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# Biogas to Energy

The World Market for Biogas Plants

**Extract**

Cologne, June 2016

ecoprogram 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 MW<sub>el</sub> to 9,600 MW<sub>el</sub>, 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, ecoprogram 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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Italy

<b>Number of biogas plants</b>	<b>740</b>	<b>Capacity of existing biogas plants [MW<sub>el</sub>]</b>	<b>551</b>
<b>Overall investment 2016-25 [m €]</b>	<b>936</b>	<b>Capacity increase 2016-2025 [MW<sub>el</sub>]</b>	<b>195</b>
Inhabitants [m]	60.9	Target biogas capacity 2020* [MW <sub>el</sub> ]	1,200
Land surface [k ha]	30,134	RE as of 2012 / target for 2020* [GW <sub>el</sub> ]	31 / 44

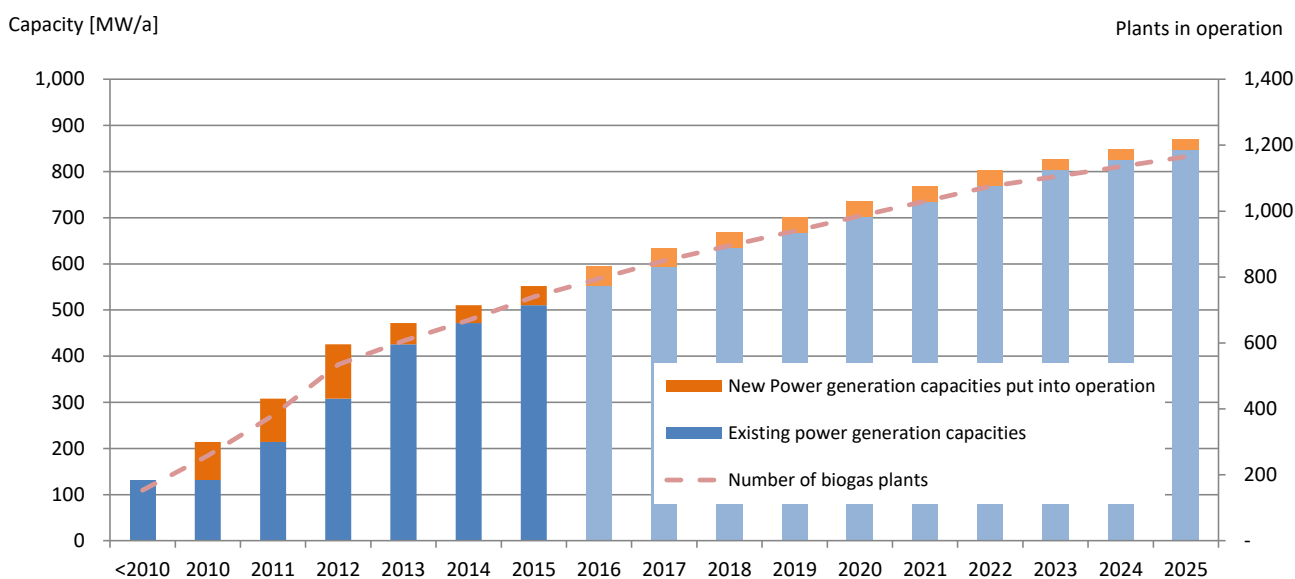
Management summary

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<sub>el</sub>.

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<sub>el</sub> will be commissioned.

**Figure 95: Market forecast Italy**



Data estimated up to 2015, from 2016 on: forecast, source: ecoprolog

After the high feed-in tariff for plants < 1 MW<sub>el</sub> 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<sub>el</sub> still are comparatively high. Plants of up to 1 MW<sub>el</sub> are one focus of this development.

[...]

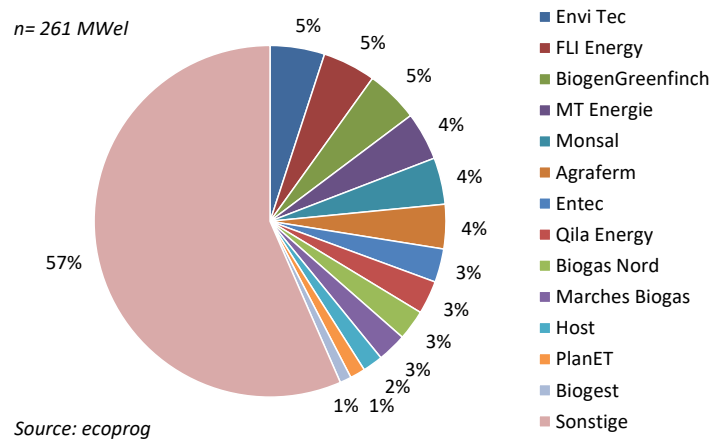
[...]

**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<sub>el</sub> 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<sub>el</sub>.

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

Electrical capacity of a plant	Basic compensation kWh [pence/€ct]	Export bonus kWh [pence/€ct]
up to 250 kW <sub>el</sub>	8.21 / 10.26	4.91 / 6.13
up to 500 kW <sub>el</sub>	7.58 / 9.47	
up to 5,000 kW <sub>el</sub>	7.81 / 9.76	

Source: Ofgem, exchange rate as of April 2016

[...]

