



R^{Energy} Roof GmbH

Business Plan

**Amin Boulassouak
Kai Eßer
Pascal Matke**

Idea

- Using of free roofing areas from public schools and gyms to build PV-Systems
- Schools rent PV-Systems to generate power for their own needs
- Unused generated electrical current will be supplied to the electrical grid

Current market situation

- Cologne has many public gym halls and schools with unused roof space
- Many roofs are built even, so PV-modules can be installed in any direction
- Schools and Gyms have an electrical demand, which can be partly supplied with own PV-generators
- Due to the very low feed-in tariff, the only supply to the grid is not profitable

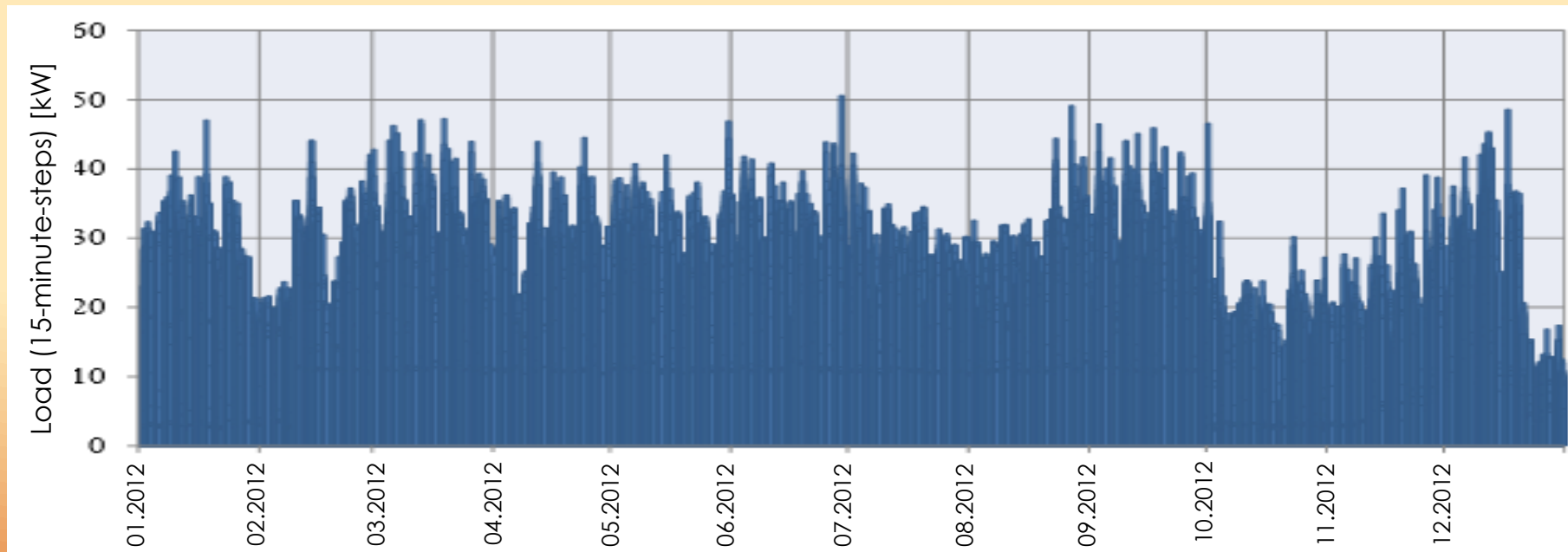
Form of business organisation

Business will be formed as a limited company (GmbH)

