ZORG BIOGAS

01

version

Proposal

Biogas plant using 246 t press mud from sugarcane /day

Date: 24/02/2026
Validity: 12 months

CONTENT

OVERVIEW

We offer a solution to process press mud from sugarcane into biogas in the single high-load reactor (HLR). The proposed HLR technology is superior to the conventional CSTR . HLR is 3 times smaller and cheaper than CSTR. For 246 t of the press mud per day capacity 2xHLR units with volume of each 4920 m^3 are enough.

Sugarcane press mud for the biogas plant will be partially used fresh, while the remaining portion will be stored to ensure uninterrupted and stable loading of the reactors during the year.

The generated biogas will be supplied to the the boiler house for gas turbines.

Zorg will provide detailed engineering, supply all relevant process equipment, and deliver supervision during construction, commissioning, and start-up, including operator training. Civil works, construction, and installation will be executed by the Customer under Zorg's technical supervision and quality control.
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Raw material potential

Substrate	Quantity (tonnes/day)	Quantity (tonnes/year)	DM content: (%)	ODM content (%)	DM quantity (tonne s/ day)	ODM quantity (tonnes / day)	Biogas yield (m^3 / tonneODM)	Biogas (m^3 /day)	Methane content (%)	Equivalent to natural gas (m^3 /day)
Press mud from sugarcane	246	90 000	50	82	123	100,86	630	63 541	58	37 077

*-DM- Dry matter
**-ODM- organic dry matter

Biogas plant characteristics

Characteristics	Values	Figures
Number of reactors	units	2
Reactor HLR		
a) Volume:		
Work	m^3	4290
Overall		4578
b) Temperature	^0C	52
c) Overall dimensions of the digester:		
diameter	m	27,0
height		8,0
d) Organic load	kgODM/m3	11,75
e) Hydraulic retention time (gross/net)	days	26/24
Number of gasholders	units	1
a) Volume:	m^3	1500
b) Dimensions of the gasholder:		
diameter	m	15,4
height		11,8

Number of personnel

	Shift 1	Shift 2	Shift 3
Head of the Biogas Plant	1	-	-
Operator	1	1	1
Driver	1	1	-
Total	6		

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 + H2O→ C5H7NO2+HCO3.
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 H20 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

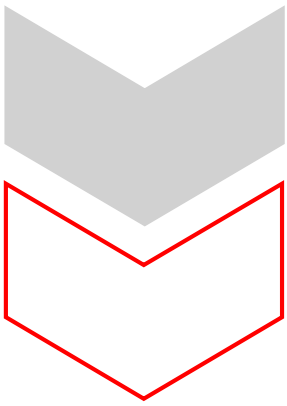
Press mud from sugarcane is directed into a loader. The loader input substrates by portion to a reactor using augers. In the reactor the substrate is brought up to a temperature of +52°C. Constant temperature is sustained for the entire digesting period. To prevent a rise in temperature (for example, in summer), the biogas station is equipped with a coolers (dry cooling). The reactor operating regime is thermophilic. The heated substrate in the digesters is blended periodically. Mixing is performed by vertical mixers. The average time of processing in the reactor is 24 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 to the separation area and transported for storage; liquid filtrate is directed to the technological needs (dilution).Biogas goes up under overlap and delivered into an external 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. Then accumulated in gasholders 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, biogas goes to the boiler house for gas turbines.

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, SF-02)

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 20m³/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:	**3,6 m**
Length:	**12,9 m**
Width:	**2,6 m**
Volume:	**50 m³**
Quantity:	**2 pcs.**

Reactor (RT-01, RT-02)

Reactor is a tank of cylindrical form (for better mixing during the fermentation). It is built of cast-in-situ reinforced concrete based on sulphate-resistant cement with thickness of walls and bottom - 0,25m. Overlap of reactor is reinforce concrete plate. On the tank's wall and in the bottom, there is to be installed pipelines for heating, intended for assurance and maintenance of the optimal fermentation process temperature at thermophilic conditions. For heat conservation and reduction of heat energy consumption, the reactor walls, overlap and bottom are insulated outside with 100 mm slabs of extruded polystyrene foam. Over the heater, the substructure walls and bottom are insulated with roll damp proofing. Superstructure and substructure heat insulation is protected by shaped sheet from the outside mechanical damages and rodents. The reactor`s bottom has a slope 1%.

