

Biogas Technology GmbH

Presented By:
Silvia Schultz
Federico Garcia
Fredric Sonnek

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A decorative graphic at the bottom of the slide. It features a horizontal band with a gradient from light orange to dark orange. Overlaid on this band is a pattern of binary code (0s and 1s) in a light grey color. To the right of the band, there are several overlapping circles in shades of orange and grey, creating a modern, tech-oriented aesthetic.

BioGas Technology GmbH

- *Current situation*
 - *About Garcia GbR*
 - *About Schulz GbR*
 - *About Sonnek GmbH*
- *Market Analysis*
 - *Location*
 - *Special Characteristics*
 - *Current issues*
- *Solution to issues*
- *Biogas production process*
- *About Biogas Technology GmbH Company*
 - *Conformation of company*
 - *Buisness*
 - *Investment Costs*
 - *Equivalent cost calculation*
 - *Financing*
 - *Benefits*
 - *Overall Profit*

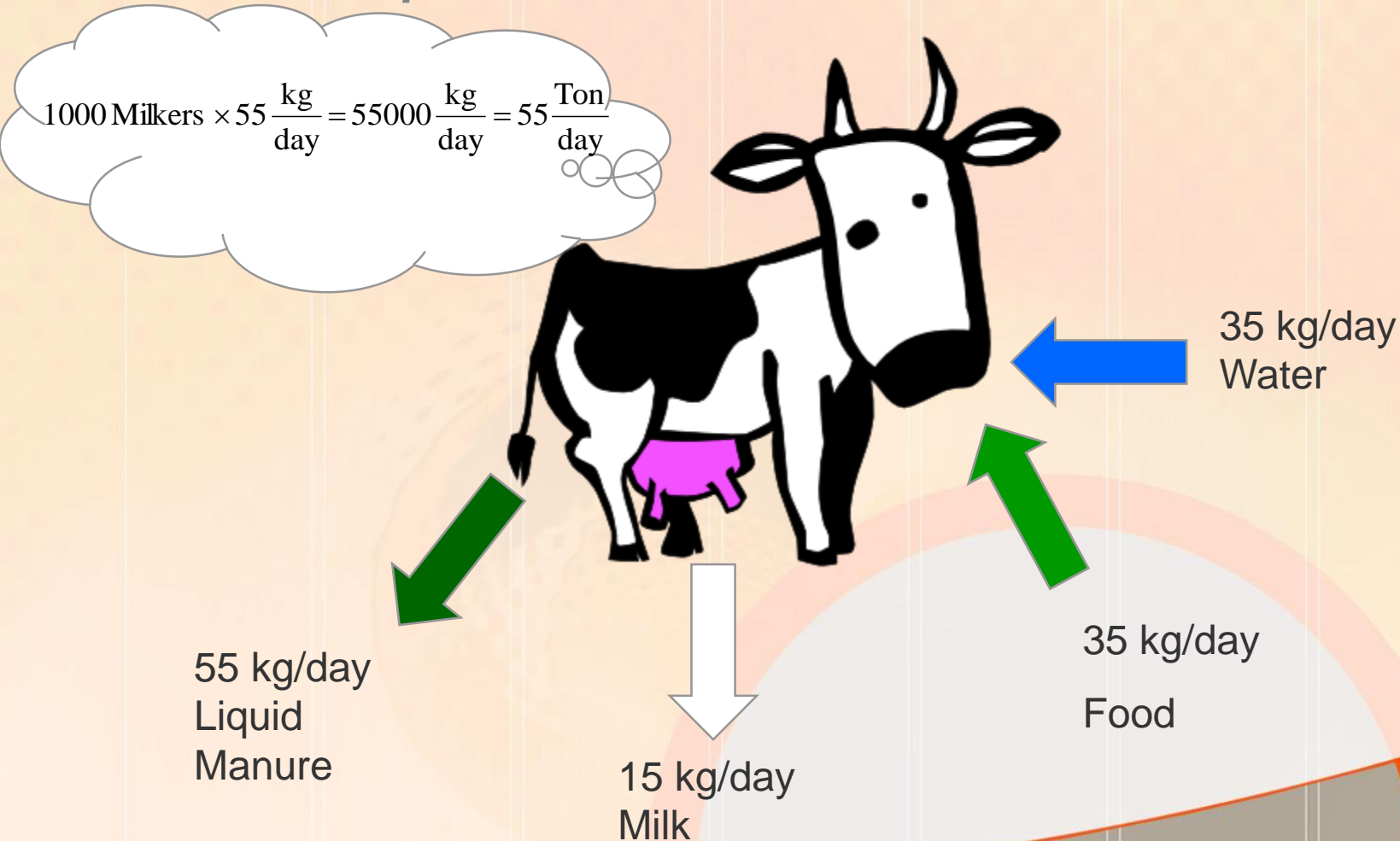
About Garcia GbR

- *Automated Farm Facility*
- *1000 milker Cows*
- *100 hectares*
- *Electricity*
 - *to drive the milking machines*
 - *illumination.*
- *In the winter*
 - *Barns must then be heated*



About Garcia GbR

- Lots of liquid manure accumulated!!!*



About Schulz GbR

- *Potato Farm*
- *400 hectares*
- *Storage capacity of 20000 Ton*
- *Potatoes need*
 - *To be stored at a constant temperature (8 °C)*
 - *During a period of up to 9 months*
- *Electricity, Cooling and Heating Needed!!*



