REPORT

THE AGRICULTURAL BIOGAS PLANTS IN POLAND

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1 SUMMARY

The analysis of the existing biogas plants in Poland indicates that the majority of them function in the direct vicinity of large animal farms or industrial plants, that is, close to the source of substrates. Currently there are 45 agricultural biogas plants in Poland with total electric capacity of 54 MW. The average installed electric capacity of the existing agricultural biogas plants is 1.2 MWe. Only three plants have the installed capacity of less than 0.5 MW. Generally it can be said that in the current investment environment in Poland the desired capacity of biogas plans is limited: from the bottom by economic calculations, and from the top by the availability of substrates and/or possibility of connecting to electrical grid. Optimal electric capacity of a biogas plant is 0.5 – 1.6 MWe – projects with such capacity are most effective financially and logistically (substrate supply and digestate utilization).

In 2013 Polish biogas plants produced:

- 112.43 milion m^3 of agricultural biogas,
- 227.98 GWh of electricity,
- 249.08 GWh of heat.

The present report was compiled on the basis of widely available documents and information. This report provides information as of March, 2014.

2 DEVELOPMENT OF AGRICULTURAL BIOGAS POWER PLANTS MARKET IN POLAND

The development of biogas market in Poland is strongly connected with legal determinants. The first attempts to introduce biogas into Polish power industry on a large scale took place in 2001. It was then assumed in The Strategy of Development of Renewable Energetics that in 2010 in Poland biogas plants would have reached 30 MW of installed capacity and the production of electric energy from agricultural biogas would have amounted to 120 GWh a year. Now it is known to us that these, in fact not really unreasonable, assumptions were not achieved [1]. However, first steps towards identifying the obstacles and barriers to progress of this sector of renewable energetics. In 2005 the Evaluation of the Strategy of Development of Renewable Energetics and the "Directions of Development of Energetic Use of Biogas with a Suggestion of Action" was written. It was an expert opinion made to an order from the Department of Environment that was supposed to evaluate the current state of development of renewable energetics in Poland. In this document the barriers to development

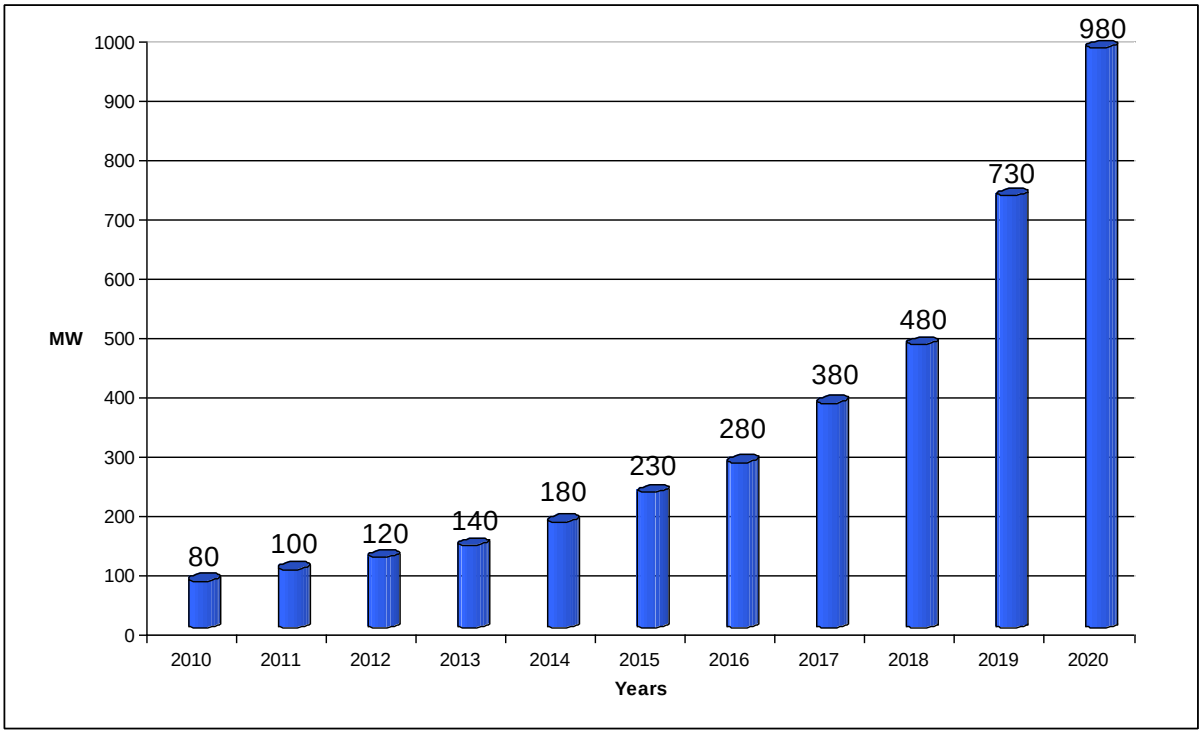
of agricultural biogas plants were analyzed and described, and the ways to overcome them were indicated. These theories, however, did not translate into practice. In 2005 the "green certificate" system came into effect. It supported the development of renewable sources of energy. In the same year the first agricultural biogas plant in Poland was built – the project was carried out by Poldanor S.A. in Pawłówko (Przechlewo district) [1].

The breakthrough came not until 2008, when Innovative Energetics – Energy Agriculture (IE-EA) programme was inaugurated with its famous slogan "biogas plants in all districts." In May, 2009, Ministry of Agriculture and Rural Development presented the assumptions of Agricultural Biogas Plants Development Programme, which, according to the department, were supposed to be a base for the IE-EA programme and to create favourable conditions for exploitation of agricultural energy potential. Ministry of Economy in cooperation with Ministry of Agriculture and Rural Development drew up a document called Directions of Agricultural Biogas Plants Development from 2010 to 2020 (DABPD), which was accepted by Council of Ministers on 15 July 2010. The implementation of DABPD is a priority of the fifth chapter of Energy policy in Poland until 2030 (Development of renewable sources of energy, including biofuel) [1].

3 THE POTENTIAL FOR DEVELOPMENT OF BIOGAS POWER PLANTS IN POLAND

The National Action Plan Concerning Energy from Renewable Sources (NAP) introduces a way in which Poland could attain the domestic target of market share for energy from renewable sources (15.5 % until 2020 in general and 19 % in energy market). The document also considers a high potential for biogas (agriculture biogas, landfill gas, sewage sludge biogas) development in Poland. According to the NAP in 2020 in Polish biogas plants will have reached 980 MW of total installed electric capacity [1].

Diagram 1. Increase of capacity of agricultural biogas plants in Poland according to the NAP.



Source: National Action Plan Concerning Energy from Renewable Sources.

The NAP assumed that in 2013 total installed electric capacity of biogas plants would reach 140 MW. According to data of Agricultural Market Agency (ARR) in 2013 there are installed electric capacity of 230 MW. The aim for 2013 has therefore been accomplished, but what definitely will be needed in the next years is a much faster increase in capacity. Agricultural biogas plants currently constitute only about 30 % of installed capacity of all biogas plants, but the potential for further development of landfill biogas or sewage sludge biogas plants are limited. Therefore the nearest future will probably bring the

fastest increase in number of facilities and in total installed capacity as far as agricultural biogas power plants are concerned [1].

4 RAW MATERIALS USED IN AGRICULTURAL BIOGAS IN POLAND

Essentially the most common substrates currently used in Polish installations is corn silage and other plants (32 installations), manure (20 installations) and distillers/waste from the distillery (10 installation). The common use of these substrates is mostly due to their high availability, ease of transport, cost of acquisition and ownership by the installation of appropriate technology, which allows the production of biogas with a specific type of material [2]. List of substrates used in Polish biogas Plants is presented in table 1.

Table 1. List of raw materials used for the production of agricultural biogas in 2011-2013.

	Type of raw material used to produce agricultural biogas	The amount of raw materials consumed in the production of agricultural biogas (in tonnes)		
		2011	2012	2013
1	Liquid Manure	265 960.79	349 173.12	455 583.14
2	Distillery slop	30 465.11	146 607.49	354 362.00
3	Corn silage	108 876.14	241 590.19	287 414.40
4	Residues from fruit and vegetables	10 984.35	86 109.22	268 599.14
5	Pulp	6 922.45	37 081.80	109 311.68
6	Pig manure	11 640.53	23 502.98	30 778.09
7	Whey	1 933.00	12 854.34	12 577.07
8	Potato pulp	7 258.49	6 627.27	10 143.53
9	Poultry manure	0.00	0.00	7 905.72
10	Glycerine	0.00	302.71	6 254.96
11	Slaughter waste	0.00	663.19	5 481.09
12	Residues from the processing of plant products	0.00	50.06	3 742.28
13	Fatty waste	285.65	305.17	3 631.61
14	Waste protein-fatty	0.00	0.00	3 568.98
15	Waste plant	0.00	292.98	2 402.74
16	Fodder	0.00	1 951.94	2 197.97
17	Grass silage	7 217.10	1 683.17	1 845.47
18	Lees	0.00	230.08	1 749.29
19	Liquid wheat	0.00	864.79	1 531.67
20	Waste chocolate	0.00	0.00	1 387.76
21	Protein deposits	0.00	1 020.08	1 247.02
22	Straw	0.00	153.45	1 196.01
23	Fatty sludge plant	0.00	620.54	1 094.54
24	Sludges protein-fatty	0.00	408.65	1 016.90
25	Waste from food processing	0.00	0.00	791.59
26	Cereal silage	5 973.80	348.48	485.52

Source: Agricultural Market Agency (ARR); 11 of March 2014 [2].

5 EXISTING BIOGAS PLANTS IN POLAND

Currently there are 45 agricultural biogas plants in Poland with total electric capacity of 54 MW [3].
It was in 2008 that the development of agricultural power plants in Poland speeded up, supported by a positive attitude of the government and by emerging possibilities of financing; it is worth stressing, though, that the first agricultural biogas plant in the country was launched just after Poland joined the EU – in 2005. It was the same year that the system of so called *green certificates* was initiated. This system is the foundation of Polish renewable energy sources support system. The first biogas facility was located in Pawłówko, next to a pig farm that belonged to Poldanor S.A., an agricultural company with Danish capital founded in 1994 [4].

