UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Master Degree Project in Innovation and Industrial Management

Business Models for Renewable Energy Technology

A case study of Perpend AB

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Master Degree Project No. 2015:32
Graduate School

Abstract

The concept of business models (BM) have gained a lot of interest from both companies and academics during the last century. Prominent frameworks such as the Business Model Canvas (BMC) and the Value Proposition Canvas (VPC) are applied extensively throughout a large variety of industries for the purpose of mapping out how the company can create, deliver and capture value from their offers. However, not much research connecting such BM-frameworks to the rapidly evolving renewable energy sector have been conducted. This thesis explores that very gap in academic literature by studying how a case company (Perpend AB) with a novel technology for renewable energy production can develop a BM for their products. The purpose of this thesis is to investigate how Perpend can make the benefits of their novel technological products visible and accessible to potential customers with the abovementioned BM-frameworks as starting point. Findings show several potential approaches to creating BMs for the renewable energy sector in general and for Perpend's products in particular. This study culminates in developing two different BMs for Perpend, both with different possibilities and challenges to take into consideration. Additionally, an action plan for how Perpend can manage the process of applying the proposed BMs in a dynamic fashion believed to increase the chances of success is suggested.

Acknowledgements

This Master of Science thesis was written during the spring of 2015 at the University of Gothenburg School of Business, Economics and Law. We would like to express our appreciation to all individuals who contributed and made this research possible.

First of all, we would like to direct our sincerest gratitude to our supervisor Rick Middel for all the valuable input and guidance he have provided us throughout the process. We also want to thank Roland NG Gustafsson at Perpend AB for giving us the opportunity to study his company and for the invaluable knowledge he have contributed with.

Furthermore, we would like to take this opportunity to thank Sandra Johansson at Miljöbron for connecting us with Perpend AB and our group of opponents who provided with appreciated feedback throughout the entire process of writing this thesis.

Last but not least, we are most grateful to the interview respondents at Ray metallfabrik, Götessons, Länghems kök, Hållanders sågverk, Herrljunga träindustri and Blomdahls mekaniska for taking the time to participate in our research study.

Thank you!

Joakim Eskilsson & Pontus Bertilsson

June 2015

Acronyms

BM Business Model

BMC Business Model Canvas

CVP Customer Value Proposition

SLR Systematic Literature Review

VP Value Proposition

VPC Value Proposition Canvas

Exhibits

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1. Introduction

1.1 Background

The concept of business models (BM) have gained a lot of interest from both companies and academics during the last century partly because it proposes a theoretical perspective on how companies can "create, deliver, and capture value" from their offers (Osterwalder and Pigneur, 2010, p.14). BMs can be used as a management tool for the purpose of mapping out the activities that are taking place in order to deliver a product to a customer (Hacklin and Wallnöfer, 2012) or as a mean for pursuing novel technological opportunities (Chesbrough and Rosenblom, 2002). Creating new BMs in order to get the most out of new technology has developed into an increasingly important part of companies' struggle for growth, profitability (Zott, Amit and Massa, 2011) and not least sustainability (Wells, 2013) in different industries.

Changes to BMs are in fact perceived by managers in a wide variety of industries as essential when it comes to being innovative and successful. For instance, a study conducted by IBM Global Business Services (2008) comprising of interviews with over 1000 CEOs, showed that practically all CEOs wanted to change their BMs and over 60% of them had already initiated significant changes. There are also several good examples of how companies have managed to successfully create new BMs in order to benefit from technologies that does not fit within existing company structures. One of the more famous being Xerox's commercialization of the copy machine "model 914" (Chesbrough and Rosenbloom, 2002). Instead of going with the stream and offer the same deals as competitors, who sold their copy machines and obtained revenues via a traditional buyer-seller relationship, Xerox innovated their cost structures in a way that in the end was beneficial for both the company and the customers. They managed to create a new BM where the actual product was leased at a comparably low fixed fee. This did not earn Xerox any money as the leasing price was far away from covering the actual value of the product. However, with a fixed cost per printed copy, the novel and significantly faster printing technology in the model 914 enabled customers to make a lot more prints than earlier as past copy machines where inhibited by slower printing speed. This resulted in a massive increase of printed copies which in turn generated great revenues for Xerox at the same time as their customers' jobs progressed a bit smoother. Xerox's revolutionary BM together with a novel technology changed the dynamics of an entire industry: strong proof for the power of BMs.

Spending time on developing a suitable BM for the industry you are operating within can undoubtedly be a powerful tool for generating new and promising ways to do business. How to actually succeed in doing so and what BM that fits with a certain technological innovation is though harder to determine. A BM proven to be successful in one case might in fact not be suitable in another. Therefore, companies need to continuously reevaluate and innovate their

BMs as new technologies are developed. As stated by Chesbrough (2010, p.2) “a mediocre technology pursued within a great BM may be more valuable than a great technology exploited via a mediocre business model”.

One industry that recently have been subject for debate is that of energy production (Richter, 2013). Traditionally, energy producers have built their BMs around electricity generated from non-renewable sources. Fossil fuel scarcity, climate changes (Huber, Dimkova and Hamacher, 2014) and updated sustainability policies (Cowell and Strachan, 2007) have though forced energy companies to adapt their businesses in accordance to future demand. Even though progress is slow, renewable energy[1] sources such as wind and sun have begun to replace traditional, non-renewable energy sources such as oil as part of a current sustainability trend (Huber, Dimkova and Hamacher, 2014). Technological advancements in the renewable energy sector is being made and there are quite a lot of literature available on the subject. However, not much research about how companies can construct BMs specifically adapted for novel renewable energy technology have been published.

Guided by a case study, we want to investigate what a BM actually can look like in reality for a company focused on renewable energy technology. Perpend, the company in question, have given us the opportunity to take a closer look at suitable BMs for their product.

1.2 Perpend

Perpend is a newly founded company based on an innovative and sustainable technology for the generation of electricity. The company have developed a type of windmill energy system which combines patented vertical-axis wind turbines with solar panels and energy storage units, completely adapted to an urban setting. The windmills can be adapted to the specific energy needs of the customer as the product is built upon modules of different sizes and combinations of wind/solar power. The energy systems are especially beneficial at locations with windy conditions, low interest rates and high spot prices on electricity. Perpend want to attract both companies and private customers to invest in their technology, especially but not exclusively in regions where these conditions can be found.

This brand new product is thought to be more efficient both energy and cost wise compared to other comparable products on the market. However, as the technology is brand new and still in the prototyping phase, Perpend are unsure about how to actually get their product onto the market in a way that delivers value both for them and for potential customers. A BM both suitable for the product and a possible market therefore needs to be developed in order for Perpend to utilize the potential of their technology.

[1] The term renewable energy refers to energy produced with either wind, biomass, solar or wave power (Lund, 2007).

Perpend are confident that their patented technology will be efficient and generate an energy production cost that is lower than the market spot price. The fact that they provide a product yet unknown on any market do however propose a couple of challenges when it comes to creating a BM. Being the only actor within this new type of renewable energy systems, Perpend need to create a spot on the market by themselves. In addition, potential customers are rather unaware of this novel type of energy system resulting in a need to educate and inform about what the product actually can provide the customers with in terms of value. Gaining insights from potential customers on what benefits as well as issues Perpend's product might generate is therefore important for understanding how the value proposition for their novel renewable energy technology actually should look like. In turn, a smart BM that allows Perpend to reach out to and educate a potential market segment might help to get the energy systems onto the market.

This thesis will hence focus on how BMs can be created for the specific case of Perpend and their products.

1.3 Purpose and research question

The purpose of this thesis is to investigate how Perpend can make the benefits of their novel technological products visible and accessible for potential customers with the help of BMs. The thesis will thus address issues regarding how Perpend can align existing resources into a BM which promotes their technology in a way that is attractive to the customers. The aim is to help Perpend to make their technology more visible to potential customers and to get this novel technology a small push-start onto the market. The following research question has been derived:

What could be a suitable business model for Perpend's novel technology for renewable energy production?

In order to be able to answer this research question and further relate it to our purpose, two sub-questions have been formulated:

1) *How can the benefits of Perpend's renewable energy systems be easily available for potential customers?*
2) *How can potential customers gain awareness of Perpend's systems for renewable energy production?*

The first sub-question is connected to the fact that Perpend has a novel product yet without a clear spot on the market. In order to create a BM, channels for how to reach out to potential markets and customers need to be established. The question is thus important to answer as it is a significant first step to take in order to create a BM specifically for Perpend.

The second sub-question relates to the problem with offering a novel product to a market that is rather unaware of its existence. In order to educate potential customers about a novel product,

it is important to investigate how they perceive that product and what potential issues that might be solved or relieved by it. Raising awareness of Perpend's product is therefore an important part of a potential value proposition, which in turn make up a significant share of the overall BM.

1.4 Delimitations

As the time and resources have been rather limited we have made a couple of important delimitations to suit the scope of our thesis. First of all, we chose to limit the study to a specific geographical area of the inlands of Sweden: Tranemo and Herrljunga municipality. We did so for two main reasons. Firstly, these two regions are similar both in their geographical position and with regards to weather conditions. The similarities enabled us to compare and contrast interview findings in a more structured manner even though our respondents comprise of companies with differences regarding their line of business and energy consumption. Secondly, Perpend are situated close to these two regions in which most businesses fit the criteria of producing companies with a maximum of 50 employees. The closeness to these companies thus make them beneficial subjects for both us and Perpend to approach.

Furthermore, this research is to a large extent qualitative partly due to the limited amount of interview respondents. There are two reasons for why the number of interviewed companies were not higher. First of all, the companies featured in this research are all prominent in their respective areas and generally interested in new technology which made them more susceptible to our research compared to other companies in the chosen regions. Other potential prospects did not want to participate in the research for reasons related to either disinterest, lack of time or because they did not fit the selection criteria. If more companies were represented in the research, additional elements of a more quantitative nature might have been possible to include which in turn could have contributed to a deeper level of analysis. However, the availability of companies did restrict us to exclude such elements from the research.

This thesis is also focused on a single case company which leads to potential problems related to generalizability. Both the company and the product in question are however unique with few or no directly comparable cases. We therefore chose not to include other case companies in the renewable energy sector as it would be difficult to draw unbiased conclusions between different types of products that most likely also depend on different types of technology. The generalizability of the research is further elaborated on in the methodology section.

2. Systematic literature review

This chapter begins with a discussion regarding the definition of BMs in order to give the reader a better understanding for this concept, central to the thesis. Next follows a thorough review of BM-literature connected to renewable energy production. Different tools for how to construct BMs is a major part of the chapter as that is closely linked to the purpose of the research. We will therefore dive deeper into conceptual frameworks for how to design BMs and link this to renewable energy technology in order to further connect to the case study.

2.1 Business models

Before we immerse deeper into theories of BMs we find it useful to define the concept as different opinions on what BMs actually are can be found throughout the literature (Morris, Schindehutte and Allen, 2005). Zott, Amit and Massa (2011) for instance established in their work that even though the concept is widely used and often associated with how companies can provide and generate value, a general definition of the concept has not yet been accepted.

The interest for the concept of BMs grew rapidly during the 1990s and onwards with a large increase in the number of published papers on the subject (Hacklin and Wallnöfer, 2012). Some authors argue that the rise of e-commerce and the larger expansion of internet during the late 20th century were some of the most important influences for this increase in attention since it changed the dynamics of how companies can manage their businesses (Chesbrough and Rosenbloom, 2002; Magretta, 2002). The fact that more and more academics turned their attention to BMs also meant that several different definitions emerged, resulting in ambiguity around the concept.

Osterwalder and Pigneur (2010) argue for the importance of a concept definition of BMs that everyone can agree upon and understand as the basis for discussion, both in the academic as well as the corporate world. They mean that the real challenge is to create a concept definition that is simple enough for everyone to comprehend intuitively without being too generalizing with regards to how companies work and do business. Osterwalder and Pigneur (2010) rose to the challenge by developing the now well established Business Model Canvas (BMC): a framework comprised of nine building blocks illustrating the logic behind a company's attempts on earning money from their offers. This model will be explained in further detail in subsequent parts of this chapter, but for now we will concentrate on the definition of BMs that Osterwalder and Pigneur (2010, p. 14) among others based their framework upon:

> "The rationale of how an organization creates, delivers, and captures value"

This definition is today widely diffused and often applied in research as base for what the purpose of a BM is. It is also the definition that subsequently will be used throughout this thesis as it provides a perspicuous overview of the concept with the customer as a central part.