About Schulz GbR

- Biological Waste Produced:*



85-90% To Market



10-15% Rotten



Green parts of the potatoes

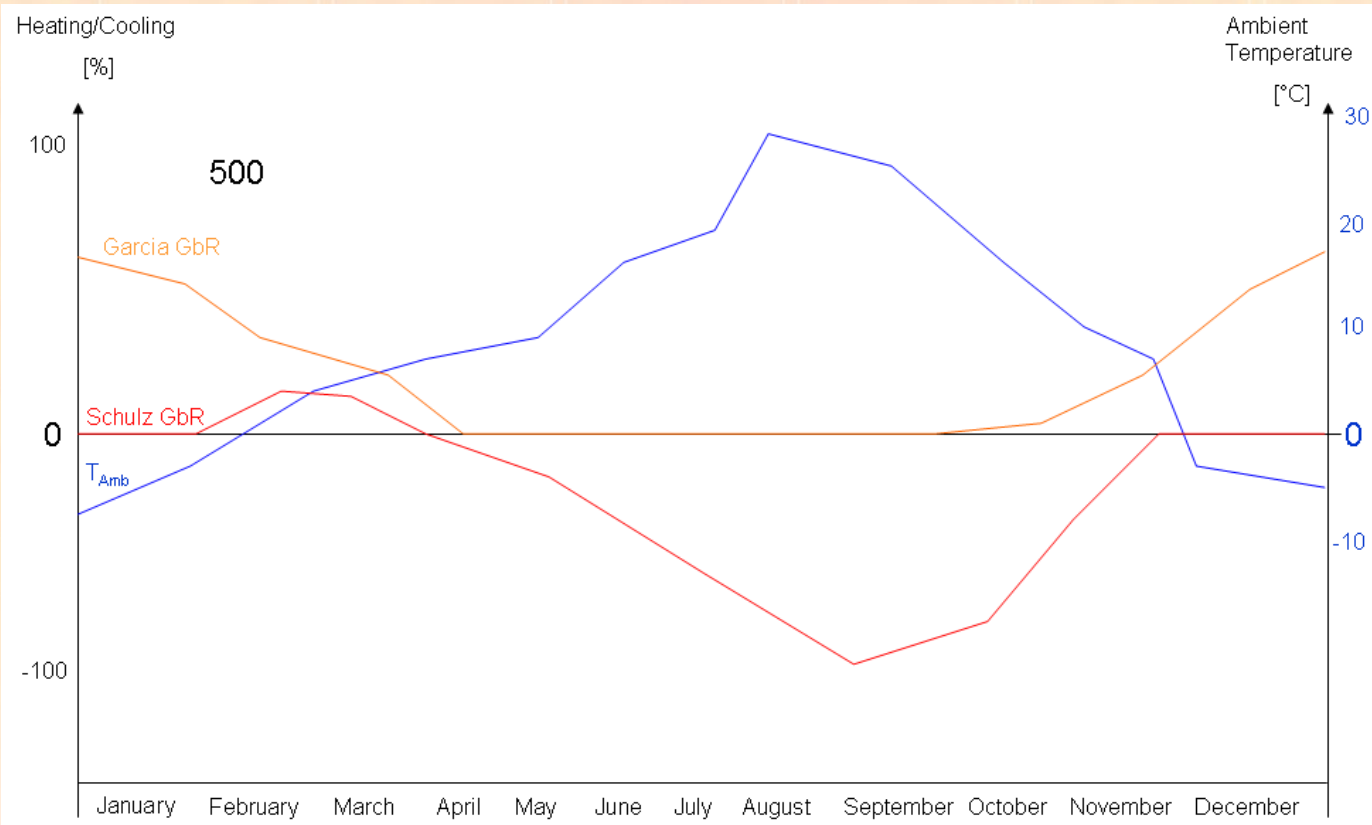
$$\text{Biomass Rotten} = 20000 \text{ Ton} \times \frac{5}{100} = 1000 \frac{\text{Ton}}{\text{year}}$$

$$\text{Biomass Green} = 20000 \text{ Ton} \times \frac{30}{100} = 6000 \frac{\text{Ton}}{\text{year}}$$

$$\frac{1000 \text{ Ton} + 6000 \text{ Ton}}{365 \text{ days}} = \frac{7000 \text{ Ton}}{365 \text{ days}} \approx 20 \frac{\text{Ton}}{\text{day}} \approx 0,8 \frac{\text{Ton}}{\text{hour}}$$



Energy heating And Cooling

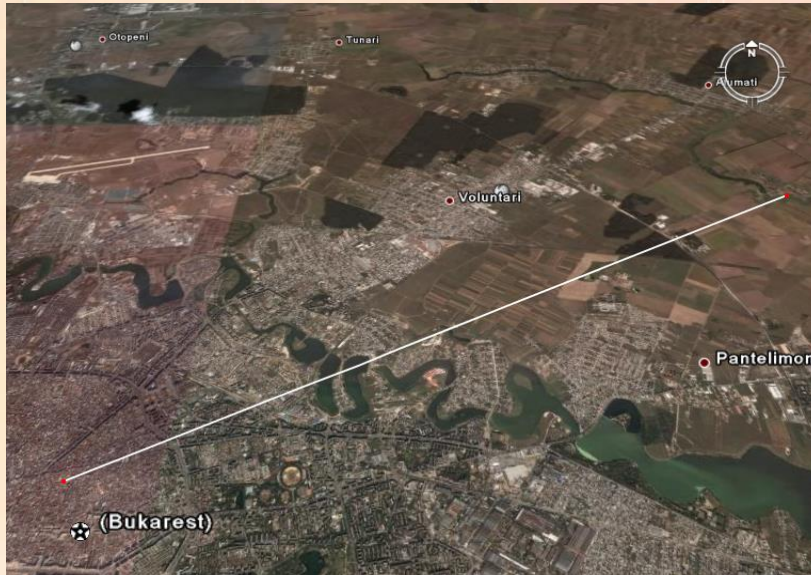


→ A large amount of energy is needed for cooling and heating



Location

- *Rumania- Few km from Bukarest*



About Sonnek GmbH

- *Carbon-Dioxide emission trading*
- *Consulting of affected companies*
- *Emission certificates*
- *Generates certificates from:*
 - *Reduction of emission Projects*
 - *Certificates are sold:*
 - *To investing companies for fixed prices*
 - *In European Market*



Fredric

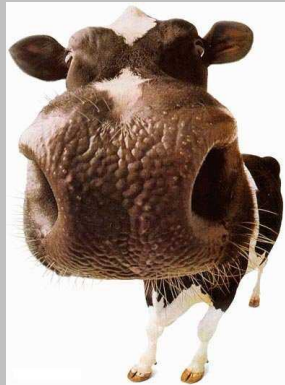


About Biogas Technology GmbH

Biogas Technology



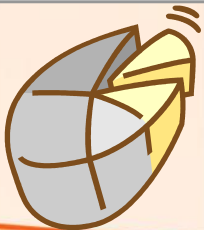
Garcia



Schulz



Sonnek



10%



10%



80%



About Biogas Technology GmbH


- *Company name: Biogas Technology GmbH*
- *Porpoise of company:*
 - *The porpoise of the company is to gather three different companies into one limited company to produce electricity, heat and Carbon Dioxide emission certificates. While producing biogas from waste products bought from farms, the company will use the heat and energy produced and sell certificates for emission reduction.*
- *The amount of share capital is: \$300,100 €*
- *Payment to each partner :*
 - *based on the initial inversion percentage.*
- *Restricted to a limited period of time of 16 years.*