Specifications

Height:	**8,0 m**
Diameter:	**27,0 m**
Total volume:	**4578 m^3**
Substrate volume:	**4290 m^3**
Quantity:	**2 pcs.**

Reactor vertical agitator (AG-01 ... AG-12)

Vertical agitators are designed and engineered to guarantee high energy efficiency. We use gear units and motors from respected European manufacturers. This guarantees the long life of our mixers. All motors and gear units are available with ATEX certifications.
Agitators are designed for mixing substrates with a high solids content of 13-18%. The blades of the mixers are set at an optimum angle, and the external motor of the mixer is mounted on a special support.

Specifications

Engine power:	**15 kW**
Quantity per reactor:	**6 pcs**
Total quantity:	**12 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-02, 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, PU-03)

Engine power:	**18,5 kW**
Flow rate:	**60 m3/hour**
Pressure:	**4 bar**
Quantity:	**2 pcs**

Filtrate pump (PU-04)

Engine power:	**18,5 kW**
Flow rate:	**60 m3/hour**
Pressure:	**4 bar**
Quantity:	**1 pcs**

Separator (SR-01, SR-02)

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:	**10-20 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:	**6,0 m**
Height:	**2,5 m**
Total volume:	**70 m^3**
Quantity:	**1 pcs**

Receiving tank (FT-01)

Diameter:	**6,0 m**
Height:	**2,5 m**
Total volume:	**70 m^3**
Quantity:	**1 pcs**

Submersible mixer (AG-13, AG-14)

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-13)**
Nominal power:	**3,0 kW**
Quantity:	**1 pcs**
Submersible mixer for the filtrate tank	**(AG-14)**
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:	**15,4 m**
Diameter:	**11,8 m**
The total volume :	**1500 m^3**
Quantity:	**1 pcs**

Biogas dryer and cooling (CHL-01, CHL-02)

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:	**2700 m^3/hour**
Gas inlet temperature:	**+55°C**
Gas outlet temperature:	**+20°C**
Electric power:	**64 кВт**
Quantity:	**2 pcs**

Biogas compressor (BC-01, BC-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:	**2700 m3/hour**
Pressure:	**150 mbar**
Engine power:	**20,0 kW**
Quantity:	**2 pcs**

Desulphurization system

The desulphurization system is a 3-step system. Stage 1 is adding Ferrum Hydrooxide. 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 contcentration 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

The volume of charcoal filters:	**300 kg**
Quantity:	**2 pcs**

Flare (BF-01)

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:	**2700 m^3/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 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:	**2 bar**

The pumping station feeding propylene glycol

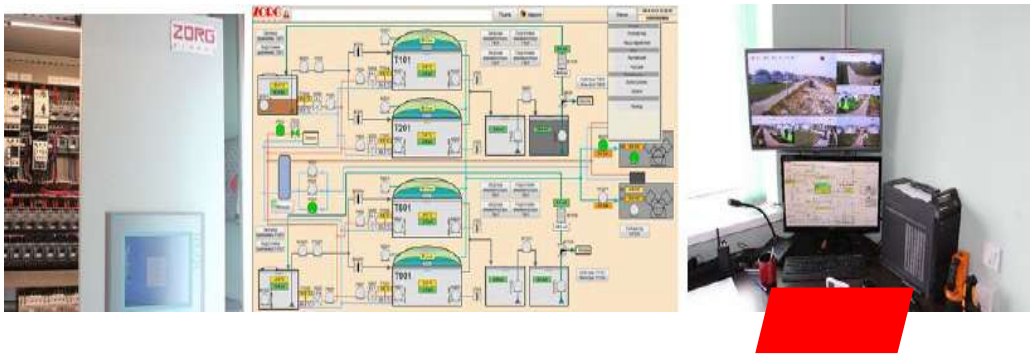
Engine power:	**0,7 kW**
Flow:	**1 m^3/hour**
Pressure:	**4 bar**

