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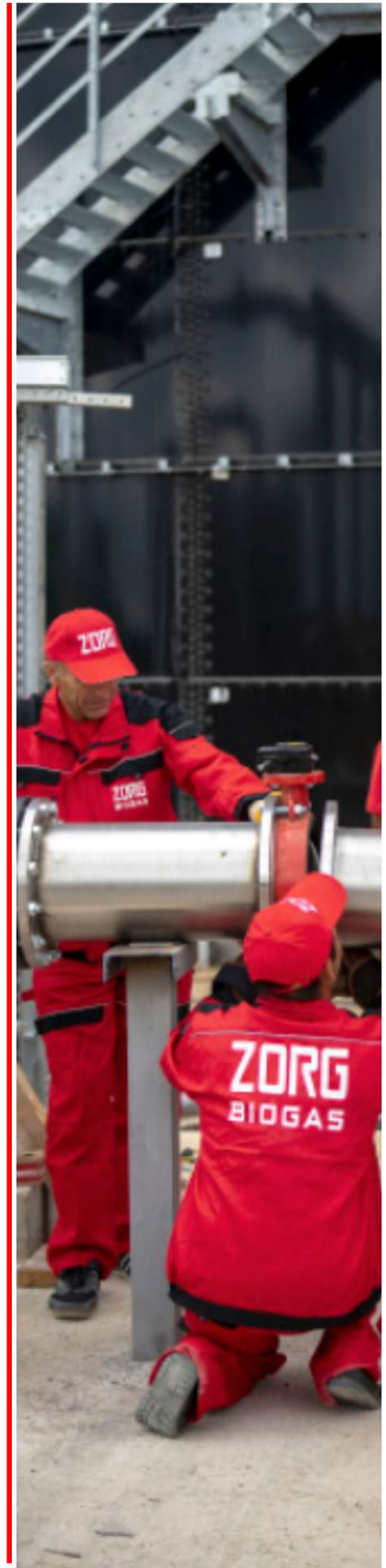
version

Proposal

Biogas plant 120 tonnes cow manure + 20 tonnes whey/day



Date: 05/05/2026
Validity: 6 months



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OVERVIEW

We offer a solution to process cattle manure and milk whey into biogas and electric power 669kW gross/601 kW net. The process is based on the technology of mesophilic anaerobic digestion in a steel CSTR reactor. Biogas is used in a cogeneration heat power plant. To compare different concepts of biogas plants it is necessary to pay attention not only to the price, but also to the quality and small but very important details. The temperature is maintained with an accuracy of 0,1°C. There is a double filtration of biogas, which saves burners and engines life. Biogas plants has a lot of features, which are known only to the experienced company. For example, operational temperature, foam safety valves and etc.

Raw material potential

57	Quantity (tonnes/day)	Quantity (tonnes/year)	DM content: (%)	ODM content (%)	DM quantity (tonnes / day)	ODM quantity (tonnes / day)	Biogas yield (m ³ / tonneODM)	Biogas (m ³ /day)	Methane content (%)	El. power kW
Cattle manure	120	43 800	12	85	14,4	12,24	490	5 998	60	
Milk whey	20	7 300	5	92	0,92	71,46	750	690	60	
Total	140	51 100	11					6 688	60	669

*-DM- Dry matter

**-ODM- organic dry matter

Biogas plant characteristics

Characteristics	Values	Figures
Number of reactors	units	1
Volume:		
Work	m ³	3100
Overall		3532
Temperature	°C	38
Overall dimensions of the digester:		
diameter	m	28,16
height		5,67
Organic load	kgODM/m ³	4,23
Hydraulic retention time (gross/net)	days	25/22
Number of gasholders	units	1
Volume:	m ³	1528
Dimensions of the gasholder:		
diameter	m	29
height		5,8

Number of personnel

	Shift 1	Shift 2	Shift 3
Operator	1	1	1
Total	3		



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 → C₅H₇N₂O₂ + HCO₃.