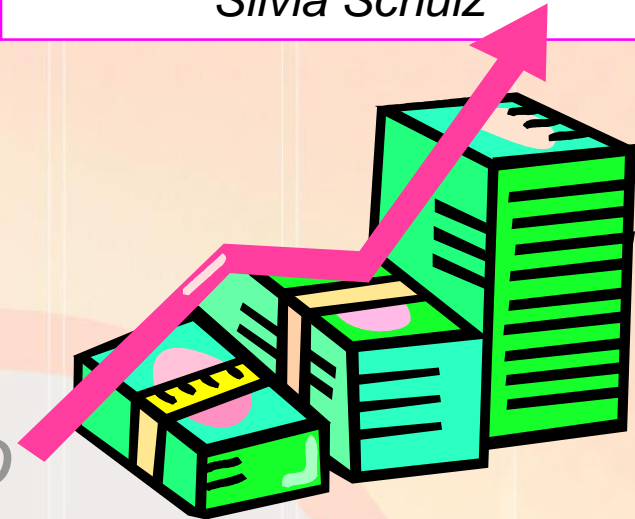
About Biogas Technology GmbH

- *Company Benefits:*
 1. *Complete business leaves a profit to each part.*
 2. *Schulz and Garcia buy electricity and heat products cheaper than outsource*
 3. *Schulz and Garcia sell waste (manure and rotten potato) to the company*

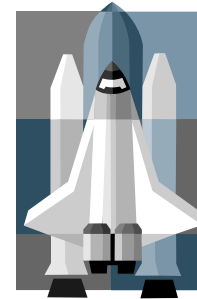
Company Structure:

CEO: 
Federico García

Board of Directors:
Federico Garcia
Frederich Sonnek
Silvia Schulz



*Processes &
Technology*

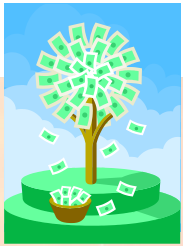


Biogas Technology GmbH

Technical Background and investment costs



Biogas production process



Acre



Manure



Fermenter



Gas



Electricity

Heat

Cold

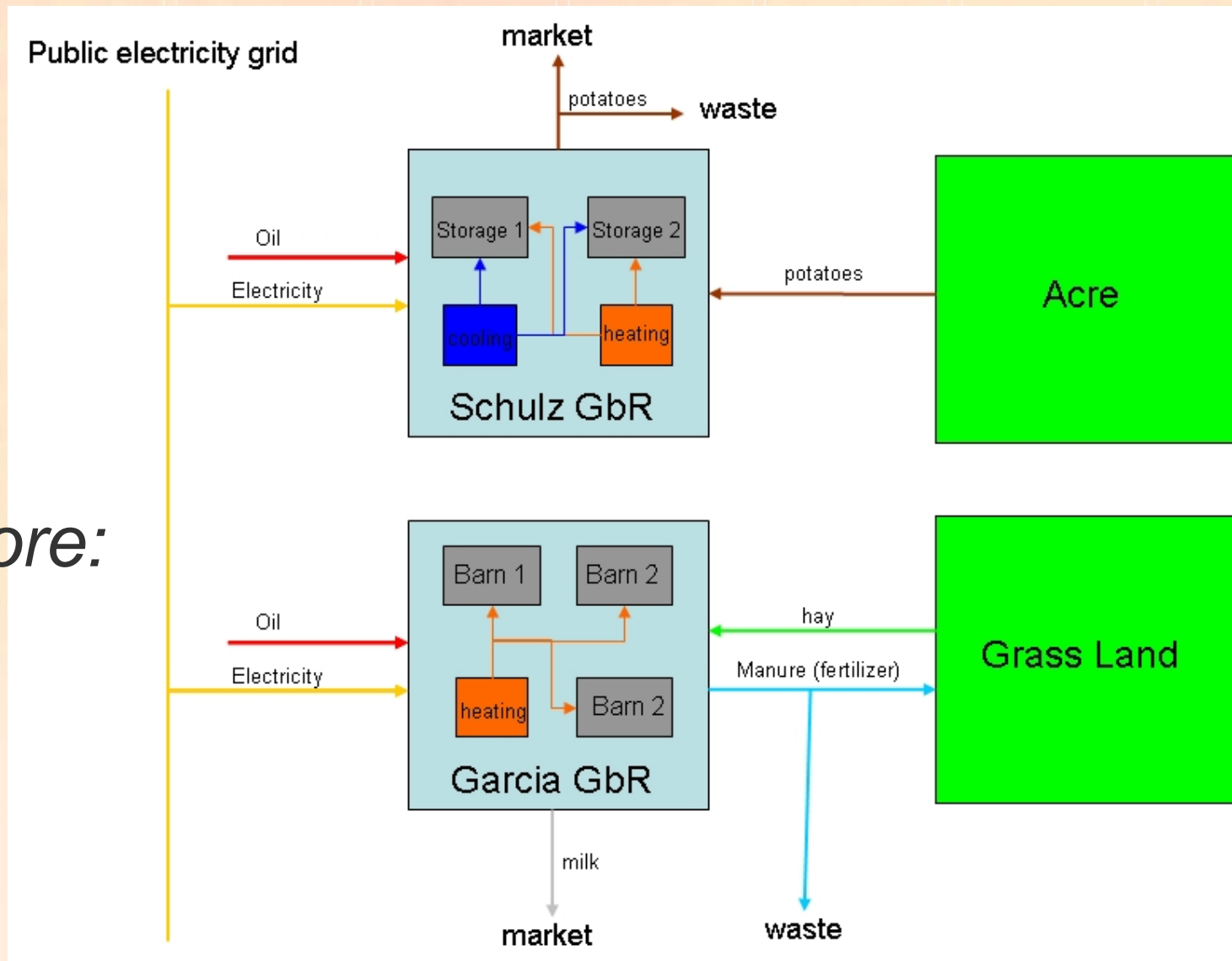


Chilling machine



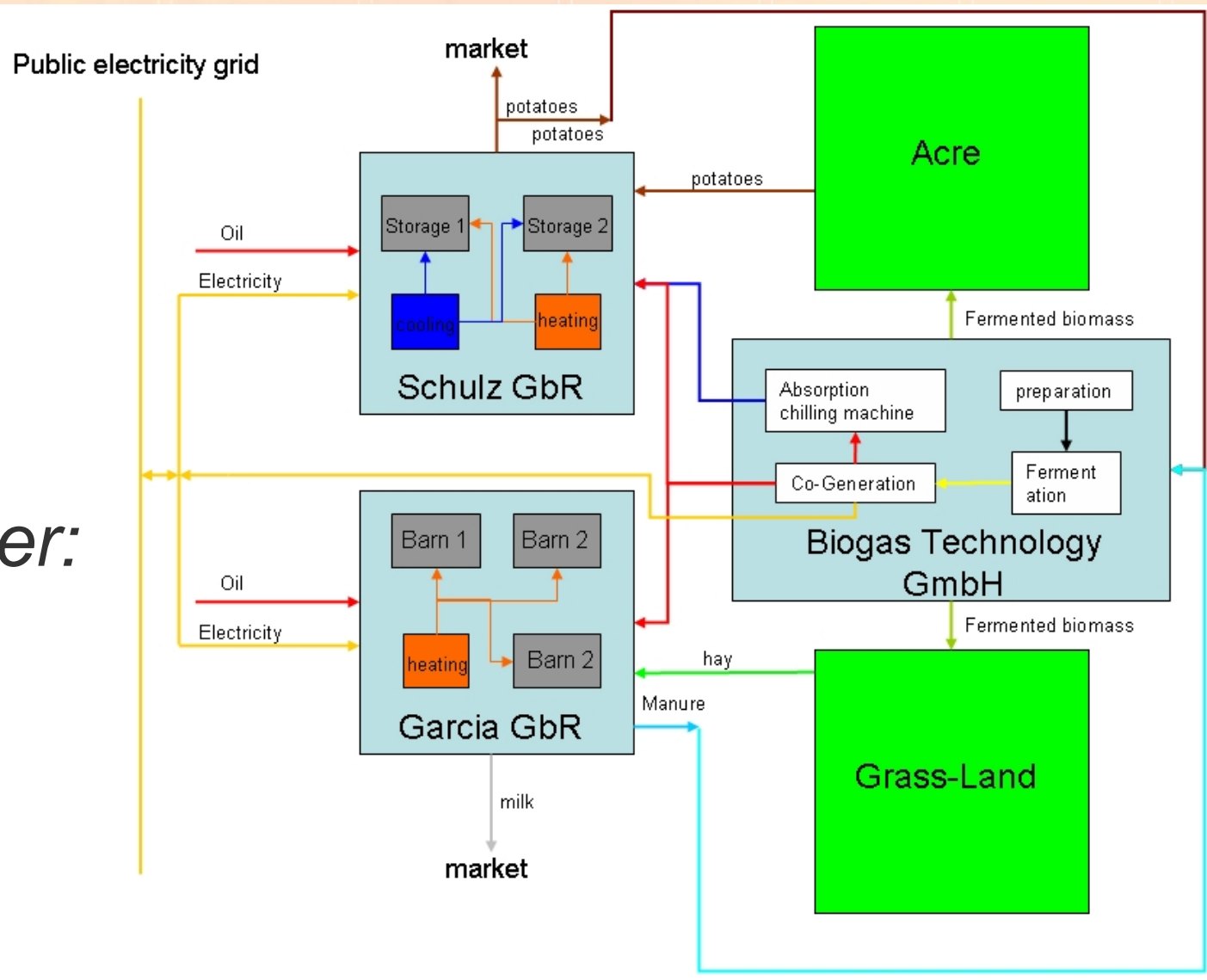
Old Scenario

Before:



New Scenario

After:



Biogas Facilities



© Schmack Biogas AG



Fermenter

Rotten potatoes: $2,52 \frac{\text{m}^3}{\text{days}} \times 40 \text{ days} = 100 \text{ m}^3$

Potato haulm: $12,3 \frac{\text{m}^3}{\text{days}} \times 50 \text{ days} = 615 \text{ m}^3$

Liquid manure: $46 \frac{\text{m}^3}{\text{days}} \times 30 \text{ days} = 1380 \text{ m}^3$

Theoretical Volume = $2095 \text{ m}^3 = 2100 \text{ m}^3$



© LJM AG



Investment Costs (I): Building



	Cost Position		
Building			
1	Granular subbase		
2	Bio-reactor		
3	Heat insulation		
4	Gas line		
5	Gas storage		
6	Substrate line		
7	Granary		
Techniques			
8	Heating		
9	Pump		
10	Gas preparation		
11	Electrical installation		
12	Tube extruder		
13	Sensors		
14	Controller		
=	$23182 \text{ €} + 98 \frac{\text{€}}{\text{m}^3} \times \text{Fermenter Volume}$		
Total fermenter costs	$23182 \text{ €} + 98 \frac{\text{€}}{\text{m}^3} \times 2100 \text{ m}^3$		228 982,00 €
Depreciation costs	16 years		14 311,38 €

Produced Biogas

Rotten potatoes: $1000 \frac{\text{ton}}{\text{year}} \times 180 \frac{\text{m}^3}{\text{ton}} = 180'000 \frac{\text{m}^3}{\text{year}}$

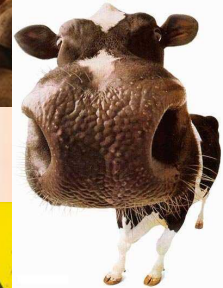
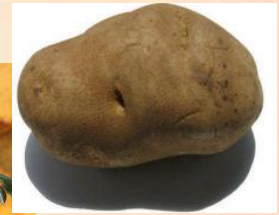
Potato haulm: $6000 \frac{\text{ton}}{\text{year}} \times 90 \frac{\text{m}^3}{\text{ton}} = 540'000 \frac{\text{m}^3}{\text{year}}$

Liquid manure: $1000 \text{ milkers} \times 1,11 \frac{\text{m}^3}{\text{milkers} \cdot \text{days}} \times 365 \text{ days} = 405'150 \frac{\text{m}^3}{\text{year}}$

Total gas Production: $540000 \frac{\text{m}^3}{\text{year}} + 180000 \frac{\text{m}^3}{\text{year}} + 405150 \frac{\text{m}^3}{\text{year}} = 1'125'150 \frac{\text{m}^3}{\text{year}}$

Power = $1'125'150 \frac{\text{m}^3}{\text{year}} \times 6 \frac{\text{kWh}}{\text{m}^3} \times \frac{91,78}{100} = 6'195'976 \frac{\text{kwh}}{\text{year}}$

→ Energy consumption of a normal house = 30'000 kWh



Co-Generator

Electric efficiency	37 %	
Thermal Efficiency	45 %	
No operation at	30 days = 8040 h/year	Availability = 91,78
Energy content of biogas	6 kWh/m ³	
Average operation time	8.040 h/ year	
Rated engine power	$\frac{1125150 \frac{m^3}{year}}{8040 \frac{h}{year}} \times \frac{37}{100} \times 6 \frac{kWh}{m^3}$	310 kW _{el}
+ 20% peak load	310 kW x 1,2	375 kW _{el}



