

The logo for AMMONGAS features the word "AMMONGAS" in a bold, blue, sans-serif font. Above the text is a blue curved line that arches over the letters. The background of the entire slide is a photograph of industrial equipment, including a large stainless steel tank with a curved pipe on top and a metal frame structure, set against a clear blue sky with some light clouds. In the distance, a line of trees and a residential area are visible.

AMMONGAS

Vaasa Gas Exchange – 22/03/2018

Biogas Upgrading

Alexander Ryhl, Sales Coordinator, Engineer

About AMMONGAS



- Engineering company specialized in air and gas purification systems.
- Located in Copenhagen, Denmark.
- Experience in Norway, Finland and Denmark.

- Alexander Ryhl
 - Sales Coordinator, Engineer.
 - Global Business Engineer, DTU
 - Ammongas since 2016.



Biogas upgrading



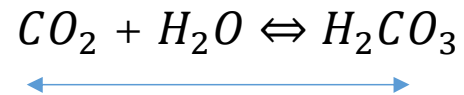
bio-methane treatment

- Presurless system.
- Low power consumption.
- High CO₂ separation efficiency –Meaning high CH₄ purity .
- Methane slip below 0,1%.
- No pre-treatment of raw biogas (H₂S, VOC etc.)
- Removes 99% of H₂S along with the CO₂.
- CO₂ can be used for other applications.

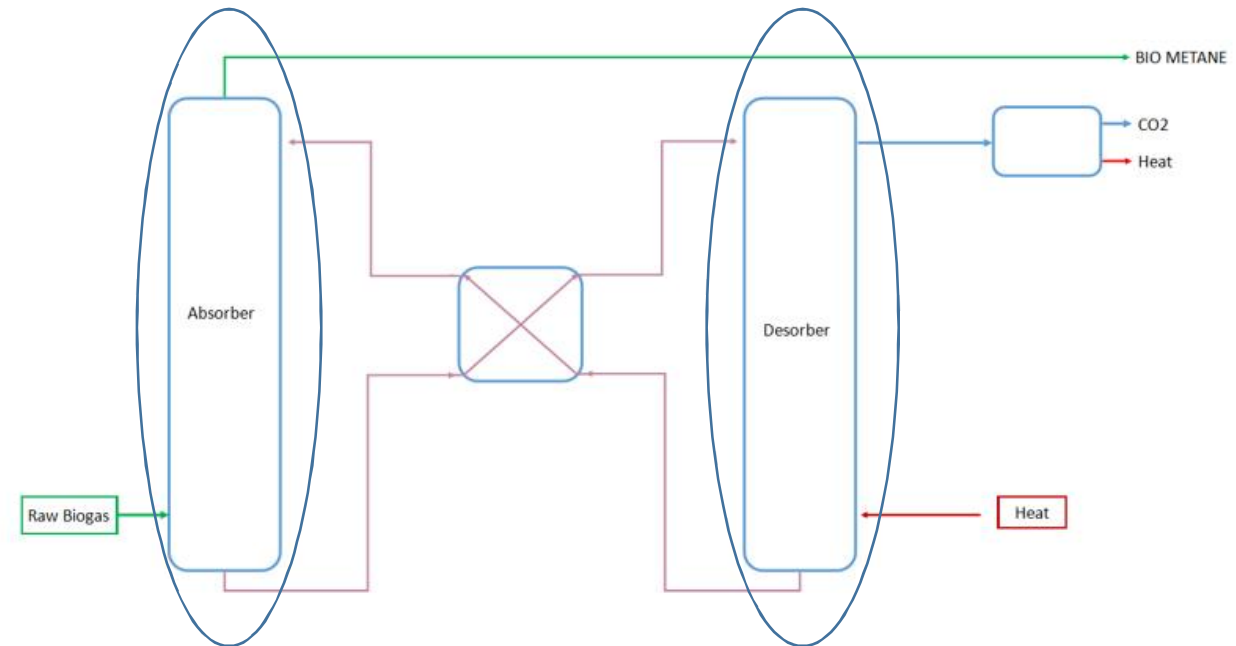
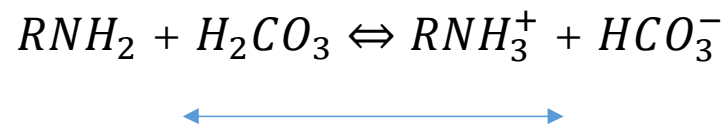
Biogas upgrading

- Absorption/desorption of CO₂ using amines .