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:	**2 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 ET2005, 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

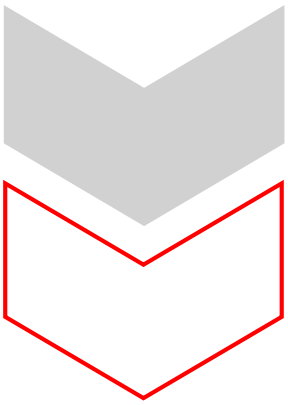
Laboratory

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



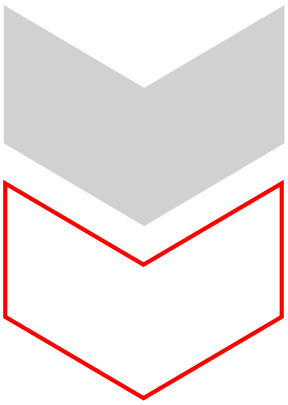
№	Equipment	Characteristic	Quantity
1	**Loader**	**V=50 m3**	**2**
1.1	Container bunker		2
1.2	Feeding screws	set.	2
2	**Submersible mixer**	**N=3,0kW**	**1**
2.1	Airtight motor gearbox		1
2.2	Hydraulic screw (wear-resistant steel)		1
2.3	Mixer control mechanism		1
2.4	Electric motor mount		1
2.5	Set of fasteners		1
3	**Reactor vertical agitator**	**N=15 kW**	**12**
3.1	Airtight motor gearbox		12
3.2	Hydraulic screw (wear-resistant steel)		12
3.3	Shaft (adapted to the height of the fermenter)		12
3.4	Blade		12
3.5	Frequency converter		12
3.6	Mounting bracket to bottom of the mixer		12
4	**Submersible mixer**	**N=3,0kW**	**1**
5	**Safety valve of digesters**		**2**
6	**Window with a searchlight**	**set**	**2**
6.1	Inspection window RD300 (mounts and sealant included)	Ø300	4
6.2	Spotlight (mount system bundled) VISULUX UL50 -G -H	230V, 50W, IP65	2
7	**Substrate digested pump**	**60 m3/hour N=18,5 kW**	**2**

№	Equipment	Characteristic	Quantity
8	**Separator**	**N=7.5kW**	**2**
8.1	Body		2
8.2	Substrate Supply Pipe 4 ’’		2
8.3	Engine - Gearbox	N=7,5 kW	2
8.4	Frame		2
8.5	Screw		2
8.6	Sieve for filtration		2
9	**Liquid substrate pump**	**25 m3/hour N=5,5 kW**	**1**
10	**Filtrate pump**	**60 m3/hour N=18,5 kW**	**1**
11	**PVC gas holder H/D =3/4**	**1500 m3**	1
11.1	Weather protection film	Ø15,4 m	1
11.2	Gasholder film PELD methane permeation max.260 cm3/m2*d*1 bar, 650 N/5cm biogas resistant		1
11.3	Air blower	16A, 0,5kW	
11.4	Excess and minimum pressure valve		1
11.5	Dome level sensor		1
11.6	Mounting system		1
11.7	Accessories		1
11.8	Safety valve		1
12	**Biogas Cooling System**	**2700 m3/h**	**2**
12.1	Chiller		2
12.2	Heat exchanger		2
12.3	Polypropylene glycol tank		2
13	**Desulphurization system**		**1**
13.1	Numbers of charcoal columns	3kg	2

