Business Plan

District Energy Supply

Entrepreneurship

Prof. Dr. Ulrich Daldrup

Ebrahim Riad, Janis Kaltschnee, Hamed Atajafari, Hazem Masoud,
Ilias Pavlou, Mustafa Halim, Tassnime Douieb

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1 Executive Summary

Innovative, sustainable and extremely profitable – these attributes suit perfectly to the company District Energy Supply (DES). Almost every new residential area is supplied by the electrical grid and each household has its own heating system. However, modern technology creates an opportunity for innovative concepts of an energy supply for new residential area. With a PV and CHP power plant, battery and heating storage as well as a private electricity and district heating grid, new residential area can reach self-sufficiency. No connection to the grid is necessary. DES provides suitable solutions for new residential areas. Due to the PV power plant and the high efficiency of the CHP plant, new residential areas designed by DES are extremely sustainable and a reliable concept for the future.

Furthermore, our customers save a lot of money since they pay less in our area as grid-connected customers. Not only our customers save money, our shareholder gains a huge dividend as well. After 20-year lifetime, the project generates a total dividend of 1,721,073.41 €. If you compare the value to the total cost in the beginning of the project of 589,050 €, you notice the extreme profitability at first sight.

Through a combination of a careful analysis, a strong management team, and this comprehensive business plan, DES will be able to reach its objectives and become a stable and profitable business serving its customers.

2 Field Analysis

2.1 Main Idea of our Business

District energy systems play a crucial role in providing local, affordable and sustainable energy supply, improving energy efficiency and supporting energy access efforts.In addition, implementation of renewable sources in such systems provides significant opportunities for countries and cities to decline greenhouse gas emissions. Basically, energy production includes different stages and a wide range of components and experts are involved in the projects. In general, private investments in such projects require a techno-economic evaluation which could estimate the energy supply and demand, investment costs and pay-back period.

The present work aims to implement a business model for a solar-powered and heating network in the Niestetal in Germany. 58 entities appear in our imaginary map of a new residential area. The main objectives here are to evaluate the project from technical and economic point of view. In the first stage, an attempt has been made to calculate the quantity of supply and demand and plant size.

2.2 Market Trends

It is very unlikely that yesterday's technology could address the future demand for energy. A smarter solution is required that can undertake the three top pillars of energy trilemma: security, affordability and sustainability, all at the same time. If the solution focuses on just one dimension, it is unlikely to be able to address the sustainable urban development. The district energy supply (DES) capable of providing required energy, either in the form of electricity or heating that utilize available local renewable energy /waste resources might be one of the best solutions to this trilemma.

The DES systems are commonly used in remote areas. However, by increasing the penetration of renewable energies in residential applications and the growth in ownership of small scale energy generators, the concept of District Energy Supply System is merging into the heart of urban areas.

Intelligent algorithms that link the potential demand to the supply, using user behavior analysis and meteorological data ensures the flexibility of the system. At the same time due to a reduction in cost and distribution, the energy would be more affordable.

2.3 Market Target

Everyone uses energy for one purpose or the other, and so when it comes to the market for those that use energy, we would say everyone. However, the target market we intended to focus on for our business fell on a residential area with adequate sun exposure, consisting of different Household types and few commercial entities with moderate energy consumption, located in the municipality of Niestetal in Hessen, Germany.

The case of our market target analysis is in some way particular since our business is quite small and our customers are already defined. We have chosen a new residential area in which all the houses and other commercial buildings are our customers, which means that we will be providing our service to every entity located in that area.

2.4 Competitive Advantage

Our vision at DES is to ensure that we offer our customers the best services for the fairest rates in the energy supply industry. To achieve this, we have certain strategies in place that will allow us have competitive advantage over our competitors in the industry.

DES provides:

- a local and sustainable energy generation;
- an enhanced energy security by using energy storage;
- independency from conventional energy provider and therefore a hedge against rising energy prices;
- a reduced energy bill;
- an Intelligent usage control;
- and an excellent customer care by ensuring that we remain updated as regards happenings in the industry and also giving the highest professional service to our customers.

Having all these strategies in place is also of vital importance to communicate our brand effectively as we intend to grow our business in the future by supplying many other customers in different segments and in different areas.

3 Description of the Business Model

3.1 New Residential Area

An imaginary map for the new residential area where each facility is either a customer or a part of the energy production has been built. The base of a real new residential area has been taken to conceive how would a real modern district powered by its own grid be like and depending on this base a map has been modeled. A number of shops which the people living in such a district need on a daily basis, households and facilities needed to serve them have been set. According to the sum of the load profile of all mentioned facilities an electric demand has been roughly calculated, and electric facilities with certain capacities to serve such a district have been settled on.

CHP Plant and additional serving utilities for powering the residential buildings all have been allocated on this map.

The District designed consists of:

-44 Households with the areas ranging between 105 - 280m^2.

-1 Bakery

-1 Cafeteria

-1 Supermarket

-1 Barbershop

-1 Pharmacy

-1 Industrial facility

-2 Restaurants

-2 Green areas

-1 Facility for Energy storage

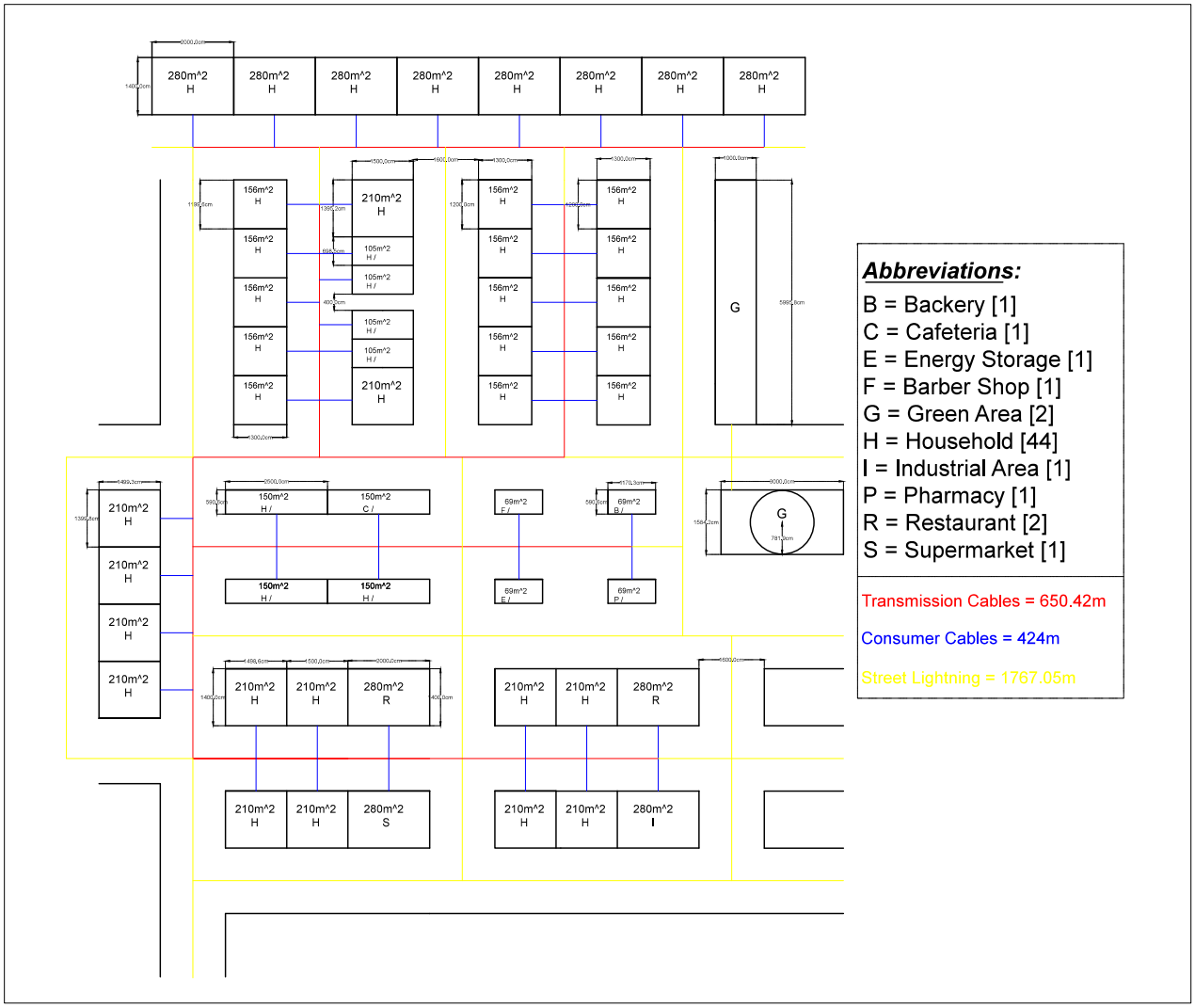

Figure 1 - Map of the new residential area

A rough design for the underground electricity cables for the main energy transmission is made which came to find that 650 meters of cables are needed. To connect both households and different facilities to the transmission lines an additional 424 meters of cables is needed. And similarly, for connecting street lighting to the transmission lines extra 1767 meters of lighting cables are needed.

3.2 Assets

3.2.1 Electricity Grid

Our company constructs a private electricity grid "mini-grid", which operates in isolation from national electricity transmission networks. The electricity generation within the system of the grid will be through solar PV panels from solar energy in day time (which we have outsourced), and CHP (combined heat and power) plant in night and peak load time. The excessive amount of energy from day time will be stored in our central battery storage system which also will be fed into the grid in night time.

The generated electricity from both, solar PV and CHP plants will be distributed with an internal distribution network. As of the current plan our private electricity grid will not be connected to the national electricity grid, but it will have the possibility to be connected to the national electricity grid for the purpose of utilizing the energy policy measures determined by the Federal Government.

The private electricity grid will target the supply of electricity to the localized group of customers only. It will further have the possibility to be expanded with respect to the demand growth in the future, based on the population growth forecast. The dynamic nature of the grid ensures the sustainability and reliability of the system. Additionally, the customers of the grid will have the advantage of paying a lower wage comparing to the national electricity grid.

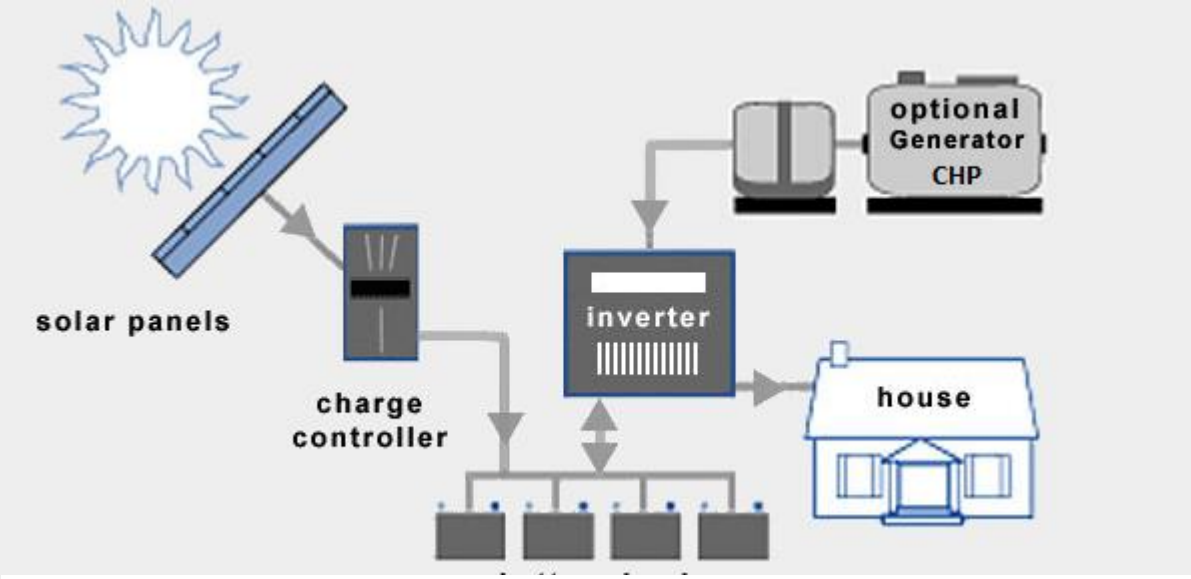

Figure 2 - Example of an electrical grid

3.2.2 District Heating Grid

Our company constructs a private heating grid "district heating grid" that operates as an isolated heating network. We will install CHP (Combined Heat and Power) units to cover the generation and distribution of thermal energy in the district network that aims to supply the heat demand of the local district. The excessive amount of thermal energy will be stored in our central heat storage system to supply the heat demand in peak time and prevent the heat losses. The CHP units consume natural gas as fuel and the device which functions at the consumer end is radiator with hot water as its fuel. In addition to lower energy costs, the district heating network is a tool to reduce the CO_2 emissions.

