Type series of biogas station

Biogas station marking		T19	T30	T38	T47	T63	T79	T85	T97
Biogas production	m^3/d	1900	3000	3800	4700	6300	7900	8500	9700
Max. electric power output	kW	160	300	400	480	600	750	900	1000
Biogas station consumption and losses	kW	32	60	80	95	120	150	180	200
Actual electric power output	kW	128	240	320	385	480	600	720	800
Heating capacity	kW	240	380	480	590	740	980	1110	1240
Fermenters - diameter	m	2x13,71	2x15,43	2x17,14	2x18,00	2x20,57	2x21,43	2x22,29	2x24,00
- height	L	6	7	7	8	8	9	9	9
Fermentation volume	m^3	2x1000	2x1600	2x2000	2x2550	2x3350	2x4200	2x4500	2x5250
Gasholder volume	m^3	2x235	2x245	2x470	2x550	2x760	2x925	2x1125	2x1320
Input raw materials									
Liquid manure	t/d	43	69	86	110,5	144,5	181	194	227,5
Plant biomass	t/d	7	11	14	17	23	29	31	35
Homogenization tank - diameter	m	5,14	5,14	6,00	6,86	7,71	8,57	8,57	9,43
- height	L	2	3	3	3	3	3	3	3
Digester product discharge									
Settling tank - diameter	m	15,43	18,00	19,71	20,57	24,00	24,86	25,71	31,71
- height	L	6	7	7	8	8	9	9	7
Gasholder volume	m^3	345	550	700	760	1320	1400	1500	2700

An essential performance parameter of the biogas stations (BGS) series of biogas stations is reliable daily biogas production. Calculation values for production of biogas from input substrates are determined with a sufficient reserve so they can be achieved with any liquid manure of domestic animals and silo plant biomass.

Addressing a particular biogas station, performance parameters as well as layout design are considered depending on particular customer requirements.

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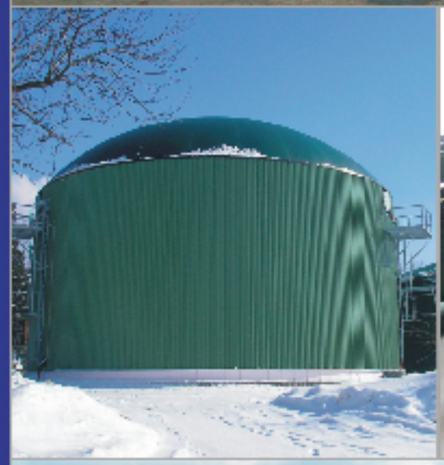
BIOGAS STATION



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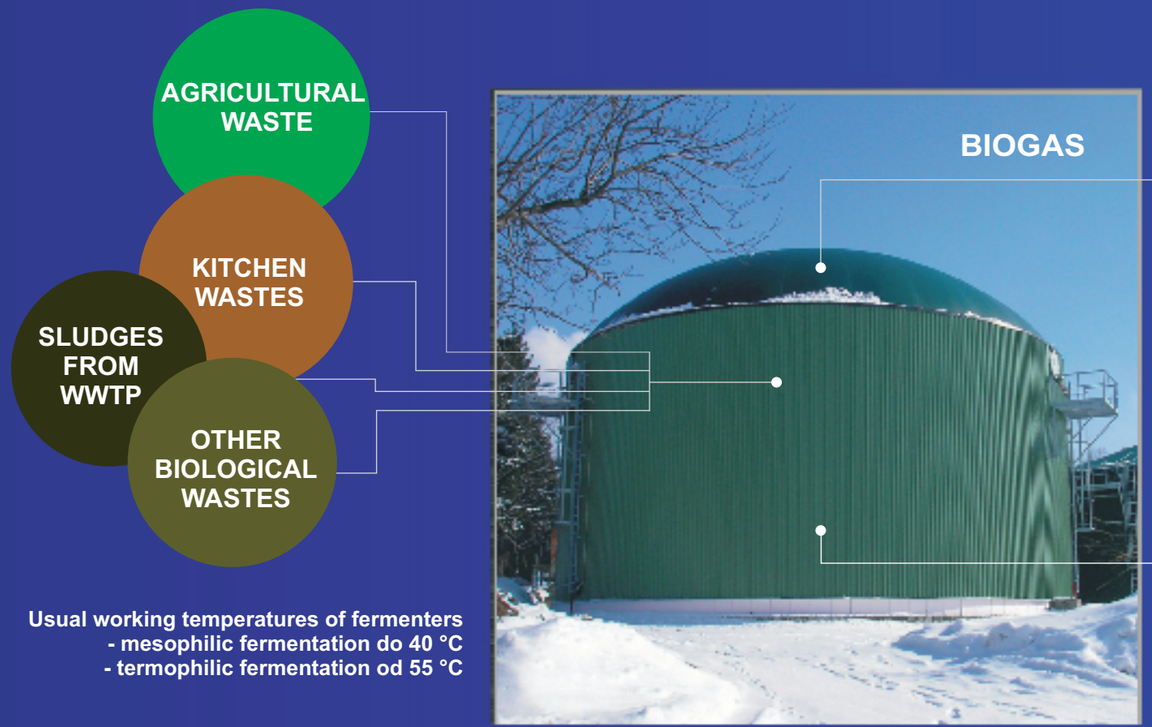
BIOGAS STATION