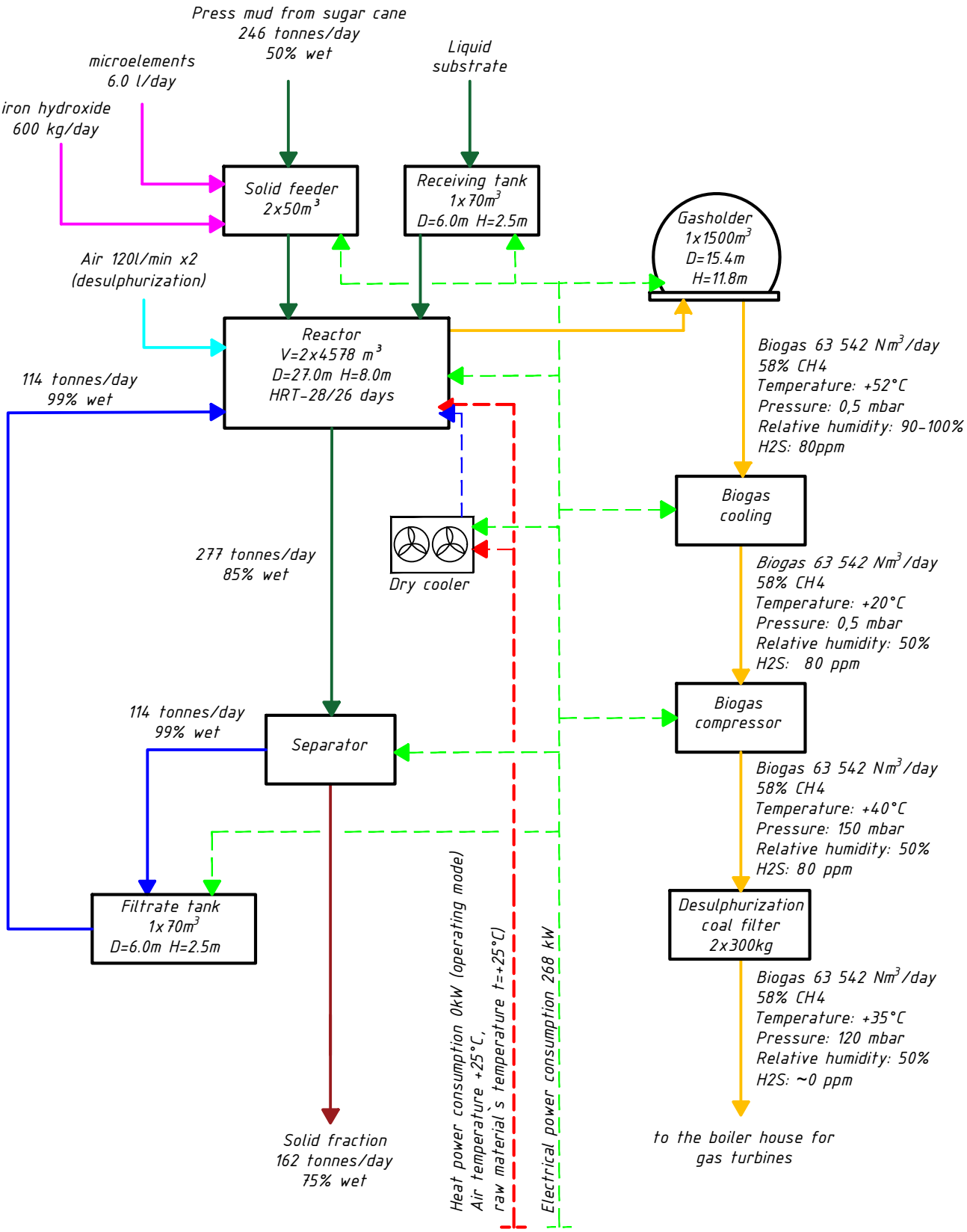
№	Equipment	Characteristic	Quantity
14	**Biogas compressor**	**Q=2700m3/h, H=150mBar, N=20kW**	**2**
15	**Electromagnetic flow meter**		**1**
16	**Flare**	**2700 m3/h**	**1**
17	**Gas equipment included**	**set**	**1**
17.1	Drainage pump with float	DN=50, Q=1m3/h, H=13 m	2
18	**The heat supply system**	**set**	**1**
18.1	Diaphragm expansion tank	V=1000 l,P=6Bar T=120°C	1
18.2	Circulating pump for supplying heat carrier	Q=30 m3/h,H=1bar	1
18.3	Propylene glycol feed pump station heating systems	Q=1,0 m3/h, H=4 bar	1
18.4	Circulation pump for supplying heat carrier to the digester	Q=18 m3/h, H=1.1 bar	1
19	**Water supply and sewerage system, complete, disassembled**	**set**	**1**
20	**Automation with electrical equipment**	**set**	**1**
20.1	Incoming distribution cabinet with a set of automation DB-1		1
20.2	Incoming distribution cabinet with a set of automation DB-2		1
21	**Sensors, set**		**1**
21.1	Gas pressure sensor 0,025Bar		2
21.2	Gas pressure sensor 0,4Bar		2
21.3	Pressure sensor(substrate level) 1,0Bar		4
21.4	Pressure sensor (substrate pressure) 2,5bar		4

