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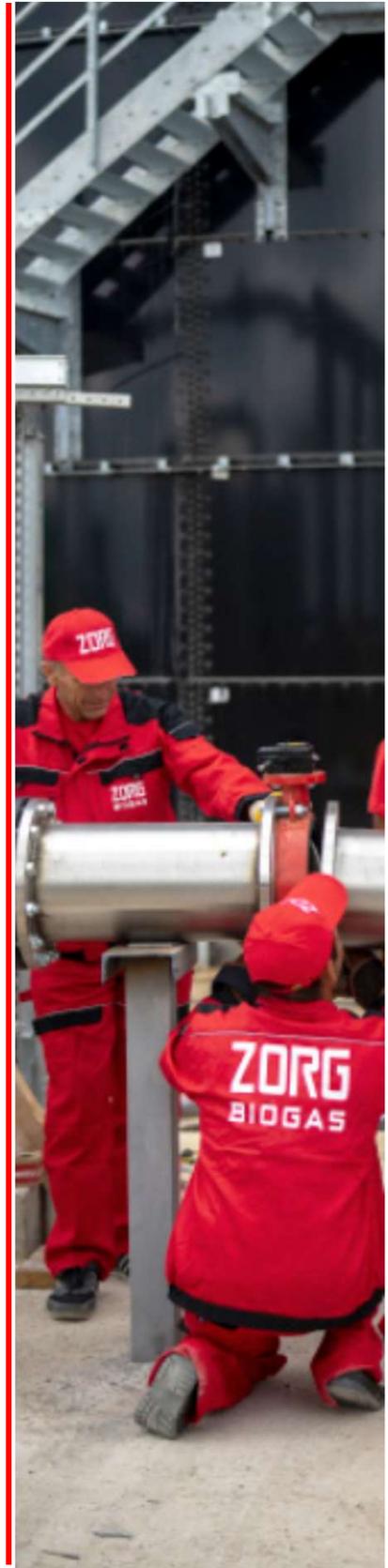
Proposal

Biogas plant at a cow farm
1297 kW gross / 1150 kW netto



Date: 11/03/2026

Validity: 1 year



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OVERVIEW

We offer a biogas plant for processing dairy farm manure using proven CSTR technology. The digester will be constructed of sheet metal with an enamel coating, taking into account local climatic conditions. From 180 tons of semi liquid manure and 64 tons of manure with bedding per day, the expected daily biogas output is 12,209 m³. When burned in a power generator, it will produce 1,297 kW gross electrical power/1,150 kW netto, including on-site consumption.

The digested material is valuable biofertilizer, comprising 116 tons of solid fertilizer and 113 tons of liquid fertilizer. Biofertilizer can be used for local agricultural fields and will result in savings on mineral fertilizers. Biofertilizer is superior in quality to raw manure. Raw manure cannot be applied directly to the soil; it must be stored. While stored, manure loses up to half of its nitrogen. Biofertilizer, however, retains all the nitrogen.

Raw material potential

Substrate	Quantity (tonnes/day)	Quantity (tonnes/year)	DM content (%)	oDM content (%)	DM quantity (tonnes/day)	oDM quantity (tonnes/day)	Biogas yield (m ³ /tonnesOD M)	Biogas (m ³ /day)	Methane content (%)	Biogas (m ³ /year)
Cattle manure (semi liquid)	180	65700	12	85	21,6	18,36	460	8446	60	3082650
Cattle manure (with bedding)	64	23360	35	80	22,4	17,92	210	3763	60	1373570
Total	244	89060			44,00	36,28		12209	60	4456220

***-DM- dry matters
 ***-oDM- organic dry matters

Biogas plant characteristics

Characteristics	Values	Figures
Reactor	units	1
Volume:		
Work	m ³	5629
Overall		6150
Temperature	°C	38
Overall dimensions of the digester:		
diameter	m	33,29
height		7,07
Organic load	kgODM/m3	6,45
Hydraulic retention time (gross/netto)	days	25/23
Number of gasholders	units	1
Volume:	m ³	3002
Dimensions of the gasholder:		
diameter		33,0
Height	m	8,25

Number of personnel

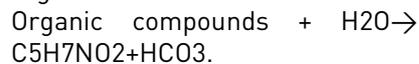
	Shift 1	Shift 2	Shift 3
Chief Engineer	1	-	-
Operator	1	1	1
Total	4		



Biogas plant working principle



The technology is based on the biochemical conversion of organic materials from high molecular weight compounds to low molecular weight compounds. The first stage of this process is hydrolysis. Hydrolysis produces organic acids and alcohols.



Further conversion of obtained dissolved compounds like organic acids and alcohols (C₅H₇NO₂, HCO₃) into gases - CH₄, CO₂. C₅H₇NO₂ + HCO₃ + H₂O → CH₄ + CO₂ + NH₄.

Biological process of consecutive (phasic) conversion of organic compounds take place in anaerobic environment i.e. in oxygen-free tank (biological reactor). At the first stage of fermentation, substrate hydrolysis take place under acidogenic bacteria influence. At the second stage, elementary organic compounds come through hydrolysis oxidation by means of hetero-acidogenic bacteria with production of acetate, carbon dioxide, and free hydrogen. The

other part of the organic compound including acetate forms C₁ compounds (elementary organic acids). Produced substances are the feedstock for methanogenic bacteria of the third type. This stage flows in two processes of A and B type the character which depends on caused by different bacteria type. These two types of bacteria convert the compound obtained during the first and second stages into methane CH₄, water H₂O and carbon dioxide CO₂. Methanogenic bacteria are more sensitive to the living environment compared to acidogenic bacteria. They require a complete anaerobic environment and a longer reproduction period. The speed and scale of anaerobic fermentation depends on bacteria metabolic activity. That is why the biogas plant chemical process includes hydrolysis stage, oxidation, and methanization stage. For that kind of substrate, these processes take place in the same reactor

Technological process of biogas production

Cattle manure (semi liquid) is directed into a receiving tank. The receiving tank is equipped with a submersible mixer, level sensors. Substrate from the receiving tank is loaded into the reactor by portion with pump. Maize silage is directed into a loader. The loader input substrates by portion to a reactor using augers. In the reactor the substrate is brought up to a temperature of +38°C. Constant temperature is sustained for the entire digesting period. The reactor operating regime is mesophilic. The heated substrate in the digester is blended periodically. Mixing is performed by submersible agitators. The average time of processing in the reactors is 25 days. After the reactor, the substrate is fed by pump to a separator area where it is separated into solid and liquid bio-fertilizer. Solid bio-fertilizer is discharged from the separation area and transported for storage; liquid filtrate is directed to a filtrate tank. Biogas goes up under overlap and delivered into a gasholder through pipeline. The gas holder's weather protective film protects the gasholder from precipitation and damage by foreign objects. The weather protective film is fixed firmly by a special system. To protect the gasholder from overpressure, digesters are equipped with safety valves, which start working at a pressure of 5 mbars and bleeds

biogas to the atmosphere.