There are however alternatives to Osterwalder and Pigneur's (2010) definition, although with less focus on customers. Chesbrough and Rosenbloom (2002) for example mean that this definition only is one of several modern interpretations on Andrew's (1971) description of a business unit's strategy. He explains for example that by leveraging an organizations resources, a corporate strategy can be formed with the resources of the organization as a base. This connection to strategy is one factor that has contributed to the earlier mentioned ambiguity that surrounds the BM-concept. We want to make clear that there in fact is a distinction between a company's strategy and their BM. With Osterwalder and Pigneur's (2010) definition in mind, strategy is referred to as the choice of BMs that a company makes in order to be able to compete in the marketplace (Casadesus-Masanell and Ricart, 2010). The strategy can thus be thought of as the rationale for how a company develops their BM in a way that helps them to compete (Magretta, 2002). Osterwalder and Pigneur (2010) similarly state that a BM is a blue print for how a business strategy should be implemented. There is hence a connection between BMs and strategy but it is important to keep them apart as they cannot or at least should not replace one another.

Chesbrough and Rosenblom (2002) explains a BM as a model which unlocks underlying value of a technology, meaning that a BM supports and helps the existing technology to thrive. They continue the argument by presenting a drawback of the BM-concept as its underlying logic might suppress and hinder new technologies and their development: as the BM is constructed around current technologies it may need to be readapted in order to make the most out of a new or refined technology. When an organization's BM is plotted out and confirmed it can seem like a set and rather unchangeable structure, thereby hindering development as new products for instance might not fit with the current BM. Adaptability and change therefore needs to be a part of the strategy when working with BMs in order to take advantage of new technologies and to foster development. Generating new BMs when the old ones are not in phase with the company's resources anymore is thus an essential task for a company aiming to take advantage of future technologies.

Chesbrough and Rosenblom (2002) describe the case of Xerox and their spin-offs in order to stress the importance of revitalizing BMs. Xerox developed a range of different technologies, such as adobe, 3Com and SynOptics, but did not succeed to incorporate and transform these technologies into their existing BMs. Some of these technologies and spin-offs proved to be successes that often became pioneers within their fields. Chesbrough and Rosenblom (2002) argue that the reason for the success of these spin-offs were that they broke free from Xerox which enabled them to develop novel BMs better aligned with the needs of the new technologies. If Xerox would have paid more attention to innovation with regards to their BMs and adapted it towards these new technologies they surely could have benefitted more from the technologies.

Gambardella and McGahan (2010) argue for the importance to study sociological and marketing insights in order to understand and examine which technology that will be commercially successful. Furthermore, there is a need for experimentation and matching customer needs with technological solutions, which makes BM-experimentation important in order to extract as much value as possible from a product, market or technology.

Like Chesbrough and Rosenblom's case description (2002), Johnson, Christensen and Kagermann (2008) describe the importance of, as they call it "reinvention of BM", by taking a closer look at Apple and their success with the iPod. At the time, Apple was no pioneer when it came to launching portable music. Companies such as Diamond Multimedia introduced a portable MP3 player with an elegant design as early as 1998 which can be compared to the iPod that first was introduced in 2003. Instead of being first on the market, reinvention of their BM is highlighted as one of Apple's crucial success factors. The difference between Apple and Diamond Multimedia was that Apple based their BM around downloading music and made it very convenient via iTunes. They did not just wrap a good technology in a nice design, they created an innovative BM that combined both hardware, software and service. The combination of low-margin iTunes music with high-margin iPods created value for the customers at the same time as it optimized the value Apple generated from the technology.

Regarding the energy supply market, Richter (2013) argues that traditionally strong actors are facing big challenges with private users and external investors that are advancing in the renewable energy sector. This has led to a need for BMs better suited for the commercialization of technologies for renewable energy production (Richter, 2013). Richter (2013) approached the challenge of adapting BMs to new technological opportunities and market conditions by identifying and plotting out BMs for renewable energy from two different angles; one from the *utility side* and one from the *customer side*.

The utility side BM is focused on bulk generation of electricity from renewable energy sources such as wind and solar power that subsequently is distributed to customers via the traditional electrical grid. The customers thus obtain electricity via an intermediate player and the producing company never have direct contact with the end-user (Richter, 2013).

The customer side BM is less centralized than the above and builds on smaller scale electricity generation closer to the end-users. The customers (often private persons or small to medium size companies) are here more integrated as they are more involved in the electricity production and often provide physical space for the technology where they live or operate (Richter, 2013). A more suitable model for renewable energy projects according to Devine-Wright (2005) as the people who work and live close to the energy production should be integrated in order to avoid resistance.

Results from interviews with larger electricity companies regarding the two different BMs showed that they were not very willing to advance into the customer side BM as they do not consider themselves to have the knowledge nor the capabilities necessary for doing so (Richter, 2013). They clearly favored the large scale traditional utility side BMs and did not recognize smaller actors with more customer centric BMs as much of a threat. Richter (2013) concludes that these large actors must adapt their BMs to the smaller scale customer side or continue to loose market shares to smaller better adapted actors. Like Huber, Dimkova and Hamacher, (2014), Richter (2013) mean that these smaller actors are threatening the larger conglomerates with higher flexibility and product/service offers better suited for meeting future demands.

2.2 Value Proposition Canvas

The Value Proposition Canvas (VPC) is a framework developed by Osterwalder, Pigneur, Bernarda and Smith (2014) for the purpose of highlighting the value proposition as an important part of every BM. The framework is thought to function as a first step to the construction of a complete BM with the BMC which was designed to work as a mapping tool that enables entrepreneurs to visualize, describe and design their BMs in a logical manner. The BMC-framework is today commonly accepted as one of the most influential BM-tools on the market, which will be further elaborated on in subsequent sections. The BMC have though received some criticism that spurred the development of the VPC. Critics mean that the BMC have varying levels of abstraction for the different elements in the framework: some receive more detailed description than others.

The aim of the VPC-framework, illustrated by *Figure 1*, is to explicate how value is created for customers and how the better understanding of customer demands can help a company to develop attractive offers. As stated by Teece (2010) and Trimi and Berbegal-Mirabent (2012) companies need to be more customer centric treating the value proposition as a key aspect for the successful development of BMs with regards to novel technologies. Innovations (especially technological ones) do not create value by default. Understanding what the customer wants and being able to provide precisely that at the same time as value is created for the company is therefore a crucial part of every BM (Teece, 2010). When these two objectives (customer understanding and value creation design) are aligned, a fit between demand and supply is achieved (Osterwalder et al. 2014).

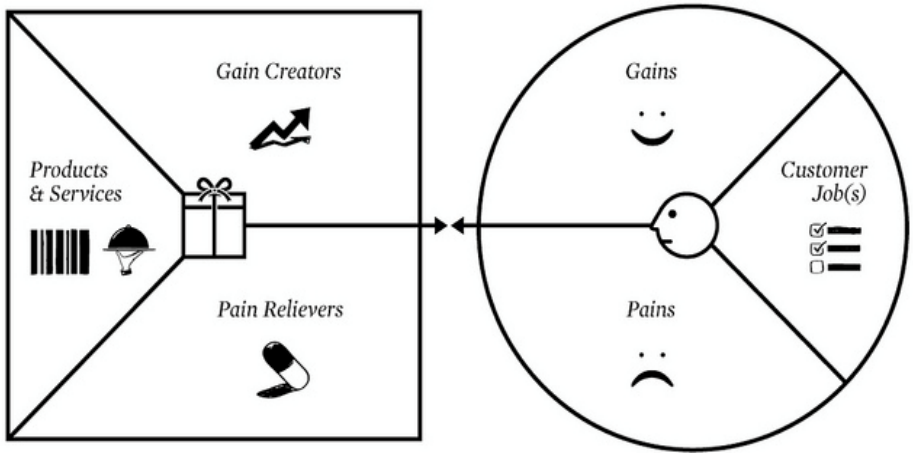


Figure 1 The Value Proposition Canvas (Osterwalder et al., 2014).

The VPC builds on the BMC and should be used as a complement to concentrate the focus on two important BMC-elements: customer segments to the right and value propositions to the left (Osterwalder et al. 2014).

2.2.1 Products and services

At the far left of the framework, the products and services that are offered to the customers are presented. It is basically just a list of all the products that make up a company's value proposition. These products/services do not however deliver value without help – help from the customers in the sense that the product triggers a need (Teece, 2010). These needs are illustrated in the VPC as either *gain creators* or *pain relievers* (Osterwalder et al. 2014).

2.2.2 Pain relievers

One tactic a company can use to create value is to eradicate or ease things that create difficulties for the customers. According to Osterwalder et al. (2014) important questions to think about at this point could be:

- Do the products offer possibilities to save resources such as money, time or energy?
- Do the products offer a better solution to a problem than other products aimed at meeting the same needs with for instance higher quality?
- Do the products reduce risks in relation to e.g. money or technology?

Important is also to know whether the identified pain relievers are vital for the customer or not. Some pain relievers can truly offer a great deal of value while others only produce moderate amounts of relief.

2.2.3 Gain creators

As opposed to the above, gain creators are the benefits provided in accordance to customer demands: the issues a customer anticipates the product to help them with. Besides what is already mentioned in the pain relievers section, Osterwalder et al. (2014) proposes questions a company should ask themselves when it comes to gain creators:

- Do the products provide the value expected from the customers or are the benefits greater than the customer anticipated?
- Do the products contribute to making the life of the customer easier by for instance cost savings or better access?
- Do the products create social benefits for the customer with for instance increased goodwill?

As with pain relievers, gain creators can be of varying importance to the customer and it is important to differentiate between what is "essential" for the customer and what is more "nice to have" (Osterwalder et al. 2014, p. 34).

2.2.4 Customer jobs

The tasks customers do or are trying to do in their work are referred to as customer jobs. These can be divided into three categories (Osterwalder et al. 2014):

- **Functional jobs**: specific tasks aimed at solving an existing problem.
- **Social jobs**: tasks that will increase the reputation and goodwill of the customer, for instance by higher commitment to CSR or sustainability issues.
- **Personal/emotional jobs**: endeavors for reaching a "specific emotional state" such as job security or a feeling that the job performed by the customer do make a societal difference.

2.2.5 Customer pains

Annoying occurrences, risks or things that obstructs the customer from performing their jobs are known as customer pains in the VPC. These pains can be present either before, after or during the customer's tasks are completed. Pains can be functional (something does not work as desired), social (damaging to e.g. reputation as something makes the customer look bad), emotional (the customer feels bad when they do something) or ancillary (the customer is annoyed about having to do something) (Osterwalder et al. 2014).

Although many upsides of adopting technology for energy production from e.g. wind or solar power can be detected, there are also challenges/pains. Huber, Dimkova and Hamacher (2014) for instance discuss the increasing pressure for flexibility that is put on an energy system when a growing share of the produced energy comes from wind and solar power. Flexibility is here regarded as "the ability of a power system to respond to changes in power demand and generation" (Huber, Dimkova and Hamacher, 2014, p. 1). Pflüger (2010) as well as Huber, Dimkova and Hamacher (2014) continue by stating that energy production with the help of wind and solar power is uncertain as the technology would demand a constant stream of wind/sun in order to work without interruption. For instance, weather conditions differ depending on geographical location and it is hard to accurately foresee when and where the weather conditions are to be most favorable for a given wind or solar power technology.

2.2.6 Customer gains

The value a customer obtains from purchasing and using a given product is called a customer gain. These gains reflect the outcomes a product will yield for the customers as well as what the benefits of those outcomes are. A product or service can generate several different outcomes for a customer ranging from quite obvious ones such as cost reductions or higher efficiency to more tacit gains such as social wellbeing or goodwill (Osterwalder et al. 2014). Osterwalder et al. (2014) further distinguish between four general types of gains:

- **Required**: the most fundamental requirements a customer have on the product, for instance that a phone can be used for calling people with. The product offered to the customer would in a sense be worthless if these necessities are not met.
- **Expected**: not as important for a provided customer solution to work but still something that can be expected from the offered product or service. For instance, Apple phones are expected to be good looking with a neat design even if the general purpose of a phone in fact is to call people with.
- **Desired gains**: unexpected benefits that the customers would like to have but do not necessarily think will be provided by the product or service. If asked, the customer would probably state these desires but not as general requirements for the provided solution to work.
- **Unexpected gains**: gains that are not explicitly thought of from the customer's point of view. These gains go further than the needs of the customers and might even give the company a competitive edge.

With an adaption to sustainable energy systems there are two expected and rather obvious gains. Firstly, the positive environmental effects and secondly the economic gains from cheaper electricity (Söderholm and Klaassen, 2007; Pflüger, 2010). Ferguson (2008) adds to these positive aspects by stating that wind power in fact can achieve a power density equal to that of coal, meaning that the energy production (provided a constant supply of wind and/or sun) can be just as effective as burning coal, only much more beneficial for the environment.

2.3 Business Model Canvas

As earlier mentioned the BMC is commonly accepted and used by both academics and practitioners as a mapping tool that enables companies to visualize their BMs (Osterwalder et al. 2014). Visualizing a BM is, according to Osterwalder and Pigneur (2010), best done with the help of nine separate but interdependent building blocks that form the base for how a company plans on generating revenues from their products or services. These blocks illustrated in *Figure 2*, were developed for the purpose of mapping out the parts that a BM is thought to consist of. Together, the blocks form a BMC. These are further explained below.