3.2.3 Combined Heat Power Plant

Cogeneration (COGEN) through CHP "Combined Heat and Power" is defined as the concurrent production of electricity with the use and recovery of heat. It is an exceptionally proficient energy conversion form that is able to accomplish primary energy savings of around 40% when compared with onsite heating gas boiler or electricity grid. The power supply security which is immensely important for power consumers can be achieved through gas-based cogeneration or CHP [1].

For our supply purpose, to operate at a high efficiency and reduced level of carbon emissions, in addition present a reliable solution we selected the combined heat and power (CHP) technology. It will also act as a core component of our electrical energy system in peak time spans. According to our calculations the CHP will have an output electrical energy of 140 kW and a thermal energy of 209 kW that will operate with 91% efficiency.

Figure 3 - Viessmann VITOBLOC 200 [2]

3.2.4 Battery Storage

Throughout the electricity generation system of our "mini-grid", we install a central battery storage system to consume all the excess power we get from solar energy, this will also enable us to prevent the solar power to go to waste as our system will be entirely off-grid. With central battery storage for our customers, we will gain the advantages of economies of scale; this means we will receive a lower price while the customers do not loose space in their basements. In addition, with central battery storage system, our solar power can go from variable to dispatch-able, in simple words, our customers can choose and pick the time to use the energy and this maximizes our self-consumption of solar power. With respect to the calculations we did, the size of our central battery storage will be 400 kWh, this will suffice to store that amount of electrical energy to feed the customers with secure and reliable electricity during the night time.

Figure 4 - Example of a battery storage system [3]

3.2.5 Heat Storage

The central heat storage functions as a pressurized heat accumulator tank. The heat collector is utilized for short time spans (days/weekly) storage of energy that is based on water. Independent of energy content, with respect to the weight content, the tank is constant. The accumulator is charge in a way that the same amount of cold water extracts from the bottom of the tank at the same time when the supply of hot water in the top of the tank takes place. The distinguished levels of density separate the hot water from cold water, with an approximate 1-meter-high nonusable separation layer. In reverse, when the discharging takes place, the cold-water supply occurs through the bottom and the hot water releases from the top at the same time [4].

Throughout the heat generation system of our "district heating grid", we install a central heat storage system to consume all the excess thermal energy we get from CHP; this will also enable us to prevent the thermal energy to go to waste. The capacity of our central heat storage will be 40000 kWh and the bulky heat storages of our central heat storage system will need an area of 1000 m^2. With central heat storage for our customers, we will gain the advantages of reducing the need for peak generation capacity, enhancing district heating grid reliability and improve the overall performance of the grid.

3.2.6 PV Power Plant

The large-scale PV (Photovoltaic) system that aims to feed the electricity grid with commercial electricity is called Solar Park, also known as PV Power Plant. The fact that PV Power Plant supplies electricity at the level of utility makes it distinguished among other solar applications like decentralized solar power and rooftop solar power generation that target a limited number of consumers. The solar power is generated by photovoltaic solar cells which converts the sunlight into electricity directly.

It would be of value to briefly discuss the working principle of PV Power Plant, the solar energy is generated when the sunlight hits the photovoltaic solar panels, the nature of solar photovoltaic panels is to generate DC (direct current) form of electricity when converts the sunlight radiation into electricity. As a process of converting the DC electricity generated by solar panels into AC (Alternating Current), the DC electricity goes through inverter and gets converted to AC electricity, this happens for the purpose of local electric utility and end use, as the consumers use the electricity in form of AC electricity due to the fact that all daily used appliances operate in AC electricity and also, the commercial form of electricity is AC. Afterwards, the AC electricity runs through transformers to step up for transmission, through transmission lines the electricity reaches the electric utilities and again runs through the step-down transformers for distribution and finally reaches the end user or consumer.

Throughout the course of "District Energy Supply", we have outsourced the PV Power Plant and we are not responsible either for generation, operation or maintenance of the plant, we purchase the power from the PV power plant operator at a fixed price only. Additionally, as mentioned before, the PV power plant is not connected to the national grid, but the power plant is designed in a way that is able to be connected to the grid upon extension of grid network to the area or to get benefits of policy measures in the country as FIT (Feed in Tariffs), FIP (Feed in Premium) and many more in the future. The extra amount of electricity that should cover the peak time spans is generated by CHP plant that has been explained previously.

It is noteworthy at this point to discuss the electricity demand forecast and electricity generation profile of the "District Energy Supply", we could manage to get the 15 minutes' solar radiation data of Niestetal which is a reliable set of data for calculation of a specific location. We based our assumption on a district or a small town to be electrified. According to the number of households, the associated consumption of energy in terms of electric appliances of households, the size of households, number of shops that can be characterized as; bakery, cafeteria, barber shop, pharmacy, restaurant and supermarket we forecasted our electricity demand. Additionally, green area and industrial area were also the components of demand forecast. The demand forecast and calculation show that 126 kW power is needed to electrify our area of interest, this has been presented in details in chapter 4.1.1.

With respect to the electricity demand, we calculated the needed amount of electricity to be supplied by "District Energy Supply" and to cover also a small amount of future expansion of demand; we sized the electricity supply to 200 kW. The electricity will be supplied by the PV Power Plant mainly during the summer period, the fact that renewable energy resources are perceived as variable energy resources and in a system of complex energy supply only one renewable resource cannot be reliable, thus to cover the gap between the demand and supply of electricity in our system, CHP comes into play.

3.3 Employers

Employers built the backbone of every company. Reliable and motivated people enhance the quality of every company. Therefore, the company DES will set high requirements for their managing director.

The business model of DES requires a constant contact and information exchange with the stakeholders of the company. In the first phase of the project, the managing director is responsible for construction of the company's assets as planned. Furthermore, the managing director needs to be a reliable contact person for the customers. As the customer constitutes the only source of income of the company, they must be satisfied at any time. Hence, a good customer care is the key element of our company. If the customers have question during the time of construction, the employers of DES will be available to answer them appropriately. If there are uncertainties regarding the monitoring and energy bills, the employers of DES will clear them. If unforeseen events appear, the employers of DES will handle them.

Additionally, the contact to the company's partner is an essential task of the managing director. The partner of the companies is supplying companies as the gas supplier and the manufacturer of the CHP or the storage facilities. The assets are supposed to have

a long life-time. In case that an asset does not work as planned, the managing director is responsible that adjustments succeed.

As a result, DES will employ two managing directors who are responsible for the company to an equal share. However, the managing directors will split responsibilities. A managing director takes over the current projects and supervises them. The other managing director acquires new projects. Two employees are necessary, since in case of holiday or illness our customer need at least one contact person.

4 Calculations

4.1 Demand

In order to determine our plant capacity and design our energy supply system, we had to estimate the average energy demand of all our customers in the residential area. Therefore, rough calculations of power and heat demand have been conducted.

4.1.1 Power Demand

The power consumption calculations were based on load profile data of different customer categories provided from BDEW (Der *Bundesverband der Energie und Wasserwirtschaft* e.V.). These load profiles represent the pattern of electricity usage in 15 minutes intervals over a whole year period.
According to the BDEW, the following load profiles that characterize each customer category or class have been used.

	BDEW Profile
Households	H0
Production Companies	G1
Trade and Commerce	G4
Hotels and restaurants	G2

Table 1 - BDEW load profiles

For each customer category the total annual consumption has been calculated (see Table below).

	Load Factor (LF)	**Annual Consumption per unit (kWh/a)**	**Number of units**	**Total Annual Consumption (kWh/a)**
Household type 1	H0	4000	79	316000
Household type 2	H0	3000	4	12000
Bakery	G1	90000	1	90000
Super Market	G1	25000	1	25000
Restaurant	G2	50000	2	100000
Pharmacy	G4	20000	1	20000
Friseur	G4	10000	1	10000
Cafeteria	G4	20000	1	20000

Table 2 -Annual consumption

The next step was to interpolate the data given by the BDEW to calculate the electricity consumption and the power demand of all customers in all the 15 minutes intervals of one-year period.

The following table shows an excerpt from the calculation sheet.

Date	Time	H0	Electricity Consumption H0 (kWh)	G1	Electricity Consumption G1 (kWh)	G2	Electricity Consumption G2 (kWh)	G4	Electricity Consumption G4 (kWh)	Total Electricity Consumption (kWh)	Electricity Demand (kW)
1/1/2011	0:00:00	0.02718	8.92	0.00643	7.39	0.01843	1.84	0.01443	0.43	18.59	74.34
1/1/2011	0:15:00	0.02519	8.26	0.00625	0.72	0.01718	1.72	0.01410	0.42	11.12	44.49
1/1/2011	0:30:00	0.02329	7.64	0.00615	0.71	0.01590	1.59	0.01375	0.41	10.35	41.40
1/1/2011	0:45:00	0.02146	7.04	0.00615	0.71	0.01468	1.47	0.01350	0.41	9.62	38.48
1/1/2011	1:00:00	0.01969	6.46	0.00625	0.72	0.01360	1.36	0.01340	0.40	8.94	35.76
1/1/2011	1:15:00	0.01807	5.93	0.00640	0.74	0.01265	1.27	0.01340	0.40	8.33	33.32
1/1/2011	1:30:00	0.01664	5.46	0.00655	0.75	0.01180	1.18	0.01345	0.40	7.79	31.18
1/1/2011	1:45:00	0.01550	5.08	0.00663	0.76	0.01100	1.10	0.01350	0.41	7.35	29.41
1/1/2011	2:00:00	0.01469	4.82	0.00658	0.76	0.01025	1.03	0.01350	0.41	7.01	28.02
1/1/2011	2:15:00	0.01413	4.63	0.00643	0.74	0.00955	0.96	0.01343	0.40	6.73	26.93
1/1/2011	2:30:00	0.01372	4.50	0.00628	0.72	0.00898	0.90	0.01335	0.40	6.52	26.08
1/1/2011	2:45:00	0.01345	4.41	0.00615	0.71	0.00855	0.86	0.01328	0.40	6.37	25.49
1/1/2011	3:00:00	0.01317	4.32	0.00610	0.70	0.00833	0.83	0.01323	0.40	6.25	25.00
1/1/2011	3:15:00	0.01289	4.23	0.00613	0.70	0.00825	0.83	0.01318	0.40	6.15	24.61
1/1/2011	3:30:00	0.01264	4.15	0.00615	0.71	0.00828	0.83	0.01313	0.39	6.08	24.30
1/1/2011	3:45:00	0.01242	4.07	0.00615	0.71	0.00833	0.83	0.01305	0.39	6.01	24.02
1/1/2011	4:00:00	0.01221	4.00	0.00613	0.70	0.00833	0.83	0.01295	0.39	5.93	23.73
1/1/2011	4:15:00	0.01205	3.95	0.00608	0.70	0.00828	0.83	0.01290	0.39	5.87	23.47
1/1/2011	4:30:00	0.01196	3.92	0.00608	0.70	0.00813	0.81	0.01290	0.39	5.82	23.29
1/1/2011	4:45:00	0.01190	3.90	0.00615	0.71	0.00783	0.78	0.01305	0.39	5.78	23.14
1/1/2011	5:00:00	0.01190	3.90	0.00635	0.73	0.00743	0.74	0.01335	0.40	5.78	23.11
1/1/2011	5:15:00	0.01192	3.91	0.00663	0.76	0.00713	0.71	0.01380	0.41	5.80	23.20
1/1/2011	5:30:00	0.01202	3.94	0.00690	0.79	0.00725	0.73	0.01430	0.43	5.89	23.56

total demand | monthly demand curves | January | February | March | April | May | June | July | August | September | October

Table 3 – Electricity demand calculations

Results:

The average electricity consumption is about **65.47 kW** with an annual demand of **573.54 MWh.**

The power demand curve of our residential area varies between **126.6 kW** at a January morning and **18.79 kW** on a September afternoon.

