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Reducing advising process time for energy storing solutions

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Management summary

This research project focusses on optimising the advising process for energy storing solutions at Stroom Door Zon. The aim is to reduce required man-hours for advising on battery energy storing solutions, while maintaining advice quality. Stroom Door Zon specializes in the installation of renewable energy technology, including solar panels and batteries, targeting small and medium-sized enterprises, farmers and private consumers.

The study applies the business process management lifecycle to the following research question: *How to redesign the BESS advising process of Stroom Door Zon such that the required man-hours are reduced, while maintaining the advice quality?* The research goal is a 25% reduction in process time from 12 hours on average to 9 hours on average.

In the process landscape model, the advising process is identified as a core process in the company's value chain. The process is directly related to the project planning and the network relationships. Redesigning the advising process should not lead to an increase in process time for these related processes.

An as-is process model of the advising process is developed in business model process notation 2.0. The process model is based on internal interviews with the process owners and process observation. Key parts in the process are: The phone call, the on-site meeting, technical advice creation and advice & quotation drafting.

The process is analysed through customer interviews and process owner interviews. This analysis is complemented by value stream mapping based analysis and a strength, weaknesses, opportunities, threats analysis. Key findings include:

- The on-site meeting has a high value perceived by the customer.
- The process is highly dependent on individual employee expertise.
- There is a lack of information structure in the process.
- The value of the advice creation is not always translated well in the drafted advice and quotation.

Based on the value stream mapping based analysis a new process time estimation is made for the as-is process. The as-is process time is now estimated to be 8 hours instead of the originally estimated 12 hours.

A new process design is presented in the to-be process model, solving all problems identified in the process analysis. The redesign improves the as-is process on three topics:

1. **Altering the process flow:** Automating the collection of documentation and insurance requirements immediately after the initial customer phone call.
2. **Designing an information structure:** Enhancing enterprise resource planning system functionalities to streamline data storage and retrieval based on created customer profiles.
3. **Time guidelines:** Setting time limits for phone calls (10 minutes), small talk (10 minutes) and the on-site meetings (maximum 1.5 hours) to improve efficiency.

The redesign is estimated to immediately reduce process time with an estimated 30 minutes (7h 30min). This is a reduction of 37.5% compared to the original process time estimation (12h) and a reduction of 6.25% compared to the improved estimate (8h). The redesign enables additional time reductions in related processes. The process redesign is geared for scale up and new staff. Additionally, the value delivered to the customer is increased.

It is recommended that Stroom Door Zon finishes the business process model lifecycle by completing the last two steps. These steps concern process implementation and process monitoring and controlling. Process implementation can be based on the implementation plan presented in this research.

Acknowledgements

This bachelor thesis, titled “*Reducing Advising Process Time for Energy Storing Solutions,*” marks the culmination of my industrial engineering management studies.

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Furthermore, I want to thank my family, friends, and girlfriend for their encouragement, interest, and valuable feedback. A special thanks to my grandfather, who sadly passed away during the writing of this thesis. His kindness, curiosity about my work, and entrepreneurial spirit have been a source of inspiration throughout my studies.

Completing this thesis has been an interesting and valuable experience. It is my hope it contributes to the foundation of a successful battery business case for Stroom Door Zon. Enjoy the read.

Best,

Mart van der Stege

January 31, 2025

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List of acronyms and abbreviations

SDZ Stroom Door Zon

SME Small and medium-sized enterprises

BPMN 2.0 Business process modelling notation 2.0

SWOT Strength, weaknesses, opportunities, threats

ERP Enterprise resource planning

PV Photo voltaic

BESS Battery energy storage system

kW Kilowatt

kWh Kilowatt-hour

EMS Energy management system

BPMLC Business process management lifecycle

EV Electric vehicle

VSM Value stream mapping

1. Introduction

This chapter introduces the background of this research. The company and relevant trends are discussed. The theoretical concepts which influence the research problem are explained and the research problem is identified. The chapter closes with the research questions and the methodology chosen to solve the problem.

1.1 Company background

The company of this graduation assignment is Stroom door Zon B.V., hereafter referred to as ‘SDZ.’ SDZ is a company focused on durable energy solutions and is based in Barneveld, the Netherlands. The private limited company has five fulltime employees and uses freelancers who are connected to the company. The company was founded in March 2019 after years of working in the industry by the owners. When starting out, the company was focussed on solar panels as reflected in the Dutch name, which can be translated to: ‘power through sun’. SDZ is the parent company in a network of more private companies for specific markets. Since these operate closely together, it is decided to discuss this thesis in the context of SDZ and disregard the smaller (administrative) private companies.

SDZ’s target audience consists of small and medium-sized enterprises (SMEs), farmers and private consumers. The offered products can be categorized in three main technology sections: Solar panels, heat pumps and batteries [26]. SDZ forms the link between supplier and customer, delivering installation and customised advice.

With the arising problem of grid congestion [5], providing advice has become more complicated and therefore more important. SDZ sees batteries as one of the most important solutions to grid congestion problems for customers. Furthermore, it identifies batteries as an interesting solution both financially and sustainably. This bachelor assignment is originated in the process of advising customers advising on batteries by SDZ with attention to the topics grid congestion, financing, and sustainability.

1.2 Company background in trends

There are three (global) developments which are of relevance to the market position of SDZ: The global energy crisis, the arising problem of grid congestion and the intended abolition of the Dutch ‘Salderingsregeling.’ The International Energy Agency has stated the following about the first development, the energy crisis: *“Energy markets began to tighten in 2021 because of a variety of factors, including the extraordinarily rapid economic rebound following the pandemic. But the situation escalated dramatically into a full-blown global energy crisis following Russia’s invasion of Ukraine in February 2022. The price of natural gas reached record highs, and as a result so did electricity in some markets.”* [1]. This crisis influenced the durable energy solutions market hugely, increasing sales of both solar panels and heat pumps. It meant a rapid growth for SDZ and solidified its financial position.

The second development is the increase in grid congestion. Grid congestion occurs when the demand or generation of electricity peaks and exceeds the current capacity of the grid network. This leads to inefficiencies and potential reliability problems such as grid outages, cascade failures, and blackouts [5]. These problems can be solved from multiple perspectives as identified in the literature study of Akkouch et al. [6] (Figure 1). One of the current measures to minimise grid congestion is to limit grid connections for the user. This influences the ability to draw power from the grid and the ability to deliver power to the grid. Limiting power traffic influences companies in the ability to use power for their processes, to expand such processes or to deliver power to the grid through photovoltaic (PV) panels [27]. Batteries are used as a solution on the user side, also referred to as a solution in the micro-grid. They either deliver power when the grid cannot deliver enough to meet demand or otherwise, they store energy when there

is overproduction at the local site through PV panels, for example [4]. The specific application of batteries for peak shaving is discussed in the theoretical framework.

The abolition of the ‘Salderingregeling’ is the third influential development. It considers a regulation which allows consumers to balance generated power from PV panels with the used power throughout a year without regard to the point in time at which power is used or generated. The government intends to abolish this incentive starting 2027 [2]. Losing this advantage would mean that solar panels become less profitable, because it is to be expected that consumers will have to pay more energy taxes and receive reduced payments for the returned power. However, it would increase the benefits of energy storing solutions, since storing your own generated electricity and using it later, would mean avoiding energy taxes and reduced payments [28]. Furthermore, a battery energy storing solution (BESS) enables the customer to react to energy market prices.

1.3 Management problem

In Section 1.2 the influence of global or national developments on the BESS advising process were discussed. As a result of those developments, the PV panel market has cooled off over the last year. The battery market on the contrary has grown rapidly due to the same developments. For the SDZ group this means that the (future) focus shifts from PV panels to energy storing projects. The energy storing branch is relatively young and less developed than the PV panel branch. The branch is believed to hold lots of potential, but growth is necessary to create an independent, BESS focused company branch.

The company currently has no insight in their used process for battery sales. However, the company expects that the sales process could yield improved results. The company requires analysis of this problem and insight into the internal processes.

1.4 Theoretical framework

The management problem of SDZ is focused on the sales process for energy storage solutions. To be able to improve upon this process, it is necessary to understand the (technological) background of the process. In the theoretical framework the characteristics of a BESS are outlined, together with the involved management systems and available financial systems. This provides the required basic understanding for improving the BESS advising process. The process is partly managed within an IT system. Therefore, this system is also discussed.

1.4.1 BESS installation

The increasing integration of renewable energy sources (RES) and the growing demand for (sustainable) power solutions have necessitated the widespread deployment of energy storage systems [4]. Among these systems, BESS have emerged as a promising technology due to their flexibility, scalability, and cost-effectiveness as is established by Saldarini et al. [4]. There are multiple ways of storing energy, this thesis will focus on BESS.

The **lithium-ion battery** is established as the dominant choice for batteries due to their high energy density, long cycle life, and relatively low self-discharge rates [4]. For the same reasons this is the main battery technology sold by SDZ.

In the battery advising process two main criteria for batteries are of importance. The storage capacity and the power for charging and discharging. Charging or discharging power is the level at which a battery can maximally deliver or receive power, it is measured in kilowatts (kW). Capacity is measured in kilowatt hours (kWh), it indicates the total amount of energy stored. A battery with a capacity of 10 kWh can deliver ten kW power for one hour, or five kW for 2 hours.

The needed capacity is influenced by the power usage of a customer and its ability to charge. The ability to charge might be limited by the allowed power consumption and local power generation through the increasing use of renewable energy sources.

The expected increase of renewable energy sources is mainly accelerated by **PV panels** [6]. **PV panels** convert solar energy into electrical energy. This expected increase can also be seen in the technology's popularity amongst consumers, Reuters publishes that for 68% of the population solar panels form their favourite form of energy [7]. Since solar energy is intermittent and variable in nature, energy storage is often useful to mitigate this variability, thereby improving the quality of power production [8]. In many advising cases the customer has solar panels. The solar panel output must be considered for the advising process. As explained, batteries have a capacity and a charging and discharging power. For the solar panels, comparable values must be known: The average total output of the PV panels system and the peak outputs of the system. The combined installation of PV panels and a BESS is controlled through soft- and hard-ware.

Energy management systems (EMSes) have been introduced in electrical power systems to perform optimized operations of the electrical grid infrastructure and to provide support to the grid operator in terms of optimized decisions [9]. An EMS has four key functions in a micro grid: Monitoring, controlling, optimization of flows and electrical power usage. An EMS monitors power consumption and generation, in case of high peaks or shortages the EMS can react. When there is a peak in generation, but not in consumption, the EMS can redirect the power usage by charging an electric vehicle (EV), a BESS or heating a buffer tank. A more rigid measurement is to switch off the inverters of a PV panel installation to avoid congestion. When there is shortage on the grid, the EMS can decide to lower charging speeds and use energy stored in the BESS. This avoids penalties or high energy cost from suppliers and enables trading on energy markets as is discussed in Section 1.4.2.

1.4.2 BESS objectives

The cost of energy usage is for industrial users not only determined by a grid-user's total energy consumption, but also by the highest power demand from the superior grid-level. In more recent years, there have been cases of limited maximum power consumption. The maximum power demand is usually decided by the peak power point of a monthly load profile [10]. Therefore, avoiding or reducing such peaks can be financially rewarding. In case of a too limited maximum power consumption, it is even necessary. This process is called **peak shaving**, and it is not a new technique. Industrial users with high peak demand have already been using diesel or gasoline generators to reduce cost for a long time [11]. In such a case generators power a peak process or, provide a part of the needed power to shave the peak. This same approach can now be taken by using a BESS combined with an EMS to reduce power consumption peaks, which reduces the cost of energy usage.

The storage of energy is still limited and costly, which influences its application. Energy prices are influenced by the lack of storage, usage, and production. Electricity demand typically follows a seasonal profile, it is lower at night and higher during the day. In so-called winter peaking countries, the demand is higher in the winter than in the summer and in summer peaking countries the other way around. Solar panels produce more power in the summer than in the winter, meeting or opposing demand, depending on the country [12]. Fluctuating demand and supply together with uncertainty cause fluctuating energy prices, which allows for **energy trading**. Consumers and SMEs might increase BESS profitability by using storage capacity (partly) for trading.

For consumers and SMEs, the most important distinction in trading energy is the market to trade on. This is determined by the time horizon on the delivery period and the trading period. The delivery

period is the period in which the power is delivered to the buyer. The trading period is the period in advance of the delivery period, during which the energy is acquired.

The three main categories are: Long-term market, Day-ahead market, and the intraday market. The long-term markets trade between four years and one month before the delivery period. The day-ahead market one day in advance and the intraday market on the day itself with intervals of 15 minutes, an hour or longer.

The long-term market is accessed by large producers, large users, or Balance Responsible Parties (BRPs). For users of this market, it is important to set electricity prices for a given period. Due to its scale, it is less important for SMEs and consumers. The day-ahead market and intraday market are not available for individuals, only for BRPs [13]. This means that individuals or SMEs have access to such markets via a partner, who trades on their behalf. Often a share of-, or the entire battery capacity, is controlled by such providers using an EMS.

Accessing energy trading markets can provide profits to the user. BESS used for trading are installed with the sole purpose of trading or with trading as a form of additional income to help cover BESS investment cost.

1.4.3 National grants

In many cases the acquisition of a BESS is influenced by National grants. Worldwide many countries – often with large economies – provide national grants or subsidies for investments in durable energy or low carbon energy solutions [14]. In such cases the BESS is often part of such rulings, which allows for tax deduction or even direct grants. In case of a direct grant, the amount can be used directly for cost calculation. When tax deductions such as investment depreciation come into play, forecasted profits must be considered as well.

The appliance of grants or tax rules must be evaluated for each customer since different cases might allow for different appliances. Most customers of SDZ are situated in the Netherlands. Therefore, in the advising process the Dutch national grants or tax rules are applied. The most applied grants and tax rules are the EIA, KIA and DUMAVA [15]. The EIA is the energy investment deduction, it allows a company to additionally deduct 40% of the investment cost of a BESS from the company profits before taxes. The KIA is a comparable rule which allows for additional deductions of small investments from company profits before taxes. The DUMAVA is a grant scheme which covers part of the BESS investment cost for healthcare, monumental, or public buildings [15].

1.4.4 ERP system

The BESS advising process is partly administrated in an Enterprise Resource Planning (ERP) system. ERP systems are configurable information system packages that integrate information and information-based processes within and across functional areas in an organisation [18]. Resources in organisations consist amongst others of: People, facilities, materials, and money. An ERP holds the combination of management for resources in the organisation. SDZ makes use of Airtable as ERP system. They include Customer Relationship Management, Finance Resource management and Human Resource Management.

1.5 Problem identification

The sales process for a BESS has many influential parameters, some of which are described in the theoretical framework. All these different parameters are multidisciplinary and influence the process in a unique way. To scope this thesis, one problem is selected to be solved, this is the core problem. The goal of this thesis is to solve that problem in a structured scientific way.

To select a core problem, first a basic understanding of the process is required. This is done by conducting explorative research and combining the resulting knowledge with the theoretical framework. The methods used for explorative research are aligned with the methodology proposed for this thesis: The business process management lifecycle. The internal stakeholders were gathered in a workshop as described by Dumas et al. [3]. This was followed up by observation of the process to control conclusions of the workshop. Combined with the theoretical framework involved with this process the following problem cluster was drawn up.

1.5.1 Problem cluster

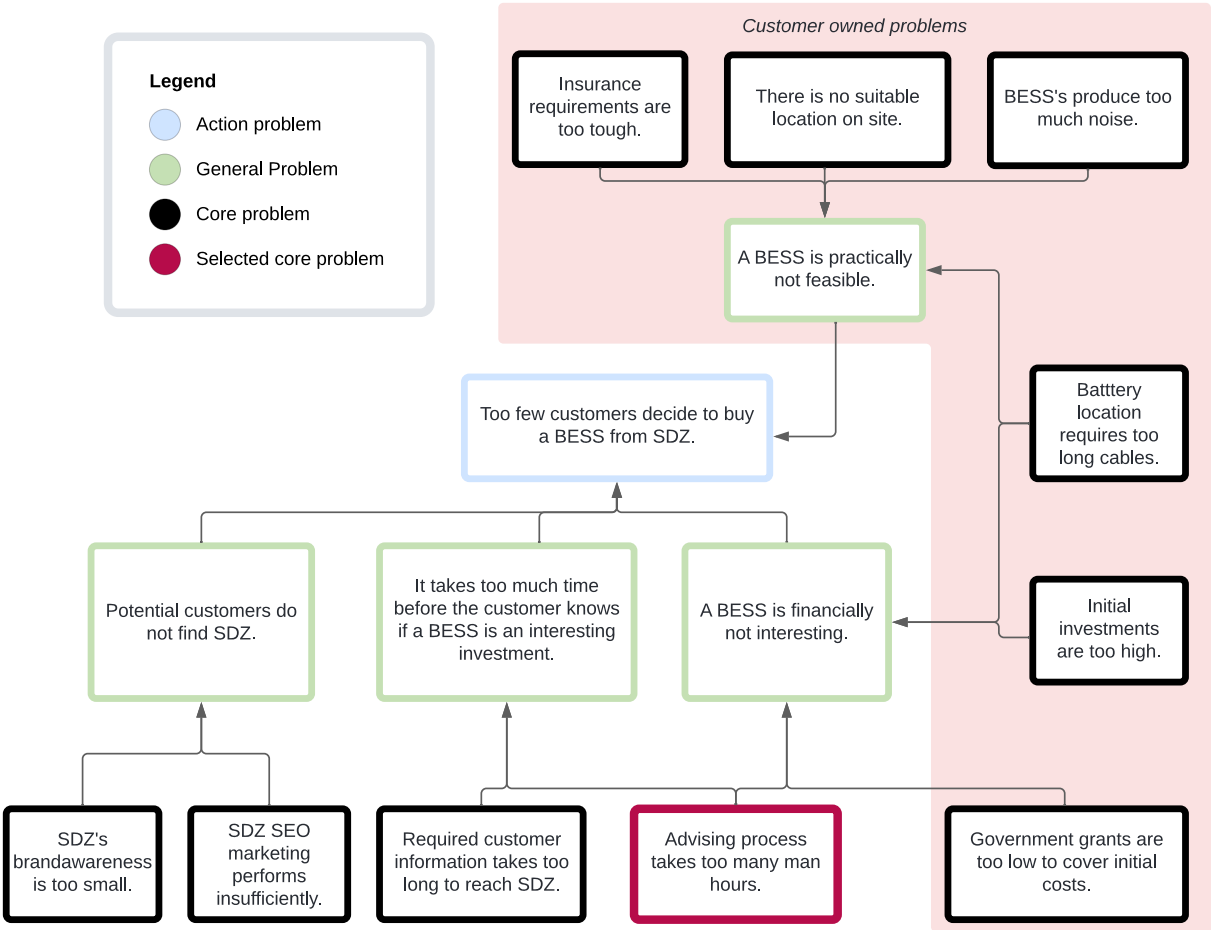


Figure 1: Problem Cluster

The action problem follows from the management problem described in Section 1.3, the energy storage branch holds much potential, but the market is currently small, and the sales process could yield improved results. This is phrased as follows: ‘Too few customers decide to buy an energy storage system from SDZ’. This problem was analysed in the workshop and possible core problems were extracted.