Air is supplied in portions to the digester for biogas bio-purification from hydrogen sulfide.

Desulfurization system is three-stage purification of sulfur that is contained in the biogas:

-iron hydroxide adding - the first stage;

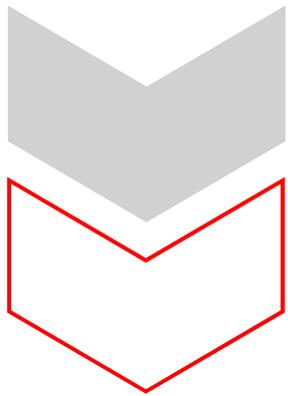
-by air- second stage of purification;

-coal column - the third stage.

Accumulated in gasholder biogas goes through a gas pipeline to a biogas cooler with a condensate discharge unit and then to a compressor, where the pressure is raised up to 80-150 mbar to meet engine requirements. After the compressor, biogas is fed to activated coal filters to remove hydrogen sulfide (H₂S). After filters, the biogas goes to the co-generator to produce electric and heat energy.

All technological processes are controlled and operated by an automatic system. Biogas plant work is monitored at the central control room monitor. The control room is equipped with a central control unit, which allows the switching of any biogas plant module into automatic or manual mode with local or remote control.

MAIN EQUIPMENT





Solid feeder (SF-01)

Solid feeder machines have been proven in various situations. Solid feeder has the solid design, which guarantees a maximum functionality and less maintenance, combined to a low energy consumption. Because of the vertically oriented walls, there is no change for the material to get stuck or build bridges. The conveyor chains and the milling-unit allow continuous dosing by various types of materials. Furthermore, the material is loosened by this dosing process. The user is able to control the material flow up to 15 m³/h or more, regarding to the own consumption of electrical power by the machine. In addition, the corrosion protection, wear resistance and high quality allow customers to use our product for a long period of time.

Specifications

Height:	2,0 m
Length:	5,0 m
Width:	2,3 m
Volume:	20 m³
Quantity:	1 pcs.



Reactor (R-01)

The fermenter is an important part of the biogas plant, made of sheet metal with an enamel coating. Metal reactors are installed on a concrete base. The enamel layer protects the surface of the entire metal structure. The enamel is glassy and very resistant to aggressive pH and mechanical damage. The enameled fermenter is assembled from steel segments. Such a fermenter is quickly and safely mounted. The steel fermenter has the following advantages:

- Steel panels are joined at bolted joints with a special sealant. Thus, the impermeability of the substrate through the joint is achieved, and certain panels can be replaced;
- The enamel coating is layered using the PUESTA method. This is a special powder that is laid in layers by electrostatic attraction.
- Bolts are made of stainless steel;
- All elements (flanges, etc.) are connected through an EPDM membrane to protect the enamel.

To reduce heat consumption and maintain a constant temperature, the fermenter is insulated. The outside of the fermenter is covered with a decorative coating

Specifications

Height:	7,07 m
Diameter:	33,29m
Total volume:	6150 m³
Substrate volume	5628 m³
Quantity:	1 pcs.



Reactor`s mixer Paddle-giant (AG-01..05)

The inclined paddle high-power mixer Paddle-giant is designed and engineered for high efficiency with all types of raw materials (including highly viscous media). The operating mode is designed to maximize the preservation of bacterial populations (to achieve optimal gas output).

The mixer bearing is made of special, extremely wear-resistant and rust-proof plastic. All components can be replaced without the need to drain the reactor or replace the mixer shaft. The operating principle is ideal for breaking up floating layers and supports the mixing of solidification layers. Degassing of the substrate is simplified.

This type of mixer is suitable for minor fluctuations in filling levels. In the production of mixers, gearboxes and motors from well-known European manufacturers are used. This guarantees a long service life of our mixers. All motors and gearboxes are available with ATEX certificates.

Specifications

Engine power:	15 kW
Quantity per reactor:	5 pcs
Total quantity:	5 pcs



Pump equipment (PU-01...PU-04)

Pumps are used to transport substrate to the equipment and facilities in the biogas plant and away. Biogas plant design allows to access easily to all pumps. Pumps are driven by helical geared motor. Stator has hopper inlet for optimum filling of the pumping chamber, wear-protected, robust universal joint with feeding screw, robust bearing pedestal with close-coupled drive and self-centering of the drive shaft. Pumps have modular design for high flexibility, low life-cycle-costs.

Specifications

Liquid substrate pump (PU-01)

Engine power:	18,5 kW
Flow rate:	60 m ³ /hour
Pressure:	4 bar
Quantity:	1 pcs

Substrate pump (PU-02. 03)

Engine power:	15,0 kW
Flow rate:	8-25 m ³ /hour
Pressure:	4 bar
Quantity:	2 pcs

Filtrate pump (PU-04)

Engine power:	18,5 kW
Flow rate:	60 m ³ /hour
Pressure:	4 bar
Quantity:	1 pcs



Separator (SR-01)

The Press Screw Separator covers a broad spectrum of applications, from agriculture to biogas and bioethanol plants. The innovative technology separates substrates in its solid and liquid elements. The secret of the versatility of the press screw separator is that it can adjust to different dry matter contents and Thick liquids (20% dry matter content). Slotted screens have different assortment and width of table cells and give possibility work with small solids and fiber contents. In the slotted screen, the solids are screened out from the liquid. The solids build up a layer which also acts as a filter to separate finer particles from the liquid. The auger flights convey this layer to the solids outlet. The screen surface is cleaned and a new filter layer is formed. The design of the screens is not conducive to plugging. The pressure in the first part of the screen is low but increases with the solid consistency to the solid output. The consistence of the gained solid can be varied with the help of a output regulator by the amount and position of counter weights. This way the required consistency of the final product for either further storage, use as fertilizer or the basis for compost can be reached. The liquid phase can easily be drained through a pipe or hose system.