The analysis of the existing biogas plants in Poland indicates that the majority of them function in the direct vicinity of large animal farms or industrial plants, that is, close to the source of substrates. Such a solution significantly simplifies substrate supply logistics, as well as minimizes transport costs (it is possible to install pipelines or conveyor belts). It is of particular importance when it comes to substrates of relatively low biogas production efficiency (substrates that give low amount of biogas from a ton of fresh mass), e.g. slurry or whey.
The average installed electric capacity of the existing agricultural biogas plants is 1.2 MWe. Only three plants have the installed capacity of less than 0.5 MW (in Niedoradz, Sławkowo and Kujanki), which results from economic calculations. What is more profitable currently is construction of biogas plants with higher installed capacity, under condition that, of course, there is sufficient amount of substrates available in a given location. Out of existing plants, 8 (in Koczała, Liszkowo, Konopnica, Boleszyn, Zalesie, Rypin, Darżyno and Strzelin) have installed capacity of about 2 MW. Generally it can be said that in the current investment environment in Poland the desired capacity of biogas plans is limited: from the bottom by economic calculations, and from the top by the availability of substrates and/or possibility of connecting to electrical grid. Optimal electric capacity of a biogas plant is 0.5- 1.6 MWe – projects with such capacity are most effective financially and logistically (substrate supply and digestate utilization) [1].

The following table 2 presents data on the production of biogas, electricity and heat from agricultural biogas in years 2011 – 2013 [1].

Table 2. Production of agricultural biogas, electricity and heat from agricultural biogas in years 2011 – 2013.

Years	Number of agricultural biogas produced [million m^3]	The amount of electricity generated from agricultural biogas [GWh]	The amount of heat generated from agricultural biogas [GWh]
2011	36.65	73.43	82.63
2012	73.15	141.80	160.13
2013	112.43	227.98	249.08

Source: Agricultural Market Agency (ARR); 11 of March 2014 [2]

From 1 January 2011, the President of the Agricultural Market Agency is a body registrar energy companies involved in the production of agricultural biogas.

Entities entered into this register are required to submit quarterly reports containing information on:

a. the quantities and types of materials used in the manufacture of agricultural biogas or to generate electricity from agricultural biogas,
b. the quantities of agricultural biogas produced, detailing the amount of agricultural biogas introduced into the gas distribution network, used to generate electricity in a split arrangement or cogeneration or used in any other way,
c. the amount of heat and electricity produced from agricultural biogas in a split arrangement or cogeneration.

Existing biogas plants in Poland are presented on Figure 1, Table 3 and in Appendix 1 to this report.

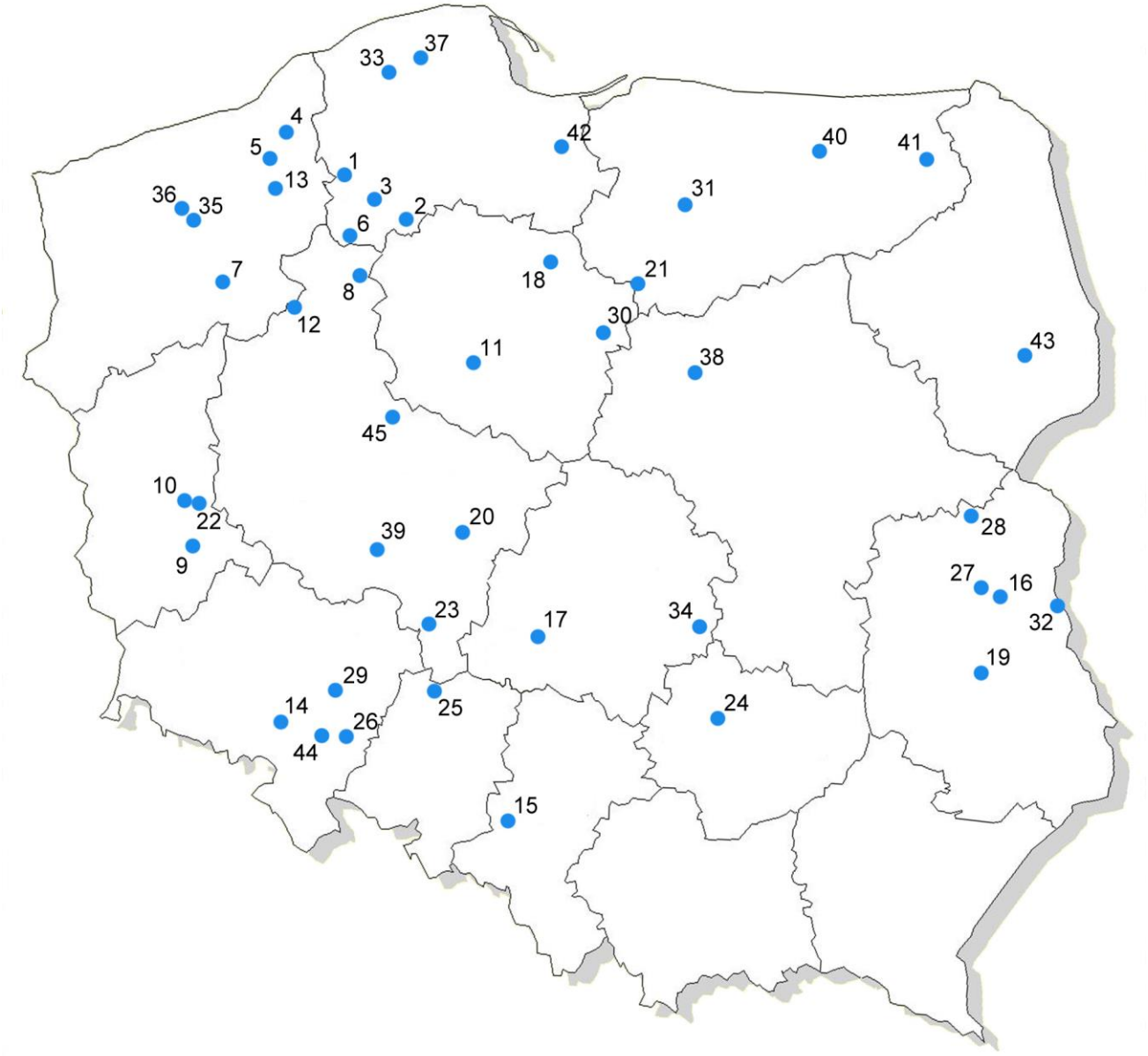


Figure 1. Existing biogas plants in Poland.

Table 3. Existing biogas plants in Poland.

1. Ag. biogas plant in Koczała	16. Ag. biogas plant in Uhnin	31. Ag. biogas plant in Łęguty
2. Ag. biogas plant in Pawłówko	17. Ag. biogas plant in Konopnica	32. Ag. biogas plant in Orchówek
3. Ag. biogas plant in Płaszczyca	18. Ag. biogas plant in Mełno	33. Ag. biogas plant in Darżyno
4. Ag. biogas plant in Nacław	19. Ag. biogas plant in Piaski	34. Ag. biogas plant in Sobawiny near Opoczno
5. Ag. biogas plant in Świelino	20. Ag. biogas plant in Zbiersk - Cukrownia	35. Ag. biogas plant in Byszewo
6. Ag. biogas plant in Uniechówek	21. Ag. biogas plant in Boleszyn	36. Ag. biogas plant in Przemysław
7. Ag. biogas plant in Giżyno	22. Ag. biogas plant in Klępsk	37. Ag. biogas plant in Lębork
8. Ag. biogas plant in Kujanki	23. Ag. biogas plant in Szklarka Myślniewska	38. Ag. biogas plant in Glinojeck
9. Ag. biogas plant in Niedoradz	24. Ag. biogas plant in Piekoszów	39. Ag. biogas plant in Borzęciczki
10. Ag. biogas plant in Kalsk	25. Ag. biogas plant in Zalesie	40. Ag. biogas plant in Sławkowo
11. Ag. biogas plant in Liszkowo	26. Ag. biogas plant in Strzelin	41. Ag. biogas plant in Giże
12. Ag. biogas plant in Skrzatusz	27. Ag. biogas plant in Koczergi near Parczew	42. Ag. biogas plant in Tragamin near Malborka
13. Ag. biogas plant in Grzmiąca	28. Ag. biogas plant in Zaścianki	43. Ag. biogas plant in Ryboły
14. Ag. biogas plant in Świdnica	29. Ag. biogas plant in Bielany Wrocławskie	44. Ag. biogas plant in Łagiewniki
15. Ag biogas plant in Łany Wielkie	30. Ag. biogas plant in Rypin	45. Ag. biogas plant in Działyń

6 DETAILED DESCRIPTION OF BIOGAS PLANTS IN POLAND

Each biogas plant has a different , personalized design, adapted to the different composition of the feed material. Biogas plant mostly consists of :

- Tanks for biomass,
- Fermentation tanks,
- Tanks for fermented substances,
- Cogeneration system (gas engine + electric generator) producing electricity and heat, installed in the building of a technical or container,
- Sanitary, safety , electrical , including control systems that integrate all components.

In the reservoir of raw material, otherwise referred to as the *preliminary storage tank*, are mixed together animal excrement and organic waste, which are thus fed into the fermentation chamber. Fermentation chamber (known as a *bioreactor*) is the heart of biogas plant, because there is a process of fermentation of organic material and production of biogas. The fermentation chamber should meet certain basic assumptions, to ensure the proper conduct of the process. Its walls must be gas and fluid proof, and thanks to good thermal insulation to prevent heat loss and temperature extremes.

To fermentation process was efficient, fermentation tank should be equipped with a stirring system. These are generally mechanical stirrer placed inside the chamber, or the hydraulic pump disposed outside or inside the chamber. In order to ensure optimal fermentation process inside the fermenter there must be a uniform temperature. We have to take into account that each type of bacteria involved in the metabolic processes needs a different temperature. If the desired temperature ranges are exceeded, may be inhibited or even damage the bacteria.

There are three temperature ranges in which the fermentation process takes place :

- Psychrophilic (at 10 - 25 ˚C)
- Mesophilic (at 32 - 42 ˚C)
- Thermophilic (at 50 - 55 ˚C).

Selection process temperature depends on the individual parameters of biogas plant, but biogas production is only viable mesophilic and thermophilic in the temperature range.

Detailed description of existing biogas plants in Poland is presented below.