Further conversion of obtained dissolved compounds like organic acids and alcohols (C₅H₇N₂O₂, HCO₃) into gases - CH₄, CO₂. C₅H₇N₂O₂ + HCO₃ + H₂O → CH₄ + CO₂ + NH₄.

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

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

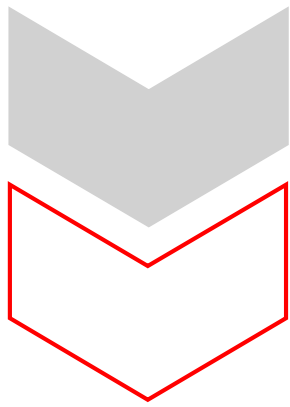
Technological process of biogas production

Cattle manure and milk whey are transported to biogas plant and directed to receiving tank. From the tank substrate is supplied by pump by portion to a reactor. In the reactor the substrate is brought up to a temperature of +38°C. Constant temperature is sustained for the entire digesting period. To prevent a rise in temperature (for example, in summer), the biogas plant is equipped with a cooler (dry cooling). The reactor operating regime is mesophilic. The heated substrate in the digesters is blended periodically. Mixing is performed by submersible agitators. The average time of processing in the reactor is 22 days. After the reactor, the substrate is fed by a pump to a separator area where it is separated into solid and liquid bio-fertilizer. Solid bio-fertilizer is discharged from the separation area and transported for storage; liquid filtrate is directed to a storage. Biogas goes up under a double membrane overlap (gasholder). The gasholder system has a two-layer construction. The gas holder's weather protective film protects the gasholder from precipitation and damage by foreign objects. To protect the gasholder from overpressure, digester is equipped with safety valve, which start working at a pressure of 5 mbar and bleeds biogas to the atmosphere. Then accumulated in the gasholder

biogas goes through a gas pipeline 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 filter to remove hydrogen sulfide (H₂S). After the filter, biogas goes to cogeneration power plant, where it is used as fuel for production of electricity and heat. Heat from the congenator is fed to a heat exchanger for heating the digesters. Heating equipment is used for distribution of heat between biogas plant facilities.

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





Receiving tank and filtrate tank (RT-01, FT-01)

Reservoir for reception of liquid kinds of raw materials. Tank is equipped with level sensors and side agitators for mixing raw materials. Tanks serve as a buffer for collection substrates and then to supply substrates to points of biogas plant according to the technological process.

Specifications

Receiving tank

Diameter:	8,0 m
Height:	3,0 m
Volume:	150 m³
Quantity:	1 pcs.

Filtrate tank

Diameter:	8,0 m
Height:	3,0 m
Volume:	150 m³
Quantity:	1 pcs.



Submersible mixer (AG-01...AG-05)

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. 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 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

Agitator of the receiving tank:

Nominal power:	5,5 kW
Quantity:	1 pcs

Agitator of the reactor:

Nominal power:	15 kW
Quantity:	3 pcs

Agitator of the filtrate tank:

Nominal power:	3,0 kW
Quantity:	1 pcs



Reactor (RT-01)

Reactor is an important part of a biogas plant made of enameled sheet metal. The steel digester is installed on a concrete basis. A layer of enamel protects the surface of the entire metal structure. The enamel is vitreous and very resistant to aggressive pH and mechanical damage. Enameled digester assembled from steel segments. Such a digester is quickly and safely mounted. Steel panels are joined on bolted joints with a special sealant. The enamel coating is layered according to the PUESTA method. This is a special powder that is laid in layers by electrostatic attraction. Thus, uniformity of coating, density and smoothness are achieved. Bolts 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 digester is isolated. Outside the digester is coated with a decorative coating

Specifications

Height:	5,67 m
Diameter:	28,16 m
Total volume:	3532 m³
Substrate volume	3100 m³
Quantity:	1 pcs.