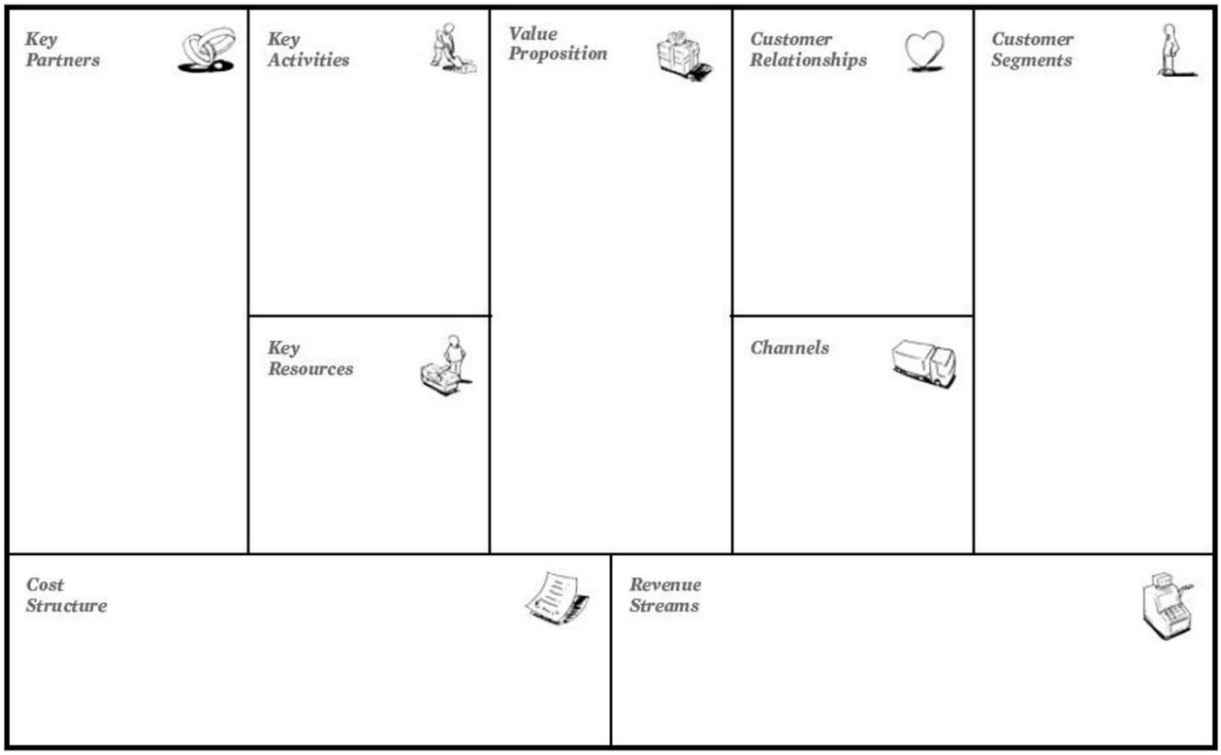


Figure 2 The Business Model Canvas (Osterwalder and Pigneur, 2010).

2.3.1 Customer segments

To the far right in the BMC, customer segments represent what different groups of people or organizations that the given company wants to reach with their offers. The customers lie at the very core of every successful BM, without them no company will live for very long. According to Trimi and Berbegal-Mirabent (2012) that is especially true for businesses driven by technological novelty (such as Perpend). Trimi and Berbegal-Mirabent (2012) here argue for the need to transform the traditional balance between customers and suppliers. Businesses revolving around technological advancements need to focus on delivering their technology to the customers. Therefore, BMs in these type of companies need to be more customer-centered and flexible compared to other businesses. Gambardella and McGahan (2010) similarly bring up the difficulty for firms with new technology and/or patents to convince the market to start using it and to gain

sufficient compensation from it. BMs in technology driven companies are thus required to be adaptable for the re-shaping of strategy and changing of business logics in alignment with customer needs.

According to Osterwalder and Pigneur (2010) it is of importance that a company divides their customers into one or several segments in order to distinguish what type of offer that is appropriate for what type of customer. There are many different types of customer segments, for instance diversified markets, mass markets or as we shall take a closer look at: niche markets.

Factors such as climate change, exhaustion of fossil fuel sources and resistance to nuclear power production (Huber, Dimkova and Hamacher, 2014) have all influenced a current trend for a transition towards more renewable energy (Cowell and Strachan, 2007; Huber, Dimkova and Hamacher, 2014; Söderholm and Klaassen, 2007; Richter, 2013). In addition, the EU decided to put up a goal for renewable energy sources agreeing upon that no less than 20% of all energy consumption within the EU should come from such sources before 2020 (Cowell and Strachan, 2007). These factors have encouraged companies to niche themselves towards purely sustainable energy production with wind and solar power as the fastest growing sectors (Huber, Dimkova and Hamacher, 2014). In such industries it is important to localize the customers that value sustainability and renewable energy the most in order to maximize customer value (Richter, 2012). Localizing businesses that value sustainability could for instance be done by screening companies' value propositions (VP) and product descriptions for sustainability aspects. Identifying which businesses that recognizes sustainability as valuable will enhance the chances for a successful BM in companies focusing on renewable energy technology. However, regardless of which type of segment focus is put upon it is important that the company makes an active choice regarding which segments to overlook and which segments that demand a distinct offer (Osterwalder and Pigneur, 2010).

2.3.2 Value proposition

The block named value proposition represents the combination of products and/or services that provides value to a chosen customer segment. If we recognize the customer segments as central to a good BM and as vital for business, the VP can be thought of as the reason a targeted customer actually should chose a given company over a competitor (Osterwalder and Pigneur, 2010).

According to Johnson, Christensen and Kagermann (2008), creators of the Customer Value Proposition framework (CVP)[2], a BM should ideally start with the creation of a VP. The reason for this is when you are trying to invent or reinvent a BM you need to identify what exactly it is that the customer needs. From these defined needs a clear VP should be developed. They further state that a precise and therefore also good VP often focuses on one single job that should be done. A common mistake is that VP designers often try to broaden their offers by trying to

[2] An illustration of the CVP-model can be found in *Appendix 2*.

achieve several different things. It is according to Johnson, Christensen and Kagermann (2008) better to concentrate the VP on the one aspect that are of most value to the customers in order to sharpen the precision of the offer. Richter (2012) connects this notion to the current trend for a more sustainable society and argues that consumers might be willing to pay extra in order to ensure the sustainability of their energy source. In other words, the consumers are seeing more value in renewable energy sources compared to other sources. Companies focused on sustainable energy production can thus gain an advantage towards other energy suppliers by utilizing that knowledge in their VP (Richter, 2012).

The precision of a VP: how exact you can pin down how to get the job done is, according to Johnson, Christensen and Kagermann (2008), the most important aspect of a VP. Important things to keep in mind in order to get an as accurate VP as possible are common barriers that hinder people from getting their jobs done such as wealth, access, skill or time. The VP should therefore be customized around these aspects in order to, as precisely as possible, reflect customer needs (Johnson, Christensen and Kagermann, 2008). Osterwalder and Pigneur (2010) further state that whether or not the proposition is considered valuable for the customer also depends on (Osterwalder and Pigneur, 2010):

- **Novelty**: a new product that satisfies a need that the customers did not know they had, simply because no similar offers existed on the market before.
- **Price**: offering a higher perceived value to a lower price can create value for customers, especially price sensitive ones.
- **Availability**: making products or services available to customers that previously did not have access to them.
- **Function**: improving the functionality of products or services can attract more customers and provide value in the sense that better functionality can be gained for the same price.

2.3.3 Channels

A company communicates with and reaches customers via different channels in order to provide value. The channel block is hence meant to function as a bridge between a company's VP and customer segments. These channels are important for how a business is perceived by the outside world as they raise awareness of products, help customers to evaluate offers, facilitate customer purchases, deliver the VP to customers and provide after sales support (Osterwalder and Pigneur, 2010). These five are stated by Osterwalder and Pigneur (2010) as channel phases. Each channel can include one or several of the phases.

Osterwalder and Pigneur (2010) further state that communication channels can be divided into five types: sales force, web sales, own stores, partner stores and wholesaler. In turn these types are categorized as either direct channels (internally owned ones such as sales force or web sales) or indirect channels such as partner stores or wholesalers. The importance of these channels

increases with the novelty of the product/technology as newer technology often demand more vigorous information exchange. It is therefore important to work close to the customer in order to see how the novel technology is adopted and received by the user (Richter, 2012).

Further, Würtenberger et al. (2012) stress the importance of educating potential customers that are unaware of available options and how the new technologies actually work. Such a lack of information/knowledge also might lead to a lack of competence of installers on the market. In turn, that might lead to poorly installed equipment which does not reflect the true potential of the technology, further underlining the importance of educating the market (Würtenberger et al., 2012). Devine-Wright (2005) argues that such risks might be mitigated with the help of meetings and workshops between the innovators and their targeted customers. These meetings and workshops will help customers to better understand the benefits of the new product and help the innovator to construct a market for the product(s). Such meetings and workshops preferably should include demonstrations and informative sessions that describes the benefits and nature of the technology.

2.3.4 Customer relationships

What type of relationship a company establishes with a specific customer segment is important to consider as the relationship can vary from highly personal to much more automated and mechanical. Depending on what motive a company might have for establishing a relationship, varying amounts of attention might be demanded. Osterwalder and Pigneur (2010) for instance list three such motives:

- **Acquire customers**: to gain new customers
- **Retain customers**: to keep existing customers
- **Increase sales**

Richter (2012) argues that sustainable energy producers can use these motives in conjunction with the current sustainability trend to enhance their corporate image as well as increase the customers' level of trust. Such outcomes (e.g. positive corporate image and enhanced customer trust) might though be subject for issues related to differences in incentives (Würtenberger et al., 2012). The ones paying for the energy (companies or private persons) and the ones investing in new technology for the industry (governments or other companies) are often different parties leading to a split of incentives with the effects of a decreased sense of urgency. For example, a tenant often merely pays the energy bill and might not be willing to contribute to the initial investment cost as he/she may move out before the investment cost has repaid itself. It is therefore of vital importance to assess what type of relationship that a provider should have with their customers.

2.3.5 Revenue streams

Customers together with revenues make up the very core of any BM. Without money, a company cannot prosper and without customers there will not be any money to obtain. According to Osterwalder and Pigneur (2010) the revenue stream block is intended to help the company ask themselves questions such as how much a customer segment might be willing to pay for a product and how the payments should be carried out. Johnson, Christensen and Kagermann (2008) adds to this by stating that it is important to decide if you should compete through differentiation, price or some kind of combination in order to gain revenues.

Revenues can be generated with the help of several different actions, for instance by selling physical assets (e.g. products), letting customers make use of immaterial assets by licensing agreements or by promoting a product or service with advertisement (Osterwalder and Pigneur, 2010). Which revenue stream(s) a company can establish is of course industry and/or product dependent. However, each revenue stream can also be greatly affected by what type of pricing mechanism the company choses to have. Osterwalder and Pigneur (2010) mentions two general methods for pricing, namely fixed and dynamic where the former represents predefined prices based on static variables and the latter prices that are fluid and changeable depending on market conditions.

Since the cost structures in the energy market have been based around hefty investments and economies of scale, the revenue streams have been adapted to those circumstances leading to high investments and low unit prices (Richter, 2012). According to Würtenberger et al. (2012) the current price of energy is considered too low compared to the environmental impact that non-renewable energy sources are thought to have. In turn, that hinders new more sustainable technology from reaching the market (Richter, 2012). As the structure is not fully set for the renewable energy market, the revenue model needs to be tested in order to take full advantage of the potentially new structure (Würtenberger et al., 2012). In addition, the heavy investments make the investors more risk averse. The combination of risk averseness and low energy prices makes the energy market a hostile place for investments in new technology which might hamper further development in the field.

Furthermore, as described in *2.3.4 Customer relationships*, a split of incentives might occur between the companies investing in renewable energy technology and the ones buying the actual electricity. Würtenberger et al. (2012) argue that such issues in some cases can be mitigated by introducing a higher rent on the property subject for a renewable energy investment. That rent increase will in turn cover parts of the initial investment cost, contributing to a relationship where the tenant/customer actually helps the renewable energy company to fund the building of the technology.

2.3.6 Key resources

The most important assets a company need in order for their BM to work are called key resources. These are the resources that enables the company to develop and present their value proposition to their customers and therefore a vital part for business. What type of resources that are perceived as 'key' are dependent on what kind of BM that a company choses. A manufacturing business might for instance focus on physical assets such as the machines they use for producing products while a knowledge intense company such as a consulting agency might focus more on the expertise inherent in their employees. In general these key resources can be divided into four categories (Osterwalder and Pigneur, 2010):

- **Physical**: assets such as buildings, vehicles, machines or systems.
- **Immaterial**: non-physical assets such as trademarks, patented knowledge or customer databases.
- **Human**: the people working within the organization, their skills and personal know-how.
- **Financial**: monetary resources such as cash, credit or equity bonds.

