

01

version

Proposal

Biogas plant

944 kW net / 1099 kW gross
using pig manure



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CONTENTS

Overview	3
Raw material potential	4
Biogas plant characteristics	5
Number of personnel	5
Working principle	6
Technological process of biogas production	7
Main equipment	8
Steel CSTR reactor	9
Submersible mixer	10
Window with spotlight	11
Pump equipment	12
Tank-mounted gasholder	13
Biogas cooling system	14
Biogas compressor	15
Desulphurisation system	16
CHP generator 2020 V12	17
CHP container and engine compartment	18
Biogas flare	19
Water supply and sewerage system	20
Heating system	21
Dry cooler	22
Automation and electrical equipment	23
Sensors	24
Specification list	25
Appendices	29
Material flow diagram	30
Basic diagram	31
Plan of the biogas plant	32
Electrical power consumption	33
Equipment prices	34
Implementation terms and payment	35
List of exclusions	36
Contacts	37



OVERVIEW

Zorg Biogas proposes a plant for the anaerobic digestion of 450 tonnes of pig manure per day. A single glass-fused-to-steel CSTR digester combines controlled feeding, mixing and temperature regulation for stable mesophilic operation at 38°C.

The feedstock potential is 10,519 Nm³ of biogas per day at 60% methane. Process air is supplied at 5% of this volume. The gas treatment system is sized for a combined design flow of 11,045 Nm³/day, approximately 460 Nm³/h. Adding air does not increase the methane or energy yield.

A containerised 2020 V12 CHP package converts cleaned gas into electricity and useful heat. On the project calculation basis, electrical output is approximately 1,099 kW gross and 944 kW net after plant auxiliaries. Heat recovery supports the digester heating circuit and supplies surplus heat to the farm.

The existing separation and lagoon facilities receive the digestate. The project combines on-site energy production with controlled manure treatment and nutrient recovery for agricultural use. Zorg provides engineering, equipment, construction supervision, commissioning and training. The client carries out civil works and installation 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)
Pig manure	450	164 250	5	85	22,5	19,13	550	10 519	60	3 839 435

**-DM- dry matters

***-oDM- organic dry matters

Biogas plant characteristics

Characteristics	Values	Figures
Reactor	units	1
Volume:		
Work	m ³	9994
Overall		10938
Temperature	°C	38
Overall dimensions of the digester:		
diameter	m	35.91
height		10.80
Organic load	kgODM/m3	1,69
Hydraulic retention time (gross/netto)	days	24/22
Number of gasholders	units	1
Volume:	m ³	3151
Dimensions of the gasholder:		
diameter		35.91
Height	m	7.40

Number of personnel

	Shift 1	Shift 2	Shift 3
Chief Engineer	1	1	-
Operator	1	1	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 C_1 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

Pig manure is collected in the existing receiving tank, which is equipped with a submersible mixer and level sensors. Metered portions are pumped into the digester.

The glass-fused-to-steel reactor operates at 38°C. Submerged agitators mix the substrate periodically, while the heating system and dry cooler regulate the temperature. The working substrate volume is 9,994 m³, giving about 22 days of hydraulic retention.

Digestate is pumped to the existing separator. The solid fraction is transferred to storage; filtrate flows to the existing lagoon.

Biogas collects in the tank-mounted double-membrane gasholder. Membrane support air is supplied separately from process air. Pressure protection and level monitoring safeguard the gas storage system.

Ferric chloride (iron(III) chloride, FeCl₃) is dosed at 42 kg/day. Controlled process air is supplied to the digester at 5% of the raw biogas volume: approximately 526 Nm³/day.

For equipment sizing, the combined gas flow is 11,045 Nm³/day or 460 Nm³/h. On this dilution basis, the methane fraction is 57.14%; methane production remains approximately 6,311 Nm³/day.

Gas is cooled and dried. Pressure after the cooler is 0.5 mbar. Two blowers, one duty and one standby, provide 200 mbar discharge pressure.

The activated carbon filter removes residual hydrogen sulphide. The specified H₂S concentration is 80 ppm before polishing and 0 ppm afterwards. The filter pressure drop is 5 mbar, leaving 195 mbar at the CHP gas supply.

One 2020 V12 CHP package produces electricity and heat. Automatic controls monitor process conditions, alarms and local or remote operation.

