How is a micro agricultural biogas plant defined in Poland?

Connected to the grid at max 110 kV

(National Act on Energy Law Art.3, pkt 20b – definition of general RES micro-installation)
Micro agricultural biogas plants in modular containers

Wet fermentation – modular containers

- digester tank – heated, thermally insulated, with stirrers, the ceiling is usually a biogas tank (made with a double membrane supported by air-cushion)
- the secondary digester tank – heated, with stirrer and storage of biogas in the ceiling

- easy to transport
- low cost
- building permit not necessary
- simple operation
- easy control of the process parameters
Micro agricultural biogas plants in modular containers – example 1

Modular container micro agricultural biogas plants

- internal dimensions: 12 x 2.5 x 2.5 m
- digester tank + biogas tank + installation transfer the rest of the digestate
- biogas production from 3.5 to 5 m3 per hour

<table>
<thead>
<tr>
<th>Component</th>
<th>PLN</th>
<th>EUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digester tank</td>
<td>120 000</td>
<td>28 600</td>
</tr>
<tr>
<td>CHP - 10 kWel</td>
<td>60 000</td>
<td>14 300</td>
</tr>
<tr>
<td>Automation and control systems</td>
<td>30 000</td>
<td>7 100</td>
</tr>
<tr>
<td>Metering system and connection to the electric grid</td>
<td>20 000</td>
<td>4 800</td>
</tr>
<tr>
<td>Biogas tank</td>
<td>5 000</td>
<td>1 200</td>
</tr>
<tr>
<td>Documentation, technical design, supervision</td>
<td>10 000</td>
<td>2 400</td>
</tr>
<tr>
<td>Adaptation of the existing tank for fermentation pulp</td>
<td>2 000</td>
<td>500</td>
</tr>
<tr>
<td>Labour</td>
<td>10 000</td>
<td>2 400</td>
</tr>
<tr>
<td>Technological installations, area preparation</td>
<td>13 000</td>
<td>3 100</td>
</tr>
<tr>
<td>Start-up, transportation, training, transfer of investments</td>
<td>5 000</td>
<td>1 200</td>
</tr>
<tr>
<td>Storage tank water heater</td>
<td>10 000</td>
<td>2 400</td>
</tr>
<tr>
<td>Other</td>
<td>14 250</td>
<td>3 400</td>
</tr>
<tr>
<td>SUM</td>
<td>299 250</td>
<td>71 400</td>
</tr>
</tbody>
</table>
Micro agricultural biogas plants in modular containers – example 2

Modular container micro agricultural biogas plants integrated with CHP

- with CHP 25 kWel: cost ap. 1.5 mln PLN (~350,000 EUR)
- dimensions: 12.4 x 2.5 x 5.4 m
How many micro agricultural biogas plants in Poland?

- **no obligation to register** micro agricultural biogas plants in Agricultural Market Agency (ARR)

- **obligation to prepare reports** of the electricity produced in micro-installations by all operators of the distribution system

  - according to reports **now there is no micro agricultural biogas plant connected to the grid** in Poland

  - so far: 1 x plant of 25-30 kWel (Studzionka),
    1 x plant of 10 kWel (Lubań - in construction phase), and....

Why there is so low number of micro agricultural biogas plants in Poland??? – **see legal conditions**!
What are the incentives (or difficulties) for the development of micro agricultural biogas plants in Poland?

- permits related to construction
- permits related to environmental protection
- economic activity and registers
- access to the public grid
- energy, heat and agricultural biogas sale
- subsidy during operation (certificates for electricity and agricultural biogas, auction system of energy sales – planned)
- tax policy
- requirements for digested manure used as fertilizer
- subsidy for investment

And in details...
Permits related to construction

• building permit decision
  – not required for installations which are not permanently attached to the ground (e.g. microbiogas plants as container)
    – only notification of construction
  – in the absence of local development plan, decision of conditions for construction and land management must be obtained
  – before the application several documents must be obtained: terms of grid connection, terms of rainwater drainage, terms of connection to water supply, terms of sewage

• use permit decision (only in case of building permit decision)

• decision of the Technical Inspection on operation of pressure (closed) boilers and tanks
Permits related to environmental protection

• decision to permit the processing of waste (issued for 10 years)
  — but person who is not an entrepreneur, using waste for their own needs is exempted from this obligation in case when type of waste is indicated in the relevant regulation (at the moment the draft of the regulation does not include waste 19 06 06 or 19 06 05)
  — types of waste:
    • 19 06 05 - liquid from anaerobic treatment of animal and plant waste
    • 19 06 06 - digestate from anaerobic treatment of animal and plant waste
  — method of the processing of waste 19 06 05 and 19 06 06:
    • by R10 - land treatment resulting in benefit to agriculture or an improvement of the environment

• limitation of emissions to air from micro energy plants is not regulated
Economic activity and registers

• agricultural biogas generation requires to start an economic activity as energy company and register in Agricultural Market Agency (ARR)

But...

