

Business Administration

Making Power Supply Transition Possible

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Business Idea

Business Idea 1/2

- German government has announced the transition of german power system from fossil based power generation to renewables
- High number of solar cells have been installed during the past years
- Different characteristics of this energy source have to be considered

Business Idea 2/2

- Requirements to bring consumption and generation together occur
- Power generated in solar cells has to be stored to be in line with consumption
- On local level batteries are the best choice of power storage
- This business shall distribute these batteries

Background

Politics, Market, Technology

Background Politics

- Number of installed Solarcells in Germany increases
- Problems Occuring:
 - volatile character fotovoltaics
 - Difference between availability and demand
 - Storage of electricity Distribution of other power generation facilities
 - Reverse direction of power flow has been monitored (from bottom to the top instead of vice versa)
- Political Reactions:
 - According to the Update of the Renewable Feed-In Law 2012 a special fee for power from solar cells that is not fed to the grid but consumed by the producers is granted

Background Market

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- Installed number of solarcells in Germany (2011) more than 835.000
- Installed capacity of solarcells in Germany (2011): 17.000 MW
- highest number of possible customers in Bavaria, Baden-Württemberg and Northrhine-Westfalia
- Market is not fully set up yet
 - early positioning possible
- Market for domestic powerstorage created by law
 - incentive based
 - Low investment risk

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State	Number of Installations	Installed Capacity (MW)
Baden-Württemberg	183.049	2.906
Bayern	300.417	6.358
Berlin	6.306	68
Brandenburg	14.036	599
Bremen	1.067	14
Hamburg	2	15
Hessen	59.069	868
Mecklenburg-Vorpommern	6.203	246
Niedersachsen	73.704	1.479
Nordrhein-Westfalen	118.242	1.925
Rheinland-Pfalz	301	135
Saarland	12.145	158
Sachsen	17.148	528
Sachsen-Anhalt	10.539	437
Schleswig-Holstein	20.874	695
Thüringen	11.931	350
Overall	835.033	16.783

Market development

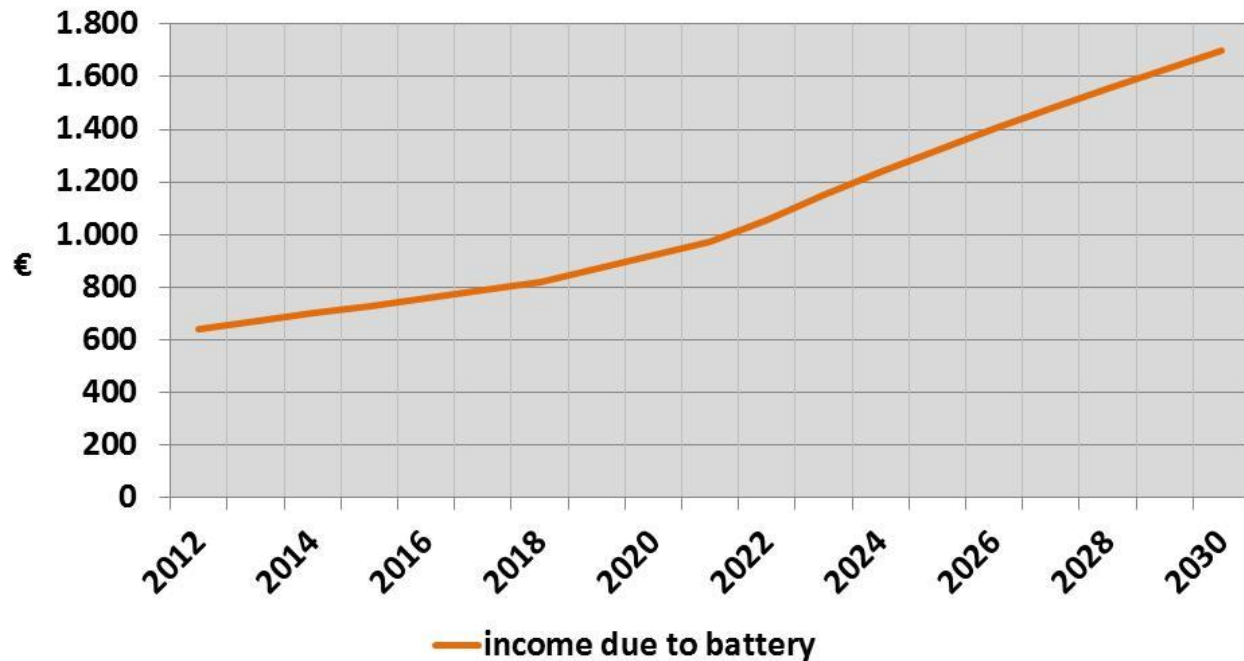
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- Income due to the use of a battery is highly dependent on the actual feed-in fee, the electricity price, the installed power and the rate of achieved own consumption
- Assumptions
 - Decrease of feed-in fee according to EEG 2012 9%
 - Increase of household electricity price 2%
 - Installed power 10 kW peak
 - Own consumption with battery 80%
 - Own consumption without battery 15%
- Batteries will become more and more attractive**

