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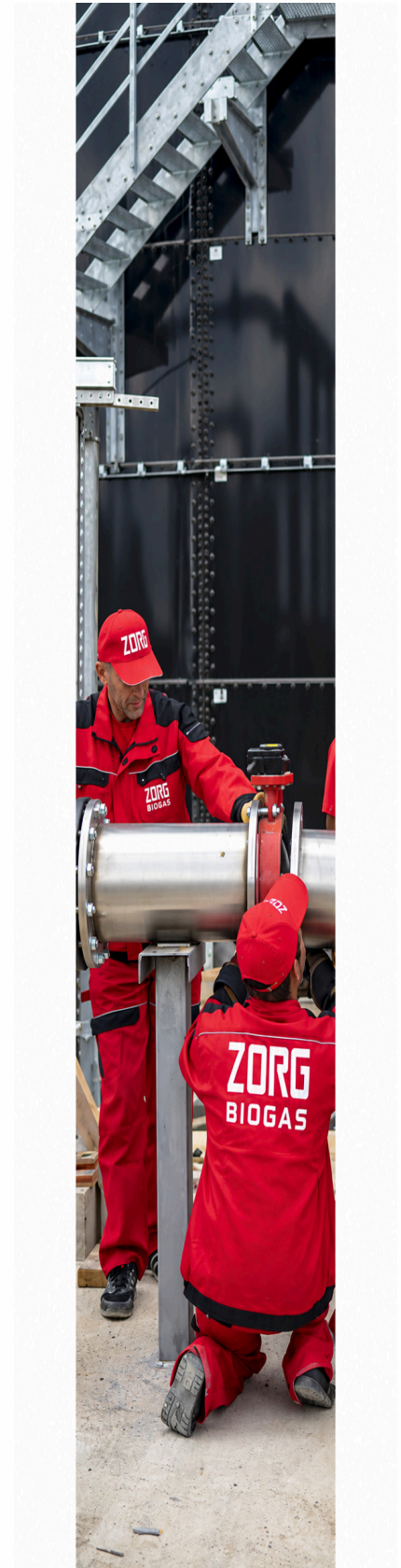
Proposal

Biogas plant: 1,000 kW gross
55 tonnes/day of broiler dung



Date: 02/10/2026

Validity: 12 months



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OVERVIEW

Zorg Biogas offers an integrated solution for processing 55 tonnes of broiler dung with bedding and 4 tonnes of fatty pulp per day. A single glass-fused-to-steel CSTR digester combines controlled feeding, mixing and temperature regulation for mesophilic anaerobic digestion.

The feedstock calculation gives 9,274 Nm³ of biogas per day. A containerised 2020 V12 CHP unit with 1,200 kW installed electrical capacity converts the cleaned gas into electricity and useful heat. At the stated feed rate, the project electrical balance is approximately 1,000 kW gross and 898 kW net. Recovered heat supports digester heating and can serve other site needs.

Poultry dung requires careful management of ammonia, solids and fibrous bedding. The solid feeder loosens and meters the material, while the digester mixing system supports uniform conditions. A biological scrubber removes hydrogen sulphide using controlled air and micronutrient dosing. Its liquid circuit can assist ammonia management, subject to process pH and operating conditions.

Gas treatment includes biological scrubbing, cooling, compression and activated carbon polishing. The equipment is specified for a gas flow of 450 Nm³/h, allowing for the stated process air addition. Digestate separation produces solid and liquid fractions for managed nutrient recovery.

Zorg provides detailed engineering, equipment supply, construction supervision, commissioning and operator training. Civil works and installation are performed by the client under Zorg supervision.

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 /tonnesODM)	Biogas (m ³ /day)	Methane content (%)	Biomethane (m ³ /year)
Chicken dung with bedding	55	20 075	55	76	30,3	22,99	370	8 506	60	3 104 690
Fatty pulp	4	1 460	20	96	0,8	0,77	1000	768	75	280 320
Total	59	21 535			31,1	23,76		9 274	61	3 385 010

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

Biogas plant characteristics

Characteristics	Values	Figures
Reactor	units	1
Volume:		
Work	m ³	3413
Overall		3974
Temperature	°C	38
Overall dimensions of the digester:		
diameter	m	29,88
height		5,67
Organic load	kgODM/m3	6,96
Hydraulic retention time (gross/net)	days	28/24
Number of gasholders	units	1
Volume:	m ³	1690
Dimensions of the gasholder:		
diameter		30,0
Height	m	6,0

Number of personnel

	Shift 1	Shift 2	Shift 3
Operator	1	1	1
Driver	1	-	-
Manager	1	-	-
Total	5		



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.

