

Gobigas project: Wood gasification to biomethane

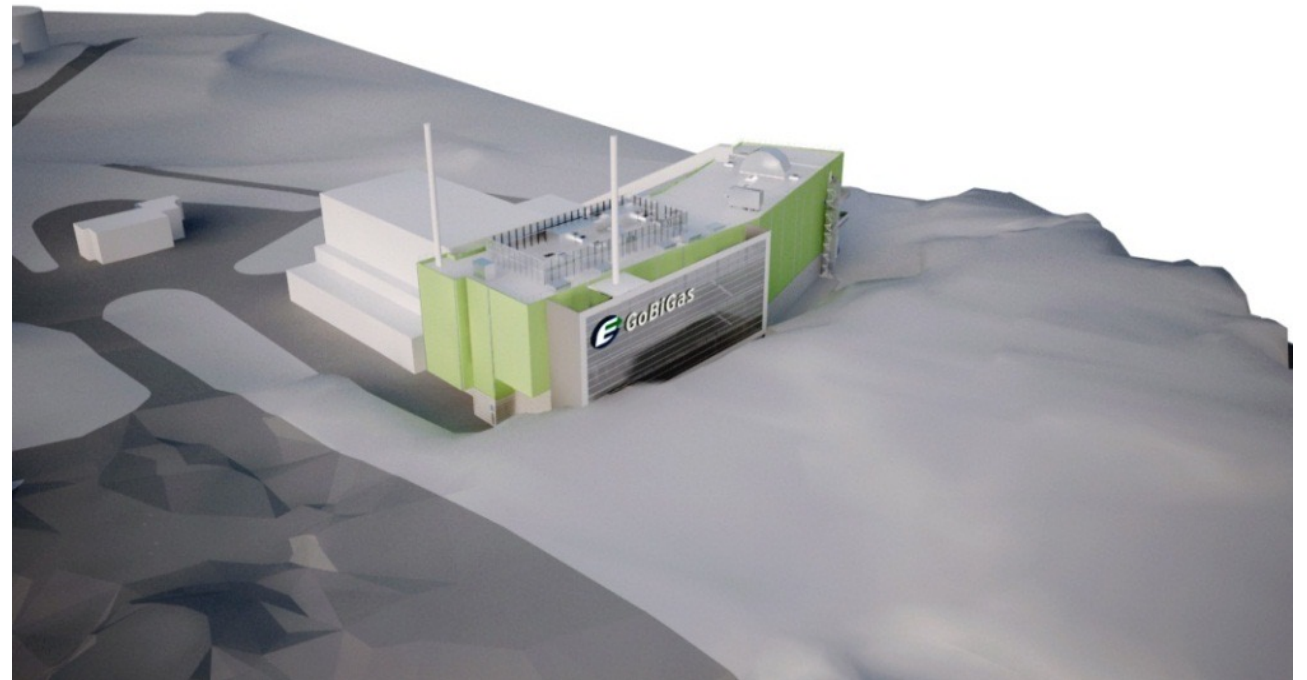
Prof. Henrik Thunman, Chalmers University of Technology

GoBiGas – First-of-its-Kind

- First in the world for high quality biomethane from biomass through gasification