Increasing of possible yearly earnings of rooftop solarcells with batteries depending on the year of installation



Background Market

- Developing new market with great potential.
- Several solar panel manufacturer with installed capacity of 883.000 units in Germany over all the states collectively.
- Currently 883.000 units installed all over Germany with an increase in client expected with the decrease in price of Solar Cells.
- Along with new clients the existing solar panels also require batteries.

Background Market

- With the government providing incentives in the form of monetary gains, the people are attracted to install more panels leading to an increase in the demand of the batteries.
- Currently un-used potential in this field.
- With the solar panel installer as an associates, eliminating all the competitors in the market.

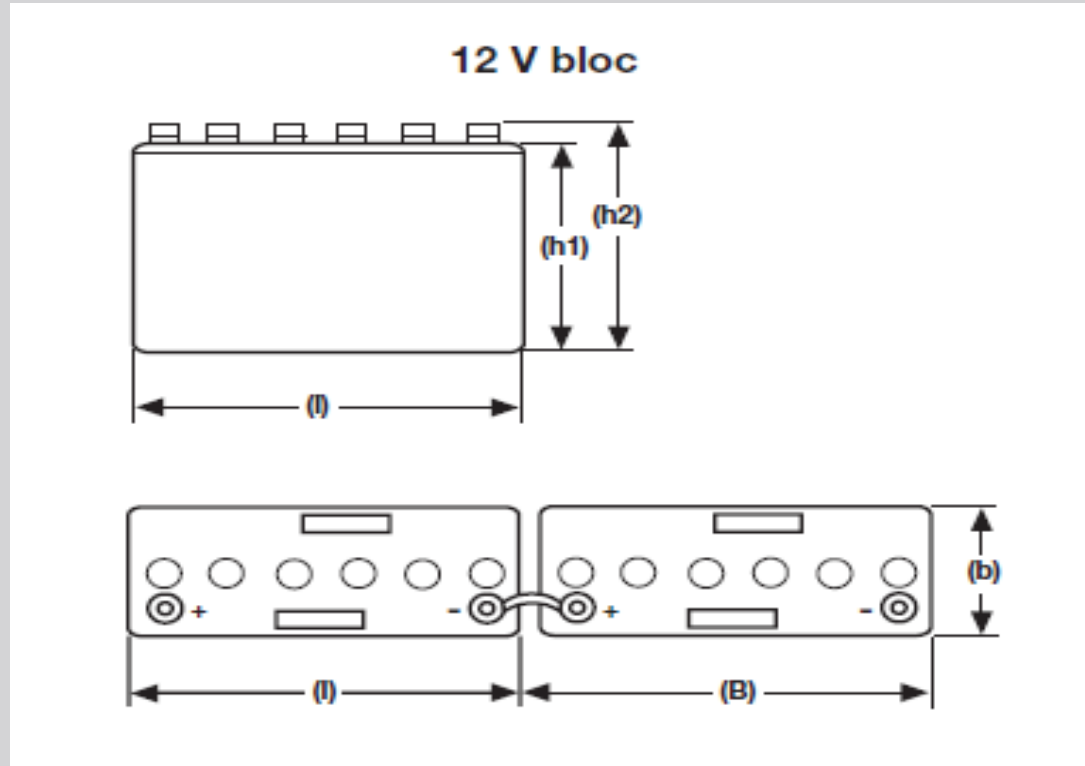
Background Technology

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- Best Choice of Voltage: 12V
- Storage Capacity per battery 3 kWh
- Several Batteries can be stacked together to customize the system according to the customers asset to achieve best results
- AGM (Absorbent Glass Material) lead-acid batteries shows best characteristics for this application.
- Other types
 - GEL-batteries
 - Flooded-Batteries
 - RV-Marine-Batteries