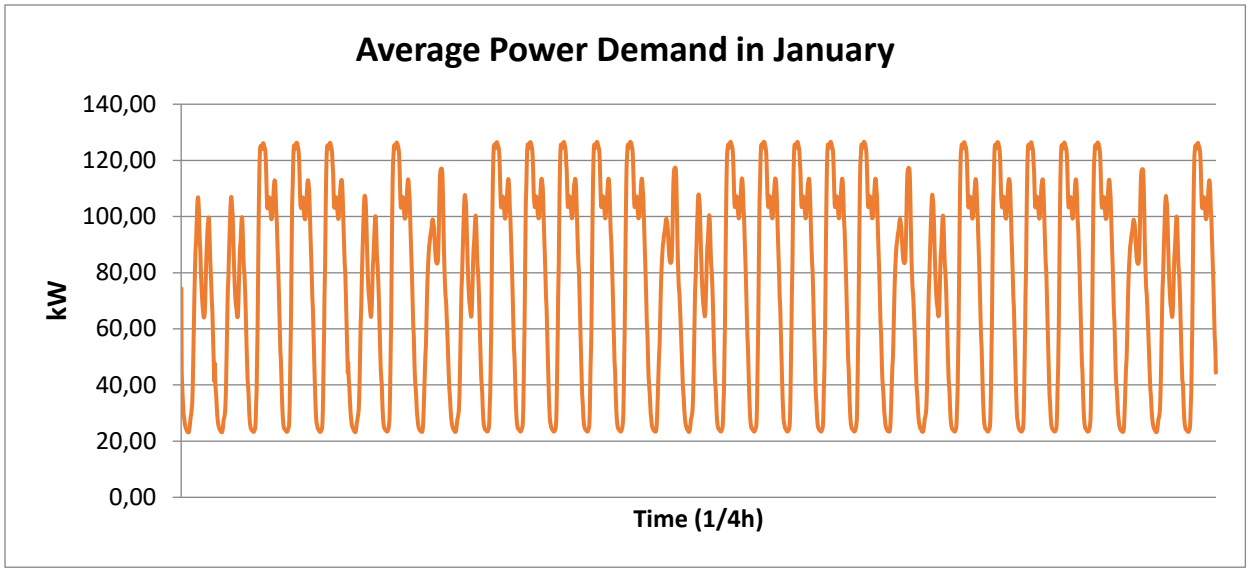

Figure 5 - Average Power Demand January

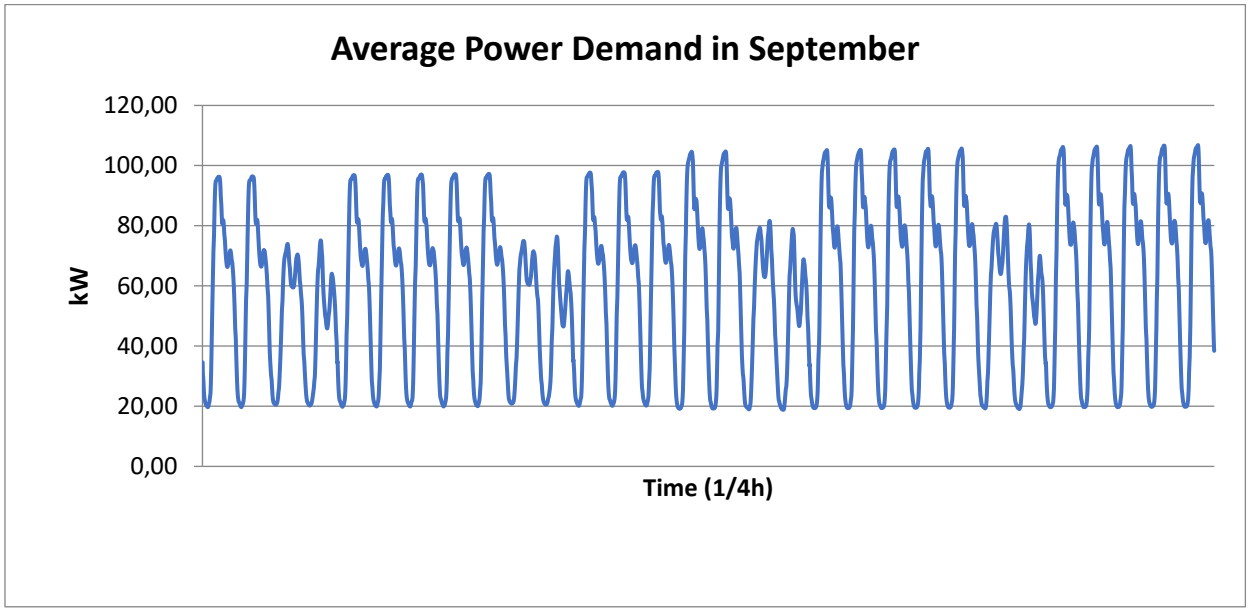

Figure 6 - Average Power Demand September

4.1.2 Heat Demand

The heating load data was taken from the "Entranze Project" report[1] which provides an overview of the energy needs for heating, cooling and DHW for several building types, located in different European climatic contexts [5].

The following tables show an excerpt from the calculation sheet.

	Single House (105m²)							
	Heat Demand/unit (kWh/m²)	n° of units	Total Heat demand (kWh/m²)	Total Heat demand (kWh)		Total Heat Energy demand (kWh)	hours/ month	Total Heat demand (kW)
January	33.4	4	133.6	14,028	January	757,722	744	1,018
February	30.0		120.0	12,600	February	483,588	672	720
March	21.2		84.8	8,904	March	338,240	744	455
April	9.5		38.0	3,990	April	163,221	720	227
May	3.2		12.8	1,344	May	60,983	744	82
June	0.0		0.0	0	June	8,676	720	12
July	0.0		0.0	0	July	8,538	744	11
August	0.0		0.0	0	August	7,700	744	10
September	2.2		8.8	924	September	33,903	720	47
October	11.4		45.6	4,788	October	170,151	744	229
November	24.9		99.6	10,458	November	385,224	720	535
December	32.9		131.6	13,818	December	509,368	744	685
Annual	168.7		674.8	70,854	Annual	1,822,976	8,760	4,031

Table 4 – Heat Demand Calculation

The average heat consumption is **336 kW** with an annual heat demand of **1.8 GWh.**

The heat demand curve of our residential area varies between **1,018kW** in January and **10 kW** in August.

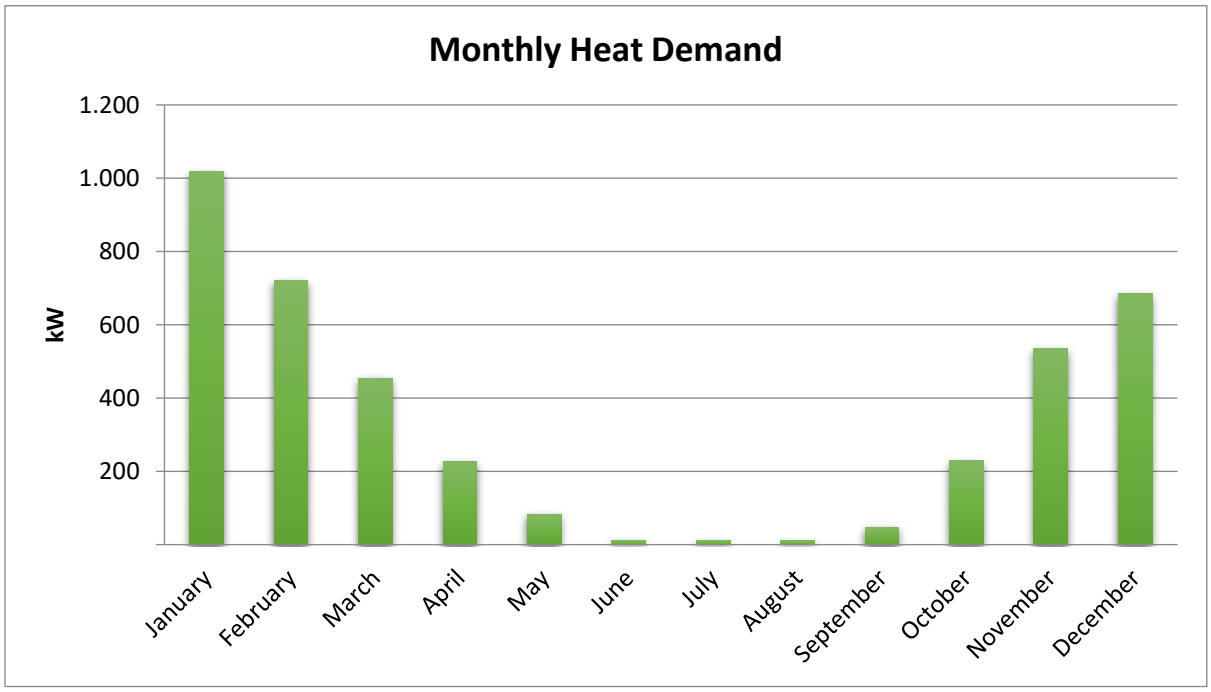

Figure 7 - Monthly Heat Demand

4.2 Supply

As mentioned before, the district is run mainly by PV generation system for the main energy supply with a CHP backup unit that also provide heat supply and a battery unit for energy storage. The generation profiles of the PV system and the CHP unit vary depending on consumption and also the season of the year. For example, during the season of winter in the month of January, the irradiation of the sun is very low which result in low generation values by the PV system. Figure 8 shows that the maximum energy generated by the PV system is almost 55 KW per day, which is much lower than the maximum average demand which is estimated to 126 KW. On the other hand, the CHP power supply characteristic shows higher contribution (120 to 127 KW) as shown in Figure 9 to back up the lack of power supply from the PV system during January.

Due to the low generation value of the PV system, all the energy produced is consumed giving no chance to the battery to store energy. Hence, the battery storage during January is almost zero.