Plates (tank wall enameled, roof)
Flange, nozzle, lap joint flanges outside
2 off control glass 2 x DN 250 with water flush
Ex light
Manhole
Ladder, stair and walkway
Brackets and clamps for pipe along tank edge
(internal/external)



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

Substrate feed pump (PU-01)

Engine power:	5,5 kW
Flow rate:	30 m3/hour
Pressure:	4 bar
Quantity:	1 pcs

Substrate pump (PU-02)

Engine power:	5,5 kW
Flow rate:	30 m3/hour
Pressure:	4 bar
Quantity:	1 pcs

Filtrate pump (PU-03)

Engine power:	5,5 kW
Flow rate:	30 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 cleaned 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:	5,5 kW
Flow rate:	3-20 m3/hour

Quantity:	1 pcs
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Equipment
Frame
Screw
Sieve for the filtration
Counterweights
The design of the protective room



Gasholder (GH-01)

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

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

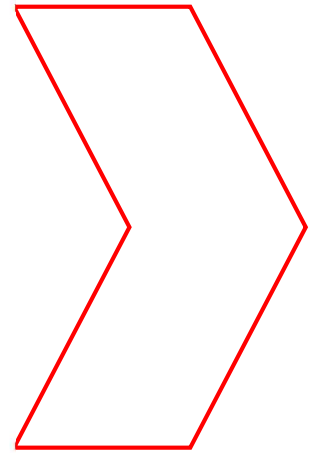
The internal film is stretched under normal biogas pressure. Air is blown into the space between the external and internal membranes to pressurize the internal membrane and form the shape of the external membrane.

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

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

Specifications

Height:	5,8 m
Diameter:	26,0 m
The total volume :	1528 m³
Quantity:	1 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:	300 m ³ /hour
Pressure:	150 mbar
Engine power:	3,0 kW

Quantity:	2 pcs
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Desulphurization system

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

Specifications

Charcoal filter	(CF-01)
The volume of charcoal:	100 kg
Quantity:	1 pcs



Gas analyzer (CH₄, CO₂, H₂S) (GA-01)

The gas analyzer is a combined measuring device. It consists of a fixed Control block and a mobile gas measuring device. The Control block is designed for the automatic measurement and monitoring of the amount* and composition of gases produced in biogas plants. The device measures the gas compositions at the individual measuring locations sequentially. The mobile gas measuring device is usually docked to the Control box via the docking station (stationary measurements). As an option, mobile measurements can be taken at selected measuring locations. The gas measuring device is removed from the Control docking station to carry out the measurement. When it is replaced in the docking station, the calculated measurement values are transmitted to the Control block and displayed.

Specifications

Set includes

Device for wall mounting
LCD display menu
Flow meter / control valve
Sensors

Quantity:

1 pcs

Defined gases methane % (CH₄), carbon dioxide % (CO₂), hydrogen sulfide ppm (H₂S)



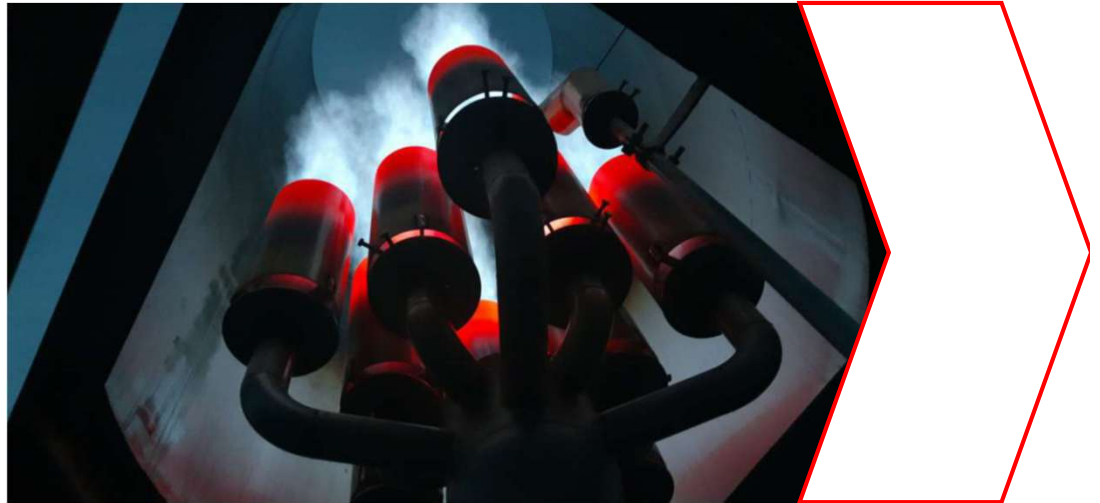
Cogeneration power plant (CHP-01)