1. Agricultural biogas plant in Koczała

Electrical capacity: 2126 kWe	**Owner of the plant**: Poldanor S.A.
Thermal capacity: 2206 kWt	**Opening date**: 15 April 2009

Location:

Town/village: Koczała
District: Koczała
County: Człuchów
Province: Pomorskie

Project description (main facilities):

- Two-chamber pre-storage tank with capacity 4,000 m^3
- Component storage tank with capacity 615 m^3
- Mixing tank with capacity 352 m^3
- 3 fermenters with capacity 9 030 m^3
- 2 post-fermentation tanks with capacity 7 980 m^3
- Component storage area
- Service building
- Transformer station
- Pumping station

Input materials:

- Liquid manure feedstock – 55 000 tonnes per year
- Corn silage feedstock – 25 000 tonnes per year
- Glycerine feedstock – 10 000 tonnes per year
- Total capacity of fermentation chambers 9 000 m^3
- 2 power and heat units with a total electric power of 2126 kW and thermal power of 2206 kW
- Gas furnace with a thermal power of 1900 kW

Annual output of the plant:

- Biogas: approx. 8 212 500 m^3/year
- Electricity: approx. 16 761 384 kWh/year
- Heat: approx. 17 392 104 kWh/year

2. Agricultural biogas plant in Pawłówko

Electrical capacity: 946 kWe	**Owner of the plant**: Poldanor S.A.
Thermal capacity: 1101 kWt	**Opening date**: June 9, 2005

Location:

Town/village: Pawłówko
District: Chojnice
County: Chojnice
Province: Pomorskie

Project description (main facilities):

- Raw material reception station
- Primary tank with pumping station
- 2 digestion tanks
- Technical facility with hygienisation unit
- Post-digestion tank

Input materials:

- Liquid manure input – 29 000 tons/year
- Maize silage input – 5 500 tons/year
- Slaughter waste input – 3 000 tons/year
- Glycerine input – 1 000 tons/year
- Total capacity of digestion chambers – 1500 m^3
- 2 combined heating and power stations with the electric power of 230 kW and 495 kW
- Gas boiler with the thermal power of 350 kW

Annual output if the biogas plant:

- Biogas: approx. 3 802 655 m^3/year
- Electricity: approx. 7 458 260 kWh/year
- Heat: approx. 8 680 284 kWh/year

3. Agricultural biogas plant in Płaszczyca

Electrical capacity: 625 kWe	**Owner of the plant**: Poldanor S.A.
Thermal capacity: 680 kWt	**Opening date**: April 21, 2008

Location:

Town/village: Płaszczyca
District: Przechlewo
County: Człóchów
Province: Pomorskie

Project description (main facilities):

- 2 primary tanks with the capacity of 300 m^3
- Component tank with the capacity of 300 m^3
- Digestion tank with the capacity of 1500 m^3
- Post-digestion tank with the capacity of 2000 m^3
- Technical facility
- Technical shelter
- Fire-fighting tank

Input materials:

- Liquid manure input – 18 500 tons/year
- Maize silage input – 3 700 tons/year
- Plant waste input – 1 000 tons/year
- Herbal product processing waste input – 500 tons/year
- Combined heating and power station with the electric power of 625 kW and thermal power of 692 kW
- Heating boiler with the thermal power of 600 kW.

Annual output of the plant:

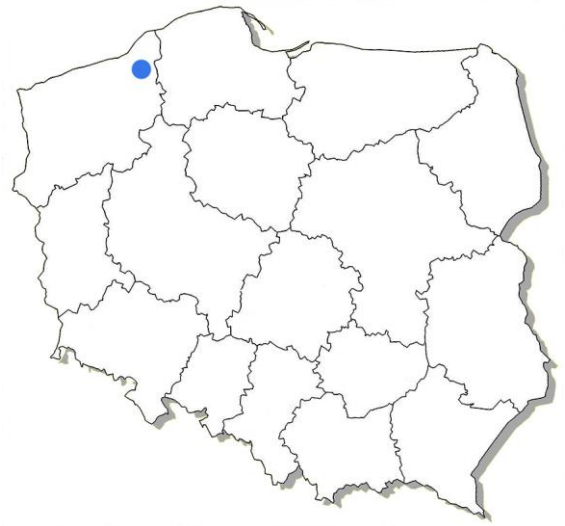
- Biogas: approx. 2 299 500 m^3/year
- Electricity: approx. 4 927 500 kWh/year
- Heat: approx. 5 361 120 kWh/year

4. Agricultural biogas plant in Nacław

Electrical capacity: 625 kWe	**Owner of the plant**: Poldanor S.A.
Thermal capacity: 686 kWt	**Opening date**: 7 June, 2010

Location:

Town/village: Nacław
District: Polanów
County: Koszalin
Province: Zachodniopomorskie



Project description (main facilities):

- Component storage area with a feeder, with total area 288 m^2
- Component storage tank no. 1 with capacity 32 m^3
- Component storage tank no. 2 with capacity 32 m^3
- Pre-storage tank with capacity 1 000 m^3
- Fermenter with capacity 1 250 m^3
- Post-fermentation tank with capacity 2 000 m^3
- Service building
- Service shed with mixing tank
- Cogeneration unit with a power of 625 kWe and 680 kWt
- Heat furnace with a power of 690 kW
- Emergency cooler
- Two-chamber tank for pre-fermented liquid manure – 2 x 10 000 m^3

Input materials:

- Liquid manure feedstock – 20 000 tonnes per year
- Corn silage feedstock – 13 800 tonnes per year
- Glycerine feedstock – 4 700 tonnes per year (optional)

Annual output of the plant:

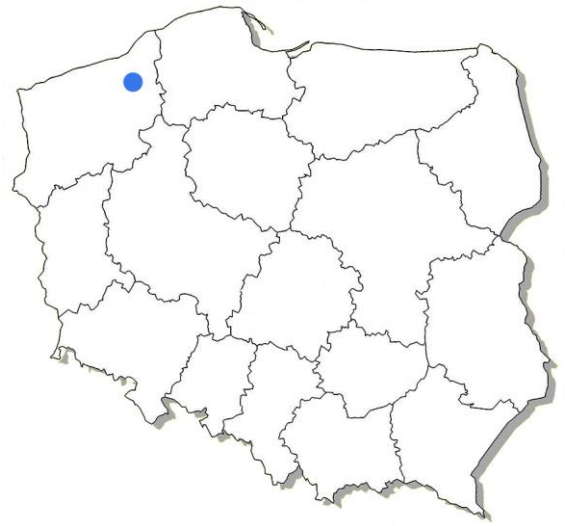
- Biogas – approx. 2 299 500 m^3/year
- Electricity – approx. 4 927 500 kWh/year
- Heat – approx. 5 408 424 kWh/year

5. Agricultural biogas plant in Świelino

Electrical capacity: 625 kWe	**Owner of the plant**: Poldanor S.A.
Thermal capacity: 686 kWt	**Opening date**: 15 November, 2010

Location:

Town/village Świelino
District: Bobolice
County: Koszalin
Province: Zachodniopomorskie



Project description (main facilities):

- Component storage area
- Pre-storage tank with capacity 962 m^3
- Component storage tank with capacity 962 m^3
- Fermenter with capacity 3 990 m^3
- Post-fermentation tank with capacity 2 490 m^3
- Service building
- Pumping station
- Biogas purification system
- Cooler
- Transformer station
- Power generator with power of 625 kWe and 686 kWt
- Heat furnace with power of 701 kW

Input materials:

- Liquid manure feedstock – 11 000 tonnes per year
- Corn silage feedstock – 14 000 tonnes per year
- Glycerine feedstock – 4 000 tonnes per year (optional)

Annual output of the plant:

- Biogas – approx. 2 299 500 m^3/year
- Electricity – approx. 4 927 500 kWh/year
- Heat – approx. 5 408 424 kWh/year

6. Agricultural biogas plant in Uniechówek

Electrical capacity: 1063 kWe	**Owner of the plant**: Poldanor S.A.
Thermal capacity: 1081 kWt	**Opening date**: 18 April, 2011

Location:

Town/village: Uniechówek
District: Debrzno
County: Człuchów
Province: Pomorskie

Project description (main facilities):

- Component storage area
- Pre-storage tank with capacity 1 464 m^3
- Component storage tank with capacity 962 m^3
- Fermenter no. 1 with capacity 3 990 m^3
- Fermenter no. 2 with capacity 3 884 m^3
- Post-fermentation tank with capacity 2 490 m^3
- Service building
- Pumping station
- Biogas purification system
- Cooler
- Transformer station
- Power generator with a capacity of 1 063 kWe and 1 081 kWt
- Heat furnace with a power of 1 200 kW

Input materials:

- Liquid manure feedstock: approx. 36 500 tonnes per year
- Corn silage feedstock: approx. 17 520 tonnes per year

Annual output of the plant:

- Biogas: approx. 4 100 200 m^3/year
- Electricity: approx. 8 380 700 kWh/year
- Heat: approx. 8 522 604 kWh/year

7. Agricultural biogas plant in Giżyno

Electrical capacity: 1063 kWe	**Owner of the plant**: Poldanor S.A.
Thermal capacity: 1081 kWt.	**Opening date**: 23 september, 2011

Location:

Town/village: Giżyno
District: Kalisz Pomorski
County: Drawski
Province: Zachodniopomorskie

Project description (main facilities):

- Component storage area
- Pre-storage tank with capacity 1 464 m^3
- Component storage tank with capacity 962 m^3
- Fermenter no. 1 with capacity 3 990 m^3
- Fermenter no. 2 with capacity 3 884 m^3
- Post-fermentation tank with capacity 2 490 m^3
- Service building
- Pumping station
- Biogas purification system
- Cooler
- Transformer station
- Power generator with a capacity of 1 063 kWe and 1 081 kWt
- Heat furnace with a power of 1 200 kW

Input materials:

- Liquid manure feedstock: approx. 36 500 tonnes per year
- Corn silage feedstock: approx. 17 520 tonnes per year

Annual output of the plant:

- Biogas: approx. 4 100 200 m^3/year
- Electricity: approx. 8 380 000 kWh/year
- Heat: approx. 8 520 000 kWh/year

8. Agricultural biogas plant in Kujanki

Electrical capacity: 330 kWe	**Owner of the plant**: Poldanor S.A.
Thermal capacity: 342 kWt	**Opening date**: 2 October 2008

Location:

Town/village: Kujanki
District: Człuchów
County: Człuchów
Province: Pomorskie

Project description (main facilities):

The agricultural biogas plant in Kujanki produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.