Many of the problems which lead to customers deciding not to invest in BESS are not owned by SDZ. This means that even though those problems are part of an outcome not favoured by SDZ, SDZ cannot influence them, and the problem is therefore in this case, owned by the customer.

By applying elimination as described by Van Heerkens and Van Winden, only problems at the end of the cluster are considered as possible core problems, these are the first problems in the causal chain [16]. The problems not owned by SDZ are also discarded. This leaves four problems, of which two are related to marketing and communication, which is not the scope of this thesis. Therefore, the core problem must be either related to the required man-hours or the time it takes customer information to reach SDZ. The

customer information reaching SDZ is owned by the client, making the customer the problem owner. The selected core problem is: The advising process takes too many man-hours.

1.5.2 Core problem

The selected core problem, as defined in the problem cluster, is missing a norm and reality. Therefore, we rephrase the core problem, using one variable, a norm, and reality. The core problem can be solved by closing the gap between norm and reality.

- Variable: The man-hours required for the advising process.
- Norm: 9 hours on average.
- Reality: 12 hours on average.
- Gap: The gap is 3 hours, which is a 25% reduction.

The defined core problem:

The required number of man-hours in the advising process of SDZ for battery packages should be reduced from 12 hours on average to 9 hours on average (25% reduction).

1.5.3 Motivation

Battery projects often require situational bound advice from the internal experts to the customer. Currently management has no defined process for mapping the situation and providing advice based on that situation. The advising process is a complicated process due to many involved parameters. Internal experts have amongst others to consider customer power usage, power usage peaks, energy contract bounds, on-side power generation profiles, investment capacity, grants and subsidies, insurance requirements and governmental regulations. Information on these topics must be gathered, processed and estimated to base advice on for the project. It is expected that changing the process and introducing standardized process parts can help reduce the required time needed. Therefore, management believes that the most progress or improvements can be made on the required man-hours.

1.6 Research question

The research question is based on the defined core problem of Section 1.5: “The advising process of SDZ takes too many man-hours.” This problem is scoped on the entire advising process. To solve this problem, the entire process must be analysed and redesigned. This results in the following research question: *How to redesign the BESS advising process of Stroom Door Zon such that the required man-hours are reduced, while maintaining the advice quality?*

In support of answering the main research questions, sub-questions are formulated. The sub-questions are part of the problem-solving methodology for the main research question as discussed in the next section.

1.7 Problem solving methodology

This research is conducted in the structure of the Business Process Management Life Cycle (BPMLC) as described by Dumas et al. [3]. The focus of this research is the establishment of the process currently used, the analysis of this process and to re-design the current process. The BPMLC is a structured approach to managing and improving business processes. The research sub-questions are integrated within this approach. This methodology provides structure to this entire research project, including deliverables. This would be less the case with methodologies such as the Managerial Problem-Solving Method of Heerkens and Van Winden or the Design Science Research methodology of Peffers et al. [16-17].

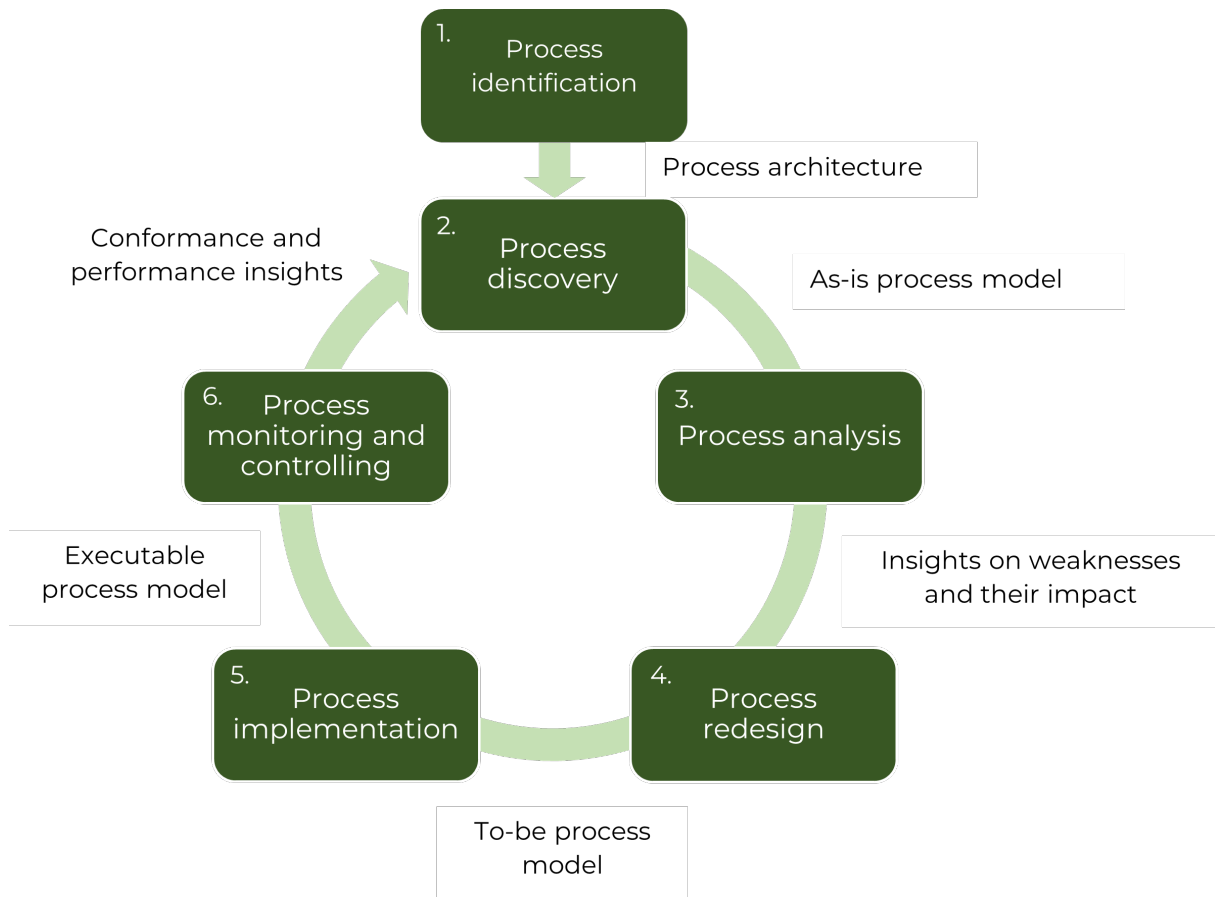


Figure 2: Business process management life cycle

The methodology loops through several steps, each with a corresponding sub-question, deliverable and research objective. The scope of this thesis is the first four steps of the BPMLC.

1. Process identification

The process identification phase gives an overview of the processes involved in the subject, which is being researched. It identifies the process which was chosen for the rest of the cycle. This is done in a process architecture. The process identification shows some resemblance with the problem identification step. Therefore, parts of the problem cluster and selection of the core problem are reused as input for the process architecture. The selected process is the process corresponding to the chosen core problem: The advising process for BESS.

This phase is conducted to answer the following sub-question:

1. How does the BESS advising process of Stroom Door Zon relate to other existing processes in the organisation?

2. Process discovery

The process discovery phase is the main reason why this methodology is chosen. It provides explicit attention to establishing the current process. Since the advising process of BESS can be quite complicated and the process is currently not yet defined, this process step is the most important.

In the second phase the following sub-questions are answered:

2. What is the current design of the BESS advising process within Stroom Door Zon?
 - 2a. What are the steps of this process?
 - 2b. What information do these steps aim to collect?
 - 2c. How is such information processed and stored?

The main deliverable for answering this sub-question is the as-is process model. This process model is made in BPMN language 2.0 [3]. For the as-is process model explorative research was required to be done. This was done through a workshop with all internal stakeholders, forward interviews with individual stakeholders, observation of the advising process, and feedback sessions. In the feedback sessions a first version of the as-is process model was presented to internal stakeholders, on which the stakeholders could provide feedback.

3. Process analysis

The third step in the cycle is meant to draw conclusions about the current process. The third sub-question is answered:

3. Where can the current BESS advising process be improved upon?

Some additional sub-questions provide steady guidance for answering the third sub-question. These additional questions analyse the value and essential parts of the advising process.

- 3a. Which information is essential to a potential customer, to assess whether a BESS is of interest?
- 3b. Which steps are essential in an advising process to assess whether a BESS is of interest to the customer?
- 3c. Which parts of the advising process are experienced as most valuable by the customer?

These questions are answered through conducting interviews with the corresponding stakeholders. Questions 3a and 3c are answered in interviews with the customer. The research population consists of an approach of the target group of SDZ. Currently, SDZ mostly delivers to agricultural companies such as farmers, those form the main research population. Consumers and SMEs are considered via an installing partner. The semi - structured approach is the best fit to the interviews. The interviews follow a backward approach to find the essential information for a customer and a forward approach to find the most valuable parts.

Question 3b is discussed in interviews with the employees of SDZ. This is done in one on one interviews which are semi structured.

Based on the answers to the question 3a-c, process analysis is done through value-stream based mapping. Value-stream mapping is a technique borrowed from lean manufacturing, based on the concept of value chain analysis. The technique allows analysis of the value of each step of the process [19]. The value is perceived by the customer. The answers to the questions form the basis to assign value to process steps. A rendition of this technique will be used to analyse the process.

In addition to this a SWOT analysis is made to include observations made in this thesis process into the conclusion for research question 3 [23].

The conclusions of the three additional research questions, the value-stream mapping and the SWOT analysis provide the answer to the third sub-question.

4. Process redesign

The conclusions of the process analysis step are used to redesign the process. This is based on alteration of steps, removal of steps or the inclusions of artefacts. Expected design changes are related to the inclusion of customer information in advisory meetings, meeting structure and information artefacts. The goal of this redesign is to solve the action problem. In this methodology phase the final sub-question is answered.

4. How should the advising process be redesigned to enable such improvements?

In answering the fourth sub-question additional attention is given to the information input in the process. This results in an additional question with relationship to four information sources.

4a. How should information within the process be structured to fit the redesign?

In addition to the information created in the process, the company has identified information topics which are currently not yet or limited part of the advising process. The company believes that including these topics will increase the quality of the advising process. These topics are therefore considered for inclusion in the process redesign.

- i. Expected financial margins on energy trading for SMEs and consumers.
- ii. The influence on energy cost of controlling PV panels with an EMS based on market prices.
- iii. Expected investment cost trend of BESS in the coming five years.
- iv. Subsidies and grants.
- v. Government rules for storing chemical batteries: PGS 37-1 [21].

4b. Which steps by the organisation are needed to implement the new process design?

The process redesign results in a to-be process model and advice for the design of information artefacts. This To-be process model is reviewed in a feedback session with internal stakeholders.

2. Process identification

Process identification is concerned with two steps: Definition of process architecture and selection of processes. In Section 1.7, the influence of the problem identification is explained. Common practice in the BPMLC is to start with process architecture, measure process performance, identify relationships and systematically select processes which require BPM optimisation [20].

In this thesis the process is already selected by the organisation and identified in the problem identification phase (Section 1.4). The goal of the process identification must be redefined. There exists a selected process, which is measured in performance. The process architecture thus does not serve the purpose of selecting a fitting process or analysing its performance.

The process architecture is still relevant to this thesis. Process architecture also has the objective to gain understanding of the processes SDZ is involved in as well as their interrelationships [3]. Understanding the relations of the advising process to different processes in the organisation enables a better understanding of the needed improvements.

2.1 Process landscape model

A process landscape model maps the processes of SDZ. This process landscape model is made in the context of the BESS subsidiary of SDZ and shows a high-level definition of processes. This model distinguishes three different types of processes.

- Core processes: Key processes in the business case of BESS.
- Management processes: Processes providing guidance for the (future) execution of core processes.
- Support processes: Processes assisting for smooth execution of the core and management processes [20].

Figure 3 displays the core processes in a value chain, which shows how value for the customer is created. The value chain shows the order and relationships between core processes. Relationships are explained by decomposing or specialising processes. The boxes pointing down or upwards indicate processes which provide input for the core processes. The core processes are displayed in arrowheads to indicate the process flow.

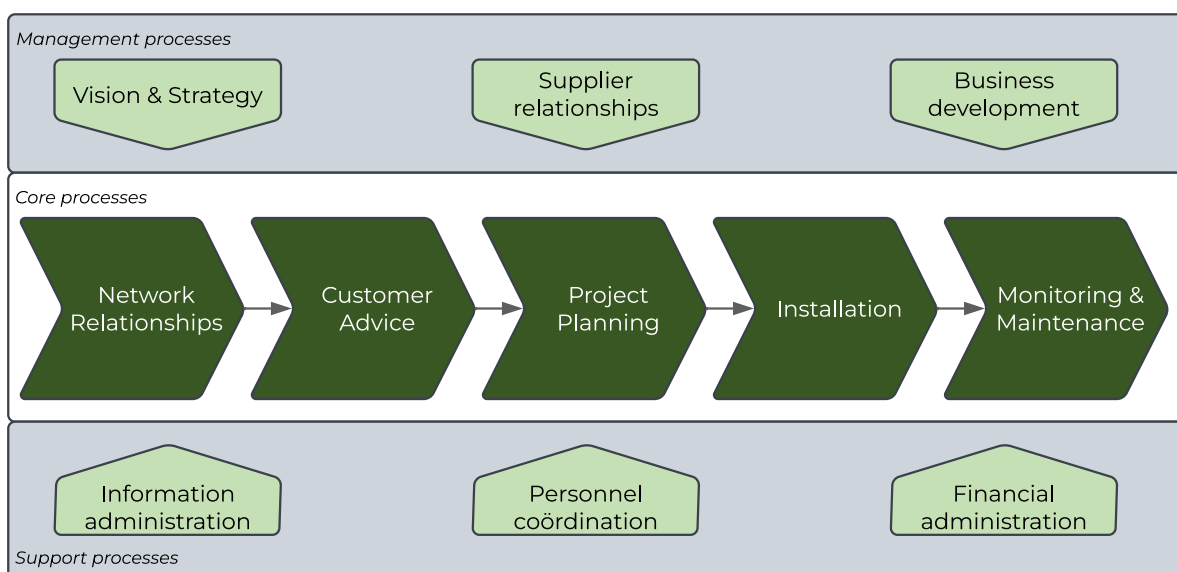


Figure 3: SDZ Battery process landscape model

Network relationships form the first step in the value chain. Most customers come from this network and maintaining relationships is the basis for the core business activity of SDZ. The advising process is the second step in the value chain. When the advice is changed, the project planning changes, the materials and needed personnel change and therefore, the installation process changes. The eventual goal of this thesis is to reduce needed man-hours for the advising process of SDZ, this process is defined and analysed in the next stages of the BPMLC. Since we zoom in on this process in chapter 3, this process is not decomposed or specialised in this chapter.

In the value chain the advising process is directly related to the project planning. This relationship consists of the input from the advice to the project planning. Reducing man-hours in the customer advice process should not lead to increased man-hours in the project planning. Because of this relationship first some attention is paid to the project planning. The project planning can be decomposed and specialised in some additional steps (Figure 4) [3]. The rectangular boxes in the Figures 4 and 5 indicate individual processes, whilst the arrowheads indicate process flow.

The Project planning consists of personnel planning and material purchasing (Figure 4). Changing customer advice or unclear advice can lead to increased or decreased needed personnel, where required freelancers are financially impactful. It can also lead to an unclear bill of materials. An unclear bill of materials results in more work on the project planning side.

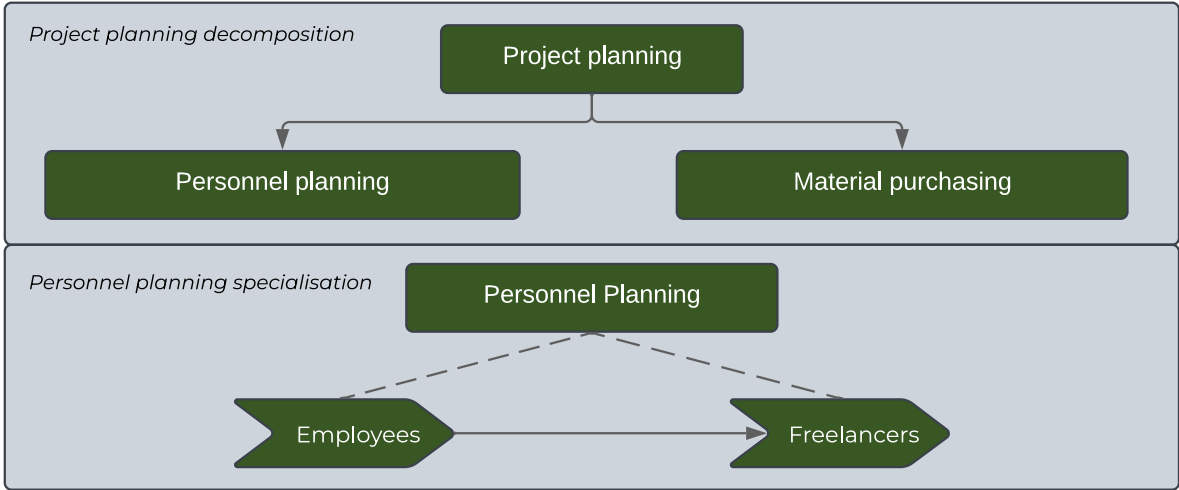


Figure 4: Project planning decomposition and personnel planning specialisation

The customer advice process is preceded by the network relationships process. The network relationships form the starting point of the advising process. To understand this starting point the network relationships can be decomposed into two components (Figure 5).

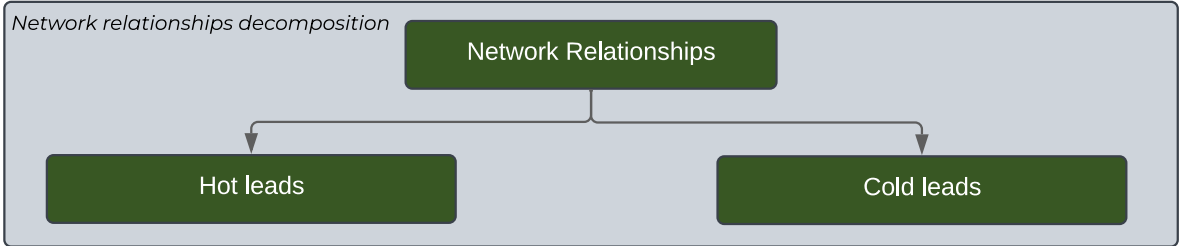


Figure 5: Network relationships decomposition

Many customers of SDZ are coming directly from network relationships. Customers find the company through referrals or via relations of the SDZ owners. Only a small portion of customers finds the company through routes such as the website. The network relationships are therefore very important to the company. In general, such a network yields two lead types: Hot and cold. Leads can be distinguished based on how close customers are to buying a product or service, where hot leads are the closest to buying [24]. Hot leads are often a result of close network relationships and lead to more specific advice, whilst cold leads often lead to generic information requests. Leads might come from a third party in the network of Stroom Door Zon. In such a case a third party fee can be included in the quotation at the end of the advising process.

