This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691911

Technology Description (TD) for

Anaerobic Digestion Technologies

Contact Information:

TECHNOLOGY/ EQUIPMENT SUPPLIER	*Name of institution:*	Metal Expert Sp. z o.o. Sp.J.		
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	Date (of filling the TD):	15-12-2017		

Technology Description:

NAME OF TECHNOLOGY	Agricultural micro-biogas plant with micro-cogeneration of 10 kW of electricity and 15 kW of thermal energy
ASSIGNMENT OF TECHNOLOGY	One prototype installation, checked in real conditions. Another installation in progress
TECHNICAL READINESS LEVEL **TRL 1** - basic principles observed **TRL 2** - technology concept formulated **TRL 3** - experimental proof of concept **TRL 4** - technology validated in lab **TRL 5** - technology validated in relevant environment (industrially relevant environment in case of key enabling technologies) **TRL 6** - technology demonstrated in relevant environment (industrially relevant environment in case of key enabling technologies) **TRL 7** - system prototype demonstration in an operational environment **TRL 8** - system completed and qualified **TRL 9** - actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)	1 2 3 4 5 6 7 **8 9**

What is the core innovation? (Please explain here what is innovative on this technology and which problem does the technology solve.)	Innovation of agricultural micro-biogas plant consists in introducing to the market a prosumer product, which uses a wide range of resources and possibilities of individual farms. This solution has not been used so far in the production of electricity and heat for internal use of these farms. The micro-biogas plant affects the thinking of individual farmers about the possibility of using waste generated by their farms, which results in pro-ecological actions - simultaneous energy production by relatively small farms and waste management.
Vision of the innovation (Please describe here what impact you see for the future)	Our innovative micro-biogas plant installation impacts on the future in three ways. 1. Change the way of management of waste from agricultural production. wastes no longer go directly to farmland, also the farmer does not bear the costs of waste collection by specialized units. 2. Development of distributed energy. Maintaining a high share of renewable energy sources in electricity production may occur not only on the basis of large power plants, but also in dispersed generation, of which a great examples are micro-biogas plants installed in small and medium farms. 3. Energy production for own needs. The farmer, producing electricity and heat as a prosumer for his farm, is provided with a constant supply of energy regardless of the conditions in the network. In addition, micro-biogas plant saves money on expenses incurred by purchasing energy in a standard way.
What are the R&D needs for your technology? (Are there any barriers or challenges which still need to be overcome?)	An integral part of the construction and commercialization of the biogas plant by Metal Expert is the performance of biogas-related tests for the installation prototype for various substrate variants (i.e.. cow slurry, silage maize, wheat straw). Estimated biogas-related tests derived from individual substrates of the methane fermentation process is already described in many scientific studies, nevertheless these values are considered to be determined in laboratory conditions. The assessment of biogas production capacity in a particular installation (produced by Metal Expert) must be specified in detail for specific substrates and presented to a potential customer. Metal

		Expert's research will aim to gain practical knowledge, not just theoretical knowledge.
TECHNOLOGY/EQUIPMENT AVAILABILITY		YES
PATENT RIGHTS		NO
METHOD OF MAKING THE TECHNOLOGY AVAILABLE	*Licence selling*	NO
	Licence granting	NO
POSSIBLE END USERS OF TECHNOLOGY	*Please name end users/ contacts that should be invited to project workshops*	Small and medium farms: agricultural, breeding, horticultural, agro-food processing plants.

Description of the technology/equipment: (Pls. describe the technology. You may include pictures or graphics.)

The ferment chamber (1) is designed as a cylindrical, welded, sealed container made of carbon steel with internal dimensions Ø 2,6 x 13,5 m. The basis of the tank are the 4 outriggers made of welded construction.

In the front part of the tank there is a loading compartment opened at the top (2) also equipped with a ramp for moving the loaded material and a pump shaft (3). Pumped fermented manure goes to the middle of the digester where there is carried out single-stage methane fermentation - mesophilic fermentation.

