## Biogas Plant Inventory

*(Status: end of 2013)*

<table>
<thead>
<tr>
<th>Category</th>
<th>Nb. of plants</th>
<th>Gross energy production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture:</td>
<td>96</td>
<td>226 GWh/a</td>
</tr>
<tr>
<td>Biowaste:</td>
<td>29</td>
<td>275 GWh/a</td>
</tr>
<tr>
<td>Industrial waste water:</td>
<td>22</td>
<td>67 GWh/a</td>
</tr>
<tr>
<td>Wastewater treatment plants:</td>
<td>~ 465 (288 with CHP)</td>
<td>550 GWh/a</td>
</tr>
</tbody>
</table>

Biogas Plant Inventory

Gross gas production

- Agriculture
- Industrial waste water
- Biowaste
Biogas Plant Inventory

WWTP – gross gas production

GWh/a

# Biogas Plant Inventory

*Upgrading plants*

<table>
<thead>
<tr>
<th>Place</th>
<th>Substrate</th>
<th>Utilisation</th>
<th>Technology</th>
<th>Capacity</th>
<th>Operation start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volketswil</td>
<td>Biowaste</td>
<td>Gas grid</td>
<td>Chemical scrubber</td>
<td>100 Nm³/h</td>
<td>2010</td>
</tr>
<tr>
<td>Lavigny</td>
<td>Biowaste</td>
<td>Gas grid</td>
<td>PSA</td>
<td>100 Nm³/h</td>
<td>2009</td>
</tr>
<tr>
<td>Utzensdorf</td>
<td>Biowaste</td>
<td>Gas grid</td>
<td>PSA</td>
<td>100 Nm³/h</td>
<td>2009</td>
</tr>
<tr>
<td>Pratteln</td>
<td>Biowaste</td>
<td>Gas grid</td>
<td>Organic physical scr.</td>
<td>100 Nm³/h</td>
<td>2006</td>
</tr>
<tr>
<td>Otelfingen</td>
<td>Biowaste</td>
<td>Vehicle fuel</td>
<td>PSA</td>
<td>50 Nm³/h</td>
<td>1998</td>
</tr>
<tr>
<td>Rümlang</td>
<td>Biowaste</td>
<td>Vehicle fuel</td>
<td>PSA</td>
<td>30 Nm³/h</td>
<td>1995</td>
</tr>
<tr>
<td>Samstagern</td>
<td>Biowaste</td>
<td>Gas grid</td>
<td>PSA</td>
<td>50 Nm³/h</td>
<td>1995</td>
</tr>
<tr>
<td>Widnau</td>
<td>Agr., co-digestion</td>
<td>Gas grid</td>
<td>PSA</td>
<td>100 Nm³/h</td>
<td>2008</td>
</tr>
<tr>
<td>Inwil</td>
<td>Agr., co-digestion</td>
<td>Gas grid</td>
<td>Amine scrubber</td>
<td>300 Nm³/h</td>
<td>2008</td>
</tr>
</tbody>
</table>
## Biogas Plant Inventory

*Upgrading plants*

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<th>Capacity Nm³/h</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Geneva</td>
<td>Sewage sludge</td>
<td>Gas grid</td>
<td>PSA</td>
<td>350</td>
<td>2013</td>
</tr>
<tr>
<td>Zurich</td>
<td>Sewage sl. + Biowaste</td>
<td>Gas grid</td>
<td>Amine scrubber</td>
<td>1400</td>
<td>2013</td>
</tr>
<tr>
<td>Fribourg</td>
<td>Sewage sludge</td>
<td>Gas grid</td>
<td>PSA</td>
<td>250</td>
<td>2012</td>
</tr>
<tr>
<td>Roche</td>
<td>Sewage sludge</td>
<td>Gas grid</td>
<td>PSA</td>
<td>250</td>
<td>2009</td>
</tr>
<tr>
<td>Obermeilen</td>
<td>Sewage sludge</td>
<td>Gas grid</td>
<td>Chemical scrubber</td>
<td>60</td>
<td>2008</td>
</tr>
<tr>
<td>Berne</td>
<td>Sewage sludge</td>
<td>Gas grid</td>
<td>Amine scrubber</td>
<td>1500</td>
<td>2007</td>
</tr>
<tr>
<td>Romanshorn</td>
<td>Sewage sludge</td>
<td>Gas grid</td>
<td>Organic physical scr.</td>
<td>20</td>
<td>2007</td>
</tr>
<tr>
<td>Emmenbrücke</td>
<td>Sewage sludge</td>
<td>Gas grid</td>
<td>PSA</td>
<td>90</td>
<td>2005</td>
</tr>
<tr>
<td>Münchwilen</td>
<td>Animal by-products</td>
<td>Gas grid</td>
<td>Chemical scrubber</td>
<td>650</td>
<td>2011</td>
</tr>
<tr>
<td>Aarberg</td>
<td></td>
<td>Gas grid</td>
<td>PSA</td>
<td>500</td>
<td>2013</td>
</tr>
</tbody>
</table>
Biogas utilisation
(Status: end of 2013)

