Biomethane Quality & distribution

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Overview

Biomethane ambitions and market

Growth biomethane volume and facilitating growth

Gas grid and gas quality and standards
Biomethane

- Biomethane
  - Upgrading of biogas from anaerobic digestion of wet biomass.
  - Gasification of solid dry biomass.
  - Plant size 20Nm3/hr – 10000Nm3/hr
- Quality of gas fit for public distribution

Gasquality
- Different gas quality standards in EU countries
- Biogas from sources such as sewage sludge and industrial waste is forbidden in some countries
- EU standardization on Nat Gas & Bio methane
Biomethane ambition & market

Ambitions

• Biomethane could deliver more than a third of Europe’s natural gas production or around 10% of the European consumption

• Ambitions Countries: increase production with subsidy schemes, first CHP more & more Biomethane

Economics

• Side effect: Increase in biomass prices

• Biomethane business case competes with CHP and BioLNG

• 40-60 Cts cost of production Nm3

• No subsidy, no biomethane

<table>
<thead>
<tr>
<th>Country</th>
<th>Biomethane plants</th>
<th>Biomethane plants feeding the grid</th>
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</thead>
<tbody>
<tr>
<td>Austria</td>
<td>10</td>
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<tr>
<td>Croatia</td>
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<td>Netherlands</td>
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<td>Poland</td>
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<td>Slovakia</td>
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<td>Sweden</td>
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<td>Switzerland</td>
<td>17</td>
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</tbody>
</table>
Biomethane ambition & market

Market
Search for feasible business cases
Winning cases
- Organic Waste households
- Organic waste food-industry
- Manure + waste streams
- Production Green Gas + CNG or LBG for transport + CO2

Technical Developments
- Manure digestion on micro scale (20m3-60 m3 hour), farm scale (200 cows)
- Upscaling: Biogas hubs + larger plants
- Upgrading technologies (cryogenic)
- Biogas hubs: separate biogas grid with central upgrading unit to create biomethane
Feed in: for example Max 1200 M3/hr. (small City)
Agricultural area’s much lower.
Average size plant ca. 300-400 m3/hr.
Feed-in capacity is limited, often one or two per Gate Station grid
Growth biomethane volume

DSO Grid: View on current Grid structure
DSO Grid and growth injection: View on current Grid structure
Make a Scenario Analysis

Will yearly growth of volume with subsidy scheme fit with current infrastructure in place? (connecting feed-in on current grid)

Capacity is limited in area’s where production of biomethane is foreseen (agricultural area’s)

EU wide same cap. limitation expected, withholding growth of biomethane feed-in
Facilitating Growth: Compression & central upgrading

Biogashub

To facilitate compression in time is needed (10% of current demand substitution with biomethane)

But first:
- Can you create more local demand?
- Is a biogashub more cost efficient?
Gas: New sources will be introduced

- As a DSO you will receive a specific type or blend of gas, depending on geographical area.
- Quality Gas: Complies with National Standards (bandwidth wobbe).
- For Power to Gas: Also feed-in in local DSO grid.
Facilitating Growth: A new business model for the DSO Resulting in a Smart Gas Grid

New DSO tasks:
- Gas Mixing, Upgrading, Treatment
- Compression, Storage
- Dynamic Pressure Management
- Quality monitoring

\( Q = \) a gas with a specific quality
Handling Quality Change: Composition changes at end-user locations

- **Single direction section**
  (all see the same changes, but at different moments)

  ![Diagram of gas flow](image)

  - **Frontal flow encounter**
    (your quality depends on where you are and what all parties do)
But what about the gas quality?  
DSO perspective

Introduction wider Wobbe band in EU
- Gas received from TSO: LNG terminal, International connections
- Local production of Biomethane (also TSO)
- Introduction upstream operability (compression TSO (16 bar higher grid))
- Local production of SNG (TSO?)

Gas quality treatment: Interchangeability DSO grid and upstream (Different gas qualities?)
- Biomethane: Wobbe setpoint
- Methane number higher than >100 (AVL 3.2) vs 70?
- Calorific value
- Alignment Gas quality DSO/TSO and local injection
Simulation: Gasnet Texel (MPC)

- **8201 users**
  - 254 stations/streets
  - 193 loops (6 big loops)

- 100mbar

**MPC**
Model Predictive Control (impact 8-24-48 uur)

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**Map**

- High use 1
- High use 2
- High use 3
- Loop 1
- Loop 2
- Loop 3
- Loop 4
- Loop 5
- Loop 6

**Graph**

- dagpatronen Texel GOS

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**Bar Graph**

- [Graph Details]

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**Additional Text**

- Impact 8-24-48 uur
Product liability:
Where is the product you distribute?

