activation occurs in ca. 10 minutes
- Hotspot formation is immediate
- Progressive increase of the hotspot area
- At steady state, hotspot area limited to ca. 25 % of the reactor length
- Max. temperature ca. 560 ° C

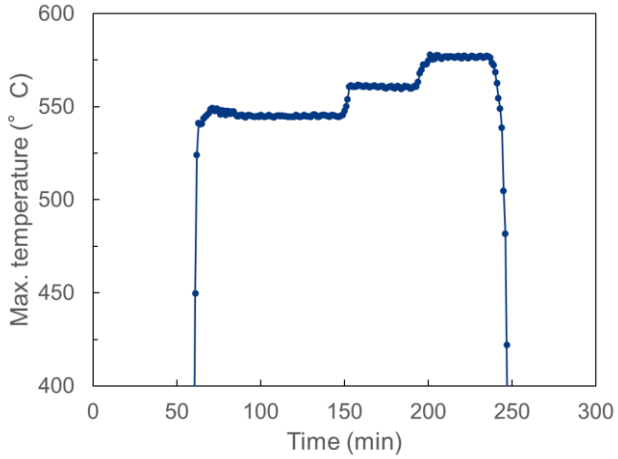
Evolution of max. temperature



- Max temperature increases with load
  - Increased heat production
- Max temperature location shifts down with load
  - Effect of convection
  - Increased effect of axial dispersion
- Quick adaptation to the new load case

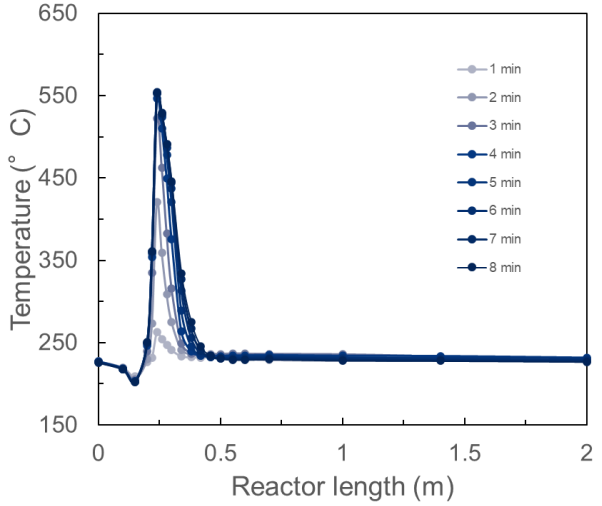
Conclusion dynamics of activation

- Quick activation from hot standby (ca. 10-15 min)



- Formation of cold spot at inlet
  - Convective flow of cold(er) gas
  - Larger extent with larger flow

- Hotspot position moves towards the end of the reactor with higher flow
  - Better heat transfer (convection)
  - Larger heat production



- Maximal temperature remains in the safe range in all cases (< 600 ° C)

Outlook – where are we going?

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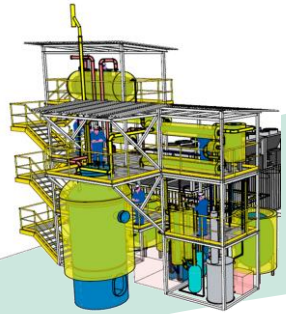
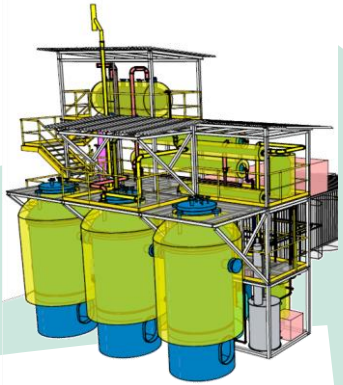
Pre-industrial demonstators
[50 Nm³ Feed/h]
[10 Nm³ SNG/h]

Lab-scale evidences

1st commercial plant



Upscaling to industrial scale
[2000 Nm³ Feed/h]
[400 Nm³ SNG/h]



Full scale plant
Engineering, Procurement
And Commissioning

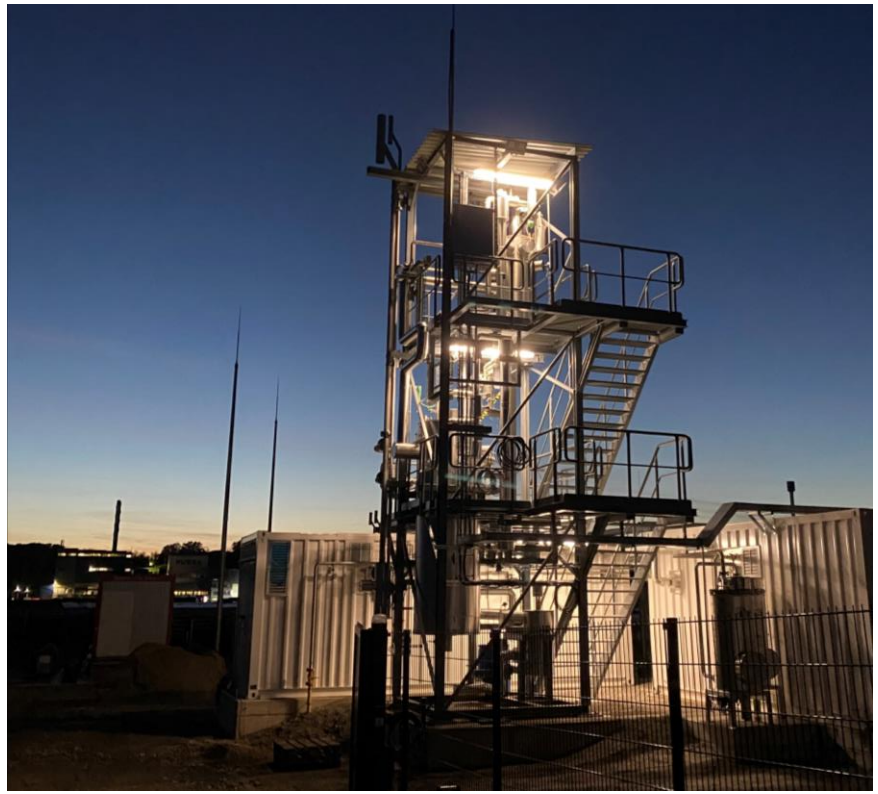
Series production

Technology validation
Data for upscaling & engineering
Operation experience

Acknowledgments

Power-to-Gas teams from:

- ❑ Hitachi Zosen Inova AG
- ❑ Hitachi Zosen Inova Biomethan GmbH
- ❑ Hitachi Zosen Inova Etogas GmbH
- ❑ Hitachi Zosen Corporation



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Thank you for your attention!