© Quil Ceda Power Corporation

$$\text{Heat Production} = 6'195'976 \frac{kWh}{year} \times \frac{45}{100} = 2'788'189 \frac{kWh}{year}$$

$$\text{Electric energy} = 6'195'976 \text{ kWh} \times \frac{37}{100} = 2'292'511 \text{ kWh}$$

$$\text{Heat needed} = 2100 \text{ m}^3 \times 500 \frac{kWh}{m^3 \cdot year} = 1'050'000 \frac{kWh}{year}$$

$$\text{Usable electric energy} = 2'292'511 \text{ kWh} \times \left(1 - \frac{10}{100}\right) = 2'063'260 \text{ kWh}$$

$$\text{Usable heat} = 2'788'189 \frac{kWh}{year} - 1'050'000 \frac{kWh}{year} = 1'738'189 \frac{kWh}{year}$$



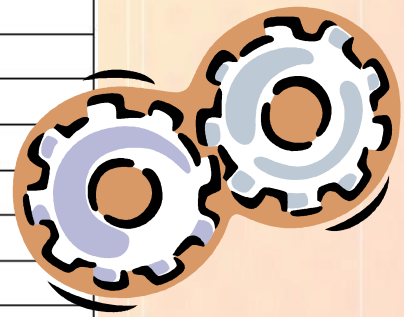
Absorption freezing machine

- An Absorption freezing machines is able to transfer heat into cooling capacity
- This offers the possibility to used the waste heat of the engine not only for heating, but also for cooling
- Another product is consequently introduced which can be sold on the market
- Absorption freezing machines have an efficiency of 70 %



$$\text{Maximal produced cooling} = 1738189 \frac{\text{kWh}}{\text{year}} \times \frac{70}{100} = 1216732 \frac{\text{kWh}}{\text{year}}$$

Investment Costs (II): Machinery



	Cost Position	
Co-Generator equipment		
1	Engine equipment	
2	Heat line	
3	Electrical installation	
4	Sonic insulated site	
5	Emergency cooling system	
=	$23182 \text{ €} + 283 \frac{\text{€}}{\text{kW}} \times \text{rated engine power}$	
Equipment costs	$11870 \text{ €} + 283 \frac{\text{€}}{\text{kW}} \times 375 \text{ kW}$	117995,00 €
Tri-Generator		
1	Gas-Engine (300 € x kW) with Generator	112 500,00 €
1	200 kW Absorption freezing machine	50 000,00 €
Tri-Generator costs		162500
Machinery costs		280 495,00 €
Depreciation costs		
Equipment	16 years	10 500,00 €
Engine	10 years	11 250,00 €
Depreciation costs		21 750,00 €



Co-Fermentation

- Using other biomass than liquid manure is called **Co-Fermentation**
- Biomass that is used as **Co-Substrates** often needs special treatment:

- Crushing
- Preparation
- Pasteurization



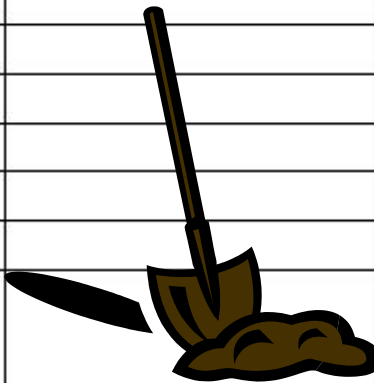
→ Additional installations are required to process all parts of the potato in the biogas facility

→ **This leads to additional costs**



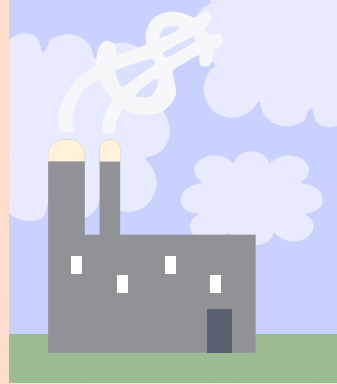
Investment Costs (III): Co-Fermentation and Off-Sites



	Cost Position	
1	Storage room	
2	Substrate preparation	
3	Substrate crushing	
4	Pasteurizing	
5	Additional pumps	
=	$10983 \text{ €} + 4055 \frac{\text{€}}{\text{m}^3 \cdot \text{day}} \times \text{volume co-substrate}$	
Total Co-Fermentation and Off-sites	$10983 \text{ €} + 4055 \frac{\text{€}}{\text{m}^3 \cdot \text{day}} \times 14,8 \text{ m}^3 \cdot \text{day}$	70 997,00 €
Depreciation costs	16 years	4 437,31 €



Total Investment Costs



Cost Position			
Fermenter costs	228 982,00 €		14 311,38 €
Machinery costs	280 495,00 €		21 750,00 €
Co-Fermentation costs	70 997,00 €		4 437,31 €
Unexpected	10 000,00 €		-
Total investment costs	590 474,00 €	Total depreciation costs	40 498,69 €

Investment analysis

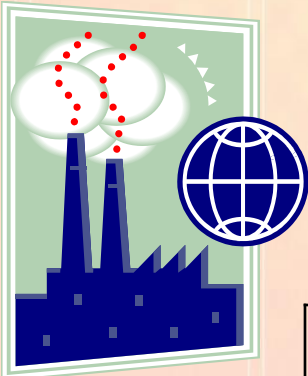


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Emission Trading



Generated Emission Reduction Units



Business as usual scenario:

<i>Emittent</i>	<i>CO2-Emissions [tCO₂]</i>
Schulz GbR	1423,35
Garcia GbR	451,6 tCO ₂
Total Emission	1875 tCO₂

Improved scenario:

<i>Emittent</i>	<i>CO2-Emissions [tCO₂]</i>
Schulz GbR	63,6
Garcia GbR	96,6
Total Emission	160,2 tCO₂



➔ 1715 Emission Reduction Units per year will be generated



Benefit from Emission Trading

- A JI-Projects runs over a maximal period of 7 years
- Consequently 7 times the annual amount of ERUs can be obtained:

$$1715 \frac{\text{tCO}_2}{\text{year}} \times 7 \text{ years} = 12005 \text{ tCO}_2 = 12'005 \text{ ERUs}$$

- Taking into account a price of 20,00 € per ERU, the benefit can be calculated:

$$12005 \text{ ERUs} \times 20 \frac{\text{€}}{\text{ERU}} = 240'100,00 \text{ €}$$