Flow calculated:
path of lowest resistance

flow results 10 minutes (yellow) in 50 minutes
Gasquality roles: old and new parties fullfilling a (new) gasquality role

- The (Professional) Producer: Exit = entry or blending specs? DSO as a contractor on gasquality & monitor
- The DSO: Quality improvement, propane addition (right calorific value), : Role as a producer, caloric value & quality measurement
- DSO legal: product liability, safety, more producers within one area, monitoring gasquality 24/24h: Role as a productowner
- The TSO and DSO: Pressure settings, Quality upstream, downstream:
- Role as a producer (quality treatment)

<table>
<thead>
<tr>
<th>New activities for a DSO?</th>
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<tbody>
<tr>
<td>Quality Measurement (calorific value)</td>
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<tr>
<td>Volume measurement</td>
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<tr>
<td>Quality improvement: Propane addition</td>
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<tr>
<td>24/24 hr monitoring Quality</td>
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<tr>
<td>Odorant Injection</td>
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<tr>
<td>Quality Control</td>
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<tr>
<td>Pressure control</td>
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<tr>
<td>Transport (compression)</td>
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<td>Transport (flow) More producers within one distribution area, Prioritization Producers</td>
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Gas quality & roles:
24 h monitoring gas quality

<table>
<thead>
<tr>
<th>Main Properties</th>
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<tbody>
<tr>
<td>Calorific Value</td>
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<tr>
<td>Wobbe-index</td>
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<td>Gas composition</td>
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<tr>
<td>CH4</td>
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<tr>
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<td>N2</td>
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<td>Properties</td>
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<td>Pressure</td>
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<tr>
<td>Water dew point</td>
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<tr>
<td>Odorant pump</td>
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<tr>
<td>Volume/flow</td>
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<tr>
<td>Nm3</td>
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<tr>
<td>m³(n)/h</td>
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Gas quality & roles

Specs for LNG ≠ Storage ≠ Bio methane ≠ Power plants ≠ large users ≠ small user ≠ CNG
Right quality right purposes

Right specs for LNG ≠ Storage ≠ Bio methane ≠ Power plants ≠ large users ≠ small user ≠ CNG

For GAD and Non GAD Appliances

Normalisation on gas quality:

- Gas in TSO/Nat Gas
  - Natural Gas
  - CEN/TC 234/WG11
  - Gas infrastructure

- Gas in TSO/DSO network
  - Biomethane CEN/TC 408

- Biomethanev for NGV/CNG
  - DSO conn.
  - 408 CNG from public grid connection
  - No grid conn.
  - 408 CNG from biogasplant

- Natural Gas 234/Wg11
- +
- Natural Gas 234/Wg11

Migration of current and new appliances to handle a new wider Wobbe bandwidth
Gasquality Biomethane

Natural gas (234/WG11)
- Wobbe Index
- Higher Heating Value
- Relative density
- Methane number
- CO2
- Temperature
- Hydrocarbon dewpoint
- Water content
- Water dew point
- Oxygen
- COS
- H2S
- S total
- Hydrocarbons dew point
- Dust Impurities
- Mercaptan

+ Biomethane specific (408)
- Wobbe Index (setpoint)
- Higher Heating Value (propane addition)
- Methane number (>100) (jump)
- Temperature (feed in point) (steel, PE)
- Sulfur total (Odorisation)
- Silicon (issue)
  (aligned with local nat gas spec)

+ Gassification
- Benzene
- Carbon monoxide

CNG
- Methane number
- Water dew point (200 Bars)
- Silicon
- Total Sulfur: Desulphirisation?

Drafts: First quarter 2013
Siloxanes

5 ppm D5 Siloxanes effect

Heat exchanger effect
(siloxanes 5 ppm D5)
Methane number

Methane number: > 85 (Avl 3.2), minimum of stationary gas engines, speed of change 0.3 MN/s; Possible solutions: Forecast, only TSO grid

CAT:
Big fast changes are a serious problem for all current engines. trade-off between:
  • Tolerance to gas composition change
  • Efficiency
  • Reliability
  • Stability of Engine Load or

Engine speed
  • Investment
  • Emissions
Speed of change Methane Number

Variation speed in methane number per G-gas region, 2011 - May 2012

MN variation in 15 minutes, maximum realised : 3.1 in 15' (AVL list)

TSO, what about the DSO situation with biomethane feed-in?
Quality change is a current ongoing process, installations can handle a specific bandwidth, with additional extra safety margins.
Summary

Change in quality: EU Standard
•  Migration of current and new appliances to handle a new and wider Wobbe bandwidth

New Gases entering the network
•  A ‘blend’ of gases will be distributed

New DSO tasks:
•  Gas Mixing, Upgrading, Treatment
•  Compression, Storage
•  Dynamic Pressure Management
•  Quality monitoring

Product Liability
•  You have to know exactly what is and has been distributed.

Is the regulatory framework in place to fullfill these new tasks?
Are the TSO’s and DSO’s aligned (gasquality, roles) ?
Do TSO and DSO’s work together towards one goal ?
Questions?
To help create a better society in the regions in which we operate and to contribute to social and economic growth.
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