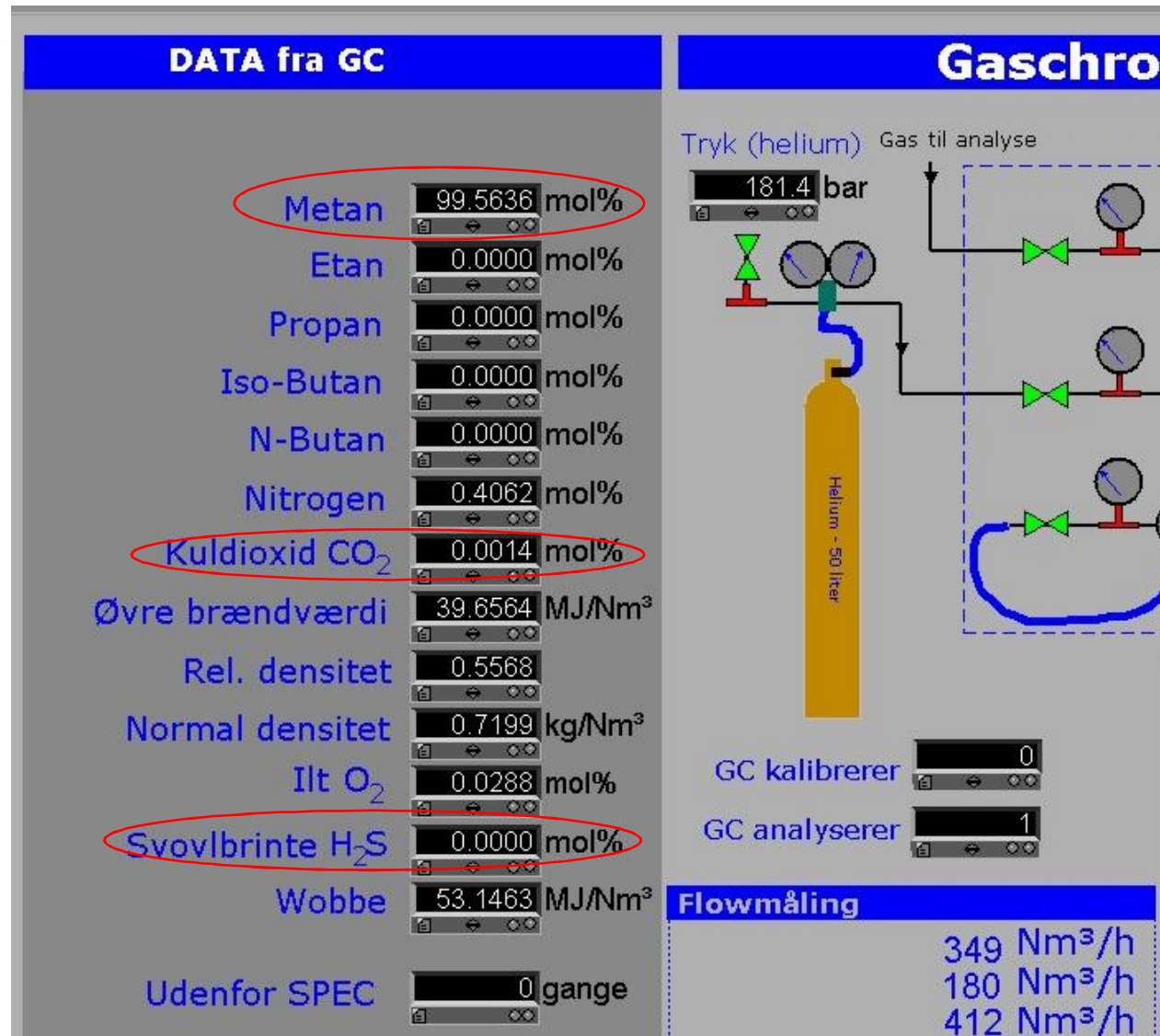
- CO₂ reaction with water -> carbonic acid.



