Biogas to Energy
The World Market for Biogas Plants

Cologne, June 2016
ecoprog GmbH

**Biogas to Energy – The World Market for Biogas Plants**

The worldwide construction of new biogas plants will continue in the next 10 years. Between 2016 and 2025, the installed capacity will increase from around 7,000 MWel to 9,600 MWel, while the number of biogas plants will grow from circa 12,000 to 15,000.

Subsidies for electricity, heat or fuel produced in biogas facilities will remain the main driver for this development. However, as many (especially European) countries cut their support schemes, this development will not be as dynamic as in the early 2010s. These reductions show the most severe impacts in the formerly dominating German market.

Many market players are thus exploring new ways for doing business. Apart from tapping new international sales markets, many technology providers are currently developing their service business related to optimising existing plants (repowering).

Against this backdrop, ecoprog GmbH has once again analysed, together with local partners, the global market for biogas plants. This is the fourth edition of our study.

**The market study “Biogas to Energy” includes:**

- A detailed analysis of the essential political, economic, managerial and technological trends for constructing and operating biogas plants.
- A concrete description of the current and future market volumes by countries, up to and including 2025, based on a transparent and comprehensible methodology.
- A description of more than 7,300 biogas plants, including essential technical data such as capacity, date of commissioning, used substrates as well as contact addresses. These plants represent about 85% of the worldwide installed electrical capacity from biogas.
- A description of more than 770 new construction projects, over 140 of which are currently being built. These projects are also listed with their essential technical data and contact addresses.
- A presentation and analysis of the most important biogas plant operators and manufacturers.

The study is available in **German and English from 3,900,- € plus VAT**.

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Biogas to Energy – The World Market for Biogas Plants
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Italy

<table>
<thead>
<tr>
<th>Number of biogas plants</th>
<th>740</th>
<th>Capacity of existing biogas plants [MW_{el}]</th>
<th>551</th>
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<td>Overall investment 2016-25 [m €]</td>
<td>936</td>
<td>Capacity increase 2016-2025 [MW_{el}]</td>
<td>195</td>
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<td>Inhabitants [m]</td>
<td>60.9</td>
<td>Target biogas capacity 2020* [MW_{el}]</td>
<td>1,200</td>
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<tr>
<td>Land surface [k ha]</td>
<td>30.134</td>
<td>RE as of 2012 / target for 2020* [GW_{el}]</td>
<td>31 / 44</td>
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Management summary

The construction of biogas plants continues in Italy, even though this development is less dynamic than in the past. Apart from agricultural plants, biowaste fermentation becomes more important as well. The new support scheme from 2017 onwards offers high feed-in tariffs, especially for plants with sizes of up to 600 kW_{el}.

Market development

Italy remains an attractive biogas market, even though it will no longer develop in such a dynamic way as from 2011 to 2013. By 2025, almost 200 new biogas plants with a capacity of about 195 MW_{el} will be commissioned.

Figure 95: Market forecast Italy

After the high feed-in tariff for plants < 1 MW_{el} was abolished, the booming biogas plant construction has slowed down in the past years. However, the number of plants constructed per year remains significant, as the subsidies for plants with sizes of up to 5 MW_{el} still are comparatively high. Plants of up to 1 MW_{el} are one focus of this development.

[...]

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Competition

Until a few years ago, technologies in the biogas segment had, with only few exceptions, been based on imports and especially German plant manufacturers benefitted from this situation. However, as the market developed in a more dynamic way, domestic providers have also been able to work it successfully.

The domestic manufacturers FLI Energy and Biogen Greenfinch, for instance, now have the same market shares as German firm EnviTec with its strong international focus. International companies mainly come from Germany, Austria and Denmark.

Figure 145: Competitive structure UK

Background

The UK has several support schemes to promote biogas plants and the feed-in tariff is the most important one among them. However, subsidies are capped as of 2016 and from 2016 to 2020, no more than 20 MW_{el} will be authorised per year. Industry associations have criticised this cap as a market restriction, as significantly larger capacities were installed in the past years, sometimes exceeding 50 MW_{el}.