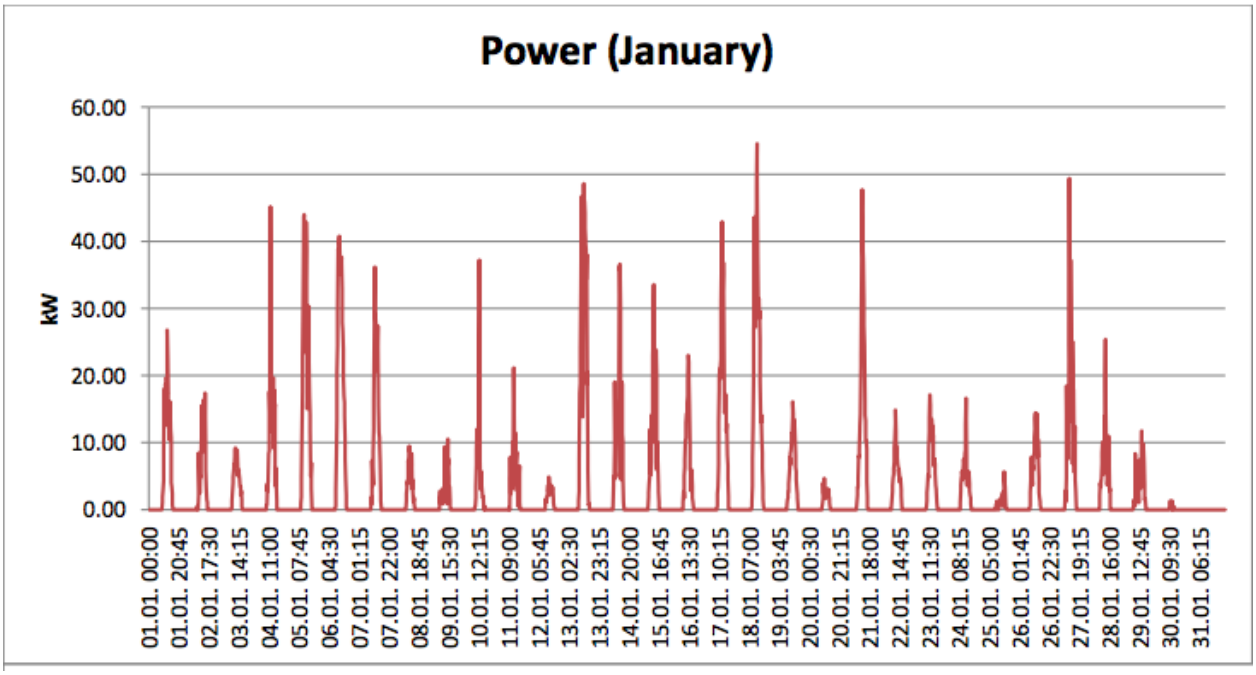

Figure 8 - PV system generation profile during January (Winter season)

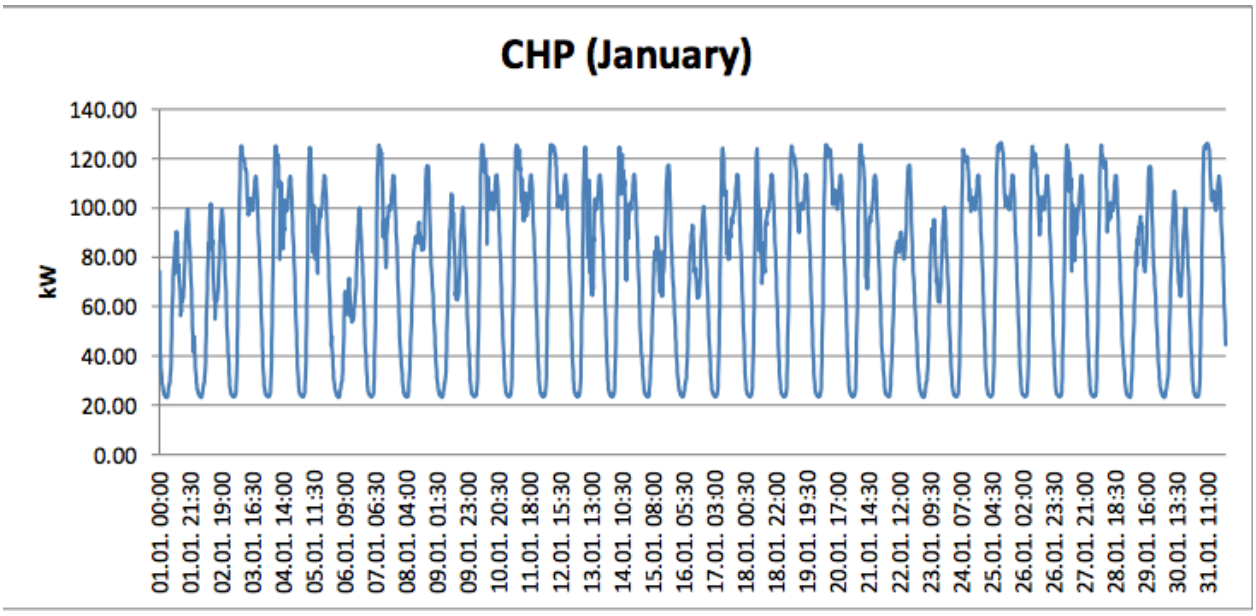

Figure 9 - CHP generation profile during January (Winter season)

On the other hand, during the summer season the load profile for PV system, CHP unit and the battery system is totally different. The increased period of sunshine during July amplifies the generation of the PV system reaching to values nearly to 145 kW during the day as shown in figure 10.

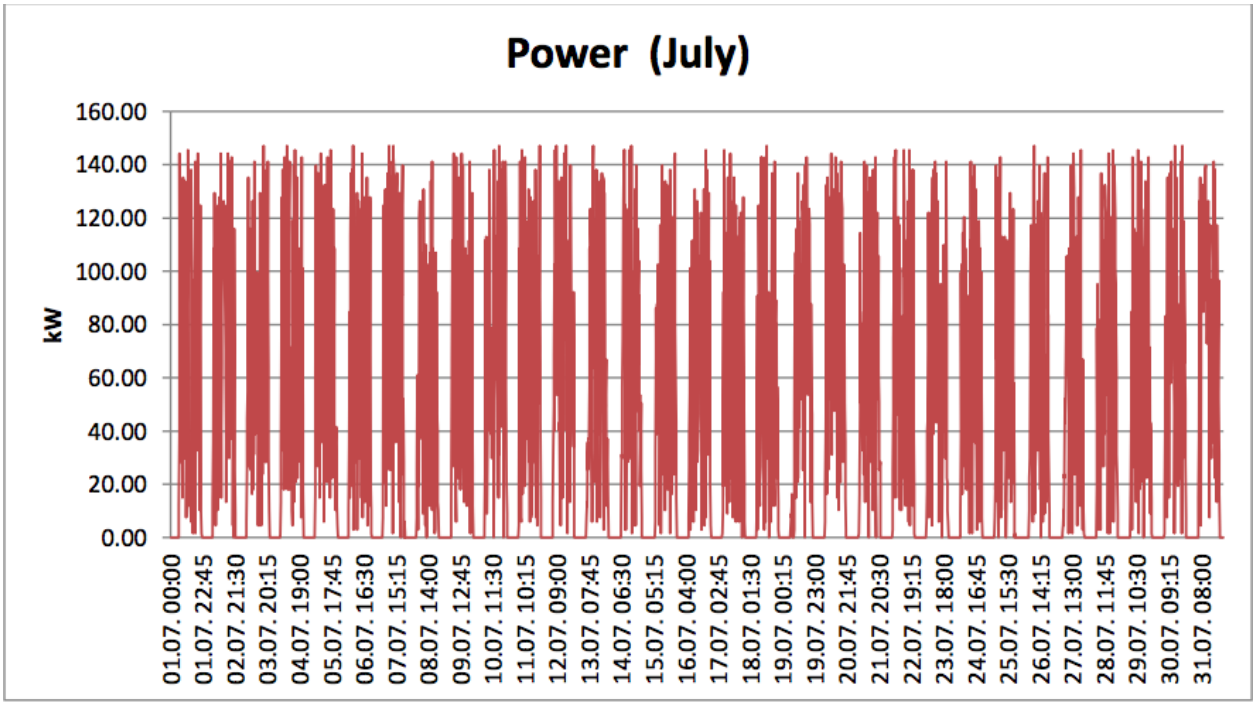

Figure 10 - PV system generation profile during July (Summer season)

Hence, the battery system is more active in terms of energy storage due to the excess generated power by the PV system, where the battery system reaches a high value of nearly 400 kWh per day during July as shown in figure 11. As a result, the CHP unit share of supply decrease during July reaching values around 90 kW per day as shown in figure 5.

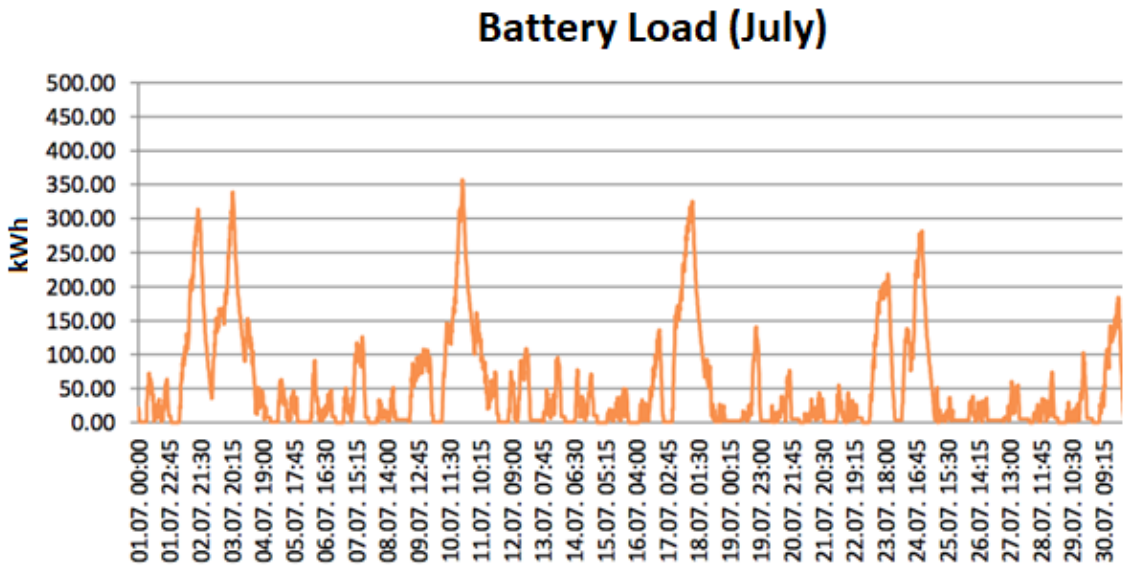

Figure 11 - Battery system load profile during July (Summer season)

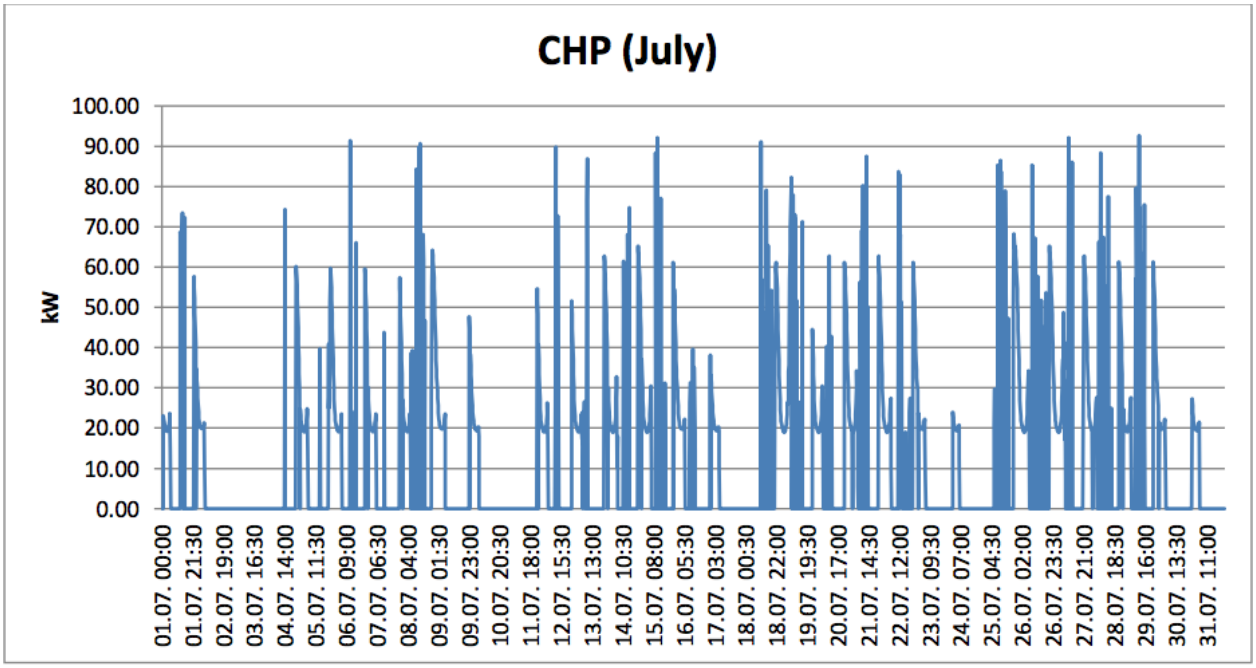

Figure 12 - CHP unit generation profile during July (Summer season)

5 Costs

5.1 Costs at project start

At the beginning of the project, the majority of the cost appears. The company DES needs to purchase all of the assets at project start to secure a reliable operation. The CHP power plant will be bought the product VITOBLOC 200 from the company Viessmann, which is known for their high-quality standards and reliability. According to [6], the cost for an installed power of one kW electric is 1000€. Since the product has a power of 140 kW, we assume a purchase price of 140,000€. The CHP does not only produce electricity, it produces heat as well. This heat must be stored so our company gains temporal flexibility in supplying our customers. We assumed that a capacity of 40,000 kWh is sufficient. This capacity can be storage in an area of 1000 cubic meters. The price for one cubic meter of storage capacity is estimated with a value of 150 €. Hence, the total price for Heat Storage accounts 150,000 €.