Input materials:

- Liquid manure feedstock
- Glycerine

Annual output of the plant:

- Biogas: approx. 1 124 470 m^3/year
- Electricity: approx. 2 602 000 kWh/year
- Heat: approx. 2 696 000 kWh/year

9. Agricultural biogas plant in Niedoradz

Electrical capacity: 252 kWe	**Owner of the plant**: Biogas Agri Sp. z o.o.
Thermal capacity: 291 kWt	**Opening date**: 2009

Location:

Town/village: Niedoradz
District: Otyń
County: Nowosolski
Province: Lubuskie

Project description (main facilities):

The agricultural biogas plant in Niedoradz produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. Biogas plant is located at the large-scale pig farm. The input material is composed of liquid pig manure mixed with supplementary components: poultry and corn silage. Technology provider in Niedoradz is BD Agro Renewables, and the owner of a biogas plant is Biogas Agri Sp. z o.o.

Input materials:

- Pig and poultry manure feedstock
- Corn silage

Annual output of the plant:

- Biogas: approx. 631 000 m^3/year
- Electricity: approx. 1 300 000 kWh/year
- Heat: approx. 1 500 000 kWh/year

10. Agricultural biogas plant in Kalsk

Electrical capacity: 1140 kWe	**Owner of the plant**: Gospodarstwo Rolne in Buków Sp. z o.o.
Thermal capacity: 1060 kWt.	**Opening date**: 2010

Location:

Town/village: Kalsk near Sulechów
District: Sulechów
County: Zielona Góra
Province: Lubuskie

Project description (main facilities):

The agricultural biogas plant in Kalsk produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. The electricity (92%) is sold to the power company and the remainder (8%) is consumed by the plant. The heat generated is used to heat the local dryer. The owner of a biogas plant is Gospodarstwo Rolne in Buków Sp. z o.o.

Input materials:

- Pig and poultry manure feedstock
- Corn silage

Annual output of the plant:

- Biogas: approx. 5 000 000 m^3/year
- Electricity: approx. 9 000 000 kWh/year
- Heat: approx. 12 500 000 kWh/year

11. Agricultural biogas plant in Liszkowo

Electrical capacity: 2126 kWe	**Owner of the plant**: ENEA - Elektrownie Wodne Sp. z o.o.
Thermal capacity: 1198 kWt	**Opening date**: 2009

Location:

Town/village: Liszkowo
District: Rojewo
County: Inowrocław
Province: Kujawsko-pomorskie

Project description (main facilities):

The agricultural biogas plant in Liszkowo produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The input material is composed of plant substrates, mainly corn silage and others plant wastes in smaller quantities. Additional is used distillery slop.
The biogas plant was built by Agrogaz Sp. z o.o., then sold to energy company ENEA. Currently, the owner of the plant is the company ENEA - Elektrownie Wodne Sp. z o.o.

The Liszkowo biogas plant is composed of the following facilities:

- Fermenters with capacity 12 000 m^3
- 2 power generator Jenbacher MC 320 with a capacity of 2.1 MW

Input materials:

- Corn silage
- Plant wastes
- Distillery slop

Annual output of the plant:

- Biogas: approx. 7 400 000 m^3/year
- Electricity: approx. 14 400 000 kWh/year
- Heat: approx. 8 100 000 kWh/year

12. Agricultural biogas plant in Skrzatusz

Electrical capacity: 526 kWe	**Owner of the plant**: Biogaz Zeneris Sp. z o.o.
Thermal capacity: 505 kWt	**Opening date**: March, 2011

Location:

Town/village: Skatusz
District: Szydłowo
County: Pilsk
Province: Wielkopolskie

Project description (main facilities):

The agricultural biogas plant in Skrzatusz produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. The input material is composed of distillery slop mixed with supplementary components: potato pulp, corn silage, slaughter waste input and by-products from the production of carrot juice. The electricity is sold to the power company, and 200 kW of thermal energy in the form of steam provides a local distillery.

Main facilities:

- Pre-storage tank with capacity 402 m^3
- Fermenter with capacity 3 041 m^3
- Post-fermentation tank with capacity 1 061 m^3
- Service building
- Pumping station

Input materials:

- Distillery slop – 43 tons/day
- Potato pulp – 15 tons/day
- Corn silage – 15 tons/day
- Slaughter waste input 5.5 tons/day
- Products from the production of carrot juice – 7 tons/day

Annual output of the plant:

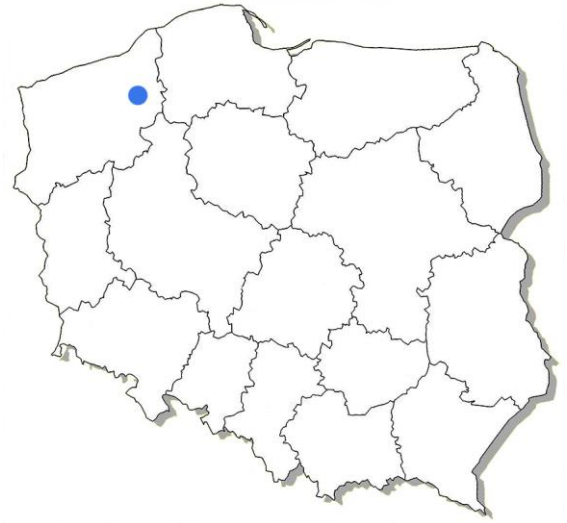
- Biogas: approx. 2 102 400 m^3/year
- Electricity: approx. 4 607 760 kWh/year
- Heat: approx. 4 423 800 kWh/year

13. Agricultural biogas plant in Grzmiąca

Electrical capacity: 1600 kWe	**Owner of the plant**: Eko-Energia Grzmiąca Sp. z o.o.
Thermal capacity: 1600 kWt	**Opening date**: 26 January, 2011

Location:

Town/village: Grzmiąca
District: Grzmiąca
County: Szczecinecki
Province: Zachodniopomorskie



Project description (main facilities):

The agricultural biogas plant in Grzmiąca produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The heat produced from the biogas is used to heat public buildings - schools, sports hall, health center and residential areas. The owner of the plant is Eko-Energia Grzmiąca Sp. z o.o.

Main facilities:

- 2 x pre-storage tank with capacity 59 m^3
- 3 x fermenter with capacity 2 945 m^3
- Post-fermentation tank with capacity 4 825 m^3
- Service building
- Pumping station

Input materials:

- Pig and poultry manure
- Corn and grass silage
- Raw materials from the processing industry – distillery slop, potato pulp and used cooking oil

Annual output of the plant:

- Biogas: approx. 7 000 000 m^3/year
- Electricity: approx. 13 500 000 kWh/year
- Heat: approx. 14 500 000 kWh/year

14. Agricultural biogas plant in Świdnica

Electrical capacity: 900 kWe	**Owner of the plant**: BIO-WAT Sp. z o.o.
Thermal capacity: 1100 kWt	**Opening date**: 2011

Location:

Town/village: Świdnica
District: Świdnica
County: Świdnica
Province: Dolnośląskie

Project description (main facilities):

The agricultural biogas plant in Świdnica produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.

Input materials:

- Corn and grass silage
- Beet leaves

Annual output of the plant:

- Biogas: approx. 4 000 000 m^3/year
- Electricity: approx. 7 200 000 kWh/year
- Heat: approx. 8 800 000 kWh/year

15. Agricultural biogas plant in Łany Wielkie

Electrical capacity: 526 kWe	**Owner of the plant**: BIO-BUT Sp. z o.o.
Thermal capacity: 540 kWt	**Opening date**: 29 November, 2011

Location:

Town/village: Łany Wielkie
District: Sośnicowice
County: Gliwice
Province: Śląskie

Project description (main facilities):

The agricultural biogas plant in Łany Wielkie produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The biogas plant is working with a distillery located in the neighborhood. The biogas plant receives waste in the form of distillery slopes and supplying generated thermal energy to distillery. The owner of the plant is BIO-BUT Sp. z o.o.

Main facilities:

- Pre-storage tank with capacity 950 m^3
- Fermenter with capacity 5 440 m^3
- Service building
- Pumping station

Input materials:

- Distillery slop – 18 250 tones/year
- Corn silage – 1 054 tons/year
- Manure – 14 600 tones/year

Annual output of the plant:

- Biogas: approx. 2 470 915 m^3/year
- Electricity: approx. 4 471 000 kWh/year
- Heat: approx. 4 625 000 kWh/year

16. Agricultural biogas plant in Uhnin

Electrical capacity: 1200 kWe	**Owner of the plant**: Bioelektrownia Sp. z o.o.
Thermal capacity: 1160 kWt	**Opening date**: 29 September, 2011

Location:

Town/village: Uhnin
District: Dębowa Kłoda
County: Parczew
Province: Lubelskie

Project description (main facilities):

The agricultural biogas plant in Uhnin produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The biogas plant cover annual demand for energy of about 19 thousand people, residents of the municipality and town Parczew and municipality Dębowa Kłoda.
The owner of the plant is Bioelektrownia Sp. z o.o.

Input materials:

- Corn, grass and rye silage
- Distillery slop
- Potato pulp

Annual output of the plant:

- Biogas: approx. 4 500 000 m^3/year
- Electricity: approx. 10 000 000 kWh/year
- Heat: approx. 9 600 000 kWh/year

17. Agricultural biogas plant in Konopnica

Electrical capacity: 1998 kWe	**Owner of the plant**: Bioenergy Project Sp. z o.o.
Thermal capacity: 2128 kWt	**Opening date**: June, 2012

Location:

Town/village: Konopnica
District: Rawa Mazowiecka
County: Rawski
Province: Łódzkie

Project description (main facilities):

The agricultural biogas plant in Konopnica produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The electricity is partly sold to the power company. The thermal energy is used for own needs, but most of it is supplied by district heating to the city of Rawa Mazowiecka and the surrounding industrial plants. The owner of the plant is Bioenergy Project Sp. z o.o.

Input materials:

- Corn and grass silage

Annual output of the plant:

- Biogas: approx. 9 353 755 m^3/year
- Electricity: approx. 17 083 000 kWh/year
- Heat: approx. 18 194 000 kWh/year

18. Agricultural biogas plant in Mełno

Electrical capacity: 1600 kWe	**Owner of the plant**: Allter power Sp. z o.o.
Thermal capacity: 1800 kWt	**Opening date**: 2012

Location:

Town/village: Mełno
District: Gruta
County: Grudziądz
Province: Kujawsko-pomorskie

Project description (main facilities):

The agricultural biogas plant in Mełno produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. Installation was established in the former sugar factory in Mełno, together with the biogas plant was built a distillery. Distillers is the substrate used in the biogas plant and the heat generated during combustion is used to generate steam for the distillery. The biogas plant in Mełno is the first in Poland where the biogas is produced in a process of a thermophilic fermentation - fermentation tank temperature reaches 55°C. The owner of the plant is Allter power Sp. z o.o.