Organic compounds + $H_2O \rightarrow C_5H_7NO_2 + HCO_3$.

Further conversion of obtained dissolved compounds like organic acids and alcohols ($C_5H_7NO_2, HCO_3$) into gases - CH_4, CO_2 . $C_5H_7NO_2 + HCO_3 + H_2O \rightarrow CH_4 + CO_2 + NH_4$.

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 CH_4 , water H_2O and carbon dioxide CO_2 . 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

Broiler dung with bedding is loaded into the solid feeder and conveyed in measured portions to the digester by screws. Fatty pulp enters the receiving tank, where a submersible mixer and level sensors support controlled pumping to the reactor.

The digester operates at 38°C. Paddle agitators mix the substrate periodically, and the heating circuit and dry cooler regulate the temperature. The reactor has a total volume of 3,974 m³ and a working volume of 3,413 m³. The stated hydraulic retention times are 28 days on total volume and 24 days on working volume.

Digestate is pumped to the screw press separator. The solid fraction is discharged for storage, while filtrate flows to the filtrate tank. Part of the liquid is returned to the process.

Biogas is collected in the tank-mounted double-membrane gasholder. Membrane support air is separate from the process air supplied to the scrubber. Pressure protection devices safeguard gas storage.

Gas from the gasholder passes through the biological scrubber. Micronutrients are dosed at 3 kg/day. Air is supplied to the scrubber at 10% of the raw biogas volume, equivalent to about 927 Nm³/day.

For gas equipment sizing, the combined flow is approximately 10,201 Nm³/day, or 425 Nm³/h. The scrubber, cooling package, compressors and activated carbon filter are specified for 450 Nm³/h. Air addition does not increase methane production.

The specified H₂S concentration after scrubbing is 100 ppm. Gas then passes through cooling and condensate removal at 0.5 mbar. Two gas compressors, one duty and one standby, provide 200 mbar discharge pressure.

Activated carbon removes residual H₂S. The specified outlet concentration is 0 ppm. A 5 mbar pressure drop across the filter leaves 195 mbar at the CHP gas supply.

The 2020 V12 CHP unit produces electricity and heat. Plant automation monitors process conditions, equipment status, alarms and operating modes.

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:	1,56 m
Length:	5,83 m
Width:	2,79 m
Volume:	20 m ³
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:	5,67 m
Diameter:	29,88 m
Total volume:	3974 m ³
Substrate volume	3413 m ³
Quantity:	1 pcs.



Reactor`s mixer Paddle-giant (AG-01..04)

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:	11 kW
Quantity per reactor:	4 pcs
Total quantity:	4 pcs



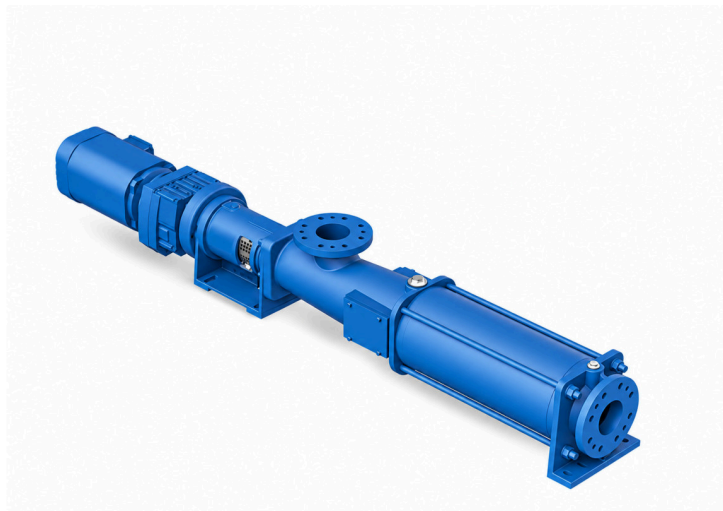
Window with spotlight (SG-01)

Inspection windows are designed for visual control of processes inside the fermenter. Spotlights were made in explosion-proof with automatic disconnection. Inspection windows are equipped with a cleaning washing system.

Specifications

Inspection windows: Ø300

Spotligh:
VISULUX UL50 -G -H 230V, 50W, IP65



Pump equipment (PU-01...PU-03)

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:	5,5 kW
Flow rate:	25 m3/hour
Pressure:	4 bar
Quantity:	1 pcs

Substrate pump (PU-02)

Engine power:	11 kW
Flow rate:	8-25 m3/hour
Pressure:	4 bar
Quantity:	1 pcs

Filtrate pump (PU-03)

Engine power:	5,5 kW
Flow rate:	25 m3/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:	8-20 m3/hour

Quantity:	1 pcs
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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.