Specifications

Engine power: 7,5 kW
Flow rate: 8-25 m³/hour

Quantity: 2 pcs

Equipment
Frame
Screw
Sieve for the filtration
Counterweights
The design of the protective room



Receiving tank (RT-01) and Filtrate tank (FT-01)

Reinforced concrete reservoir for reception of liquid kinds of raw materials. The reservoirs are equipped with level sensors and submersible agitators for mixing substrate.

Specifications

Receiving tank (RT-01)

Diameter:	10,0 m
Height:	3,0 m
Total volume:	118 m ³
Quantity:	1 pcs

Filtrate tank (FT-01)

Diameter:	10,0 m
Height:	3,0 m
Total volume:	118 m ³
Quantity:	1 pcs



Submersible mixer (AG-06... AG-07)

The submersible motor agitator serves for mixing renewable raw materials (RRM), liquid substrate as manure and similar substrates. The electro-motor driven submersible agitator is designed for submersion operations in potentially explosive environments of Ex zone 2 and complies with Directive 94/9 EC. The submersible agitator can be attached to most sliding masts by means of the motor support. A mounting option for a hauling cable is provided on the motor support for height adjustment purposes.

Due to the 4-roller guidance of the motor support, the agitator can be lifted and lowered without friction and the square mast, even if the pull of the hauling cable is slightly angular. The motor support is designed for a 100 x 100 mm square sliding mast as standard, but can also be used for an 80 x 80 mm sliding mast by changing the rollers. The strain relief of the connecting cable can be positioned in the extension of the motor or towards the top on the motor support, depending on the requirements. This enables universal utilization with the most various installation kits.

The geared motor is made of spheroidal graphite iron (GGG40) and painted, the propeller is galvanized and the motor support is made of stainless steel. The submersible motor agitator is designed as a water pressure-tight monoblock unit for driving the three-vane propeller. The submersible agitator is of modular design, submersible electro-motor with flange-mounted planetary gear and bearing flange for holding the propeller. The conical shaft in the bearing flange is mounted in the oil bath by two angular roller bearings and sealed off from the agitating substrate with a mechanical seal.

Specifications

Submersible mixer for the receiving tank	(AG-06)
Nominal power:	5,0 kW
Quantity:	1 pcs
Submersible mixer for the filtrate tank FT-01	(AG-07)
Nominal power:	5,0 kW
Quantity:	1 pcs



Gasholder (GH-01)

The gasholder provides for biogas storage and for equalizing pressure and biogas composition. The gasholder system has a two-layer construction. The external material consists of a weather-proof film of PVC-coated polyester fabrics with UV protection. Both sides are finished with an external N/5cm, internal membrane PELD (gasholder) membrane.

The gasholder has a methane permeation maximum of $260 \text{ cm}^3/\text{m}^2 \cdot 1 \text{ bar}$ biogas resistance. The gasholder film temperature range allows operation from -30°C to $+60^\circ\text{C}$.

The internal film is stretched under normal biogas pressure. Air is blown into the space between the external and internal membranes to pressurize the internal membrane and form the shape of the external membrane.

The biogas pressure in the gasholder is 2-5 mbar. The membranes are designed and cut out on NC machines. Welding is executed by high frequency currents. These steps yield substantial improvements for quality and service life compared to handmade membranes welded by standard welding equipment.

To prevent damage to the gasholder as a result of overpressure conditions, a safety valve is installed. To survey the internal membrane, an inspection window is installed on the external membrane.

Specifications

Height:	8,25 m
Diameter:	33,0 m
The total volume :	3002 m ³
Quantity:	1 pcs



Biogas dryer and cooling (CHL-01)

Biogas dryer and cooling are provided with special equipment as GAS COOLER and AIR-COOLED LIQUID CHILLER. Biogas plants thanks to an extensive range of dedicated Biogas solutions, low pressure heat exchangers, a comprehensive range of water chillers and RWD Dry Coolers. Designed as one-way shell-and-tube heat exchanger. Process gas inside of the tubes; cooling water in the shell. All parts in contact with the process gas made of stainless steel 316Ti or 316L; heat exchanger shell made of stainless steel/ Designed with gas outlet chamber outlet connection radial; inspection opening axial Official acceptance according to PED 2014/68/EU in accordance with ADMerkblätter and factory pressure test.

Specifications

Gas volume flow:	510 m ³ /hour
Gas inlet temperature:	+38°C
Gas outlet temperature:	+10°C
Electric power:	25,2 кВт
Quantity:	1 pcs



Biogas compressor (BC-01..02)

Biogas blower is a device used to move gas and increase pressure thanks to a rotating impeller within a toroidal channel, so there is a progressive increase of energy.

Blower is used to transporting biogas from gasholder storage to consumer (biogas upgrading plant in our case).

Specifications

Flow rate:	510 m3/hour
Pressure:	150 mbar
Engine power:	7,5 kW

Quantity:	2 pcs
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Desulphurization system

The desulphurization system is a 3-step system. Stage 1 is adding Iron Hydroxide. Stage 2 - biological. Adding a certain portion of air to the fermenter. Air by special bacteria, converting H₂S into S. After 1 and 2 steps the sulphur concentration is 80 ppm. Stage 3 - activated charcoal filtration, as activated charcoal has the capability to absorb sulfur. After passing through activated charcoal filters, the sulfur concentration is reduced to 0 ppm.