- Carbonic acid reacts with amine.



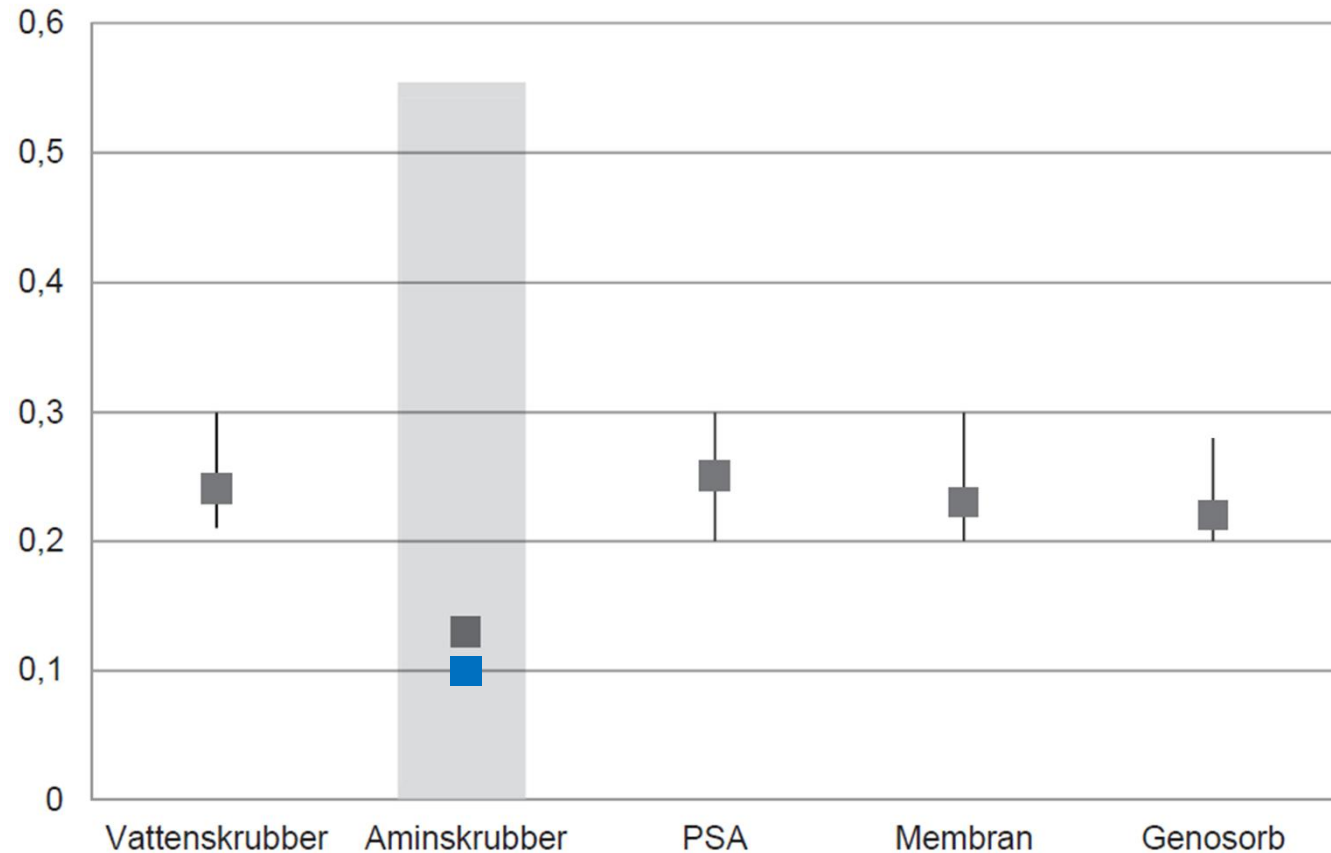
Bio-methane purity