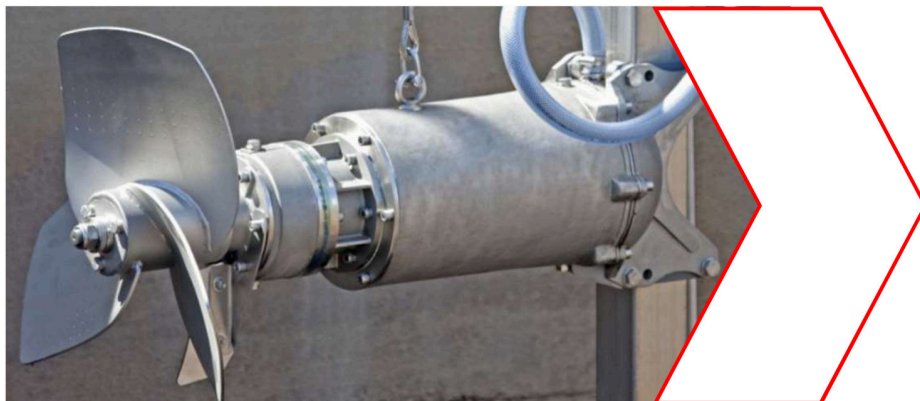
Specifications

Receiving tank (RT-01)

Diameter:	7,0 m
Height:	2,5 m
Total volume:	48 m ³
Quantity:	1 pcs

Filtrate tank (FT-01)

Diameter:	6,0 m
Height:	2,5 m
Total volume:	48 m ³
Quantity:	1 pcs



Submersible mixer (AG-05... AG-06)

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-05)
Nominal power:	3,0 kW
Quantity:	1 pcs
Submersible mixer for the filtrate tank FT-01	(AG-06)
Nominal power:	3,0 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 cm³/m² * 1 bar biogas resistance. The gasholder film temperature range allows operation from -30°C to +60°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:	6,0 m
Diameter:	30,0 m
The total volume :	1690 m ³
Quantity:	1 pcs



Biogas Scrubber (SC-01)

The biological scrubber reduces hydrogen sulphide in the biogas before cooling and final activated carbon polishing. Gas contacts the circulating liquid and biofilm, where sulphur compounds are transferred and biologically converted.

Controlled air addition supports the biological process. Micronutrients are supplied to the scrubber liquid circuit at 3 kg/day. The air supply is 10% of the raw biogas volume. The specified H₂S outlet concentration is 100 ppm.

The corrosion-resistant vessel, liquid circulation system and instrumentation are integrated with the plant controls.

Specifications

Gas flow capacity	450 Nm ³ /h
Process air	10% of raw biogas volume
Micronutrients	3 kg/day
Specified H ₂ S outlet	100 ppm
Quantity	1 unit



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 flow capacity	450 Nm ³ /h
Gas inlet / outlet temperature	40°C / 10°C
Electrical load allowance	18 kW
Downstream gas pressure	0.5 mbar
Quantity	1 unit



Biogas compressor (BC-01, BC-02)

The biogas compressors supply cooled gas to the activated carbon filter and CHP unit. Two units are installed, one operating and one on standby. Variable-speed control adjusts delivery to the actual gas flow.

The project duty is 450 Nm³/h at a discharge pressure of 200 mbar. The selected motor allowance is 5.5 kW per unit.

Specifications

Project gas flow	450 Nm ³ /h
Discharge pressure	200 mbar
Motor rating	5.5 kW
Quantity	2 units: duty + standby



Activated Carbon Filter (CF-01)

The activated carbon filter provides final polishing of biogas after biological scrubbing, cooling and compression. Its porous media adsorb residual hydrogen sulphide before the gas reaches the CHP unit.

The specified H₂S concentration is 100 ppm at the inlet and 0 ppm at the outlet. The pressure drop across the filter is 5 mbar, reducing gas pressure from 200 to 195 mbar. The carbon charge is replaced according to operating conditions and outlet gas measurements.

Specifications

Gas flow capacity	450 Nm ³ /h
Activated carbon charge	200 kg
Specified H ₂ S inlet / outlet	100 / 0 ppm
Pressure drop	5 mbar
Gas outlet pressure	195 mbar
Quantity	1 unit



CHP generator 2020 V12 (CHP-01)

The containerised CHP unit converts cleaned biogas into electricity and useful heat. The package comprises a gas engine, generator, controls, ventilation and cooling systems. Heat recovery connects the engine circuit to the plant heating system.