When identifying key resources and processes you need to investigate what resources that truly are delivering value and what processes that are needed in order to deliver those resources. Often there is no specific resource or process that by itself are making the difference, rather a combination. Therefore, the integration of key processes and resources is essential. Focusing on the VP and revenue streams makes it clear how to interrelate the key resources and processes (Johnson, Christensen and Kagermann, 2008).

2.3.7 Key activities

There are certain activities that a company must carry out in order for the chosen BM to work as desired. These activities are closely connected to key resources and will, like the above, also be dependent upon BM type. Key activities are classified either as *production*, *problem solving* or *platform/network*. Production is about delivering, designing and producing a product in larger quantities and is often a key activity in production based businesses. Problem solving is about finding specialized solutions to specific customer problems. The final one, platform/network, are BMs that are dependent upon for instance networks of people or specific platform software (Osterwalder and Pigneur, 2010). Google is a great example of a company that relies on a platform as a key activity. The platform is the actual webpage which is continuously updated and maintained in order to serve customer needs.

Regarding future advancements in the renewable energy production area several authors, including Huber, Dimkova and Hamacher (2014) and Pflüger (2010), stress the importance of solving problems with variability in energy supply extracted from renewables in order to meet the demand even during cloudy days or days with little wind. An important task for renewable energy companies to deal with is therefore how extracted electricity from renewable sources can

be stored when more energy than needed is produced. If that cannot be done, meeting a goal of more than 20% renewable energy from such sources will, according to Huber, Dimkova and Hamacher (2014), demand serious requirements for flexibility where technology for non-renewable power sources would have to "step in" with short notice when the renewable energy technology fails to deliver. A key activity for renewable energy companies is therefore a problem solving approach to customer demands (Osterwalder and Pigneur, 2010) with regards to variability and flexibility of energy generation technology (Huber, Dimkova and Hamacher, 2014).

2.3.8 Key partnerships

A BM is unlikely to be feasible without networking activities with external parties such as suppliers, partner firms or wholesalers. Nowadays, partnerships are becoming an increasingly important part of how companies do business as they can provide additional resources, risk reduction and scale benefits (Osterwalder and Pigneur, 2010). In the renewable energy industry, one such key partner is the very community in which the energy will be produced. A more locally embedded approach to renewable energy development where people in the nearby region are part of the projects is less likely to be thought of as controversial. Reaching targets for renewable energy will thus progress smoother if the community is allowed to participate in the development of renewable energy projects (Devine-Wright, 2005).

2.3.9 Cost structures

The final building block of the BMC represents the most important costs that arise when working in accordance to a specific BM. These costs are perceived as fairly easy to estimate when the other blocks are defined as they are generated by the resources, partnerships and activities that are needed for the business. Important here is to figure out which blocks in the BM that give rise to the largest costs. Osterwalder and Pigneur (2010) distinguish two types of cost structures:

- **Cost driven structures**: focus is on minimizing costs whenever possible.
- **Value driven structures**: focus is here instead on the creation of value, not so much on what consequences the costs of the BM might incur.

In turn the two structures can be characterized by either economies of scale or scope, fixed costs or variable costs. Würtenberger et al. (2012) point out that energy issues lack priority due to the relatively low cost energy has compared to other costs for companies and private persons. This results in that resources are focused on core assets and more cost intense areas which might hamper the development and investment in the energy industry. In addition, as described in *2.3.5 Revenue streams*, past cost structures have been based on heavy investments and economies of scale. Therefore, the cost structures as well as the revenue streams in this scenario, needs to be tested in order to find the most suitable solution as the market is not yet set (Richter, 2012).

2.4 The BMC-framework: pros and cons

The BMC can be used as a tool for the visualization of a company's BM and provides promising potential for mapping out its underlying processes (Osterwalder and Pigneur, 2010; Chesbrough, 2010). The simplicity and practicality of the framework is stressed by Spanz (2012) as two further strengths. Hulme (2011) and Trimi and Berbegal-Mirabent (2012) both support these arguments saying that the canvas is essential for the learning curve of a start-up company for several reasons. Firstly, the BMC helps the entrepreneur to keep reflecting over the elements of the canvas as it is used as a visualization tool. Secondly, it allows different stakeholders such as entrepreneurs, customers, executives and even competitors to understand the different elements of the BM. The canvas thus also enables a constructive debate regarding the BM between the different stakeholders, leading to enhanced chances for identifying opportunities and risks. Thirdly, it forces the entrepreneurs to handle every single building block both individually and conjointly. This is important as it reduces the risk of missing out on key-activities for different components. Fourthly, by making the BM visible creativity and innovation is stimulated.

The BMC is also stated by Chesbrough (2010) as an experimentation approach that allows a company to test and validate different BMs. It allows the company to clarify for themselves what they want to achieve with their BMs, further strengthening the argument that the canvas provides a powerful and visual tool for the explication of BMs.

There are though some critique against mapping approaches in general and the BMC in particular. As stated earlier, strategy and BMs are often viewed as related to each other but should not be confused as one concept. One common critique specifically directed at the BMC is related to the strategic goals of a company and the fact that the BMC fails at taking these into account (Komisar and Lineback, 2001; Kraaijenbrink, 2012). A company's strive for revenues is certainly important and very much in focus in the BMC. There are however other objectives related to strategy that can be argued as equally important for a company to consider. A non-profit company might for instance be less fit for the BMC approach than a manufacturing firm that relies on revenue streams.

Other critics point out the lack of attention to competitive forces. Ching and Fauvel (2013) mean that competition is a crucial part of a functioning BM but that it is left out of the BMC in order to keep it simple and easily applied. Kraaijenbrink (2012) adds to this by stating that a company more or less can chose their competitors and that the different building blocks of the BM changes depending on competitive forces. A competition-component is thus viewed by these critics as a vital part of BMs that should be taken into account when mapping out a BM with the BMC.

Some criticism have also been directed towards the varying amount of attention given to different parts of the canvas. Kraaijenbrink (2012) calls this "mixed levels of abstraction" meaning that some blocks in the BMC (e.g. customer relationships, channels, key resources and key

activities) are more detailed and thoroughly examined than others which results in an asymmetrical model. The different blocks might as a consequence receive varying amounts of attention that simplifies some aspects of the BM a bit too much while others could benefit from a more detailed explanation (Ching and Fauvel, 2013).

2.5 Theoretical conclusions

The findings made throughout the literature review have been summarized in *Figure 3*. These findings have been plotted out in the BMC-framework to better visualize how a BM for renewable energy technology could look like according to researched theory.

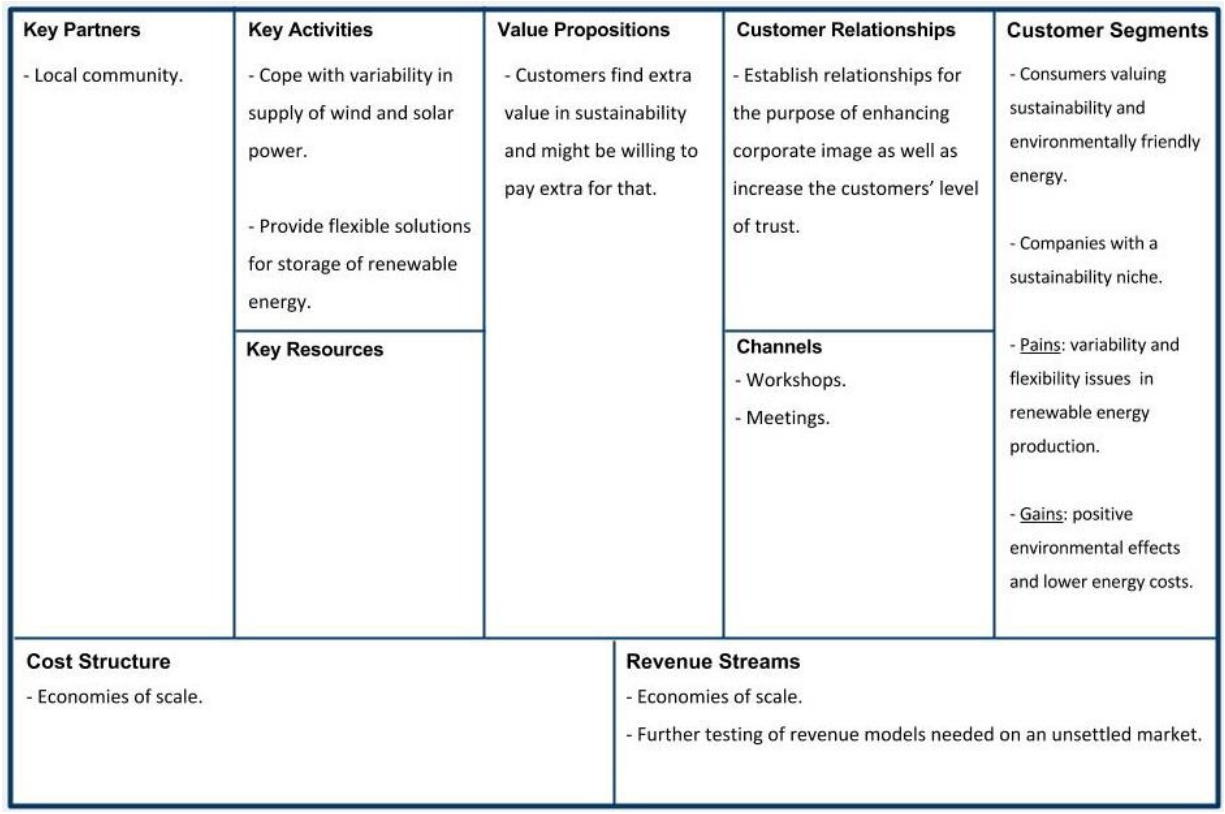


Figure 3 Theoretical findings summarized in the BMC.

3. Methodology

Connecting the purpose and research question to an appropriate research design is a task of utter importance for academic writers. This section describes the methods that we chose for the sake of our thesis and the reasons for why those particular choices were made. The chapter begins with a description of the research design followed by an explanation of how the literature review was conducted. Finally, the empirical findings as well as the quality of the research is discussed.

3.1 Research approach

3.1.1 Inductive and deductive logics

We did start from theory and verified it in reality as well as use our empirical data to make interpretations of that reality. With that in mind we both used inductive and deductive logics resulting in an abductive research approach. An abductive approach means that we went from theory to empirics and from empirics to theory, back and forth. When new empirical data came in we adjusted and refined our theory. By using an abductive approach we were able to avoid being locked in with a certain type of mindset. Instead we were able to switch policies in alignment with new findings during the time we worked with it (Eriksson and Wiedersheim-Paul, 2001).

3.1.2 Qualitative study

Since renewable energy BMs within new businesses and in completely new markets is rather unexplored it is important to extract as much information from the limited amount of data available as possible. In order to better comprehend the empirical data, be able to draw conclusions from different angles and to make the research meaningful for the purpose of the study, a qualitative approach is preferable (Bryman and Bell, 2011).

3.1.3 Case study

As previously stated, we did conduct a case study with Perpend AB in order to investigate how a BM can look like for their novel technological products. The novelty of both the company and the product makes an explorative research approach most suitable for the project. According to Brown (2006) such an approach is preferred when few previous studies have been conducted on the researched subject, further strengthening our choice for conducting an explorative case study.

Yin (2003) describes case studies as a method for focusing on contemporary events. The contemporary event in our case is the current situation Prepend are in. In alignment with Yin's (2003) arguments for conducting a case study this thesis will be based on Perpend's situation.

3.2 Systematic literature review

Yin (2003) argues that a systematic literature review (SLR) preferably should be constructed when basing research on case studies. The main purpose of a SLR is to utilize existing theory to develop sharper and more insightful knowledge/questions about the topic. The starting point of the literature review is the questions developed in *1.3 purpose and research question*. The thoughts forwarded in that section is subsequently developed and further refined with the help of the SLR.

We mainly used the databases GUNDA and LIBRIS at the Gothenburg university library website to find theories and articles regarding the subject researched in this thesis. We have also used the web search engine Google Scholar, which indexes published scholarly literature, for complementing secondary sources. Further sources of information have been articles, blogs, web pages and influential people on the subject in order to validate as well as scrutinize theory. The keywords used for obtaining material for this study were: *business model, business model innovation, value proposition, sustainable energy, renewable energy, wind power, solar power, wind energy* and *solar energy*.