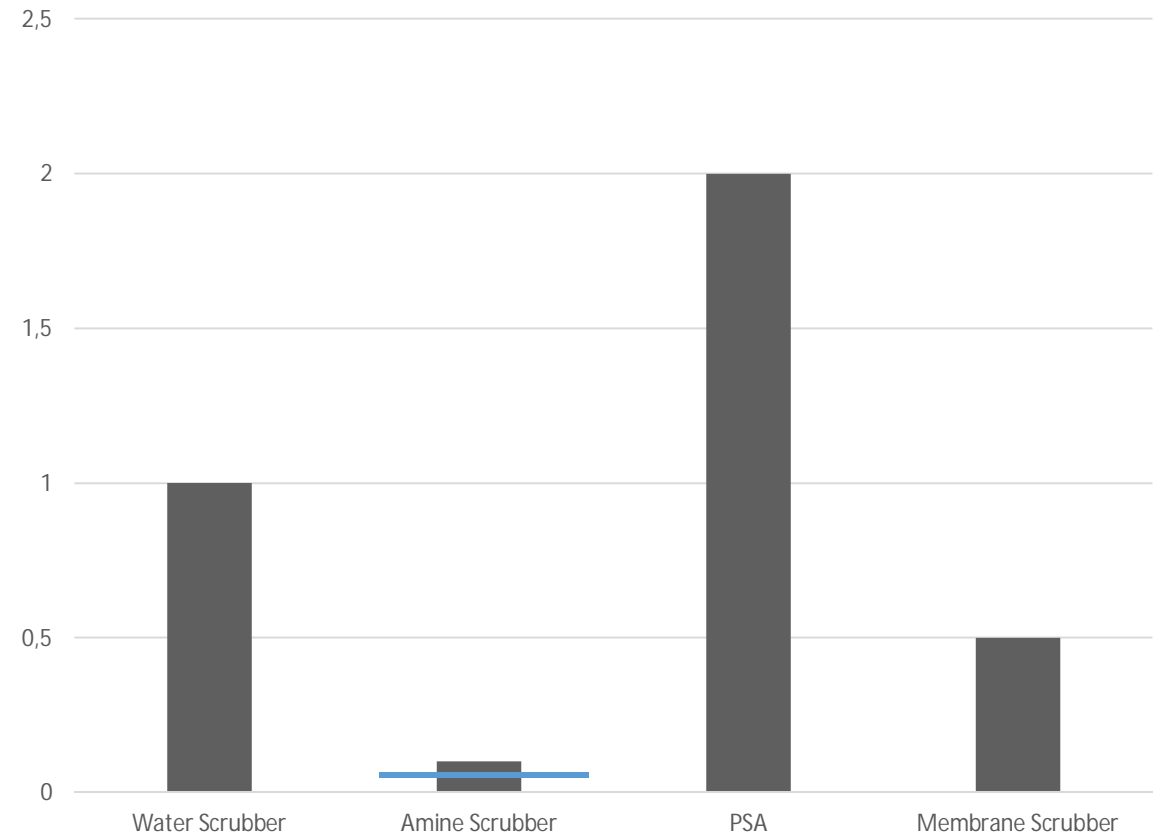
- CH₄: 99,56mol%
- CO₂: 0,0014mol%
- H₂S: 0,000mol%

Biogas upgrading

Power consumption[kWh/Nm³]