Specifications

Charcoal filter	(CF-01)
The volume of charcoal:	300 kg
Quantity:	1 pcs



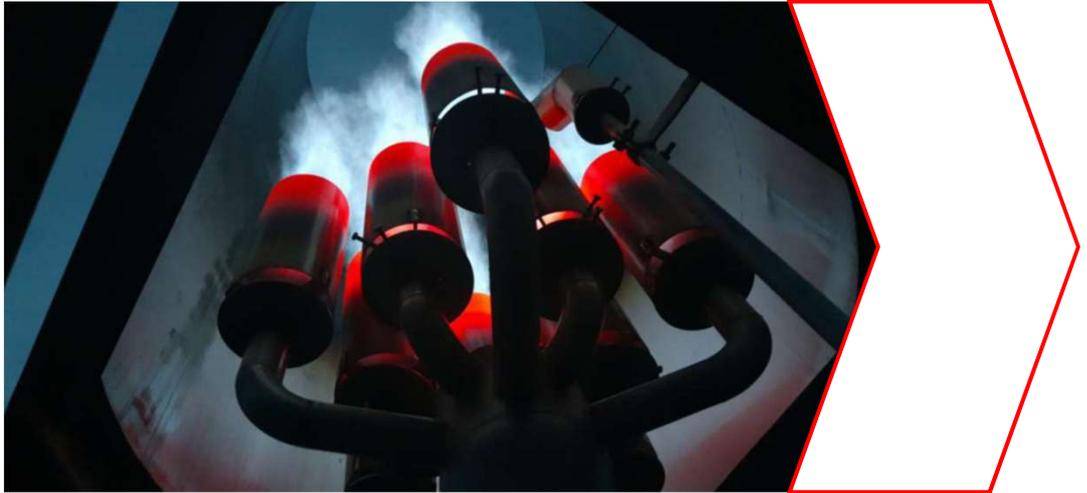
Cogeneration Power Plant (CHP-01)

A cogeneration power plant (CHP) is used for producing electricity and heat. CHP is a very efficient technology for generating electricity and heat together. A CHP plant is an installation where there is simultaneous generation of usable electric power and heat in a single process, and it can provide a secure and highly efficient method of generating electricity and heat at the point of use. Due to the utilization of heat from electricity generation and the avoidance of transmission losses, due to electricity being generated on site, CHP typically achieves a 35 per cent reduction in primary energy usage compared with power stations and heat only boilers. This allows for economic savings where there is a suitable balance between heat and power loads. Another important factor, showing the benefits of cogeneration and CHP, is its low environmental impact. CHP produces lower quantities of pollutant emissions and heat pollution of the atmosphere. The current mix of CHP installations achieves a reduction of over 10 per cent in CO₂ emissions in comparison with combined-cycle gas turbines.

Specifications

Produced electric power:	1560 kW
Produced heat power:	1566 kW
Generator:	50Hz
Количество:	1 шт.

Emissions
NO_x <500 mg / Nm³ (5% O₂)



Flare

Flare is designed for the temporary or periodical complete combustion of the biogas produced by biogas plants without the possibility of its use as an energy source. The burn system consists of a burner and additional equipment. The burner is designed on the principle of injection and consists of a combustion nozzle with an injector with an air supply control system, flame protection tube, fitting and burner control system. The biogas combustion system is made of stainless steel.

The supporting structure holds the burner and vertically mounted socket. The burn control system is installed in a case, which is mounted on the supporting structure of the combustion system and contains all the elements for monitoring and controlling ignition and flame.

Specifications

Flow rate:	510 m³/hour
Pressure:	min 10 mbar- max 60 mbar

Quantity:	1 pcs
------------------	--------------

Water supplying and sewerage system



Water supplying system provides biogas plant feed water, water for network circuits, the domestic water and fire safety systems. As used centrifugal single stage pumps as main pumping elements. These pumps are designed for pumping waste water, household / domestic water and sewage. Pressure Boosting Systems are designed for pure water pressure boosting in industrial plants. The booster comprises 2 to 3 (connected in parallel pumps) installed on a common base frame, and provided with all the necessary fittings.

Specifications

Drain pump
Pressure 4m
Flow 2-3 m³ / h
Engine 0,24 kW

Equipment
Pump case control
Stove-base
gauges
Check valves
Float switches
Brackets
Valves



Heating system

Heating equipment is used for biogas plant heating and for sustaining constant temperature in the fermenter. Heating equipment includes circulation pumps, heat exchanger, heating manifold and pipes. The heat from the boiler is transferred to the biogas plant by using heat exchanger, and then is pumped through of biogas plant by circulation pumps. A heat carrier prepares water with an additive of ethylene glycol. Inlet temperature in the fermenter is 60C, the outlet is 40C.

Specifications

Circulating pump feeding heat carrier

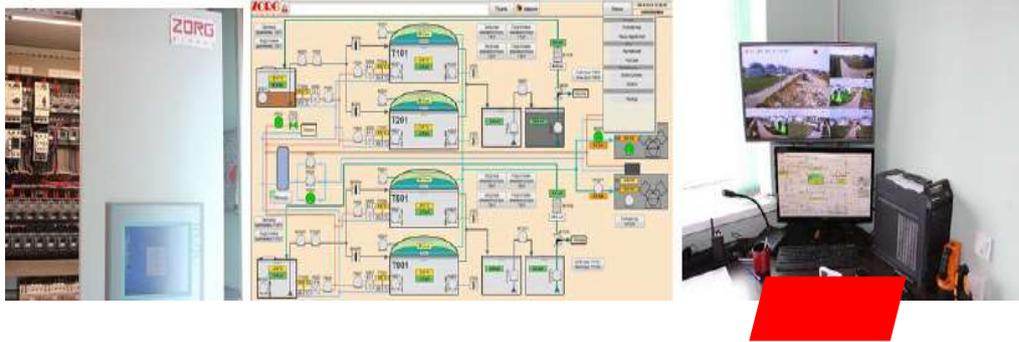
Engine power:	3,5 kW
Flow:	28 m ³ /hour
Pressure:	1 bar

Circulating pump feeding heat carrier

Engine power:	2,0 kW
Flow:	12m ³ /hour
Pressure:	1 bar

The pumping station feeding propylene glycol

Engine power:	0,7 kW
Flow:	1 m ³ /hour
Pressure:	4 bar



Automation and electrical equipment

Process control equipment is used for supervision and regulation operation of the plant and for the limitation of damage. In case of emergency (for example, breakdown of the electrical power supply) the biogas plant is automatically transferred to safe operating conditions by the process instrumentation. Critical electrically driven devices are supplied with emergency power. An automatic system allows the supervision of the plant in real time and to recognize and correct aberrations immediately; to run the plant at its optimum saving resources and costs; and to record for the electronic database operation parameters. The automatic system consists of a control cabinet and sensors for parameter control of technological processes and execution devices.

The control cabinet is designed based on the industrial controller Siemens CPU315-DP2, using periphery distributing system Simatic ET200S, and operator panel OP277 Touch with touch-sensitive controls. Communications is executed by PROFIBUS and MPI with physical interface RS-485. The control program is designed based on the Simatic Step7. The control cabinet is a modular design. The upper part has a power box with central and front-end processor. The periphery distributing system, Simatic ET200S, is installed with input - output units. The lower part with interface relay and clips is installed for connecting execution devices. The entire plant is controlled by a single operator.