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

Specifications

Produced electric power:	max 800 kW
Produced heat power:	max 422 kW
Emissions:	NO _x < 500 mg/Nm ³ (5% O ₂)
Generator:	400V, 50Hz

Quantity:	1 pcs
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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:	280 m³/hour
Pressure:	min 10 mbar- max 60 mbar

Quantity:	1 pcs
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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:	2,0 kW
Flow:	20 m ³ /hour
Pressure:	1 bar

Circulating pump feeding heat carrier

Engine power:	0,8 kW
Flow:	3 m ³ /hour
Pressure:	1 bar

The pumping station feeding propylene glycol

Engine power:	0,8 kW
Flow:	1 m ³ /hour
Pressure:	4 bar

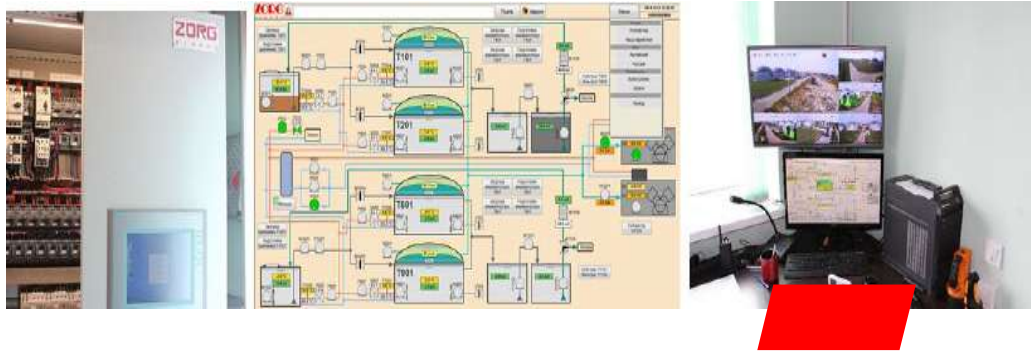


Dry cooler (cooling substrate system)

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:	80 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	Submersible mixer	N=5,5kW	1
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 submersible agitator	N=15 kW	3
3.1	Airtight motor gearbox		3
3.2	Hydraulic screw (wear-resistant steel)		3
3.3	Shaft (adapted to the height of the fermenter)		3
3.4	Blade		3
3.5	Frequency converter		3
3.6	Mounting bracket to bottom of the mixer		3
4	Safety valve of digesters		1
5	Window with a searchlight	set	1
5.1	Inspection window RD300 (mounts and sealant included)	Ø300	2
5.2	Spotlight (mount system bundled) VISULUX UL50 -G -H	230V, 50W, IP65	1
6	Substrate feed pump	30 m3/hour N=5,5 kW	1
7	Substrate digested pump	30 m3/hour N=5,5 kW	1

Nº	Equipment	Characteristic	Quantity
8	Separator	N=5,5 kW	1
8.1	Body		1
8.2	Substrate Supply Pipe 4 ''		1
8.3	Engine - Gearbox	N=4,0 kW	1
8.4	Frame		1
8.5	Screw		1
8.6	Sieve for filtration		1
9	Filtrate pump	30 m3/hour N=5,5 kW	1
10	PVC gas holder	1528 m3	1
10.1	Weather protection film	Ø29 m	1
10.2	Gasholder film PELD methane permeation max.260 cm3/m2*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	Desulphurization system		1
11.1	Numbers of charcoal columns	100 kg	1