MAIN EQUIPMENT





Reactor (R-01)

The digester is assembled from glass-fused-to-steel panels on a reinforced concrete foundation. The enamel coating protects the steel from the corrosive process environment. Bolted panel joints and dedicated sealants form a watertight vessel and allow individual panels to be replaced.

The steel shell is thermally insulated and protected by external cladding. Heating circuits and submerged agitators maintain a uniform mesophilic process temperature of 38°C. A double-membrane gasholder is mounted on top of the tank.

The selected shell is 35.91 m in diameter and 10.80 m high, with a geometric volume of 10,938 m³. The working substrate volume remains 9,994 m³, providing approximately 22 days of hydraulic retention at 450 tonnes/day.

Specifications

Construction	Glass-fused-to-steel CSTR
Diameter	35.91 m
Wall height	10.80 m
Geometric volume	10,938 m ³
Working substrate volume	9,994 m ³
Quantity	1 unit



Submersible mixer (AG-01... AG-08)

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 reactor	(AG-01..07)
Nominal power:	15,0 kW
Quantity:	7 pcs
Submersible mixer for the receiving tank	(AG-08)
Nominal power:	7,5 kW
Quantity:	1 pcs



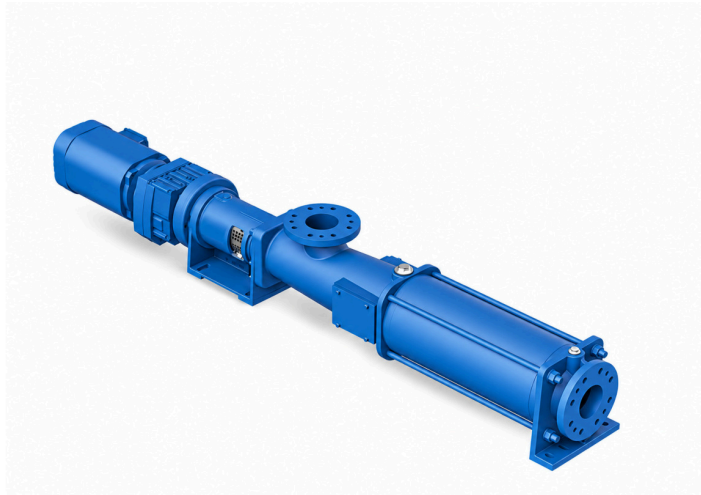
Window with spotlight (SG-01, SG-02)

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

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



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

Substrate pump (PU-02. 03)

Engine power:	7,5 kW
Flow rate:	8-25 m ³ /hour
Pressure:	4 bar
Quantity:	2 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 PE/LD (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

Type	Tank-mounted double membrane
Tank diameter	35.91 m
Usable gas storage	3,151 m ³
Quantity	1 unit



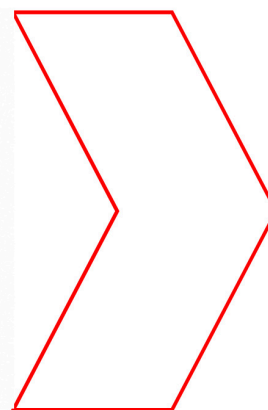
Biogas dryer and cooling (CHL-01)

The cooling and condensate removal package dries biogas before compression and activated carbon polishing. The gas heat exchanger uses corrosion-resistant surfaces and a circulating chilled-water circuit.

The design flow including process air is 460 Nm³/h, approximately 524 m³/h at 38°C and near-atmospheric pressure. A 600 m³/h cooling package is selected. Gas is cooled to 10°C; the downstream balance allows 15°C after pipework heat gain. Gas pressure after cooling is 0.5 mbar.

Specifications

Gas flow capacity	600 m ³ /h
Design inlet / outlet temperature	38°C / 10°C
Downstream gas pressure	0.5 mbar
Electrical load allowance	18.9 kW
Quantity	1 unit



Biogas compressor (BC-01, BC-02)



The gas blowers convey cooled biogas to the activated carbon filter and CHP unit. Two units are installed, one operating and one on standby.

The selected E10 MS blower with a 7.5 kW motor has a catalogue capacity of 620 m³/h at 200 mbar. This covers the project gas flow including 5% process air. Speed control adjusts delivery to the actual gas production and engine demand.

Specifications

Execution	E10 MS, 50 Hz
Capacity at 200 mbar	620 m ³ /h
Operating discharge pressure	200 mbar
Motor rating	7.5 kW
Quantity	2 units: duty + standby



Desulphurization system

Hydrogen sulphide removal combines ferric chloride dosing, controlled biological treatment with process air and activated carbon polishing. Iron(III) chloride consumption is 42 kg/day. The air supply is 5% of the raw biogas volume.