2.2 Conclusion

The relationships between processes provide the answer to the sub-question: *How does the BESS advising process of Stroom Door Zon relate to other existing processes in the organisation?*

The advising process is part of the core processes which form the value chain. It is supported by financial and information administration and personnel coordination. It is guided by the managerial processes, amongst which supplier relationships, which influences available materials and cost price.

The Advising process is directly related to the network relationships process and the project planning process. Network relationships often decide how the customer enters the advising process and whether an additional fee should be included in a quotation. Project planning is directly influenced by the advising process. Reduced man-hours should not lead to increased project planning hours. BESS advise should lead to a clear proposal for installation such that it can be matched with personnel and materials.

3. Process discovery

In the second step of the BPMLC, process discovery is conducted. The aim of this step is to establish an as-is process model. This chapter reports on the findings for the following research questions:

2. What is the current design of the BESS advising process within Stroom Door Zon?
 - 2a. What are the core steps of this process?
 - 2b. What information do these steps aim to collect?
 - 2c. How is such information processed and stored?

3.1 Approach

The as-is process model is created through exploratory research. This started in the planning of this thesis by conducting interviews with the internal stakeholders of SDZ to get acquainted with the current steps in the used process. This yields a bird's eye process view of the core process steps and thus the answer to sub-question 2b. This bird's eye view is used as starting point to find: Which information is collected in such steps and how this information is processed and stored. To gather that knowledge the process was observed in real life. This is complimented by the inclusion of common knowledge available on the subject. Additionally, questions were asked to internal experts to create more clarity on the process. Finally, the process was reviewed by the involved employees and provided with improvement suggestions. All this knowledge combined lead to the as-is process model which answers sub-questions 2a and 2c.

3.2 Bird's eye process view

Process models have three defining elements: *Mapping*, *abstraction* and *purpose* [3]. *Mapping* means that a model is a representation of something in the real world. *Abstraction* defines the level of generalisation of a model. The created model serves a *purpose* which determines the topic mapped and the abstraction. In this case a first model is made to gather a broad understanding of the advising process (*Mapping*). This means that only the largest process steps are important and specific information flows can be ignored (*Abstraction*). The model is made to let SDZ employees agree upon the rough process flow before creating a detailed process model (*purpose*) and can be found in Appendix D.

In Section 2.1 the antecedent process of the advising process is discussed. The network relationships were decomposed in two results: The hot leads and cold leads. This start is also represented in the bird's eye view model. The first process step is a phone call in which the customer's aim is discussed. This is followed by an on-site meeting in which three topics are discussed: The current situation, the required new situation and the financial situation. After the meeting SDZ experts make a first estimation of practical feasibility of the required installation. In an internal meeting the requirements and inputs are discussed to decide on the technical requirements. The responsible SDZ employee drafts an advice based on that discussion and draws up the corresponding quotation. This quotation is then sent to the customer in- or excluding an additional third party fee. A third party fee occurs when SDZ provides part of a larger project from a different company.

3.3 BPMN 2.0

The bird's eye view model provided an overview of the core tasks of the process. When modelling in more detail, less *abstract* with the specific goal to create an as-is process model, a structured modelling language is needed. As mentioned, this is the BPM notation 2.0. Figure 6 provides a short introduction into the main modelling language components to understand the as-is process model.

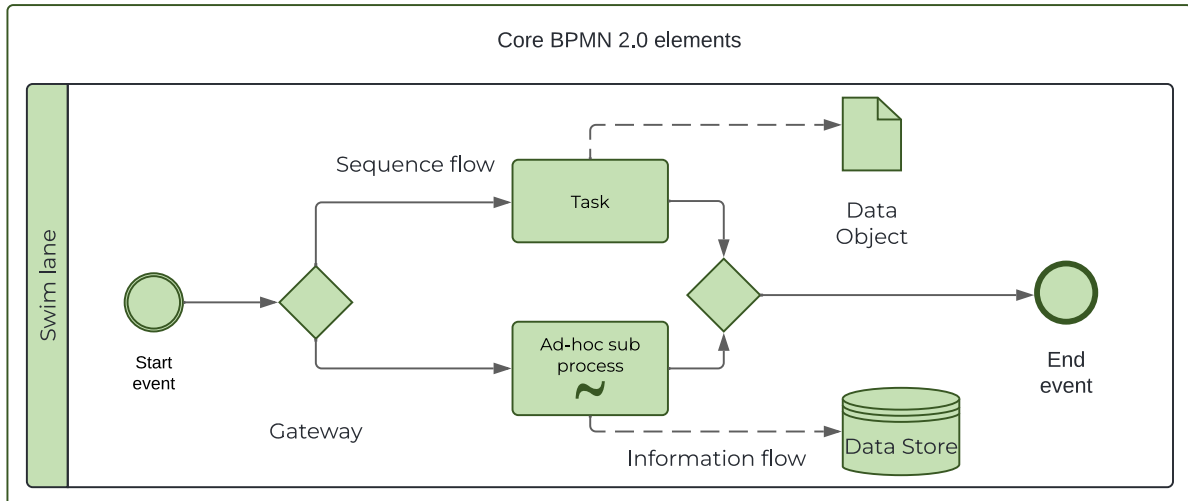


Figure 6: Core BPMN 2.0 elements [3]

Processes can be divided into swimming lanes. Each swimming lane represents a participant, all elements in a swimming lane are performed by that participant. Processes start and end with a specific event. The flow of the process is shown through non interrupted arrows. When the process splits up in multiple activities, either performed at the same time or exclusively, a gateway is used. Process tasks are shown in square boxes. The ad-hoc subprocess is a specific task which consists of a small subprocess, with its own start and end (The subprocess itself is not shown in Figure 6). Within an ad-hoc subprocess tasks can be performed in an order estimated fitting by the participant. Information flows in processes are shown as dotted lines. Information can flow between participants or from a participant to an artefact. The artefacts represent stored process information. Information only available within the process is shown as a data object. Information also available outside of the process is shown as a data storage [3].

3.4 As-is process model

The as-is process model is discussed in four steps. First the different participants are highlighted. Secondly, the main process is explained. Thirdly, a subprocess of the main process is discussed and highlighted. Finally, in the fourth step the participant processes are explained.

3.4.1 Participants

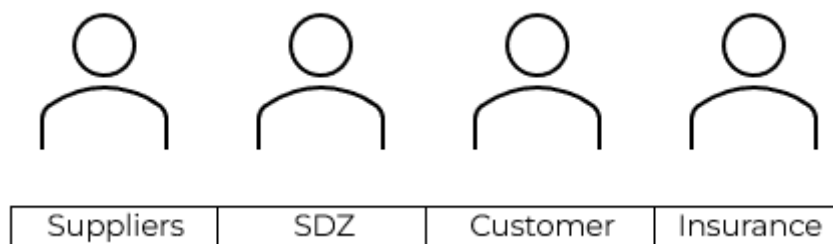


Figure 7: Advising process participants

The advising process has four different types of participants (Figure 7). Central are the customer and SDZ. Both the customer and SDZ are represented by one employee each. If an additional employee is involved in a process step, a participant icon like the ones in Figure 7 is present in the process model. The insurance agency is the company where the customer is insured. The insurance agency can have requirements for new installations for it to be insured. Suppliers are in this process model also

represented as one participant. There are multiple suppliers, but interactions are always between SDZ and one supplier. If there are more suppliers involved, the same process applies to each individual supplier. Suppliers provide additional information on installations and material quotation for large projects.

3.4.2 SDZ main process

The process starts with the distinction also shown in the bird’s eye view model. The two branches formed after this distinction are discussed separately, starting with the case of the ‘Cold lead or simple consumer’. A simple consumer is a private consumer who only needs the battery for his private home and has no irregular household power usage. All other hot leads are considered as complex. The process model is cut off at the orange dot in Figure 8 and continues at the orange dot in Figure 9.

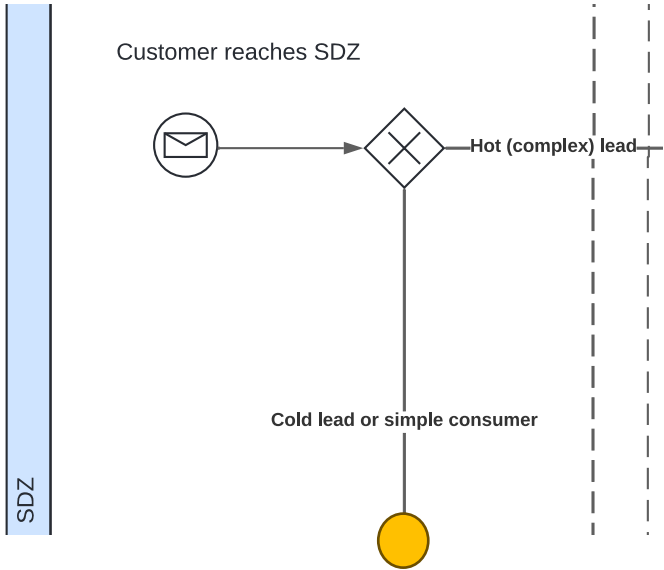


Figure 8: SDZ main process start

Cold lead or simple consumer process

The simple consumer case is a straightforward process. The customer is reached with a phone call. This phone call is an ad-hoc sub process. Based on the output of the phone call, immediately an advice is devised. This is paired to a quotation and sent to the customer via email, the process ends here. In case the customer is not interested in an advice or quotation the process ends as well, although in an earlier stage

Simple customer process

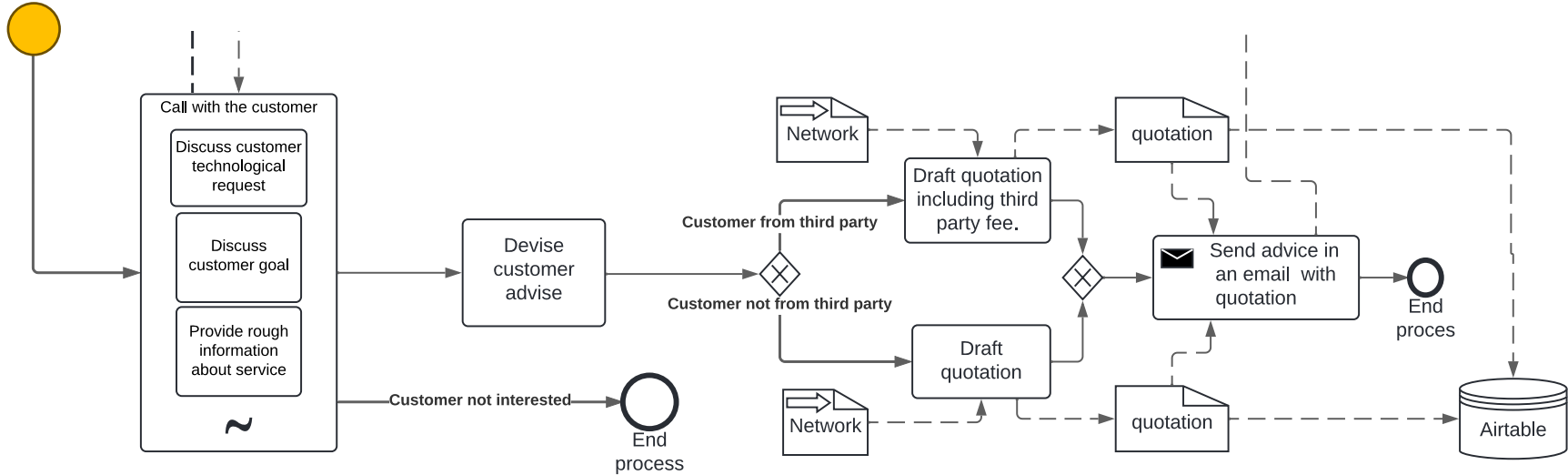


Figure 9: Simple customer process branch

Hot lead or complex customer process

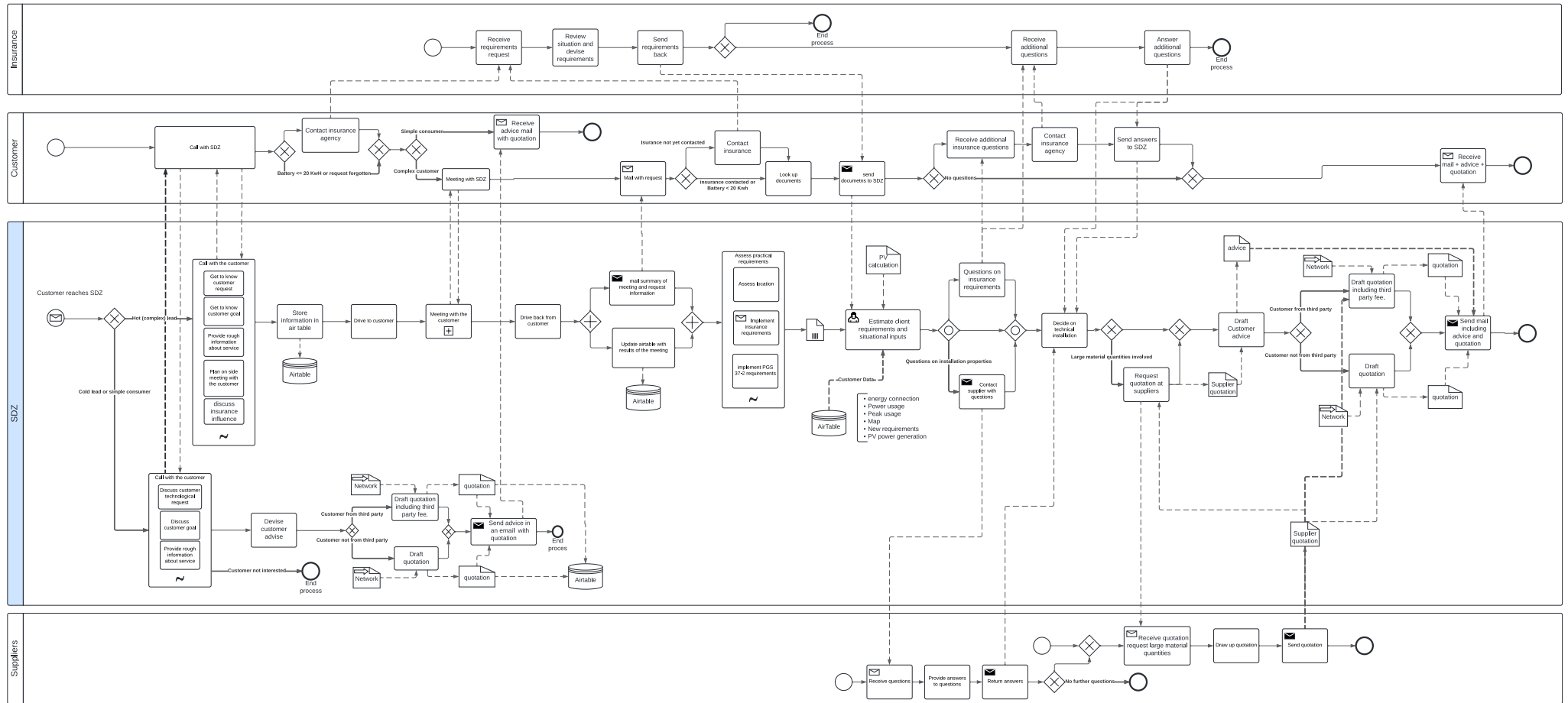


Figure 10: As-is process model

The case for a complex customer holds many more tasks and information flows, which makes it a big and more complicated model shown in figure 10. Like the simple consumer branch, the complex customer starts with a call. In this call the customer request is discussed, often this is linked to the customer goal. Sometimes, in later stages or in this call, it is found that the customer goal is not directly related to the customer request. In the call, rough information is provided about SDZ services. In addition to that, an on-site meeting is planned. The customer is asked to discuss the BESS with their insurance agent, to ask about insurance requirements on BESS.

The information gathered in this call is stored within the ERP system: Airtable. The next step is the on-site meeting. This meeting is seen as a subprocess and discussed in Section 3.4.3. After this meeting a summary of the meeting is sent via mail to the customer including a repeated request for the documentation mentioned in the meeting. In the meantime, the information of the meeting is stored in Airtable. The SDZ employee then moves on to assessing the practical feasibility of the project. This is related to the possible location, the insurance requirements and the borderlines of the PGS 37-1 requirements. PGS 37-1 is a general Dutch ruling on the storing of chemicals such as Lithium [21].

The SDZ employee then meets with a colleague to discuss the relevant inputs and create a rough proposal. Inputs are coming from the previous assessment, the necessary information stored in Airtable, the requested documents sent by the customer and the calculation of PV power generation in case of new to be installed PV panels. The SDZ employees discuss the possibilities. When there are remaining questions on the insurance requirements or the technical properties of installations, the insurance agency (via the customer or direct) or suppliers are contacted. After that, a decision is made on what installation to advise. In the case of large projects, suppliers are asked to provide a quotation for large quantities. This is the final piece of information needed to draft the customer advice. A significant discount might influence which specific material or brand is offered. The customer advice is created in a document. The quotation is drafted within Airtable and includes a third party fee in the case of a third party lead. The quotation and the advice are sent to the customer via e-mail, ending the process.

3.4.3 SDZ subprocess

The meeting with the customer can be seen as a sub-process in the total advising process. It entirely takes place at the customers location. The process has four general steps in a sequence:

1. Map the current situation.
2. Discuss the requirements of the new situation.
3. Discuss the financial situation.
4. Recon the location.

These tasks are in order, but the process allows to return to a previous step if in a next step information is missing. In Section 3.4 the ad-hoc subprocess concept was explained. Each step within the meeting with the customer is an ad-hoc subprocess. This allows the on-site employee to have a flexible meeting, providing attention where needed and following a natural conversation flow. The specifics of the information and requirements are discussed for each step, below Figure 11.