Access doors and service passages provide access to the engine, generator and auxiliary equipment. Automatic control manages engine operation, electrical protection and communication with the plant control system.

Project configuration

Engine model	2020 V12
Installed electrical capacity	1,200 kW
Rated speed	1,500 rpm
Frequency	50 Hz
Engine configuration	V12, 53.1 litres
Fuel	Cleaned biogas
Gas supply pressure	195 mbar
CHP auxiliary demand	20 kW
Quantity	1 containerised unit

Photograph: example of containerised execution. Final fuel settings and performance are matched to the project biogas composition.

CHP unit - external and internal views



Container, cooling and ventilation equipment



Engine compartment and service access

The enclosure protects the equipment and provides ventilation and access for maintenance. The engine and generator are mounted on a common base, with service connections arranged inside the container. The CHP control panel integrates operating measurements, alarms and protective functions.

Photographs illustrate typical execution of the containerised package.



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

Gas flow capacity	450 Nm ³ /h
Operating pressure range	10-60 mbar
Quantity	1 unit

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 using 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



Dry cooler (cooling substrate system)

Device is designed to cool the substrate to working temperature according to technological regime. When use high temperature substrate, there is a chance of uncontrolled heating. The cooler is connected to the heating pipes, heat exchangers and it will be activated if it is need.

Specifications

Heat power:	100 kW
Electric power:	4 kW
Quantity:	1 pcs



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



Laboratory

Monitoring and control of parameters of raw materials and fermentation processes is important for the efficient operation of a biogas plant. The laboratory allows you to assess the content of dry matter in the input raw materials, fermented mass, determine the ratio of volatile organic acids to total inorganic carbon (FOS/TAC parameter), determine the degree of substrate fermentation in fermenters, the level of biogas output, and evaluate the efficiency of separator.

Equipment

Analytical scales

Moisture analyzer

Automatic titrator

Laboratory pH meter

Centrifuge

A set of flasks

Equipment specification list



Nº	Equipment	Characteristic	Quantity
1	Loader	V=20m3	1
1.1	Container bunker		1
1.2	Feeding screws	set.	1
2	Submersible mixer	N=3,0 kW	2
2.1	Airtight motor gearbox		2
2.2	Hydraulic screw (wear-resistant steel)		2
2.3	Mixer control mechanism		2
2.4	Electric motor mount		2
2.5	Set of fasteners		2
3	Reactor (steel enameled tank)	V=3974m3	1
3.1	Inspection window	unit	1
3.2	Flanges for connecting communications, unit		1
3.3	Service kits (for mixers, valves and connections)		1
3.4	Electric motor mounting		1
4	Reactor`s agitator	N=11 kW	4
4.1	Airtight motor gearbox		4
4.2	Hydraulic screw (wear-resistant steel)		4
4.3	Shaft (adapted to the height of the fermenter)		4
4.4	Blade		4
4.5	Frequency converter		4
4.6	Mounting bracket to bottom of the mixer		4
5	Safety valve of digesters		1
6	Substrate digested pump	8-20 m3/hour N=11.0 kW	1

Nº	Equipment	Characteristic	Quantity
7	Separator	N=7,5 kW, 8-20m³/h	1
7.1	Body		1
7.2	Substrate Supply Pipe 4 ''		1
7.3	Engine - Gearbox	N=7,5 kW	1
7.4	Frame		1
7.5	Screw		1
7.6	Sieve for filtration		1
8	Liquid substrate pump	25 m³/hour N=5,5 kW	1
9	Filtrate pump	25 m³/hour N=5,5 kW	1
10	PVC gas holder	1690 m³	1
10.1	Weather protection film	Ø30 m	1
10.2	Gasholder film PELD methane permeation max.260 cm ³ /m ² *d*1 bar, 650 N/5cm biogas resistant		1
10.3	Air blower	16A, 0,5kW	
10.4	Excess and minimum pressure valve		1
10.5	Dome level sensor		1
10.6	Mounting system		1
10.7	Accessories		1
10.8	Safety valve		1
11	Biogas Cooling System	450 Nm³/h	1
11.1	Chiller		1
11.2	Heat exchanger		1
11.3	Polypropylene glycol tank		1
12	Gas desulphurisation		1
12.1	Activated carbon filter	200 kg	1
12.2	Scrubber	450 Nm ³ /h	1