Battery	Volts	Length (mm)	Width (mm)	Height (mm)	Weight (Kg)	Rated Capacity (Ah)
8DA AGM Battery	12	527	277	239	74	255
8DL AGM Battery	12	527	277	220	74	255

Model Based Pricing

Influences, Model, Challenges

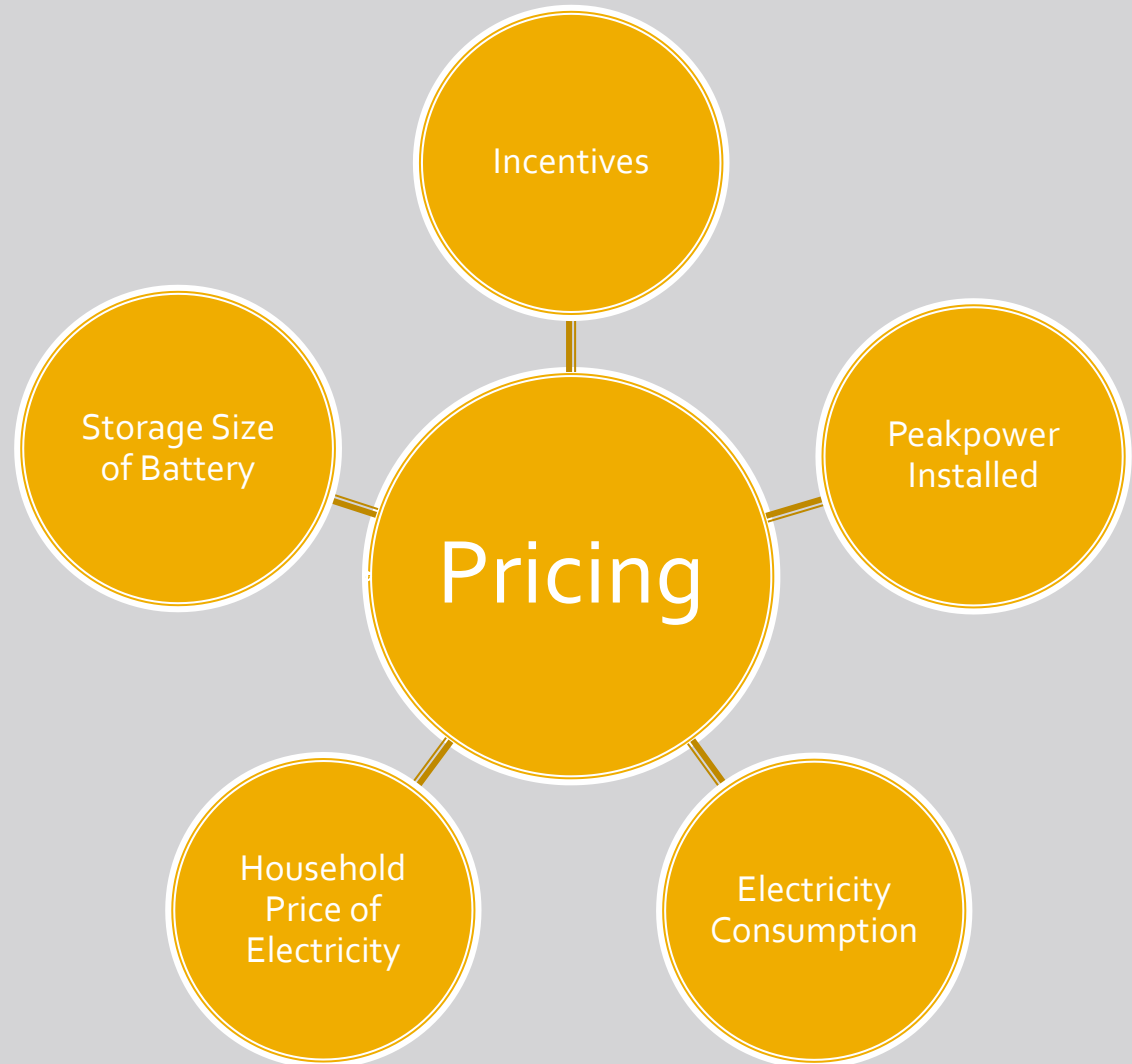
Influences

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- Pricing is a challenging process
- Pricing is examined with the aid of a model
- Considerations needed
 - Incentives granted by the law
 - Household price of electricity
 - Configuration of the asset
 - Consumption behaviour of the customer



Pricing by Model

- Hourly curves for generation and consumption are generated
- Shiftable amount of electricity is determined