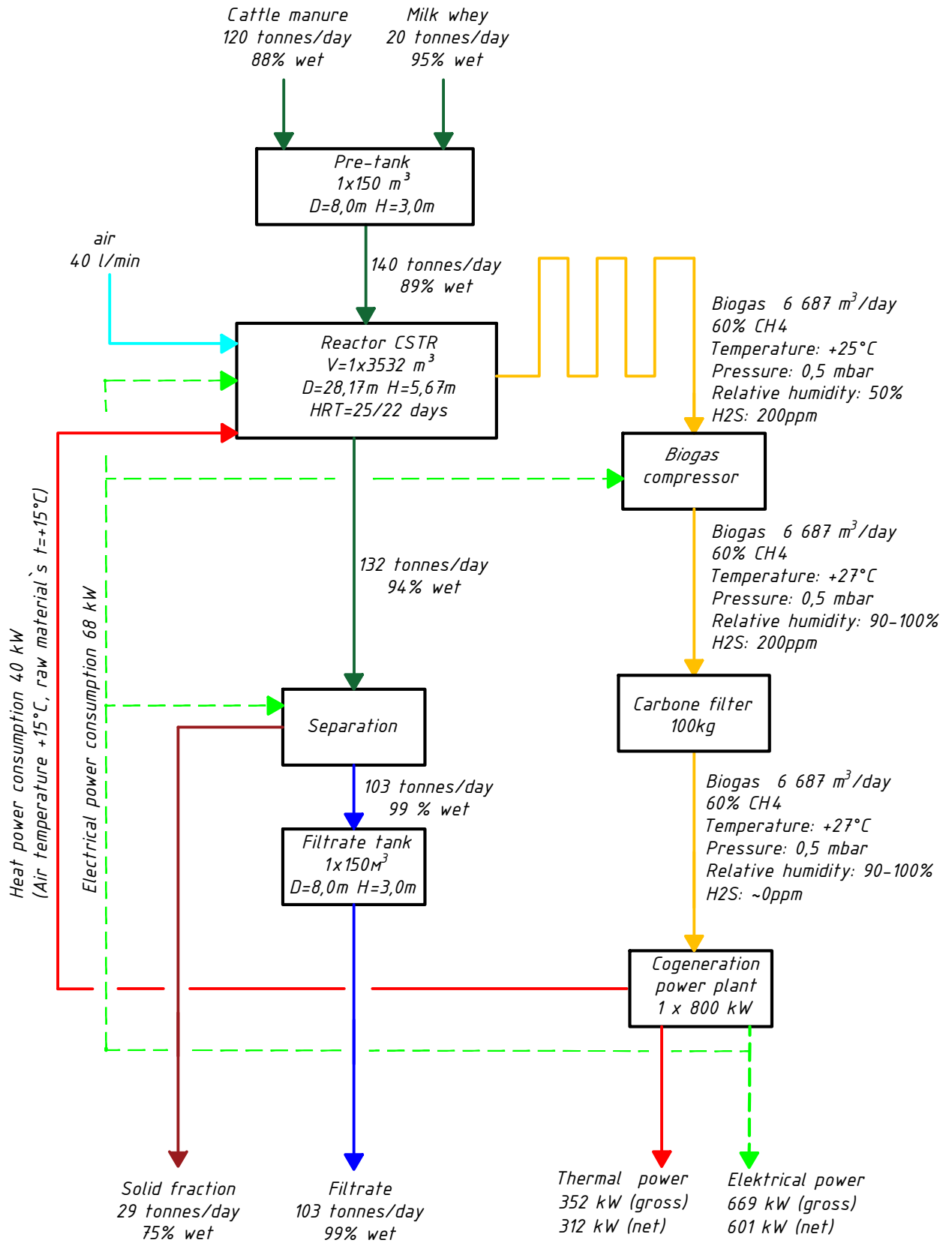
Nº	Equipment	Characteristic	Quantity
12	Biogas compressor	Q=300m3/h, H=150mBar, N=3 kW	2
13	Electromagnetic flow meter		1
14	Flare	270 m3/h	1
15	Cogeneration power plant	800 kW	1
16	Portable gas analyser	set	1
17	Gas equipment included	set	1
17.1	Drainage pump with float	DN=50, Q=1m3/h, H=13 m	2
18	The 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		2
21.4	Pressure sensor (substrate pressure) 2,5bar		2