Specifications

Incoming control case with automatic set ASE-1, 2, 3

Base Siemens CPU315-DP2 controller

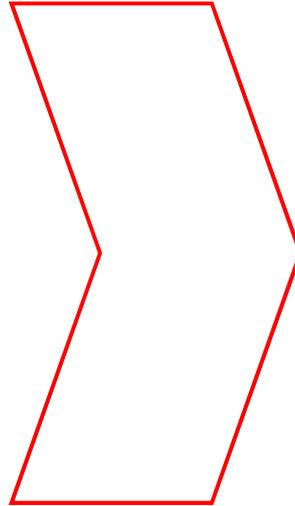
Peripherals Simatic ET200S

Control panel OP277 touchscreen

Communication PROFIBUS and MPI

Interface RS-485

Control system Simatic Step7



Gas analyzer (CH₄, CO₂, H₂S, O₂)



Gas analyzer is a measuring device for determining the qualitative and quantitative composition of a gas mixture. In absorption gas analyzers installed at biogas plants, the components of the biogas mixture are sequentially absorbed by various reagents. Automatic gas analyzers continuously measure any physical and physicochemical characteristics of the gas mixture or its individual components. Their operation is based on physical analysis methods, including auxiliary chemical reactions.

Specifications

The kit includes
Wall mounting bracket
LC display
Flow meter / control valve
Sensors



Sensors set

Sensors are used to measure physical quantities (temperature, pressure, level of moisture) data collection.
installation kits

Specifications

Conductometric sensor
Pressure Sensor / level
Ultrasonic sensor
Gas Pressure Sensor
Temperature converters with protective sleeves
The moisture sensor and the gas temperature

Equipment specification list

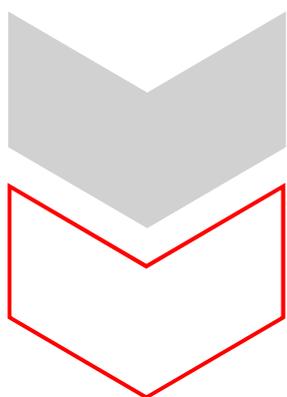


Nº	Equipment	Characteristic	Quantity
1	Loader	V=20m3	1
1.1	Container bunker		1
1.2	Feeding screws	set.	1
2	Reactor`s agitator	N=15 kW	5
2.1	Airtight motor gearbox		5
2.2	Hydraulic screw (wear-resistant steel)		5
2.3	Shaft (adapted to the height of the fermenter)		5
2.4	Blade		5
2.5	Frequency converter		5
2.6	Mounting bracket to bottom of the mixer		5
3	Safety valve of digesters		5
4	Liquid substrate pump	60 m3/hour N=18,5 kW	1
5	Substrate digested pump	8-20 m3/hour N=15,0kW	2
6	Filtrate pump	60 m3/hour N=18,5 kW	1
7	Separator	N=7,5 kW, 10-15m3/h	2
7.1	Body		2
7.2	Substrate Supply Pipe 4 ''		2
7.3	Engine - Gearbox	N=7,5 kW	2
7.4	Frame		2
7.5	Screw		2
7.6	Sieve for filtration		2
8	Submersible mixer	N=5,0 kW	2
8.1	Airtight motor gearbox		2
8.2	Hydraulic screw (wear-resistant steel)		2
8.3	Mixer control mechanism		2
8.4	Electric motor mount		2

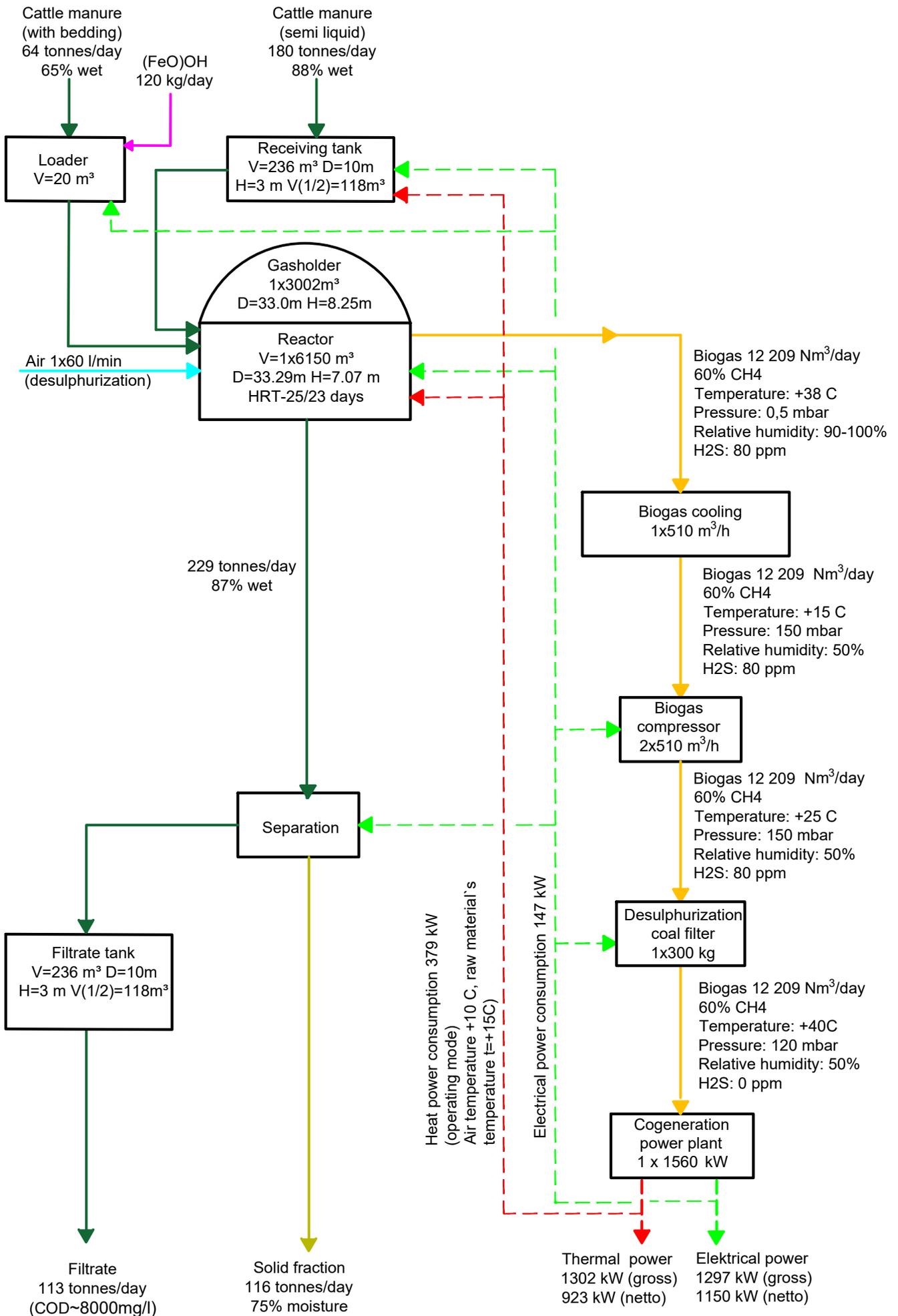
Nº	Equipment	Characteristic	Quantity
8.5	Set of fasteners		2
9	PVC gas holder	3002 m3	1
9.1	Weather protection film	Ø33,0m	1
9.2	Gasholder film PELD methane permeation max.260 cm3/m2*d*1 bar, 650 N/5cm biogas resistant		1
9.3	Air blower	16A, 0,5kW	
9.4	Excess and minimum pressure valve		1
9.5	Dome level sensor		1
9.6	Mounting system		1
9.7	Accessories		1
9.8	Safety valve		1
10	Biogas Cooling System	510 m3/h	1
10.1	Chiller		1
10.2	Heat exchanger		1
10.3	Polypropylene glycol tank		1
11	Desulphurization system		1
11.1	Numbers of charcoal columns	300 kg	1
12	Biogas compressor	Q=510m3/h, H=150mBar, N=7,5 kW	2
13	Electromagnetic flow meter		1
14	Gas analyzer		1
15	Flare	510 m3/h	1
16	Gas equipment included	set	1
16.1	Drainage pump with float	DN=50, Q=1m3/h, H=13 m	2
17	The heat supply system	set	1
17.1	Diaphragm expansion tank	V=1000 l,P=6Bar T=120°C	1
17.2	Circulating pump for supplying heat carrier	Q=30 m3/h,H=1bar	1
17.3	Propylene glycol feed pump station heating systems	Q=1,0 m3/h, H=4 bar	1
17.4	Circulation pump for supplying heat carrier to the digester	Q=18 m3/h, H=1.1 bar	1
18	Water supply and sewerage system, complete, disassembled	set	1