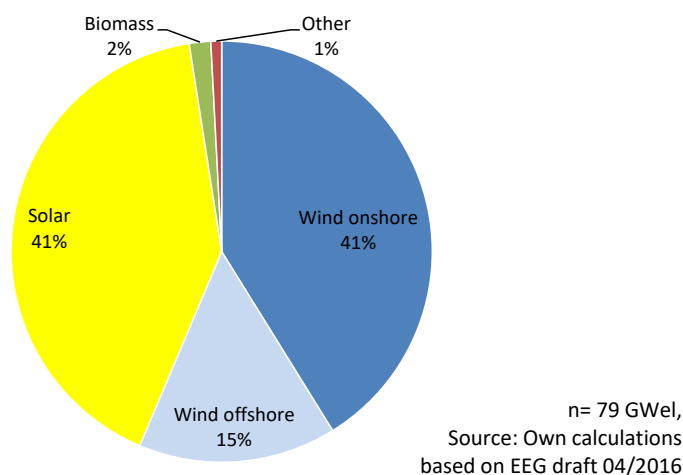
## Background

[...]

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**



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 €/ct/kWh.
- Submitted projects may not exceed the maximum size of 20 MW<sub>el</sub>.
- 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 MW<sub>el</sub> limit for solid biomass are too low.

[...]



## Plants

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

**Figure 33: Project outlook China**

Plant	Country	Plant type	Fuel type	Capacity (kW <sub>el</sub> )	Start of operation	Status
[...]						
Fengtai	China	biomethane (grid)	agricultural	n/a	2016	under construction
Wuhu	China	biogas (chp)	biowaste	6,752	2017	planned
Beijing III	China	biogas (chp)	biowaste	n/a	2017	planned
Jaiozu	China	biogas (chp)	biowaste	n/a	2017	planned
Mianzhu	China	biogas (chp)	agricultural	n/a	2017	planned
Jiayu	China	biomethane (grid)	only manure	175	n/a	planned
[...]						

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 m<sup>3</sup>/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 (kWel): 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 (kWel): 625  
 Heat production (kWth): 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 (kWel): 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 (kWel): 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 (kWel): 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 (kWel): 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 (kWel): 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 (kWel): 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 (kWel): 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 (Nm<sup>3</sup>/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 (kWeI): 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 (kWeI): 250  
Use of biogas: biogas (chp)  
Feedstock category: agricultural  
Input capacity (t/a): 9.890

#### Operator

Gaec des Moulins de Kerollet  
Kerollet  
56190 Arzal  
Tel: +33 297 45 06 26

Remarks: The production of biogas amounts to 990,000 m<sup>3</sup>.

### Athie, France

Status: active  
Start of operation: 2015  
Electric Installed capacity (kWeI): 590  
Use of biogas: biogas (chp)  
Feedstock: poultry and cattle manure, cereal residues, grass clippings  
Feedstock category: agricultural  
Input capacity (t/a): 12.000  
Investment (m €): 4

#### Operator

A.E.D.Agri Energie Dondaine  
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 (Nm<sup>3</sup>/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 RUELE DU PUIITS 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 (kWeI): 150  
Use of biogas: biogas (chp)  
Feedstock: cattle manue  
Feedstock category: agricultural

### Aubigné-Racan, France

#### (Aubigne-Racan, Aubigne Racan)

Status: active  
Start of operation: 2000  
Electric Installed capacity (kWeI): 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 m<sup>3</sup>.

[...]

## Plant register

[...]		Eslohe, Germany	232
Endeholz, Germany	230	Espenau-Mönchehof, Germany	232
Energiepark Ecoson, Netherlands	664	Espoo II, Finland	486
Enfas, Turkey	946	Essen (Oldb.) I, Germany	232
Enfield Farm, United Kingdom	876	Essen (Oldb.) II, Germany	233
Enfield, United Kingdom	876	Essen (Oldb.) III, Germany	233
Engeln I, Germany	230	Essen, Germany	232
Engeln II, Germany	230	Essen-Kettwig, Germany	233
Engen, Germany	230	Esserts Blay, France	520
Engerwitzdorf, Austria	688	Este I, Italy	600
Engstingen, Germany	230	Este, Italy	600
Eniwa, Japan	1023	Etampes, France	520
Ennezat, France	519	Étampes, France	520
Ennigerloh, Germany	231	Etrépigny, France	520
Enosburg Falls, USA	979	Etréville, France	520
Entenfellner I, Austria	688	Ettleben, Germany	233
Entenfellner II, Austria	688	Ettlingen, Germany	233
Entre Rios do Oeste, Brazil	1009	Etusson, France	520
Épaux-Bézu, France	519	Eugene, USA	979
Eppeville, France	519	Euston, United Kingdom	876
Eptagonia, Cyprus	930	Eutingen, Germany	233
Eptagonia, Cyprus	930	Evansville, USA	979
Epuisay, France	519	Exeter (UK), United Kingdom	877
Epworth, United Kingdom	876	Exeter (US), USA	979
Eraclea, Italy	600	Eydelstedt I, Germany	233
Erdeborn, Germany	231	Eydelstedt II, Germany	233
Erfstadt, Germany	231	Eydelstedt III, Germany	233
Erfurt I, Germany	231	Eye, United Kingdom	877
Erfurt II, Germany	231	Faarborg, Denmark	129
Ergeisheim, Germany	231	Fabel, Germany	233
Erglu novads, Latvia	649	Fabro, Italy	601
Ering, Germany	231	Faedo, Italy	601
Erkersreuth, Germany	231	Faenza, Italy	601
Erkheim, Germany	231	Fahrbinde, Germany	234
Erlangen, Germany	231	Fahrenkrug, Germany	234
Ermensee, Switzerland	768	Fair Oaks Farms, USA	980
Erode, India	82	Fair Oaks I, USA	980
Ertingen, Germany	232	Faizabad, India	82
Erxleben I, Germany	232	Falaise, France	520
Erxleben II, Germany	232	Falconara Marittima, Italy	601
Esbeek, Netherlands	664	Falkenberg (GER) I, Germany	234
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## Price and product information

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