The concept of BMs have been researched in a variety of different settings. There are however a limited amount of academic publications on BMs for renewable energy and how entirely new BMs for novel products yet without an identified market can be developed within that field. The BM-frameworks discussed in this thesis are quite general and applicable to a wide range of cases and industries. Our aim is to give suggestions on how the BMC and the VPC can be more explicated towards renewable energy products. An explorative approach will enable us to further investigate the use of BM-frameworks within the field of renewable energy in general and novel renewable energy technologies in particular. In turn, the outcome of the research can initiate the process of filling the academic gap that exists between BM-research and renewable energy technology research.

3.3 Empirical data

3.3.1 Primary and secondary data

We have used both primary and secondary sources as parts of our empirical data. We have however mainly used primary sources gathered from interviews in order to get information and feedback from external sources. Further, as we have conducted a case study and worked closely with Perpend, they have given us access to internal documents and reports about their current business. These documents have been used with the purpose to get deeper knowledge about Perpend and their technology as internal information is a vital complement to external information for the development of BMs.

3.3.2 Interviews

We conducted our interviews in an unstructured to semi-structured way. Our aim was not to only get answers on certain predefined questions in order to draw parallels between general answers

on the questions we asked (Bryman and Bell, 2011). Our aim was rather to reach a deeper understanding of the subject and extract as much relevant information from our respondents as possible so that we were able to construct BMs that help us understand the chosen subject to an as large extent as possible.

In order to be able to extract as much information as possible from our respondents we tried to start conversations regarding a couple of predefined topics (Yin, 2003). The interviews were guided by a template with subjects related to the study. This guide was the starting point for the interviews and what led the discussion. As with most semi-structured interviews, that did however not restrict the dialogue to subjects stated in the template. Room was given during the interviews for follow-up questions and/or topics that was not predefined.

The beginning sections of the template dealt with the current situation of the company with regards to sustainability and energy usage. Next followed an explanation of Perpend's technology where pictures of the products, energy calculations for different sized modules and a wind map was presented to give the respondents a better understanding of the energy systems. This was followed by a dialogue where the interviewee was asked to reason around topics related to Perpend's renewable energy system. The interview template as well as the document used for illustrating the products can be found in *Appendix 1 Interview template*. As a complement to interviews with the chosen companies, open interviews and ongoing conversations with Perpend were held in order to gather internal information as well.

During the interviews we as interviewers had two main tasks. Firstly, to follow our line of inquiry and study protocol. Secondly, to ask the questions in an unbiased manner that also are aligned with the inquiry (Yin, 2003). Further, we have actively chosen to present the technology and product of Perpend at the end of the interviews. The reason that we chose to conduct the interviews this way was because we wanted the respondents to reason around their situation as a firm without any influences from Perpend's technology in the beginning of the interviews. If we instead would have started off by illustrating the actual products, the respondents could have been influenced by what we have said and thus provided biased answers with regards to the beginning sections of the interviews.

3.3.3 Selection of respondents

The criteria used in order to find suitable respondents were firstly, that the interviewee would have a decision making position in the company enabling them to make investment decisions. This resulted in that all of the interviewees were either CEOs, company owners or a combination of both. Secondly, we chose companies that were dependent on electricity with a varying yearly energy consumption. This in order to see if the demanded energy volume would have any impact on how Perpend's energy systems were perceived. We also made an active choice to restrict our respondent group to a rather small geographical area with relatively similar weather conditions. In addition, all responding companies were of similar size (small companies with maximum 50

employees) to limit the research to a somewhat more homogeneous potential customer group. By doing so, the results are easier to generalize to similar actors than if we would have had a wider spread on size and type of company. In turn, that provided us the opportunity to draw parallels between the respondents and get a more in-depth analysis of the chosen segment. A summary of the interview respondents can be found in *Table 1*.

Interviewed company (interviewee)	Turnover (2014)	Number of employees	Location	Yearly energy consumption (MWh)	Duration of interview
Ray metallfabrik (Owner/CEO)	39.3 MSEK	50	Tranemo	1000	45 min
Götessons (Owner)	140.1 MSEK	50	Tranemo	200	60 min
Länghems kök (Owner)	32.4 MSEK	23	Tranemo	324	55 min
Hållanders sågverk (Owner/CEO)	102 MSEK	16	Tranemo	3.6	50 min
Herrljunga träindustri (CEO)	25.5 MSEK	20	Herrljunga	463	65 min
Blomdahls Mekaniska (Owner/CEO)	22 MSEK	31	Herrljunga	686	50 min

Table 1 Selection of respondents.

3.4 Quality of the research

Since this thesis is based on a single case study, the internal reliability of the research can be argued to be of great importance. Bryman and Bell (2011) describe internal reliability as whether the certainty of the chosen indicators are consistent or not, something that more commonly is associated with quantitative research. However, one problem in qualitative research that relates to validity and reliability can for instance be can when asking questions in the interviews that the respondents are having trouble to separate the questions and subjects from each other. That might in turn lead to that previous questions and answers affect subsequent ones. It is therefore of importance to be aware of this risk and try to mitigate the effects of it to an as large extent as possible. One way to mitigate this is by trying to develop questions that are easily distinguishable from each other in order to minimize the possibility of misunderstandings. The fact that we will conduct semi-structured to unstructured interviews might also diminish such risks as it will provide us with the opportunity to adapt questions to specific respondents in order to minimize the possibilities of misunderstandings.

Some authors do however propose different measures on qualitative research than validity and reliability as such concepts are perceived as more appropriate for quantitative research. Guba and Lincoln (1994) for instance argue for an alternative approach to evaluating research in which authenticity and trustworthiness are core elements. One approach to ensuring higher trustworthiness of the research and especially the empirical findings is to use respondent validation: the researcher seeks to establish a good correspondence between what has been established in the findings and how participants of the research perceived the experience (Bryman and Bell, 2011). We have, to an as large extent as possible considering the limited time frame of the research study, corresponded with Perpend regarding findings throughout the research process. This in order to validate that the information we have gathered also matches Perpend's experiences and observations. This did to some extent improve the quality of the findings as the accuracy of what was established in the empirical findings increased. However, the fact that similar validation methods could not be applied to all participants of the research due to limited time (both on the authors' account and the interviewed companies') restricted the impact respondent validation had on the research.

Bryman and Bell (2011) further argue for the use of triangulation in order to improve credibility of qualitative research. Triangulation is the use of several different sources of data and/or methods for gathering data when conducting research. We have in this research study conducted internal interviews with the case company, external interviews with potential customers and used other primary sources of information in the form of business documents and conversations with Perpend in order to collect empirical material. Additionally, we have corresponded frequently with our supervisor regarding important decisions related to the research approach in order to increase our chances for credible results (Bryman and Bell, 2011). The concept of triangulation have thus been applied throughout this research study for the purpose of ensuring higher credibility.

Building on one single and rather specific case might also impact the generalizability of the research to other settings. This will be a limitation of the research as the findings can be hard to directly apply to other companies and technologies. The purpose of the thesis is however to only investigate the case of one company. Generalizability of the research is therefore not a main objective.

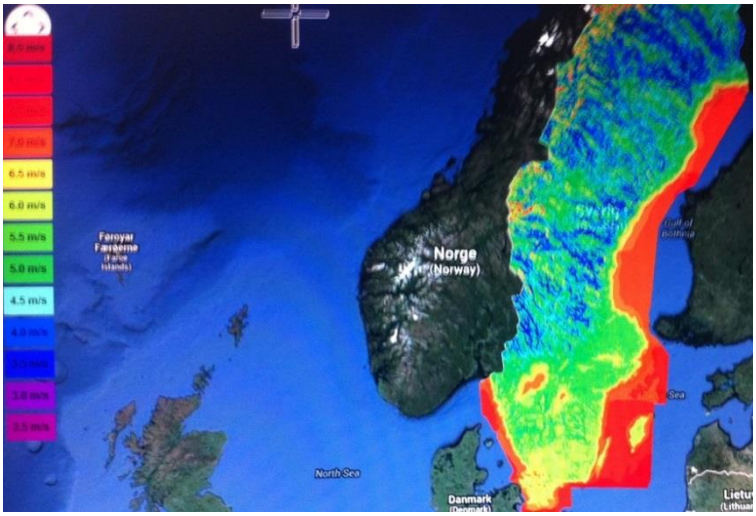
4. Empirical findings

The findings from our empirical research is presented in this chapter. Initially, the section provides an introduction to the case company and their products. This is followed by a presentation of the empirical results which to a great extent have been structured according to the topics identified in the SLR. The findings are summarized in two figures, one in section 4.9 Value proposition and one at the end of the chapter in section 4.17 Empirical conclusions, in order to provide a clearer overview of the results.

4.1 Introduction to Perpend and their products

Perpend AB was first founded in the year 2010 as the result of an exhaustive research program aimed at investigating the possibilities of novel ultralight materials in various artefacts. The founder and owner of the company, Roland NG Gustafsson, initiated the research program together with MIT, Cambridge University and Volvo in the year 2000. The program lasted for five years and was based on a lightweight structure initially invented by Roland and later patented by Volvo. The materials researched and developed throughout the program are to be used in Perpend's patented renewable energy systems that currently are in the prototyping phase.

As can be seen in *Picture 1*, Sweden with its long costal line and beneficial wind conditions propose a very good spot for distributed renewable energy production which made it an ideal country for Perpend to start up their business in. Average wind speed is here represented by color, ranging from purple where wind speed is very low to bright red where average wind speed is very high.



Picture 1 Wind map over Sweden (Windmap.se, 2015).

Perpend's energy systems are built upon modules where wind power from vertical axis turbines are combined with solar panels and energy storage systems in different configurations depending on wind and weather conditions. The actual windmill can thus be adapted according to specific conditions and needs. For instance, a windmill in the inland of Sweden where wind speed generally is quite low can be built with several wind turbines stacked on top of each other in order to better utilize wind power. In addition, the body of the wind mill is covered with solar panels which work as a complement to the wind turbines. The fact that Perpend's products are designed to be adaptable has resulted in that the company want to attract customers in the entire country, not only those in connection to the more wind power friendly coastal areas.

The products are thought to have few pure competitors as the combination of wind power, solar power and energy storage systems is a totally new approach for renewable energy production. There are however approximately ten other companies in Sweden that work with smaller wind turbines for renewable energy production. None of them with a similar product though.

4.2 Customer segments

The respondent at Perpend argued during the interviews that there are many potential customer segments of interest for the company. Early adopters that are willing to invest in new technology for renewable energy are thought to be important pioneers that can help Perpend to spread the word of their technology. These early adopters are, according to Perpend, an important "engine of growth" for the company as they will contribute to the wider diffusion of the products. After this initial step where the very first customers have started to use Perpend's technology, three major customer groups are thought to be of most interest for the company. Firstly, property owners and households that utilize electricity both for buildings and electric cars are stated as important customers as the economic and environmental benefits of the technology in those cases are thought to be especially large. Secondly, commercial buildings (shops, offices and warehouses), industrial real estate and agriculture are stated as major potential customer segments as lowering the costs of electricity here can yield large savings. The respondent at Perpend added that an environmentally friendly company profile might give these types of customers a competitive advantage and greater social awareness. Finally, municipalities that plan on investing in "charging stations for electric vehicles" are stated by Perpend to be a potential customer group.

All respondents are owners or CEOs of small producing companies in Tranemo or Herrljunga municipality. The companies are also situated in the inlands of Sweden with similar weather conditions. During the interviews, it came to light that most of these companies (five out of six) also are family owned and have been since they first started their businesses. The remaining company, Herrljunga trä, have not been owned by the same person since their origin but has had the same CEO for almost 20 years now.

One major difference amongst the interviewed companies are their annual electricity consumption. Hållanders sågverk had by far the lowest consumption with 3.6 MWh per year. Ray metallfabrik were at the other extreme with circa 1000 MWh. The rest of the respondents all had an energy consumption ranging from 200 MWh to 600 MWh.

Furthermore, all responding companies stated that they own the facilities in which they operate, both office buildings and production buildings. All of the interviewed also stated that they own the land on which their buildings stand on and that they have further space for future expansion of their businesses. The majority of them thereto added that they were unsure about how easily they could obtain building permits if they were to grow their business with additional facilities in connection to the current location.

4.3 Customer jobs

The manufacturing of various products is a core task performed at all the interviewed companies. All respondents also stated that they were very much dependent upon electricity for heating up buildings and power machines. These two objectives are important for their businesses to work as desired and to be able to compete. Two of the companies, Hållanders sågverk and Herrljunga trä, work within the wood industry and respectively argued that they also need electricity for the drying of raw wood and heating of containers for special glue.

The production of various products was also stated by Götessons and Länghems kök to be a task influenced by specific customer demands related to sustainability. Having production processes and materials that meet these requirements were not viewed by the two companies as equally important for the prosperity of the business as the sheer production of products. However, being environmentally friendly is of such importance that both companies value it as a core task for the purpose to retain existing customers and attract new ones. Götessons further argued that ensuring that the electricity they use is "green" is an important part of maintaining the company's good reputation and therefore a job that is continuously ongoing on the firm.