- This profit is however not sold as a regular product
- But Sonnek GmbH is investing the 240'100,00 € into the company
- and will consequently obtain the exclusive rights on selling the ERUs



Investment analysis



Biogas Technology GmbH

Financing & Cost Calculation



Financing Costs



$$590\,474,00\text{€} - 240\,100,00\text{€} = 350\,374,00\text{€}$$

Year	Remaining debt	Interest fee costs	Payback	Overall Payback
1	350,374.00 €	24,526.18 €	0.00 €	23,826.18 €
2	350,374.00 €	24,526.18 €	23,358.27 €	47,884.45 €
3	317,682.40 €	22,891.10 €	23,358.27 €	46,249.37 €
4	294,990.80 €	21,256.02 €	23,358.27 €	44,614.29 €
5	272,299.20 €	19,620.94 €	23,358.27 €	42,979.21 €
6	249,607.60 €	17,985.87 €	23,358.27 €	41,344.13 €
7	226,916.00 €	16,350.79 €	23,358.27 €	39,709.05 €
8	204,224.40 €	14,715.71 €	23,358.27 €	38,073.97 €
9	181,532.80 €	13,080.63 €	23,358.27 €	36,438.90 €
10	158,841.20 €	11,445.55 €	23,358.27 €	34,803.82 €
11	136,149.60 €	9,810.47 €	23,358.27 €	33,168.74 €
12	113,458.00 €	8,175.39 €	23,358.27 €	31,533.66 €
13	90,766.40 €	6,540.31 €	23,358.27 €	29,898.58 €
14	68,074.80 €	4,905.24 €	23,358.27 €	28,263.50 €
15	45,383.20 €	3,270.16 €	23,358.27 €	26,628.42 €
16	22,691.60 €	1,635.08 €	23,358.27 €	24,993.35 €

Financing costs = 220 735.62 €

Raw Material Costs



	<i>Cost Position</i>	<i>Price [€/m³]</i>	<i>Annual demand [m³/year]</i>	<i>Costs</i>
<i>1</i>	<i>Liquid manure</i>	<i>2</i>	<i>16 790</i>	<i>33580,00 €</i>
<i>2</i>	<i>Rotten potatoes</i>	<i>1</i>	<i>920</i>	<i>920,00 €</i>
<i>3</i>	<i>Potato haulm</i>	<i>0,5</i>	<i>4500</i>	<i>2250,00 €</i>
<i>Total raw material costs</i>				<i>36 750,00 €</i>

Labor Costs



	<i>Cost Position</i>	<i>Wage [€/h]</i>	<i>Annual demand [h/year]</i>	<i>Costs [year]</i>
1	CEO			18000,00€*
2	Labour	4	350	1400,00 €
Total labour costs				19400,00 €

Additional Expenses



	<i>Cost Position</i>	<i>Price</i>	<i>Costs</i>
1	<i>Assurance</i>	<i>0,5 [% of Investment costs]</i>	<i>2952,37 €</i>
<i>Maintenance</i>			
2	<i>Building</i>	<i>1 [% of Building costs]</i>	<i>2289,82 €</i>
3	<i>Equipment</i>	<i>1 [% of Equipment costs]</i>	<i>1179,95 €</i>
4	<i>Chilling machine</i>	<i>1 [% of machine costs]</i>	<i>500,00 €</i>
5	<i>Engine</i>	<i>10 [% of Engine costs]</i>	<i>11250,00 €</i>
6	<i>Rental fee</i>	<i>500 € per month</i>	<i>6000,00 €</i>
<i>Additional costs</i>			<i>24 172,14 €</i>

Estimated Production

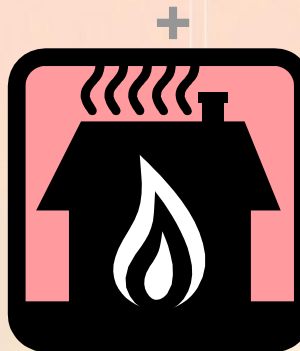
For electricity

$$2063260 \frac{\text{kWh}}{\text{year}} \times 0,07 \frac{\text{€}}{\text{kWh}} = 144\,428 \frac{\text{€}}{\text{year}}$$



For heat

$$579396 \frac{\text{kWh}}{\text{year}} \times 0,040 \frac{\text{€}}{\text{kWh}} = 23\,175,84 \frac{\text{€}}{\text{year}}$$



For cooling energy

$$1075200 \frac{\text{kWh}}{\text{year}} \times 0,060 \frac{\text{€}}{\text{kWh}} = 64\,512,00 \frac{\text{€}}{\text{year}}$$



Equivalent cost calculation

Division with equivalents for raw material costs for the first year					
		Total costs: 36,750.00 €			
Sort	1	2	3	4	5
	Equivalent	Qty. Produces [kWh]	Units of account 1*2	Units costs [€/kWh] Unit of all * 1	Total costs per sort
Heat	0.5	1,738,189.00	869,094.50	0.004	7,478.58 €
Electricity	1.0	2,063,260.00	2,063,260.00	0.009	17,754.41 €
Cooling energy	1.1	1,216,732.00	1,338,405.20	0.009	11,517.01 €
			4,270,759.70		36,750.00 €
Unit of all=	Total costs	36,750.00 €	= 0.01		
	Total Qty. Produced	4,270,759.70			

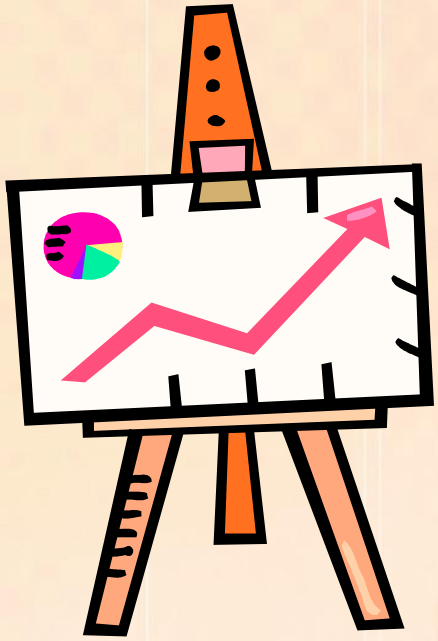
For the following cost calculation it is necessary to give all products equivalents

The division of the costs through the sum of all quantities times the respective equivalent gives the “Unit of all”