Nº	Equipment	Characteristic	Quantity
19	Automation with electrical equipment	set	1
19.1	Incoming distribution cabinet with a set of automation DB-1		1
19.2	Incoming distribution cabinet with a set of automation DB-2		1
20	Sensors, set		1
20.1	Gas pressure sensor 0,025Bar		1
20.2	Gas pressure sensor 0,4Bar		1
20.3	Pressure sensor(substrate level) 1,0Bar		2
20.4	Pressure sensor (substrate pressure) 2,5bar		2
20.5	Resistive thermometer (gas temperature)		3
20.6	Resistive thermometer with thermo well (fermenter substrate temperature)		3
20.7	Resistive thermometer with thermo-well (digester tank substrate temperature)		3
20.8	Resistive thermometer (heat conductor temperature)		3
20.9	Conductometric sensor of maximum level		3
20.10	Conductometric sensor of water level		3
20.11	Dome position sensor		1
20.12	Coolant pressure sensor	SEN 3276 B065 G1/2 6Bar	7
20.13	Humidity and gas temperature sensor	ESFTF-I	1
21	Cogeneration power plant	set	1

ANNEXES



Material flow diagram

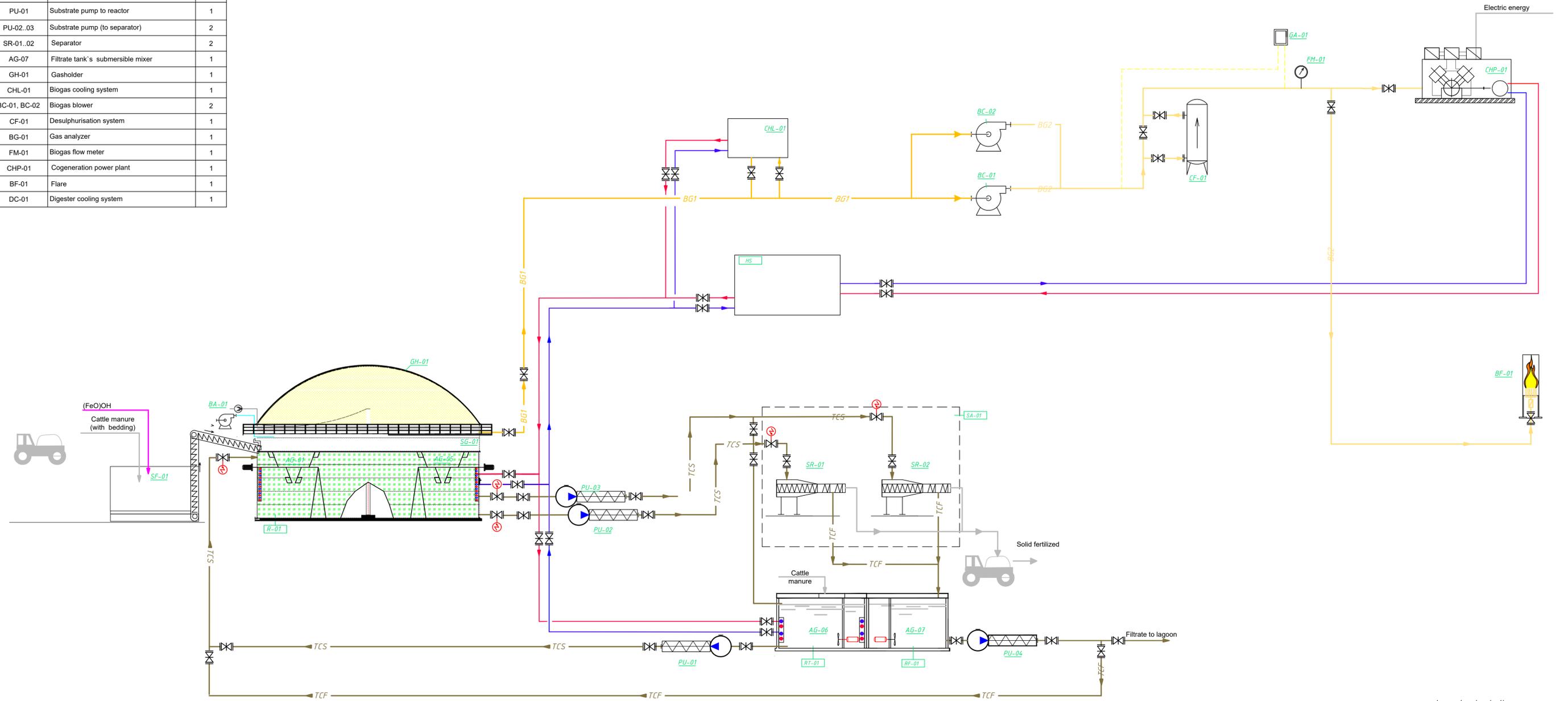


Specification

N/№	Name	Q-ty