- First Swedish plant to inject biomethane into the national grid

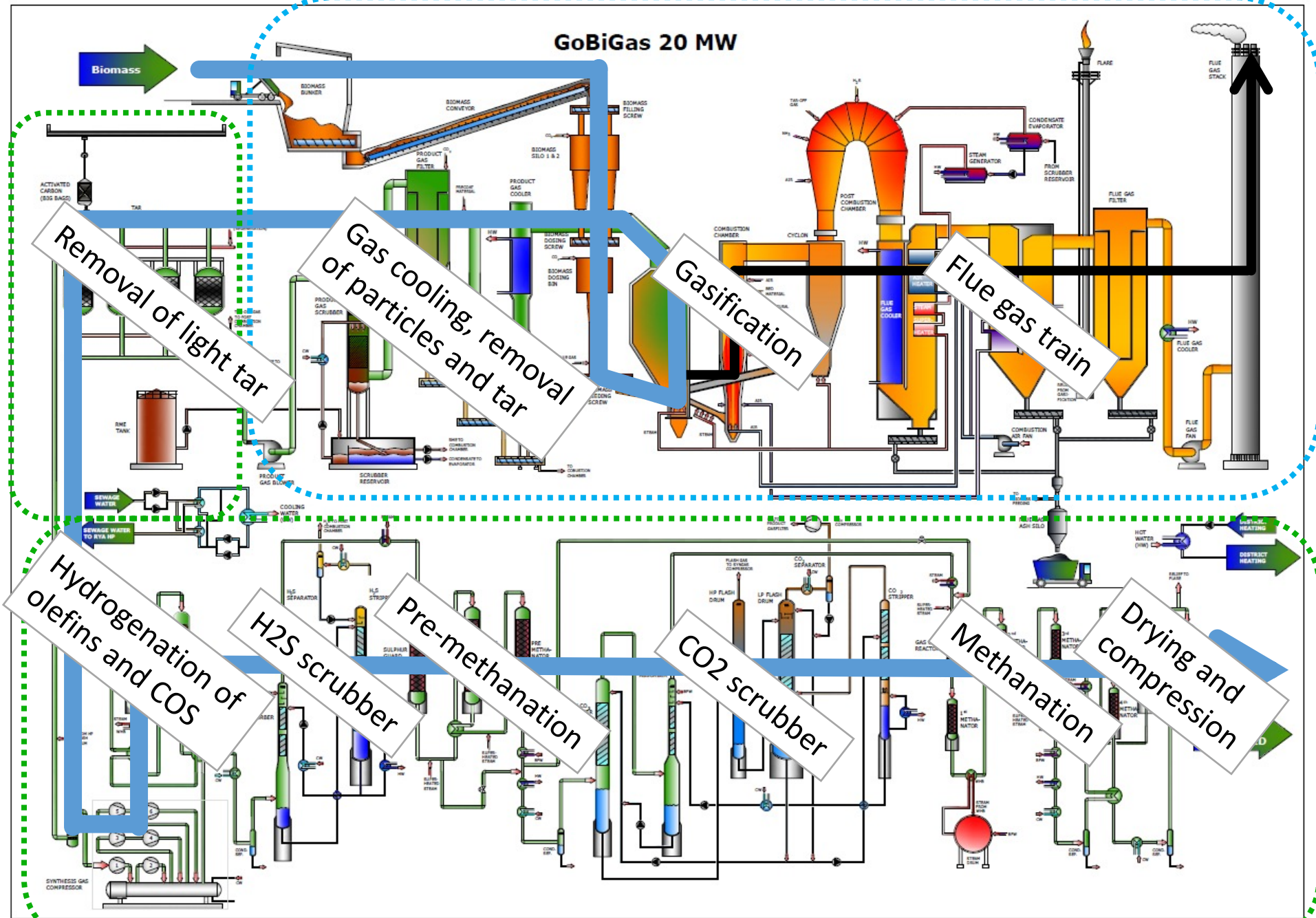


Gothenburg Biomass Gasification Project (GoBiGas)



- Two phases:
 1. 20 MW Biomethane
(32 MW fuel, 6 dry ton biomass/h)
 2. 80 – 100 MW Biomethane
(125-150 MW fuel 25-30 dry ton biomass/h)
- Phase 1, demonstration, to build experience for the second commercial phase
- Performance goal of demonstration
 - Biomass to Biomethane ≥ 65 %
 - Biomass to Energy ≥ 90 %
 - 8,000 hours continuous operation per year