Input materials:

- Distillery slop

Annual output of the plant:

- Biogas: approx. 6 200 000 m^3/year
- Electricity: approx. 12 800 000 kWh/year
- Heat: approx. 14 400 000 kWh/year

19. Agricultural biogas plant in Piaski

Electrical capacity: 999 kWe	**Owner of the plant**: Wikana Bioenergia Sp. J..
Thermal capacity: 1039 kWt	**Opening date**: 7 October, 2011

Location:

Town/village: Piaski
District: Piaski
County: Świdnica
Province: Lubelskie

Project description (main facilities):

The agricultural biogas plant in Piaski produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. The substrates are supplied from local dairy and the surrounding farms. The owner of the plant is Wikana Bioenergia Sp. j.

Input materials:

- Corn silage
- Whey
- Manure

Annual output of the plant:

- Biogas: approx. 4 250 000 m^3/year
- Electricity: approx. 8 000 000 kWh/year
- Heat: approx. 9 600 000 kWh/year

20. Agricultural biogas plant in Zbiersk - Cukrownia

Electrical capacity: 1600 kWe	**Owner of the plant**: AWW Wawrzyniak Sp. J.
Thermal capacity: 1620 kWt	**Opening date**: 2012

Location:

Town/village: Zbiersk
District: Stawiszyn
County: Kalisz
Province: Wielkopolskie

Project description (main facilities):

The agricultural biogas plant in Zbiersk produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. The owner of the plant is AWW Wawrzyniak Sp. J.

Input materials:

- Distillery slop

Annual output of the plant:

- Biogas: approx. 4 176 558 m^3/year
- Electricity: approx. 12 800 000 kWh/year
- Heat: approx. 12 960 000 kWh/year

21. Agricultural biogas plant in Boleszyn

Electrical capacity: 2000 kWe	**Owner of the plant**: Biogal Sp. z o.o.
Thermal capacity: 2020 kWt	**Opening date**: May, 2012

Location:

Town/village: Boleszyn
District: Grodziczno
County: Nowomiejski
Province: Warmińsko-mazurskie

Project description (main facilities):

The agricultural biogas plant in Boleszyn produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The owner of the plant is Biogal Sp. z o.o.

Input materials:

- Corn silage
- Manure
- Distillery slop
- Whey

Annual output of the plant:

- Biogas: approx. 7 840 000 m^3/year
- Electricity: approx. 15 200 000 kWh/year
- Heat: approx. 15 360 000 kWh/year

22. Agricultural biogas plant in Klępsk

Electrical capacity: 1000 kWe	**Owner of the plant**: Gospodarstwo Rolne Kargowa – Klępsk Ryszard Maj.
Thermal capacity: 1400 kWt	**Opening date**: 2012

Location:

Town/village: Klępsk
District: Sulechów
County: Zielona Góra
Province: Lubuskie

Project description (main facilities):

The agricultural biogas plant in Klępsk produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. The owner of the plant is Gospodarstwo Rolne Kargowa – Klępsk Ryszard Maj.

Input materials:

- Corn silage
- Pig manure

Annual output of the plant:

- Biogas: approx. 4 633 117m^3/year
- Electricity: approx. 8 147 000 kWh/year
- Heat: approx. 11 406 000 kWh/year

23. Agricultural biogas plant in Szklarka Myślniewska

Electrical capacity: 660 kWe	**Owner of the plant**: P.P.H.U. "SERAFIN" Sp. z o.o.
Thermal capacity: 640 kWt	**Opening date**: 2012

Location:

Town/village: Szklarka Myślniewska
District: Ostrzeszów
County: Ostrzeszów
Province: Wielkopolskie

Project description (main facilities):

The agricultural biogas plant in Szklarka Myślniewska produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The owner of the plant is P.P.H.U. "SERAFIN" Sp. z o.o.

Input materials:

- Corn silage
- Pig manure

Annual output of the plant:

- Biogas: approx. 3 000 000 m^3/year
- Electricity: approx. 5 493 000 kWh/year
- Heat: approx. 5 326 000 kWh/year

24. Agricultural biogas plant in Piekoszów

Electrical capacity: 800 kWe	**Owner of the plant**: Elektrociepłownia Bartos Sp. z o.o.
Thermal capacity: 855 kWt	**Opening date**: July, 2012

Location:

Town/village: Piekoszów
District: Piekoszów
County: Kielce
Province: Świętokrzyskie

Project description (main facilities):

The agricultural biogas plant in Piekoszów produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The owner of the plant is Elektrociepłownia Bartos Sp. z o.o.

Main facilities:

- 3 x fermenter with capacity 1 526 m^3
- 2 x post-fermentation tank with capacity 4 526 m^3
- Service building
- Pumping station

Input materials:

- Corn silage
- Manure (all together 22 210 tons/year)

Annual output of the plant:

- Biogas: approx. 2 464 000 m^3/year
- Electricity: approx. 6 200 000 kWh/year
- Heat: approx. 6 350 000 kWh/year

25. Agricultural biogas plant in Zalesie

Electrical capacity: 2000 kWe	**Owner of the plant**: Polskie Biogazownie "Energy Zalesie" Sp. z o.o.
Thermal capacity: 2016 kWt	**Opening date**: 10 October, 2012

Location:

Town/village: Zalesie
District: Domaszowice
County: Namysłów
Province: Opolskie

Project description (main facilities):

The agricultural biogas plant in Zalesie produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. The biogas plant was established with a large pig farm Ferma-Pol. They produced about 70 000 m3 of liquid manure per year. The electricity is sold to the power company and thermal energy is used mainly for own needs.

Main facilities:

- Pre-storage tank with capacity 452 m^3
- 2 x fermenter with capacity 3 147 m^3
- Post-fermentation tank with capacity 4 823 m^3
- Service building
- Pumping station

Input materials:

- Liquid manure
- Potato pulp

Annual output of the plant:

- Biogas: approx. 8 000 000 m^3/year
- Electricity: approx. 17 520 000 kWh/year
- Heat: approx. 17 660 000 kWh/year

26. Agricultural biogas plant in Strzelin

Electrical capacity: 2000 kWe	**Owner of the plant**: Südzucker Polska S.A.
Thermal capacity: 2065 kWt	**Opening date**: 2012

Location:

Town/village: Strzelin
District: Strzelin
County: Strzelin
Province: Dolnośląskie

Project description (main facilities):

The agricultural biogas plant in Zalesie produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The biogas plant was established at the sugar factory. Generated electricity cover sugar factory needs, and the rest is sold to the grid. The thermal energy is used for heating the sugar factory and sugar production process.
The owner of the plant is Südzucker Polska S.A.

Input materials:

- Beet pulp

Annual output of the plant:

- Biogas: approx. 9 894 549 m^3/year
- Electricity: approx. 17 520 000 kWh/year
- Heat: approx. 18 089 000 kWh/year

27. Agricultural biogas plant in Koczergi

Electrical capacity: 1200 kWe	**Owner of the plant**: DMG Sp. z o.o.
Thermal capacity: 1300 kWt	**Opening date**: 2013

Location:

- **Town/village:** Koczergi near Parczew
- **District:** Parczew
- **County:** Parczew
- **Province:** Lubelskie

Project description (main facilities):

The agricultural biogas plant in Koczergi produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. The owner of the plant is DMG Sp. z o.o.

Input materials:

- Corn silage

Annual output of the plant:

- Biogas: approx. 4 300 000 m^3/year
- Electricity: approx. 10 200 000 kWh/year
- Heat: approx. 11 050 000 kWh/year

28. Agricultural biogas plant in Zaścianki

Electrical capacity: 1200 kWe	**Owner of the plant**: BIO-POWER Sp. z o.o.
Thermal capacity: 1251 kWt	**Opening date**: 2013

Location:

- **Town/village:** Zaścianki
- **District:** Międzyrzec Podlaski
- **County:** Bialski
- **Province:** Lubelskie

Project description (main facilities):

The agricultural biogas plant in Zaścianki produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The owner of the plant is BIO-POWER Sp. z o.o.

Input materials:

- Corn silage

Annual output of the plant:

- Biogas: approx. 3 500 000 m^3/year
- Electricity: approx. 9 000 000 kWh/year
- Heat: approx. 9 300 000 kWh/year

29. Agricultural biogas plant in Bielany Wrocławskie

Electrical capacity: 526 kWe	**Owner of the plant**: Cargill Poland Sp. z o.o..
Thermal capacity: 581 kWt	**Opening date**: June, 2012

Location:

Town/village: Bielany Wrocławskie
District: Kobierzyce
County: Wrocław
Province: Dolnośląskie

Project description (main facilities):

The agricultural biogas plant in Bielany Wrocławskie produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
Biogas production is based on materials derived from wheat processing factory Cargill in Bielany Wrocławskie. Electricity and heat produced from biogas supply only factory, reducing a few percent of the energy consumption and gas in the factory (the heat from the cogeneration unit is used for gluten drying technologies). The owner of the plant is Cargill Poland Sp. z o.o.

Input materials:

- Wheat

Annual output of the plant:

- Biogas: approx. 1 300 000 m^3/year
- Electricity: approx. 3 400 000 kWh/year
- Heat: approx. 3 750 000 kWh/year

30. Agricultural biogas plant in Rypin

Electrical capacity: 1875 kWe	**Owner of the plant**: Biogazownia Rypin Sp. z o.o.
Thermal capacity: 1780 kWt	**Opening date**: 2013

Location:

Town/village: Rypin
District: Rypin
County: Rypin
Province: Kujawsko-pomorskie

Project description (main facilities):

The agricultural biogas plant in Rypin produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. This is the first biogas plant in Poland, built by a group of farmers. Its main input (substrate) is corn silage, harvested from the fields of farmers who are co-owners of biogas plant. The second material is a slurry coming from the farms of those farmers.