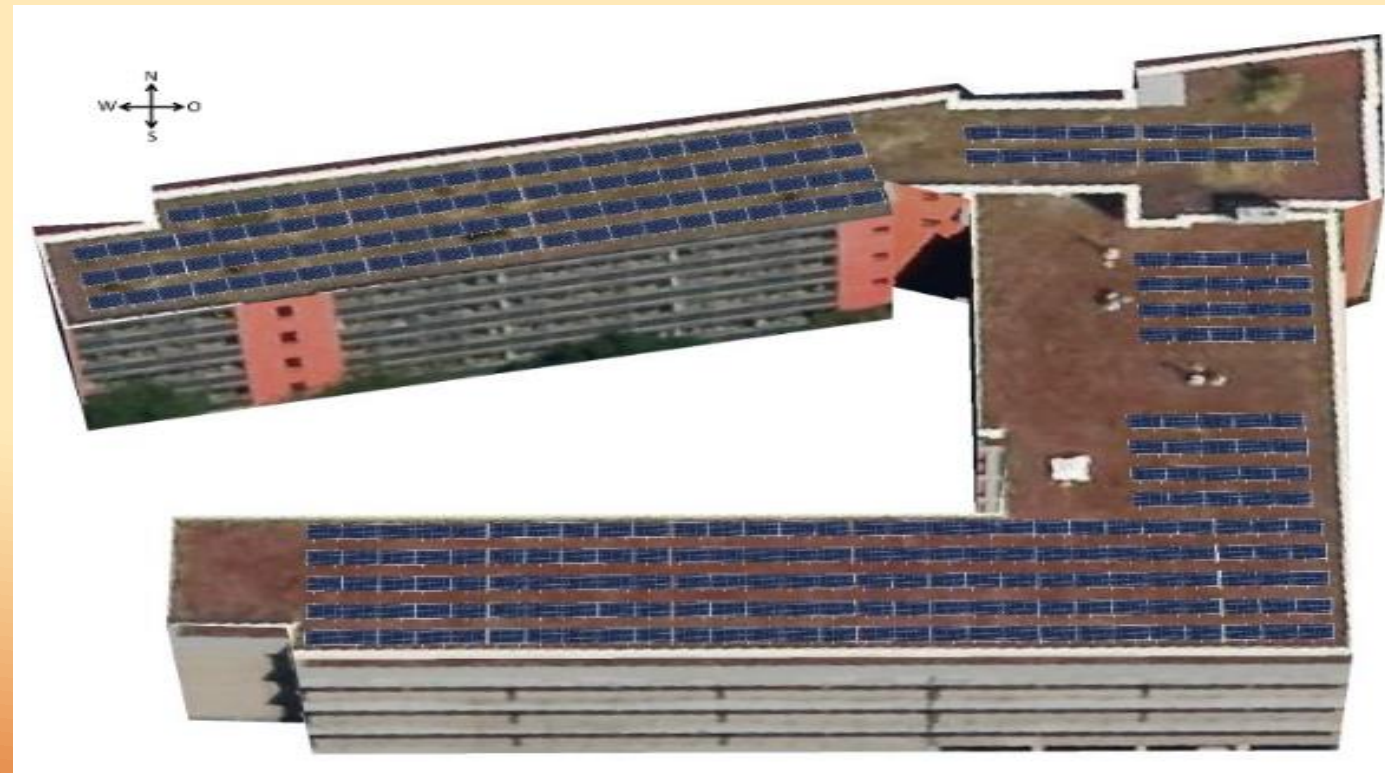
- Minimum risk of getting into personal debt
- Risk of loosing capital is limited to 25.000 €