BIOGAS GENERATION

Biogas is generated through microbial degradation of organic substances without access to oxygen (anaerobic fermentation).
This is a natural process in nature, e.g. in the digestion tract of animals, in waste dumps, in cesspools etc.
Biogas is comprised primarily of CH_4 (50 - 80 %) and CO_2 (30 - 50 %), some quantity of H_2 (0 - 1 %), H_2S (0 - 3 %), N_2 (0 - 2 %) a H_2O (2 - 7 % as water vapour).
Biogas is a valuable energy raw. Biogas efficiency depends on its methane content, and it varies in a range of 14 - 27 MJ/m^3. With a content of 60 % methane, it reaches approx. 22 MJ/m^3.



Usual working temperatures of fermenters
- mesophilic fermentation do 40 °C
- termophilic fermentation od 55 °C

Biogas is transformed into electric and heat power in a cogeneration unit. Biogas might be possibly also modified and cleaned up into parameters of natural gas or CNG (compressed natural gas).

OUTPUTS

- ELECTRIC POWER
- HEAT
- TREATED BIOGAS
- STABILIZED MATERIAL

Digested anaerobic stabilized material (digestate) can be used as a quality organic fertilizer.

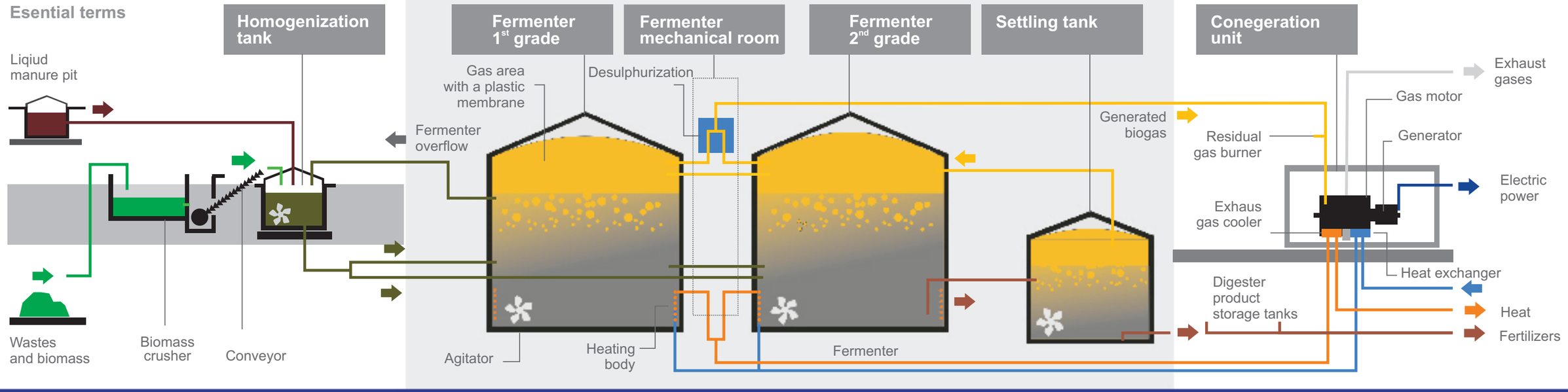
THE MOST SIGNIFICANT BIOGAS STATION BENEFITS