Ad-hoc subprocess: Meeting with the customer

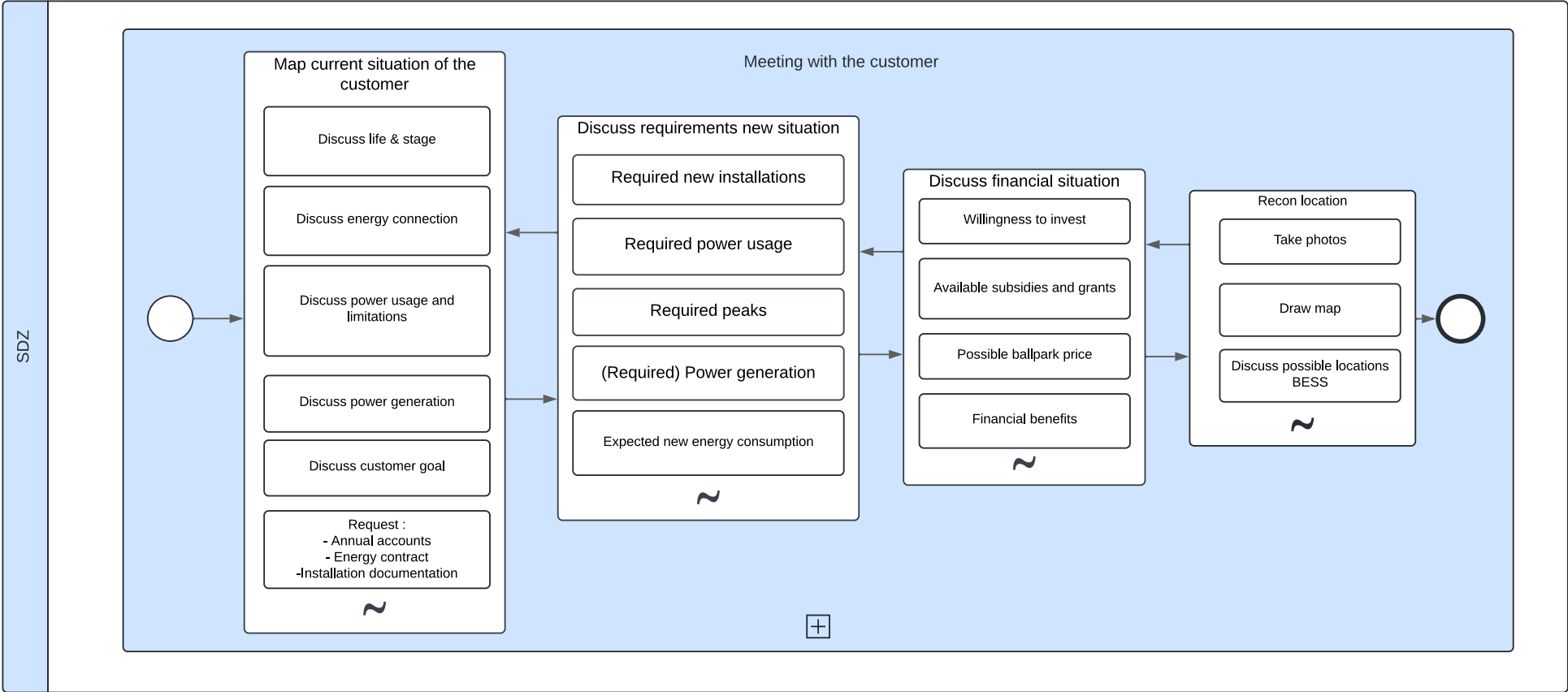


Figure 11: Meeting with the customer sub-process

Map current situation of the customer

The life & stage of the customer is discussed to get a feeling **for where someone is in their life**. Examples of differentiation are: Someone who is planning his retirement or someone who has just started a business. Life & stage can be closely related to the goal and the willingness to invest. Energy connections are the type of connections a site has to the grid. The larger the connection, the more power can be transported, but also the more expensive. A site combining living space with business related buildings might have multiple connections.

Power usage discusses the current amount of power used and the contractual limitations on usage. It also discusses installations which currently use lots of power. When applicable power generation is discussed, often in form of PV, but sometimes windmills or generators are applicable. The customer goal is also shown in the bird's eye process view: Solving a net congestion problem or realising financial benefits. A customer might have both in mind, but eventually one is always the main goal. The SDZ employee tries to find out what it exactly is. Last, some information is requested: The annual accounts of the energy supplier, the energy contract and installation documentation of power generating installations.

Discuss requirements new situation

The required new installation always includes a battery but might also include PV panels, EV chargers, heat pumps or other equipment. When there are already PV panels or other durable energy related installations, an EMS is often already in place. The same goes for more installation materials, this can reduce needed installation costs.

Required power usage discusses the average total power consumption for the new situation. Whereas the required peak power consumption discusses the highest needed power consumption spike. It might be the case that an additional machine is no problem for the entire usage contractual limit but that it is a problem for the maximum peak consumption. Power generation is also relevant to the new situation. This could consider (additional) PV panels, but it could also be the question whether a battery can be used as an emergency power generator. The expected new energy consumption tries to sketch future additional power usage. Changes influencing consumption might be: Additional machines, turning to electric heating or switching to an EV charger.

Discuss financial situation

The willingness to invest is not asked point-blank. It is, however required that the SDZ employee has a general feel for the topic. This can also be reached by asking questions about importance of quality or aesthetics. The available subsidies and grants are discussed shortly, the length of the topic depends on the knowledge and resources of the customer. National grants are always mentioned, local grants can be researched by SDZ but are often dealt with by an accountant. Customers often request a ballpark price, in such case a rough estimation of the magnitude of the price is given. Lastly, financial benefits are discussed. This depends on the goal and requirements of the customer, examples are: A smaller energy connection, reduced usage or peaks, trading benefits and tax benefits.

Recon location

The location is toured, viewing all installations and the fuse boxes. Possible locations are also viewed and discussed. The location is photographed and in case of multiple buildings and connections a map is drawn. This might cause additional questions on previous topics; in which case a previous step is re-addressed.

3.4.4 Participant processes

Steps in the SDZ BESS advising process have counterparts at the other participants. Often these are related to receiving, requesting or sending information. The steps of the information processing on the side of external stakeholders are roughly estimated and could be specialised or decomposed. However, steps not conducted by SDZ, are not directly influenced by SDZ and are therefore not part of the thesis scope.

3.5 Results and conclusion

The third chapter is concluded by the extraction of information from the as-is process model. The extraction of information follows the structure of the sub-questions 2a, 2b and 2c. Finally, a conclusion to the second research question is provided.

3.5.1 Results

2a. What are the core steps of the advising process?

The first step is calling with the customer and deciding on the customer target. This is followed by meeting the customer and gathering the customer input. The next core step is estimating the practical feasibility. Afterwards, all input and requirements are discussed, and a decision is made about the recommended installation. This input is transformed in a quotation and advice which is sent to the customer.

2b. What information do these steps aim to collect?

The aim of the call is to gather the customer goal and request. Also, the insurance requirements are requested. The aim of the meeting is to verify the information gathered in the phone call. Additionally, it collects:

- Energy connection type (s)
- Location map & photos
- Possible BESS locations
- New requirements on energy connections, power usage, peak usage
- Required installation parts
- Planned additional power using installations
- Existing power generation
- General estimation of customer willing to invest

After the meeting the following documents are requested per mail:

- Annual energy consumption accounts
- Energy contract
- Installation documentation on energy consuming or generating installations
- If not yet provided: Insurance requirements

From these documents the following information can be extracted:

- Yearly power usage
- Contract limits
- Installation safety requirements

In the practical assessment, SDZ tests feasibility based on location data, insurance requirements and PGS 37-1 directives. This yields information about the location and required installations.

In the estimation of inputs PV calculations are included in addition to the existing information, since BESS allow for optimization of power generation. The aim of the step is to create a concept advice. Asking questions aims to get additional information on either insurance requirements or installation properties. Quotation requests result in pricing information.

2c. How is such information processed and stored?

Information is stored within the ERP system. When it is not stored, it is used in the next process step. The information is used to create the advice and the quotation. The advice consists of a choice of battery, location design, EMS system and additional installation needs (e.g. PV (dis)assembly, inverters or required cables). The quotation is based on the cost price of all the materials, the estimation of required man-hours, yearly maintenance costs and a standard margin.

3.5.2 Conclusion

2. What is the current design of the BESS advising process within Stroom Door Zon?

The answers to the sub-research questions form the content of the as-is process model (Figure 10). This model shows the current design of the BESS advising process within SDZ and its core steps. Information is gathered in the customer meeting and via mail after the meeting. Gathered information is stored within the ERP system or used in the next process step.

4. Process analysis

In the third step of the problem-solving approach the current process is analysed to answer the following research question:

3. Where can the current BESS advising process be improved upon?

As explained in Chapter 1 some additional sub-questions provide steady guidance for answering the research question above. These additional questions analyse the value and essential parts of the advising process.

- 3a. Which information is essential to a potential customer, to assess whether a BESS is of interest?
- 3b. Which steps are essential in an advising process to assess whether a BESS is of interest to the customer?
- 3c. Which parts of the advising process are experienced as most valuable by the customer?

4.1 Approach

The sub-questions can be divided into two groups. Questions 3a and 3c focus on customer opinions and experience, while question 3b is to be addressed from a SDZ perspective. The approach of finding the answer to these questions is therefore split up. As explained in Chapter 1, interviews are conducted with customers and employees. The interviews with customers provide answers for questions 3a and 3c whilst the internal interviews provide answers for question 2b.

The output of the interviews is combined with observations throughout this thesis process. In a value stream mapping-based analysis, the value output of the interviews is combined with the estimates of time needed for each process parts based on the interviews. In the SWOT analysis the performance of the entire process is reviewed with a future perspective. These two analyses and the conclusions of the interviews yield topics, that account for waste of time in this process. Time wasting process steps currently do not yield optimal value or take too much time to reach the value. Therefore, those are the topics on which the current BESS advising process can be improved upon.

4.2 External interview approach

This section justifies the interview approach. First, the selection of customers for the research population is explained. Secondly, the conceptions of those customers or about those customers are discussed to create context to the interviews and identify a possible bias. Thirdly, the structure of the interview is explained.

4.2.1 customer selection

The first set of interviews were conducted with customers. The customer group of SDZ consists of agricultural companies (farmers), SMEs and private consumers. Most up and running BESS installed by SDZ are currently at agricultural companies. These form the most accessible group and currently the largest share of customers for SDZ. Three agricultural customers of SDZ were interviewed to analyse the current process.

The private consumers are generally part of the simple customer branch. This branch is concise and most of the time does not result in a sale. This branch takes up little time and is not matched with a reliable customer base. Therefore, it was decided with SDZ that no consumer is interviewed, and this branch is left out of the scope. Improvements on the process might of course still be implemented on this branch. Furthermore, some attention is paid to the branch at the internal interviews.

SMEs were also difficult to reach, due to the small base of customers. SMEs and private consumers do come to SDZ via a partner installation company. The owner of this company is interviewed to gain some insight in what this process looks like and where it can be improved.

4.2.2 Customer conceptions

SDZ understands their customer group from their own point of view. This has two sides which cause its relevance to discuss here. First, SDZ's conceptions about their customers provide context to the interviews and ensure a fitting interpretation. Secondly, the conceptions shape interpretations and conclusions which introduces a bias. Discussing the understandings of SDZ about their target group before providing the analysis of the process helps to counter such a bias.

As described in Section 4.2.1, the main group of current customers with a finished installation consists of agricultural customers. Therefore, interviewing the agricultural customers is the most fitting decision. This does lead to a bias tilted towards the opinions of that specific group. SDZ believes agricultural customers are more likely to appreciate a personal, informal approach. For this reason, more time is given to the small talk section of the process. Secondly, it is also the reason standardised communication is avoided by some employees. Third, agricultural customers are expected to be less direct in communication style than SME owners. It is believed that SMEs are more likely to directly talk about the numbers: meaning that performance and finances are discussed. Agricultural companies are often sooner convinced by the feeling that a company is trustworthy opposed to being convince by financial arguments.

4.2.3 Interview structure

After selecting the customers, a fitting interview approach was chosen. Customers from SDZ form an important network of positive reviews and word of mouth advertising. Therefore, the interview approach should not negatively influence the opinion of the customer of SDZ, while still allowing room for critical questions if needed. The customers were called in advance to plan the interview. In this call it became clear that the customers were less enthusiast about a face-to-face meeting for the interview. Therefore, it was decided to conduct the interview by phone. The interviews were conducted semi-structured. The as-is process module forms the backbone of the interview structure. From this process model four main steps were taken as interview topics: The phone call, meeting, mail communication and advice + quotation. The semi-structure allowed for an organised interview, which was also clear to the interviewee. Nonetheless, it was possible to dive deeper into specific details with additional questions.

The interviews took on average approximately 25 minutes. This allowed for enough time with all interviewees to go over the entire process and discuss their opinions.

4.3 External interview results and analysis

The results will be discussed in the same structure as the interviews, by following the process structure in four steps. Each of the interview transcripts can be found in Appendix A. The four steps are:

1. The phone call
2. The on-site meeting
3. Mail communication
4. Advice and quotation

4.3.1 The phone call

The phone call is used for three goals. The customers get some first information about the BESS. Options are briefly discussed and, in some cases, a rough price. Some customers also appreciate to get the feel of SDZ by talking to an employee. SDZ always plans an on-site meeting for larger customers, customers

do have this same goal. The phone call is appreciated as an introduction but is often merely seen as kick-off for the advising process.

4.3.2 The on-site meeting

The on-site meeting is perceived as very valuable by the customers. All interviewees explain that feeling or trustworthiness is very important to them. The time taken for the on-site meeting is the most important because of the positive outcome of this feeling. The customers have no strong feelings about the number of colleagues visiting. One suffices, but two is not specifically to much.

The first part of the meeting, small talk, is also appreciated by the customer. However, all interviewees do mention in some form, that it is not required to spend too much time on this: *“Nonetheless, this doesn’t have to take very long.”* or *“This doesn’t have to be shorter, but also not endless.”* [Appendix A.2, A.1]. The small talk is mostly appreciated due to the personal interest: *“The personal attention is perceived as nice by the customer.”* and *“The personal approach is experienced as very pleasant.”* [Appendix A.2, A.1].

The length of meetings differed amongst interviewees but on average was between 1 hour and 1.5 hour. One of the customers had a meeting which lasted over 2 hours. This customer indicated that the availability of SDZ was pleasant but that the meeting was rather long.

The customers expect information about the total BESS. They are interested in the capabilities and services of SDZ. The techniques are often unknown to the customer and require explanations. The communication of SDZ in the meetings is perceived as positive. Customers do not always have the relevant documents ready, which influences the possible answers on location and the length of the communication afterwards.

4.3.3 Mail communication

Customers appreciated a summary of the meeting via e-mail. The length of this mail can be rather short. In general, the current communication between the customers and SDZ is sufficient. Customers are aware of the status of the process and appreciate the lack of redundant emails.

Customers do not care for personalised emails. *“It does not add to the experience that the mail is personalised. A standardised mail would also have been fine.”* [Appendix A.1]. One interviewee, however, does question the feasibility of standardised mails, because of the difference between customers: *“... cases are very customer specific.”* [Appendix A.2].

When documents are not yet present in the meeting, often some additional communication is needed, this is incorporated into the summary mail if possible. Sometimes, additional calls are needed.

4.3.4 Advice and quotation

Customer are satisfied with the current design of the advice. *“Jargon and technologies were explained well”, “... the argumentation was presented in a straightforward manner.”* and *“The advice was clearly structured, and the technical details were well explained.”*. Customers have no preference for how the advice is presented, this can be done in a structured standardised format [Appendix A.3, A.1, A.2]. For one customer the advice was not clear enough, this customer had a call after the advice with SDZ for some additional explanation.

The quotation caused some more uncertainty. The total price of the quotation is clear and well structured. The quotation in general lacks some additional explanations. One interviewee explains that the quotation could have been more disaggregated and delineated. It was unclear which parts were the responsibility of the customer, and which services were provided by SDZ. Additional attention could also be given to

the grants and subsidies. One customer sees this as an additional service SDZ could provide but does not specifically expect it from SDZ. Another customer explains that he knew about subsidies but almost missed deadlines because he was not aware of the rules, even though an accountant and advisor were involved besides SDZ.

Customers eventually base their decision on a combination of feeling and information. As mentioned, getting a feeling of trustworthiness is important. This is combined with technical information, sometimes with special regard to certain topics. The acoustics and noise of the BESS are, for example, mentioned by one customer as of particular importance. The customer likes to have a clear explanation of the options. Price often comes secondary, although it remains important. One customer is quoted: “... *a few thousand euros more or less does not make the difference for such an installation.*” [Appendix A.2].

4.3.5 Results

A. *Which information is essential to a potential customer, to assess whether a BESS is of interest?*

Customers like to get a good feeling of trustworthiness of the installer. This is combined with information topics which form the answer to this research question.

These topics are:

- Which are the options for the specific situation.
- How do these options work.
- The SDZ services
- Clear argumentation of the proposed solution.
- Quotation.
- Information on grants and subsidies.

Based on the interviews it is debatable whether information on grants and subsidies can be called essential. However, the information is used in the decision-making process, the uncertainty is more on the part of how extensive the information given by SDZ should be. Furthermore, in Section 4.2 customer conceptions are discussed, which leads to the believe that SMEs would even more be interested in the financial numbers. This can also be argued based on the interview with the partner installer: The main input of SDZ in such a process is the quotation for their work [Appendix A.4]. Therefore, quotation and information on grants and subsidies are regarded as essential information.

C. *What parts of the advising process are experienced as most valuable by the customer?*

The on-site meeting is perceived as most valuable by the customer: The personal approach and available time stand out. The time and approach are important for the customer to explore their options and get a good understanding. This is completed by the quotation and the written advice, which could be improved to provide even more value. The option for additional communication when needed is also highly appreciated by the customer. Small standard parts, such as the phone call or the summary, are less valuable to the customer. For these steps the customer is less concerned with format, structure or content as long as the functionality remains.

4.4 Internal interview approach

The internal interviews are conducted with each of the three employees involved in the process. All employees have their own style and background before entering the advising process. An employee with a sales background is likely to act differently in the advising process compared to someone with an installation background. To account for these differences, present in the company, in-depth interviews were conducted with all three employees which interact with the advising process.

The interviews take between 35 min and 1 hour. They are semi-structured, following the same approach as the external interviews, by taking the advising process as framework for the interview. This means that the four steps are discussed: Phone call, on-site meeting, mail communication and advice and quotation. All these steps are this time focussed on the actions of the employee. The advice and quotation are aimed on the time it takes to write or construct certain parts.

4.5 Internal interview results and analysis

The results are discussed in the same structure as the interviews, by following the process structure in four steps. In addition to this, data handling in the entire process is discussed. Each of the interviews' transcriptions can be found in the Appendix A.

4.5.1 The phone call

There is a large difference between employees how much time is spent on the phone call. Employees give estimates of “3-5 minutes”, “5-15 minutes” and “15-25 minutes” [Appendix B.3, B.2, B.1]. All employees follow roughly the same approach to the phone call. General information is provided to the customer about SDZ services and about BESS. The employee tries to estimate how close someone is to buying a BESS (hot or cold lead). Also, the size of the needed BESS is estimated by the employee. In case of a hot lead interested in a larger BESS, a visit is planned. Planning this visit is the most important part of the phone call.