• electricity generation (and its sale) in micro-installations, by a person who is not an entrepreneur, does not require to start an economic activity as energy company and register in Agricultural Market Agency (ARR)

—no change in the amount of social security contributions: in Poland contributions of farmers regulates KRUS (Agricultural Social Insurance Fund), while the contribution of entrepreneurs regulates ZUS (Social Insurance Institution)
Access to the public grid and guarantee of purchase

- **obligation to purchase heat** from RES by energy companies in an amount not greater than the demand of the customers of this company
- **guarantee of purchase of agricultural biogas** (meeting the quality requirements) to the gas grid
- **guarantee and priority of purchase of electricity** produced from renewable energy sources (RES) by operator of the grid *(no charge from micro-installations for the connection to the grid)*
Different guarantee prices of electricity

• **guarantee to purchase electricity** generated by the micro agricultural biogas plant connected to the grid at a price equal to **80% of the average selling price (wholesale)** of electricity in the previous calendar year, announced by the Energy Regulatory Office (URE)
  – 2013: 146 PLN/MWh - **about 35 EUR/MWh** (to comparison: average price of electricity purchase by households is about 140 EUR/MWh)

  **OR**

• if the agricultural biogas plant is **registered in ARR, what implies being an energy company** (micro-installations are exempted from this obligation), at a price equal to **100%** above mentioned price
  – 2013: 182 PLN/MWh – **about 45 EUR/MWh**......still not enough!
Certificates of origin of electricity and agricultural biogas

<table>
<thead>
<tr>
<th>Color</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>from the generation of electricity from renewable energy sources (RES)</td>
<td>support lasts only until 2020</td>
</tr>
<tr>
<td></td>
<td>~ 50 (&lt; 70) EUR/MWh</td>
<td></td>
</tr>
<tr>
<td>AND</td>
<td>from the generation of electricity in high-efficiency CHP</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td>from fuel gas and other fuels if the installed capacity &lt;1 MW (e.g. microbiogas plant)</td>
<td>support lasts until 2018</td>
</tr>
<tr>
<td>Violet</td>
<td>~ 15 EUR/MWh</td>
<td></td>
</tr>
<tr>
<td></td>
<td>from the generation of electricity in high-efficiency CHP</td>
<td></td>
</tr>
<tr>
<td>Violet</td>
<td>from agricultural biogas</td>
<td>support lasts only until 2018</td>
</tr>
<tr>
<td>Violet</td>
<td>~ 15 EUR/MWh</td>
<td></td>
</tr>
<tr>
<td>Brown</td>
<td>from the generation of agricultural biogas, injected into the gas grid</td>
<td>support lasts only until 2020</td>
</tr>
<tr>
<td>Brown</td>
<td>~ 50 (&lt; 70) EUR/MWh</td>
<td></td>
</tr>
</tbody>
</table>
Subsidies during operation - certificates only for energy companies...

- **certificates** of origin for electricity and agricultural biogas are issued **only for energy companies** registered in Agricultural Market Agency (ARR)

  But simultaneously......

- **electricity generation (and its sale) in micro-installations**, by a person who is not an entrepreneur, **does not require to start an economic activity** as energy company and register in ARR
What is the profit from the electricity production/sales?

- Level of income - set on the basis of the current energy market (prices are not fixed)
- Price of electricity sold – guaranteed on the basis of average prices from the previous year
- Price for electricity consumed ~ 12 c€/kWh (120 €/MWh)
Beneficial tax policy
– excise on electricity and agricultural biogas

• excise duty on electricity – 20 PLN/MWh (~5 EUR/MWh)
  – not required for electricity produced from RES, on the basis of a document confirming cancellation of the certificate of origin of electricity (but what in case of planned auction system of energy sales???)
  – not required for consumption of electricity produced from plants < 1 MW, not sending to the grid

• excise duty on agricultural biogas – 0 PLN
Requirements connected with digestate

• fertilizer (waste recovery - R10)
  – 19 06 05 - liquid from anaerobic treatment of animal and plant waste
  – 19 06 06 - digestate from anaerobic treatment of animal and plant waste

• only a few requirements:
  – 19 06 05: waste meets requirements for natural fertilizers specified in the Act of 10 July 2007 on fertilizers and fertilization,
  – 19 06 06: waste is applied uniformly over the entire surface of the soil, out to a depth of 30 cm
Project: National Act on RES (probably by 2015) – new in the field of definition and economic activity

**PROJECTED LAW for RES**

- **definition of micro-installation:**
  - max electric power - 40 kWel (connected to the grid at max 110 kV) or...
  - max thermal power produced in CHP – 120 kWth

- **producer of energy or heat** and this time also of **agricultural biogas** from micro agricultural biogas plant (of up to 160,000 m³ per year) **does not have to start an economic activity, but has to enter the register of producers**
Project: National Act on RES
- new solutions in guarantee of purchase of electricity

• guarantee of purchase of electricity produced from micro-installations by operator of the grid over the 15 years (max until 2035)
  – settlement of the difference between the amount of electricity drawn from the grid and the amount of electricity introduced into the grid, every half year

