GoBiGas
Technical successes and economic challenges
GoBiGas – Pioneering New Technology

• The world’s first plant for bio-methane from biomass through gasification
• Injects bio-methane into the transmission grid, potentially reaching all of Europe
GoBiGas - Partners

Swedish Centre for Biomass Gasification (SFC)
R&D gasifier 2 MW
Prof. Henrik Thunman
~ 20 PhD students

Eric Zinn EPTP 160621
The GoBiGas project

- The first plant in the world to produce bio-methane from biomass continuously through gasification
  - Using forest residues as feed stock
  - Polygeneration – producing fuel and heat
- Injects bio-methane into the transmission grid for:
  - Vehicle fuel
  - Fuel to CHP or heat production
  - Feedstock to process industry
- Commercializing the technology in two phases:
  - Phase 1 - 20 MW demo plant, partly financed by Swedish Energy Agency
  - Phase 2 - 80 – 100 MW commercial plant, when the technology is proven in phase 1 and the market conditions are sufficient
  - Phase 2, a selected project by the EU Commission in NER300 but is currently not being developed.
The GoBiGas sites for Phase 1 & 2

Overall performance goals
- Biomass to bio-methane > 65 %
- Energy efficiency > 90%
- Planned operation 8000 h/year

Production in Phase 1
Bio-methane 20 MW
160 GWh/yr ⇔ 2200 Nm^3/hr
District Heating 50 GWh/yr

Consumption
Fuel 32 MW
Electricity 3 MW
RME (bio-oil) 0.5 MW
Check out the video! http://goteborgenergi.streamingbolaget.se/video/156153/link
Technical successes
Unexpectedly high levels of tar in product gas
How did we reduce tars?

• Activate the olivine sand (Mg, Si, Fe)!
• What makes the olivine “active”? How is this activity achieved?
• Addition of K₂CO₃ activates olivine

<table>
<thead>
<tr>
<th></th>
<th>Before K₂CO₃</th>
<th>After K₂CO₃</th>
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</thead>
<tbody>
<tr>
<td>Total tar* (g/m³)</td>
<td>43.1</td>
<td>13.1</td>
</tr>
<tr>
<td>Total tar, excl. BTX** (g/m³)</td>
<td>21.8</td>
<td>4.4</td>
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Fresh olivine

Used olivine

Used olivine after K₂CO₃

Analysis: Dr. Pavleta Knutsson

Analysis: Dr. Pavleta Knutsson

Analysis: TOP ANALYTIC, BSE-image

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Problems with screw conveyor

Maintenance stop
Improving the screw conveyor technique

Pictures: Dr. Claes Breitholtz, Valmet Power AB
GoBiGas - status

• 29 GWh biogas delivered in total in 2015.
• 26,5 GWh delivered to transportation, 74 % CO2 reduction (RED).
• Record of two months of continuous delivery of bio-SNG.
• 100 % capacity in gasification.
• 80 % capacity in methanation due to high levels of benzene.
• Currently changing feedstock to wood chips.
GoBiGas - status

Gasification in operation >7500 hours

Availability, gasification process

Operational time per run [hrs]

Accumulated operation [hrs]
GoBiGas - status

Total delivery 44 GWh of which 41 GWh since Aug 2015

CH4 96.5-97.5%
N2 0.6-0.8%
H2 2%
CO2 0-0.5%

HH value 10.8 kWh/Nm3 (spec 10.1-13.2)
Wobbe Index 14.6 (spec 13.6 – 15.8)
Commercially viable?

• Possibly in DE, NL, FR, IT, UK, DK – which all have ambitious support schemes which include biogas and/or bio-SNG.

• Currently not in SE, where we await long-term regulations and support schemes for biogas.

The Swedish government knows that bio-SNG needs to be a part of its targets.
Conclusions

• GoBiGas is now online

• Major hurdles have been solved in the gasification stage and the gasifier now operates at full load.
  - Alkali needs to be in balance to achieve sufficient reduction and simplification of tars
  - Fuel feeding into the bed needs attention and reconstruction is probably required to enable 8000h/year operation

• Optimization of carbon beds for benzene removal now restricts the unit to go to full load
  - Condensation and heat recovery

• Expecting challenges with chips
  - Moisture, impurities, etc.
Thank you for your attention!