4.5.2 The on-site meeting

Two out of three employees prefer to go alone to the on-site meeting. It makes the employee feel more in control and more structured. Attending with two employees might also lead to the customer believing that SDZ has a too large profit margin, since they have time enough to attend with two employees where one would suffice.

All employees do small talk with the customer, although the length depends on the interest of the customer. When they do, small talk is also used to gain information about the customer, such as life stage and company phase. Small talk is used to form a bond with the customer. Estimates for the lengths of this part are: “5-10 minutes”, “10-15 minutes” and “10-20 minutes” [Appendix B.3, B.2, B.1].

All employees try to gain the information as described in the process model, a structure to gain this information is not used. One employee says that such a structure is a preferred outcome of this thesis. The available information provided by the customer is used as input for the conversation and later the advice. Important to all employees is the scouting of the location. This helps to get a clear picture of possible obstacles and enables early conversations with the customer about possible insurance demands or government rules.

The storing of data and photos is identified as a weak point in the current process. According to two out of three employees often a map should be created. Photos are important to all employees. Knowledge about the location or the required cable length is often only remembered by the visiting employee.

The total meeting takes approximately 30 minutes – 2 hours. Most employees estimate between 1 hour and 1.5 hour.

4.5.3 Mail communication

Little time is spent on the mail communication (approximately 5 minutes). Such mails are always personal. One employee is quoted: “*This could have been a WhatsApp message*” [Appendix B.1]

4.5.4 Advice and quotation

Currently no structure is used for the advice. The length and content of the advice might differ per customer. The rough lines of which system and which location can be provided rather quickly. An employee is quoted: *“For the entire installation, the devil is in the details.”* [Appendix B.2]. Controlling third party machines or EMSes take a lot of time. Each brand has its own approach, when a product of a new brand is encountered, this takes a lot of additional time. When such details are not considered as part of the advising process this shortens the process largely, but it saves no time, since this time is moved to the project planning. Currently, there is no information stored about individual products and the approach to connecting them. *“Photos from physical connections from different installations can prove valuable knowledge when installing such a product again.”* [Appendix B.2].

Many parts in the quotation are fixed (estimated: 90%). Due to this fact, drafting the quotation does not require much time. The parameters decide the boundaries of the quotation. Examples are the cable length, the programming of an EMS and the small materials. Much of the quotation work is done by one employee.

4.5.5 Data handling

In various steps of the process, information related to the customer project is stored. After the phone call often, a folder is created in the database. If this is not done, it takes up more time at the on-site meeting, since laptops are not used by most employees and creating a folder is more difficult on a phone. At the on-site meeting, one of the colleagues uses a laptop to create drawings and store information, which is not seen as ideal. It would be preferred to have the ability to draw in photos or make notes on-site. Photos are not always uploaded; in such a case a colleague must send a reminder or call for the information. If the information is stored well, this can also be used for the installation documentation.

4.5.6 Results

B. Which steps are essential in an advising process to assess whether a BESS is of interest to the customer?

The phone call is essential for two goals: Knowing if a customer is a hot lead for a big BESS, and in such case, planning the meeting. Providing or getting information is not per se essential. Asking to prepare documents for the on-site meeting could be essential but does not happen structurally with the same intensity.

The on-site meeting is very important to build a bond with the customer and get insight into the life stage of the customer. This is essential to estimate what might be a good investment. Getting information and scouting the location is the most important. The information from research question 2b is precise and essential. Power usage is reviewed month by month instead of annually. Not yet in the information list is the missed generation of PV panels. PV generation might be shut off in case of a too high main voltage, which leads to missed power generation.

Mailing communication is not essential to assess whether a BESS is of interest to the customer. Although sometimes necessary if the customer has not yet provided the required documentation.

The knowledge resulting from the on-site meeting is essential to provide a quotation and an advice. Discussing these inputs to create such advice is also essential to get to the right conclusion. The insurance demands might also influence feasibility and are therefore essential. The quotation and advice themselves are not essential to SDZ to assess whether a BESS is of interest to the customer. A rough estimation of the advice and quotation is enough.

Data handling lacks a structured approach. This requires additional contact between team members or SDZ and the customer. It also limits the opportunity to reuse information in the project planning phase.

4.6 VSM based analysis

Value stream mapping is a technique borrowed from Lean management [23]. The VSM technique has comparable features to the BPM lifecycle. Therefore, not the entire VSM approach is used. The stream of activities in the advising process is mapped based on VSM principles. Each of the activities is paired with an estimate of spent time and a perceived value by the customer. This allows for comparison between spent time and added value. The time spent on the activity is denoted in minutes. All data is gathered or based on the interviews, both internal and external. As mentioned in Section 4.1 the simple consumers are left out of scope. The average time spent is also solely based on the complex customers.

The perceived value by the customer is assigned a value between 1-5, based on the necessity of the step and the additional value it provides. Additional value is seen as value specifically perceived by the customer. Steps which are necessary for the process, but the customers do not perceive them as a selling point are therefore given a low number. The values are assigned in steps of 0.5. With 1 being the lowest value and five the highest value. The values were assigned based on the customer interviews and afterwards discussed with one of the internal employees. As a result of this discussion some alterations were made. In Table 1 the meaning of values is displayed, an additional 0.5 means that the value is perceived as somewhere between the integers.

1	Not useful and does not provide additional value.
2	Useful, but provides little to no additional value.
3	Useful and provides additional value.
4	Useful and is perceived as main provided value.
5	Useful and is perceived as a unique selling point.

Table 1: Perceived customer value range

4.6.1 Diagram

Eight process steps are considered for the analysis. Customer contact concerns all mails and calls which are standard part of the process. This includes, but is not limited to, the summarizing mail and the mail containing the advice and quotation. The additional customer contact contains all contact outside of the standard process. The total length of the process in Figure 12 excludes time to drive to the customer and time spent to store data, since these two have no direct relationship to customer value. Time to drive to the customer is estimated at 2 hours in total and time to store data at 15 minutes.

1. **Calling the customer**
The call is appreciated but largely serves a practical purpose: To plan a meeting. Both the customer and SDZ employees indicate that in the entire process the call has limited effect on the eventual advice. Therefore, the value 2.5 is assigned.
2. **On-site meeting**
The on-site meeting is regarded very important by both customer and employee, it is essential to the provided value. Customers mention the available time as a unique reason to choose SDZ. Therefore, the value 5 is assigned.
3. **Customer contact**
Customer contact is regarded as practical but contributes little to the value proposition delivered. This is strengthened by the fact that it might include repeated requests. Therefore, the value 2 is assigned.

4. Additional customer contact

Additional customer contact is part of the flexibility of SDZ. The customer really appreciates this, it is mentioned by 2 out of 3 customers in the interviews. It helps SDZ to provide personal advice. Therefore, the value 4 is assigned.

5. Preparing advice

The preparing of the advice takes up a lot of time. This is a large part of the value delivered to the customer as described by the employees, but the customer does not always perceive it as such. Therefore, the value 3.5 is assigned.

6. Advice discussion

The discussion of the advice improves the advice given in the process. Due to the two required colleagues, it takes up quite some time. The discussion also serves a developmental function, colleagues learn from each other. The customer has no knowledge of this discussion. All this is more difficult to translate into customer value. Therefore, the value 2.5 is assigned.

7. Drafting advice

The advice drafting takes up little time. It translates all work into value for the customer. The advice is received well by the customer, but not great. No customers mention specific appreciation of the advice and 2 out of 3 interviewed customers mention that additional explanation was needed. Therefore, the value 2.5 is assigned.

8. Drafting the quotation

The quotation is important to the customer, but often the advice and on-site visit are more relevant. Customers believe the quotation can be improved on clarity and additional information. The customers do not mention the quotation as specifically of value. Therefore, the value 2 is assigned.

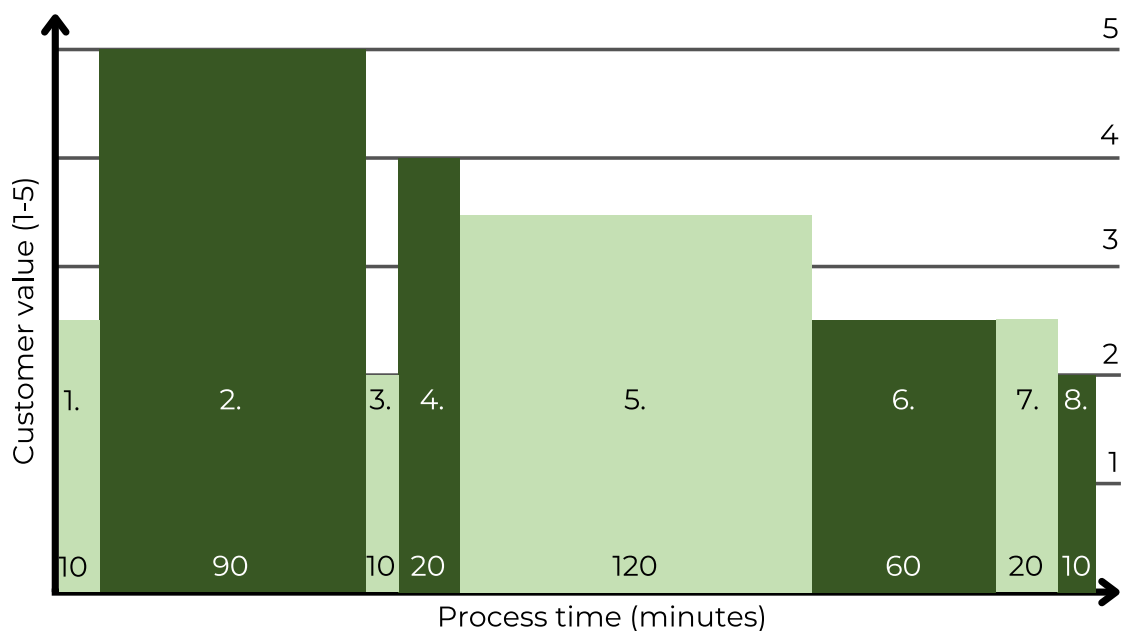


Figure 12: VSM based diagram

4.6.2 Analysis

The VSM based analysis is the first analysis which reconstructs process parts, and the time spent on each part. In chapter 1 internal experts estimate process time to be 12 hours. The goal of this thesis is to reduce this process time with 25%, from 12 hours to 9 hours. The analysis of the interview results provides an improved insight into the process. Based on the customer interviews and the opinions of

internal experts for each single process part, an estimate of 8 hours is made. The possible reasons for this discrepancy are part of the discussion.

Besides finding a more accurate estimate of the process length, the goal of the VSM analysis is to compare customer value to spent time. In general, it is concluded that process parts which take more time (60+ minutes), are regarded positively in provided additional value (minimum score of 2.5). The goal of this entire thesis is to reduce process time, whilst maintaining advice quality. In regard of this analysis this means that the values assigned must be maintained or improved.

A lot of time is spent on preparing and discussing the advice, but this does not translate to a very high customer value. One of the results of the interviews includes that the written advice and quotation do not always represent the value created in the preparation of the advice. The on-site meeting is also a time-consuming process step, but this is rightly translated into value. Customer contact takes up relatively little time, however, it is not valued very highly (value 2).

4.7 SWOT analysis

In addition to the data provided by the interviews and the VSM based analysis a SWOT (Strength – Weaknesses – Opportunities – Threats) analysis is made of the entire process [22]. During the observation phase of this research some additional observation about the process were made regarding process time. These observations were discussed in a meeting with the employees. This discussion resulted in the topics described on the SWOT analysis. This analysis allows to review the process in a future-oriented perspective and include those observations.

Figure 13 contains the SWOT analysis in a standard format. This SWOT analysis only considers topics not yet discussed in the interviews or the value stream mapping.

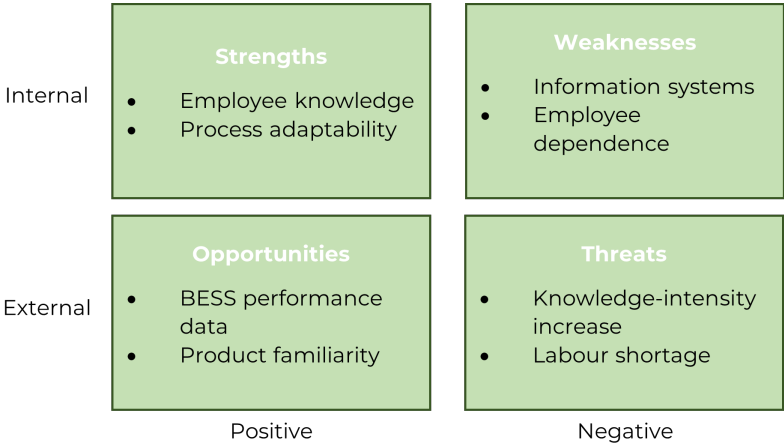


Figure 13: Advising process SWOT analysis

Strengths

The process is very knowledge intensive; the employees/owners hold a lot of this knowledge and can use this to provide accurate advice at a high level to the customer. The process is very flexible and can be adapted to the customer. If there is need for additional explanations or contact this can be arranged. This results in a very personalised process.

Weaknesses

Little to no information is stored in information systems. There is currently no infrastructure for storing knowledge or increasing the owned knowledge. The process is therefore very employee dependent. All

knowledge is stored in the minds of the employees/owners. This is a weakness because if something causes one of the employees to be unable to continue a process, it is very difficult to take over or replace this employee.

Opportunities

BESS systems are a novel technology. There is not yet a lot of public data available on the performance of BESS systems in specific contexts. This makes it difficult to assess the profitability of a system. An increase in such data could make it easier to advise on BESS. Many customers are currently not that familiar with BESS, increased product familiarity could reduce the need for explanation about the technology and increase customer leads.

Threats

An increase of knowledge intensity could be a threat for the process. This requires even more knowledge in the possession of the employee if there are no good information systems. Increased knowledge intensity is to be expected with new laws, financial rules and technologies [29]. Labour shortage limits the availability of capable personnel which is needed for the company to grow with the current employee dependent process [30].

4.8 Conclusion

3. Where can the current BESS advising process be improved upon?

Documentation is not in all cases requested in the phone call before the on-site meeting. Having the documentation available on-site provides almost all information needed. It also eliminates the need for additional contact to request that documentation.

The external interviews point out that small talk is beneficiary, but time spent on small talk is allowed to be limited. This same principle holds for the entire on-site meeting. Time spent on mails and the first phone call can be minimalised. For written contact, functionality is appreciated over personality.

Quotation can be improved on structure and information provision. The written advice does not translate the value creation of the advice well enough to the customer. Both can be improved.

The information provision in the entire process is a weak point. This fuels time spent to look up data or register new data during the advising process. This time wasting will increase strongly in the case of an employee becoming unavailable unexpectedly. It is currently difficult to include new employees in the process, since much information and knowledge is stored in individual memory.

The process analysis shows that the process takes less time than initially estimated. Internal experts estimated process time to be 12 hours. Based on the process analysis an estimate of 8 hours was made.

5. Process redesign

This chapter provides the answer to research question four. Based on the conclusions of the process analysis, proposals for process redesign are made.

4. *How should the advising process be redesigned to enable such improvements?*

First, the conclusions related to time wasting will be discussed and countered with a proposed measure. Second, the information structures are discussed to answer sub-question 4a., followed by proposed measures. All measures were brainstormed and discussed together with SDZ, during the entire length of conducting this research. This chapter only considers the final redesign. Redesigns which were considered, but were not deemed fitting, are not discussed.

4a. *How should information within the process be structured to fit the redesign?*

In sub-question 4b the steps required by the organisation to implement these measurements are discussed. The organisation currently uses Airtable as an ERP system, Airtable can also function as a workflow management system. The organisation aims to have all information flow and data storage within one system. Therefore, all redesign of the information structure must be integrated in Airtable.

4b. *Which steps by the organisation are needed to implement the new process design?*

All conclusions about measures and implementation are processed in the To-be process module, which are then discussed with the SDZ process owners. This discussion is the basis for the expected effect of redesign and the conclusions.

5.1 Time wasting

To decrease process time a lean approach to process redesign is used. Central to the lean approach is the voice of the customer. Individual process steps are assessed on the value they provide to the customer (voice of the customer). Alteration on the process design can be made based on the value they provide [3]. The changes are immediately implemented in the ERP systems, which adopts an ERP driven redesign approach as discussed in Section 5.2.

5.1.1 Process flow design

Process analysis showed two problems in the process flow (leaving information structures out of scope). First, documentation and insurance requirements should be requested during the first phone call such that it is available at the on-site meeting. Second, before the meeting, a *business lead* should be created in the ERP system, which creates a cloud folder. If this is not done, time spent on creating the folder and uploading data on-site is increased. These two are improved jointly by altering the process flow:

In the ERP system a standard mail can be designed listing and explaining the requested documents and insurance requirements. When creating the business lead, the needed documents are selected in the ERP system, which are then automatically requested via a mail. Received documents can automatically be stored in the right folder. Insurance contact details are also requested, such these can be contacted directly in case of questions.

This suggested improvement measure removes the need for personal contact about the documentation. An on-site explanation of the documentation is not needed. The interviews show no preference for personal contact about documentation, justifying the elimination of these steps. Information can always be stored right away in the folder.

5.1.2 Fasten process steps

Three process steps are in the right place within the process flow but can provide the same value whilst taking less time. The spent time is often reliant on the customer. Therefore, a directive for maximum process time is given, which can decrease average time spent. BPMN 2.0 is already prepared for such measurements with inclusion of timer events in the language [3]. Since the time limit is a directive instead of a fixed rule it allows for exceptions. Dumas et al. discusses these exceptions as ‘*rainy day scenarios*’, a process model should include ways to deal with such a scenario [3].

The phone call serves a practical purpose, the content is repeated in the on-site meeting. Based on the internal expert interviews, the aim should be to keep the phone call at maximum 10 minutes. Small talk is very valuable for the customer, specifically in the agricultural sector. Though, spent time is allowed to be limited. Based on the interviews, 10 minutes should be spent on small talk.

The entire on-site meeting can also be limited. On average 1 hours to 1.5 hours is spent on the meeting. The 1.5 hours is the directive for the maximum. Based on the external interviews, additional time results in no additional value. A tight day planning could be a way to enforce the maximum, if the employee has difficulty staying within 1.5 hours. The employee can schedule a second appointment in his day, which leaves maximum 1.5 hour for the customer meeting.

5.2 Information structures

Research question 2b and 2c describe the information gained in the process. That data is complimented by existing information about BESS. The topics for that information are mentioned as part of research question 4a:

- i. Expected financial margins on energy trading for SMEs and consumers.
- ii. The influence on energy cost of controlling PV panels with an EMS based on market prices.
- iii. Expected investment cost trend of BESS in the coming five years.
- iv. Subsidies and Grants.
- v. Government rules for storing chemical batteries: PGS 37-1 [21].