Nº	Equipment	Characteristic	Quantity
21.5	Resistive thermometer (gas temperature)		3
21.6	Resistive thermometer with thermo well (fermenter substrate temperature)		3
21.7	Resistive thermometer with thermo-well (digester tank substrate temperature)		3
21.8	Resistive thermometer (heat conductor temperature)		3
21.9	Conductometric sensor of maximum level		3
21.10	Conductometric sensor of water level		3
21.11	Dome position sensor		1
21.12	Coolant pressure sensor	SEN 3276 B065 G1/2 6Bar	2
22	Dry cooler 80 kW heat pow.		1
23	Steel enamel tank (Reactor)	V=3532 m3	1

APPENDICES



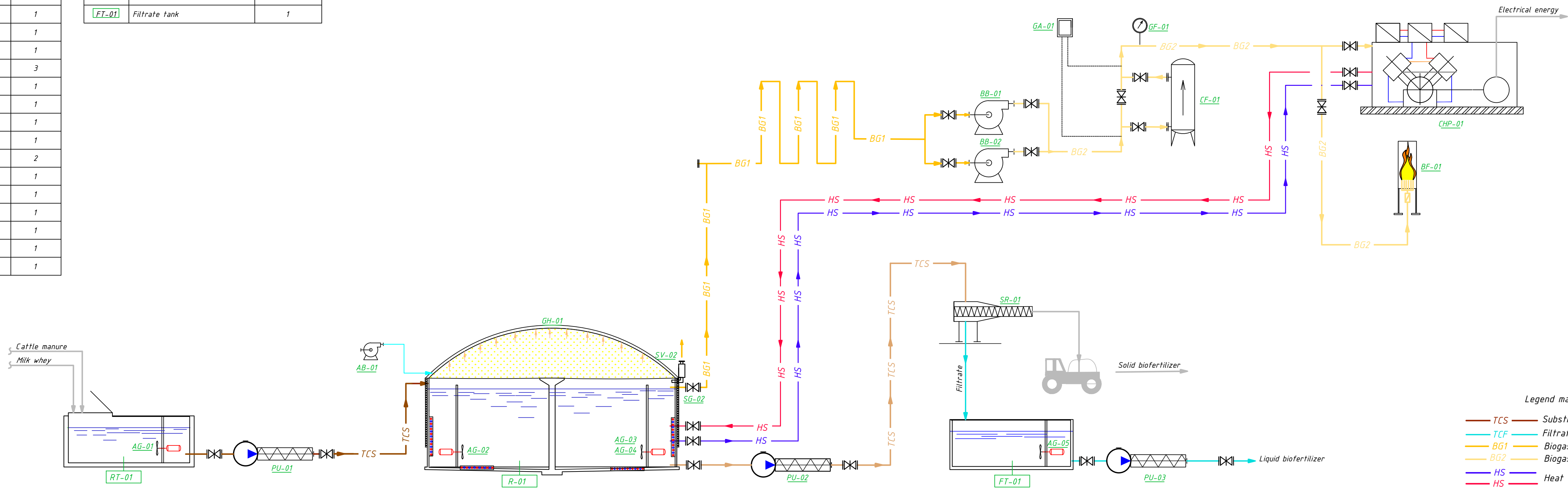
Material flow diagram



Basic diagram

Explication		
N/Nº	Name	Quantity
AG-01	Submersible mixer	1
PU-01	Substrate feed pump	1
GH-01	Gasholder	1
SV-01	Safety valve	1
SG-01	Inspection windows	1
AG-02... AG-04	Reactor submersible agitator	3
PU-02	Substrate pump	1
SR-01	Separator	1
AG-05	Submersible mixer	1
PU-03	Filtrate pump	1
BB-01, BB-02	Biogas blower	2
CF-01	Desulphurisation system	1
GF-01	Biogas flow meter	1
GA-01	Biogas analyzer	1
CHP-01	Cogeneration power plant	1
BF-01	Biogas flare	1
AB-01	Air blower-01	1