Main facilities:

- Pre-storage tank with capacity 226 m^3
- Pre-storage tank with capacity 519 m^3
- 2 x fermenter with capacity 3 165 m^3
- 2 x post-fermentation tank with capacity 4 945 m^3
- Service building
- Pumping station

Input materials:

- Corn silage
- Slurry

Annual output of the plant:

- Biogas: approx. 6 811 090 m^3/year
- Electricity: approx. 15 000 000 kWh/year
- Heat: approx. 14 240 000 kWh/year

31. Agricultural biogas plant in Łęguty

Electrical capacity: 1200 kWe	**Owner of the plant**: Minex-Invest Sp. z o.o.
Thermal capacity: 1220 kWt.	**Opening date**: 2012

Location:

Town/village: Łęguty
District: Gietrzwałd
County: Olsztyn
Province: Warmińsko-mazurskie

Project description (main facilities):

The agricultural biogas plant in Łęguty produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. The owner of the plant is Minex-Invest Sp. z o.o.

Main facilities:

- 2 x pre-storage tank with capacity 180 m^3
- 2 x pre-storage tank with capacity 340 m^3
- 2 x fermenter with capacity 3 147 m^3
- 2 x post-fermentation tank with capacity 3 147 m^3
- Service building
- Pumping station

Input materials:

- Manure
- Corn silage
- Distillery slop
- Glycerine

Annual output of the plant:

- Biogas: approx. 4 561 200 m^3/year
- Electricity: approx. 10 200 000 kWh/year
- Heat: approx. 10 370 000 kWh/year

32. Agricultural biogas plant in Orchówek

Electrical capacity: 1063 kWe	**Owner of the plant**: EKOENERGIA WKM Sp. z o.o.
Thermal capacity: 1299 kWt	**Opening date**: 2013

Location:

Town/village: Orchówek
District: Włodawa
County: Włodawa
Province: Lubelskie

Project description (main facilities):

The agricultural biogas plant in Orchówek produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
This is biogas plant working on the basis of wastes from the industry such as livestock manure, waste from sewage treatment plants, plant tissues, bagasse.
The owner of the plant is EKOENERGIA WKM Sp. z o.o.

Main facilities:

- Fermenter with capacity 3 500 m^3
- Post-fermentation tank with capacity 4 300 m^3
- Service building
- Pumping station

Input materials:

- Livestock manure
- Waste from sewage treatment plants
- Plant tissues
- Bagasse

Annual output of the plant:

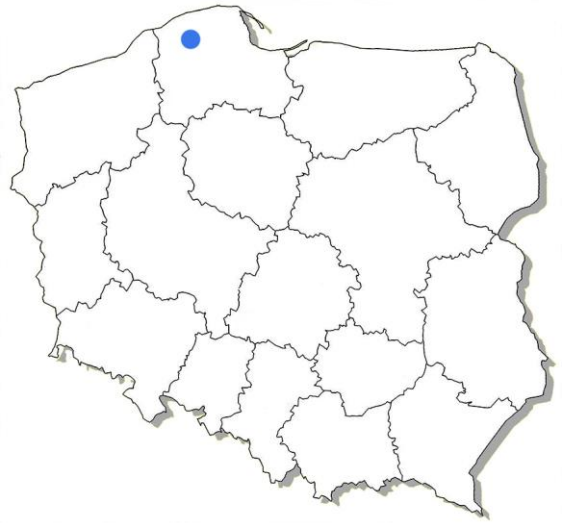
- Biogas: approx. 3 500 000 m^3/year
- Electricity: approx. 8 326 000 kWh/year
- Heat: approx. 9 394 000 kWh/year

33. Agricultural biogas plant in Darżyno

Electrical capacity: 2400 kWe	**Owner of the plant**: Nadmorskie Elektrownie Wiatrowe Darżyno Sp. z o.o.
Thermal capacity: 2448 kWt	**Opening date**: 2013

Location:

Town/village: Darżno
District: Potęgowo
County: Słupsk
Province: Pomorskie



Project description (main facilities):

The agricultural biogas plant in Darżyno produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. The owner of the plant is Nadmorskie Elektrownie Wiatrowe Darżyno Sp. z o.o.

Main facilities:

- 2 x pre-storage tank with capacity 190 m^3
- 2 x pre-storage tank with capacity 340 m^3
- 4 x fermenter with capacity 4 400 m^3
- 4 x post-fermentation tank with capacity 5 000 m^3
- Service building
- Pumping station

Input materials:

- Waste from food industry
- Potato pulp
- Plant waste

Annual output of the plant:

- Biogas: approx. 7 700 000 m^3/year
- Electricity: approx. 19 000 000 kWh/year
- Heat: approx. 19 500 000 kWh/year

34. Agricultural biogas plant in Sobawiny

Electrical capacity: 500 kWe	**Owner of the plant**: Zakład Usługowo-Handlowy (ZUH) "Wojciechowski" Zdzisław Wojciechowski.
Thermal capacity: 646 kWt	**Opening date**: 11 September, 2013

Location:

Town/village: Sobawiny near Opoczno
District: Opoczno
County: Opoczno
Province: Łódzkie

Project description (main facilities):

The agricultural biogas plant in Sobawiny produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The input material is composed of corn silage from their crops (belonging to the owner of the company ZUH Wojciechowski, who bought and leased for this purpose a total of 200 hectares of fields), and meat waste from the factory meat Wojciechowski.
The owner of the plant is Zakład Usługowo-Handlowy (ZUH) "Wojciechowski" Zdzisław Wojciechowski.

Input materials:

- Corn silage
- Waste form meat industry

Annual output of the plant:

- Biogas: approx. 1 883 314 m^3/year
- Electricity: approx. 4 000 000 kWh/year
- Heat: approx. 5 168 000 kWh/year

35. Agricultural biogas plant in Byszewo

Electrical capacity: 1165 kWe	**Owner of the plant**: EL-KA Sp. z o.o.
Thermal capacity: 1201 kWt	**Opening date**: 2013

Location:

Town/village: Byszewo
District: Łobez
County: Łobez
Province: Zachodniopomorskie

Project description (main facilities):

The agricultural biogas plant in Byszewo produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The owner of the plant is EL-KA Sp. z o.o.

Main facilities:

- Pre-storage tank with capacity 200 m^3
- 2 x fermenter with capacity 2 077 m^3
- Post-fermentation tank with capacity 2 556 m^3
- 2x final tank with capacity 2 455 m^3
- Service building
- Pumping station

Input materials:

- Poultry manure
- Corn silage

Annual output of the plant:

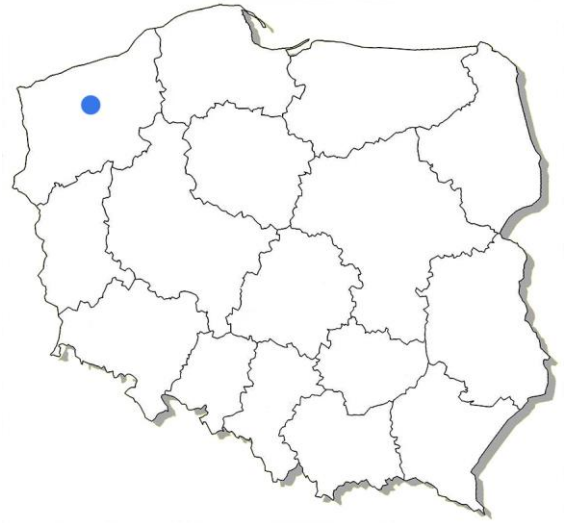
- Biogas: approx. 4 400 000 m^3/year
- Electricity: approx. 9 320 000 kWh/year
- Heat: approx. 9 608 000 kWh/year

36. Agricultural biogas plant in Przemysław

Electrical capacity: 1600 kWe	**Owner of the plant**: BIOGAZ Przemysław "Łąkrol" Sp. z o.o.
Thermal capacity: 1600 kWt	**Opening date**: 2 September, 2013

Location:

Town/village: Przemysław
District: Resko
County: Łobez
Province: Zachodniopomorskie



Project description (main facilities):

The agricultural biogas plant in Przemysław produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.

Main facilities:

- 2 x pre-storage tank with capacity 154 m^3
- 3 x fermenter with capacity 2 944 m^3
- Fermenter no. 2 with capacity 2 600 m^3
- Fermenter no. 3 with capacity 3 826 m^3
- Post-fermentation tank with capacity 3 434 m^3
- Final tank with capacity 4 625 m^3
- Service building
- Pumping station

Input materials:

- Liquid manure
- Distillery slop
- Corn and grass silage
- Beet pulp

Annual output of the plant:

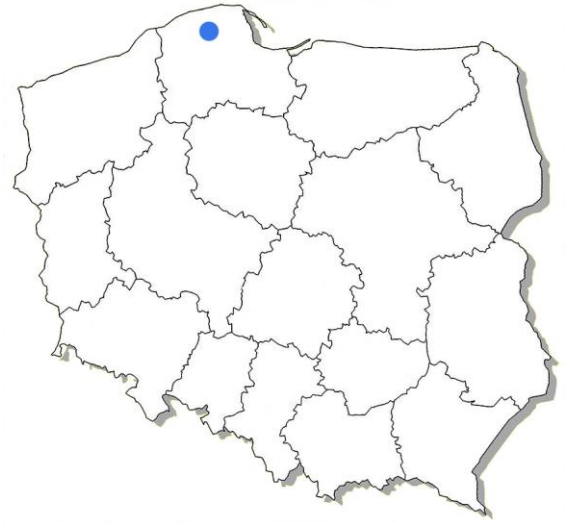
- Biogas: approx. 7 000 000 m^3/year
- Electricity: approx. 13 500 000 kWh/year
- Heat: approx. 13 500 000 kWh/year

37. Agricultural biogas plant in Lębork

Electrical capacity: 1200 kWe	**Owner of the plant**: FARM FRITES POLAND S.A.
Thermal capacity: 1223 kWt	**Opening date**: October 2013

Location:

Town/village: Lębork
District: Lębork
County: Lębork
Province: Pomorskie



Project description (main facilities):

The agricultural biogas plant in Lębork produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. The owner of the plant is FARM FRITES POLAND S.A.