The specified H₂S concentration before the carbon filter is 80 ppm. Activated carbon provides final polishing to 0 ppm H₂S. At 200 mbar compressor discharge pressure and 5 mbar filter pressure drop, the downstream pressure is 195 mbar.

Specifications

Filter gas flow capacity	500 Nm ³ /h
Activated carbon charge	200 kg
Specified H ₂ S outlet	0 ppm
Filter pressure drop	5 mbar
Gas outlet pressure	195 mbar
Quantity	1 unit



CHP generator 2020 V12

The containerised CHP package converts cleaned biogas into electricity and useful heat. It combines a twelve-cylinder gas engine, alternator, controls, ventilation, cooling circuits and service systems in an insulated enclosure.

The engine jacket heat recovery circuit is integrated with the plant heating system. Exhaust heat recovery is included in the project thermal balance. Automatic controls supervise engine operation, electrical protection and communication with plant automation.

Project configuration

Engine model	2020 V12
Genset class / biogas rating	1,200 kW / 1,150 kW
Project electrical output	1,099 kW gross / 944 kW net
Project recovered heat	1,135 kW gross
Engine configuration	V12, 53.1 litres
Rated speed / frequency	1,500 rpm / 50 Hz
Gas supply pressure	195 mbar
CHP auxiliary load allowance	20 kW
Quantity	1 containerised unit

Calculation basis: methane LHV 9.97 kWh/Nm³; electrical efficiency 41.9%, thermal efficiency 43.3%. Project performance is calculated for the stated gas supply. Photograph shows typical containerised execution.

CHP package - container and engine compartment



External view: enclosure, cooling and ventilation



Internal view: engine, alternator and service access

The insulated container provides weather protection, ventilation and access for maintenance. The engine and alternator are installed on a common base. Service doors and access passages support inspection of the gas, lubrication and cooling systems.

The control panel displays operating measurements and alarms. Protective functions coordinate the engine, generator and gas supply. Heat recovery is integrated with the plant heating circuit.

Photographs show examples of containerised execution.



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	500 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 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



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



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	Reactor`s agitator	N=15 kW	7
1.1	Airtight motor gearbox		7
1.2	Hydraulic screw (wear-resistant steel)		7
1.3	Shaft (adapted to the height of the fermenter)		2
1.4	Blade		7
1.5	Frequency converter		7
1.6	Mounting bracket to bottom of the mixer		7
2	Safety valve of digesters		1
3	Window with a searchlight	set	1
3.1	Inspection window RD300 (mounts and sealant included)	Ø300	2
3.2	Spotlight (mount system bundled) VISULUX UL50 -G -H	230V, 50W, IP65	1
4	Liquid substrate pump	60 m3/hour N=18,5 kW	1
7	Substrate digested pump	8-20 m3/hour N=11.0 kW	1
8	PVC gas holder	3151 m3	1
8.1	Weather protection film	Ø35.91m	1
8.2	Gasholder film PELD methane permeation max.260 cm3/m2*d*1 bar, 650 N/5cm biogas resistant		1
8.3	Air blower	16A, 0,5kW	
8.4	Excess and minimum pressure valve		1
8.5	Dome level sensor		1
8.6	Mounting system		1
8.7	Accessories		1
8.8	Safety valve		1