Figure 146: Feed-in tariff in the UK 2016-2019

<table>
<thead>
<tr>
<th>Electrical capacity of a plant</th>
<th>Basic compensation kWh [pence/€ct]</th>
<th>Export bonus kWh [pence/€ct]</th>
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<tbody>
<tr>
<td>up to 250 kW_{el}</td>
<td>8.21 / 10.26</td>
<td></td>
</tr>
<tr>
<td>up to 500 kW_{el}</td>
<td>7.58 / 9.47</td>
<td>4.91 / 6.13</td>
</tr>
<tr>
<td>up to 5,000 kW_{el}</td>
<td>7.81 / 9.76</td>
<td></td>
</tr>
</tbody>
</table>

Source: Ofgem, exchange rate as of April 2016

[...]
Background

[...]

Ever since the EEG came into effect, it has been amended five times, especially in the light of reducing costs and pushing competition, with the sixth amendment currently in preparation. Passing of the EEG 2016 is scheduled for this year, even though there is no final version yet. However, a draft was published in this year’s April and this is expected to come into effect without any major changes.

According to the EEG, developing RE by 2030 should mainly happen by considerably expanding wind and solar power technologies, which are currently inexpensive. By contrast, biomass only plays a marginal role.

Figure 85: 2030 RE development targets in Germany

![Diagram showing RE development targets in Germany with percentages: Wind onshore 41%, Wind offshore 15%, Solar 41%, Biomass 2%, Other 1%, n= 79 GWel, Source: Own calculations based on EEG draft 04/2016]

The Federal Government may introduce a tender system for biomass, but is not obliged to do so. The following framework conditions have already been determined for such a tender:

- The volume to be tendered should be geared towards the development goal of 100 MW annually; this is including the existing support scheme.
- The maximum biomass subsidy amounts to €14.88/kWh.
- Submitted projects may not exceed the maximum size of 20 MWel.
- Already existing plants commissioned earlier than January 2012 may also participate in the tender.
- [...]

Many biomass associations want this tender to be introduced. Given the current framework conditions, however, such a tender system would not be able to significantly stimulate the market, as both the maximum subsidies and the annual 100 MWel limit for solid biomass are too low.

[...]

Wind onshore 41%
Wind offshore 15%
Solar 41%
Biomass 2%
Other 1%
n= 79 GWel, Source: Own calculations based on EEG draft 04/2016
Plants

We have detailed information on 9 biogas plants, generating a total of 11.6 MWel of electricity. Agricultural substrates (slurry) and industrial biowaste are their main input materials. According to the Chinese biomass association, about 40 MWel of electricity is generated from biogas throughout the country.

Figure 33: Project outlook China

<table>
<thead>
<tr>
<th>Plant</th>
<th>Country</th>
<th>Plant type</th>
<th>Fuel type</th>
<th>Capacity (kWel)</th>
<th>Start of operation</th>
<th>Status</th>
</tr>
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<tbody>
<tr>
<td>Fengtai</td>
<td>China</td>
<td>biomethane (grid)</td>
<td>agricultural</td>
<td>n/a</td>
<td>2016</td>
<td>under construction</td>
</tr>
<tr>
<td>Wuhu</td>
<td>China</td>
<td>biogas (chp)</td>
<td>biowaste</td>
<td>6,752</td>
<td>2017</td>
<td>planned</td>
</tr>
<tr>
<td>Beijing III</td>
<td>China</td>
<td>biogas (chp)</td>
<td>biowaste</td>
<td>n/a</td>
<td>2017</td>
<td>planned</td>
</tr>
<tr>
<td>Jiaozu</td>
<td>China</td>
<td>biogas (chp)</td>
<td>biowaste</td>
<td>n/a</td>
<td>2017</td>
<td>planned</td>
</tr>
<tr>
<td>Mianzhu</td>
<td>China</td>
<td>biogas (chp)</td>
<td>agricultural</td>
<td>n/a</td>
<td>2017</td>
<td>planned</td>
</tr>
<tr>
<td>Jiayu</td>
<td>China</td>
<td>biomethane (grid)</td>
<td>only manure</td>
<td>175</td>
<td>n/a</td>
<td>planned</td>
</tr>
</tbody>
</table>

The number of reports on so-called kitchen waste projects that also generate biogas has increased since 2015. Such facilities use waste from canteens, kitchens, restaurants and industrial food enterprises. There are small and large projects as well as composting only plants and large biogas facilities. However, only very few of them are generating electricity.

