



General data

Company

Universidad Santiago de Compostela

Date

11/05/2024

The aim of BIOGAS3 project is to promote the sustainable production of renewable energy from the biogas obtained of agricultural residues and food and beverage industry waste in small-scale concept for energy self-suffiency. This project is co-funded by the Intelligent Energy Europe Programme of the European Union, Contract N°:IEE/13/SI2.675801.

smallBIOGAS is a software tool to develop economic and sustainability analysis in order to evaluate the viability of small-scale anaerobic digestion installations (ca. or less than 100 kWel; 372308 m3biogas/year, 65% CH4). The tool is adapted to the conditions of all participating countries of the project (France, Germany, Ireland, Italy, Poland, Spain and Sweden).

The results obtained from the use of this calculation tool are intended to provide the user with a guide about the viability of a small-scale biogas plant. The authors recommend further consultation with expert centres before investing in any biogas facility. The authors and promoters of this software tool accept no responsibility for any damages resulting from the use made of the tool smallBIOGAS.

Input from user

Output from smallBIOGAS tool







Location data

Country	Spain		
Administrative division	Cantabria Cantabria		
Annual average temperature	14,1	°C	
Percentage of wastes located at a distance equal or less than 10 km	100	%	
from the agro-food company			
Percentage of wastes located at a distance higher than 10 km from the agro-food company	0	%	

Biogas production process data

Anaerobic digestion process	Wet	
Annual amount of waste introduced in the digester (fresh matter)	108.652,48	t/year
Annual amount of waste introduced in the digester (dry matter)	10.865,25	t/year
Annual amount of waste introduced in the digester (dry organic matter)	8.692,20	t/year
Annual amount of organic matter degraded	4.893,71	t/year
Needs of dilution water (only for wet digestion processes)	0	m3/year
Digestate recirculation rate	0	%
Needs of waste in terms of dry matter to concentrate (only for dry digestion)	0	t/year
Total amount of digestate produced (fresh matter)	103.882,49	t/year
Volume of anaerobic digester	10.911,25	m³
Hydraulic retention time	35,14	days
Thermal energy required for the heating of the anaerobic digester	3.664,92	MWh/year
Gross methane production (annual)	1.764.516,28	Nm3/year
Gross biogas production (annual)	2.897.399,47	Nm3/year
Gross biogas production (average per hour)	330,75	Nm3/h
Excessive digestate recirculation (if recirculation rate is >30%)	No	
Ammonia inhibition risk	No	
C/N ratio out of range	C/N too low (11)	







Use of the biogas 1 (Biomethane)

Data of the biogas valorisation system

Use of biogas in
Use of produced electric energy
Use of produced thermal energy
Use of produced biomethane

Needs of thermal energy near to the biogas plant Needs of electric energy near to the biogas plant

Thermal energy in the biomethane obtained
Losses of energy in the purification process
Thermal output energy of the purifier
Biomethane output flow rate of the purifier
Installed capacity of the purifier
Higher heating power of the biomethane produced
Annual net amount of biomethane produced

Investment in biomethane system Income due to biomethane sale

Flow rate of biomethane produced

Biomethane
No
No
Injection into gas
grid
0,00
0,00

MWh/year MWh/year

19.515,55 MWh/year 2.829,75 MWh/year 16.685,80 MWh/year 188,58 Nm3CH4/h Nm3CH4/h 198,01 MWh/year 16.352,08 1.478.488,19 Nm3/year 184,81 Nm3CH4/h

720.821,07 € 0,00 €/year





Economic viability analysis. Investment project

Investment	4.338.688,16	€
Piogos plant	3.617.867,09	€
Biogas plant		€
Biogas valorisation system	720.821,07	
Other	0,00	€
Income	166.211,99	€/year
Sale of Biomethane	0,00	€/year
Energy savings	0,00	€/year
Waste management	0,00	€/year
Other incomes	0,00	€/year
Sale or saving (sale or use) of digestate	166.211,99	€/year
Selling price of electric energy	0,00	c€/kWh
Selling price of thermal energy	0,00	c€/kWh
Selling price of biomethane	0,00	c€/kWh
Expenses	334.644,38	€/year
Operating and maintenance (O&M)	33.242,40	€/year
Staff	84.097,02	€/year
Transport and handling of waste	217.304,96	€/year
Cost of waste (co-substrates)	0,00	€
Transport of digestate	0,00	€
Other expenses	0,00	€/year
O&M as percentage of the sale of products and energy savings	20,00	%
Labour intensity	0,0002	h/t·d
Labour cost	15,00	€/h
Days worked per year	258,00	working da







Economic viability analysis. Financial study of the investment project.

Financing	4.338.688,16	€
Subsidies	0,00	€
Own funding	1.301.606,45	€
Loans	3.037.081,71	€
Percentage of subsidies	0,00	%
Percentage of own funding	30,00	%
Percentage of loan	70,00	%
Interest rate of loan	4,70	%
Financial indicators		
	100 100 00	C/
Gross operating profit or earnings before interest, taxes, depreciation and amortization (EBITDA)	-168.432,39	€/year
Net present value (NPV)	-5.984.963,48	€
NPV/initial investment	-1,379	-
Internal return rate (IRR)		%
Payback period	>15	years
Weighted Average Cost of Capital (WACC)	5,90	%
Capital Recovery Factor (CRF)	10,23	%

Environmental viability analysis

Primary energy obtained from the recovery of the biogas	16.352,08	MWh/year
Savings of CO2 emissions	4.545,88	t/year
Cavings of CO2 citiosions		
Savings in artificial fertilizers	412879,42	kgN/year
Utilization of the digestate in	Vulnerable area	
Cultivation area required for application of digestate	2.428,70	ha

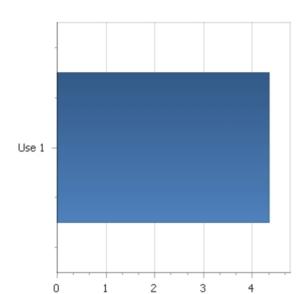




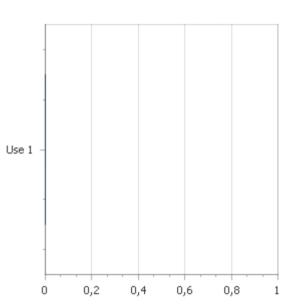


Overview

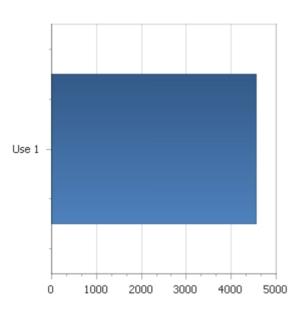




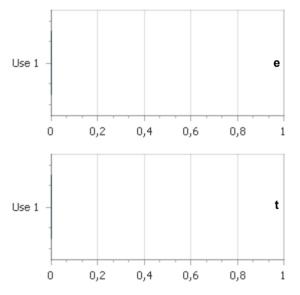
Payback period (years)



CO2-eq emissions savings (t/year)



Self-consumed energy (%)



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