Since the electricity generation from PV appears in large amounts in the summer period, our company needs large storage facilities in order to store the overproduction of the PV power plant. In our calculations of the load profiles we found out that a battery storage capacity of 400 kWh is necessary. According to a research group of RWTH Aachen, we can assume a price of 500 € per kWh for large scale storage facilities. This results in a total price of 200,000 € for Battery Storage.

The CHP power plant, battery and heat storage require an area to locate them on. The purchase of an area close to our consumer has the advantage that our company is visible for the costumers and the assets are in a short distance to the grids. Therefore, our company purchases an area in the new residential area. An area of 500 m^2 is sufficient for the assets. One square-meter land costs 110 € in the municipality of Niestetal [7]. Hence, at project start costs of 55,000 € for the purchase of an area appear.

The Heat Distribution grid has the piping of 65 mm diameter. According to this the initial investment cost accounts to 442 €/m, including the Trench cost in an open field. Additionally, the average length of Transmission and consumers Cables is 1974.42 meters. Therefore, the initial cost for the piping accounts to 474,893.63 € [8]. The Low voltage DC grid is conducted by underground cables (LVDC U/G). According to [9], the initial installation cost accounts for 41 €/m, which results in roughly 44,050€.

5.2 *Costs during project*

During the time of operation energy cost for the purchase of electricity and gas for the CHP arise. Furthermore, the operation and maintenance cost for the assets need to be covered as well. The cost for the PV and CHP power plant change within the periods of a year. During the winter period, where is almost no electricity generation from the PV power plant, the CHP power operates at its maximum. As the CHP power plants produces besides electricity also heat, we can cover the demand of our customers. However, in the summer period when the heat demand is relatively low, the share of the PV power plant in the electricity generation is higher.

As mentioned above, we assume that the annual electricity generation from the PV power plants of 238,182 kWh is constant over the duration of the project. The purchase price of a kWh from the PV power plant is estimated with a value of 0.07 €, which was yield at the current PV tender [10]. This results in an annual purchase price of 16,113 € for electricity generated from PV Figure 12 shows that the majority of the costs appear in the summer period when the daily sunshine hours reach its maximum.

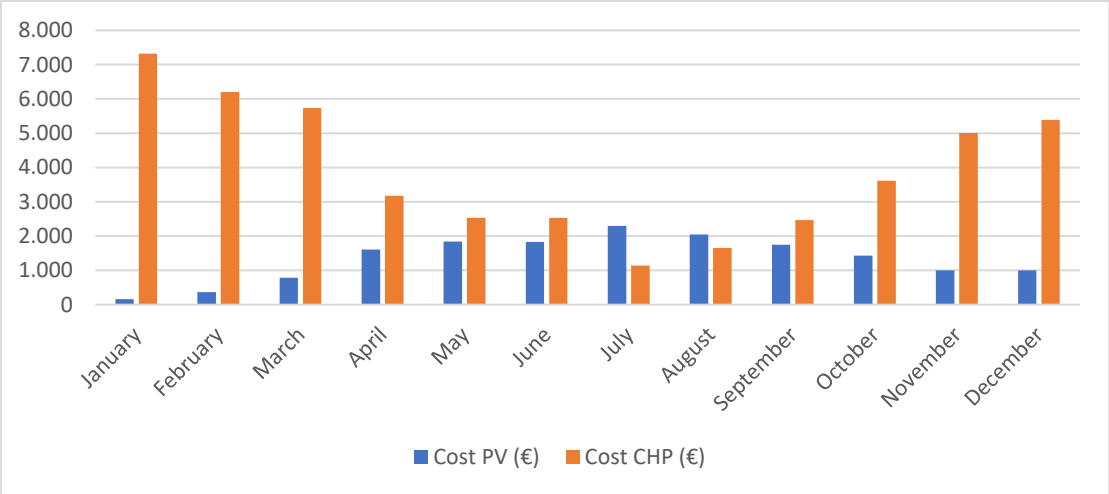

Figure 13 - Monthly Cost of PV and CHP

The annual electricity generation of the CHP power plant is 341,910 kWh. After taking the efficiency of the CHP (35%) into consideration, we reach an annual gas demand 976,886 kWh. According to the statistic institute 'Statista', the average cost for industrial customers for a kWh is 4.72 €Cent [11]. Hence, DES must purchase gas for 46,769 €.

In order to facilitate an adequate operation and maintenance of the assets we calculate annual cost of 15,977 €. For every kWh of electricity, the CHP produces roughly 1.5 kWh of heat. According to [12], the operation and maintenance cost for a CHP accounts

2 €Cent per kWh produced. As a result, operation and maintenance for the district heating grid costs 10,257 € per year. For the electricity grid we calculate the costs for operation and maintenance with 1 €Cent per kWh produced. This resulted in annual cost of 5,720 €.

As mentioned in chapter 11.2, we assume an annual payment of our managing directors of 40,000 €. On top of the payment, our company has to pay its share of social insurance costs. Since we employ 2 directors, our annual personal costs are estimated with the value of 93,320 € per year.

According to the depreciation rate of different items .According to the depreciation rate of different items .The annual cost was calculated ,using the following values in this table.

	Asset	Depreciationrate in years	Depreciation rate in years (%)
1.1	Electrical Grid	10	10%
1.2	District Heating Grid	10	10%
1.3	Combined heat and power plants (combined heat and power plants)	10	10%
1.4	Battery Storage	15	7%
1.5	Heat Storage	15	7%

Table 5 - Depreciation cost per asset [13]

Combined heat and power plant were assumed earlier to cost 140,000€ with a distribution of 10% of it being paid annually ,as shown in the figure .So that 14,000€ is to be paid annually for 10 years.

The cost of the electrical grid and the heating grid are 44,050€ ,and 474,900€ respectively to be paid both on annual basis with a 10% per annum as wellMeans, 4,405€ and 47,490€ per grid.

	Annual Cost	**Total Cost**	**Time**
Electrical Grid	4,405.00€	44,050.00€	**10**
District Heating Grid	47,490.00€	474,900.00€	**10**
Combined Heat Power Plant	14,000.00€	140,000.00€	**10**
Battery Storage	26,666.67€	400,000.00€	**15**
Heat Storage	10,000.00€	150,000.00€	**15**

Table 6 - Deprecation cost for assets of DES

The battery storage has got a different depreciation rate of 7% per year, which means 15 years are needed instead. Therefore, the total cost of 400,000€ it to be paid at a rate of 26,666.67€ per year . Heat storage with a total cost of 150,000€ could not be found in the ministry of finance documents but it was assumed just like the battery storage with a 7% rate to make an annual payment of 10,000€.

6 Revenues

6.1 Revenues at project start

At the time of the project start the customers will pay a connection fee to the electricity and district heating grid. This fee is expected to cover partly the expenses of the construction of the grids. The amount will be 3000 € for each grid. After the deduction of VAT, we receive 2521 € per grid connection. Since we have 2 grids and 58 connected customers, the revenue at project start accounts 292,436€.

6.2 Revenues during project

The main source of income will be monthly revenue streams. The customers of our company will pay a monthly tariff for electricity and heat. The electricity tariff accounts 28 €Cents per kilowatt-hour (kWh), which is still 2 €Cents below the German average of 30 €Cents. After taking the VAT into account, we receive 23.53 €Cents per kWh. The monthly revenues, displayed in figure 14, are in the winter period slightly higher than in the summer period. The total annual revenue from the supply of electricity is 134,953.93 €.

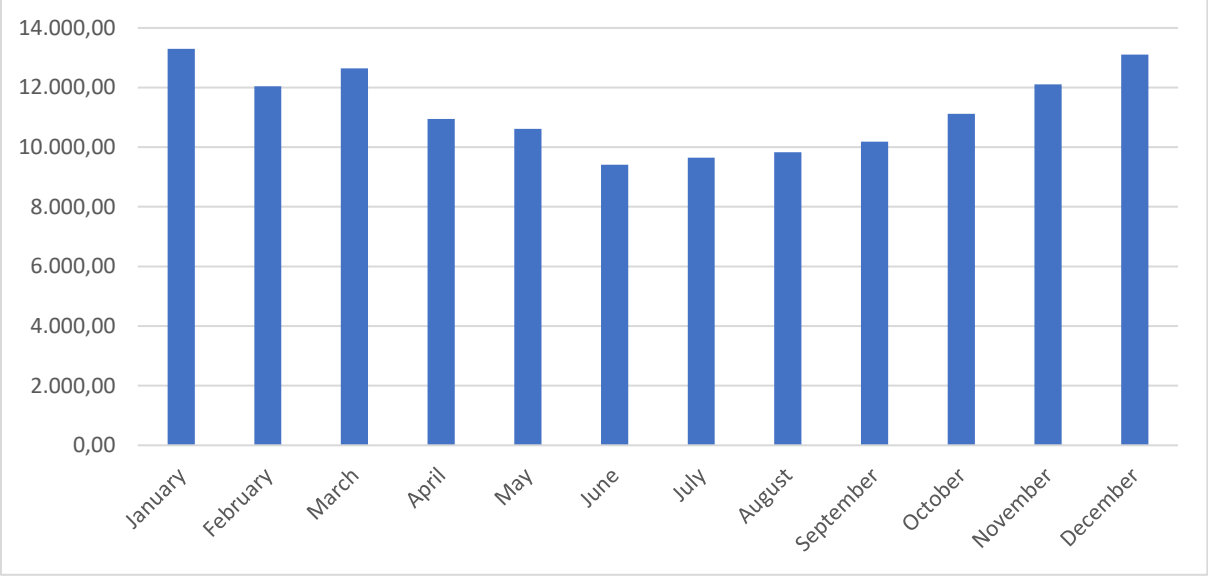

Figure 14 - Income from electricity supply

The supply of heat will cost our costumers 8 €Cents per kWh. As the German average cost for heat supply accounts 10 €Cents per kWh, our customers save also 2€Cents. After deducting VAT, we receive 6.72 €Cent per kWh. As a result, the annual revenue stream from heat supply accounts 196,774 €. Figure 15 shows that the main revenue is generated in the winter period. In conclusion, our total annual revenue is 331,727.93 €.

