Perspectives of Biogas and Biomethane in a Changing Electricity System in Europe – Resources, Technologies, Challenges

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Scientific Consulting

Expert reviews

Virtual institute
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Biogas technology

Energy

Waste Management

Long term experiences in consulting and research.

National and international multidisciplinary network.

Services for systems integration.

Networking.

Knowledge Transfer.

Publication.
Biogas – solutions in waste management, nutrient cycle & energy system

Source: Agentur für erneuerbare Energien, 2014

Turbo Expo 16/June/2014
By 2030 the European biogas industry will produce as much “green gas” (biomethane produced by upgrading of biogas and SYNGAS) as “green electricity” and by using the European natural gas distribution network it will be available for consumers all over Europe for generating electricity, heating/cooling and motor fuel applications.

Source: Kovacs, 2014
Mission

• In 2030 **18-20 billion m³ of biomethane** should be produced in Europe, what will correspond to about 3% of the present natural gas consumption of the European Union.

• The biomethane production will achieve different levels in the European countries (due to different local conditions) but **the consumption could be evenly spread all over Europe, especially in the transportation sector.**

• **Biomethane trade should be developed** to enable harmonising production and consumption on European level.

Source: Kovacs, 2014

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Over 13,800 biogas plants in Europe in 2012 and more than 7,400 MW$_{el}$ of installed capacity

Source: Wellinger, 2014
Present status of Biomethane in Europe

- 230 upgrading units in 15 countries
- Capacity: 166,000 m³/hr or 0.7 billion m³/year
- Grid injection in 10 countries: (AT, CH, DE, DK, FR, FI, LX, NL, NO, SE, UK)
- Transportation fuel use in: (all of above plus IT and HU)
- Registries in 7 countries

Source: Wellinger, 2014
Actual and planned biogas production

**Total Biogas production is about 14bio m3 of NG equiv.**

**The target for 2020 is 28bio m3 NG equiv.**

Source: Wellinger, 2014
<table>
<thead>
<tr>
<th>Source</th>
<th>Type</th>
<th>Potential (TWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NREAP</td>
<td>target 2020</td>
<td>280</td>
</tr>
<tr>
<td>AEBIOM</td>
<td>techn. potential</td>
<td>779</td>
</tr>
<tr>
<td></td>
<td>pract. Potential</td>
<td>459</td>
</tr>
<tr>
<td>DBFZ</td>
<td>theor. Potential</td>
<td>1930</td>
</tr>
</tbody>
</table>

Source: Kovacs, 2014
Biomethane supply forecast in 109 Nm³/year

Source: Kovacs, 2014
Biogas –
the joker in the energy matrix

- **Multiple use** (electricity, heat/cold, fuel)
- **Efficient use** possible (cogeneration)
- **Storable** (one of a few renewable energies)
  - can be used for balancing fluctuating energy production from wind, solar or hydro power
- **Portable** (gas grid, gas bottles, storage tanks)
- **Sustainable** (renewable, low greenhouse-gas emissions, recycling of waste)

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Options for the use of biogas

**CHP on site**

- **Electricity**
  - Own needs
  - Heating of buildings
  - Process heat
- **Heat**
  - Own needs
  - Drying
- **Cold**
  - Food industry
  - Cooling of buildings

**Purification and grid injection**

- **Fuel**
  - Biomethane
  - Electricity
  - Heat/Cold
  - Fuel
- **Grid injection**
  - Heating of buildings
## Electricity production technologies

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Motor-CHP (Biogas)</th>
<th>Gas Turbine</th>
<th>Micro turbine</th>
<th>Motor Stirling</th>
<th>Fuel cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical capacity (kW&lt;sub&gt;el&lt;/sub&gt;)</td>
<td>30 – 3000</td>
<td>3500 – 15000</td>
<td>30 – 300</td>
<td>&lt;150</td>
<td>300 – 1500</td>
</tr>
<tr>
<td>Need for purification</td>
<td>medium</td>
<td>medium</td>
<td>medium</td>
<td>Low-medium</td>
<td>high</td>
</tr>
<tr>
<td>Investment (EUR/kW&lt;sub&gt;el&lt;/sub&gt;)</td>
<td>400 – 1100</td>
<td>900 – 15000</td>
<td>600 – 12000</td>
<td>1300 – 1500</td>
<td>3000 – 4000</td>
</tr>
<tr>
<td>Maintenance (EUR/kWh)</td>
<td>0,01 – 0,02</td>
<td>0,005 – 0,010</td>
<td>0,008 – 0,015</td>
<td>0,003 – 0,005</td>
<td>0,003 – 0,010</td>
</tr>
</tbody>
</table>

Source: Wellinger, 2013
Present status of Biogas upgrading

- 230 upgrading units in 15 countries
- PSA, Water scrubber, Amine scrubber, physical adsorption, membranes, cryogenic separation
- > 20 suppliers
- Local fuel or gas grid injection
- LNG / LBG
The Bottlenecks

There are major bottlenecks for the deployment of biogas & biomethane:

1. The post 2030 targets proposed by the Commission
2. Biogas production costs
3. Harmonisation of legal requirements (Waste, Wastewater, Agriculture, Environment, Energy)
4. The sustainability criteria
5. The cross-border trade
Energy and climate package – 2030 (COM/2014/15)

- Reducing greenhouse gas emissions by 40% (1990 reference year)
- Increasing the share of renewable energy to at least 27% (binding on the EU, but target would not be translated into national targets)
- Continued improvements in energy efficiency
- Reform of the EU emissions trading system
  COM(2014) 20 /2 – proposal for a decision concerning the establishment and operation of a market stability reserve


Source: Baxter, 2014

Turbo Expo 16/June/2014
A Roadmap for moving to a competitive low carbon economy in 2050: COM(2011)112

Source: Baxter, 2014

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Milestones in the Biomethane Roadmap

2015
- Natural gas grid - single mass-balance circle
- CEN biomethane standards
- Biomethane Registry Club operational

2020
- Biomass gasification - industrial scale
- Joint server of biomethane registries
- EECS expanded for biomethane

2025
- Biological methanisation - industrial scale
- Biomethane integrated in ETS
- 2,0 billion m³ biomethane used in transportation

Source: Kovacs, 2014
ETS: Emission Trading System
EECS: European Energy Certificate System

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The way forward

- Biogas and Biomethane production will increase necessarily
- Technologies are mature and reliable
- Utilisation technologies depend on political framework / incentives
- Standardisation is advancing
- First steps for international trade are made
- Targets for 2020 are difficult to meet but still possible
- Some political and technical hurdles give a few head aches

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Biogas Production – Gasification - Biomethane

plenary sessions - parallel sessions - poster session – exhibition - study tours

Co-hosts: Netherlands Enterprise Agency, Energy Valley

Conference of European Biogas Association

30 September - 2 October 2014
Alkmaar region, Netherlands

www.BiogasConference.eu
Biogas – Key technology in Energy and material cycle of the future

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