- Best configuration of a storage system considering storage size, cost and profit is determined

Model Feed in Characteristics of Solar cells 1/2

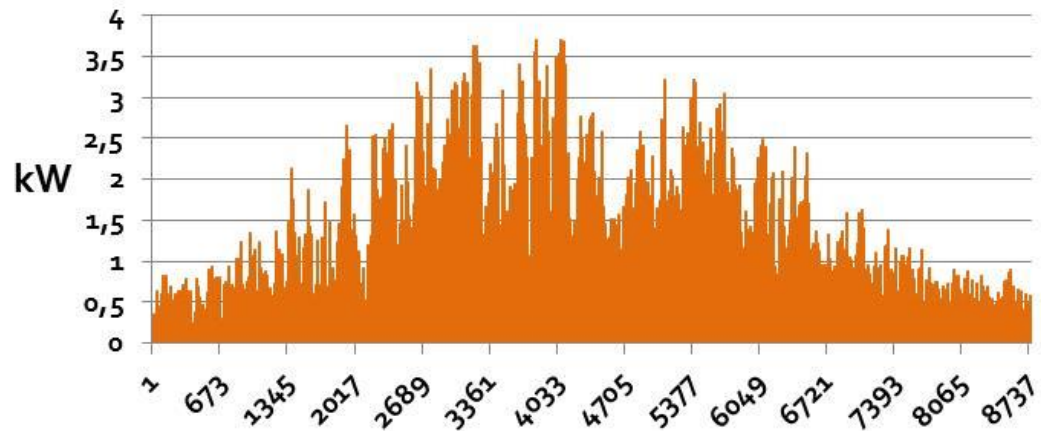
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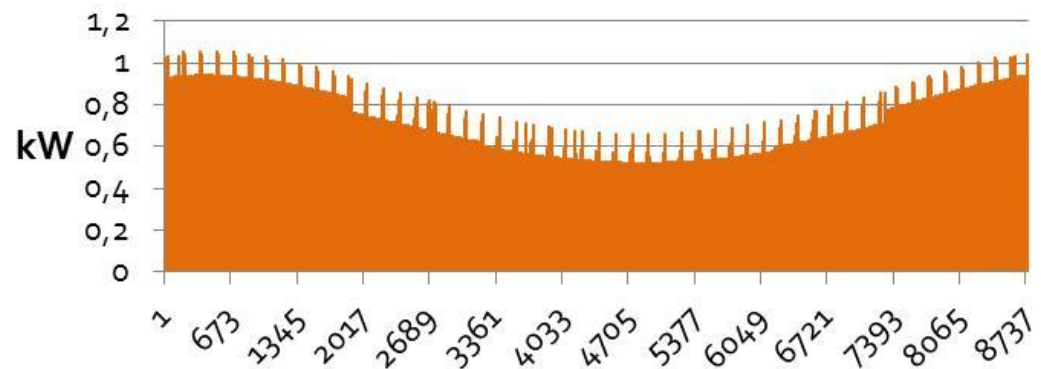
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- Upper picture shows the representative power generation of a 5 kW peak power solar cell within one year
- Lower picture shows the representative consumption behaviour of potential customers according to the standardized load profile used by municipalities in Germany to plan power generation
- 1st hour on the 01.01.
8760th hour on the 31.12.