Electrical demand

In 2012 an example school had an electrical demand of 156,7 MWh

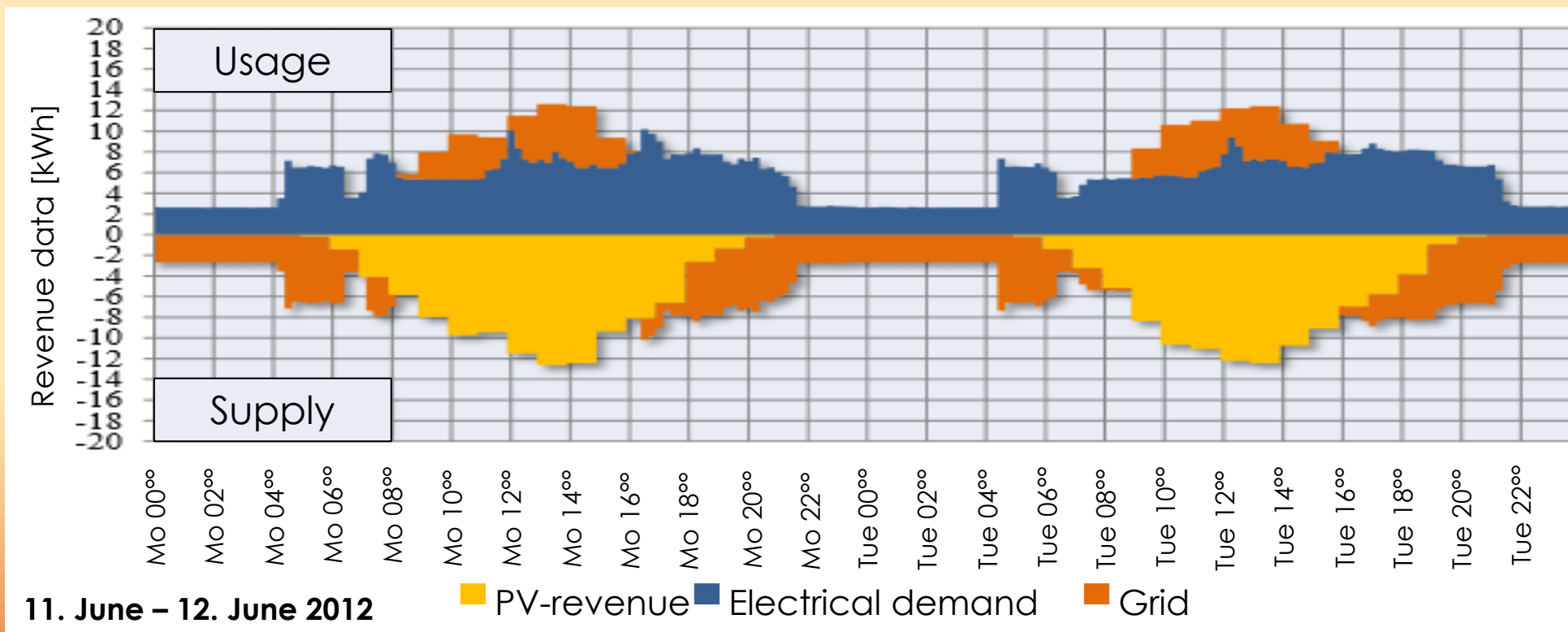


Possible usage of a roof from the example school



- Area: 487,12 m²
- 289 PV modules
- Total capacity: 65KWp
- KWh generation per year:
64.490 kWh
- Expected lifetime: 30years
- No battery storage => too expensive

Electrical revenue



Investment Calculation

1700 € per kWp → 65 kWp * 1700 € = 110.500 €

Investment	Price [€]	Depreciation [%]	Depreciation costs [€]
Roof	none		
PV-Modules	110.500,00	5,00	5.525,00
Mounting			
Inverter			
Cables / Plugs			
Installation			
Sum	110.500,00		5.525,00

Financing

- **110.500,00 €** total investment
- 40% own capital funds: **44200,00 €**
- 60% outside financing (KfW bank loan): **66300,00 €**
 - interest rate 4,5 %, 20 years running time

Financing

Year	Balance of debt [€]	Interest Rate [%]	Interest Costs Paid p.a. [€]	Repayment [€]
1	66.300,00	4,50	2.983,50	3.315,00
2	62.985,00	4,50	2.834,33	3.315,00
3	59.670,00	4,50	2.685,15	3.315,00
4	56.355,00	4,50	2.535,98	3.315,00
5	53.040,00	4,50	2.386,80	3.315,00
6	49.725,00	4,50	2.237,63	3.315,00
7	46.410,00	4,50	2.088,45	3.315,00
8	43.095,00	4,50	1.939,28	3.315,00
9	39.780,00	4,50	1.790,10	3.315,00
10	36.465,00	4,50	1.640,93	3.315,00
11	33.150,00	4,50	1.491,75	3.315,00
12	29.835,00	4,50	1.342,58	3.315,00
13	26.520,00	4,50	1.193,40	3.315,00
14	23.205,00	4,50	1.044,23	3.315,00
15	19.890,00	4,50	895,05	3.315,00
16	16.575,00	4,50	745,88	3.315,00
17	13.260,00	4,50	596,70	3.315,00
18	9.945,00	4,50	447,53	3.315,00
19	6.630,00	4,50	298,35	3.315,00
20	3.315,00	4,50	149,18	3.315,00
Total interest paid			31.326,75	
	Total Repayment			66.300,00

Self-costs per generated kWh in year 1

Expenditure per year

➤ Insurance:		350,00€
➤ Operating costs:	30€/kWp * 65kWp =	1.950,00€
➤ Financing in year 1:		2.983,50€
➤ Depreciation:		<u>5.525,00€</u>
➤ Sum of expenditure:		10.808,50€