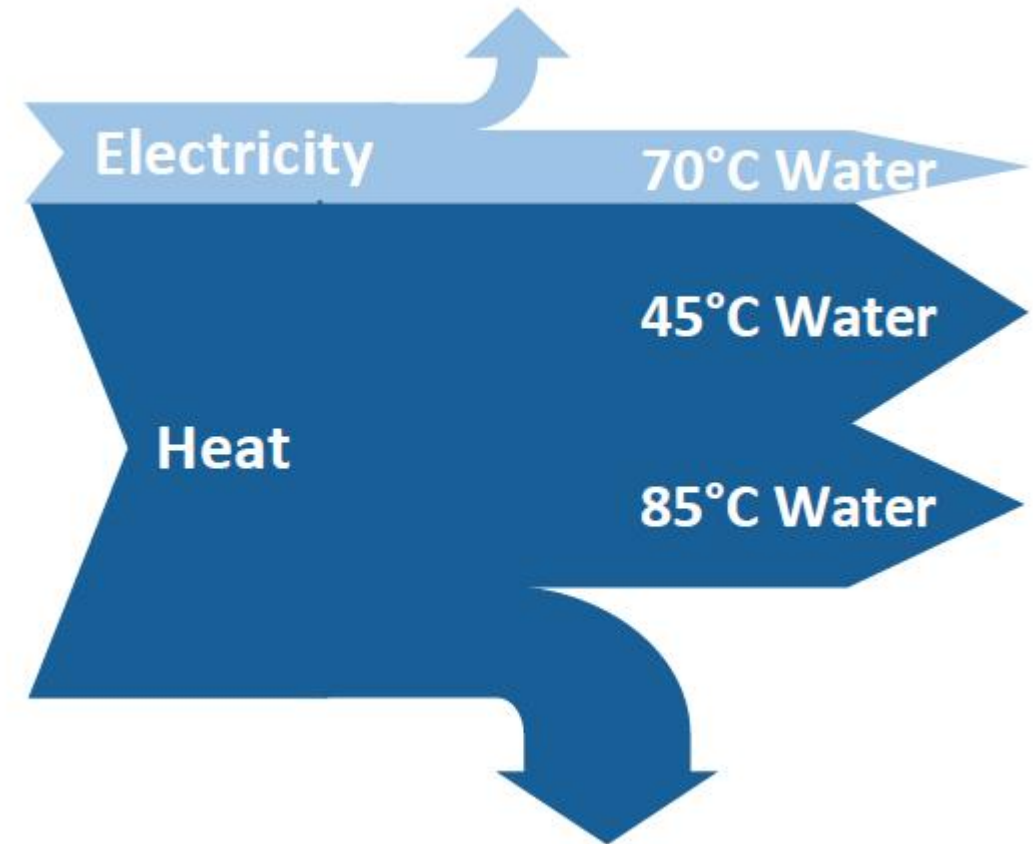


Methane slip %

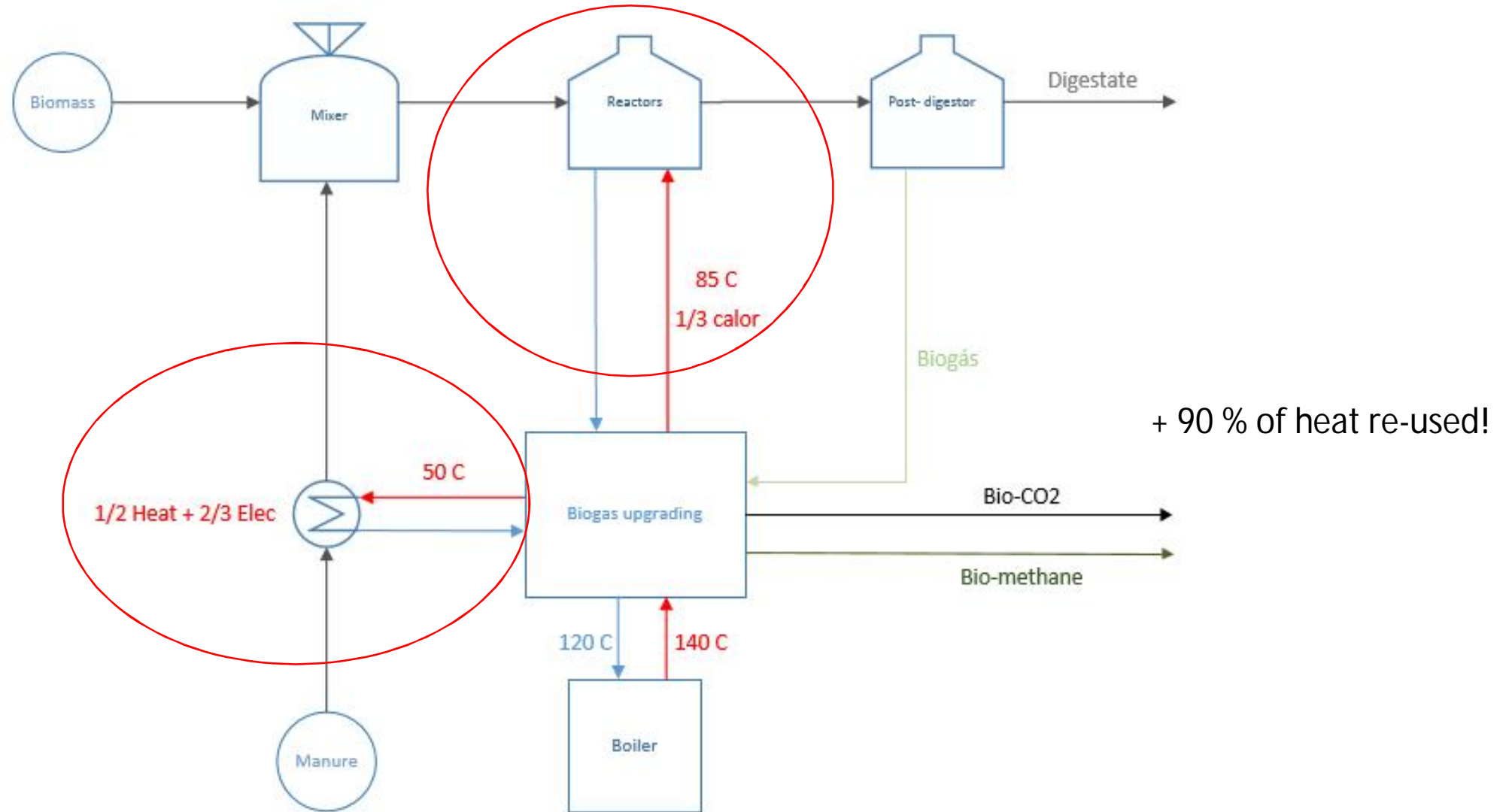


SGC Rapport 2013:270

- Consumed heat in desorption can be re-used in the biogas plant



Heat recovery



Heat recovery



High temperature heat

Biomass heat exchanger

Heat recovery



→ Biomass heat exchanger

Modular design



Bio-methane uses



Transport



Injection to natural gas grid

Hashøj Dk 250 m³/h



- Pilot plant.
- Commissioned in 2011.
- Currently used to test new solvents and working conditions.
- We have a close cooperation with costumers and suppliers to continuously improve our systems.

Ammongas 300m³/h



Hamar, Norway

Stormossen, Finland



Ammongas 600m³/h



Frevar, Norway

Ammongas 1200 - 1500m³/h



Skive, Denmark



Ivar, Norway



Ammongas 3000m³/h



Horsens, Denmark

References



- | | | |
|------------------------------|------------------------------------------------------|---------------------------------|
| • Hashøj, Denmark, 2011 | 250Nm ³ /h: Biogas plant: | Pilot plant. |
| • Fredrikstad, Norway, 2013: | 600Nm ³ /h: Waste water and biogas plant: | Local transportation use. |