• quarterly - information to the operator of the grid: the amount of generated electricity or agricultural biogas, and electricity sold or agricultural biogas injected into the gas grid
Project: National Act on RES
- new solutions in brown and green certificates (probably by 2016)

- **Brown certificates of origin of agricultural biogas**
  - issued for producers of agricultural biogas, registered in the register of producers *(this time no obligation to be an energy company)*
  - entitled for a period of 15 years (max until 2035); period is counted from the first time when a certificate of origin was issued

- **Green certificates of origin of electricity only for existing installations!**
  - issued for producers of electricity, registered in the register of producers *(this time no obligation to be an energy company)*
  - entitled for a period of 15 years (max until 2035); period is counted from the first time when a certificate of origin was issued
  - the expected price < the replacement fee 300 PLN/MWh (< 70 EUR/MWh)
Project: National Act on RES
- auction instead of green certificates (probably by 2016)

• **For new installations – auction system of energy sales**
  – only for energy companies (bank guarantee or deposit)
  – the producer of energy offers the price, which can not exceed the reference price (the sum of the average selling price of electricity in the previous year and the weighted average prices of property rights arising from green certificates of origin in 2011-2013)
  – the lowest offers = winners – 15 years of guarantee selling price of electricity, yearly information to Energy Regulatory Office about the amount of produced electricity
  – auction at least once a year
What will be the profit from the electricity production/sales (project)?

<table>
<thead>
<tr>
<th>Source of income for existing installations (according to project of National Act on RES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity sold</td>
</tr>
<tr>
<td>Green certificate for el. produced</td>
</tr>
<tr>
<td>Yellow certificate for el. produced</td>
</tr>
<tr>
<td><strong>SUM – for el. sold</strong></td>
</tr>
<tr>
<td><strong>SUM – for el. produced (not sold)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Income for energy company, EUR/MWh</th>
<th>Income for not an entrepreneur, EUR/MWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td><strong>125</strong></td>
<td><strong>95</strong></td>
</tr>
<tr>
<td><strong>80</strong></td>
<td><strong>50</strong></td>
</tr>
</tbody>
</table>

- level of income - set on the basis of the current energy market (prices are not fixed)
- electricity - sold in a competitive market (not guaranteed)
What will be the profit from the electricity production/sales (project)?

**Source of income for new installations** (according to project of National Act on RES):
- Electricity sold at auction
- Electricity sold in a comp. market
- Yellow certificate for el. produced

**SUM – el. sold at auction**
- 135

**SUM – el. sold in a comp. market**
- 75

**SUM – el. produced (not sold)**
- 30

**Income for energy company, EUR/MWh**
- 45 + 60
- 45
- 30
- **135**
- 75
- **30**

**Income for not an entrepreneur, EUR/MWh**
- 0
- 45
- 0
- 0

- part of prices at auction connected with green certificates (i.e. 60 EUR/MWh) – set on the basis of average prices of 2011-2013 (according to project of National Act on RES)
- level of other income - set on the basis of the current energy market (prices are not fixed)
National subsidy for investment in micro agricultural biogas plants

• loan and grants for plant construction
  – the National Fund for Environmental Protection and Water Management, e.g.:

  • program Prosumer-financing microinstallations of RES (grant up to 40% of the qualified investment costs (up to 300,000 PLN or 450,000 PLN in case of > 1 plant for one building), loans for the rest)
  • GIS – Green Investment Scheme – agricultural biogas plants (grant up to 45% of the qualified investment costs, regional funds system for the rest)

– Voivodship (Province) Funds for Environmental Protection and Water Management
EU subsidy for investment in micro agricultural biogas plants

• grants for plant construction
  – the European Union 2014-2020 funds – at the moment only projects, e.g.:
  • the Operational Programme Infrastructure and Environment - PRIORITY INVESTMENT 4.1 Promoting the production and distribution of energy from renewable sources
  • the Regional Operational Programmes of particular voivodeship
  • The Rural Development Programme
Bank support for investment in micro agricultural biogas plant

• loan for plant construction
  – financing by banks

  • Bank Gospodarki Żywnościowej (loan is available both for individuals and legal entities engaged in economic activities in the production of fuels and energy from renewable sources; bank also offers “project finance” method investment support)

  • Bank Ochrony Środowiska (preferential loans with interest rate subsidies paid by the NFOŚiGW and WFOŚiGW)
Micro agricultural biogas plants - best practice in Poland

Micro agricultural biogas plant in Studzionka

—substrates:
  • chicken manure
  • pig slurry

—components:
  • fermentation tank (railway tank)
  • tank for fermentation pulp (for the secondary recovery of biogas from pulp)
  • biogas tank (plastic membrane)
Micro agricultural biogas plants - best practice in Poland

Micro agricultural biogas plant in Studzionka
– CHP 25-30 kWel
– 2 kWh from 1 m$^3$ of biogas (55% of methane)
– cost of investment – 400,000 PLN (~100,000 EUR)

• But....
due to current regulations, the operator has trouble with profitable operation...
Thank you for your attention

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