Expenditure / generated kWh = **Self-costs [€/kWh]**

$$10.808,50€ / 64.490 \text{ kWh} = \mathbf{00,17 \text{ €}}$$

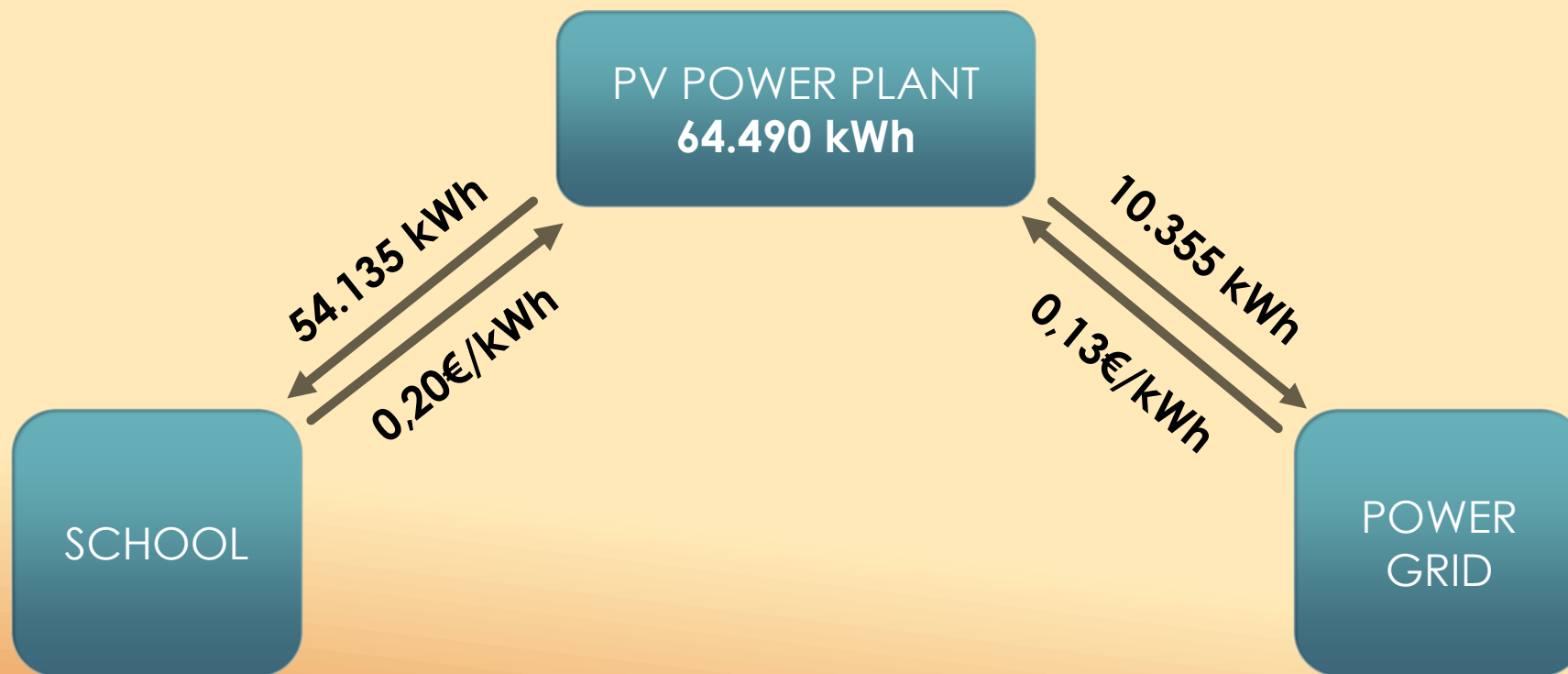
Self-costs per generated kWh: 1 to 10 years

Year	1	2	3	4	5	6	7	8	9	10
Generated power [kWh]	64.490,00	64.490,00	64.490,00	64.490,00	64.490,00	64.490,00	64.490,00	64.490,00	64.490,00	64.490,00
Costs	Costs per year [€]									
Depreciation costs	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €
Financing costs	2.983,50 €	2.834,33 €	2.685,15 €	2.535,98 €	2.386,80 €	2.237,63 €	2.088,45 €	1.939,28 €	1.790,10 €	1.640,93 €
Insurance	350,00 €	350,00 €	350,00 €	350,00 €	350,00 €	350,00 €	350,00 €	350,00 €	350,00 €	350,00 €
Operating costs	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €
Sum of costs	10.808,50 €	10.659,33 €	10.510,15 €	10.360,98 €	10.211,80 €	10.062,63 €	9.913,45 €	9.764,28 €	9.615,10 €	9.465,93 €
Costs per kWh	0,17 €	0,17 €	0,16 €	0,16 €	0,16 €	0,16 €	0,15 €	0,15 €	0,15 €	0,15 €