- stabilization of excrements of domestic animals and odour reduction
- sophisticated use of organic wastes
- ecological generation of electric and thermal power
- production of quality organic fertilizers
- closed cycle of soil fertility improvement
- decreased dependency on fossil fuels and reduction of greenhouse gas
- extended activities and income sources for farming/ranching and the rural economy in general
- increase the competitiveness of agriculture and stabilization
- increased energy self-sufficiency

COMPLEX TURNKEY DESIGN

- free-of-charge consultancy and design proposals
- assistance in grants gaining up to 30 % of the investment
- funding procurement
- appropriate design and construction activity, appropriate know-how
- planning permit and building permit procurement
- appropriate production
- supply and implementation works
- warranty and after-warranty services

A FUNCTION CHART OF A BIOGAS STATION (BGS)



RECEIVING EQUIPMENT FOR THE PLANT BIOMASS AND LIQUID MANURE PIT

Plant biomass receiving equipment consists of a hopper with agitator device and an elevating screw. It is followed by a crusher from which the crushed substrate is fed into a homogenization tank. The crusher provides a constant granulation of the input biomass independently of the gathering machines work quality. Feedstock is typically handled by a front-end loader.

A liquid manure pit is a glass-fused to steel tank covered by the smelltight textile roof. A liquid manure is delivered from the farm, which is at the same place as biogas station. The pit is not used if the liquid manure is delivered by transport tanks and discharged directly into a homogenization tank.

HOMOGENIZATION TANK

The surface of the cylindrical tank is made from glass-fused steel sheets. It serves for homogenization of liquid manure with treated plant mass. The working volume of the tank is sufficient to hold a day of input of the substrate. It is equipped with an agitator, two pumps, appropriate piping, and it is covered by an odour-sealing textile roof. The roof incorporates two inspection holes for maintenance of the agitator and pumps. An exit ladder and platform is available at each entry. A homogenization tank shell is provided with insulation made from mineral wool jacketed with a trapezoid

FERMENTERS

Each typified size of BPS always has two identical, mirrored cylindrical fermenters assembled from glass-fused steel sheets. The interior space of the fermenter is divided into a fermentation space (bottom) and gas area (top). The contents of the fermentation space are mechanically blended and heated by an integrated heating coil made from steel pipes, through which warm water from the cogeneration unit flows. The gas space is enclosed by a membrane with a plastic textile cover. Depending on the gas amount, the membrane swells between its lowest and highest positions, by which a saddled gasholder generates a balancing volume of the appropriate size for each fermenter. A liquid safety unit is installed on the exit pipe of biogas from the fermenter. The fermenter is protected by the atmospheric safety overflow which ends in the homogenization tank. Fermenters are typically provided with thermal sealing made from mineral wool covered by an aesthetic jacket of trapezoid shell in a colour as required by the Owner, or other locally approved insulation technique.

DESULPHURIZATION

Each fermenter is provided with its appropriate desulphurization equipment based on the principle of the air dosing into the gas space of the fermenter. The desulphurization unit consists of an air source, dosing unit, injector and power distributor. A compressor station serves as the air source. The equipment decreases the hydrogen sulphide content in the biogas to required levels prior to further use. Depending on a customer's requirements, other methods of biological or chemical desulphurization can be used.