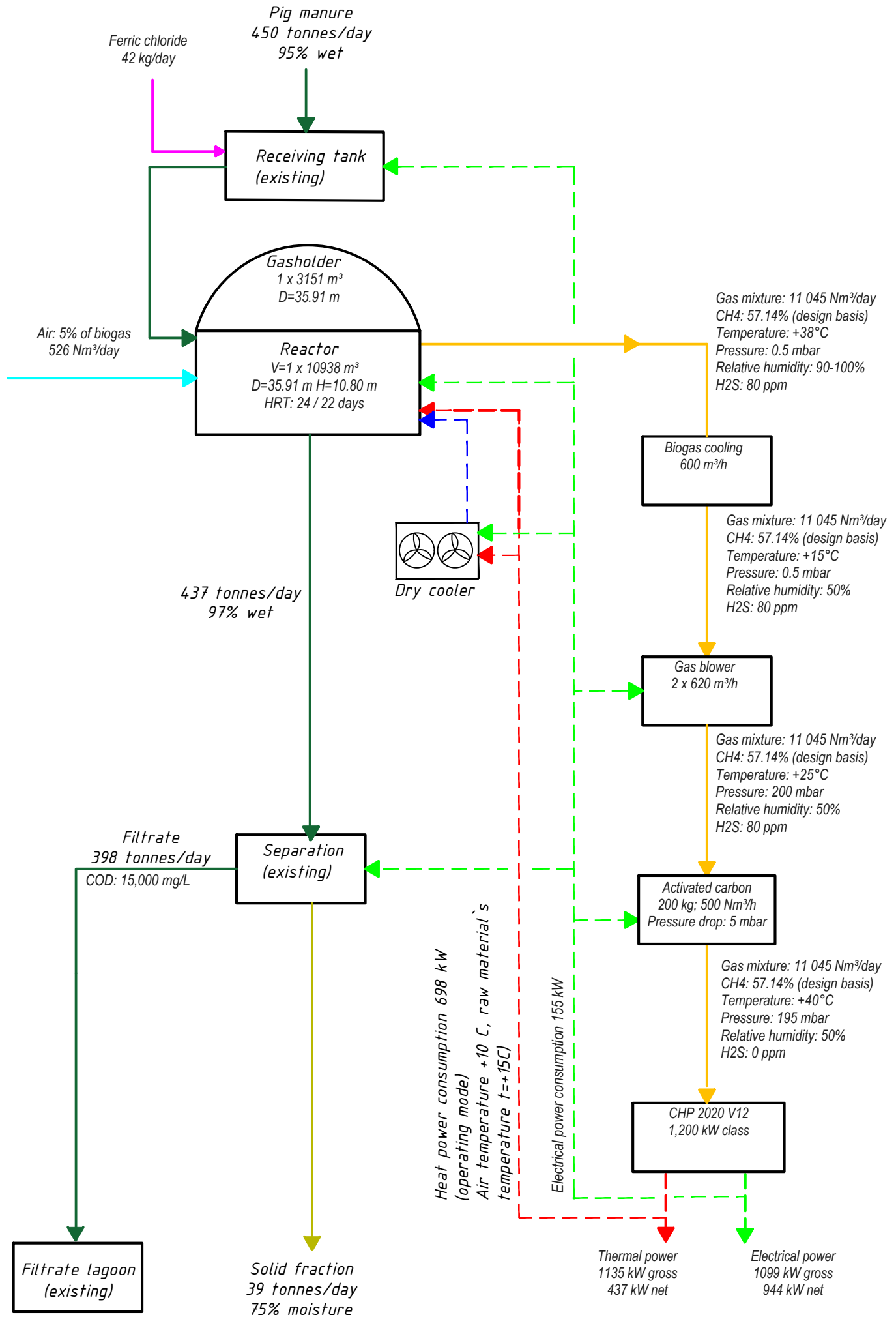
No	Equipment	Characteristic	Quantity
9	Biogas Cooling System	600 m³/h	1
9.1	Chiller		1
9.2	Heat exchanger		1
9.3	Polypropylene glycol tank		1
10	Desulphurization system		1
10.1	Numbers of charcoal columns	200 kg	1
11	Biogas compressor	Q=620 m³/h H=200 mbar N=7.5 kW	2
12	Electromagnetic flow meter		1
13	Flare	500 Nm³/h	1
14	Gas equipment included	set	1
14.1	Drainage pump with float	DN=50, Q=1m³/h, H=13 m	2
15	The heat supply system	set	1
15.1	Diaphragm expansion tank	V=1000 l,P=6Bar T=120°C	1
15.2	Circulating pump for supplying heat carrier	Q=30 m³/h,H=1bar	1
15.3	Propylene glycol feed pump station heating systems	Q=1,0 m³/h, H=4 bar	1
15.4	Circulation pump for supplying heat carrier to the digester	Q=18 m³/h, H=1.1 bar	1
16	Electromagnetic flow meter		1
17	Flare	500 Nm³/h	1
18	Gas equipment included	set	1
18.1	Drainage pump with float	DN=50, Q=1m³/h, H=13 m	2
19	The heat supply system	set	1
19.1	Diaphragm expansion tank	V=1000 l,P=6Bar T=120°C	1
19.2	Circulating pump for supplying heat carrier	Q=30 m³/h,H=1bar	1
19.3	Propylene glycol feed pump station heating systems	Q=1,0 m³/h, H=4 bar	1
19.4	Circulation pump for supplying heat carrier to the digester	Q=18 m³/h, H=1.1 bar	1