Point IV and V concern government published regulations. These rules differ per customer, due to location, type of installation and historical usage of financial rules. The information on points IV and V can be categorized according to these distinctions. Points I-III help to inform the customer about the financial performance of BESS. The customer interviews show that the customer would be interested to receive such information in or with the quotation.

The process redesign related to information structures applies the method ERP-driven Redesign. A key concept to ERP-driven Redesign is that ERP systems are already developed with a basic understanding of the organization of the business process. Improvement on such a process can be achieved by making the ERP system more “process aware” and aligning the ERP system with characteristics of the organization itself [3]. The improvements suggested in this section are aimed on that goal.

5.2.1 Customer profile

In the as-is process, when an employee creates a *business lead* in the ERP system, a customer profile is made. In the process redesign his profile can be used as starting point for storing information gathered in the on-site meeting. The profile can be extended with the information of sub-question 2b.:

- Energy connection type (s)
- New requirements on energy connections:
 - power usage
 - peak usage
- Required installation parts

- Planned additional power using installations
- Existing power generation
- Missing PV generation
- BESS location
- General estimation of customer willing to invest

The ERP system is already available via an app. This leaves flexibility to use a preferred mobile advice. The extended information can be used as structure for the on-site meeting, such that nothing is forgotten. The interviews showed that such a structure was a desired outcome for this research. In the as-is structure the customer profile is linked directly to the cloud folder. In the to-be process, this link can be used to take photos, which are then uploaded to the folder automatically. This system should be designed such that notes can be made for each picture. In the as-is process, on-site a map is made of the BESS location to assess cable length. In the to-be process, the creation of this map can be included in the customer profile creation, based on the customer's address, which is already part of the profile. Uploading photos on-site, making online notes and creating the map limits time spent on uploading data after the meeting. Furthermore, it allows for other employees to have all knowledge needed to continue the process. This minimizes the weaknesses and threats discussed in the SWOT analysis of Section 4.8.

5.2.2 Information usage

In the to-be process the customer profile can be connected to the information on points IV and V. The location and type of installation can both be extracted from the customer profiles; these can serve as attributes for the corresponding information about the subsidies and grants or the PGS 37-1. Matching the categorisation of points IV and V to the customer profile data allows for presentation of only applicable information.

For PGS: 37-1, this means that the SDZ employees can quickly check the regulations which apply to the BESS in case. This limits time spent on researching regulations or additional conversations with the insurance agency about the regulations. The subsidies and grants are used for the advice and quotation delivered to the customer. Currently, this information is very limited, but the external interviews showed that more information would positively be regarded. In the ERP system an advice structure can be made, which uses the applicable standard information about the subsidies and grants. The applicable information is selected in the same manner as for the PGS 37-1.

Both the PGS 37-1 and the Dutch regulations on subsidies and grants have been analysed on the possibility to categorize the information based on the customer profile. The information on the topics has been summarized in Dutch. The summaries are categorized on topics. Parts of these summaries are shown in Appendices 3.B and 3.C.

5.2.4 Information storing

The ERP system makes use of datasheets for different installations. Additional information requested in the advice process is currently not stored. The current design of datasheets for different installations can be extended to the BESS installation including all additional information requested during the process. The same layout can be used in follow-up processes. Much time is spent on figuring out specific connections within the EMS systems in use. A new, unfamiliar installation requires the most time. A picture of a same system already connected can reduce time needed. To acquire this benefit for all employees, pictures of new connections can be stored in the datasheets.

Customers must be informed on potential financial performance of a BESS based on information points I, II and III. To keep an active profile on the performance, information must be stored in a general folder. There, it can be updated frequently with the latest additional data or research. A relevant example of

such research is the report on home and neighbourhood batteries from CE Delft [25]. Updating a financial profile to such insights allows all employees to profit from research of one employee.

5.2.5 Follow-up processes

The connection photo storage leads to reduced process time in the installation phase. The storing of data: Maps, photos and all information on the installation matched to installation datasheet makes the creation of installation documentation much easier. This also holds for the project plan for the installers. Storing information well in the advising process leads to reduced process time in the next process steps.

5.3 To-be process model

The as-is process model is modified to include all described changes in the first part of this chapter. Two new symbols are introduced to the process model: The process clock and the service symbol. The service symbol is represented by two gears and indicates that a process step is conducted with or in software: In this case Airtable. The process clock provides a limit on the process time of a step in the model. The major changes in the process model are indicated with a green lining. In the case of the *call to the customer* subprocess the outer green lining means that a step was eliminated from the process model.

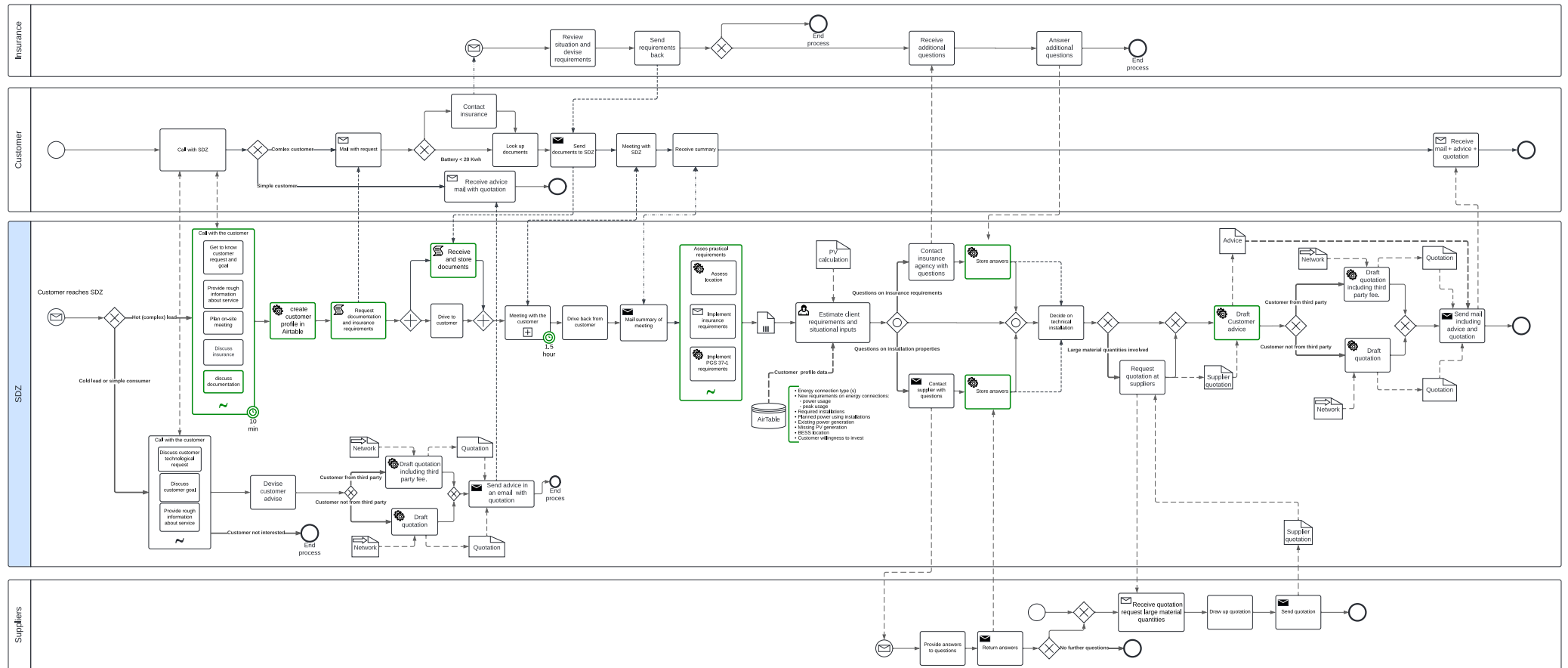


Figure 14: To-be process model

Ad-hoc subprocess: Meeting with the customer

The meeting with the customer is also redesigned. In this subprocess the same two new symbols are added. The entire meeting is not allowed to take longer than 1.5 hours. The small talk, *discuss life & stage*, is limited on the ten minutes. During the meeting the customer profile is updated in Airtable, as indicated by the two gears in the top left corner. Specifically, *take photos* and *draw map* are now also done within the customer profile. The request for documentation is left out of this meeting, in the redesign this is requested before the meeting. The changes made in the subprocess are indicated with a green lining. In the *map current situation of the customer* subprocess one process step was eliminated.

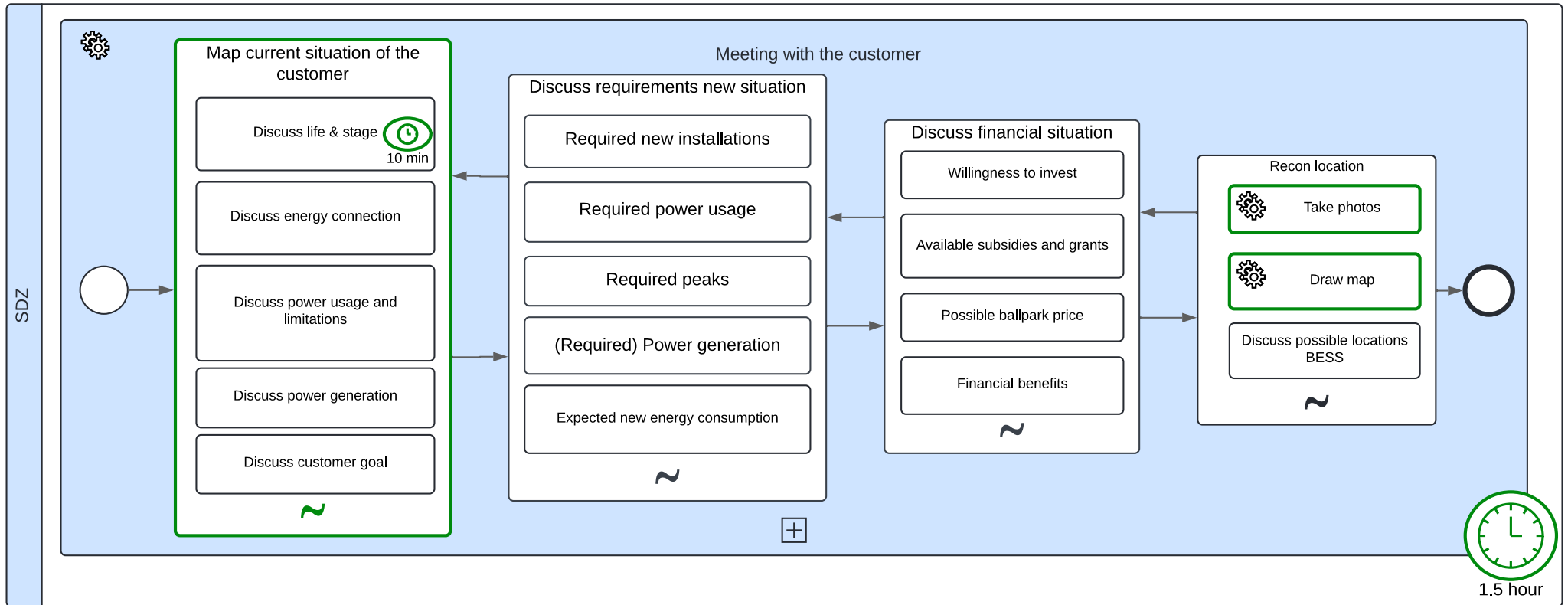


Figure 15: To-be process – Ad-hoc subprocess

5.4 Estimated process time decrease

The to-be process model was discussed with the internal experts. Together an estimation of the saved process time was made. This results in expectations for each process step.

The altered process flow and fastened process steps lead to an immediate expected process time decrease of 30 minutes. The information structures save time in looking up information and enabling easy storage of information, this is estimated on 5 to 10 minutes. However, there is also an increase in information that must be stored – customer profile, datasheets, financial information -, which can increase process time, this is also estimated on 5 to 10 minutes. Therefore, it is expected that the information structure does not save significant time and might even increase process time slightly if there is no increase in employees.

Expectations are that the battery market will grow in the coming years and with it the company and its advising process [31]. When the company and the number of customers grow supporting staff and new advising employees are a necessity. Due to lack of experience and increased need for communication, process time is expected to increase when adding employees. In such a case it is expected that the to-be advising process time can reduce this time increase with a minimum of 30 minutes to well over an hour compared to the as-is process. Furthermore, the stored information can be reused in the process landscape. It is expected that use of the stored information also leads to reduced process time for the creation of working documents, installation and the training of new personnel. Since these are not part of the scope of this research they are not discussed in more detail. Additionally, the overall quality of the process and the value delivered to the customer are increased without increasing process time.

5.5 Process implementation

5.5.1 IT infrastructure

Process implementation is reliant on the IT infrastructure and information gathering. In the introduction the limitation to Airtable is mentioned. The entire implementation in the IT infrastructure must be created in Airtable. The IT infrastructure must be redesigned to enable the process redesign. This means that the functionality of Airtable shifts from an ERP to a workflow management system. The information topics must be gathered and categorized according to the IT structure. The following steps are recommended to implement the process:

1. Modify the customer profile format in Airtable to include all needed information. It is important that the mobile customer format is modified such that it can be filled in on-site.
2. In the customer profile creation, a format for the documentation request mail must be built. This should include a retrieval system of the documentation to the cloud storage.
3. The available information on subsidies, grants and governmental rules must be completed and categorized accordingly.
4. An information storage system for points IV and V must be designed in Airtable.
5. The customer profile must enable retrieval of relevant information from the storage system based on the content of a customer profile.
6. On each battery type sold by SDZ a datasheet should be available.
7. An advice format should be created including customer based relevant information on the installation and the corresponding subsidies and grants.
8. A general cloud storage for financial information is created.

SDZ has an employee responsible for automatization and IT structure. The responsibility of executing the eight steps described above should be transferred to this employee.

5.5.2 Employee training

In addition to modifying the IT infrastructure, the process owners should be familiar with the process redesign. The process redesign has three levels which should be communicated. The process flow changes, the process step times, and the usage of IT. Employees should be shown and explained how the flow of the process has changed. Employees should be explained how to interpret and use process time directives. This should be communicated in a presentation for all relevant employees. All stakeholders have been involved in the process redesign which enables direct communication of the changes. The usage of IT can be presented by the responsible employee in a training.

In larger organisations change management would be of great importance. In the case of SDZ three persons are involved with the advising process and with this research. All three are (part) owner of the company. These employees have been updated regularly and were interviewed to get to the analysis results. Possible improvements have been discussed in multiple meetings. This means that management and employees were involved in the redesign and are aware of the changes. The presentation of the changes is mostly there to conclude the research and provide a kick-off to the new process use. Therefore, in this case large scale change management is not required.

5.5.3 Feasibility

Large parts of the process redesign are reliant on the redesign of Airtable. Each of the measures were reviewed on feasibility in Airtable. For all proposed measures, features exist or can be programmed in Airtable to enable the process redesign.

The financial costs of IT redesign are not considered for the process redesign. Before starting implementation, the IT manager should make an estimation on budget needed to implement the changes. Since this manager only started in 2025, this is currently difficult to estimate. Based on the required budget it would be possible to prioritize changes. In all cases it would be preferable to start with updating the customer profile within Airtable.

5.6 Conclusion

4. *How should the advising process be redesigned to enable such improvements?*
 - 4a. *How should information within the process be structured to fit the redesign?*
 - 4b. *Which steps by the organisation are needed to implement the new process design?*

The to-be process model includes all measurements for the redesign to reduce process time. The VSM based analysis discussed in Chapter 4 concluded that the actual process time is estimated at 8 hours. This is already an hour lower than the reduced goal of this thesis. The redesign suggested in this chapter is aimed at reducing process time in the future by eliminating process weaknesses which lead to drastic increases in process time.

The customer profile in the ERP system should be extended with the essential information found in Chapter 3. Photos on-site should be made directly in the cloud based storage. Map drawing should be a functionality within the ERP or cloud based storage. The customer documentation should be requested in an automated e-mail and stored in the cloud base storage linked to the customer profile. Governmental regulations are stored and categorized within the ERP. Relevant information is extracted based on the customer profile. These steps increase the alignment between the ERP system and the characteristics of the business process. It also increases the process awareness of the ERP system as prescribed by Dumas et al. [3].

The altered process flow and fastened process steps lead to an immediate expected process time decrease of 30 minutes, as estimated by internal experts. It is expected that the information structure

redesign does not save significant time immediately and might even increase process time slightly if there is no increase in employees.

The process redesign should be explained to the IT manager. The 8 steps needed to implement the new process design should be communicated as needed for the IT infrastructure. The IT manager should create an implementation plan and include the information structure in the existing platform. The implementation plan should include budget estimations and a prioritization of redesign steps. The IT manager can create an instruction training for the employees. In a general meeting the process redesign should be explained to all involved employees, followed by the training on IT use.

6. Conclusion

In Section 6.1 the conclusion of this research is presented. The limitations of the performed research are discussed in Section 6.2 and in Section 6.3 the results and the limitations of the research are discussed. The thesis is concluded by providing recommendations for SDZ to further develop their process.

6.1 Conclusion

This section provides the answer to the research question: *How to redesign the BESS advising process of Stroom Door Zon such that the required man-hours are reduced, while maintaining the advice quality?*

1. The process landscape model

In the process landscape model (Figure 3), network relationships and project planning are identified as processes which are influenced when the advising process is redesigned. Redesign of the advising process must not influence process time in these processes negatively.

2. The as-is process model

Based on multiple iterations of feedback sessions and workshops the as-is process model (Figure 10) was created in the BPMN 2.0 language. This is the first accurate visualisation of the current process and the basis which allows for process analysis. The as-is process model yields a list of information gathered in the process.

3. The process analysis

Based on the as-is process model, stakeholder interviews and VSM based analysis provided insight in the process performance. As a result of the analysis, the information list is revised to contain all essential information which is needed to create customer advice. This forms the basis for process redesign. The analysis shows time wasting during the phone call with the customer and the on-site meeting. The final advice and quotation miss opportunities to provide optimal value to the customer. In the SWOT analysis overall process vulnerabilities are identified: An information structure is lacking in the process; this limits cooperation and scale-up of the process. Furthermore, the analysis resulted in an improved estimation of process time. The as-is process is after analysis estimated on 8 hours process time, the as – is process time was originally estimated on 12 hours. The research goal was to reduce the process time from the estimated 12 hours to 9 hours in the to-be process model.