4.4 Customer pains

The respondents situated within Tranemo municipality all purchased their electricity from an energy supplier called 7H Kraft. The other two interviewed companies, located in Herrljunga, instead got their electricity from a small local firm called Herrljunga el. It became clear during the interviews that the companies buying from the larger 7H Kraft were more worried about power failures than the ones buying from Herrljunga el, even though all of the respondents generally were quite happy with their current energy supplier. Power failures were generally uncommon but could have significant impacts on productivity for all the responding companies.

All the interviewed companies further stated that a stable and flexible source of energy that delivers whenever the company needs it, together with a low electricity price, was one of the most important determinants for choosing energy supplier. Five of the companies also mentioned that they recently had benchmarked offers from other energy suppliers with the current ones in order to see if any economical savings could be obtained by switching to another supplier.

One of the responding companies, Blomdahls mekaniska, expressed some concern regarding the size of the actual energy system and argued that the energy storage component inside the windmill might take up a lot of space. He further mentioned that he was skeptical regarding that the batteries would be sufficient for Blomdahls mekaniska's energy consumption as he had some previous experience with battery based energy storage that ended up taking too much space and with a shorter life span than expected.

4.5 Customer gains

All of the responding companies stated that they would require Perpend's products to be an investment that could generate savings within a 5-10 year period. The respondent at Perpend in turn stated that the most important thing was to make the product economically defendable and provide a relatively short and individual pay-off plan.

Further, a positive side effect from investing in one of Perpend's energy systems was stated by the respondents to be that their companies could claim that the energy they use come from 100% renewable sources. The respondent at Perpend as well as the interviewed companies argued that the positive environmental effects of investing in such a product is expected and viewed as a general requirement. All of the responding companies did also say that such an investment would generate a positive marketing effect for their businesses. Two of the respondents even stated that the increased sense of sustainability and the PR associated with it would be something to calculate with when deciding whether to make such an investment or not.

Götessons further said that the visual publicity of installing one of Perpend's products on their property could give them a competitive edge and make their customers associate them with sustainability. The sustainability pressure from certain customers were significant according to Götessons and an investment of this sort would ease that pressure and perhaps even transform it into a positive aspect that can validate parts of the investment.

4.6 Products and services

Novel patented vertical axis wind turbines combined with solar panels and energy storage systems make up the core product offered by Perpend. The respondent at Perpend further said that these renewable energy systems will provide customers with the opportunity to produce low cost energy in direct connection to themselves and/or the end user. The windmills can also have a secondary function according to Perpend: they can be used for commercial purposes where companies can pay for putting up advertisement of the body of the energy system.

4.7 Pain relievers

All of the interviewed companies stressed the importance of a stable supply of electricity at a low price as one of the most important factors when choosing energy supplier. According to Perpend, their technology have the ability to store electricity which would ensure a stable supply of energy.

Hållanders sågverk, Länghems kök and Götessons argued that their customers put great value in sustainability and environmental friendliness. These customer demands make up incentives for the three companies to commit to sustainable production processes. They did however state that some of the steps that needed to be taken for reaching some of the customer demands are costly and time consuming. A dilemma with that, according to the respondents at Hållanders sågverk and Länghems kök, are that they might lose parts of their good reputation if they cannot

guarantee to meet the customers' demands for sustainability. Further investments in order to ensure better environmental friendliness did though worry the companies as they might invoke too large costs, stressing the importance of a relatively short pay-off period.

The respondent at Perpend argued that their product makes it possible to store electricity which is a rather unique function when speaking of renewable energy production as it can ensure a stable supply of energy. The ability to keep a constant and stable supply of electricity is further stated by both Perpend and four out of six interviewed companies as essential for the possibility for Perpend's product to succeed. The two other respondents, Götessons and Blomdahls mekaniska, would rather want the product integrated with the regular electricity network instead of having a storage capacity with batteries. Götessons explained that it would reduce uncertainty and eliminate some reliability concerns as the fixed electricity grid would ensure a constant stream of electricity if Perpend's energy systems would fail to deliver.

The respondent further argued that consumers will be in control of their own energy supply and will be able to extract energy from the stored electricity if something unforeseen happened hence mitigating risks with an uncertain energy supply. Hållanders sågverk, Götessons and Länghems kök stated that they do have to keep up with customers that are pressuring them for more sustainable products and processes and that one way to meet increasing demands is with "greener" energy sources. The three companies agreed that a product such as Perpend's could enable them to guarantee that all energy came from renewable sources.

4.8 Gain creators

Every one of the interviewed companies identified an extra value being generated from Perpend's product with regards to the positive publicity it would bring them from an environmental point of view. Half of them even stated that environmental friendliness in fact can help them to differentiate their offers from competitors and thus give them a competitive advantage. The fact that the product itself is new and unique also evoked interest amongst the respondents. Hållanders sågverk for instance argued that such a product probably would give them great publicity as an environmentally friendly company and that having such a novel energy system by itself might generate better business. They further argued that similar effects have been seen in the company when they invested in a central heating plant for the purpose of making better use of residuals from their production.

All responding companies within Tranemo municipality (four out of six) speculated that having one of Perpend's energy systems on their properties would attract positive PR and gain appreciation and presence in local newspapers etcetera. The respondent at Länghems kök stated that it would be hard to calculate the exact value of such aspects but that they in any case would have a positive effect. Blomdahls mekaniska and Götessons even identified benefits of putting their logos on someone else's energy system in order to gain positive PR. Herrljunga trä speculated that businesses selling directly to consumers would benefit greatly by putting

advertisement on these “majestic monuments” if they were to be standing close to highly trafficated roads and other busy places.

4.9 Value proposition

The empirical findings with regards to the value proposition block of the BMC and the elements of the VPC is summarized in *Figure 4*. These are plotted out in the VPC for the purpose of providing a clearer overview of the results so far.

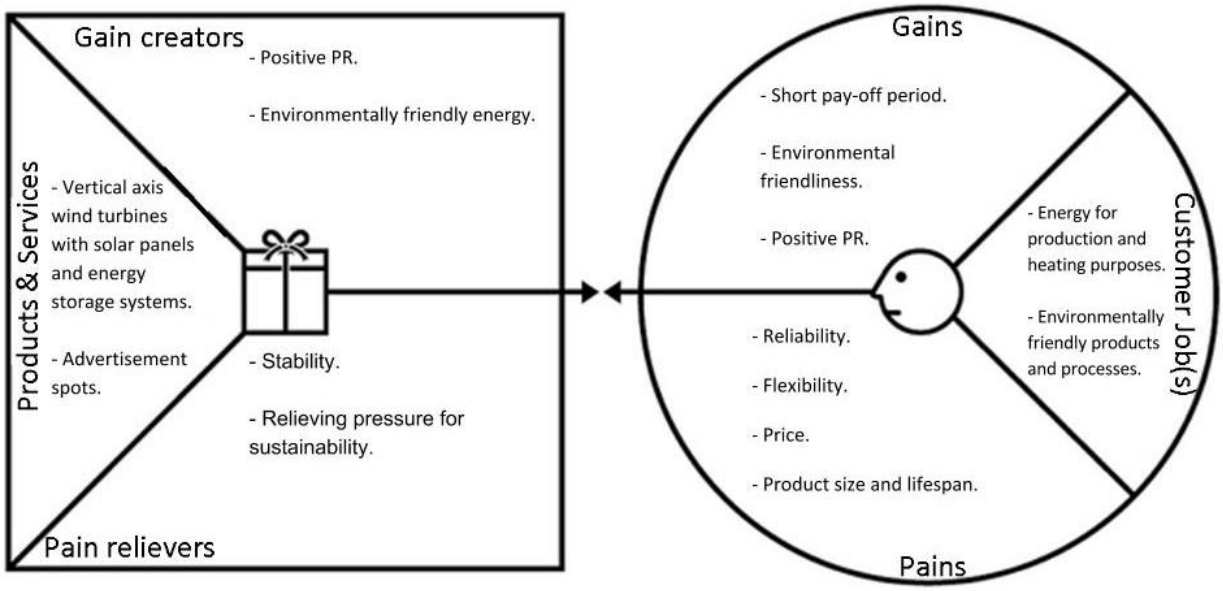


Figure 4 Empirical findings summarized in the VPC.

4.10 Channels

The respondent at Perpend also presumed that they will be able to benefit from the current sustainability trend that can be identified in a variety of different sectors all over the world. He further argued that the increasing awareness of environmental issues and the opportunities to remedy them with the help of renewable energy technology are important aspects to take into account when reaching out to possible customers. This “green trend” can, according to Perpend, contribute to a minimization of the costs associated with educating a new market. Getting people to understand what Perpend’s products can offer and how they can generate value for different companies is an important part of getting the products onto the market and the process of doing so is thought to progress smoother where people generally are more aware of environmental issues. The products are also thought to be easier to sell with less effort needed due to these trends.

Moreover, Perpend want to initiate workshops in which their products can be illustrated and demonstrated in order to reach out and educate potential customers. The respondent at Perpend also argued that different fairs could be a good alternative to inform about the existence and potential of their products. The respondent continued by explaining that their products will have

different value adding effects such as lower energy costs and a more environmental friendly company profile. It is according to Perpend important to create awareness for potential customers about such benefits in a collaborative setting where potential customers can help define the actual product offer.

The responding person at Perpend speculated that in a scenario where the market is relatively aware and educated about renewable energy products a web-based tool allowing customers to virtually design the energy system to their specific needs further could contribute to reducing the work load of Perpend. The reason for this is according to Perpend that it would enable customers to perform parts of the initial work themselves, similarly to how you design a car online before making the purchase. If such a tool was available, it would according to Perpend help to ramp up the business and increase sales due to the radical reduction of resources needed for selling one product compared to the early stage channels where a lot of energy would have to be spent on educating potential customers about the products.

4.11 Customer relationships

When talking about the company's plans to reach future customers the respondent at Perpend again mentioned the importance of educating the market because of the novelty of the product. He believed that a relationship with the customers that enables Perpend to explain and guide through different situations that might occur in the early phases of the technology is important for both parties as it might increase trust at the same time as Perpend can absorb valuable feedback along the way. He further argued for the importance of establishing a trustful relationship, especially for early adopters of the technology. Being close to the customers so that they feel safe is an important facilitating factor for Perpend to be able to explain the benefits with the technology face to face and to offer assistance if any problems occur.

Further, when talking to companies three out of six (Hållanders sågverk, Herrljunga trä and Blomdahls mekaniska) expressed positive thoughts about the possibilities to share one of Perpend's energy systems with other neighboring companies. Sharing was thought to minimize risks as the initial investment as well as potential problems with the product would be shared by several parties. Götessons also implied that group meetings would be a good alternative to reach out to customers in order to meet more than one at the time. All of the respondents agreed that they would like to see the product in motion and get references on its functionality before taking any investment decision. When asked why, the fact that the product delivers such an important output as electricity was stated as the most important contributing factor as it is essential for all the companies to be able to work properly.

Moreover, the respondent at Perpend talked about that close relationships would be of most importance during the early stages of the process of developing a market for the product. Later on when/if the product is more established he argued for a little less resource intense and more

distant relationship to the customers. He validates that notion by stating that when the product is tested and established it will not take as much effort to build trust with the customers from a personal point of view. The product itself will, if it becomes successful, create trust through references and via mouth to mouth marketing.

4.12 Revenue streams

Revenues will according to Perpend be generated from customers' investments in the product. The structure of the revenue streams are though not yet fully established. Another option for obtaining revenues would be to organize a leasing alternative where ownership of the energy system would remain at Perpend. The leasing alternative was also brought up as a suggestion from Götessons, Ray metallfabrik and Länghems kök as an attractive way for overcoming potential obstacles related to repairs and other reliability issues.

All of the companies interviewed identified the pay-off period as the most important factor for them to even consider investing in the product. The revenue streams are therefore particularly important for the potential customers after the actual investment is made. The respondent at Perpend described that the energy produced by their energy systems will have a unit price significantly lower than the market price of electricity which will enable customers to get a positive revenue stream from investing in the product. He further argued that the lower electricity costs generated by the product is possible partly due to an efficient technology and partly due to the possibility to circumvent charges and taxes connected to fixed network fees and electricity. Further, both Perpend and the potential investors in the products have the possibility to gain further revenues from using the body of the energy system as a marketing tool where advertisement can be put up.

4.13 Key resources

According to Perpend, their most important resources are the lightweight material that the products are made out of and the actual technology in the wind turbines. In addition, the patents protecting the materials and the technology make up an important resource. It was also apparent from the interviews/conversations with Perpend that more tacit assets such as the network and human capital of the people working with Perpend are key for business and the future development of the company.