№	Equipment	Characteristic	Quantity
21.5	Resistive thermometer (gas temperature)		4
21.6	Resistive thermometer with thermo well (fermenter substrate temperature)		4
21.7	Resistive thermometer with thermo-well (digester tank substrate temperature)		4
21.8	Resistive thermometer (heat conductor temperature)		4
21.9	Conductometric sensor of maximum level		4
21.10	Conductometric sensor of water level		4
21.11	Dome position sensor		1
21.12	Coolant pressure sensor	SEN 3276 B065 G1/2 6Bar	2
22	Humidity and gas temperature sensor	ESFTF-I	2
23	**Dry cooler 100kW heat pow.**		**2**
24	**Laboratory**	**set**	**1**

APPENDICES



Material flow diagram



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Explication

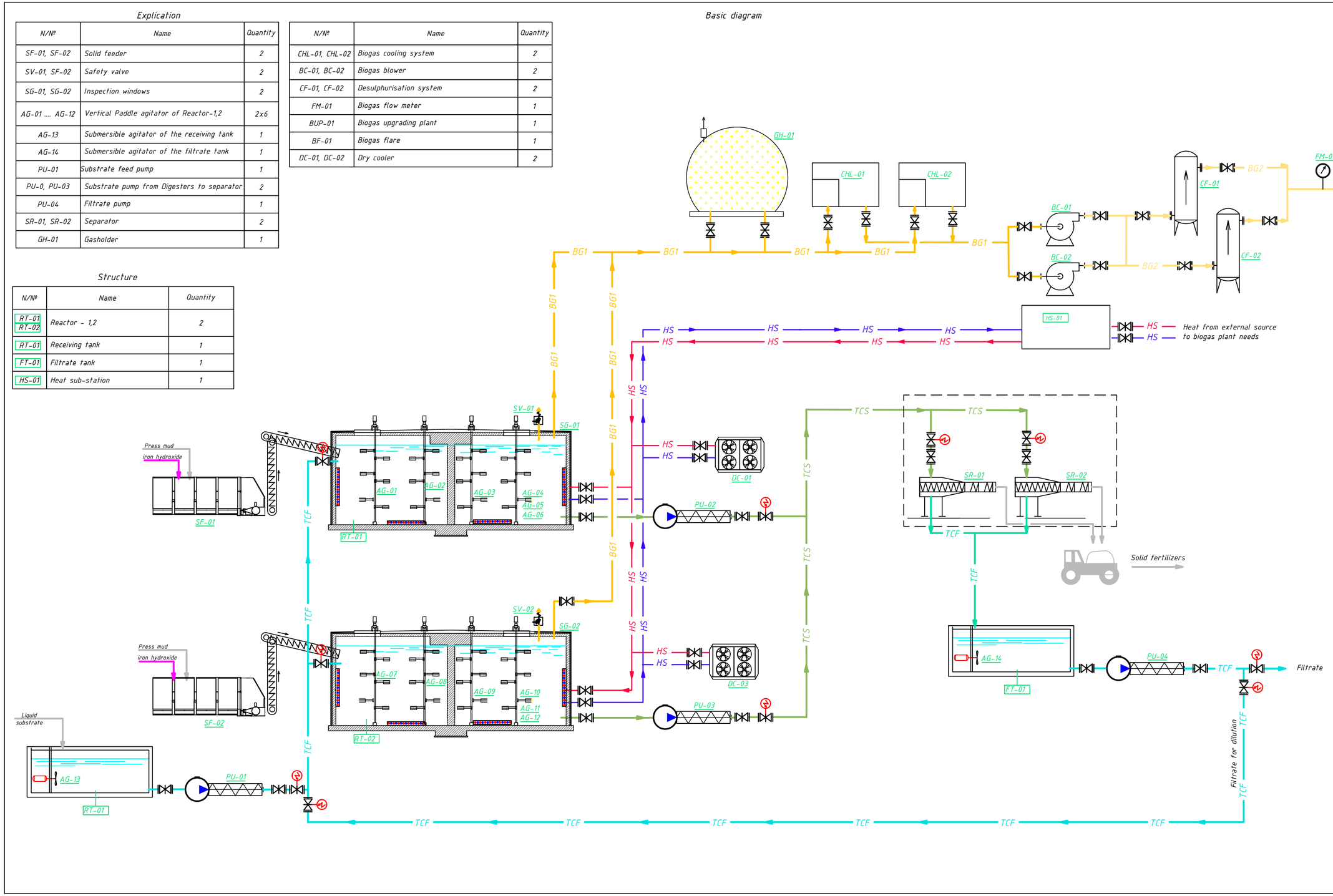
N/№	Name	Quantity
SF-01, SF-02	Solid feeder	2
SV-01, SF-02	Safety valve	2
SG-01, SG-02	Inspection windows	2
AG-01 .... AG-12	Vertical Paddle agitator of Reactor-1,2	2x6
AG-13	Submersible agitator of the receiving tank	1
AG-14	Submersible agitator of the filtrate tank	1
PU-01	Substrate feed pump	1
PU-0, PU-03	Substrate pump from Digesters to separator	2
PU-04	Filtrate pump	1
SR-01, SR-02	Separator	2
GH-01	Gasholder	1