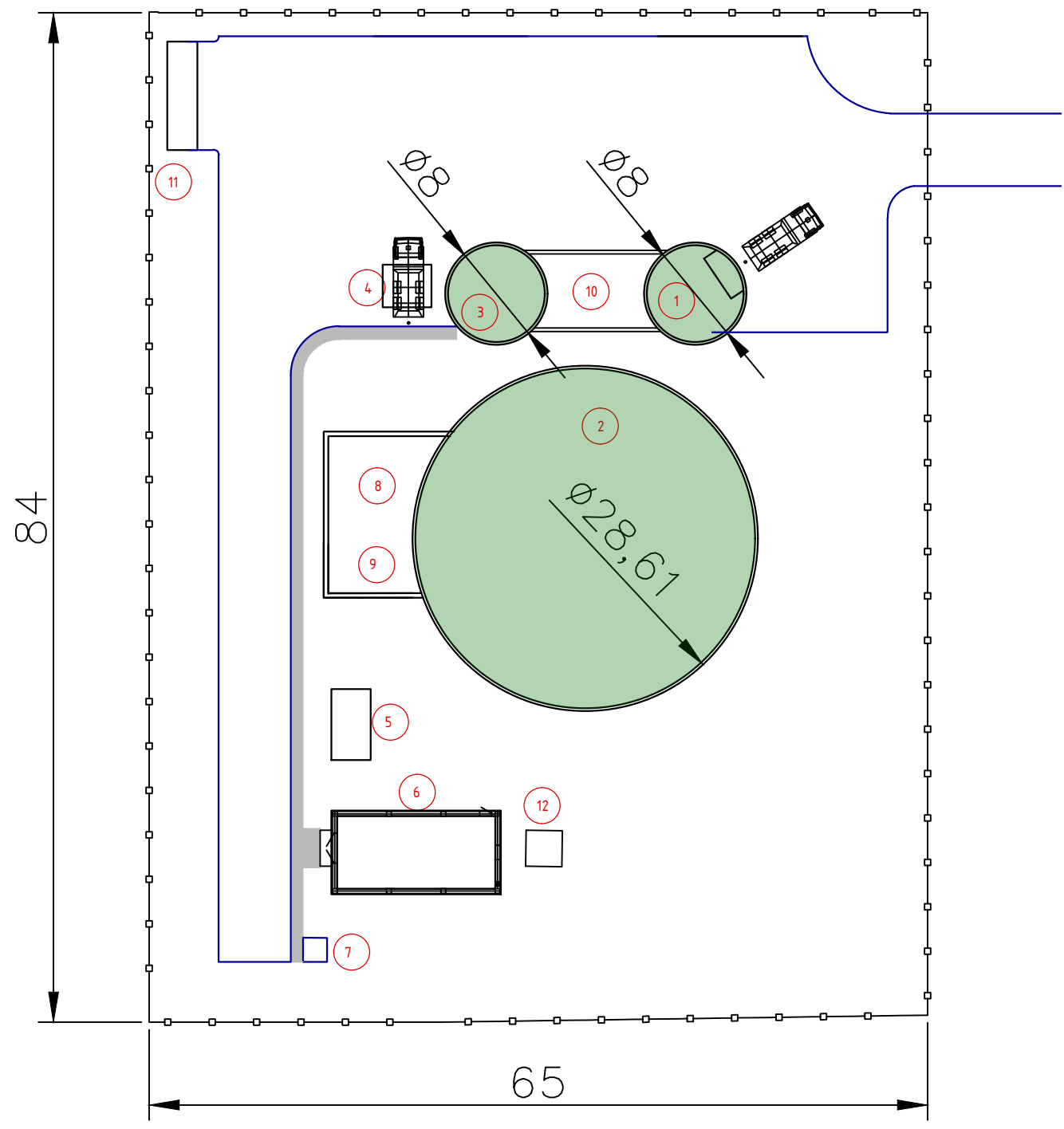
Structure		
N/Nº	Name	Quantity
RT-01	Receiving tank	1
R-01	Reactor	1
FT-01	Filtrate tank	1