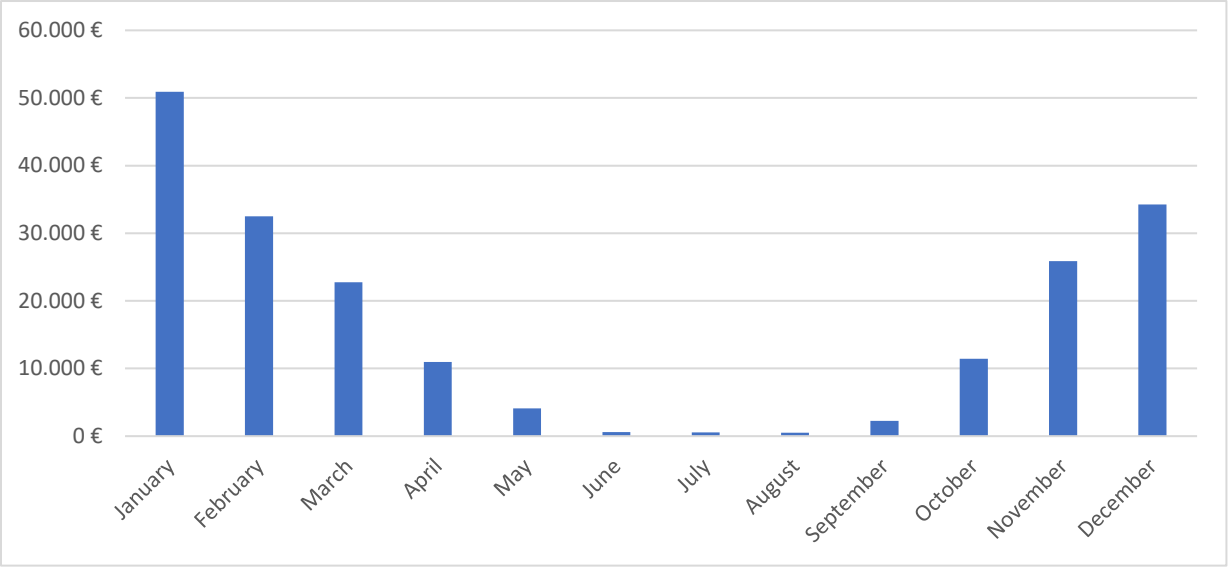

Figure 15 - Income from heat supply

7 Financial Model

DES GmbH can be characterized as high initial Capital Incentive Company. Therefore, we must first identify the financing structure that we will use, as the initial funds will not be integrated 100% by us. The proposed financial structure is **10% Equity capital**, **30% Venture fund** and **60% Bank loan**. In the following paragraphs there is a detailed analysis of the bank loan and the venture fund as well. From our part, the equity capital could reach the amount of **58,905 €**. As soon as these financial forms are being collected and agreed the implementation of our company can get started. Additionally, in the following table the exact parameters of the total investment are illustrated:

Electrical Grid	44,050 €
District Heating Grid	474 900 €
Area	55,000 €
CHP	140,000 €
Battery	200,000 €
Heat Storage	150,000 €
Total Cost	**589,050 €**
Bank Loan (60%)	353,430.00 €
Own Equity (10%)	58,905.00 €
Venture Funding (30%)	176,715.00 €

Table 7 - Financing Model

8.1 KfW – Program for Renewable Energies – Standard

Firstly, the bank loan can be taken by the KfW Bank, which offers an attractive program especially for renewable energy new installations. The exact name of it is "KfW – ProgrammErneuerbareEnergien – Standard" which enables low-interest rate financing of projects regarding the use of RE for power generation, CHP systems and RE integration into the energy system. Suitable applicants for that program are domestic and foreign private and public companies, public-law corporations, municipal special-purpose associations, public-law institutions with their own legal personality, natural persons, associations, cooperatives and foundations with legal capacity. Construction, expansion and acquisition of plants that meet the requirements of the act for the Development of RE (ErneuerbareEnergienGesetz – EEG 2017) can be included into this incentive measures.

Thoroughly, the KfW Bank can subsidize projects up to 50million Euros and classifies the projects under a specific risk which is initially identified. Due to our environmental friendly project, which combines not only the use of renewable energy technologies but also the increased efficiency of the energy system and therefore its relief in peak and demanding hours, we assume that DES could be classified in the category D. This practically means, that we must pay the interest rate of 2.47%, 2.93%, 3.75% or 4.22% for the respectively repayment periods of 5, 10, 15 or 20 years. It is worth mentioned that for the 5 years repayment period the 1st year is interest free, for the 10 years period the first 2 years are interest free and for the other 2 periods the 3 years are interest free. Under these conditions and regulations, the constructed table exhibits the exact interest costs for the 20 years' period.

Year	Balance of debt (€)	Interest Rate (%)	Interest Costs (€)	Refunding Bank Loan (€)
1	353,430.00	0.00	0.00	17,671.50
2	335,758.50	0.00	0.00	17,671.50
3	318,087.00	0.00	0.00	17,671.50
4	300,415.50	4.22	12,677.53	17,671.50
5	282,744.00	4.22	11,931.80	17,671.50
6	265,072.50	4.22	11,186.06	17,671.50
7	247,401.00	4.22	10,440.32	17,671.50
8	229,729.50	4.22	9,694.58	17,671.50
9	212,058.00	4.22	8,948.85	17,671.50
10	194,386.50	4.22	8,203.11	17,671.50
11	176,715.00	4.22	7,457.37	17,671.50
12	159,043.50	4.22	6,711.64	17,671.50
13	141,372.00	4.22	5,965.90	17,671.50
14	123,700.50	4.22	5,220.16	17,671.50
15	106,029.00	4.22	4,474.42	17,671.50
16	88,357.50	4.22	3,728.69	17,671.50
17	70,686.00	4.22	2,982.95	17,671.50
18	53,014.50	4.22	2,237.21	17,671.50
19	35,343.00	4.22	1,491.47	17,671.50
20	17,671.50	4.22	745.74	17,671.50
Sum Interest			114,097.81	
Sum Repayment				353,430.00

Table 8 - Interest Costs for the 20years' period

8.2 Venture Funds

Secondly, the Venture capital funds are investment funds that manage the money of investors who seek private equity stakes in Startup and small- to medium-sized enterprises with strong growth potential. These investments are generally characterized as high-risk/high-return opportunities. Venture capital is a type of equity financing that gives entrepreneurial or other small companies the ability to raise funding. Venture capital funds are private equity investment vehicles that seek to invest in firms that have high-risk/high-return profiles, based on a company's size, assets and stage of product development. Venture capital funds have portfolio returns that resemble a barbell approach to investing. Many of these funds make small bets on a wide variety of young Startups, believing that at least one will achieve high growth and reward the fund with a comparatively large pay-out at the end. This allows the fund to mitigate the risk that some investments will fold. To conclude with, the given shares to the future shareholders account for **49%** of the total company's shares and their credit value is **176,715 €**.

9 Balance Sheets

After collecting all of the cost and revenues we created a balance sheet for our project. The profit before tax consist of a deduction of the total cost from the total revenue. We assumed a tax for our company of 40%. After that we receive the profit after taxes. The net profit and the depreciation cost build the annual cash flow. After deducting the repayment of the credit, we get the annual dividend.

As shown in table 9, the revenue in the first year is extraordinary high, since the company receives the payment for grid connection. The financing cost start to appear in year 2021. Furthermore, the depreciation are constant during the first 10 years.

	2018	2019	2020	2021
Cost	274.740,67	274.740,67	274.740,67	287.418,20
Depreciation Costs	102.561,67	102.561,67	102.561,67	102.561,67
Labour Costs	93.320,00	93.320,00	93.320,00	93.320,00
Consumption Costs	62.882,00	62.882,00	62.882,00	62.882,00
Operation and Maintenance	15.977,00	15.977,00	15.977,00	15.977,00
Financing Costs	0,00	0,00	0,00	12.677,53
Revenue	624.163,93	331.727,93	331.727,93	331.727,93
Connection Fee	292.436,00	0,00	0,00	0,00
Electricity Supply	134.953,93	134.953,93	134.953,93	134.953,93
Heat Supply	196.774,00	196.774,00	196.774,00	196.774,00
Profit before tax	349.423,26	56.987,26	56.987,26	44.309,73
Taxes (40%)	139.769,31	22.794,91	22.794,91	17.723,89
Profit after taxes	209.653,96	34.192,36	34.192,36	26.585,84
Cash-flow (net profit + deduction)	312.215,62	136.754,02	136.754,02	129.147,51
Repayment credit	17.671,50	17.671,50	17.671,50	17.671,50
Re-investing				
Dividend	294.544,12	119.082,52	119.082,52	111.476,01

Table 9 - Balance sheet for the years 2018 – 2021

Table 10 displays the balance sheet of the period 2027-2029. In year 2028 we assume a re-investing of the CHP power plant of 140,000€ which will lower the dividend. As a result, we have a negative dividend. Furthermore, you can notice a reduction of the depreciation cost of almost 50%. This results in an increase of the tax payments. In year 2029, the dividend is lower than in 2027 since the depreciation cost are added to the dividend and higher tax payments than in the previous years.

	2027	2028	2029
Cost	282.943,78	230.303,04	229.557,31
Depreciation Costs	102.561,67	50.666,67	50.666,67
Labour Costs	93.320,00	93.320,00	93.320,00
Consumption Costs	62.882,00	62.882,00	62.882,00
Operation and Maintenance	15.977,00	15.977,00	15.977,00
Financing Costs	8.203,11	7.457,37	6.711,64
Revenue	331.727,93	331.727,93	331.727,93
Connection Fee	0,00	0,00	0,00
Electricity Supply	134.953,93	134.953,93	134.953,93
Heat Supply	196.774,00	196.774,00	196.774,00
Profit before tax	48.784,15	101.424,89	102.170,62
Taxes (40%)	19.513,66	40.569,96	40.868,25
Profit after taxes	29.270,49	60.854,94	61.302,37
Cash-flow (net profit + deduction)	131.832,16	111.521,60	111.969,04
Repayment credit	17.671,50	17.671,50	17.671,50
Re-investing		140.000,00	
Dividend	114.160,66	-46.149,90	94.297,54

Table 10 - Balance sheet for the years 2027 - 2029

Table 11 shows the period of 2033-2037. After the deduction period of the battery storage finished, we assumed to purchase a new battery storage. Therefore, the re-investment appeared in year 2033. Again, it resulted in a negative dividend. Furthermore, the costs decrease since the financing cost decrease within every year.

	2033	2034	2035	2036	2037
Cost	216.574,36	215.828,62	215.082,88	214.337,14	213.591,41
Depreciation Costs	40.666,67	40.666,67	40.666,67	40.666,67	40.666,67
Labour Costs	93.320,00	93.320,00	93.320,00	93.320,00	93.320,00
Consumption Costs	62.882,00	62.882,00	62.882,00	62.882,00	62.882,00
Operation and Maintenance	15.977,00	15.977,00	15.977,00	15.977,00	15.977,00
Financing Costs	3.728,69	2.982,95	2.237,21	1.491,47	745,74
Revenue	331.727,93	331.727,93	331.727,93	331.727,93	331.727,93
Connection Fee	0,00	0,00	0,00	0,00	0,00
Electricity Supply	134.953,93	134.953,93	134.953,93	134.953,93	134.953,93
Heat Supply	196.774,00	196.774,00	196.774,00	196.774,00	196.774,00
Profit before tax	115.153,57	115.899,31	116.645,05	117.390,79	118.136,52
Taxes (40%)	46.061,43	46.359,73	46.658,02	46.956,32	47.254,61
Profit after taxes	69.092,14	69.539,59	69.987,03	70.434,48	70.881,91
Cash-flow (net profit + deduction)	109.758,81	110.206,25	110.653,70	111.101,14	111.548,58
Repayment credit	17.671,50	17.671,50	17.671,50	17.671,50	17.671,50
Re-investing	400.000,00				
Dividend	-307.912,69	92.534,75	92.982,20	93.429,64	93.877,08

Table 11 - Balance sheet for the years 2018 – 2021

In the following graph the return of investment is illustrated. It can be seen, that the dividend of the 1st year (295,544.1 €) is already higher than our equity, which accounts to 235,620 €. Therefore, the return of investment happens in the first year of operation. As a result, we can say that our companies first project is highly profitable.