Furthermore, Perpend's products are characterized by pure assembly operations to which all individual components are supplied complete. The assembled wind turbine is installed together with the other components in a single sub frame. The only part of the energy system that is bound to be assembled by specific tools is thus the actual turbine with wings. The rest of the components are of shelf stock character meaning that they will be acquired from different suppliers in Europe. The availability of these components, are according to Perpend, important for the production of the energy systems and thus a resource vital for the business.

As for the early stages of the company where much focus is put on prototyping, Perpend have the opportunity to rent industrial facilities in which production, assembly and warehousing will take place. The building is also meant to contain an office area for six to eight persons. Being able to rent such facilities would, according to the respondent at Perpend, also enable them to establish a fixed area for demonstration and sales where potential customers can get physical access to the energy systems.

4.14 Key activities

Perpend are still in an early phase where prototyping together with informative meetings and seminars for the purpose of creating awareness about Perpend and their products can be stated as key activities. According to Perpend, educating the market about the opportunities and obstacles with renewable energy products is something that is important for the future advancement of their company. Being able to deliver a message that both educates and proposes solutions to issues with renewable energy production is thus an important part of meetings with customers. In order to deliver this message Perpend needs to find an efficient way for communicating the benefits and opportunities of the product (such as cost efficiency and environmental friendliness). Therefore, the activity of constructing a production and demonstration site is essential for the ability to deliver the intended message in a straightforward and pedagogical manner.

Another important activity is to decide how to deal with the maintenance of the energy systems in order to ensure that Perpend's products are delivering electricity with adequate levels of reliability. This can for instance be done by offering different leasing alternatives. However, the design of such alternatives are not yet established and needs to be experimented with.

4.15 Key partnerships

Perpend recognizes actors within the electrical car industry as important partners for the development of the energy systems as the lithium batteries used in cars are to make up the storage capacity of the windmills. The batteries used in electric cars do however, according to Perpend, have a quite limited life span as they need to be replaced with new batteries when they lose a certain amount of capacity. To discard batteries is however not that easy according to the respondent at Perpend. He means that Perpend can help the car companies to get rid of their used batteries as the energy systems can use the batteries for a long time even after they are useless in a car. That is possible because Perpend's products demand a lot smaller amount of the initial capacity of such batteries compared to an electric car.

Moreover, the founder and owner of Perpend has been a part of two collaborations that are essential for the development of Perpend's products. The first cooperation was a research program mainly between Volvo, Cambridge and MIT institute with the objective of developing a new lightweight material that in the end came to be a vital part of Perpend's products. The

second collaboration was called “Next Generation Vehicle” in which the light and stainless material became further refined and optimized for several different application areas including Perpend’s product and the vehicle industry. Perpend is now benefitting from the results, knowledge and networks gained from these collaborations which is key for the future of the company.

Key partnerships are also recognized by Perpend in early adopters that can help them to spread information about the product. These early adopters are thought to help create an exponential growth as they are expected to spread the word to more than one customer each. Feedback from these users is also believed to help Perpend develop and refine their product.

Götessons and Länghems kök both argued that they actively work with sustainability issues and that they wanted to be at the forefront compared to their competitors when it comes to environmentally friendly processes and more importantly products. Both companies had taken some risks by investing in new sustainable technology and stated that partnering up with similar companies in e.g. a business park could be valuable. Hållanders sågverk further stated that collaborating with other companies around Perpend’s energy systems could cut costs but also facilitate better relationships amongst the involved companies, something than they think is very valuable for future growth within Tranemo municipality.

The majority of the responding companies (four out of six) stated that they would be more interested in Perpend’s product if there was some kind of agreement between Perpend and the larger actors delivering energy via the fixed grid. Being able to connect the company’s buildings to both a renewable energy system and the fixed grid would according to Götessons make up a great incentive for investing in the product as that would guarantee both stability with regards to energy supply as well as an “environmental friendly company image”.

Distribution and installation of the products are, according to Perpend, meant to be done by a company specialized in installation of renewable energy plants with a 10% market share of renewable energy installations in Europe. Establishing a partnership with such an actor will be important for logistical reasons as Perpend will not deliver the actual products themselves. According to the respondent at Perpend, such a partner that already is established in Europe will make Perpend’s establishment easier on the continent which in turn enables them to meet a potentially increasing demand.

4.16 Cost structures

The respondent at Perpend described the early stages as quite resource intense when it comes to the process of recruiting customers. He argued for the importance of face to face recruitment in order to get hold of potential early adopters that are thought to be a vital part of the future spreading of the company’s reputation. Additionally, as the energy systems still are in a prototyping phase there is a belief that costs for the development of test sites and demo products

will contribute to a negative result during the first two years of sales. The purpose with the production and demonstration site will, according to the respondent at Perpend, contribute to making the technology and the product visible for customers. It should also function as a place to conduct studies and tests on the product for further development of the technology.

4.17 Empirical conclusions

The empirical material gathered from interviews with companies and conversations with Perpend is summarized in *Figure 5.* As with the findings from the literature review, the empirical findings are illustrated in the BMC-framework.

<table>
<tr>
<td rowspan="2">Key Partners
- Network in the upcoming electric car market to gain access to used batteries.
- Partnership with potential early adopters.
- Collaboration with business parks.</td>
<td>Key Activities
- Early phases: Hosting/attending meetings to educate potential customers.
- Develop prototypes and demo products.</td>
<td rowspan="2">Value Propositions
- Environmentally friendly energy.
- Marketing opportunities.
- Pain relievers: low electricity price, ability to store electricity, cope with sustainability pressure from customers.
- Gain creators: “green energy” leads to positive PR and diversification.</td>
<td>Customer Relationships
- Close collaborative relationships to gain insight into possible customers and obtain feedback.</td>
<td rowspan="2">Customer Segments
- Property owners utilizing electricity both in buildings and cars.
- Commercial buildings, industrial real estate and agriculture.
- Municipalities with “charging stations”.
- Pains: variability and flexibility issues related to renewable energy production.</td>
</tr>
<tr>
<td>Key Resources
Material:
- Materials, technology and patents.
Immaterial:
- Internal human capital and external networks.</td>
<td>Channels
- Workshops.
- Fairs.
- Web-based tool enabling customers to virtually design their energy systems.</td>
</tr>
<tr>
<td colspan="3">Cost Structure
- Large investment costs for development of a production and demonstration site.
- Building a customer base is money and time consuming.</td>
<td colspan="2">Revenue Streams
-Not set.
-Alternatives: traditional sales, leasing and selling marketing spots on the modules.</td>
</tr>
</table>

Figure 5 Empirical findings summarized in the BMC.

5. Analysis

In this chapter, the empirical findings are analyzed with the help of the earlier presented SLR. It begins with an examination of the elements of the VPC and BMC, structured in accordance to the headings used throughout the previous chapter. The section ends with a summarizing illustration of what has been derived from the analysis.

5.1 Customer segments

Osterwalder and Pigneur (2010) argue for the importance of identifying exactly which type of customers that form a desired customer group in order to be able to offer an appropriate bundle of products/services to that given segment. Perpend have identified a couple of broad customer groups such as property owners that use electric cars, commercial buildings, industrial real estate and agriculture. Perpend's general descriptions of potential customer groups do to some extent apply to the companies we have interviewed as they all fall under the category "industrial real estate". However, some more specific attributes of potential customer groups were found during the interviews that can contribute to a deeper understanding of who the customers actually are. These attributes related to energy demand and sustainability are further elaborated on below.

Perpend focus on one product and clearly qualifies in the market category described by Osterwalder and Pigneur (2010) as a "niche market" where renewable energy production technology is the specialization. With regards to companies niched on precisely that, Richter (2012) argues that finding customers who value sustainability in general is very important. Only identifying wide-ranging segments in which customers may or may not value sustainability should therefore not be enough for a product such as Perpend's. In that sense, Perpend's approach is not in line with what has been established in theory nor with what has been found during interviews with potential customers. In fact, companies that actually value sustainability can be an ideal segment for finding early adopters. Half the interviewed companies (Hållanders sågverk, Länghems kök and Götessons) did state that they incorporate aspects of sustainability and environmental friendliness in their businesses as a result of customer demands and/or internal incentives. These companies, especially Hållanders sågverk, also found Perpend's energy systems to be of great interest, strengthening Richter's (2012) arguments for that customers who appreciate sustainability in general might be more attractive and approachable for companies focused on renewable energy.

Furthermore, Hållanders sågverk who had a relatively low energy consumption and would be able to obtain all of their electricity from one of Perpend's energy systems were more interested in the products than for instance Ray metallfabrik who had an energy demand that was far higher than what can be produced by one of Perpend's products. This is an indication of that companies who can become self-sufficient on energy by investing in one of Perpend's products might be a stronger potential customer segment than those who cannot. Perpend argued that the first users,

so called early adopters, of their technology will be of great importance for the diffusion of their products. A company such as Hållanders sågverk with a business profile characterized by sustainability and an energy demand that can be fully covered by Perpend's product thus make up an interesting prospect for becoming such an early adopter. A further incentive for Perpend to approach such a company is that they also found the product in itself to be of great interest.

The customers should be central to every BM, especially in companies focused on new technology (Trimi and Berbegal-Mirabent, 2012) and it appeared quite clearly from the conversations with Perpend that they ideally want to concentrate on a BM that is focused on early users. Establishing contact with companies such as Hållanders sågverk who generally value environmental friendliness and have an energy demand coverable by Perpend's product could help Perpend to establish important early adopters. Close contact with such companies could also help them overcome the difficulties with convincing a new market to start using the product, which is a problem that Gambardella and McGahan (2010) bring up as important to overcome for companies with novel technologies.

After the process of establishing contact with early adopters, when the first products are operational, Perpend might instead want to broaden their customer segments a bit. Companies such as Länghems kök, Götessons and Herrljunga träindustri who all stated that they wanted to see the product in use before taking any investment decision might then be of more interest for Perpend. The process of developing customer segments could thus start by acquiring early adopters according to the criteria mentioned above and then later proceed by approaching the companies who are interested in the product but not willing to become early adopters. Customer segments can thus be broadened as time goes.

5.2 Customer jobs

The production of various products is what makes up the core of every interviewed companies' business. According to Osterwalder et al. (2014) that is what constitutes the functional jobs at the responding companies. The processes needed to perform those tasks all demand energy where electricity make up the largest share. Perpend's products are offered for the purpose of generating electricity and will thus help the customers to perform their functional tasks. However, besides that quite obvious application area for the energy systems, two of the interviewed companies stated what is described by Osterwalder et al. (2014) as social jobs to be of importance. Götessons and Länghems kök argued that the energy systems would contribute to a more environmentally friendly business which in turn would help them to retain customers and increase the goodwill of their companies. These companies thus identified a second important application area for the product: it can help them perform valuable social jobs.

5.3 Customer pains

It appeared from the interviews that the companies currently buying their electricity from 7H Kraft to some extent were concerned about power failures. Loss of power can be a serious issue for producing companies as no power means that production is not possible – what Osterwalder et al. (2014) calls "functional pains". Even though such problems were uncommon, having them regularly would propose a powerful incentive for the companies to consider other energy suppliers. Being able to ensure stability and flexibility of an energy system was therefore (together with price) defined as important determinants for choosing a certain supplier of energy. The energy storage features of Perpend's product was described for the interviewed companies but some of them still expressed their worries with regards to flexibility. For instance, Blomdahls mekaniska said that the storage units in Perpend's products might not be large or efficient enough for storing electricity that covers their demand. The factors identified by the customers are in line with the thoughts of Huber, Dimkova and Hamacher (2014) who also discuss lack of flexibility as an important issue to be overcome by renewable energy technology. They mean that the variability in supply from renewable energy sources propose a hinder for the possibility to rely on energy from renewables.

The potentially high investment cost for a product such as Perpend's was also mentioned by the responding companies as an important factor to consider when deciding on how to approach an investment decision. The companies most worried about this financial aspect were the ones with a relatively high energy demand that would require several of Perpend's energy systems in order to be covered. An investment cost that is high in relation to the annual turnover of the company was thought to evoke a higher financial risk. This is similar to the arguments of Würtenberger et al. (2012) who state that potential investors in renewable energy technology are more risk averse because of the comparably low unit price on electricity via the regular grid.

5.4 Customer gains

When conducting the company interviews, sustainability/environmental friendliness and lower energy prices were the most frequently discussed topics with regards to Perpend's energy systems. These two aspects was also found by Söderholm and Klaassen (2007) and Pflüger (2010) to be the most important and obvious gains generated from sustainable energy. Being able to obtain green and environmentally friendly energy was described by Perpend as a requirement for investing in the product, similar to how Osterwalder et al. (2014) describes "expected gains". This was also identified by the responding companies as something that is anticipated from the product. The companies did however see a short pay-off period as one of the most important determinants for investing in one of Perpend's products and often identified the sustainability aspect as somewhat of a positive side effect, more similar to how Osterwalder et al. (2014) describes "desired gains". The companies have thus identified benefits with having renewable

energy as such, although the financial side of the investment seems to be a more important aspect for the companies to consider for a potential investment decision.