Total gross biogas production: 1,117 GWh/year
(including WWTP)

- Total electricity production: 281 GWh/year
- Total biomethane production: 128 GWh/year

Number of gas vehicles: 11,287
Number of gas filling stations: 140
Digestate handling

Swiss system for Quality assurance of digestate
Digestate handling

Substrates → Biogas plant → Digestate

Positive list  |  Quality guideline for compost and digestate
Laws
Digestate handling

Positive List
The Swiss Positive List is a recommendation from the Federal office of agriculture of which substrates are suitable for AD / composting and how they are to be treated (latest update: January 2014).

Indication of:
• Hygienic class (*no problem / attention required / special treatment and/or authorisation needed*)
• If appropriate for mesophilic / thermophilic digestion
• Special remarks (high salt content, pH, …)
Digestate handling

Swiss guideline

- Which product for which utilisation?
- Definition of the quality standards of the different products
- Utilisation and application

Available from:
http://www.vks-asic.ch/Informationeninformations/Qualiti%C3%A4t%C3%A4t/Produkteproduitsfinaux/tabid/719/language/de-CH/Default.aspx
Digestate handling

Available from:
http://www.vks-asic.ch/LinkClick.aspx?fileticket=WJJ0iJBSa2o%3d&tabid=717&language=de-CH
Digestate handling

New study on hygiene of digestate (July 2014)

Tracking of pathogens in substrates from digester feeding until digestate spreading on agricultural fields

→ Salmonella, coliform bacteria, E. coli, enterococci, campylobacter

Available from:
Financial support systems

Feed-in tariff for electricity from biogas

<table>
<thead>
<tr>
<th>Power class</th>
<th>≤ 50 kW</th>
<th>≤ 100 kW</th>
<th>≤ 500 kW</th>
<th>≤ 5 MW</th>
<th>&gt; 5 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic tariff [CHF/kWh]</td>
<td>0.28</td>
<td>0.25</td>
<td>0.22</td>
<td>0.185</td>
<td>0.175</td>
</tr>
<tr>
<td>Agricultural bonus [CHF/kWh]</td>
<td>0.18</td>
<td>0.16</td>
<td>0.13</td>
<td>0.045</td>
<td>0</td>
</tr>
<tr>
<td>Heat bonus [CHF/kWh]</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
</tr>
<tr>
<td><strong>Maximum [CHF/kWh]</strong></td>
<td><strong>0.485</strong></td>
<td><strong>0.435</strong></td>
<td><strong>0.375</strong></td>
<td><strong>0.255</strong></td>
<td><strong>0.20</strong></td>
</tr>
</tbody>
</table>

Found for biomethane injection
- Voluntary support program by the Swiss Gas Association
- Objective: injection of 300 GWh biomethane within 6 years


Certificates for emission compensation
Projects reducing GHG emissions can get financial support

National strategies

Energy Strategy 2050

The Federal Council has adopted the energy strategy 2050. It’s thrust is to gradually phase out nuclear power, to develop hydro power and new renewable energies, to improve energy efficiency of buildings, appliances and transportation.

Objective for biogas: 1.6 TWh$_{el}$/y by 2050

Priority measures:
- Development of new processes and technologies
- Up-scaling or downsizing of close-to-market technologies
- Quality management
- Systems optimisation and integration
News and developments

More than 1,000 new gas vehicles
In 2013, the number of vehicles powered by natural gas / biogas has increased by 10%, while the Swiss new car market fell by 6.7 percent compared to the record year of 2012.

Growing number of gas filling stations
The number of gas filling stations increased from 135 to 140 in 2013. The average price of natural gas/biogas remained constant in 2013, still 30% cheaper than gasoline.

Source: GNV Magazine, February 2014 (http://www.gnvmagazine.com/)

Fusion of Biogas organisations
The two important organisations involved in Biogas – Biomasse Schweiz and VKS-ASIC – want to unify their forces. Negotiations are almost completed, final vote on the subject in November 2014.
Current studies and research projects

Determination of methane production in laboratory
Comparision of laboratory BMP test results and real methane production in full-scale plants (2012 – 2014)
C. Holliger, EPFL (http://lbe.epfl.ch/page-83701.html)

ORION – Organic waste management by automated small-scale AD
Development of an on-site organic waste treatment for SME (www.project-orion.eu). 7th framework programme

Source: www.project-orion.eu
Current studies and research projects

Agricultural dry batch digestion
Pilot plant of a dry batch digester, fed with dry manure (2012 – 2014). C. Morrier

Membrane separation