Power Generation of 5 kW peak Solarcells



Consumption Behaviour of Potential Customers



Model Feed in Characteristics of Solar cells 2/2

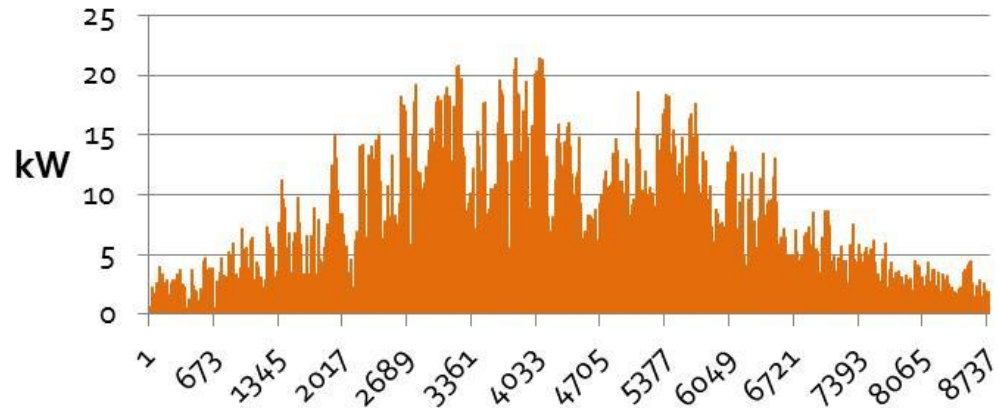
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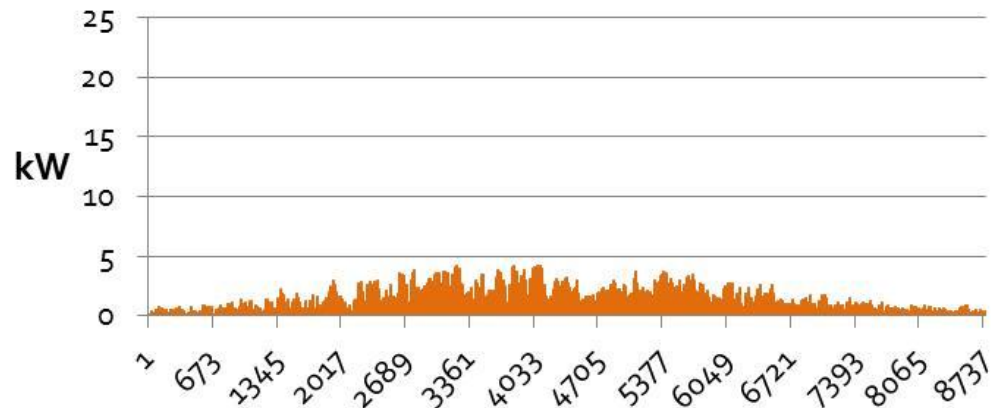
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- Upper picture shows the representative grid feed in of a 5 kW peak power solar cell within one year considering a self consumption of 15% without battery storage
- Lower picture shows the representative grid feed in of a 5 kW peak power solar cell within one year considering a self consumption of 80% with battery storage
- 1st hour on the 01.01.
8760th hour on the 31.12.

Grid Feed In without battery



Grid Feed In with battery



Customer's Point of View

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- The table shows the possible earning of the customer in 10 years for different configurations of the asset
- Considered is a commissioning of the solar cell in 2012
- With a yearly consumption of 4.000 kWh the best result can be achieved for a installed peak power of 10 kW, a battery size of 7 kWh at an increase rate of household electricity price of 2%

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Installed Peakpower kW (peak)	Battery Size kWh	Yearly Consumption kWh	Increase of Household- electricity Price	Overall profit
2	6,9	4.000	2%	-915,97 €
3	6,9	4.000	2%	-238,88 €
4	6,9	4.000	2%	243,79 €
5	6,9	4.000	2%	567,54 €
10	6,9	4.000	2%	1.166,44 €
15	6,9	4.000	2%	990,29 €
30	6,9	4.000	2%	837,99 €
2	4,6	4.000	2%	-450,51 €
3	4,6	4.000	2%	24,67 €
4	4,6	4.000	2%	314,37 €
5	4,6	4.000	2%	517,47 €
10	4,6	4.000	2%	824,06 €
15	4,6	4.000	2%	515,96 €
30	4,6	4.000	2%	561,90 €