4. To-be process model

The to-be process model (Figure 14) includes the proposed changes to solve the problems identified in the process analysis, while maintaining the advice quality. The problems are solved by changing the process flow, including process step time limits and creating a new information structure for the process. It is estimated that the redesign will immediately result in an average process time of 7.5 hours. This is a reduction of 37.5% compared to the original estimation (12h) and a reduction of 6.25% compared to the newfound estimate (8h). The process redesign will increase value delivered to the customer and reduce process vulnerability. The new design is geared to scale and new staff. Process time is expected to increase when adding employees. In such a case it is expected that the to-be advising process time can reduce this time increase with a minimum of 30 minutes to well over an hour compared to the as-is process. The redesign also reduces process time for the creation of working documents, installation and employee training processes.

6.2 Limitations

This research has provided valuable insight into the advising process of SDZ on BESS. However, the research has its limitations, impacting the results. Ten weeks is not enough time to perform an entire cycle of the BPMLC. The final two steps of the BPMLC are not performed. Step five: Process implementation is shortly discussed in Chapter 5. The effectiveness of the redesign has also not yet been validated in real life.

The researched process is a relatively new process. This results in the process still changing over time and process performance not yet being measured. The limited measurements result in more uncertain estimates, as can be seen with the initial estimates for the process length.

The influence of the process age is also noticeable in the research population for the process analysis. The research population was small, but available for in-depth interviews. Due to unavailability, no private consumers were interviewed, and the simple consumer branch of the process was left out of scope for the improvements.

6.3 Discussion

The lack of process experience within SDZ influenced this thesis. When the analysis showed a reduced estimated process time of 8 hours, the identified gap was already closed. As a result, the percentual time reduction also became less relevant, since there was a lot less time being wasted in the process than initially thought. This did however not influence the provided insight to the company.

The limited research group made interview results uncertain. Measures to counter this effect were taken and discussed in chapter 4 following the relevant literature [3]. It is, however, not realistic to expect that all effect is countered by these measurements. Therefore, uncertainty remains on true process step value for different customers groups.

Both process models have been modelled with the BPMN 2.0. Symbols in this language can have multiple meanings. In some cases, it was chosen to adopt a symbol meaning which is part of the literature but is not the most common application of the symbol in BPMN 2.0. All process steps are, nonetheless, explained clear enough to prohibit the occurrence of misconceptions.

The research into the feasibility of the proposed IT structure has been limited in this thesis. Process implementation was no part of the initial scope, but the process redesign should nevertheless be realistic. The ERP system allows for enough functionality to implement all suggested redesigns. However, a real life implementation by an IT professional should refine the proposed IT plan more and include user experience into the designs. The IT manager should include budget estimates in prioritizing the different steps of the process redesign. These additional parts of the implementation plan might lead to minor changes in the proposed process redesign.

Finally, the process redesign is done with a future minded perspective. This means that the process is designed in such a way that it allows for more personnel to be able to provide better advice to more customers. This perspective is fitting to the vision of SDZ. However, this growth is not yet the case and process requirements might change over time. It is a possibility that the process must be redesigned again when the growth is achieved.

6.4 Company recommendations

- The company should finish the BPMLC, to implement the process redesign and review its performance.

- The implementation can be done as proposed in Section 5.5. This should include the company IT manager.
- The proposed information structure can be extended to including working documents and installation documentation to increase time saving.
- The company should track process performance, by reporting spent time. This increases process knowledge and enables easier redesign.

6.5 Future research

Much research has been conducted on the technology behind BESS. In more recent years, financial performance and large scale implementation has also been research to some extent [4,5,11,10,32]. However, there is little to no research on the business design of BESS installation for SMEs. Many companies will face challenges related to the energy grid and BESS relevance will increase. It is important to create knowledge on how to advise these companies and create stable, small grids. Therefore, it is important to spend more time on researching the practical business applications of BESS. Possible topics could be the mistakes made in BESS installation, the dangers of unregulated BESS installation and energy trading or inexpensive BESS fire control.

Future research more closely related to this thesis could also be conducted:

- The research could be extended to more customers, from various groups, which could be interviewed, to create a more complete understanding of the value of the process as perceived by different customers.
- Financial performance of the advising process could be analysed. This could be related to the spent time on process steps and the delivered value.
- Profiles on financial performance of BESS for different target groups could be researched and improved over the coming years, to gain valid understanding of the financial performance of BESS.
- The simple customer branch could be analysed on time spent and perceived value.

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Appendices

A. External interviews

A.1

External interview one

Type of customer: agricultural company

Date: 12/12/2024, 11:30, call length: 24 minutes.

Delivered installation: Two BESS, Solax Trene 215 kwh, Excluding controlling hard-/software.

Introduction

The meeting was planned a week in advance. The interview was conducted via a phone call. The entire interview was conducted in Dutch and contains some private information. The interview is summarized in English and the customer is only categorized and not mentioned by name. The interview set-up is explained, including length and structure. The interview will go over the steps present in the as-is process model: Phone call, meeting, mail communication and advice + quotation. The interviewee is explained how the content of the interview will be used in the report and what privacy measurements are taken.

Structured summary

1. Phone call

a. Content

The customer was interested in the total picture of a BESS. First, the possibilities for SDZ to provide the installation and secondly the with coming financials.

b. Length

The length of the call was appreciated, enough time to get a first idea and not too long.

c. Documentation

The documentation was already requested in the phone call. The involved advisor had already prepared the useful information.

The customer explains to have contacted multiple parties at first, but shortly after contacting SDZ they aimed on SDZ.

2. Customer meeting

a. Involved colleagues.

Two colleagues visited.

b. Small talk

The small talk is appreciated, and it definitely contributes. It is very important for the feeling of the process. This doesn't have to be shorter, but also not endless. The personal approach is experienced as very pleasant.

c. Length

The meeting took 1h to 1.5h. The length was fitting, all parts which were relevant to the customer were discussed.

d. Information content

De customer was still interested in the total picture of the BESS. In more details the installation capacity of SDZ was discussed: what can they deliver? Besides that, the financials were also discussed.

- e. SDZ questions
The colleagues asked clear questions and explained the goal and what they were going to do with the answers clearly.
 - f. Structured meeting
Doing the meeting with a questionnaire would be alright but not preferred.
3. Mail communication
- a. Summarizing mail
Clear summary of the meeting. Clear structure, it is perceived positive to receive such a mail after the meeting. The mails do not have to be any longer.
 - b. Communication
 - i. Clear expectations from SDZ
 - ii. Clear additional questions.
 The contact between customer and SDZ is enough. More updates about the process are not necessary.
 - c. Personal mails
It doesn't add to the experience that the mail is personalised. A standardised mail would also have been fine.
4. Advice + quotation
- a. Advice argumentation
De advice was constructed in a clear way, the argumentation was presented in a straightforward manner. Jargon is explained sufficiently. The advice was presented in an attached file. The customer has no preference for the way the advice is presented. This can be either in a file or in the mail itself. The advice can also be standardised.
 - b. Quotation
The quotation was clearly structured and caused no additional questions.

In the quotation little to no attention is given to Grants and tax rules. The customer believes there should be paid more attention to this. Even though the customer has an advisor and an accountant, SDZ is expected as source for information. De customer explains that he/she was not aware of the ruling that an application for EIA must be submitted within 3 months of signing the quotation. It would have been nice if SDZ had told him that. Eventually it all worked out, the accountant told him about the rule when submitting, which was just in time. Additional information about financial rules surrounding BESS is seen as helpful and not pushy / intrusive.

- c. Choice basis
 - i. Feelings
The feeling for the installing company is very important. The personal visit and small talk help to large extend with this. Having a good feel is a large part of choosing SDZ. The customer does explain that you never know if your gut is right until the installation is finished and the first (financial) results are in.
 - ii. Information
The customer explains that sound was an essential part of the decision because of the location of the BESS. It was really pleasant that the customer was able to review a location where a BESS was already placed to assess the sound of the installation.

External interview two

Type of customer: agricultural company

Date: 12/12/2024, 11:30, call length: 26 minutes.

Delivered installation: One BESS, Solax Trene 215 kwh, including controlling hard-/software.

Introduction

The meeting was planned a week in advance. The interview was conducted via a phone call. The entire interview was conducted in Dutch and contains some private information. The interview is summarized in English and the customer is only categorized and not mentioned by name. The interview set-up is explained, including length and structure. The interview will go over the steps present in the as-is process model: Phone call, meeting, mail communication and advice + quotation. The interviewee is explained how the content of the interview will be used in the report and what privacy measurements are taken.

Structured summary

1. Phone call
 - a. Content
The main focus was to plan an on-site meeting.
 - b. Length
It was a (very) short call, it did not require a long talk.
 - c. Documentation
Documentation was requested in the call. The customer is not sure if he sent it right away, he might have sent it later on.
2. Customer meeting
 - a. Involved colleagues
One colleague did the visit.
 - b. Small talk
Small talk is very important to the customer. Nonetheless, this doesn't have to take very long. The personal attention is perceived as nice by the customer. Such attention also positively influences the trustworthiness of SDZ.
 - c. Length
The meeting lasted for more than two hours. This was rather long, but the availability was pleasant. This helped the customer to get all the information they wanted.
 - d. Information content
The customer was mainly interested in which technological possibilities were available and how those worked. The explanations of technology were very clear. The customer explains that BESS consist of new technology which he didn't understand all that well yet. It was a good thing that SDZ had a lot of time to explain such new concepts.
 - e. SDZ questions
Questions from SDZ were clear and well explained. The customer is enthusiastic about the on-site meeting. It is an important selling point for SDZ according to the customer.
3. Mail communication
 - a. Summarizing mail
The first mail was indeed a summarizing mail. It was pleasant to receive a summary. The discussed topics were summarized clearly. The summary was pleasant to check the topics which were discussed and to pick up the important things.
 - b. Communication

The customer experienced clear communication: this consisted of clear expectations and questions. The customer knew at any point in the process what the status was, agreements were kept. It was nice for the customer that there was no redundancy of contact, but it was still clear when something was going to happen.

c. Personal mails

The format or structure from the email is not relevant. A cheap sales story is not interesting, doesn't cut it. A standardised mail is a possibility, but it should be personally applicable in terms of content, because the customer believes that cases are very customer specific.

4. Advice + quotation

a. Advice argumentation

The advice was a single document described with an email and the quotation attached. The advice was clearly structured, and the technical details were well explained. The document itself was just not enough for the customer to be completely sure how things were. An additional phone call about the advice was an essential tool in this regard. The customer initiated this himself. Additional information or standard calling the customer after the advice is sent could be include. The customer does however also indicate that it might be good for the customer to take the initiative on this instead of it becoming standard practice.

b. Quotation

The total price was clear, but the overall quotation less so. The quotation could have been more disaggregated and delineated. The customer first indicates that the price breakdown could have been better. Then the customer explains that it was mainly in the division of tasks. Which parts are provided by SDZ and are included in the quotation price? And what does the customer have to arrange himself?

The customer indicated that subsidies and tax benefits are interesting but that he understands that SDZ does not Figure that out entirely for the customer, but that according to the interviewee, that responsibility also lies with the customer himself. This is difficult, partly because it is also very dependent on the province. Additional information is a nice plus but is not expected and may not be feasible.

c. Choice basis

i. Feelings

The customer indicates that the most important thing was reliability of the installation party. The customer mentions that not only feeling but also the clear information on technology and content-strong advice are part this idea of reliability. The time that Stroom Door Zon takes for the conversations is very important here.

ii. Information

The most important to the customer was the technical information. The explanation of technology and application to the customer's situation. It was important to understand what the options were. Price certainly plays a role but is secondary to reliability and then the technical information. The customer indicates that a few thousand euros more or less does not make the difference for such an installation.

4.3

External interview three

Type of customer: agricultural company

Date: 07/01/2024, 14:20, call length: 20 minutes.

Delivered installation: One BESS, Solax Trene 215 kwh, including controlling hard-/software.

Introduction

The interview was planned a week in advance. But the customer could not be reached at that time. Therefore, the interview was rescheduled for after the holidays. The interview was conducted via a phone call. The entire interview was conducted in Dutch and contains some private information, which is left out of the summary. The interview is summarized in English and the customer is only categorized and not mentioned by name. The interview set-up is explained to the interviewee, including length and structure. The interview will go over the steps present in the as-is process model: Phone call, meeting, mail communication and advice + quotation. The interviewee is explained how the content of the interview will be used in the report and what privacy measurements are taken.

Structured summary

1. Phone call

a. Content

The customer wanted to get a (quick) idea of the options. The customer wanted to get a feel for the company, have a direct talk with one of the employees. He gained a first idea of with whom he might go to business. The on-site meeting was also planned directly. The customer already was very much interested and got acquainted with SDZ via a common relationship.

b. Length

The customer has no recollection of the length of the call.

c. Documentation

The customer already had some of the documents or an idea about it. The documentation was not requested. The customer believes that he had part of the documentation available for the meeting.

2. Customer meeting

a. Involved colleagues.

One colleague did the visit.

b. Small talk

There was a bit of small talk at the start of the meeting. This small talk was mixed a bit with the battery related topics. The meeting rather soon went down to business.

c. Length

The meeting lasted between 1 and 1.5 hour.

d. Information content

The customer was interested in getting a price estimation. Besides that, he wanted to talk about possible options and options which were not possible. The SDZ representative already had researched the case and was well prepared. The customer indicates that he had the feeling that SDZ already had spent quite some time on it. This contributed to a good feeling about SDZ as installer. The customer explains that is it important to him that a company is not merely about sales. It is important that the

meeting is not only about selling as fast as possible, but also about honest provision of information.

e. SDZ questions

SDZ communicated clearly about the information needed from the customer and asked clear questions.

f. Improvements

The customer indicates that there was a lot of contact between SDZ and the customer. The customer already did a lot of research in advance. In the process it occurred that the customer did not fully understand things. In this case the customer could very quickly call SDZ and get answers. The customer is positive about this availability. That seems to weight more than the lack of understanding at first.

3. Mail communication

a. Summarizing mail

There was no initial summarizing mail. The summary of the case and the process was provided in the mail with the quotation. t

b. Communication

The communication was clear. As mentioned, there was a lot of contact, mainly over the phone. There were clear expectations and clear questions if information was needed.

c. Personal mails

The mail with quotation was personally addressed.

4. Advice + quotation

a. Advice argumentation

The argumentation for the advice was concise and clear. Jargon and technologies were explained well. Most of these were already discussed in earlier conversations. The parts of the advice and quotation which were unclear were additionally discussed over the phone.

b. Quotation

The structure of the quotation was clear. Additional information on finances is always welcome. Most definitely when it is related to subsidies, grants or tax benefits. The customer also indicates that he believes everybody feels the same way about that. It is always good to have all the possible information on the options. It is up to the customer and SDZ to paint a realistic picture of this. The customer says that he often is not blown away by aggressive techniques but understands why SDZ is reluctant to resolve to such techniques. The information can be provided by SDZ whilst not promising the moon. A (partner) company is not merely all about earning loads of money. That believe was also very noticeable with SDZ. Since this comes forward in the contact providing information on Subsidies, grants and tax benefits is not a bad thing.

c. Choice basis

i. Feelings

The first thing the customer mentions is the Dutch word 'gunnen'. This describes the feeling that you think some deserves it, you hope form them, you feel positively towards them. The customer reuses the word a couple of time when answering question about the basis for the choice.

The customer felt positively about SDZ and liked to give them the project. The customer had a good feeling about the trustworthiness of SDZ. The time and

availability both for the meeting as for all contact during the process, was a foundation for these feelings.

The customer explains that in these cases price is not everything. When there are multiple contenders and prices differed €1000, €1500 or even a couple of €1000s, the customer is more inclined to award projects to a company which seems like a good party. Having a good feeling for a company is the most important thing for the decision.

ii. Information

For information the customer was mostly interested in the price. SDZ offered a keen price, which made the decision even easier. The interview is finished with the following conviction: We don't know how these installations will run. Not on finances, not on downtime or on maintenance. The farmers or installer both don't know what the results will be in ten years' time. Only time will tell.

A.4

Short interview external four

The interview was conducted with an installation partner of SDZ. SDZ does some projects together with this company. Up till this point it mainly concerned small BESS at private homes. Recently the first large BESS was installed. The AC part is done by the partner. SDZ provides the battery. The contact with this company is mainly via one of the owners.

Contact

The contact has always been good, it is based on a warm relationship. The cooperation is appreciated by the partner: 'Otherwise there would have been no cooperation.' Customers are mostly larger parties with occasionally some solar panels at consumers.

Advice process

The advising process always goes through Mill technology. They communicate with the customer. Molen techniek is satisfied with this. Stroom Door Zon only has to provide a quotation for their work, this also alters the advising process for SDZ. Molen techniek processes this towards the customer. Molen Techniek is satisfied with the information supplied and sees no points for improvement there.

Communication

The communication is fast and direct. A quick call or a drop by is often the preferred way. Molen techniek has no points for improvement about mutual communication and is satisfied with its speed.

B. Internal interviews

B.1

Internal interview one

Interview with Ruben de Ruiters. Ruben is one of the technical experts and installer. The interview was conducted after interviewing the customers. It took approximately 50 min. The interview was conducted in Dutch. This page provides a summary of the interview structure and gained knowledge, leaving out company sensitive information.

Introduction

The interview set-up is explained, including length and structure. The interview will go over the steps present in the as-is process model: Phone call, meeting, mail communication and advice + quotation. The interviewee is explained how the content of the interview will be used in the report and what privacy measurements are taken. The interviewee is encouraged to talk about additional topics he thinks are relevant for the thesis.

Structured summary

1. Phone call

a. Content & goals

The interview aims to get an understanding of how close someone is to buying a BESS (hot or cold lead). A question that can be answered is “how serious is the customer's interest?”. If the customer is a hot lead an on-site meeting is planned, and the address is asked. The interviewee also uses the phone call to get an idea about the size of the needed battery. This is based on the grid connection, PV installation and generation and the type of company / location.

b. Length

The interviewee estimates the phone call length on 15-25 minutes.

2. Customer meeting

a. Involved colleagues

Ruben prefers to do the meeting with two colleagues. He explains that he sometimes forgets or misses details and that doing it together helps to prohibit that.

b. Small talk

Approximately 10-20 minutes is spent on small talk, this depends on the shown interest by the customer. It is important to create a connection between yourself and the customer. Important are the life phase and company phase in which the customer is. This provides background to the requirements discussed later on.

c. Length

An average meeting takes between 1-1.5h. A meeting might take longer in rare cases, shorter does not occur. A meeting with a consumer is often shorter though, in such cases it takes about 30min.

d. Information content

Ruben currently doesn't use a structure in getting and providing information. Such a structure would be a preferred outcome of this thesis. Ruben loves the technical side; this is often becoming the main focus point. First those details are discussed. After that financial benefits are discussed, often in the following order:

- i. Power usage optimisation
- ii. Apex markets / dynamic energy contracts
- iii. Balancing markets
- iv. Installation efficiency.

The up- and downsides of the financial benefits are discussed. Information is not always provided in a structured way. There is a lot of information in a conversation which causes trust between the customer and SDZ.