GoBiGas 20 MW

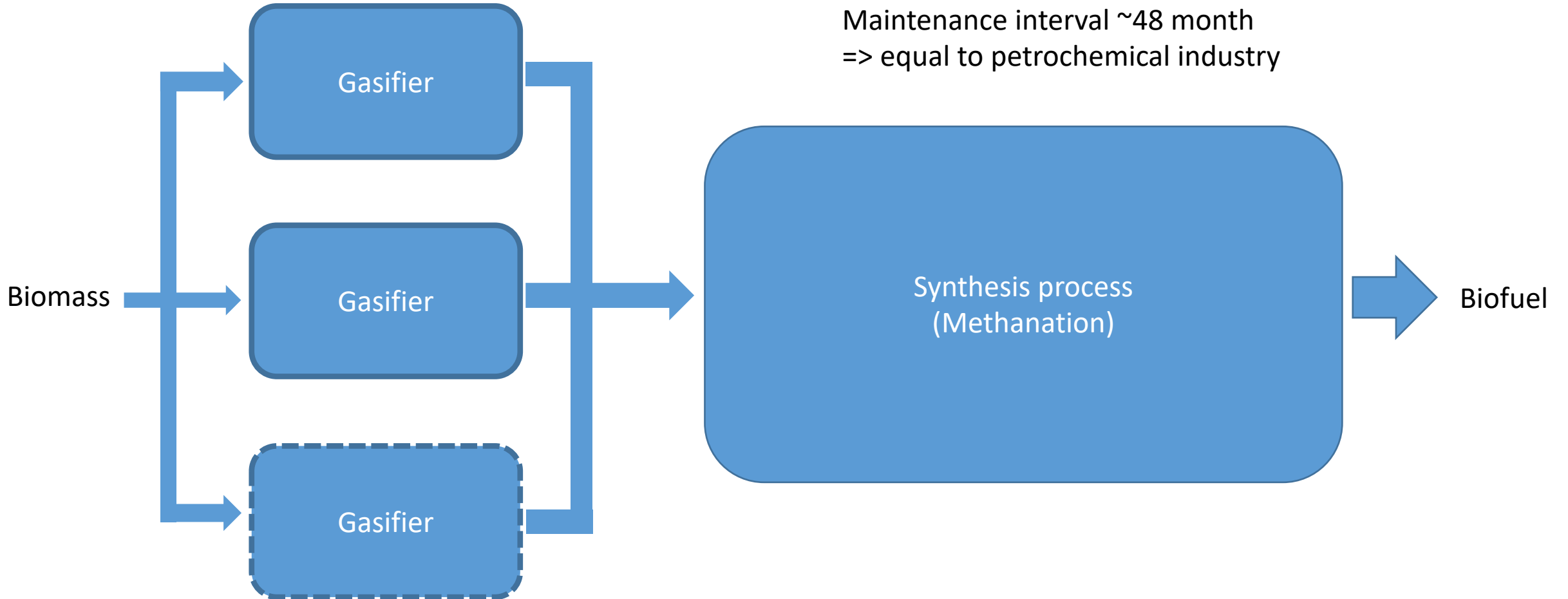


Flue gas

Biomethane

Commercial plant

Maintenance interval 12-18 month
=> equal to forest industry



GoBiGas - The Partners



Development of Gasification technology

Retrofit of commercial designs of fluidized boilers