Customer's Point of View

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- The table shows the possible earning of the customer in 10 years for different configurations of the asset
- Considered is a commissioning of the solar cell in 2012
- With a yearly consumption of 6.000 kWh the best result can be achieved for a installed peak power of 15 kW, a battery size of 7 kWh at an increase rate of household electricity price of 2%

Installed Peakpower kW (peak)	Battery Size kWh	Yearly Consumption kWh	Increase of Household- electricity Price	Overall profit
2	6,9	6.000	2%	-1.264,61 €
3	6,9	6.000	2%	-675,77 €
4	6,9	6.000	2%	-169,82 €
5	6,9	6.000	2%	209,75 €
10	6,9	6.000	2%	1.154,13 €
15	6,9	6.000	2%	1.236,09 €
30	6,9	6.000	2%	827,00 €
2	4,6	6.000	2%	-765,18 €
3	4,6	6.000	2%	-305,06 €
4	4,6	6.000	2%	41,04 €
5	4,6	6.000	2%	263,12 €
10	4,6	6.000	2%	883,18 €
15	4,6	6.000	2%	799,10 €
30	4,6	6.000	2%	556,71 €

Businessplan

Investment Costs, Expenditures, Cashflow, Losses

Investment Cost

<u>INVESTMENT COST</u>					
Description	Unit Cost (€)	Quantity	Amount of Investment(€)	Depriciation Rate(years)	Annual Depriciation(€)
<u>Building</u>					
Office Headquarters	750/month	1	9.000,00 €	0	- €
<u>Technical Equipments</u>					
Computer	750,00 €	3	2.250,00 €	3	234,00 €
Printer/Fax	200,00 €	3	600,00 €	4	150,00 €
Photocopy Machine	2.000,00 €	1	2.000,00 €	4	500,00 €
Phone	20,00 €	3	60,00 €	10	6,00 €
<u>Furniture</u>					
Office Set	1.200,00 €	3	3.600,00 €	10	360,00 €
Meeting Set	1.500,00 €	1	1.500,00 €	10	150,00 €
<u>Storage Equipments</u>					
Steel Containment	150	20	3.000,00 €	10	300,00 €
<u>Car/Maintenance/Gas</u>					
Car	1.000,00 €	3	3.000,00 €	3	234,00 €
Maintenance/Insurance	1000	3	3000	0	0
Gasoline	2.000,00 €	3	6.000,00 €	0	- €