No	Equipment	Characteristic	Quantity
20	Water supply and sewerage system, complete, disassembled	set	1
21	Automation with electrical equipment	set	1
21.1	Incoming distribution cabinet with a set of automation DB-1		1
21.2	Incoming distribution cabinet with a set of automation DB-2		1
22	Sensors, set		1
22.1	Gas pressure sensor 0,025Bar		1
22.2	Gas pressure sensor 0,4Bar		1
22.3	Pressure sensor(substrate level) 1,0Bar		2
22.4	Pressure sensor (substrate pressure) 2,5bar		2
22.5	Resistive thermometer (gas temperature)		3
22.6	Resistive thermometer with thermo well (fermenter substrate temperature)		3
22.7	Resistive thermometer with thermo-well (digester tank substrate temperature)		3
22.8	Resistive thermometer (heat conductor temperature)		3
22.9	Conductometric sensor of maximum level		3
22.10	Conductometric sensor of water level		3
22.11	Dome position sensor		1
22.12	Coolant pressure sensor	SEN 3276 B065 G1/2 6Bar	7
22.13	Humidity and gas temperature sensor	ESFTF-I	1
23	Dry cooler 100kW heat pow.		1
24	CHP 2020 V12	set	1

APPENDICES

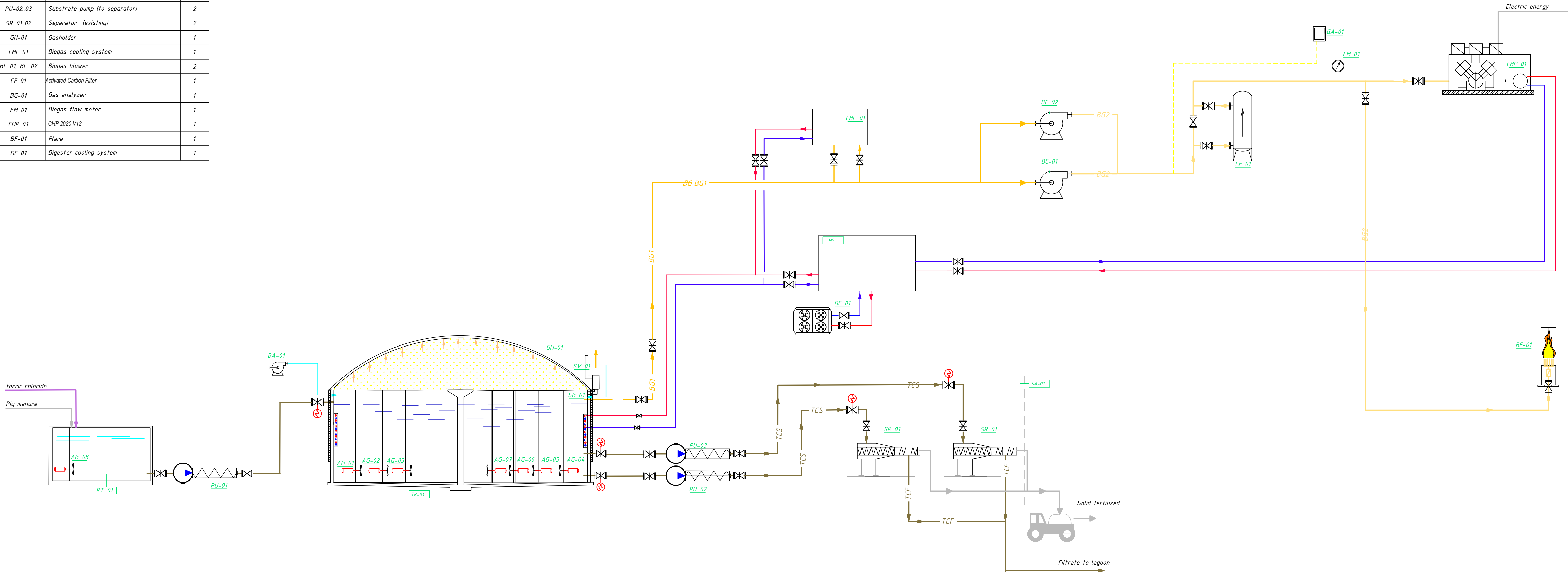


Material flow diagram



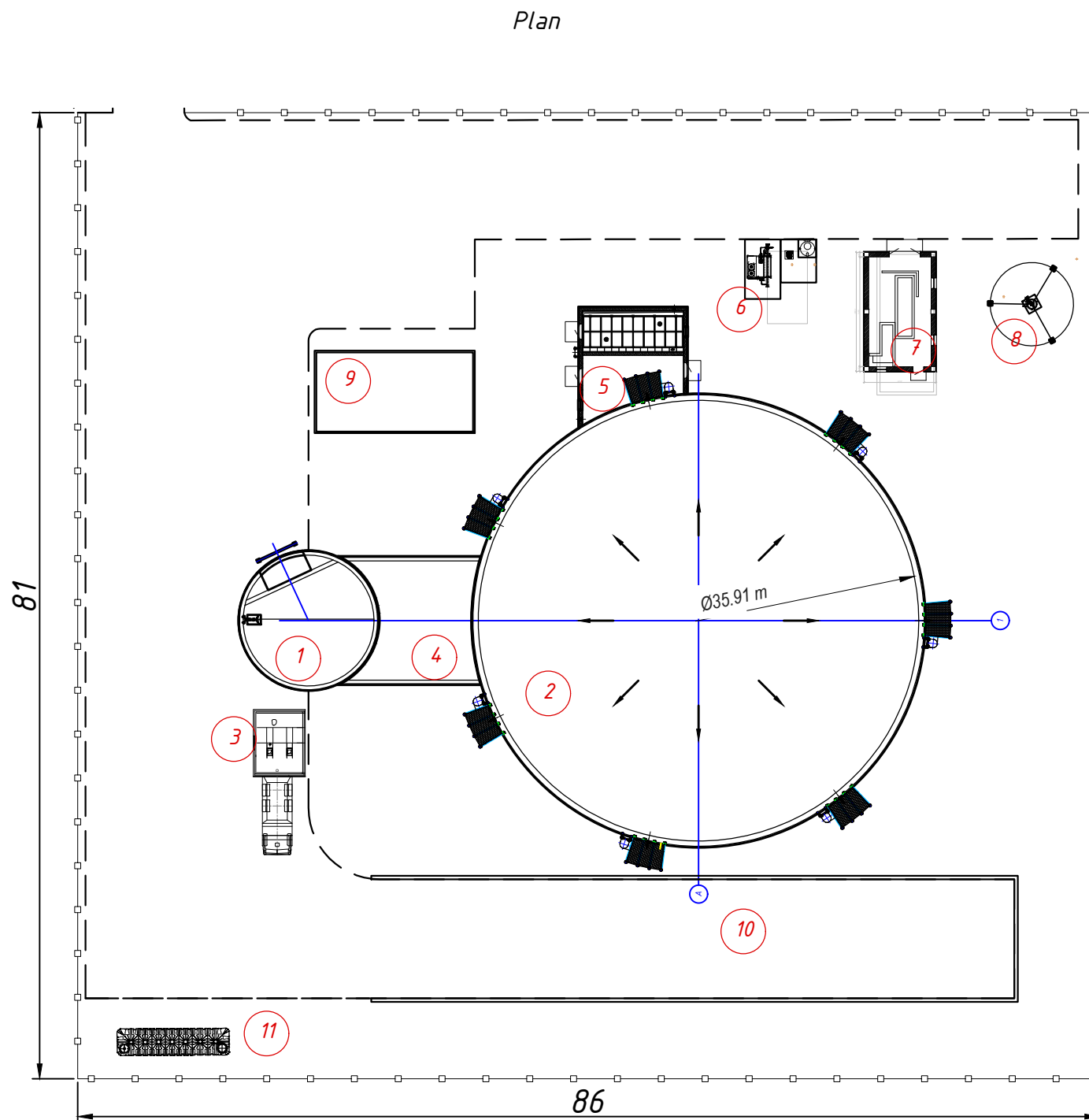
Specification		
N/Nº	Name	Q-ty
AG-08	Receiving tank's submersible mixer	1
AG-01.07	Submersible mixer	7
SV-01	Safety valve	1
SG-01	Inspection windows	1
PU-01	Substrate pump to reactor	1
PU-02.03	Substrate pump (to separator)	2
SR-01.02	Separator (existing)	2
GH-01	Gasholder	1
CHL-01	Biogas cooling system	1
BC-01, BC-02	Biogas blower	2
CF-01	Activated Carbon Filter	1
BG-01	Gas analyzer	1
FM-01	Biogas flow meter	1
CHP-01	CHP 2020 V12	1
BF-01	Flare	1
DC-01	Digester cooling system	1