SF-01	Loader machine	1
AG-06	Receiving tank's submersible mixer	1
AG-01..05	Mixer Paddle-gigant	5
SV-01	Safety valve	1
SG-01	Inspection windows	1
PU-01	Substrate pump to reactor	1
PU-02..03	Substrate pump (to separator)	2
SR-01..02	Separator	2
AG-07	Filtrate tank's submersible mixer	1
GH-01	Gasholder	1
CHL-01	Biogas cooling system	1
BC-01, BC-02	Biogas blower	2
CF-01	Desulphurisation system	1
BG-01	Gas analyzer	1
FM-01	Biogas flow meter	1
CHP-01	Cogeneration power plant	1
BF-01	Flare	1
DC-01	Digester cooling system	1

Structure

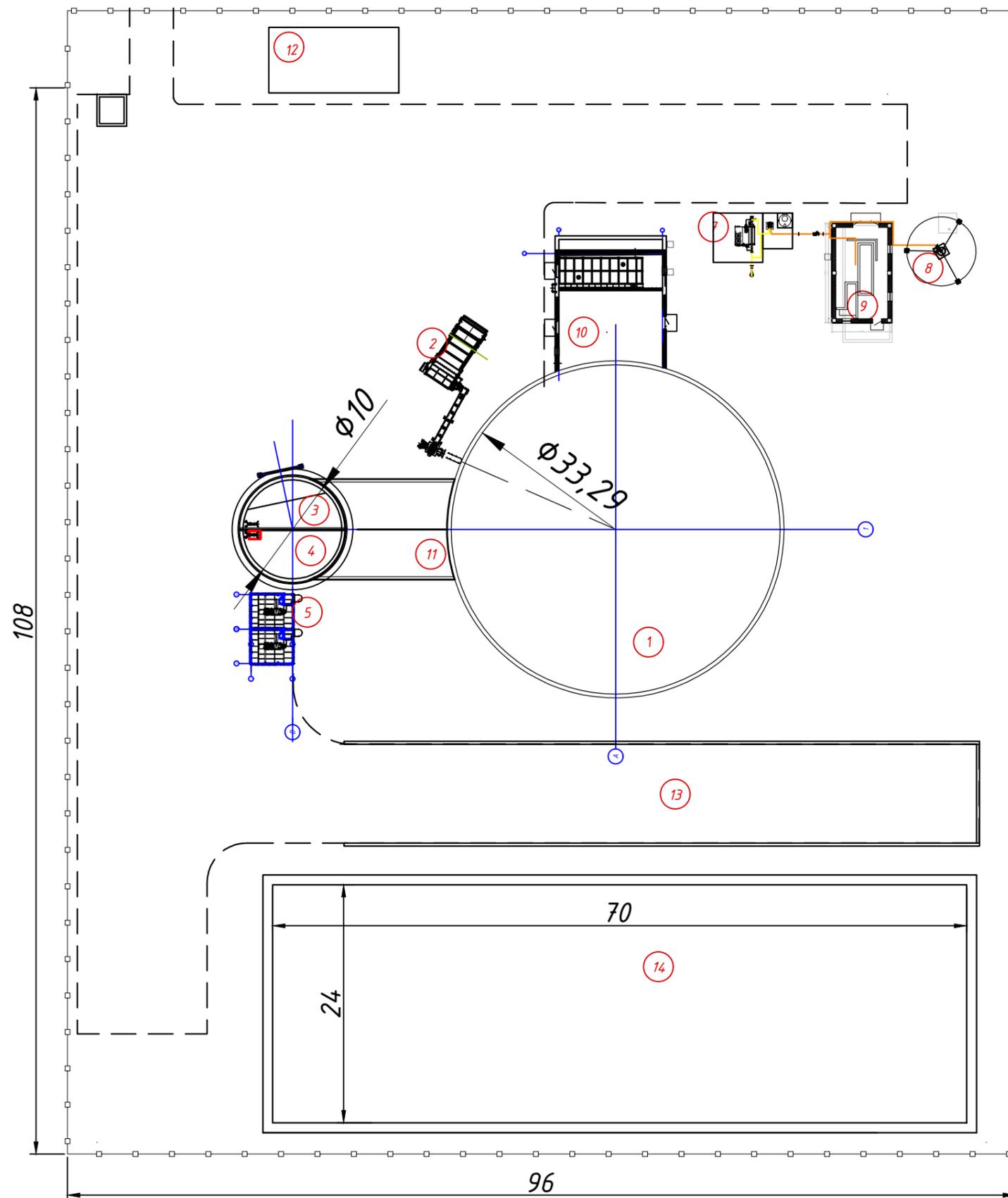
N/№	Name	Q-ty
R-01	Reactor	1
SA-01	Separator area	1
RT-01	Receiving tank	1
RF-01	Filtrate tank	1
HS	Boiler room	1



Legend main pipelines

- TCS — Substrate
- TCF — Filtrate
- BG1 — Biogas
- BG2 — Biogas
- HS — Heat system pipeline

Plan



Explication

N/№	Name	Note
1	Digester	
2	Pre-tank	
3	Filtrate tank	
4	Separator platform	
5	Lagoon	
6	Gas compressor	
7	Biogas burner	
8	CHP room (In a building)	
9	Technical room	
10	Equipment room	
11	Staff trailer	
12	Composting site	