Expenditures

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Depreciation											
<i>laptops</i>	700,00 €	700,00 €	700,00 €	-	-	700,00 €	700,00 €	700,00 €	-	-	700,00 €
<i>printer</i>	550,00 €	550,00 €	550,00 €	550,00 €	-	-	550,00 €	550,00 €	550,00 €	550,00 €	-
<i>phone</i>	6,00 €	6,00 €	6,00 €	6,00 €	6,00 €	6,00 €	6,00 €	6,00 €	6,00 €	6,00 €	6,00 €
<i>furniture</i>	510,00 €	510,00 €	510,00 €	510,00 €	510,00 €	510,00 €	510,00 €	510,00 €	510,00 €	510,00 €	510,00 €
<i>storage equipment</i>	300,00 €	300,00 €	300,00 €	300,00 €	300,00 €	300,00 €	300,00 €	300,00 €	300,00 €	300,00 €	300,00 €
<i>Company Cars</i>	3.000,00 €	3.000,00 €	3.000,00 €	3.000,00 €	3.000,00 €	3.000,00 €	-	-	-	-	3.000,00 €
Administrative / Overhead											
<i>electricity</i>	900,00 €	900,00 €	900,00 €	900,00 €	900,00 €	900,00 €	900,00 €	900,00 €	900,00 €	900,00 €	900,00 €
<i>phone</i>	1.800,00 €	1.800,00 €	1.800,00 €	1.800,00 €	1.800,00 €	1.800,00 €	1.800,00 €	1.800,00 €	1.800,00 €	1.800,00 €	1.800,00 €
<i>printing paper</i>	40,00 €	40,00 €	40,00 €	40,00 €	40,00 €	40,00 €	40,00 €	40,00 €	40,00 €	40,00 €	40,00 €
<i>stamps and stuff</i>	100,00 €	100,00 €	100,00 €	100,00 €	100,00 €	100,00 €	100,00 €	100,00 €	100,00 €	100,00 €	100,00 €
<i>unexpected cost</i>	25.000,00 €	25.000,00 €	25.000,00 €	25.000,00 €	25.000,00 €	25.000,00 €	25.000,00 €	25.000,00 €	25.000,00 €	25.000,00 €	25.000,00 €
<i>licensing and stuff</i>	1.500,00 €										
Operation & Maintenance											
<i>Insurance and Maintenance Company Cars</i>	3.000,00 €	3.000,00 €	3.000,00 €	3.000,00 €	3.000,00 €	3.000,00 €	3.000,00 €	3.000,00 €	3.000,00 €	3.000,00 €	3.000,00 €
<i>Gasoline Company Cars</i>	6.000,00 €	6.060,00 €	6.120,60 €	6.181,81 €	6.243,62 €	6.306,06 €	6.369,12 €	6.432,81 €	6.497,14 €	6.562,11 €	6.627,73 €
<i>rent for office</i>	9.000,00 €	9.000,00 €	9.000,00 €	9.000,00 €	9.000,00 €	9.000,00 €	9.000,00 €	9.000,00 €	9.000,00 €	9.000,00 €	9.000,00 €
Financing											
<i>annuity</i>	58.615,25 €	58.615,25 €	58.615,25 €	58.615,25 €	58.615,25 €	58.615,25 €	58.615,25 €	58.615,25 €	58.615,25 €	58.615,25 €	58.615,25 €
<i>remaining credit</i>	500.000 €	456.385 €	411.461 €	365.190 €	317.530 €	268.441 €	217.879 €	165.800 €	112.159 €	56.908 €	0 €
Labor											
<i>Salary workers</i>	25.200,00 €	31.500,00 €	39.900,00 €	50.400,00 €	50.400,00 €	50.400,00 €	50.400,00 €	50.400,00 €	50.400,00 €	50.400,00 €	50.400,00 €
Material											
<i>Cost for Batteries</i>	252.000,00 €	294.030,00 €	349.895,70 €	419.169,17 €	414.977,48 €	410.827,70 €	406.719,42 €	402.652,23 €	398.625,71 €	394.639,45 €	390.693,06 €
<i>wires and stuff</i>	20.000,00 €	20.000,00 €	20.000,00 €	20.000,00 €	20.000,00 €	20.000,00 €	20.000,00 €	20.000,00 €	20.000,00 €	20.000,00 €	20.000,00 €
Total Cost	408.221,25 €	455.111,25 €	519.437,55 €	598.572,23 €	593.892,35 €	590.505,02 €	584.009,80 €	580.006,30 €	575.344,10 €	571.422,82 €	569.876,04 €

- Credit given by Kreditanstalt für Wiederaufbau (KfW) at reasonable rates
 - Interest rate 3%
 - 500.000€ credit granted
 - 10 years annuity is paid

Pricing by Model

- Calculations show that a 10 year profit for the customer with an asset installed in 2012 can be as high as 500 to 1.200 €
- Price setting as sharing possible profit evenly between customer and company puts incentives to customer to buy the product, but leads to significant losses in the company

Cashflow

Total Cost		408.221,25 €	452.141,25 €	512.404,65 €	585.998,00 €	577.377,92 €	570.171,10 €	559.974,28 €	552.384,30 €	544.248,02 €	536.962,40 €	532.158,44 €
Income												
	<i>price for one Battery</i>	2.000 €	2.000 €	2.000 €	2.500 €	2.500 €	2.500 €	3.000 €	3.000 €	3.200 €	3.200 €	3.200 €
	<i>Total income</i>	240.000 €	300.000 €	380.000 €	600.000 €	600.000 €	600.000 €	720.000 €	720.000 €	768.000 €	768.000 €	768.000 €
	<i>EBIT</i>	-109.606 €	-93.526 €	-73.789 €	72.617 €	81.237 €	88.444 €	218.641 €	226.231 €	282.367 €	289.653 €	294.457 €
	<i>Tax</i>	0 €	0 €	0 €	2.100 €	3.393 €	4.474 €	24.004 €	25.142 €	33.563 €	34.656 €	35.376 €
	<i>Profit</i>	-109.606 €	-93.526 €	-73.789 €	70.517 €	77.844 €	83.970 €	194.637 €	201.089 €	248.804 €	254.997 €	259.081 €

