Biomethane Production in the UK
including small waste producers

22\textsuperscript{nd} May 2013
Alison Cartwright
alison.cartwright@norfolk.gov.uk
Overview

- Current Projects
- Upgrading options
- What’s happening in Norfolk
- Smaller projects and options
Didcot – UK’s First BtG Project

Flow of biogas - 100 m³/hr
First gas to grid on 3rd Oct 2010
Poundbury

- UK’s first commercial scale biomethane to grid project
- 500 m³/hr into grid (around 1 million therms)
- Membrane CO₂ removal plant
- SGN providing biogas to biomethane conversion service
- Development is a JV between Duchy of Cornwall and some of its tenants
Poundbury
Vale Green near Evesham

- Feedstock: Agricultural
- Biomethane Flow rate: 400m$^3$/hr
- Upgrade plant: membrane (Pentair Haffmans)
- GDN: Wales & West Utilities
- Gas to grid: Q2 2013
Doncaster

- Feedstock: Agricultural
- Biomethane Flow rate: 400m³/hr
- Upgrade plant: membrane (Air Liquide)
- GDN: NG
- Gas to grid: Q3 2013
Injecting into the Grid in the UK

1. Clean-up and upgrading Plant
2. Propane
3. Entry Facility
4. Grid Control

Reject/Recycle
Reject
Technology Review

Main points

• Methane Slip
• CO₂ in final gas (depending on local Calorific Value)
• Power Use
Technology Review (1)

Water Wash:
• 99% of biomethane goes into grid
• Key issue is methane slip
• 14m high towers
• Plant also removes H₂S and siloxanes

Membrane:
• Good technology if can reduce CH₄ in off-gas...new system being installed in UK in 2012 with 99% Ch4 to grid
  • Poundbury
• Membrane with off-gas to cryogenic process also attractive – all gas to grid and liquid CO2 by-product – installed Q2 2013
  • Vale Green
Technology Review (2)

Chemical Wash:
• 99.8% of biomethane goes into grid
• Less propane required
• 14m high towers
• Heat required to regenerate chemicals – good fit with CHP

PSA:
• Many examples in Germany
• Issue is with off-gas (as per membrane)
Norfolk County Council

• Carried out a Feedstock Study
• Looking at the feasibility of building an Anaerobic Digester and feeding into the gas grid
• Quantity of guaranteed feedstock an issue for economies of scale and return on investment
• Investigating what vehicles within fleet could be converted to gas vehicles
• Learnings taken from other projects in the UK
  – Injection into the high pressure grid
  – Upgrading technologies
  – Reduction in capital cost of grid injection unit
Other Activities in Norfolk

• Planning permission granted for a gas to grid project in North Norfolk (maize based)
• 13 gas buses running out of Beccles Depot
  – Roof mounted pressurised gas storage
  – 96% fewer emissions in comparison to a Euro 3 engine
  – Quieter running due to less vibrations
Small Waste Producers

- Coming to market smaller upgrading facilities
- Basic models - more plug and play

<table>
<thead>
<tr>
<th>Producer</th>
<th>Range</th>
<th>Cost €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Wash (Chesterfield Biogas)</td>
<td>50m³/hr – 130m³/hr</td>
<td>Between €600,000 and €700,000</td>
</tr>
<tr>
<td>Membrane (DMT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Membrane (Haffmans)</td>
<td>80m³/hr – 130m³/hr</td>
<td></td>
</tr>
</tbody>
</table>
There are practical difficulties running vehicles directly on biomethane because AD production is constant, vehicle fill patterns very lumpy.....in UK use the gas grid
Or – Vehicle fuel + CHP

- Slip-stream model
- Unit upgrades some biogas to biomethane
- 10% methane in offgas – sent back to the CHP
- Cost < €600,000
Raw biogas enters plant

Activated carbon filter
H₂S Removal

The biogas is compressed to 10 bar

Biogas drying

CO₂ Removal

CO₂ discharge system

Biomethane is measured for quality

Biomethane is compressed to 250 bar and stored
Co-operative of farmers

- NNFCC and CNG Services have been awarded funding to assess feasibility of a biogas network
- Have a network of farmers in the North West (Cheshire)
- Looking to have one upgrading station and biogas feeding into it
- This has already been carried out in Sweden
Many thanks

Questions??

alison.cartwright@norfolk.gov.uk