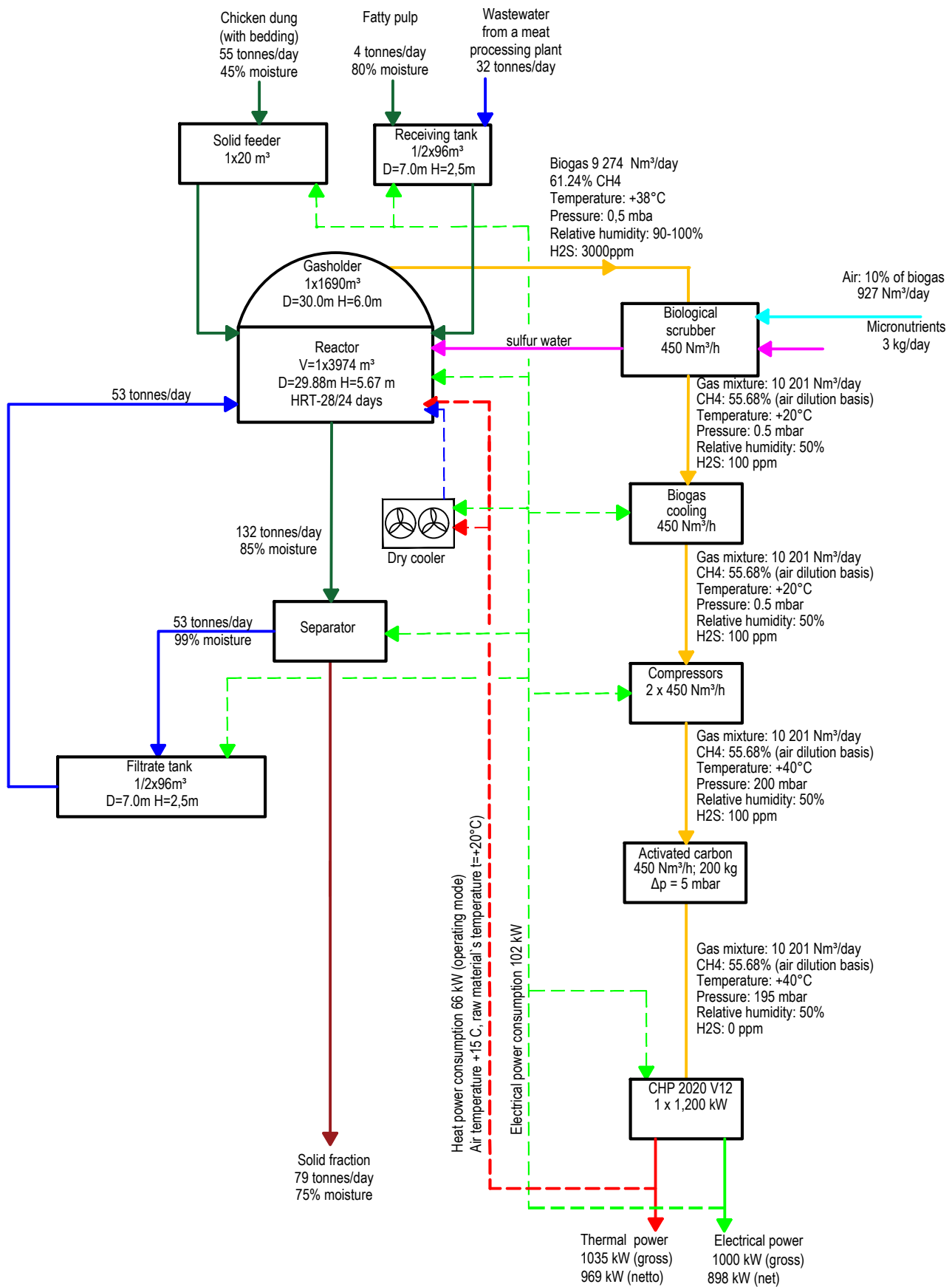
Nº	Equipment	Characteristic	Quantity
13	Biogas compressor	Q=450 Nm³/h H=200 mbar N=5.5 kW	2
14	Electromagnetic flow meter		1
15	Flare	450 Nm³/h	1
16	Gas equipment included	set	1
16.1	Drainage pump with float	DN=50, Q=1m³/h, H=13 m	2
17	The heat supply system	set	1
17.1	Diaphragm expansion tank	V=1000 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
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

Nº	Equipment	Characteristic	Quantity
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	Dry cooler 100kW heat pow.		1
22	CHP 2020 V12, 1,200 kW	set	1
23	Laboratory	set	1