Self-costs per generated kWh: 11 to 20 years

Year	11	12	13	14	15	16	17	18	19	20
Generated power [kWh]	64.490,00	64.490,00	64.490,00	64.490,00	64.490,00	64.490,00	64.490,00	64.490,00	64.490,00	64.490,00
Costs	Costs per year [€]									
Depreciation costs	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €	5.525,00 €
Financing costs	1.491,75 €	1.342,58 €	1.193,40 €	1.044,23 €	895,05 €	745,88 €	596,70 €	447,53 €	298,35 €	149,18 €
Insurance	350,00 €	350,00 €	350,00 €	350,00 €	350,00 €	350,00 €	350,00 €	350,00 €	350,00 €	350,00 €
Operating costs	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €	1.950,00 €
Sum of costs	9.316,75 €	9.167,58 €	9.018,40 €	8.869,23 €	8.720,05 €	8.570,88 €	8.421,70 €	8.272,53 €	8.123,35 €	7.974,18 €
Costs per kWh	0,14 €	0,14 €	0,14 €	0,14 €	0,14 €	0,13 €	0,13 €	0,13 €	0,13 €	0,12 €

Electricity generation and distribution per year



Revenue calculation per year

Revenue by school consumption: $54.135\text{kWh} * 0,20\text{€/kWh} = 10.827\text{€}$

Revenue by supplying to the grid: $10.355\text{kWh} * 0,13\text{€/kWh} = 1.346\text{€}$

Total revenue per year: 12.173€

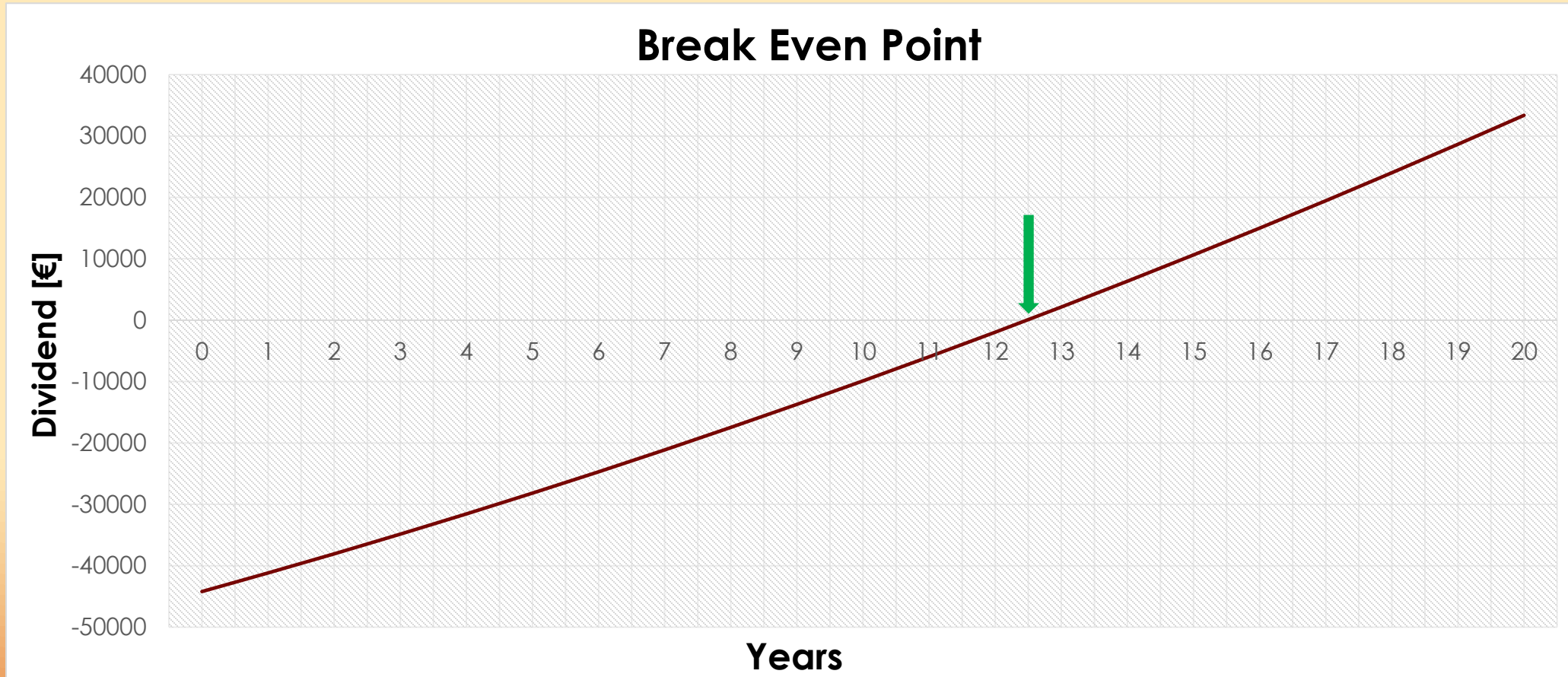
Computation of cash-flow for years 1 to 10