Input materials:

- Sludge from potato chips production

Annual output of the plant:

- Biogas: approx. 3 500 000 m^3/year
- Electricity: approx. 9 328 000 kWh/year
- Heat: approx. 9 787 000 kWh/year

38. Agricultural biogas plant in Glinojeck

Electrical capacity: 1560 kWe	**Owner of the plant**: PFEIFER & LANGEN GLINOJECK S.A
Thermal capacity: 1653 kWt	**Opening date**: 2013

Location:

Town/village: Zygmuntowo
District: Glinojeck
County: Ciechanów
Province: Mazowieckie

Project description (main facilities):

The agricultural biogas plant in Glinojeck produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The owner of the plant is PFEIFER & LANGEN GLINOJECK S.A.

Input materials:

- Waste from sugar industry

Annual output of the plant:

- Biogas: approx. 7 305 840 m^3/year
- Electricity: approx. 13 665 000 kWh/year
- Heat: approx. 14 480 000 kWh/year

39. Agricultural biogas plant in Borzęciczki

Electrical capacity: 1200 kWe	**Owner of the plant**: Elektrownia Biogazowa "Borzęciczki" Sp. z o.o.
Thermal capacity: 1320 kWt	**Opening date**: 2012

Location:

Town/village: Borzęciczki
District: Koźmin Wielkopolski
County: Krotoszyn
Province: Wielkopolskie

Project description (main facilities):

The agricultural biogas plant in Borzęciczki produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The owner of the plant is Elektrownia Biogazowa "Borzęciczki" Sp. z o.o.

Main facilities:

- Pre-storage tank with capacity 283 m^3
- Fermenter no. 1 with capacity 2 600 m^3
- Fermenter no. 2 with capacity 2 600 m^3
- Fermenter no. 3 with capacity 3 826 m^3
- Post-fermentation tank with capacity 4 241 m^3
- Post-fermentation tank with capacity 6 430 m^3
- Service building
- Pumping station

Input materials:

- Manure

Annual output of the plant:

- Biogas: approx. 3 600 000 m^3/year
- Electricity: approx. 7 694 000 kWh/year
- Heat: approx. 8 000 000 kWh/year

40. Agricultural biogas plant in Sławkowo

Electrical capacity: 400 kWe	**Owner of the plant**: Agro Bio Sp. z o.o
Thermal capacity: 445 kWt	**Opening date**: 2013

Location:

Town/village: Sławkowo
District: Kętrzyn
County: Kętrzyn
Province: Warmińsko-mazurskie

Project description (main facilities):

The agricultural biogas plant in Sławkowo produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The owner of the plant is Agro Bio Sp. z o.o

Main facilities:

- Component storage area
- Fermenter
- Post-fermentation tank
- Service building

Input materials:

- Corn silage

Annual output of the plant:

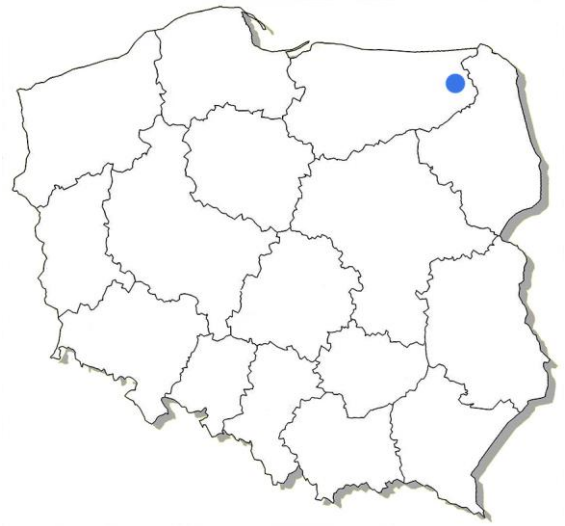
- Biogas: approx. 1 680 000 m^3/year
- Electricity: approx. 3 200 000 kWh/year
- Heat: approx. 3 560 000 kWh/year

41. Agricultural biogas plant in Giże

Electrical capacity: 1063 kWe	**Owner of the plant**: Eco-Progres Sp. z o.o.
Thermal capacity: 1104 kWt	**Opening date**: 2013

Location:

Town/village: Giże
District: Olecko
County: Olecko
Province: Warmińsko-mazurskie



Project description (main facilities):

The agricultural biogas plant in Giże produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. The owner of the plant is Eco-Progres Sp. z o.o.

Main facilities:

- Component storage area
- Pre-storage tank with capacity 190 m^3
- Fermenter no. 1 with capacity 2 280 m^3
- Fermenter no. 2 with capacity 2 280 m^3
- Post-fermentation tank with capacity 4 241 m^3
- Post-fermentation tank with capacity 4 825 m_3
- Service building
- Pumping station

Input materials:

- Corn and grass silage
- Pig and poultry manure

Annual output of the plant:

- Biogas: approx. 4 240 000 m^3/year
- Electricity: approx. 8 400 000 kWh/year
- Heat: approx. 8 832 000 kWh/year

42. Agricultural biogas plant in Tragamin

Electrical capacity: 800 kWe	**Owner of the plant**: Ośrodek Hodowli Zarodowej "Gajewo" Sp. z o.o.
Thermal capacity: 798 kWt	**Opening date**: 2012

Location:

Town/village: Tragamin near Malborka
District: Malbork
County: Malbork
Province: Pomorskie

Project description (main facilities):

The agricultural biogas plant in Tragamin produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The owner of the plant is Osrodek Hodowli Zarodowej "Gajewo" Sp. z o.o.

Main facilities:

- Component storage area
- Fermenter no. 1 with capacity 3 760 m^3
- Fermenter no. 2 with capacity 3 760 m^3
- Post-fermentation tank with capacity 2 280 m^3
- Final tank 8 140 m^3
- Transformer station
- 2 x power generator with a capacity of 400 kWe

Input materials:

- Corn silage
- Manure
- Waste from sugar industry

Annual output of the plant:

- Biogas: approx. 2 880 000 m^3/year
- Electricity: approx. 6 660 000 kWh/year
- Heat: approx. 6 640 000 kWh/year

43. Agricultural biogas plant in Ryboły

Electrical capacity: 1000 kWe	**Owner of the plant**: ADLER BIOGAZ Sp. z o.o.
Thermal capacity: 1006 kWt	**Opening date**: 2014

Location:

Town/village: Ryboły
District: Zabłudów
County: Białystok
Province: Podlaskie

Project description (main facilities):

The agricultural biogas plant in Ryboły produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit. The owner of the plant is ADLER BIOGAZ Sp. z o.o.

Input materials:

- Pig and poultry manure
- Corn silage

Annual output of the plant:

- Biogas: approx. 4 380 000 m^3/year
- Electricity: approx. 7 800 000 kWh/year
- Heat: approx. 7 847 000 kWh/year

44. Agricultural biogas plant in Łagiewniki

Electrical capacity: 800 kWe	**Owner of the plant**: Instytut Zarządzania i Samorządności Sp. z o.o.
Thermal capacity: 412 kWt	**Opening date**: June, 2013

Location:

Town/village: Łagiewniki
District: Łagiewniki
County: Dzierżoniowski
Province: Dolnośląskie

Project description (main facilities):

The agricultural biogas plant in Łagiewniki produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.
The owner of the plant is Instytut Zarządzania i Samorządności Sp. z o.o.

Input materials:

- Corn silage

Annual output of the plant:

- Biogas: approx. 2 697 500 m^3/year
- Electricity: approx. 6 017 500 kWh/year
- Heat: approx. 3 419 600 kWh/year

45. Agricultural biogas plant in Działyń

Electrical capacity: 999 kWe	**Owner of the plant**: Biogaz Działyń Sp. z o.o.
Thermal capacity: 1014 kWt	**Opening date**: December, 2013

Location:

Town/village: Działyń
District: Kłecko
County: Gniezno
Province: Wielkopolskie

Project description (main facilities):

The agricultural biogas plant in Działyń produces biogas and generates electricity and heat in the process of its combustion in a cogeneration unit.

Main facilities:

- Component storage area
- Fermenter no. 1 with capacity 3 040 m^3
- Fermenter no. 2 with capacity 3 040 m^3
- 2 x post-fermentation tank with capacity 5 650 m^3
- Transformer station
- Power generator with a capacity of 400 kWe
- Power generator with a capacity of 599 kWe

Input materials:

- Pig and cattle manure
- Corn silage

Annual output of the plant:

- Biogas: approx. 3 712 000 m^3/year
- Electricity: approx. 8 320 000 kWh/year
- Heat: approx. 8 440 000 kWh/year

7 LITERATURE

Widely available information was used in the present project's compilation (from the companies' websites, public information bulletins of offices, etc.).

[1] BioAlians doradztwo inwestycyjne; "Biogas 2012. The market of agricultural biogas plants in Poland." Warsaw 2013.
[2] http://www.arr.gov.pl/
[3] http://www.ure.gov.pl
[4] http://www.poldanor.com.pl/en/

8 APPENDIXES

Appendix 1. Existing biogas plants in Poland.

Lp.	Biogas plant Location	Investor	Feedstock	Technology	Biogas production [m^3/year]	Electrical capacity [MW_e]	Thermal capacity [MW_t]	Electricity generation [MWh_e/year]	Heat generation [MWh_e/year]
1	Koczała ul. Polna 3 77-220 Koczała woj. pomorskie	Poldanor S.A.	liquid manure, corn silage, glycerine	Mesophilic	8 212 500	2.126	2.206	16 761.384	17 392.104
2	Pawłówko 77-320 Przechlewo woj. pomorskie	Poldanor S.A.	liquid manure, maize silage, slaughter waste, glycerine	Mesophilic	3 802 655	0.946	1.101	7 458.260	8 680.284
3	Płaszczyca 77-320 Przechlewo woj. pomorskie	Poldanor S.A.	liquid manure, maize silage, plant waste, herbal product processing waste	Mesophilic	2 299 500	0.625	0.680	4 927.500	5 361.120
4	Nacław 14B 76-006 Nacław woj. Zachodnio-pomorskie	Poldanor S.A.	liquid manure, corn silage, glycerine	Mesophilic	2 299 500	0.625	0.686	4 927.500	5 408.424
5	Świelino 30 76-020 Bobolice woj. Zachodnio-pomorskie	Poldanor S.A.	liquid manure, corn silage, glycerine	Mesophilic	2 299 500	0.625	0.686	4 927.500	5 408.424
6	Uniechówek 77-310 Debrzno woj. pomorskie	Poldanor S.A.	liquid manure, corn silage	Mesophilic	4 100 200	1.063	1.081	8 380.700	8 522.604
7	Giżyno 78-540 Kalisz Pomorski woj. zachodnio-pomorskie	Poldanor S.A.	liquid manure, corn silage	Mesophilic	4 100 200	1.063	1.081	8 380.000	8 520.000
8	Kujanki 77-300 Człuchów woj. pomorskie	Poldanor S.A.	liquid manure, glycerine	Mesophilic	1 124 470	0.330	0.342	2 602.000	2 696.000
9	Niedoradz 67-106 Otyń woj. lubuskie	Biogaz Agri Sp. z o.o.	pig and poultry manure, corn silage	Mesophilic	631 000	0.252	0.291	1 300.000	1 500.000