2-4 MW

Gothenburg



2 MW

Yokohama



15 MW

Kujan Indonesia

Target

Production of
Fuels, Materials,
Chemicals
>100 MW

Upscaling of dedicated gasification design



32 MW

Gothenburg



8 MW
Güssing

FIRST GENERATION



8.5 MW
Oberwart

SECOND GENERATION



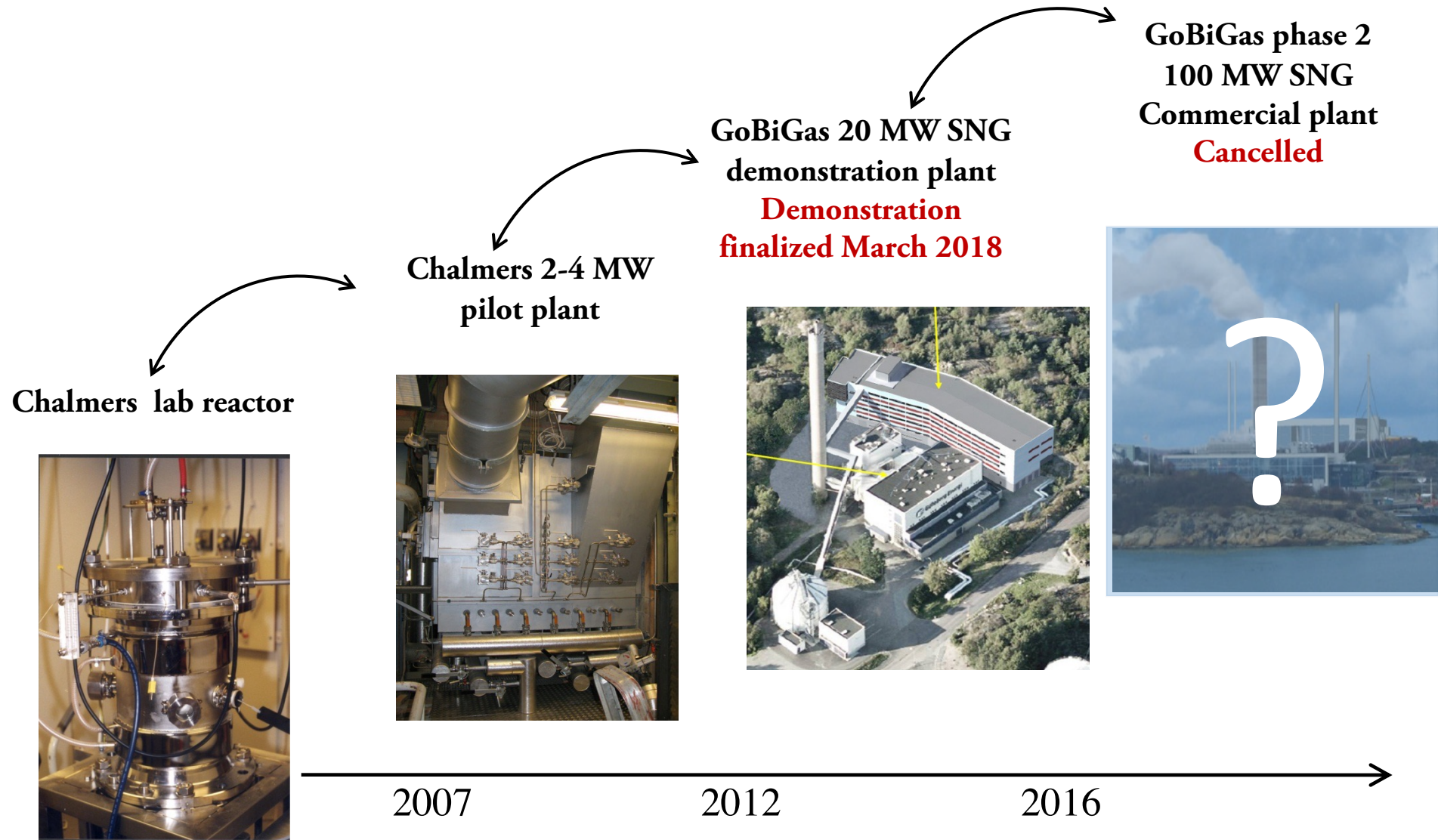
15 MW
HGA Senden

THIRD GENERATION

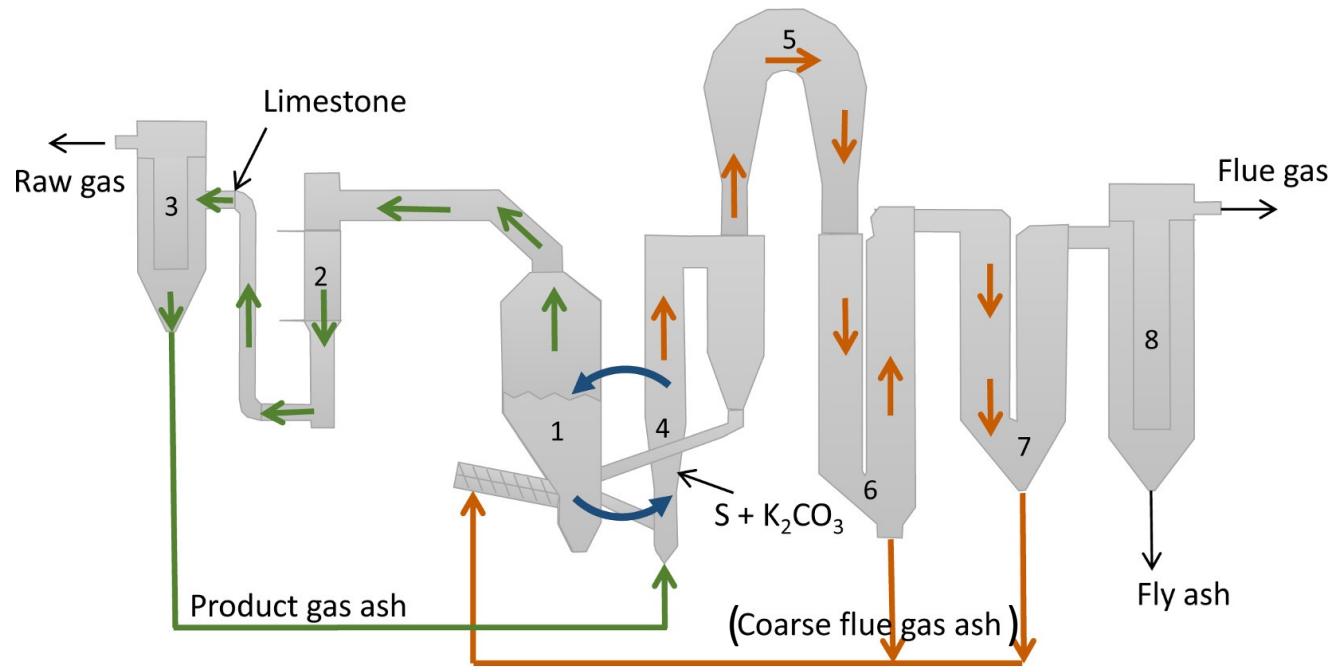
Target

Decentralized
Heat and Power
Production
<50 MW

Handling of uncertainty related to the gasification

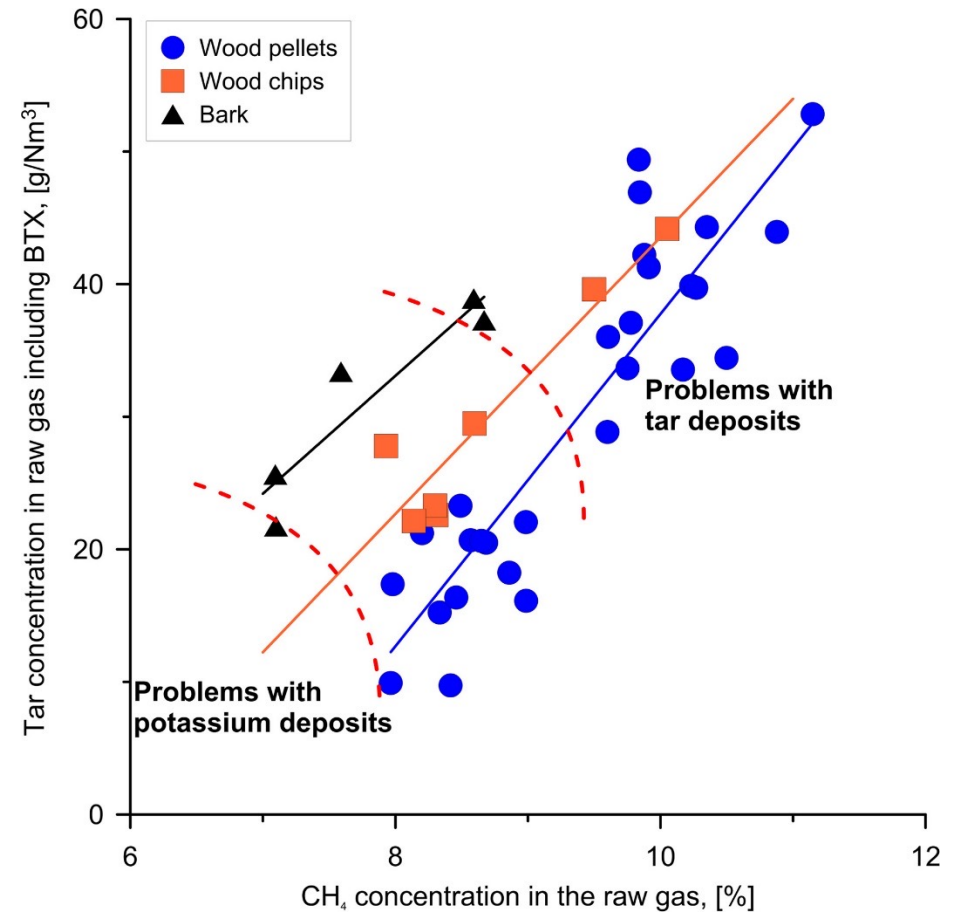


Control of the Gasification Process