Year	1	2	3	4	5	6	7	8	9	10
Revenue	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €
Costs	10.808,50 €	10.659,33 €	10.510,15 €	10.360,98 €	10.211,80 €	10.062,63 €	9.913,45 €	9.764,28 €	9.615,10 €	9.465,93 €
Profit before tax	1.364,50 €	1.513,68 €	1.662,85 €	1.812,03 €	1.961,20 €	2.110,38 €	2.259,55 €	2.408,73 €	2.557,90 €	2.707,08 €
Tax (40%)	545,80 €	605,47 €	665,14 €	724,81 €	784,48 €	844,15 €	903,82 €	963,49 €	1.023,16 €	1.082,83 €
Profit after taxes	818,70 €	908,21 €	997,71 €	1.087,22 €	1.176,72 €	1.266,23 €	1.355,73 €	1.445,24 €	1.534,74 €	1.624,25 €
Cash-flow (net-profit + depreciation)	6.343,70 €	6.433,21 €	6.522,71 €	6.612,22 €	6.701,72 €	6.791,23 €	6.880,73 €	6.970,24 €	7.059,74 €	7.149,25 €
Repayment credit	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €
Dividend	3.028,70 €	3.118,21 €	3.207,71 €	3.297,22 €	3.386,72 €	3.476,23 €	3.565,73 €	3.655,24 €	3.744,74 €	3.834,25 €

Computation of cash-flow for years 11 to 20

Year	11	12	13	14	15	16	17	18	19	20
Revenue	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €	12.173,00 €
Costs	9.316,75 €	9.167,58 €	9.018,40 €	8.869,23 €	8.720,05 €	8.570,88 €	8.421,70 €	8.272,53 €	8.123,35 €	7.974,18 €
Profit before tax	2.856,25 €	3.005,43 €	3.154,60 €	3.303,78 €	3.452,95 €	3.602,13 €	3.751,30 €	3.900,48 €	4.049,65 €	4.198,83 €
Tax (40%)	1.142,50 €	1.202,17 €	1.261,84 €	1.321,51 €	1.381,18 €	1.440,85 €	1.500,52 €	1.560,19 €	1.619,86 €	1.679,53 €
Profit after taxes	1.713,75 €	1.803,26 €	1.892,76 €	1.982,27 €	2.071,77 €	2.161,28 €	2.250,78 €	2.340,29 €	2.429,79 €	2.519,30 €
Cash-flow (net-profit + depreciation)	7.238,75 €	7.328,26 €	7.417,76 €	7.507,27 €	7.596,77 €	7.686,28 €	7.775,78 €	7.865,29 €	7.954,79 €	8.044,30 €
Repayment credit	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €	3.315,00 €
Dividend	3.923,75 €	4.013,26 €	4.102,76 €	4.192,27 €	4.281,77 €	4.371,28 €	4.460,78 €	4.550,29 €	4.639,79 €	4.729,30 €

Break Even Point



Cash flow after 20years

Operating costs:	1.950€
<u>Insurance:</u>	<u>350€</u>
Total costs:	2.300€
Total revenue:	12.173€
Profit bevor tax:	9.873€
Profit after tax:	5.923€

Conclusion

- The business plan confirms high profitability of business idea
- Enhancement of Profit by making more power plants
- Business plan shows a win-win-situation for both, the REnergyRoof GmbH and the City of Cologne
- Break-Even-Point to be reached already after 12years (Depreciation time 20)
- Advantages for City of Cologne:
 - No risks of failure of the power plant
 - High profit by fix purchasing price of 0,2€/kWh over 20years
 - Making a contribution to reduce the CO₂-Emission

References

- Prof. Dr. Ulrich Daldrup - Business Administration and Economics – CMG Lecture WS 2013/14
- Johannes Rulof - „Optionen für Energiegenossenschaften im Innenstadtbereich unter Berücksichtigung von Solarstrom-Eigenverbrauch“ (Abschlussarbeit 2013)
- http://www.seb-solar.de/image/banner_referenzen.jpg