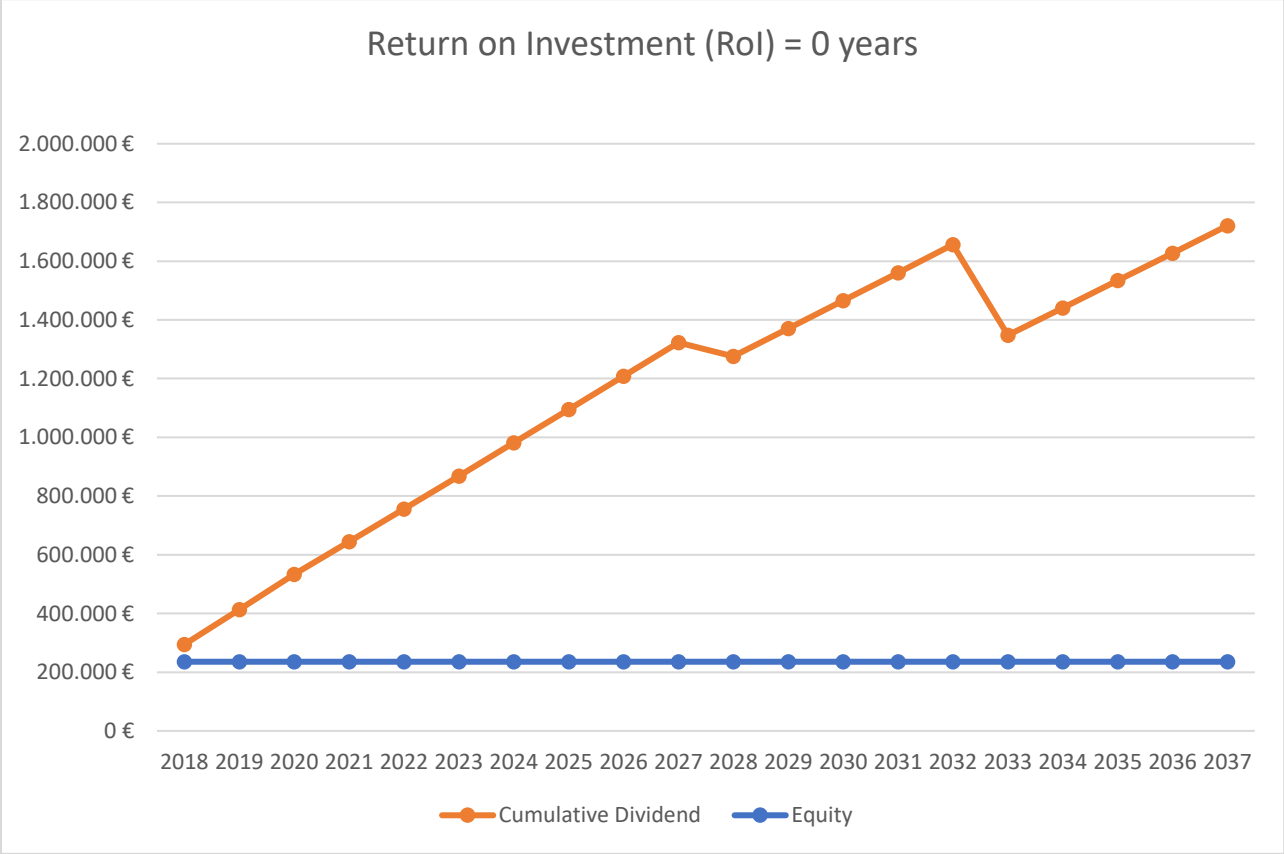

Figure 16 - Return on Investment

10 Association

10.1 Description and legal characteristics

DES is a GmbH firm which is responsible for the construction and operation of supply system of electrical power and heating to a compound in Niestetal, Germany. The GmbH legal form is the most suitable form for sitting up the company due to many reasons such as the separate legal entity with limited liability where the shareholders' liability is limited to the amount of their original investment, shareholders are not responsible for the company's debts, protecting their personal assets in the event that the company becomes insolvent, the relatively small number of shareholders, flexibility with the overall plan in terms of finance, management structure, legal acts and conditions and liability regime.

10.2 Formation

- Number of shareholders is 2, and supervisory board is to be established due to the venture fund
- A notarized agreement between shareholders is to be established as well as the venture fund
- The company must be commercially registered
- The company's articles of association (Gesellschaftsvertrag) include the characteristics of the particular GmbH such as its organisation (the name and registered office of the company, the object of the enterprise and the amount of the registered share capital) and the relationship between the company and its shareholders
- Company name is District Power Supply GmbH (DES)
- Share capital, 10% Equity Capital, 30% Venture Fund and 60% Bank loan
- Any shareholder can hold any number of shares.
- Shareholders List.
- Shareholders can contribute in the capital share in cash or in kind (non-cash such as asset, know how, membership rights or even a goodwill)

10.3 Management Structure and Organization

A Supervisory board is to be established with a CEO/Director (German or otherwise). The supervisory board members (all shareholders including the venture fund representatives) are responsible for the management of the company, for internal decision making within the company and for managing the business, including hiring, management and supervision of the employees.

10.4 Shareholder's rights

The supervisory board members are granted the rights of participation in decision making process and have the right access the information and to inspect the business accounts.

10.5 Liability Regime

Shareholders are not personally liable for the obligations of the company, but they are obliged to pay their contribution in the capital share (money or in kind).

11 Social Insurances and Employees Salary

11.1 Social Insurances

The German social insurance provides a comprehensive protection from the unexpected changes of life. It is based on what that is so-called the principle of solidarity. According to this system, every insured person has to make cooperation towards financing social insurance depending on his financial ability [14]. Basically, social insurance is categorized based on five pillars which are as follows:

- Health insurance
- Long-term care insurance
- Pension insurance
- Unemployment insurance
- Accident insurance

Health insurance

Contributions to health insurance include two main parts. Employers and employees each pay half of the amount which is decided by law. As an employee people are either compulsorily insured or a voluntary member. Employees whose salary regularly exceeds a certain threshold are no longer coercively insured, but become a voluntary member of the health insurance company or change to a private health insurance company. The employer is not required to withhold cooperation for health insurance and long-term care insurance from voluntarily insured persons and pay them to the health insurance company, but he normally does [14].

Long-term care insurance

An independent branch of social insurance was developed to cover the risk of demanding long-term nursing assistance, namely long-term care insurance. According to the German social insurance policy anyone can become in need of long-term nursing care. It happens when people need nursing care for a long-term under a sustained condition. Employees and employers have to pay half of contributions each [14].

Pension insurance

After the employee has retired from active working life, pension insurance provides for a relatively secure retirement financially. In spite of it, a private pension plan is urgently suggested in addition to the state pension system in order to prepare a given standard of living during old age. Pensions are not only paid out during old age, but also in

certain cases of decreased earning capacity or after the death of the family member who meet the family's source of income [14].

Unemployment insurance

Based on the German social insurance policy, unemployed persons who lose their job can receive unemployment benefits for a limited time. The unemployment insurance is aimed to support unemployment through the basic and advanced training, employment-creation measures, retraining and jobs services [14].

Accident insurance

Accident insurance provides financial assistance for accidents that happen during work or occupational training. Moreover, benefits are also granted for commuting accidents and occupational sickness. This type of insurance is the only one to be financed totally by the employer [14].

11.1.1 Requirements for obligatory health insurance

In Germany, all employees must be insured by obligatory health **insurance.** However, some employees are excluded from obligatory health insurance which is as follows:

- **People** whose annual payment exceeds the annual earnings **limit.** The limit is adjusted every year which is equal to **57,600 Euros** in **2017**.
- **People who have mini-job and their** monthly earnings are equal **450 Euros or their** employment period is limited in advance to a maximum of **2 months**.
- People who are full time self-employed
- People who become insurable after the age of 55.
- Judges, Civil servants and professional soldiers

These groups of employees can choose a **voluntary** insurance in a statutory health insurance fund or select a private **health** insurance.

The health insurance contribution for employees is calculated based on **the gross wage**. In this regard, a distinction is made between a **general** and a **declined contribution rate** that is carried out approximately equally by the **employee** and the **employer**. Until 2014, both employee and employer contribution rates were the

same across all funds. From 2015, the **contribution** reform lowered the contribution rates [14]. Table 12 indicates the percentage of the general contribution rate.

	2014	**from 2015**
General contribution rate	15.5%	14.6%
Employee's share	8.2%	7.3%
Employer's share	7.3%	7.3%

Table 12 - The contribution share of health insurance [15]

The income of an employee is only liable to contributions up to the income threshold which is determined every year. In **2017**, the monthly rate is defined **4,350 Euros [15]**.

In 2011, the general contribution rate for unemployment insurance increased to 3.0% and this sentence also applies to 2017. Contribution is calculated from gross salary and paid 50 per cent each by employer and employee [16]. In case of pension insurance, the contribution rate is currently 15.7%. This is calculated from the general statutory contribution rate of 14.6 percent and the additional cash contribution of 1.1 percent. Contributions are calculated from gross salary and paid fifty per cent each by employer and employee [16]. The percentage contribution share of unemployment and pension insurance is shown in table 13.

Social health insurance	**The contribution rate**
Unemployment insurance	General contribution rate : 3.00% Employee's share: 1.50% Employer's share: 1.50%
Pension insurance	General contribution rate : 15.70% Employee's share: 7.85% Employer's share: 7.85%

Table 13 - The contribution shares of unemployment and pension insurances in 2017 [15]

11.2 People Employed

In order to manage the tasks properly, the company is planned to hire two full-time managing directors. Each of the directors receives a yearly salary of 40,000 €. However, each director costs the company 46,660 € since the company has to pay its contribution to the health, unemployment and pension insurance.

Salary per year		40.000
Insurances		
Health	7,30%	2.920
Unemployment	1,50%	600
Pension	7,85%	3.140
	Total Cost	46.660

Table 14 - Employers payment

The employees receive a yearly salary of 40,000 € which is equal to a monthly salary of 3333.33 €. However, this brut value does not consider the deductions yet. As mentioned before, an employee needs to pay retirement, unemployment and health insurance. Furthermore, a solidarity surcharge of 5.5 % exists in Germany. The income taxes vary between different employees. Here, the personal situation of the employee matters. In our case we assumed an income tax of 30%. As shown in table 15, the net salary of the managing director accounts 1,595 € per month.

	Agreed salary brut	3.333,33
	Deduction:	
Retirement pay	7,85%	261,67
Unemployment insurance	1,50%	50,00
Health insurance	7,30%	243,33
Income taxes	30,00%	1.000,00
Solidarity surcharge	5,50%	183,33
	Salary net	**1.595,00**

Table 15 - Monthly salary employee

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Attachment

Example of an employments contract with the managing director

Contract of Employment

Between

District Energy Supply GmbH

Represented by its shareholders' meeting

and

Its Managing Director

On this day written below, the following contract has been entered into between District Energy Supply GmbH, hereafter referred to as the Company, and Janis Kaltschnee. This contract governs the legal relationships between the company and the managing director.

§ 1 Management and Representation Authority

1. The managing director represents the company in and out of court.

2. The managing director conducts the business of the company in accordance with the law, the partnership agreement of the GmbH, the respective valid rules of procedure and this contract of employment. He must follow the instructions of the shareholders' meeting.

3. The company may appoint additional managing directors.

§ 2 transactions subject toapproval

1. The authority of the managing director includes the execution of all measures that the ordinary business of the company entails.

2. For further measures, the managing director requires the prior consent of the shareholders' meeting, in particular in the cases governed by the articles of association.

§ 3 self-contracting

The managing director is released from the restrictions of § 181 BGB.

Note: According to § 181 BGB. The managing director cannot conclude a legal transaction with himself on behalf of the company, unless the legal transaction consists solely in the fulfillment of a liability or is legally advantageous for the GmbH. If the shareholder agreement provides for the exemption from the restrictions of § 181 BGB, this should also be included in the employment contract.

§ 4 Duties and responsibilities

1. The managing director shall conduct the business of the company with the due care of a prudent businessman and fulfill the duties incumbent upon him by law, articles of association and this contract exactly and conscientiously.

Regardless whether additional directors are appointed to whom the same rights and obligations have been assigned, each director is responsible for overseeing and monitoring the entire company.

2. The managing director assumes the rights and duties of an employer within the meaning of employment and social law or tax regulations.

3. The managing director must draw up the annual financial statements and a management report (§ 289 HGB) for the past financial year within the term of section 264 (1) HGB and send them to each shareholder immediately after their preparation.