Appendix 4

Biogas plant					
Name equipment	Instal. Pow. (kW)	Q-y (pcs)	Total installed power (kW)	Working hours per day	Consumption kWh per day
Loader V=20 m ³	12,0	1	12,0	4,6	55,2
Screw set.	12,0	1	12,0	4,6	55,2
Liquid substrate pump	18,5	1	18,5	3,0	55,5
Reactor's mixer	15,0	5	75,0	18,0	1350,0
Submersible mixer in receiving tank	5,0	1	5,0	12,0	60,0
Submersible mixer in filtrate tank	5,0	1	5,0	4,0	20,0
Biogas compressor	7,5	2	15,0	12,0	180,0
Biogas cooling system	25,2	1	25,2	24,0	604,8
Separator	7,5	2	15,0	11,0	165,0
Substrate pump to separator	15,0	2	30,0	11,0	330,0
Filtrate pump	18,5	1	18,5	1,9	35,2
Air compressor for gasholder lock	1,5	1	1,5	1,0	1,5
Air blower for double membrane	1,0	1	1,0	24,0	24,0
Circulation pump for supplying heat carrier to the digester	0,8	1	0,8	24,0	18,0
Cogeneration power plant	19,0	1	19,0	24,0	456,0
Circulation pump for Cogeneration power plant	5,0	1	5,0	24,0	120,0
Circulation pump for supplying heat to the technical building	0,8	1	0,8	only ambient temp +15°C	
Circulating pump feeding hot water at technical building	0,1	1	0,1	24,0	1,9
Propylene glycol pump station	0,8	1	0,8	0,5	0,4
Drinage pump	1,0	1	1,0	0,5	0,5
Lighting of the biogas plant territory	0,6	1	0,6	8,0	4,8
Spot light for digesters inspection windows	0,1	1	0,1	0,5	0,0
Working lighting of switchboard	0,1	1	0,1	0,5	0,1
Total installed power, kW			262		
Total consumed electric energy, kWh per day					3538
Total consumed power, kW					147



Prices for a biogas plant 1300 kW max at a milk farm 6000 cows

Pos	Name	Number of units	Unit price, EUR	Discounts *	Discounted unit price, EUR	Discounted price sub-total, EUR
1	Project documentation	1	63 000	0%	63 000	63 000
2	Supervision	1	30 000	0%	30 000	30 000
3	Startup and training	1	30 000	0%	30 000	30 000
4	Living and travel expences	1	25 000	0%	25 000	25 000
5	Delivery of the equipment (trucks)	9	2 500	0%	2 500	22 500
6	Reactor V=6150 m3	1	470 000	0%	470 000	470 000
7	Solid feeder 20 m3	1	75 000	0%	75 000	75 000
8	Screw conveyer	1	65 000	0%	65 000	65 000
9	Digester horizontal agitator 15 kW	5	42 000	0%	42 000	210 000
10	Frame for Digester agitator pos 9	5	7 000	0%	7 000	35 000
11	Liquid substrate pump 18,5 kW	1	29 000	0%	29 000	29 000
12	Digested substrate pump 15,0 kW	2	23 000	0%	23 000	46 000
13	Substrate separation unit 7,5 kW	2	52 000	0%	52 000	104 000
14	Filtrate pump 18,5 kW	1	29 000	0%	29 000	29 000
15	Submersible agitator for receiving tank 5,0 kW	1	13 000	0%	13 000	13 000
16	Submersible agitator for filtrate tank 5,0 kW	1	13 000	0%	13 000	13 000
17	Over- and under pressure safeguard	1	6 000	0%	6 000	6 000
18	Water supply and canalization system	1	29 000	0%	29 000	29 000
19	Heat supply station	1	35 000	0%	35 000	35 000
20	Automation and electric cabinet	1	135 000	0%	135 000	135 000
21	Motorized valves (set)	8	8 000	0%	8 000	64 000
22	Sensors (set)	3	21 000	0%	21 000	63 000
23	Gasholder	1	74 000	0%	74 000	74 000
24	Biogas blower 510 m3/h	2	5 000	0%	5 000	10 000
25	Desulphurization column with active coal 300 kg	1	23 000	0%	23 000	23 000
26	Biogas flare 510 m3/h	1	48 000	0%	48 000	48 000
27	Gas analyzer (portative)	1	6 500	0%	6 500	6 500
28	Gas conditioning unit	1	27 000	0%	27 000	27 000
29	Cogeneration power plant MWM Caterpillar 1560 kW with drycoolers, oil system, silencer, container assembly	1	645 000	0%	645 000	645 000
30	Construction	1	700 000	0%	700 000	700 000
TOTAL by ZORG, EUR						2 425 000
TOTAL by Client, EUR						700 000
TOTAL by ZORG+Client, EUR						3 125 000,00

Client

Implementation terms and payment

Months	04.26	05.26	06.26	07.26	08.26	09.26	10.26	11.26	12.26	01.27	02.27	03.27	04.27	05.27	06.27	07.27
Data collection																
Project documentation		50%	50%													
Equipment manufacturing				30%		20%		20%	30%							
Equipment supply																
CHP unit			30%									70%				
CHP supply																
Construction																
Supervision					50%								50%			
Plant start-up															50%	50%

Contracts

Project implementation is executed simultaneously under several contracts

-  **Engineering contract**
-  **Equipment supply contract**
-  **Supervision contract**
-  **Start-up and training contract**

List of exclusions:

- 1) Project report, civil permits and authorizations, adaptation of the project documentation by a licensed local engineering organisation for the permit purposes. Namely the organisation puts their stamp and acts act the face of the project. The design documentation is not changed in fact. 10 000 – 15 000 EUR
- 2) Topographic and geological surveys 3000-7000 EUR
- 3) Electric transformer and the external electric line 130 kW for start-up
- 4) External roads
- 5) Temporary water supply during the construction and the hydraulic test of reactors at least 7100 m³ water. It can be a technical quality water from a river, lake, well. Not salty.
- 6) Machinery to transport filtrate and the digested mass from the biogas plant to the agricultural fields (a truck, a frontal loader, a tractor)
- 7) Activated carbon 0,3 tonne per two years x 4800 EUR/tonne = 1 440 EUR
- 8) Iron hydroxide-43.8 tonnes per year x 180 EUR/tonne = 6 570 EUR
- 9) Demineralized water to the heating system 1,5 tonnes
- 10) Spare parts for two years 80 000 EURO

**ZORG
BIOGAS**

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