The larger the plants are, the higher the probability that they are equipped with a fermentation process. Our Chinese partner has analysed the 12 largest known projects with capacities between 90,000 and 320,000 annual tons. 9 of them are said to have a fermentation process and to produce biogas. Electricity generation could only be verified for 1 facility.

Major Chinese plant manufacturer China Everbright is participating in several kitchen waste projects. Western companies such as German plant manufacturer EnviTec or Swedish project developer Purac (through its subsidiary Purac Environmental System (Beijing) Co., Ltd.) have also delivered technology to kitchen waste plants.

Biogas plants and projects in China

Anyang (ROC), China
(Matoujian village)
Status: active
Start of operation: 2010
Use of biogas: biomethane (fuel)
Feedstock: cow and pig manure, biowaste, slaughter house waste and restaurant food waste
Feedstock category: industrial
Input capacity (t/a): 180,000
Manufacturer: TEG, NIRAS
Operator
Anyang Sino-Danish Biogas Energy Co Ltd (ASDB)
Remarks: The biogas will be cleaned and used for vehicle fuel. Methane production amounts to 8,500 m3/day.

Beijing I, China
Status: active
Start of operation: 2008
Use of biogas: biogas (chp)
Feedstock: sorted household waste
Feedstock category: biowaste
Input capacity (t/a): 105,000
Manufacturer: Valorga International SAS
[...]
Biogas plants and projects in the USA

Auburn Gresham, USA
Status: planned
Start of operation: 2018
Use of biogas: biogas (chp)
Input capacity (t/a): 50,000
Investment (m €): 20
Remarks: The plant will be built on the ground of an old auto impound lot. Construction will begin in 2017. The manufacturer and further details are not announced, yet.

Auburn I, USA
(Cayuga County)
Status: active
Start of operation: 2005
Electric Installed capacity (kWe): 250
Use of biogas: biogas (chp)
Feedstock: grass
Feedstock category: agricultural
Manufacturer: RCM International, LLC
Investment (m €): 1
Operator
Patterson Farms Inc
1131 Town Line Rd

Auburn II, USA
(Cayuga Regional Digester)
Status: active
Start of operation: 2012
Electric Installed capacity (kWe): 625
Heat production (kWh): 625
Use of biogas: biogas (chp)
Feedstock: slurry, foodwaste
Feedstock category: biowaste
Manufacturer: GBU mbH
Investment (m €): 2
Operator
Cayuga Soil & Water Conservation District

Aurora, USA
Status: active
Start of operation: 2009
Electric Installed capacity (kWe): 500
Use of biogas: biogas (chp)
Feedstock: slurry, manure
Feedstock category: only manure
Manufacturer: GHD, Inc.
Operator
Aurora Ridge Dairy
2542 Angling Road

Bakersfield I, USA
Status: active
Start of operation: 2009
Electric Installed capacity (kWe): 200
Use of biogas: biogas (chp)
Feedstock: slurry, manure
Feedstock category: only manure
Manufacturer: GHD, Inc.
Operator
Gervais Family Farm

Bakersfield II, USA
Status: active
Start of operation: 2014
Electric Installed capacity (kWe): 600
Use of biogas: biogas (chp)
Manufacturer: California Bioenergy, LLC
Operator
ABEC Bidart-Stockdale LLC

Bakersfield III, USA
(Lakeview Farms Dairy)
Status: under construction
Start of operation: 2016
Electric Installed capacity (kWe): 1,000
Use of biogas: biogas (chp)
Feedstock: manure
Feedstock category: only manure
Investment (m €): 4
Remarks: The plant will be supported with USD 4 million from the California Energy Commission.

Baldwin, USA
Status: active
Start of operation: 2006
Electric Installed capacity (kWe): 200
Use of biogas: biogas (chp)
Feedstock: slurry, manure
Feedstock category: only manure
Manufacturer: Komro International, LLC
Operator
Baldwin Dairy

Barberton, USA
(New Franklin)
Status: active
Start of operation: 2013
Electric Installed capacity (kWe): 810
Use of biogas: biogas (chp)
Feedstock: food waste, FOG - fats, oil, grease, sewage sludge
Feedstock category: industrial
Manufacturer: Quasar Energy Group
Operator
Quasar Energy Group
www.quasarenergygroup.com

Baxley, USA
Status: active
Start of operation: 2006
Electric Installed capacity (kWe): 200
Use of biogas: biogas (chp)
Feedstock: slurry, manure
Feedstock category: only manure
Manufacturer: GHD, Inc.
Operator
Wright Whitty Davis Farms, Inc.