4. At the same time as the annual financial statements and the annual report are sent, the managing director has to convene a shareholders' meeting in accordance with the resolution period of § 42a (2) GmbH, in which resolution must be passed on the approval of the annual financial statements and the appropriation of profits.

§ 5 Liability of the managing director

1. The company is obliged by the shareholders' meeting annually, at the latest at the time of adoption of the annual financial statements, to pass a resolution on the discharge of the managing director for the preceding activity.

2. The liability of the managing director vis-à-vis the company is limited to intentional and grossly negligent behavior.

3. The managing director is liable to the company for all damages only up to a maximum amount of .....

4. The managing director is not liable to the company if and insofar as he has acted on the express instructions of the shareholders.

5. For the benefit of the managing director, a financial loss liability insurance with a coverage of ..... € is to be concluded and held for the duration of this employment contract, the premiums of which are borne by the company. The company must take the insurance before claiming the managing director.

§ 6 Place of employment and working hours

1. The managing director has to render his services at the registered office of the company.

2. The managing director has - to the extent that no other agreements have been made to put his full work force and all his abilities and knowledge into the service of the company.

3. The managing director should as far as possible comply with the company's working hours.

However, it is required to be available for service at all times, if and to the extent that the well-being of society so requires.

§ 7 own business and secondary activity

1.ancillary activities require the prior approval of the shareholders' meeting.

or

The managing director is permitted to carry out ancillary and ancillary business, as far as it does not concern the business purpose of the company.

or

During the term of this contract, the managing director is forbidden to do any additional or unpaid work for himself or a third party.

2. Publications and lectures concerning the areas of activity of the company require the prior written consent of the general meeting of shareholders, unless they are part of normal business operations or are necessary to adequately represent the company.

3. A given consent of the shareholders' meeting can be revoked at any time, taking into account any notice periods to be observed by the managing director.

4. The assumption of offices on supervisory bodies as well as the takeover or participation in other companies and organizations requires the prior written consent of the shareholders' meeting. The consent granted for the assumption of an office can be revoked at any time, whereby in the case of a revocation existing time limits for the termination of the office taken over must be considered.

5. Gifts or other benefits of persons or companies who are in business relationship with the Company or who seek such a connection may only be accepted by the Managing Director with the prior consent of the shareholders' meeting.

§ 8 Non-competition clause

1. During the term of this contract, the managing director is forbidden to work in a self-employed, dependent or other manner for a company which is in direct or indirect competition with the company. Furthermore, he is prohibited from establishing, acquiring or directly or indirectly participating in such a company for the duration of this contract.

2. The managing director is obliged to keep absolute silence about unauthorized third parties over all operational and business affairs of the company. This obligation also applies after termination of this contract.

3. The managing director undertakes not to work for a period of one year after termination of this contract either as a self-employed, non-self-employed person or in any other way for a company which is in direct or indirect competition with the company. Furthermore, he is prohibited from building, acquiring or participating directly or indirectly in such a rival company for a period of Three years after termination of this contract.

4. This non-competition clause applies to the territory of the Federal Republic of Germany.

5. For the duration of this post-contractual non-competition clause, the company commits itself to pay the managing director compensation in the amount of 45% of his average monthly remuneration within the last twelve months before his departure. The payment is due on the end of each month.

6. The compensation pursuant to paragraph. 5 shall include the income which the managing director does not achieve or achieve during the period of the post-contractual non-competition clause arising from self-employment, employment or other gainful employment. The income to be credited also includes any unemployment benefit received by the managing director. At the request of the company, the managing director is obliged to provide information about the amount of his income.

7. If this contract is terminated by the retirement of the managing director, the preceding paragraphs 3-6 shall not apply.

8. The company may waive compliance with the post-contractual non-competition clause by means of a written declaration to the managing director. In this case, the obligation to pay the compensation ends with the expiration of three months after submission of the declaration.

9. In the event of extraordinary termination of the contract, the right of termination is entitled to cancel the post-contractual non-competition clause within one month after

pronouncement of the extraordinary termination by written declaration to the other party.

10. In the event of a breach of the non-competition clause, the Company's managing director shall pay a contractual penalty amounting to the average monthly compensation paid in the last ... months prior to termination of the contract. At the same time, for the month in which the infringement occurred, the payment of the compensation pursuant to paragraph 5 shall cease to apply.

If the infringement is in a continuing activity, the contractual penalty is forfeited for each commenced month. At the same time, compensation for each started month is waived. Further claims of the company remain unaffected by the above regulation.

§ 9 Remuneration

1. The managing director receives for his activities

a) A gross payment of € 40,000 per year, paid in twelve equal installments at the end of each calendar month.

optional **profit sharing and bonuses**

b) In addition, the managing director receives an annual bonus for his work. This is determined by the Shareholders' Meeting on the basis of the economic result of the last financial year following the adoption of the annual financial statements. In fixing the services of the managing director are taken into account. The minimum amount of the bonus is set at 5,000 €.

c) A Christmas bonus, payable in November for the salary of gross 1,000 €.

d) A holiday pay, payable with the salary for the month of June in the amount of gross 1,000€.

2. If the employment relationship of the managing director has started during the year, the Christmas bonus and holiday pay will be granted on a pro rata basis for each calendar month begun.

3. Beyond the agreed remuneration, no other remuneration will be granted.

§ 10 Remuneration for service prevention and death

1. In the event of illness or other involuntary loss of service, the Managing Director shall be entitled for a period of ..... months to the continuation of his contractual remuneration, but at the latest until the end of the employment contract.

2. For a period exceeding this period or other non-obligatory service prevention, the managing director shall receive from the company for a period of ..... other months a subsidy equal to the difference between a sickness benefit granted by the statutory or private health insurance and the monthly sickness benefit Net amount of his fixed salary.

If there is no entitlement to sickness benefit, the sickness benefit for the purposes of this paragraph shall be based on the amount which the managing director would have received from the responsible local health insurance fund by means of an insurance commensurate with his income. The salary and any applicable church tax on the differential payment is borne by the company.

3. Upon expiry of the period of payment specified in paragraph. 1, the bonus due to the Managing Director shall be reduced by one twelfth for each calendar month of continuing service prevention commenced.

4. In the event of a breach by a third party, the managing director shall assign all claims against the causer of his invalidity up to the amount of the compensation payment owed by the company under this contract, including any social security contributions thereon.

5. If the managing director dies during the term of this contract of employment, his spouse will be paid the fixed salary for the following months of the month of death. If the spouse has already died at this time, then this entitlement belongs to the legitimate children of the managing director.

§ 11 Other Services

1. For the duration of this contract, the company grants to the managing director a subsidy to the health insurance in the amount of the employer's contribution, as would be the case with health insurance, but not more than half of the amount which the managing director has to spend on his health insurance.

2. The managing director is entitled to reimbursement of the expenses incurred in the performance of his contractual duties, in particular the travel, subsistence and telephone / fax costs. If the expenses incurred exceed the lump sum permitted by the tax regulations, the expenses must be documented in detail.

§ 12 Leaves

1. The managing director is entitled to an annual leave of ..... working days.

2. The managing director has to choose the time of the holiday and the duration of the holiday taking into account his task and the interests of the companyand to agree with the managing director or the majority shareholder.

3. If the manager cannot or not completely take the holiday in the calendar year for business or personal reasons, the holiday can be canceled until 31.03. of the following year. Holidays that have not been taken until the end of the transfer period will expire without a claim for compensation.

or

If the managing director cannot or will not take the holiday for the business year or in his person for the calendar year or during the transfer period, the remaining vacation entitlement is to be settled. The holiday compensation is based on the amount of the basic salary for each leave not taken.

4. If the employment relationship is not the entire calendar year, the holiday entitlement according to paragraph. 1 is reduced pro rata temporis.

§ 13 Inventions

The results of the work of the managing director belong to the company. Insofar as it concerns inventions or technical suggestions for improvement within the meaning of the Employee Invention Act, these must be offered to the company in writing without delay.

The Company shall be entitled to declare within a period of ..... weeks after receipt of this notice whether and to what extent it intends to avail itself of the invention. In the event of recourse, the Managing Director receives remuneration in accordance with the provisions of the Law on Employee Inventions and the related remuneration guidelines. All other work results are compensated with the contractual remuneration of the managing director.

§ 14 pension entitlements

1. The company undertakes to conclude in its own name on the life of the managing director a capital insurance with a sum insured of ... .. €, which is due on the death, the onset of the occupational disability or the completion of the 65th year of the managing director. The premium payment is borne by the company.

2. To accept the insurance benefit, the managing director or persons benefiting from it are entitled. If there is no preferential treatment, then, in case of doubt, his successor are deemed to be beneficiaries.
3. The pre-emptive rights of the managing director no longer apply if the contractual relationship ends before the occurrence of the insured event or if the management commits a gross breach of duty. However, the subscription right will continue to exist if the requirements of Section 1 (1) of the Act on the Improvement of Occupational Pensions (BetrAVG) are met.
4. If the contractual relationship ends before the occurrence of the insured event, the entitlement to benefits from the insurance, which have become due by the day of departure, is reduced.

§ 15 contract duration and termination

This contract is effective from .... in force.

It is closed indefinitely.

The contract can be terminated by both sides with a period of ..... weeks

(note the minimum statutory notice periods!).

The right to an exceptional termination of the contract for good cause remains unaffected.

An important reason exists for the society in particular, if

a) the managing director resigns from the company as a partner, or is dismissed as managing director for good cause;
b) the managing director violates the provisions on ancillary activity and the non-competition clause;
c) the managing director measures gem. § 2 Abs. 2 is carried out without the prior consent of the shareholders' meeting and the company resulting in damage or the managing director repeatedly commits such violations despite warning;
d) the managing director commits serious violations of the instructions of the shareholders' meeting, unless they demand an unlawful conduct by the managing director;
e) the insolvency proceedings are opened against the assets of the company or the company is liquidated.

Each dismissal must be in a written form.

A termination of the managing director is to be addressed to each additional managing director of the company or, in case no other managing director is present, to the shareholder who has the highest capital participation in the company.

The contractual relationship ends without the need for notice of termination at the end of the month in which the managing director completes the ..... year of age or a disability is determined.

§ 16 Severance Pay

1. In the event of an ordinary cancellation or non-renewal of the employment contract by the Company, the Managing Director receives a severance payment amounting to one monthly basic salary per year of employment. The calculation of the severance payment is based on the full years of service completed at the end of the contract and the gross monthly salary received during the last service year on a monthly average.
2. The severance payment is due at the expiration of the employment contract and is paid in compliance with the applicable tax provisions.

§ 17 Secrecy

1. The managing director is obliged to maintain strictest secrecy about all matters of the company which are not the subject of public knowledge and to use secret information neither directly nor indirectly for the benefit of third parties. If there are doubts about the scope of this secrecy obligation, the managing director is obliged to bring about a decision of the shareholders' meeting. This obligation also exists after the departure of the Managing Director from the services of the Company. The managing director is however entitled to the revelation, as far as a duty fulfilling him exists.
2. By leaving the services of the Company or by exempting from its functions, the Manager is required to submit, without being requested to do so, all documents, records and designs, including copies, duplicates and the like relating to the affairs of the Company and in his possession, as well as all other documents to completely

surrender other property of the Company and to delete any data that it has stored in a private computer system. There is no right of retention on this data.

§ 18 closing provisions

1. Verbal side agreements to this contract were not made.
2. Amendments or additions to this contract are possible at any time by mutual agreement but require the text form and the approval of the shareholders' meeting in order to be effective. Contract amendments by means of company practice are therefore excluded. The above written form requirement does not apply to agreements that are made orally between the parties immediately after conclusion of the contract. Retroactive changes or additions are inadmissible. All contract changes and additions are only for the future.

2. Should individual provisions of this contract be or become invalid, this shall not affect the validity of the remaining provisions. In such a case, the parties are obliged to replace the invalid provision by a legally permissible and compatible with the remaining provisions of this contract, which comes closest to the economic content of the invalid provision.

.....

Place, Date

....

Company's Signature Managing Managing Director's Signature Director's