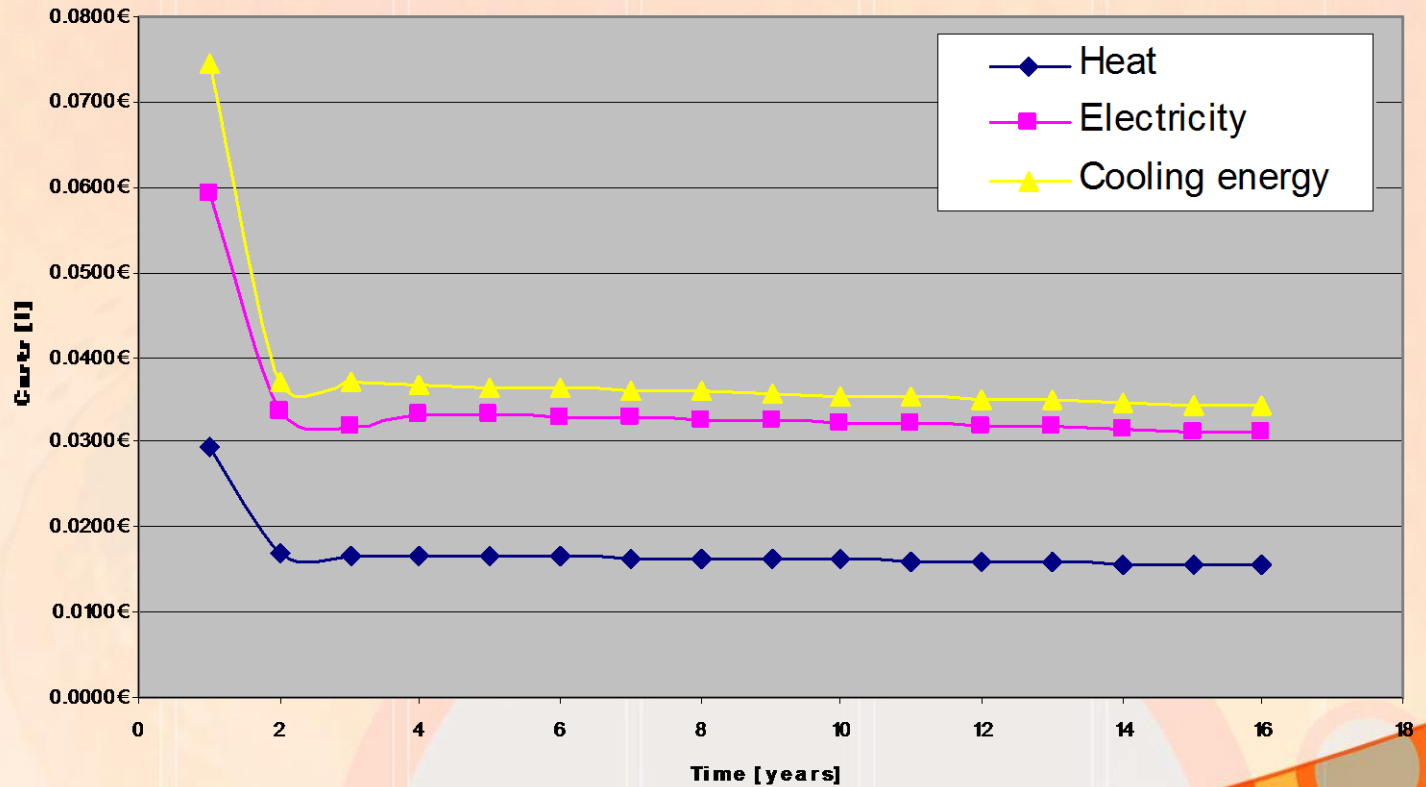
To get the cost of each unit one has to multiply the “Unit of all” times the given equivalents



Sum of Costs



Changes of costs for each product in the first 16 years



Cash-Flow Calculation



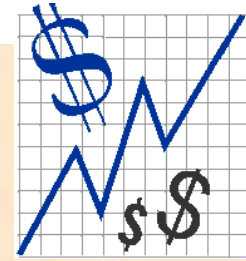
Cash flow calculation: 16 years

	1. Year	2. Year	3. Year	4. Year	5. Year	6. Year	7. Year	8. Year
Turnover	143,479.84 €	286,959.68 €	286,959.68 €	286,959.68 €	286,959.68 €	286,959.68 €	286,959.68 €	286,959.68 €
Deprecation costs	40,498.69 €	40,498.69 €	40,498.69 €	40,498.69 €	40,498.69 €	40,498.69 €	40,498.69 €	40,498.69 €
Raw material costs	36,750.00 €	36,750.00 €	36,750.00 €	36,750.00 €	36,750.00 €	36,750.00 €	36,750.00 €	36,750.00 €
Labor costs	19,400.00 €	19,400.00 €	19,400.00 €	19,400.00 €	19,400.00 €	19,400.00 €	19,400.00 €	19,400.00 €
Additional costs	24,172.14 €	24,172.14 €	24,172.14 €	24,172.14 €	24,172.14 €	24,172.14 €	24,172.14 €	24,172.14 €
Financing costs	23,826.18 €	47,884.45 €	46,249.37 €	44,614.29 €	42,979.21 €	41,344.13 €	39,709.05 €	38,073.97 €
Brutto	-1,467.17 €	118,254.40 €	119,889.48 €	121,524.56 €	123,159.64 €	124,794.72 €	126,429.80 €	128,064.88 €
Corporate tax (50%)	0.00 €	59,127.20 €	59,944.74 €	60,762.28 €	61,579.82 €	62,397.36 €	63,214.90 €	64,032.44 €
Netto	0.00 €	59,127.20 €	59,944.74 €	60,762.28 €	61,579.82 €	62,397.36 €	63,214.90 €	64,032.44 €
Cash flow (net+depr.)	39,331.52 €	99,625.89 €	100,443.43 €	101,260.97 €	102,078.51 €	102,896.05 €	103,713.59 €	104,531.13 €
Repayment credit	0.00 €	22,691.60 €	22,691.60 €	22,691.60 €	22,691.60 €	22,691.60 €	22,691.60 €	22,691.60 €
DIVIDEND	39,331.52 €	76,934.29 €	77,751.83 €	78,569.37 €	79,386.91 €	80,204.45 €	81,021.99 €	81,839.53 €