Structure		
N/Nº	Name	Q-ty
R-01	Reactor	1
SA-01	Separator area (existing)	1
RT-01	Receiving tank (existing)	1
HS	Boiler room	1



Legend main pipelines

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



Explication

N/Nº	Name
1	Receiving tank (RT-01)(existing)
2	Reactor (R-01)
3	Separator area (SA-01) (existing)
4	Equipment room
5	Technical room
6	Gas preparation
7	Cogeneration power plant (CHP-01)
8	Flare (BF-01)
9	Operator's room
10	Composting site
11	Lagoon (existing)
12	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
Liquid substrate pump	18,5	2	37,0	3,8	140,6
Reactor's submersible mixer	15,0	7	105,0	18,0	1890,0
Submersible mixer in receiving tank	7,5	1	7,5	12,0	90,0
Biogas cooling system	18.9	1	18.9	24.0	453.6
Biogas compressor	7.5	2	15.0	12.0	180.0
Separator	7,5	2	15,0	14,6	219,0
Substrate pump to separator	7,5	2	15,0	14,6	219,0
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	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	1,2	1	1,2	8,0	9,6
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			247		
Total consumed electric energy, kWh per day					3728
Total consumed power, kW					155

Prices for a biogas plant 1200 kW at a farm with 50000 finisher pigs (120 000 annually)

Pos	Name	Number of units	unit price, EUR	price sub-total, EUR
1	Project documentation	1	48.300	48.300
2	Supervision	1	40.000	40.000
3	Startup and training	1	40.000	40.000
4	Living and travel expences	1	35.000	35.000
5	Delivery of the equipment (container)	8	8.000	64.000
6	Digester submersible agitator 15 kW	7	22.400	156.800
7	Liquid substrate pump	1	22.400	22.400
8	Digested substrate pump	2	22.400	44.800
9	Submersible agitator for receiving tank 7,5 kW	1	14.700	14.700
10	Over- and under pressure safeguard	1	5.600	5.600
11	Steel glass fused digester CSTR 10938m³	1	420.000	420.000
12	Water supply and canalization system	1	20.300	20.300
13	Heat supply station	1	24.500	24.500
14	Dry-cooler cooling system for reactors	1	19.600	19.600
15	Automation and electric cabinet	1	138.000	138.000
16	Motorized valves (set)	5	7.700	38.500
17	Sensors (set)	3	25.000	75.000
18	Gasholder	1	103.500	103.500
19	Biogas cooling package 600 m³/h	1	51.000	51.000
20	Biogas blower E10 MS, 620 m³/h at 200 mbar	2	5.600	11.200
21	Desulphurization column with active coal 200 kg	1	21.000	21.000
22	Biogas flare 500 Nm³/h	1	52.200	52.200
23	Gas analyzer (portative)	1	6.000	6.000
24	Gas conditioning unit	1	25.900	25.900
25	CHP 2020 V12, 1200 kW class with drycoolers, oil system, silencer in a container	1	575.000	575.000
27	Construction	1	500.000	500.000
				2.053.300
				2.553.300,00

Client

Implementation terms and payment

Year	2025			2026									
Months	10	11	12	1	2	3	4	5	6	7	8	9	10
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 1200 kW biogas plant:

- 1) Local permits, authorisations and adaptation of the project documentation by a licensed local engineering organisation: EUR 10,000-15,000.
- 2) Topographic and geological surveys: EUR 3,000-7,000.
- 3) Electrical transformer and external power connection for 130 kW start-up demand.
- 4) External roads.
- 5) Temporary water supply for construction and reactor hydraulic testing: at least 1,000 m³/day of non-saline technical water.
- 6) Machinery for transporting filtrate and digestate to agricultural fields, including a truck, front loader and tractor.
- 7) Activated carbon: 0.2 tonne every two years x EUR 1,800/tonne = EUR 360.
- 8) Ferric chloride (iron(III) chloride): 42 kg/day x 365 days = 15.33 tonnes/year; at EUR 150/tonne = EUR 2,299.50/year.
- 9) Demineralised water for the heating system: 0.5 tonne.
- 10) Spare parts for two years: EUR 80,000.



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