Legend main pipelines

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

Plan



Explication

N/№	Name	Note
1	Receiving tank (RT-01)	
2	Reactor (R-01)	
3	Filtrate tank (FT-01)	
4	Separator (SA-01)	
5	Gas preparation	
6	Cogeneration power plant (CHP-01)	
7	Flare (BF-01)	
8	Equipment room №1	
9	Boiler room	
10	Equipment room №2	
11	Operator's room	
12	Transformer	

Prices for a biogas plant 120 tonnes cow slurry + 20 tonnes whey/day

Pos	Name	Number of units	Unit price, EUR	Price sub-total, EUR
1	Project documentation	1	45.000	45.000
2	Supervision	1	30.000	30.000
3	Startup and training	1	30.000	30.000
4	Living and travel expences	1	35.000	35.000
5	Delivery of the equipment	9	8.000	72.000
6	Cogeneration heat power plant 800kW (MWM Caterpillar)	1	465.000	465.000
7	Submersible agitator 15kW of the reactor	3	27.000	81.000
8	Submersible agitator 5,5 kW of Receiving tank	1	14.000	14.000
9	Filtrate submersible agitator 3,0kW	1	10.000	10.000
10	Substrate feed pump 5,5kW	1	21.000	21.000
11	Digested substrate pump 5,5kW	1	21.000	21.000
12	Filtrate supply pump 5,5kW	1	21.000	21.000
13	Separator 5,5 kW	1	45.000	45.000
14	Gasholder 1/5D D29m V=1528 m3	1	75.000	75.000
15	Biogas blower 300 m3/h	2	4.200	8.400
16	Desulphurization column with active coal 100 kg	1	15.000	15.000
17	Biogas flare 280 m3/h	1	38.000	38.000
18	Gas conditioning unit	1	28.000	28.000
19	Gas analyzer (portable)	1	7.000	7.000
20	Over- and under pressure safeguard	1	8.000	8.000
21	Heat supply station	1	25.000	25.000
22	Water supply and canalization system	1	15.000	15.000
23	Sensors (set)	3	25.000	75.000
24	Automation and electric cabinet	1	119.000	119.000
25	Digester Enameled steel tank V=3532m ³ (including servise stairs, platforms, manholes, pipe flanges, suppotrs, fixing etc.)	1	275.000	275.000
29	Construction and installation	1	400.000	400.000
			by ZORG, EUR	1.578.400
			by Client, EUR	400.000
			TOTAL Zorg + Client, EUR	1.978.400

Client

Implementation terms and payment

Year	2026									
Months	2	3	4	5	6	7	8	9	10	11
Project documentation	50%	50%								
Approvals and permits										
Equipment			30%		20%	20%	30%			
Equipment delivery										
CHP			30%					70%		
CHP 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 for biogas plant:

- 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 40 kW for start-up, for construction period and 68 kW for normal operation.
- 4) External roads.
- 5) Temporary water supply during the construction and the hydraulic test of reactors at least 150 m³ water per day. It can be a technical quality water from a river, lake, well. Not salty.
- 6) Machinery to transport raw material to the biogas plant.
- 7) Activated carbon 0,1 tonne per year x 4800 EUR/tonne = 480 EUR
- 8) Demineralized water to the heating system 1,0 tonnes,
- 9) Spare parts 60 000 EUR for 2 years.



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