The last point of the meeting is the location of the battery and the demands (Insurance + PGS).

- e. Maps & pictures
Maps don't help to some extent. Photos are more important. It could be useful to make notes in photos. Currently on the spot photos are made and uploaded afterwards to the drive. Ruben sometimes forgets to put the pictures in the drive in which case often Jacob-Jan asks him to do that anyway.
3. Mail communication
 - a. Time spent
5-10 minutes.
 - b. Structures
The main concern is the request for information, this could have been a WhatsApp message.
 - c. Personal approach
The emails are informal and personal.
 4. Advice & Quotation
 - a. Advice information
 - i. Essential information
The results of chapter 3 are discussed. The current fuse box design is also important input. Yearly power usage is looked at month to month. The location map is not essential.
 - ii. Time spent on additional needed knowledge

The information request for insurance is done via the customer. Simple measurements are provided. More complicated measurements can be provided via a contractor, or de customer has to provide it themselves.
 - iii. Additional questions
 1. Insurance requirements and Dutch law leaves a lot of room for interpretation. SDZ follows their own interpretation of these rules.
 2. Information requests to the suppliers are not saved somewhere.
 - b. Advice structure
 - i. Content
The advice documents follow roughly the following structure: advised technique and installation coupled to the customer situation. This is followed by an argumentation for this advice and the general conclusion.
 - ii. Length
Writing the advice takes approximately 15 minutes.
 - c. Quotation structure
 - i. Ruben is not really involved in the quotation; this is all done by Gerhard.

B.2

Internal interview two

Interview with Jacob-Jan Bos. Jacob-Jan is one of the owners of SDZ. Besides managing the business Jacob-Jan works as one of the technical experts and as installer. The interview was conducted after interviewing the customers. It took approximately 60 min. The interview was conducted in Dutch. This page provides a summary of the interview structure and gained knowledge, leaving out company sensitive information.

Introduction

The interview set-up is explained, including length and structure. The interview will go over the steps present in the as-is process model: Phone call, meeting, mail communication and advice + quotation. The interviewee is explained how the content of the interview will be used in the report and what privacy measurements are taken. The interviewee is encouraged to talk about additional topics he thinks are relevant for the thesis.

Structured summary

1. Phone call

a. Content & goals

The phone call discusses the customer and his situation. Some general topics surrounding batteries might be discussed and information provided.

Main goal is to plan an on-site visit. An important lesson is to never already give advice. Customisation is needed on location. When customers talk too much in detail or request specific advice, a conversation might politely be cut short and continued at the meeting.

b. Length

The length is in between 5-15min.

2. Customer meeting

a. Involved colleagues

When going alone Jacob-Jan feels in control, with two people it is less structured and less easy to control the conversation. This can work counterproductive. It is nice to spar amongst each other, mainly technical issues related. With two people it is possible to discuss the meeting already on the ride back, that reduces time needed later on. However, it does not cover the time lost by going together.

b. Small talk

Jacob-Jan has a sincere interest in the customer, he likes to get to know them. Sometimes, it happens that he or him and colleague do not resonate with the customer. This makes it much harder to gauge the customer and his or her request. Beside this real interest, showing interest also gains information. Jacob-Jan's interest is therefore mainly in someone company, the involved processes and the used techniques, this often works for farmers. Age and company phase are also part of this.

It takes 10-15min, however, a tour of the site might be giving in advance in which case it takes a little bit longer.

c. Length

The meeting takes 1-1.5h.

d. Information content

It starts with small talk. After that the customer is left to speak. Often touched upon topics are ideas, goals, problems and why SDZ is contacted. After that Jacob-Jan explains what SDZ could offer, what SDZ's services are. This involves some information exchange. Following the discussed services, the location is scouted. The meeting is concluded with a general conclusion and explanation of the follow up steps.

e. Maps & pictures

Photos should be uploaded as fast as possible. Ruben tends to forget this sometimes. For Jacob-Jan this is a habit and not a lot of work. It does happen that a document folder has not yet been created. In such a case on location a folder must be made whilst this by far easiest to do on the computer.

Map should maybe be created more often. This makes the process much more future proof. Now, knowledge about the location or the required cable lengths are only in the head of the one doing the meeting.

3. Mail communication

a. Time spent

Not much in practice. However, because the interviewee has no fixed office hours it does take a lot of time or space in his head.

b. Structures

There is no fixed structure in the emails. That depends on the situation.

c. Personal approach

Emails are highly personal. Much is based on relations and mutual trust.

4. Advice & Quotation

a. Advice information

i. Essential information

Evaluation of the conclusion of chapter 3.

The information analysed is correct and complete. It does not fully represent the context of the knowledge. Based on this information a battery can be advised. However, it always depends on the overall goal of the customer. A specific detail of knowledge not yet represented is the missing of PV generation in case of too high mains voltage. In such a case the PV installation is shut off because it cannot lose its power anywhere.

ii. Time spent on additional needed knowledge

Insurance requirements are often quite easy to deal with. We know generic boundaries and often only need small adjustments to our proposal.

For the entire installation the devil is in the details. This takes a lot of time; it means much research work and many adjustments.

Controlling (third) machines and the EMS takes a lot of time. New brands or productions have different compatibility issues. Connecting the PV installation to the BESS also takes up a lot of time. Photos from physique connections from different installations can prove valuable knowledge when installing such a product again.

In case of usage of the BESS for Back-up power many additional tests come into account. All such details are a specialty of SDZ. However, making it a selling point has been difficult.

iii. Additional questions

In the case Jacob-Jan has a question for the insurance agency, he likes to ask this via the customer. This involves the customer in the total process. Additionally, often such parties provide input for which SDZ already warned or mentioned to expect that. This affirms the knowledge and quality position of SDZ.

b. Advice structure

i. Content

The advice has to little structure & narrative currently. It should contain a short recap, the goal and the plan. After which the components are explained. The advice is finished with a link to the quotation and the assumptions for the quotation (cable length and used technique).

ii. Length

Approximately 20-30min. It really depends on the brainstorm and how specific ideas this yielded. Providing information (standardised) features no prominent place in the current advice, it could though. An EMS is explained in a custom text, based on the connection made with the involved installations. This can also be more elaborate. There must be balance between providing information, but not too extensive.

c. Quotation structure

The quotation always has the same structure. Some variables are cable length (communication and power cables). The required man-hours for installing are all quite stable: 1 day with two colleagues to prepare, one day with two colleagues to install and a third day with a single colleague to finish the last small chores. Roughly 50 hours are always needed. Maximum hours can increase a lot, e.g. in case of difficult P.V. installations.

B.3

Internal interview three

Interview with Gerhard van Dam. Gerhard is one of the owners, responsible for sales and installer. The interview was conducted after interviewing the customers. It took approximately 35 min. The interview was conducted in Dutch. This page provides a summary of the interview structure and gained knowledge, leaving out company sensitive information.

Introduction

The interview set-up is explained, including length and structure. The interview will go over the steps present in the as-is process model: Phone call, meeting, mail communication and advice + quotation. The interviewee is explained how the content of the interview will be used in the report and what privacy measurements are taken. The interviewee is encouraged to talk about additional topics he thinks are relevant for the thesis.

Structured summary

1. Phone call

a. Goals & content

- i. Simple consumer: 70-80% are merely interested in information. This boils down to two questions. Can I turn a profit and what are the investment costs? Nearly everyone from this group loses their interest after the call (a closed deal hasn't occurred from this group). The other part of the simple consumers has read up on the topic. They consist of anti-government people, translated into an urge to be independent, people preparing for future grid instability and the abolition of the salderings rule and gadget interested people. These are mostly interested in finding the best product. A very large share eventually procures a BESS. When they don't, they often decide to wait for a 1 or 2 years based on Gerhard's advice. With these hot leads a visitation is part of the process. Gerhard always intends to plan this within a week.

- ii. Big BESS: Often not read up about BESS. They have room to invest or have seen the technology at neighbours. The phone call discussed the need for company profits and Gerhard makes a rough estimation if their company is turning a large enough profit. IF that is the case the investment tax rules are mentioned. Gerhard always provides an Eyeball price, which is very rough to make sure you can always stay within the boundaries. The customer appreciates such price information. IF the conversation is a match, within a week a site visit is planned.
 - b. Length
 - i. Simple consumer: 3-5 minutes
 - ii. Big BESS: 3-5 minutes (sometimes even faster)
- 2. Visit
 - a. Colleagues attending

The first meeting Gerhard likes to go alone. Two-man often results in an unclear situation. The customer may also feel, they are paying too much money if two men come. The first meeting as Gerhard uses them is not rocket science, the first meeting is mostly social. With big customers Gerhard plans a second meeting in which he takes one of the technical experts along.
 - b. Small talk

Depends on the customer, most of the time in 5-10 minutes done.
 - c. Conversation length

Simple consumer: 20-40min, maximum 45 minutes.
Large BESS: 30 min – 1.5 hour. On average 45 minutes.
 - d. Information

First the information from an accountant is used, is a company profitable. Secondly, (an estimation of) the PV power generation is used as input.

The meeting starts with walking around the location. Gerhard prefers to have the conversation on the site where the actual BESS might be place. This takes 20-25min. The conversation finishing takes 10 minutes. The conversation finish is about the conclusion and smaller technical parts such as the transformers.

Gerhard aims to always provide a rough price. Based on the reaction of the customer, he can later on tweak the offer. This might for example cause him to go for some cheaper less aesthetically pleasing installation techniques or the other way around.

Lastly, the insurance demands are discussed.
 - e. Map & Photos

Gerhard takes photos of the fuse box(es). In designer, on his laptops he draws the location of the BESS. In terms of professionalisation it would be nice to have this included in Airtable. This could also be used for the installation documents.

Mails

Gerhard does not send a confirmation or summarizing email. The first mail should in his view always contain the definitive quotation. The price should be fixed, including a +/- 3% additional margin. The quotation should be sent within 24 hours after the on-site visit. When a second visit is needed this of course first planned. Mails are never personal.

Advice & quotation

1. Content advice
 - a. Needed time
Almost none, Gerhard sends a picture of the Fusebox to Jacob. A new product might cost some more time, because it requires some additional searching for specifications.
 - b. Additional questions
Always call directly. This is the shortest line to insurance or supplier. Sometimes the insurance agencies have demands which are not realistic. Conversations with the insurance are easiest directly. Via a customer might lead to disruptions.
2. Advice
The explanation of the advice is on-site. A second meeting includes everything which Jacob-Jan and Ruben might do via email. The explanation of the starting points takes approximately 5 minutes.
3. Quotation
Quotation consists of man-hours, materials and the variables: EMS, cable length and small materials. 90% of the quotation is fixed. Installing and programming an EMS takes a lot of time. Creating the quotation takes about 5 minutes maximum.

C. Information processing

C.1

Knowledge question

What is the expected price erosion trend on battery solutions in the coming five years with the purpose of providing battery sales advice?

Integration of theory

The price of batteries is forecasted in an amount per kilo Watt hour. For continuity purposes, mostly the dollar is assumed, which will also be used for this conclusion. The price of batteries estimates the production cost of a battery at market level, this is not the entire price of an energy storing solution. This research is done near the end of 2024, therefore, to draw conclusions about battery prices in five years, the year 2030 is assumed. This corresponds with the year which is often chosen in battery price forecast studies. This research is conducted, as be found in the research question, for the purpose of applying it to battery sales advice. This limits the topics to certain battery types. The research is limited to Lithium-Ion batteries of the types LFP and NMC.

Battery price forecasting is a hot topic in the scientific literature. In the past years numerous studies have been conducted. These can be categorized in three main approaches: Technology learning or experience curves, expert elicitations, and bottom-up modelling [2]. Mauler et al. (2021) provides an analysis of 53 studies on battery forecasting, which forms a basis for answering this research question [4]. There is no one correct answer what the price of batteries will be in 2030. This depends on the type of battery and even than a wide range of predictions is made. It can be said that all forecasting categories predict lowering of prices. Bloomberg (2023) provides an overview of these prices in the last decade [5]. Moving from €780 / Kilowatt-hour in 2013, to €211/ Kilowatt-hour in 2018 and €139 / Kilowatt-hour in 2023.

The questions remain what amplitude should be expected in price drops. Based on the 53 studies analysed Mauler et al. (2021) concludes that a threshold of \$75/kWh for lithium-ion batteries in 2030 is feasible, presuming that materials stay at 2020 cost levels. In an additional study from 2022 Mauler et al. elaborate on these conclusions. Including expected material cost trends are expected to be somewhere between \$76.7/kWh and \$104.1/kWh. The latest study on this topic presumed even lower prices, however applying their expected feasible reductions in production cost, the same rough approximation is shaped as the study of Mauler et al. [2].

Besides estimating the cost of lithium-ion batteries in 2030 it is also relevant to discuss the influence of this on battery energy storing systems. A breakdown of cost for such a system was conducted by Niu et al. (2019) [1]. Battery cost is only a part of the entire cost construction of a battery energy storing system. The research does, however, conclude that battery cost is significantly of influence on the cost of energy storing systems. There is no clear indication of the quantitative significance of the influence of battery cost. A case study was done on the correlation between BESS investing cost and different prices / kWh. This case study showed a linear correlation between the two.

Reduced battery cost could thus lead to reduction in battery energy storing systems. It is still uncertain whether such a reduction in cost would also lead to reduced battery prices by 2030. A study in California analysed prices for battery energy storing systems. It compared the learning curves for lithium-ion battery packs to the registered market prices of BES systems. Learning curves indicate in this case the reduction in price over the time that there is more experience in the market with the product, this is also called the experience rate. The industry average experience rates are estimated between 12% and 30%. The observed experience rate for market prices of BES systems in California was on average 1.3%. Large projects (>10kW) concluded a 11% experience rate against a -2% experience rate at small projects (<10kW). The researchers concluded that this was due to the lack of installers and therefore competition [3].

Conclusion

The expected price erosion trend estimates a reduction of battery price per kWh. This can be approximated with an expected 2030 price between \$76.7 and \$104.1 per kWh in comparison with the average 2023 price of \$139/kWh. Battery prices are of significant influence on the total cost calculation of battery energy storing systems. Research has shown that not in all cases such decrease in costs result in lower cost for the end users. This could change once the installation market matures.

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C.2

PGS 37-1 – Plaatsing

Contents

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1.1 Toepassing

<https://publicatiereeksgevaarlijkstoffennl/publicaties/online/pgs-37-1/2023/1-0-december-2023#7>

Van toepassing op lithium batterijen groter dan 20 kWh inclusief randapparatuur en BMS/EMS. 37-1 is actief vanaf ingebruikname. BESS (EOS) in opbouw vallen niet onder 37-1, en niet onder 37-2. Van toepassing tot buitenwerkstelling, in het geval van buitenwerkstelling max 30% laadniveau en individuele modules losgekoppeld. Van toepassing op EOS parken tot 400 MWh, maximaal 1000 V AC of 1500 V DC.

Voor de ingebruikname moet een EOS gecontroleerd zijn op alle onderstaande maatregelen die van toepassing zijn. Gewaarborgd door een kwaliteitsmanagementsysteem dat voldoet aan de eisen van NEN-EN-ISO 9001 of hieraan gelijkwaardig.

1.2 Verschillende types

Typicals op basis van behuizing:	
Typical 1	Zelfstanding BESS in (aangepaste) container
Typical 2	Energieopslagpark
Typical 3	BESS-park met niet-betreedbare behuizingen in de openlucht
Typicals op basis van plaatsing:	
Typical 4	Mobiel BESS
Typical 5	Inpandig BESS met eigen ruimte
Typical 6	Inpandig BESS in een open ruimte

C.3

Subsidies

EIA

Voor ondernemers die inkomstenbelasting of vennootschapsbelasting betalen. Minstens 5 KVA vermogen en 15 kWh capaciteit. Inclusies stroom/spanningsomvormer en regelsysteem. Aangesloten op een energieopwekinstallatie met opgesteld vermogen van meer dan 15 kW. Er mag 40% van de investeringskosten van de winst worden afgetrokken. (Gemiddeld levert het 10% op)

KIA

Investing	KIA
=< €2800	0%
€2801 t/m €69.765	28% van het investeringsbedrag
€69.765 t/m €129.194	€19.535
€129.194 t/m €387.580	€19.535 verminderd met 7.56% van het deel van het investeringsbedrag boven de €129.194
> €387.580	0%

Afschrijvingen

Accu mag als bedrijfsmiddel afgeschreven worden. Mogelijk afschrijftermijn is 15 jaar. Dan wordt het totale investeringsbedrag in 15 jaar afgeschreven. Ieder jaar 1/15. Dit is te combineren met EIA en KIA.

SSEB

Subsidieregeling schoon en emissieloos Bouwmaterieel aanschaf. Enige relevantie is een mobiel accupakket. Groot bedrijf kan 20% subsidie krijgen, klein bedrijf 30%.

DUMAVA

Subsidieregeling duurzaam maatschappelijk vastgoed. Maatschappelijk vastgoed: scholen, overheidsgebouwen, zorginstellingen of monumenten. Accupakketten vallen onder de maatregelen als opslag van zelfopgewekte duurzame energie.

<https://www.rvo.nl/subsidies-financiering/dumava>

“H.3 Energieopslag

a. Opslag zelfopgewekte duurzame energie

Bestemd voor: de opslag van zelfopgewekte duurzame energie

En bestaande uit: een accu of batterij, regeltechniek en een verdeelstation.

De kosten voor veiligheidsmaatregelen komen niet in aanmerking.

b. Opslag zelfopgewekte duurzame energie en uitwisseling met andere percelen

Bestemd voor: de opslag van zelfopgewekte duurzame energie en energieopslag voor en uitwisseling met andere percelen

En bestaande uit: een accu of batterij, regeltechniek en een verdeelstation.

De kosten voor veiligheidsmaatregelen en kosten buiten het eigen perceel komen niet in aanmerking.

Toelichting:

Alternatieven naast Lithium-Ion als opslagmedium zijn:

a. Zout(water),

b. Water,

c. Gesteente,

d. Staalslakken, of

e. Phase Change Material (PCM).

I.1 Intelligente lokale energie-uitwisseling

Bestemd voor: het faciliteren van een intelligent lokaal energienetwerk waarmee vraag en aanbod van diverse energiegebruikers en energiebronnen op elkaar kunnen worden afgestemd en bestaande uit: meet- en regelsysteem in combinatie met software voor de real-time koppeling tussen producenten en gebruikers binnen het energienetwerk.”

Voor losse maatregelen 20% subsidie, minimaal €5.000, voor integrale maatregelen 30%, minimaal €25.000.

SPRILA

Subsidieregeling Private Laad Infrastructuur bij bedrijven Aanschaf. Investering in stationaire batterijen bij laadstations aangelegd door een onderneming.

€160 per kWh voor mkb

€80 per kWh voor een groot bedrijf

Tot maximaal 1000 kWh

D. Bird's eye process view