| • Skive, Denmark, 2014: | 1.200Nm ³ /h: Biogas plant: | Injection to natural gas grid . |
| • Hamar, Norway, 2015: | 300Nm ³ /h: Waste water plant | Local transportation use. |
| • Horsens , Denmark, 2015: | 3.000Nm ³ /h: Biogas plant: | Injection to natural gas grid. |
| • Stavanger, Norway, 2016: | 1.500Nm ³ /h: Waste water plant | Injection to natural gas grid. |
| • Stormossen, Finland, 2017 | 300Nm ³ /h: Biogas plant: | Local transportation use. |
| • Avedøre, Denmark, 2017 | 500Nm ³ /h: Waste water plant | Injection to natural gas grid. |
| • Vrå, Denmark, 2017 | 3000Nm ³ /h: Biogas plant: | Injection to natural gas grid. |
| In process: | | |
| • Månsson, Denmark, (2018) | 1.500Nm ³ /h: Biogas plant: | Injection to natural gas grid. |
| • Grønhøj, Denmark, (2018) | 1.500Nm ³ /h: Biogas plant: | Injection to natural gas grid. |
| • Ribe, Denmark , (2018) | 2250Nm ³ /h: Biogas plant: | Injection to natural gas grid. |
| • Iglshøj, Denmark, (2018) | 1.500Nm ³ /h: Biogas plant: | Injection to natural gas grid. |
| • Storde, Denmark, (2018) | 1.500Nm ³ /h: Biogas plant: | Injection to natural gas grid. |