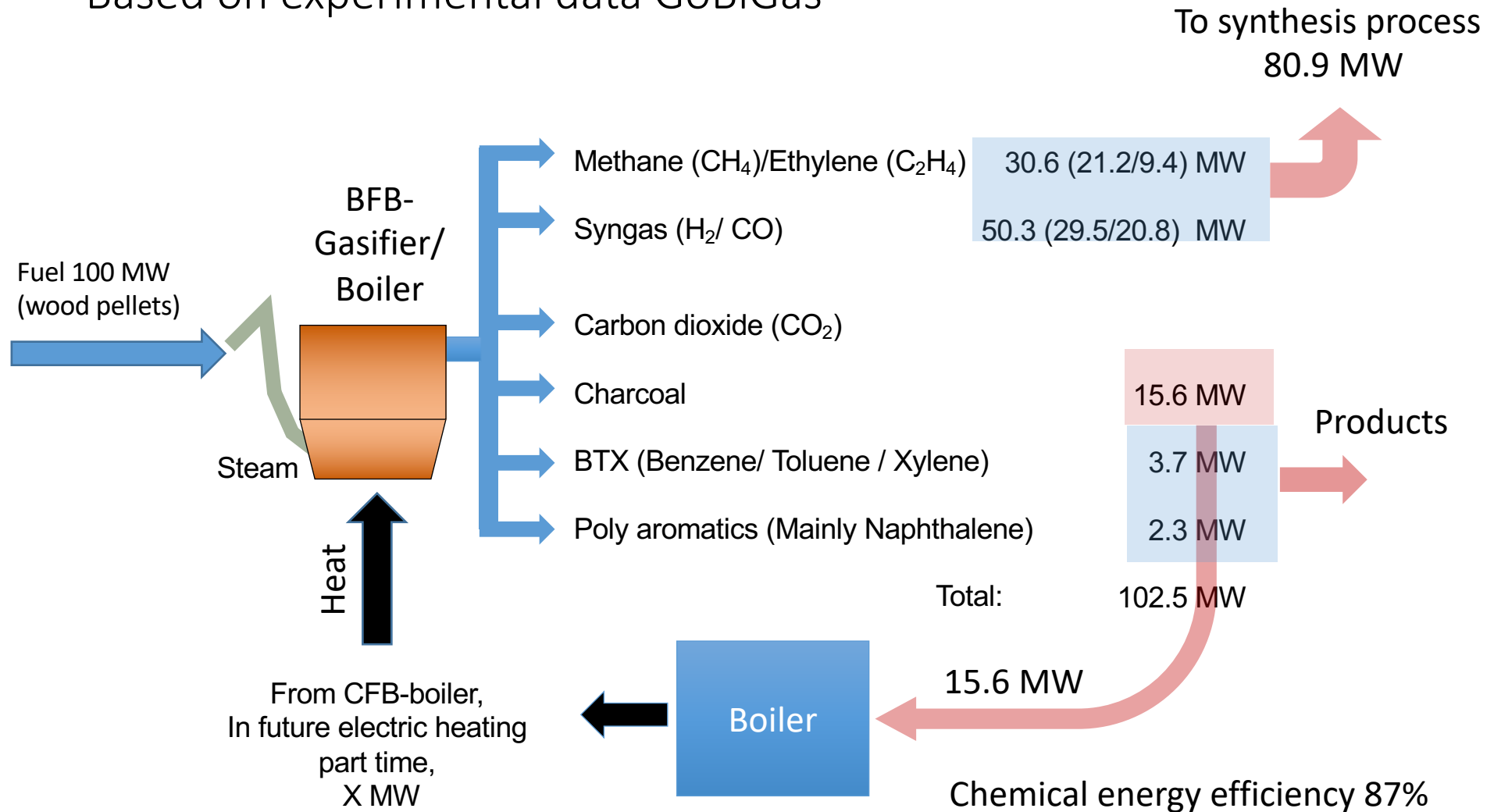
- 1 Gasifier
- 2 Product gas cooler
- 3 Product gas filter
- 4 Combustion chamber

- 5 Post combustion chamber
- 6 Convection path and flow reversal space
- 7 Convection path and flow reversal space
- 8 Flue gas filter