N/№	Name	Quantity
CHL-01, CHL-02	Biogas cooling system	2
BC-01, BC-02	Biogas blower	2
CF-01, CF-02	Desulphurisation system	2
FM-01	Biogas flow meter	1
BUP-01	Biogas upgrading plant	1
BF-01	Biogas flare	1
DC-01, DC-02	Dry cooler	2

Structure

N/№	Name	Quantity
RT-01 RT-02	Reactor - 1,2	2
RT-01	Receiving tank	1
FT-01	Filtrate tank	1
HS-01	Heat sub-station	1

Basic diagram



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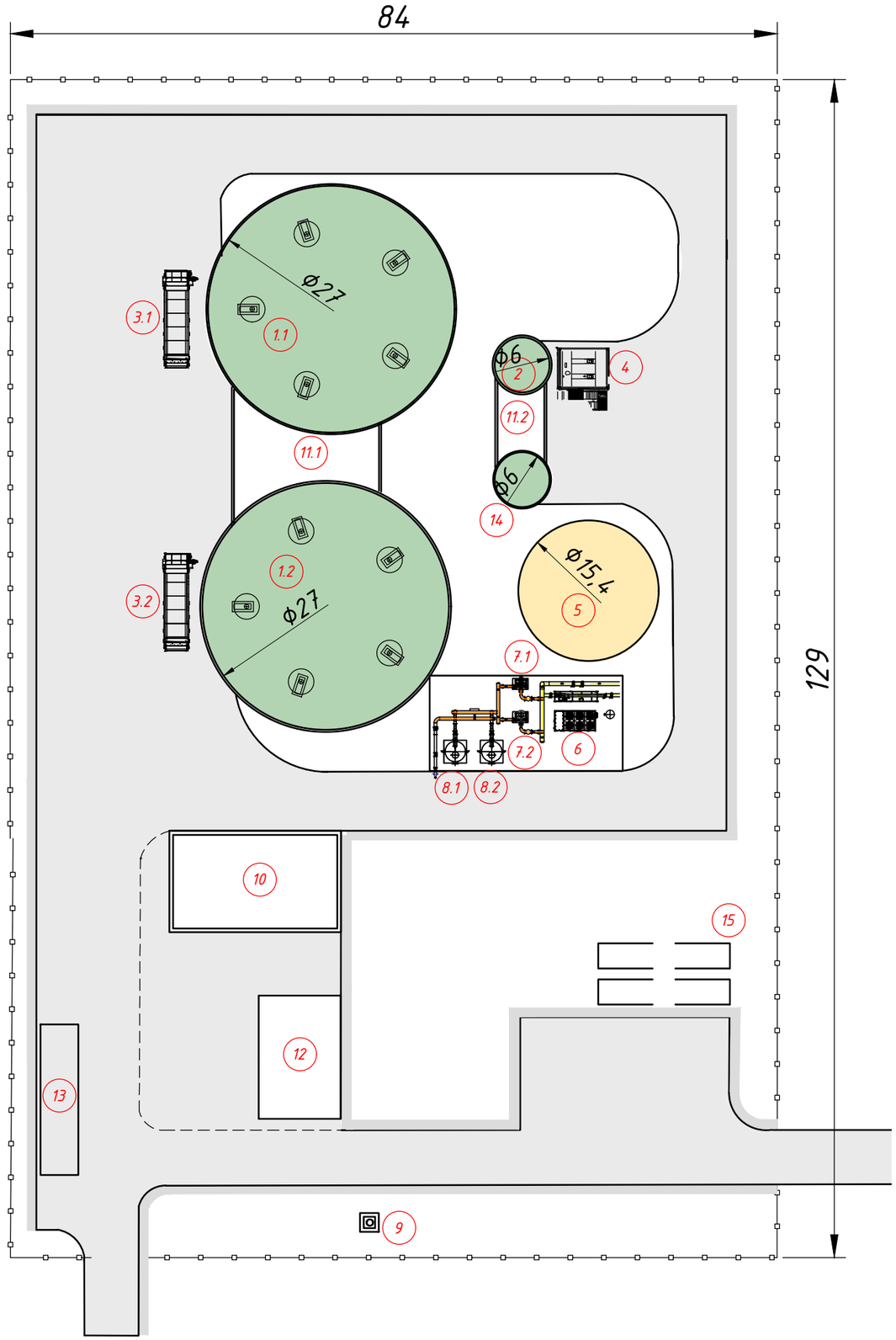
Preliminary layout plan



Explication

N/№	Name	Note
1.1	Reactor-1	R-01
1.2	Reactor-2	R-02
2	Filtrate tank	FT-01
3.1 , 3.2	Solid feeder-1 -2	SF-01, SF-02
4	Separation area	SR-01, SR-02
5	Gasgolder	GH-01
6	Biogas cooling system	CHL-01
7.1 , 7.2	Biogas compressor	BC-01, BC-02
8.1 , 8.2	Carbon filter (desulphurization)	CF-01, CF-02
9	Biogas flare	BF-01
10	Technical room (operator room)	TR-01
11.1, 11.2	Equipment room	
12	Warehouse	WH-01
13	Truck scale	W-01
14	Receiving tank	RT-01
15	Fire water tanks	

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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=50 m^3	22,0	2	44,0	8,0	352,0
Screw set.	24,0	2	48,0	8,0	384,0
Digester Vertical mixer	15,0	12	180,0	18,0	3240,0
Submersible mixer in filtrate tank	3,0	1	3,0	12,0	36,0
Submersible mixer in receiving tank	3,0	1	3,0	12,0	36,0
Biogas cooling system	63,0	2	126,0	12,0	1512,0
Biogas compressor	20,0	2	40,0	12,0	480,0
Separator	7,5	2	8,0	8,0	64,0
Feed pump	5,5	1	8,0	8,0	64,0
Substrate pump to separator	18,5	2	8,0	8,0	64,0
Filtrate pump	18,5	1	2,0	4,0	8,0
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
Digester cooling system	4,0	1	4,0	24,0	96,0
Circulation pump for supplying heat carrier to the digester	0,8	1	0,8	24,0	18,0
Circulation pump for supplying heat carrier to the digester cooling system	2,0	1	2,0	24,0	48,0
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	1,0	1	1,0	8,0	8,0
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			**482**		
Total consumed electric energy, kWh per day					**6438**
Total consumed power, kW					**268**