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Lp.	Biogas plant Location	Investor	Feedstock	Technology	Biogas production [m^3/year]	Electrical capacity [MW_e]	Thermal capacity [MW_t]	Electricity generation [MWh_e/year]	Heat generation [MWh_e/year]
10	Kalsk 69A 66-100 Sulechów woj. lubuskie	Gospodarstwo Rolne w Bukowie Sp. z o.o.	liquid manure, corn silage	Mesophilic	5 000 000	1.140	1.060	9 000.000	12 500.000
11	Liszkowo 87-93 88-190 Złotniki Kujawskie woj. kujawsko-pomorskie	Elektrownie Wodne Sp. z o.o.	corn silage, plant waste, distillery slop	Mesophilic	7 400 000	2.126	1.198	14 400.000	8 100.000
12	Skrzatusz 64-930 Szydłowo woj. wielkopolskie	Biogaz Zeneris Sp. z o.o.	corn silage, distillery slop, food waste, potato pulp	Mesophilic	2 102 400	0.526	0.505	4 607.760	4 423.800
13	ul. Sportowa 5 78-450 Grzmiąca woj. zachodnio-pomorskie	Eko-Energia Grzmiąca Sp. z o.o.	pig and poultry manure, corn and grass silage, distillery slop	Mesophilic	7 000 000	1.600	1.600	13 500.000	14 500.000
14	ul. Metalowców 22 58-100 Świdnica woj. dolnośląskie	BIO-WAT Sp. z o.o.	corn and grass silage, beet leaves	Mesophilic	4 000 000	0.900	1.100	7 200.000	8 800.000
15	ul Łabędzka 54, Łany Wielkie 44-153 Sośnicowice woj. Śląskie	BIO-BUT Sp. z o.o.	distillery slop, corn silage, manure	Mesophilic	2 470 915	0.526	0.540	4 471.000	4 625.000
16	Uhnin 141 21-211 Dębowa Kłoda woj. lubelskie	Bioelektrownia Sp. z o.o.	corn silage, rye silage, grass silage, distillery slop, potato pulp	Mesophilic	4 500 000	1.200	1.160	10 000.000	9 600.000
17	Konopnica 121 96-200 Rawa Mazowiecka woj. łódzkie	Bioenergy Project Sp. z o.o.	Corn silage, grass silage	Mesophilic	9 353 755	1.998	2.128	17 083.000	18 194.000
18	Mełno 86-330 Mełno woj. kujawsko-pomorskie	Allter Power Sp. z o.o.	distillery slop	termophilic	6 200 000	1.600	1.800	12 800.000	14 400.000

Lp.	Biogas plant Location	Investor	Feedstock	Technology	Biogas production [m^3/year]	Electrical capacity [MW_e]	Thermal capacity [MW_t]	Electricity generation [MWh_e/year]	Heat generation [MWh_e/year]
19	ul. Zamojska 26C 21-050 Piaski woj. lubelskie	Wikana Bioenergia Sp. z o.o.	corn silage, whey, manure	Mesophilic	4 250 000	0.999	1.039	8 000.000	9 600.000
20	Zbiersk Cukrownia 61 62-830 Zbiersk woj. wielkopolskie	AWW Wawrzyniak Sp. j.	distillery slop	Mesophilic	4 176 558	1.600	1.620	12 800.000	12 960.000
21	Boleszyn 7A 13-308 Mroczno woj. warmińsko-mazurskie	Biogal Sp. z o.o.	corn silage, manure, in season: distillery slop and whey	Mesophilic	7 840 000	2.000	2.020	15 200.000	15 360.000
22	Klępsk 53 66-111 Nowe Kramsko woj. lubuskie	Gospodarstwo Rolne Kargowa - Klępsk Ryszard Maj	corn silage, pig manure	Mesophilic	4 633 117	1.000	1.400	8 147.000	11 406.000
23	Szklarka Myślniewska 68A 63-500 Ostrzeszów woj. wielkopolskie	P.P.-H.-U. "SERAFIN" Sp. z o.o.	-	Mesophilic	3 000 000	0.660	0.640	5 493.000	5 326.000
24	ul. Czarnowska 56C 26-065 Piekoszów woj.świętokrzyskie	Elektrociepłownia Bartos Sp. z o.o.	corn silage, manure	Mesophilic	2 464 000	0.800	0.855	6 200.000	6 350.000
25	ul. Osiedlowa 4, Zalesie 46-146 Domaszowice woj. opolskie	Polskie Biogazownie "Energy Zalesie" Sp. z o.o.	liquid manure, potato pulp	Mesophilic	8 000 000	2.000	2.016	17 520.000	17 660.000
26	ul. Ząbkowicka 53 57-100 Strzelin woj. dolnośląskie	Südzucker Polska S.A.	beet pulp	Mesophilic	9 894 549	2.000	2.065	17 520.000	18 089.000
27	Koczergi 56B 21-200 Parczew woj. lubelskie	DMG Sp. z o.o.	Corn silage	Mesophilic	4 300 000	1.200	1.300	10 200.000	11 050.000
28	Zaścianki 86 21-560 Międzyrzec Podlaski woj. lubelskie	"BIO-POWER" Sp. z o.o.	-	Mesophilic	3 500 000	1.200	1.251	9 000.000	9 300.000

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29	ul. Mac Millan 1 Bielany Wrocławskie 55-040 Kobierzyce woj. dolnośląskie	Cargill Poland Sp. z o.o.	wheat	Mesophilic	1 300 000	0.526	0.581	3 400.000	3 750.000
30	Starorypin Prywatny 51 87-500 Rypin woj. kujawsko-pomorskie	Biogazownia Rypin Sp. z o.o.	corn silage, manure	Mesophilic	6 811 090	1.875	1.780	15 000.000	14 240.000
31	Łęguty 15 11-036 Gietrzwałd woj. warmińsko-mazurskie	Minex-Invest Sp. z o.o.	corn silage, manure, distillery slop, glycerine	Mesophilic	4 561 200	1.200	1.220	10 200.000	10 370.000
32	Orchówek ul. Garbarska 16 22-200 Włodawa woj. lubelskie	"EKOENERGIA WKM" Sp. z o.o.	waste form industry	Mesophilic	3 500 000	1.063	1.299	8 326.000	9 394.000
33	Darżyno, działka Nr 244/6 obręb Darżyno 76-230 Potęgowo woj. pomorskie	Nadmorskie Elektrownie Wiatrowe Darżyno Sp. z o.o.	waste from food industry, potato pulp, plant waste	Mesophilic	7 700 000	2.400	2.448	19 000.000	19 500.000
34	Opoczno, działki nr 34 i 35 obręb 4 Opoczno 26-300 Opoczno woj. łódzkie	Zakład Usługowo-Handlowy "Wojciechowski" Zdzisław Wojciechowski	corn silage, waste form meat industry	Mesophilic	1 883 314	0.500	0.646	4 000.000	5 168.000
35	Byszewo 17 73-150 Łobez woj. zachodniopomorskie	EL-KA Sp. z o.o.	corn silage, poultry manure	Mesophilic	4 400 000	1.165	1.201	9 320.000	9 608.000
36	dz. 27/2 Przemysław 72-315 Resko woj. zachodnio-pomorskie	BIOGAZ Przemysław "Łąkrol" Sp. z o.o. sp. komandytowa	liquid manure, corn and grass silage, distillery slop, beet pulp	Mesophilic	7 000 000	1.600	1.600	13 500.000	13 500.000
37	ul. Abrahama 13 84-300 Lębork woj. pomorskie	FARM FRITES POLAND S.A.	sludge from production	Mesophilic	3 500 000	1.200	1.223	9 328.000	9 787.000

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Lp.	Biogas plant Location	Investor	Feedstock	Technology	Biogas production [m^3/year]	Electrical capacity [MW_e]	Thermal capacity [MW_t]	Electricity generation [MWh_e/year]	Heat generation [MWh_e/year]
38	Zygmuntowo 38 06-450 Glinojeck woj. mazowieckie	PFEIFER & LANGEN GLINOJECK S.A.	waste from sugar industry	Mesophilic	7 305 840	1.560	1.653	13 665.000	14 480.000
39	Borzęciczki 29 63-720 Koźmin Wielkopolski woj. wielkopolskie	Elektrownia Biogazowa "Borzęciczki" Sp. z o.o.	manure	Mesophilic	3 600 000	1.200	1.320	7 694.000	8 000.000
40	Sławkowo 15 11-400 Kętrzyn woj. warmińsko-mazurskie	Agro Bio Sp. z o.o.	corn silage	Mesophilic	1 680 000	0.400	0.445	3 200.000	3 560.000
41	Giże 4 19-400 Olecko woj. warmińsko-mazurskie	"Eco-Progres" Sp. z o.o.	corn and grass silage, manure	Mesophilic	4 240 000	1.063	1.104	8 400.000	8 832.000
42	Tragamin 82-200 Malbork woj. pomorskie	Ośrodek Hodowli Zarodowej "Gajewo" Sp. z o.o.	corn silage, manure, waste from sugar industry	Mesophilic	2 880 000	0.800	0.798	6 660.000	6 640.000
43	Ryboły 1/1 16-060 Zabłudów woj. podlaskie	ADLER BIOGAZ Sp. z o.o.	corn silage, pig and poultry manure	Mesophilic	4 380 000	1.000	1.006	7 800.000	7 847.000
44	ul. Lipowa 7A 58-210 Łagiewniki woj. dolnośląskie	Instytut Zarządzania i Samorządności Sp. z o.o.	corn silage	Mesophilic	2 697 500	0.800	0.412	6 017.500	3 419.600
45	Działyń 24, 62-271 Działyń woj. wielkopolskie	Biogaz Działyń Sp. z o.o.	pig and cattle manure, corn silage	Mesophilic	3 712 000	0.999	1.014	8 320.000	8 440.000