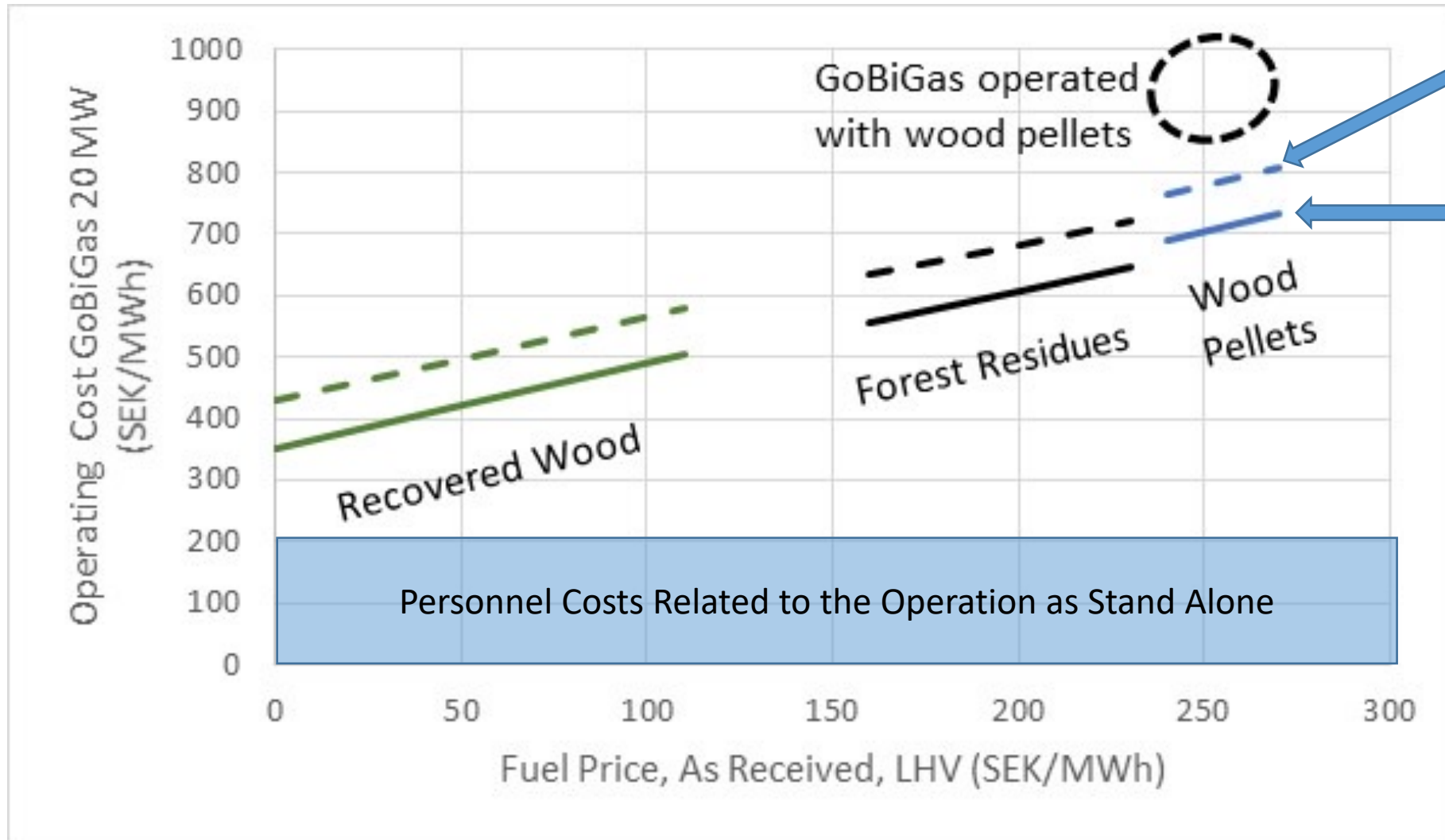


Performance of the Gasification - Optimized Commercial Process

Based on experimental data GoBiGas



Operating Cost, Demonstration Unit



With identified modification of existing process

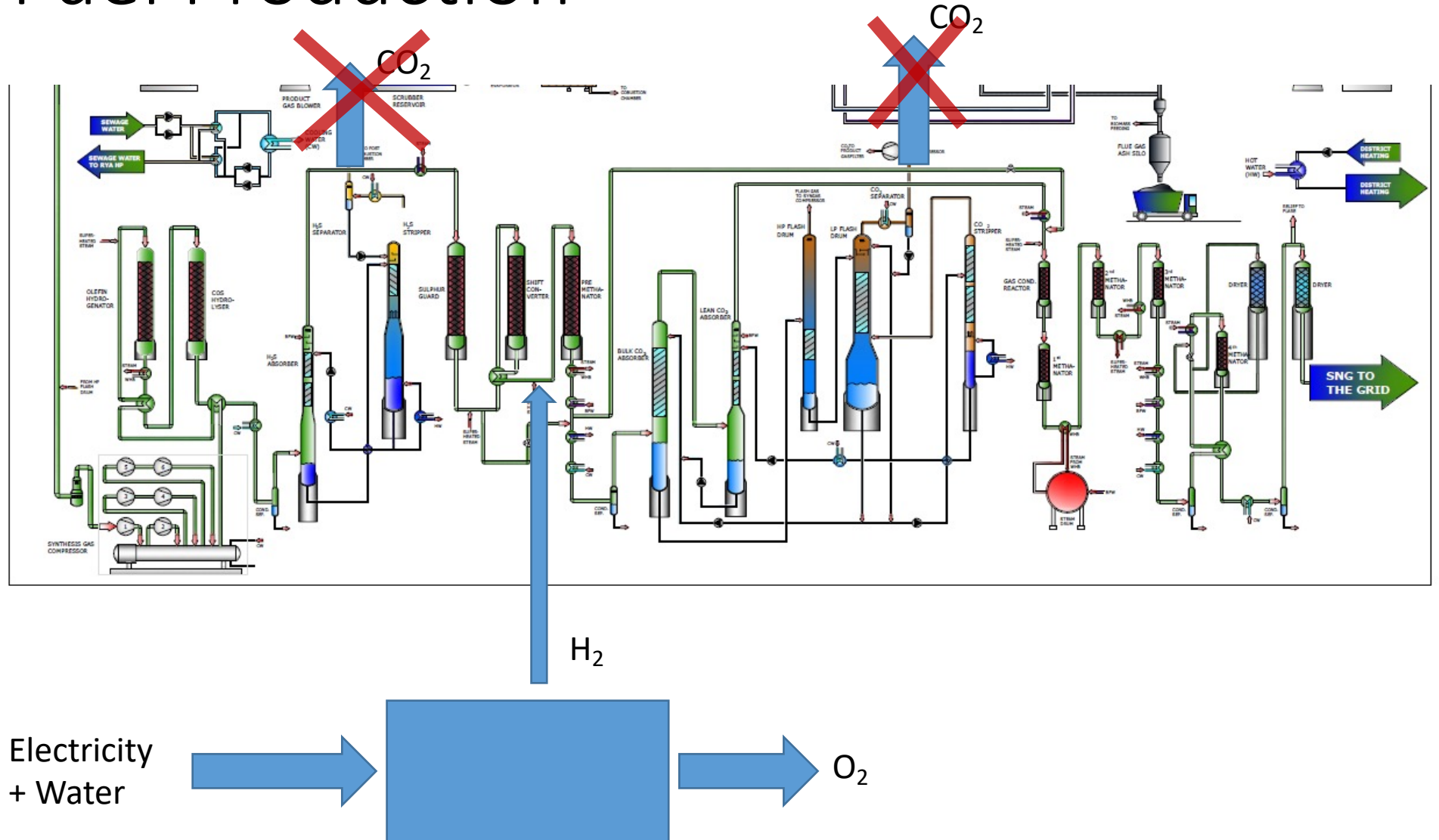
With identified modification, new plant

10SEK ~ 1€

Production Costs for a Commercial Plant

| | Commercial plant 20 MW SEK/MWh (€-cent/liter gasoline eq.) | | Commercial plant 100 MW SEK/MWh (€-cent/liter gasoline eq.) | | Commercial plant 200 MW SEK/MWh (€-cent/liter gasoline eq.) | |
|--|--|---------|---|--------|---|--------|
| Capital cost, depreciation | 430 | (38.7) | 199 | (17.9) | 145 | (13.1) |
| Capital cost, interest (5%) | 258 | (23.2) | 120 | (10.8) | 87 | (7.8) |
| Development cost | 43 | (3.9) | 20 | (1.8) | 15 | (1.4) |
| Operation costs (excluding feedstock) | 352 | (31.7) | 166 | (14.9) | 132 | (11.9) |
| Feedstock Cost | 217 | (19.5) | 217 | (19.5) | 217 | (19.5) |
| Total cost | 1300 | (117.0) | 722 | (65.0) | 596 | (53.6) |

Electro Fuel Production



Conclusions

- Demonstration met all pre-set performance goals and made the technology ready for commercial implementation
- Demonstration has provided vital information on how to operate the gasification section in an industrial scale
- Demonstration plant could not reach commercial break-even 2018 and was therefore mothballed, Autumn 2021 the disassembly of the plant began