APPENDICES



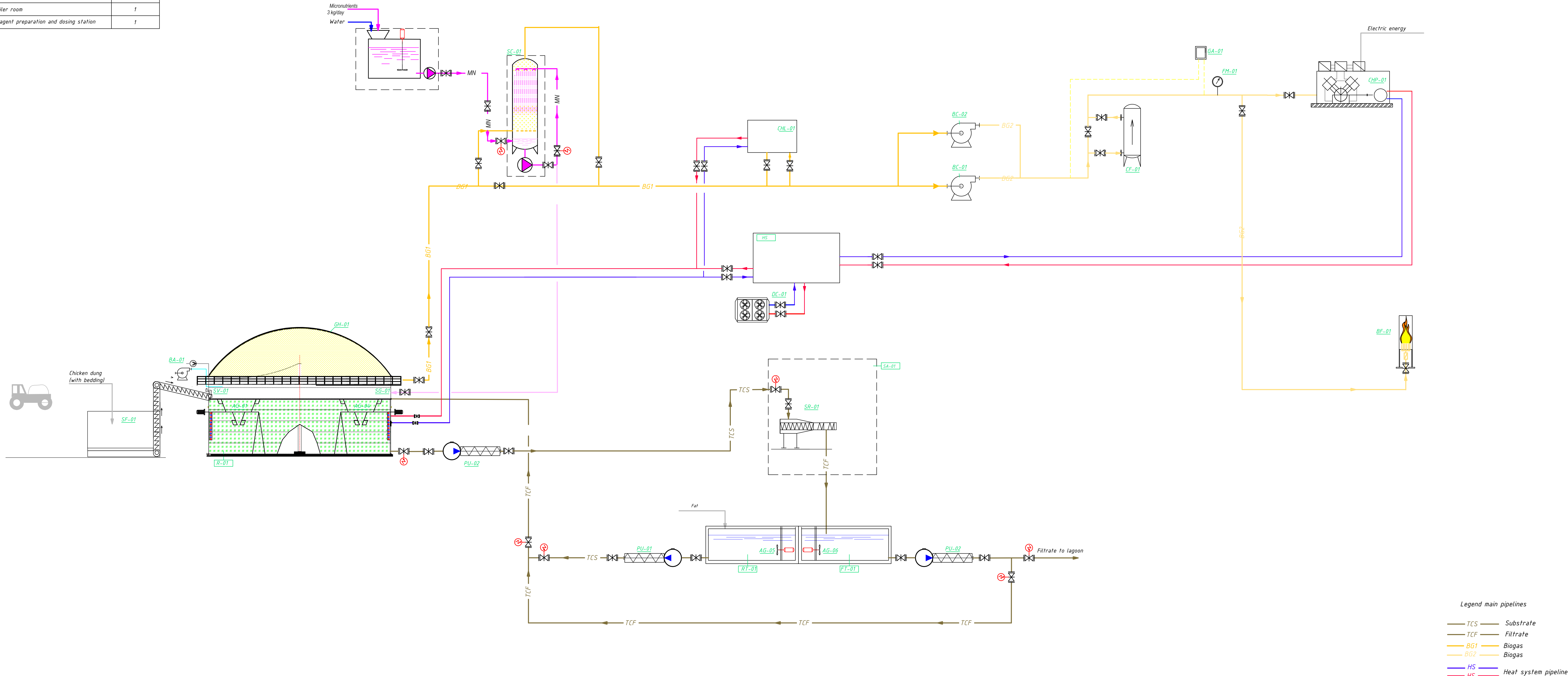
Material flow diagram

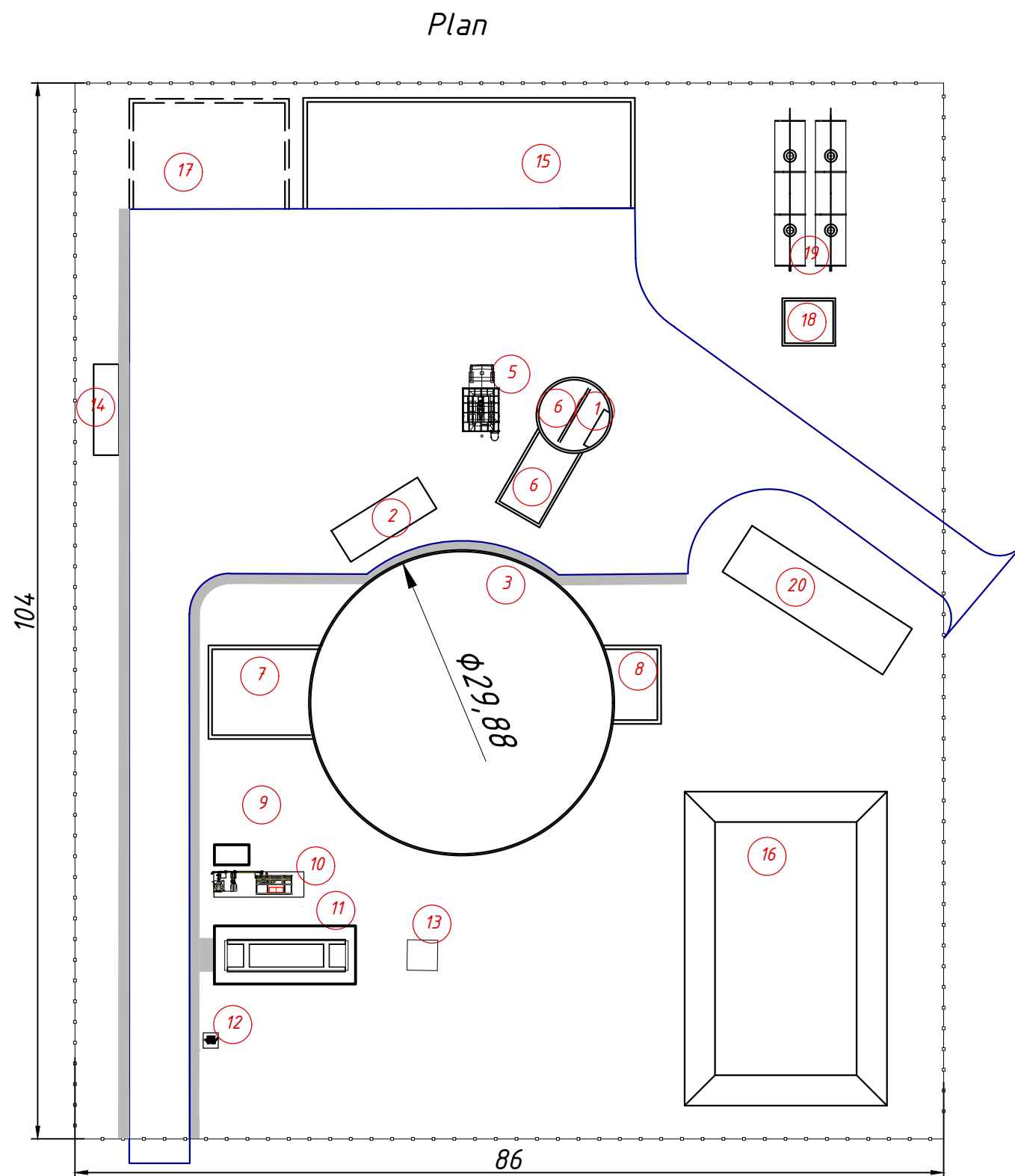


Gas volumes at normal conditions. Air addition is included in downstream sizing; reaction and drying can reduce the actual gas flow.

Specification		
N/Nº	Name	Q-ty
SF-01	Loader machine	1
AG-05	Receiving tank's submersible mixer	1
AG-01.04	Vertical mixer	4
AG-06	Filtrate tank's submersible mixer	1
SV-01	Safety valve	1
SG-01	Inspection windows	1
PU-01	Substrate pump	1
PU-02	Substrate pump (to separator)	1
SR-01	Separator	1
PU-02	Filtrate pump	1
GH-01	Gasholder	1
CHL-01	Biogas cooling system	1
BC-01, BC-02	Biogas blower	2
SC-01	Scrubber	1
CF-01	Activated Carbon Filter	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/Nº	Name	Q-ty
R-01	Digester	1
SA-01	Separator area	1
RT-01	Receiving tank	1
FT-01	Filtrate tank	1
HS	Boiler room	1
FPDS	Reagent preparation and dosing station	1





Explication

<i>N/Nº</i>	<i>Name</i>	<i>Q-ty</i>
1	Receiving tank (RT-01)	
2	Solid feeder(SF-01)	
3	Reactor (R-01)	
4	Separator (SA-01)	
5	Filtrate tank (FT-01)	
6	Equipment room	
7	Technical room	
8	Technological room	
9	Scrubber area	
10	Gas preparation	
11	Cogeneration power plant (CHP-01)	
12	Flare (BF-01)	
13	Transformer	
14	Operator's room	
15	Fermented mass storage	
16	Lagoon	
17	Drying and granulation area (perspective)	
18	Fire pump station	
19	Fire tank	
20	Rainwater treatment plants	