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Annex 5

Prices for 246 t press mud from sugarcane /day

Pos	Name	Number of units	Unit price, EUR	Discounts*	Unit price, EUR	Price sub-total, EUR	
1	Project documention	1	85.000	0%	85.000	85.000	
2	Supervision	1	40.000	0%	40.000	40.000	
3	Startup and training	1	40.000	0%	40.000	40.000	
4	Living and travel expences	1	40.000	0%	40.000	40.000	
5	Delivery of the equipment	10	10.000	0%	10.000	100.000	
6	Laboratory	1	27.000	0%	27.000	27.000	
7	Solid feeder (dosing buffer machine) 50m3	2	118.000	0%	118.000	236.000	
8	Screw conveyor	2	115.000	0%	115.000	230.000	
9	Digester vertical agitator 15kW	12	74.000	0%	74.000	888.000	
10	Frame for Digester vertical agitator pos 9	12	6.000	0%	6.000	72.000	
11	Substrate pump 5,5kW	1	22.000	0%	22.000	22.000	
12	Digested substrate pump 18,5kW	2	27.000	0%	27.000	54.000	
13	Filtrate supply pump 18,5kW	1	27.000	0%	27.000	27.000	
14	Substrate separation unit 7,5kW	2	52.000	0%	52.000	104.000	
15	Submersible mixer for receiving tank	1	10.000	0%	10.000	10.000	
16	Submersible mixer with guiding unit for filtrate tank	1	10.000	0%	10.000	10.000	
17	Over- and under pressure safeguard	2	6.000	0%	6.000	12.000	
18	Sight glasses/viewing windows with projector	2	6.000	0%	6.000	12.000	
19	Water supply and canalization system	1	27.000	0%	27.000	27.000	
20	Heat supply station	1	37.000	0%	37.000	37.000	
21	Dry-cooler (Substrate cooling system for fermenter)	2	27.000	0%	27.000	54.000	
22	Automation and electric cabinet	1	175.000	0%	175.000	175.000	
23	Sensors (set)	4	21.000	0%	21.000	84.000	
24	Gasholder 1500 m3	1	83.000	0%	83.000	83.000	
25	Biogas chiller (Biogas cooling system) 2700 m3/h	2	115.000	0%	115.000	230.000	
26	Biogas blower 2700 m3/h	2	28.000	0%	28.000	56.000	
27	Desulphurization column with active coal 300kg	2	31.000	0%	31.000	62.000	
28	Biogas flare 2700 m3/h	1	158.000	0%	158.000	158.000	
29	Gas analyzer	1	27.000	0%	27.000	27.000	
30	Gas conditioning unit	1	45.000	0%	45.000	45.000	
31	Construction and installation	1	1.500.000	0%	1.500.000	1.500.000	local

ZORG, EUR	3.047.000
by Client, EUR	1.500.000
TOTAL Zorg + Client, EUR	**4.547.000**

Implementation terms and payment

Year	2026									2027	
Months	4	5	6	7	8	9	10	11	12	1	2
Project documentation	50%		50%								
Approvals and permits											
Equipment			30%		20%	20%	30%				
Equipment delivery											
Construction											
Supervision				20%	20%	20%	20%	20%			
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:

1) Project report, civil permits and authorizations, adaptation of the project documentation by a licensed local engineering organization for the permit purposes. Namely the organization 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 for start-up, for construction period for normal operation.
4) External roads.
5) Temporary water supply during the construction and the hydraulic test of reactors 4290 m3. 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-week period and to fill with it at least 15-20% of the reactor volume 650-850 m3. The rest is filled with the water mentioned above.
7) Machinery to transport raw material to and from storage to the solid feeders (a truck, a frontal loader, a tractor).
8) Machinery to transport filtrate and the biofertilizer from the biogas plant to the agricultural fields (a truck, a frontal loader, a tractor)
9) Activated carbon 0,6 tonne per 2 years x 2500 EUR/tonne = 1500 EUR
10) Fe(OH)3, Fe(OH)2 – 219 tonnes per year x 180 EUR/tonne = 39 420 EUR
11) Microelements 2190 l per year total x 25 EUR/l
12) Demineralized water to the heating system 3,0 tonnes.
13) Spare parts 139 000 EUR for 2 years.

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