Inside the chamber there is a heating installation and an innovative system for spraying fermented liquid manure (4). The spraying installation ensures effective mixing of the fermented liquid manure in the ferment chamber.

In order to maintain a stable process of biogas production, it is important to ensure the proper temperature inside the digester. The outer surface of the ferment tank covered in an insulation layer of foam helps to keep the desired parameters of the process. Produced biogas goes into the biogas storage located on top of the ferment chamber (5). The biogas provides fuel for an internal combustion engine coupled to an asynchronous generator 10 kWe.

Generator together with heat exchangers build a CHP system which produces electricity and heat (6).

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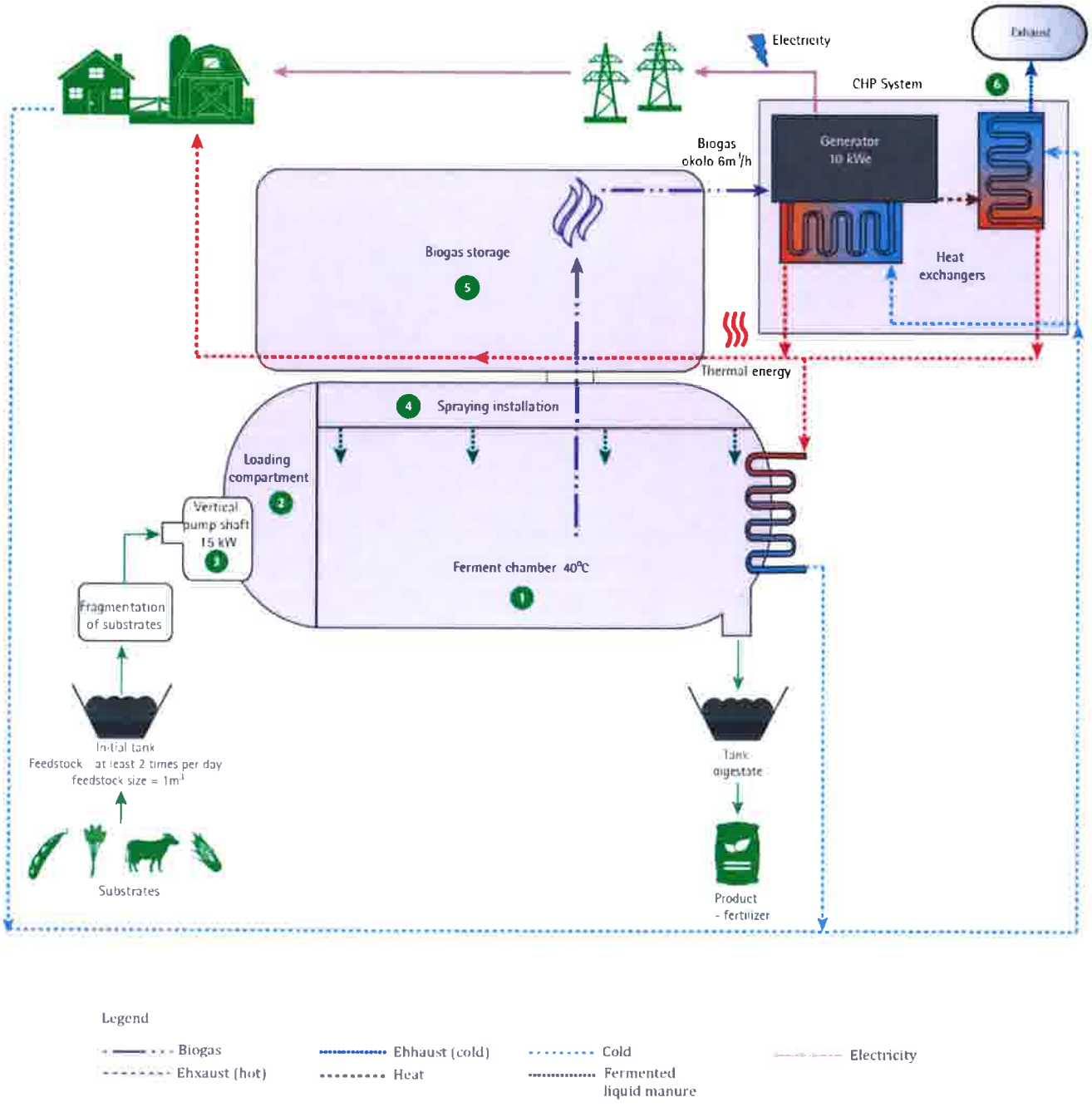

Technical Data:

Parameter	Value (please fill or tick) If value not available, please give estimate (and indicate with *).	**Comments** (e.g. which condition does the entered value correspond to?)