FERMENTER MECHANICAL ROOM

The fermenter mechanical room is most often designed as a connection of fermenters. This room is divided in terms of construction into two sections – mechanical and gas.
In the gas section are located gas meters placed on piping, closing and safety armatures, water drainage and fans to increase gas pressure. A gas section can be delivered in separated container.
In the mechanical section are located piping with pumps for sludge and heating water circulation, flowmeters, injectors, air dosing unit and the desulphurization air compressor station. There is also placed a pump for delivery of the digestate from the fermenters into a dispatch tank.

SETTLING TANK

It serves for completion of the fementation process. The inner space of the tank is divided into the decay area (bottom) and gas area (top). The decay area is mixed by submersible agitators on columns, and is not heated. The gas space i closed by a membrane made from plastic textile.

MEASUREMENT AND CONTROL

A control system provides automation of the technological equipment of the BPS. Operators communicate through a control room PC (Programmable Controls) with the graphic visualization program, which controls the process and provides current measured data, receives alarm reports, and uses archived data.

COGENERATION

The generated biogas is converted into electric and heat power in a cogeneration unit. The cogeneration unit is situated in a separate enclosure. It is provided with its appropriate power switchgear with a control microprocessor unit which provides automatic KJ operation control and synchronic operation with the public utility network. The Owner should specify whether KJ will be operated in the synchronic mode with the network, or without the network in a stand-alone island mode. The waste heat from combustion, in the form of warm water, is used for heating of the fermenters; its excess (depending on climatic conditions) is available for heating the BPS area, or as required by the Owner. If no use is found for the waste heat, it is discharged to atmosphere by an external cooler.

PROCESS BUILDING

The process building for the BGS consists of a light steel structure which is enveloped by sandwich panels. The building is divided into a substation, heat mechanical room, operator room (control room) and sanitary facilities for staff.

DEODORIZATION UNIT

The deodorization unit is a bio-filter which serves to eliminate or greatly reduce odour generated in the homogenization tank and collection pits.

BIOGAS STATION Pustějov

Co-fermentation of beef and swine waste, with the addition of other by corn silage, beet pulp and grass haylage, at a volume of 130 m3/day of the dry charge in 12 %. A mesofilic fermentation at 40 °C. Electric power production in four co-generation units (total power output 680 kW) demonstrating 95% utilization in full output performance.

BIOGAS STATION PUSTĚJOV PARAMETERS

Fermenter 1st grade

Item	Value	Unit
Fermentation tank diameter	16,29	m
Fermentation tank height	13	m
Fermentation tank volume	2 100	m^3
Required temperature in fermenter	40	°C
Heating water temperature at the entry to the reactor	50	°C
Heating water temperature at the exit from the reactor	cca 41	°C
Overpressure in the fermenter	0,58	kPa
Blending system	Mechanical	1
Blending unit	Submersible propeller Agitator	1

Fermenter 2nd grade

Item	Value	Unit
Fermentation tank diameter	16,29	m
Fermentation tank height	13	m
Fermentation tank volume	2 100	m^3
Required temperature in fermenter	40	°C
Heating water temperature at the entry to the reactor	50	°C
Heating water temperature at the exit from the reactor	41	°C
Overpressure in the fermenter	0,55	kPa
Blending system	Mechanical	1
Blending unit	Submersible propeller Agitator	1

Cogeneration unit - TEDOM Centro 2xT170 SP BIO KON

Key technical data

Item	Value	Unit
Nominal power output	2 x 165	kW
Maximum thermal efficiency in a secondary circuit	2 x 203	kW
Power input in fuel	2x 465	kW
Electric efficiency	35,3	%
Thermal efficiency	48,2	%
Total efficiency	83,5	%

Motor

Item	Value	Unit
Number of cylinders	6	1
Lift volume	11 940	cm^3
Compression ration	11:1	1
Operation revolutions	1 500	$ot.min^{-1}$
Maximum motor output	177	kW

Thermal system

Item	Value	Unit
Nominal temperature of liquids *entry/exit*	85/95	°C
Min/max water temperature	75/85	°C
Nominal flow	2 x 5,2	$kg.s^{-1}$
Nominal temperature gradient	10	K
Flue gases temperature	535	°C