[..]
Biogas plants and projects in France

Apprieu, France
Status: planned
Start of operation: 2016
Use of biogas: biomethane (grid)
Feedstock category: agricultural
Operator
Methanisere
1 B Boulevard De La Chantourne
38700 La Tronche, Isere
Remarks: Joint agricultural plant.

Argentan, France
Status: planned
Start of operation: 2016
Biogas output (Nm3/a): 80
Use of biogas: biomethane (grid)
Feedstock category: agricultural
Manufacturer: Methaneo
Remarks: Meth'Agri Argetan and the investor and project developer Methaneo have brought together 18 farms for the project; the farmers will deliver the substrate for the plant.

Argenton-les-Vallées-Boesse, France
Status: planned
Electric Installed capacity (kWel): 250
Use of biogas: biogas (chp)
Feedstock category: agricultural
Operator
Metha-Vallee
8 LA BUTTE AUX CAILLES
79150 le breuil sous argenton
Remarks: Agricultural plant.

Artenay, France
Status: active
Start of operation: 2013
Use of biogas: biogas (chp)
Feedstock: Industrial
Feedstock category: industrial
Manufacturer: Bio Dynamics
Remarks: The plant is located at a distillery.

Arzal, France
Status: active
Start of operation: 2012
Electric Installed capacity (kWel): 250
Use of biogas: biogas (chp)
Feedstock category: agricultural
Input capacity (t/a): 9,890
Operator
Gaëc des Moulins de Kerollet Kerollet
56190 Arzal
Tel: +33 297 45 06 26
Remarks: The production of biogas amounts to 990,000 m³.

Athie, France
Status: active
Start of operation: 2015
Electric Installed capacity (kWel): 590
Use of biogas: biogas (chp)
Feedstock category: industrial
Input capacity (t/a): 12,000
Investment (m €): 4
Operator
A.E.D.Agri Energie Donndaine
12 Rue du Bois
89440 Athie
Remarks: Méthanor has financed this project and promotes its agricultural biogas.

Athies-sous-Laon, France
(l’Aisne)
Status: planned
Start of operation: 2016
Biogas output (Nm3/a): 1,880.000
Use of biogas: biomethane (grid)
Feedstock: food industry waste, animal by-products, sewage sludge
Feedstock category: industrial
Input capacity (t/a): 31,000
Manufacturer: Canopy SAS
Operator
A.M.-Athies Methanisation
3 RUELLE DU PUI TS BAS
2340 SOIZE
Remarks: An application has been submitted to the council. Construction is expected to take place in 2016.

Aube, France
(l’Aube)
Status: active
Start of operation: 2015
Electric Installed capacity (kWel): 150
Use of biogas: biogas (chp)
Feedstock: cattle manure
Feedstock category: agricultural

Aubigné-Racan, France
(Aubigne-Racan, Aubigne Racan)
Status: active
Start of operation: 2000
Electric Installed capacity (kWel): 469
Heat production (kWth): 180
Use of biogas: biogas (chp)
Feedstock category: industrial
Operator
Allard Emballages
LIEU-DIT VARENNES
72800 Aubigné-Racan
Remarks: The production of biogas amounts to 250,000 m³.
## Plant register

<table>
<thead>
<tr>
<th>Name</th>
<th>Country</th>
<th>Code</th>
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</tbody>
</table>

Note: The original data contains more entries, but for brevity, only a subset is included here. For the complete list, please refer to the source material.
Price and product information

Contact:

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+49 (0) 221 788 03 88 14

You can order the market report here:

https://www.ecoprog.com/publikationen/energiewirtschaft/biogas-to-energy/order-biogas-to-energy.htm

Price models:

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- Company version: 7,800.- EUR plus VAT
- Corporate version: POA

Explanation:

Single user copy: personal copy (personalised and password-protected PDF file, sent via e-mail)
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Corporate version: for different, legally connected companies (e.g. sister companies, subsidiaries abroad).
Price depends on number of companies and employees

Additionally, you can order copies of the study on paper (hardcover book).
- Price: 150,- EUR plus VAT per book.