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	44,0	1	44,0	4,0	176,0
Screw set.	26,0	1	26,0	4,0	104,0
Reactor's mixer paddle giant	11,0	4	44,0	18,0	792,0
Submersible mixer in receiving tank	3,0	1	3,0	12,0	36,0
Submersible mixer in filtrate tank	3,0	1	3,0	12,0	36,0
Biogas cooling system	18,0	1	18,0	24,0	432,0
Biogas compressor	5,5	2	11,0	12,0	132,0
Separator	7,5	1	7,5	8,8	66,0
Substrate pump to separator	11,0	1	11,0	8,8	96,8
Liquid substrate pump	5,5	1	5,5	1,0	5,5
Filtrate pump	5,5	1	5,5	1,5	8,3
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
Scrubber	1,5	1	1,5	24,0	36,0
Circulation pump for supplying heat carrier to the digester	0,8	1	0,8	24,0	18,0
Cogeneration power plant	20,0	1	20,0	24,0	480,0
Circulation pump for supplying heat to the technical building	0,8	1	0,8	only ambient temp +15°C	
Digester cooling system	4,0	1	4,0	at t>40°C	
Circulation pump for supplying network water to the digester cooling system	2,2	1	2,2		
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			213		
Total consumed electric energy, kWh per day					2452
Total consumed power, kW					102

Prices for a 1000 kW biogas plant using 55 tonnes bedded chicken broiler dung per day

Pos	Name	Number of units	Unit price, EUR	Price sub-total, EUR
1	Project documentation	1	41.300	41.300
2	Supervision	1	40.000	40.000
3	Startup and training	1	40.000	40.000
4	Living and travel expences	1	30.000	30.000
5	Delivery of the equipment (truck)	13	8.000	104.000
6	Laboratory	1	18.900	18.900
7	Reactor V=3971 m ³ (including ladders, platforms, hatches, pipe flanges, supports, fasteners, etc.)	1	231.000	231.000
8	Solid feeder 20 m3	1	94.000	94.000
9	Screw conveyor	1	83.000	83.000
10	Digester agitator (paddle-gigant)15kW	3	43.200	129.600
11	Substrate pump 5,5 kW	1	18.900	18.900
12	Digested substrate pump 11 kW	1	20.300	20.300
13	Filtrate supply pump 5.5 kW	1	18.900	18.900
14	Substrate separation unit 7,5 kW	1	40.600	40.600
15	Submersible agitator for receiving tank 3 kW	1	7.700	7.700
16	Submersible agitator for filtrate tank 3 kW	1	7.700	7.700
17	Over- and under pressure safeguard	1	5.600	5.600
18	Water supply and canalization system	1	20.300	20.300
19	Heat supply station	1	24.500	24.500
20	Dry-cooler cooling system for reactors	1	18.900	18.900
21	Automation and electric cabinet	1	138.000	138.000
22	Motorized valves (set)	6	4.000	24.000
23	Sensors (set)	3	25.000	75.000
24	Gasholder D=30m	1	47.500	47.500
25	Biogas scrubber 450 m3/h	1	144.000	144.000
26	Biogas chiller (Biogas cooling system) 450m3/h	1	34.000	34.000
27	Biogas blower 450 Nm ³ /h	2	4.200	8.400
28	Activated carbon filter 450 Nm ³ /h, 200 kg	1	20.300	20.300
29	Biogas flare 450m3/h	1	33.600	33.600
30	Gas analyzer (portative)	1	6.000	6.000
31	Gas conditioning unit	1	25.900	25.900
32	Cogeneration power plant 1200 kW	1	498.000	498.000
33	Construction	1	500.000	500.000 local
				2.049.900
				2.549.900,00

Implementation terms and payment

Months	1	2	3	4	5	6	7	8	9	10	10	11	12
Project documentation	50%		50%										
Approvals and permits													
Equipment				30%		25%	25%	20%					
Delivery						25%	25%	25%	25%				
Construction													
Supervision				50%			50%						
Biogas 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 for 1000 kW biogas plant:

- 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 400 m³ water per day. It can be a technical quality water from a river, lake, well. Not salty.
- 6) Bacterial seed for the start-up. It can be biomass from another biogas plant. Possibly also cow manure, any kind of manure, sludge from city sewage treatment plant. Customer needs to bring the seed one-time during a 1-2 weeks period and to fill with it at least 15-20% of the reactor volume 600-800 m³. The rest is filled with the water item 7 above.
- 7) Machinery to transport Chicken dung and fatty pulp to and from storage to the solid feeders (a truck, a frontal loader, a tractor)
- 8) Machinery to transport filtrate and the digested mass from the biogas plant to the agricultural fields (a truck, a frontal loader, a tractor)
- 9) Activated carbon 0,2 tonne per two years x 1800 EUR/tonne
- 10) Demineralized water to the heating system 1.5 tonnes
- 11) Spare parts for two years 80 000 EURO



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