- Model based pricing
 - Neglecting customer profitability would be an imprudent approach
 - Price for the batteries as a share of the profit of the customer
 - Leads to high losses of the company in the beginning

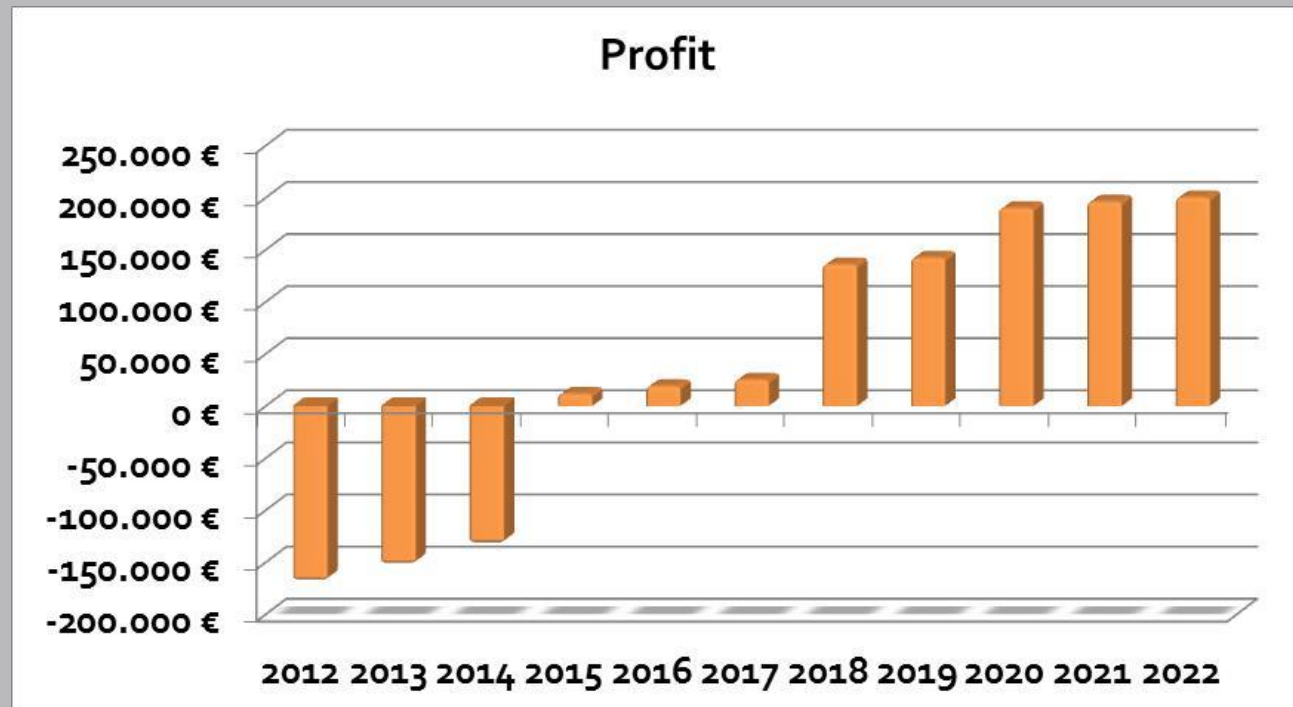
Company Profits

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- Batteries have to be offered at a low price in the beginning, generating high losses to the company
- With increasing profitability of batteries prices can be increased and break even can be achieved in 2015
- Still little profit is to be anticipated between 2015 and 2017
- Profits can assumably be earned with an additional increase of price according to the increasing profitability of batteries for the customers in 2018



Conclusion

Conclusion

- Market for batteries will be established
- Market for batteries for load shifting applications is huge
- Losses in the beginning have to be considered,
still
- Early positioning in the market can lead to high revenues in the intermediate run

Future is possible