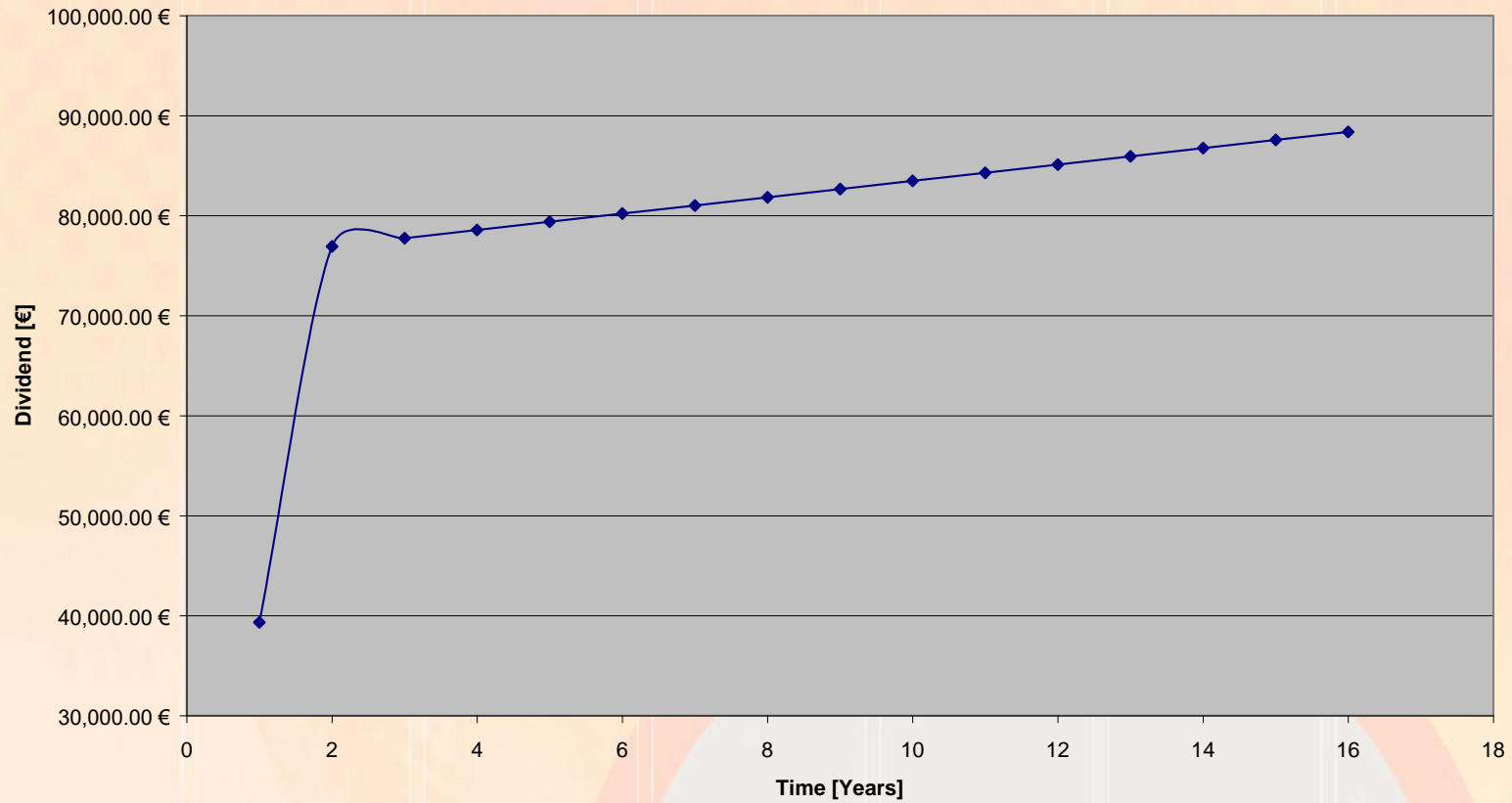
Cash flow calculation: 16 years

	9. Year	10. Year	11. Year	12. Year	13. Year	14. Year	15. Year	16. Year
Turnover	286,959.68 €	286,959.68 €	286,959.68 €	286,959.68 €	286,959.68 €	286,959.68 €	286,959.68 €	286,959.68 €
Deprecation costs	40,498.69 €	40,498.69 €	40,498.69 €	40,498.69 €	40,498.69 €	40,498.69 €	40,498.69 €	40,498.69 €
Raw material costs	36,750.00 €	36,750.00 €	36,750.00 €	36,750.00 €	36,750.00 €	36,750.00 €	36,750.00 €	36,750.00 €
Labor costs	19,400.00 €	19,400.00 €	19,400.00 €	19,400.00 €	19,400.00 €	19,400.00 €	19,400.00 €	19,400.00 €
Additional costs	24,172.14 €	24,172.14 €	24,172.14 €	24,172.14 €	24,172.14 €	24,172.14 €	24,172.14 €	24,172.14 €
Financing costs	36,438.90 €	34,803.82 €	33,168.74 €	31,533.66 €	29,898.58 €	28,263.50 €	26,628.42 €	24,993.35 €
Brutto	129,699.95 €	131,335.03 €	132,970.11 €	134,605.19 €	136,240.27 €	137,875.35 €	139,510.43 €	141,145.50 €
Corporate tax (50%)	64,849.98 €	65,667.52 €	66,485.06 €	67,302.60 €	68,120.13 €	68,937.67 €	69,755.21 €	70,572.75 €
Netto	64,849.98 €	65,667.52 €	66,485.06 €	67,302.60 €	68,120.13 €	68,937.67 €	69,755.21 €	70,572.75 €
Cash flow (net+depr.)	105,348.67 €	106,166.21 €	106,983.75 €	107,801.29 €	108,618.82 €	109,436.36 €	110,253.90 €	111,071.44 €
Repayment credit	22,691.60 €	22,691.60 €	22,691.60 €	22,691.60 €	22,691.60 €	22,691.60 €	22,691.60 €	22,691.60 €
DIVIDEND	82,657.07 €	83,474.61 €	84,292.15 €	85,109.69 €	85,927.22 €	86,744.76 €	87,562.30 €	88,379.84 €

Evolution of the dividend



Evolution of the dividend



Equity profitability

Equity profitability			
	1. Year	2. Year	3. Year
Partners equity	300,100.00 €	300,100.00 €	300,100.00 €
Net-profit	0.00 €	59,127.20 €	59,944.74 €
Total	300,100.00 €	359,227.20 €	360,044.74 €
Dividend	39,331.52 €	76,934.29 €	77,751.83 €
Profit made in % Partners equity	13.11	21.42	21.60

Conclusion

- The overall costs and profit calculation shows that the company BiogasTechnology GmbH is a profitable organization*

Thank you for your attention!