Current technology	Biogas production rate of technology at current TRL-level (Nm^3/h)	6 Nm^3/h	
Data basis for following data list	1.: market ready stage of technology (based on test runs of current techn.) **Please only use 2. or 3. if 1. not at all possible.** 2.: market ready stage of technology (based on estimate) 3.: current level (TRL) of technology	1 ☒ (preferably) 2 ☐ 3 ☐	
Technical efficiency	Methane content in biogas (%)	55% on the average	
Capacity	Flow rate and type per substrate (Mg/h)	$2m^3$/day?	
	Biogas production rate (range) (Nm^3/h)	6 Nm^3/h	
	Possible range for upscaling	Yes	
Data for assessment of economical added value, possible contribution to GHG-reduction and availability	Fermenter and biogas process technology (e.g. continuously stirred reactor, plug flow digester, box or garage type)	Ferment chamber with spraying installation	
	Electricity demand (kWh_{el}/Nm^3 biogas)	Low	
	Heat demand (kWh_{th}/Nm^3 biogas)		
	Chemical/additives demand (kg/h or kg/Nm^3 biogas)	Unnecessary	
	Demand of other substances (kg/h or kg/Nm^3 biogas)	Unnecessary	
	Temperature in fermenter (°C)	40°C	
	Pressure of biogas at exit of fermenter (bar_{abs})	0,005	
	m^3 fermenter volume used	60	
	Full load hours (h/a)	8200	
	Hydraulic retention time (days)	Subject of R&D	
	Max. dry matter content (%)	About 60-70%	

	Organic loading rate (kg VS/m³d)		
	Space requirement (m²)	50 – 70 m²	
	Staff requirement (excluding maintenance) (h/a)	Min. 2 persons (1000 h/a)	
	Specific capital costs (excluding project development, planning, permission and additional building costs) (€/Nm³)	Please give exact specific cost if possible, if not please specify range. ☐ < 5.000 €/Nm³ ☒ 5.000 - 10.000 €/Nm³ ☐ 10.000 € - 15.000 €/Nm³ ☐ > 15.000 €/Nm³	
	Maintenance costs (including spare parts, staff) (€/a or €/operating hour)	1500 €/a	
	Production costs (€/kW)	10.000	
	Expected lifetime of unit (years)	25	
Flexibility	Types of substrate (solid and liquid)	manure (high content of fibrous substances: straw, grass), high humidity 60 - 70%	
	Start-stop-flexibility	Low	
	Part-load possibility	☐Yes, ...% of full capacity ☒ No	
	Is self-maintenance of technology possible?	x Yes, 90% of total maintenance hours per year that can be done by operator himself ☐ No	
	Necessity for adaptions of other parts of the plant	No	

	Advantages/disadvantages of technology	Advantages: - increasing the share of energy from renewable energy sources in the overall energy balance, - management of waste generated in agriculture, through energy recovery - input raw materials of the process are by-products (waste scattered and degraded in the natural environment), - generation of electricity and heat for the user's needs, which is new to centralized generation systems that transmit energy over long distances, - exploitation based only on resources available to the user, which excludes the need for complex raw material logistics and significantly reduces operating costs. Disadvantages: - improper fragmentation of substrates may be a problem with feeding them to the fermentation chamber -	
	Special application area of technology	Not required	

Data Usage:

I agree that the above data can be published on the "Biomethane Map" www.biomethane-map.eu and to the further use for other possible scientific purposes.

Signature:

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