Moreover, all interview respondents did identify that the energy systems would generate positive environmental effects and that energy costs could be lowered if the pay-off period was between five to ten years. A short pay-off period enabling the investing company to enjoy the benefits of a lower unit price on electricity was thus a requirement for most of the interviewed companies. Being able to offer that should therefore initially be a task of great importance for Perpend in order to get their products onto the market. The positive publicity, green reputation and the knowledge of getting electricity from renewables should still be very important aspects for the selling/marketing of Perpend's product. However, potential financial savings for investing customers may be even more important to highlight in Perpend's value proposition as that is one of the gains most desired by the interviewed companies.

5.5 Products and services

The purpose of Perpend's products were understood by the companies as tools for the production of renewable energy. The basic product offering thus seems to be quite clear to the potential customers. However, three out of the responding companies did also state that leasing one of the products would be interesting as that could retain the ownership at Perpend who in turn would take responsibility for maintenance. When asked, Perpend also stated that leasing might be an alternative to selling the products. The fact that both potential customers and Perpend identified leasing as interesting indicates a need for a product/service bundle where repairs, maintenance and possibly operation of the product is offered as an additional service to the actual energy system. Such a combination might be a good alternative to a traditional buyer-seller relationship as the risks with adopting a new technology might be reduced from the customer's point of view. According to Gambardella and McGahan (2010) it is important to study and adapt to sociological and marketing factors in order to extract as much value as possible, especially for novel technologies. These insights on how the customers perceive the products and how they want them to be offered to best suit their needs might help Perpend to attract those important early adopters.

There was also some general critique against the product offering. For instance, Blomdahls mekaniska said that they were unsure about if the energy storage component in Perpend's product would be large or efficient enough to actually cover their energy demand. The fact that potential customers expressed concerns about the possibility to store electricity (one of the product's core elements) provides further evidence for the importance of educating the market. Being able to convince potential customers about what value the different features of the product might bring them should therefore be a priority for Perpend. The respondent at Perpend stated that there might be an opportunity for renting facilities in which the products can be tested and demonstrated. Such a site would enable the company to physically show the benefits

of their products which in turn might help to convince skeptics. The potential use of a production and demonstration side is further elaborated on in subsequent sections.

5.6 Pain relievers

As mentioned, stability of an energy system is an important aspect to consider for all the responding companies and therefore a potential customer pain. Without a stable supply of energy, the companies would not be able to work properly. According to Osterwalder et al. (2014) establishing how much value a pain reliever generates for the customer is important and it seems rather obvious that mitigating risks with variability qualifies as rather vital. The fact that electricity can be stored in Perpend's products should relieve that pain and overcome problems caused by the natural variability in supply of wind and sun. However, another option that came up during the interviews with regards to flexibility issues was to overstep the batteries and connect the product directly to the regular energy grid. This option was brought up by Götessons and Blomdahls mekaniska who expressed that one alternative could be to use the regular grid as a backup for Perpend's product. With a solution like that flexibility would not be such an issue as energy produced above the demand of the company could be sold on the regular grid. When not enough energy is produced, the grid could instead supply energy from other sources. This would also alleviate the concerns about potential power failures of the product as the energy supply would be virtually constant.

Half the interviewed companies also stated that they experience pressure from customers to ensure sustainability and environmental friendliness of their business. If they would not be able to meet such demands they worried that they might lose their reputation or even their customers. However, committing to better sustainability/environmental friendliness was thought to invoke high costs, resulting in a dilemma. According to Osterwalder et al. (2014) the possibility to save money can be an important pain reliever, which also was stated by Perpend as one of the main benefits from investing in their technology. Showing potential customers that they in fact can save money while maintaining an environmentally friendly company profile would thus help Perpend to ease two important pains stated by the companies.

An additional pain stated by the interviewed companies was the potentially high investment cost of the product. A potential solution to that issue could be if Perpend introduced a leasing alternative, further discussed under *5.5 Products and services*. By offering leasing, customers would be provided an alternative to the possibly high investment cost by instead paying a monthly fee which would help the companies to spread the costs equally over a certain time period.

5.7 Gain creators

When asked what would be required for an investment in one of Perpend's products, the interviewed companies answered that they would require a relatively short pay-off period. To

that, being able to obtain energy from a 100 % renewable source was stated as a requirement. These two value adding aspects of the product are what Osterwalder et al. (2014) calls expected value. During the interviews, it appeared quite obvious that the product also was believed to have additional positive effects greater than what initially was expected from it. For instance, Ray metallfabrik stated that owning one of Perpend's products would ease their conscience with regards to environmental issues as they currently do not work much with sustainability. They saw the likely goodwill generated from the product as an additional value, even though they would not purchase the product solely for that reason.

Moreover, an additional gain creator with the product that was mentioned by all respondents was the positive publicity that the product would bring them. It was believed that the product would be "proof" of an environmentally friendly mindset of the firm which in turn would attract media attention in the local community. The majority of the respondents said that such extra value adding aspects needed to be integrated when calculating on a possible investment. According to Osterwalder et al. (2014) it is important to take these types of value adding aspects into consideration as they can offer more to a customer than what the selling company might think. In Perpend's case, the lowering of energy cost per unit together with a sustainable source of energy make up the general value offered by the product. However, companies who were not that excited about the environmental side of the product (for instance Ray metallfabrik) still identified a value being generated from it. This is something that Perpend needs to take into consideration when presenting their product to potential customers. As earlier stated, educating and informing the market about the benefits of the product is an important task for Perpend and awareness of what exactly their products will do for their customers most likely would provide Perpend with a more solid sales argument.

Two of the respondents further stated that they would be interested in purchasing a marketing spot on one of Perpend's products provided that it would be operating close to a busy road. This is also an additional benefit that indicates a positive answer to Osterwalder et al.'s (2014) proposed question on whether or not the benefits of the product exceeds the customer's first expectations. The utilization of the windmills as commercial monuments can give Perpend an additional income from the products, something that is further elaborated on in section *5.10 Revenue streams*.

5.8 Channels

According to Osterwalder and Pigneur (2010), a company's channels should function as a bridging mechanism between the VP and the customer segment(s). As Perpend currently are in a prototyping phase, their focus should be on a close connection to potential customers in order to educate the market and make it aware of the actual product. This mindset is aligned with Würtenberger et al.'s (2012) thoughts around how companies with novel products attempt to find or even create new markets.

As stated, Perpend are trying to educate and make the market aware of the product – a task which Osterwalder and Pigneur (2010) propose to be accomplished by attending and hosting various fairs and meetings as well as collaborating with universities. Perpend do have the opportunity to set up a production and demonstration site for the purpose of making the benefits and opportunities of the product visible. This is in line with the findings gained from interviews with the different customers. In fact, most of them stated that they would like to see how the product worked in practice before they felt ready to make a decision on whether to make an investment in the product or not. Richter (2012) further stress the importance of working closely to the customer in the initial phase of a novel product in order to see how that product is perceived. That thought appears to be shared by the respondent at Perpend who have brought up similar opinions.

Furthermore, the respondent at Perpend believes that they will benefit from the current trend towards more sustainable energy sources as well as gain advantages due to a more general understanding and strive for sustainability. With an increasing interest for products such as Perpend's, the respondent stated that a steeper and more rapid learning curve is possible. In turn, this might result in that the resource intense face to face educating part of the process thereby can be shortened. When the market is aware of the product and its benefits, Perpend have thought of introducing a web-based tool that could be used as a virtual design instrument in which potential customers can visualize one of Perpend's products according to their own needs. Such a tool would require less man hours and resources for reaching potential customers as much of the initial work could be made by the actual customer. In addition, Perpend believes that an increased number of customers will help them to "spread the word" of the product and due to that also reduce the amount of resources demanded in order to sell a product.

5.9 Customer relationships

Being in an early phase characterized by prototyping, Perpend have what Osterwalder and Pignuer (2010) describes as motive for acquiring customers (i.e. they need to establish whole new relationships with customers). However, due to the novelty of Perpend's product it can be argued that the company in fact is in a sort of pre-phase to acquiring customers where the aim is to educate and make the market aware of the product's existence. As Osterwalder and Pignuer (2010) mentions, a firm in Perpend's situation need to be close to their customers in order to investigate how the product is received.

From a customer point of view the responding companies saw benefits in partnering up with companies that are geographically close in order to mitigate and spread the risks of investing in a new technology, something that Würtenberger et al. (2012) state as especially important in the energy sector. According to Perpend, one important partner will be early adopters of the product as they are the ones that will help the company to get their first products onto the market. These first users are a source of feedback and important for the early diffusion of the products as they

can help spread the word about Perpend and their energy systems. It is therefore crucial to maintain a close relationship with such customers in order to be able to extract valuable information on how the product is perceived. In addition, being close to customers is essential for companies with novel products as they need to make the public aware of what solutions and options that they can offer. In this case, Perpend need to be available to answer questions that the customers might have when first faced with the novel product/technology so that uncertainties and issues can be dealt with. Closeness to customers will also provide Perpend with the advantage of being able to learn from the users and develop the product with the help of their feedback. Establishing such relationships could for instance be done at the earlier mentioned production and demonstration site where face to face meetings can help Perpend to tailor products according to requirements and demands of the customer.

Richter (2012) states that sustainable energy producers can benefit from the current "green trend" in the sense that they can improve their corporate image and gain additional trust from customers. Further support for Richter's (2012) argument was found during the interviews with Perpend as they hope that the trend towards more usage of renewable energy sources would increase their ability to get into contact with new customers. The belief is that companies following the trend will be more interested in products such as Perpend's and therefore easier to get into contact with.

Further, three of the respondents thought that it would be a good alternative to share the product together with other companies, especially in an initial phase where a reduction of the company specific risk could be done by spreading it between partners. Risk averseness on the energy market have been researched by Würtenberger et al. (2012) who stress the importance of testing different ways to reach the customers, especially for new types of products. Offer customers the possibility to share a product (potentially by leasing), preferably with geographically close companies, could be one way to avoid risk averseness and by that establish relationships with several different customers at once. That would also provide Perpend with a larger pool of customers that potentially could provide feedback from several different angles on how the product is perceived by a group of customers. Gambardella and McGahan (2010) argued for the need to gain sociological and marketing insights in order to match customer needs with technological solutions. With that in mind, experimenting with alternative relationships such as pooling customers together around one single energy system would possibly provide Perpend with a deeper understanding about how and in what setting the customers want to use the product.

5.10 Revenue streams

Johnson, Christensen and Kagermann (2008) highlights the importance for a company to decide whether to compete through differentiation, cost or some kind of combination in order to generate revenues. The respondent at Perpend said that they primarily want to compete with

the production price in order to make it possible for the customers to have an as short pay-off period as possible. The environmental friendliness and other positive aspects (such as PR) will thus be seen as additional value adding benefits of the product. With that in mind, it seems that Perpend would benefit from a mixed approach with both cost and differentiation. Cost (i.e. short pay-off period) was stated as valuable for the interviewed companies and thus an important part for Perpend's BM. On the other hand, differentiation in the sense that Perpend offers a novel product is of great importance for the competitiveness of the company. A mixed approach could therefore prove to be most suitable for deciding how revenues should be obtained.

Würtenberger et al. (2012) describe the importance to test and experiment with different revenue models in order to find the most suitable one for a renewable energy product. Perpend stated that they preferably want to establish traditional buyer-seller relationships to their customers but that leasing also could be a possible option for obtaining revenues. Ray metallfabrik, Länghems Kök and Götessons also brought up leasing as a potential base of a revenue model for the purpose of reducing investment cost and to secure that the maintenance of the product will be handled properly. Potential customers thus argue for leasing as an alternative that can reduce their concerns with regards to investment costs and maintenance. This points towards that Perpend in fact should consider the possibility of leasing. In addition, Würtenberger et al. (2012) have pointed out a potential drawback with novel products when it comes to the lack of knowledge on the market. Lack of knowledge about a product might lead to poorly installed equipment or incorrect maintenance which in turn leads to that the product will not be utilized for its full potential. This potential drawback further point towards the benefits of leasing the products instead of selling them, especially when it comes to early adopters who are stated as important for the diffusion of the product. These early adopters are taking a risk when investing in such a new product as Perpend's and by offering an option to buying where the ownership of the product would stay with the selling company could help convincing potential customers to make an investment.

Furthermore, the respondents stated that Perpend's products would be interesting to use for commercial purposes. Perpend have considered such a secondary area of use for their products and as potential customers also state it as an attractive possibility it might be a good alternative for increasing revenues. Selling space for advertisement on the body of the windmills could also potentially bring the investing companies a better reputation as they would be associated with sustainable energy production. Blomdahls mekaniska even expressed that B2C companies would be an especially interesting segment for such an option because of the sheer size of the product, particularly if they would be standing close to highly trafficated roads where lots of people pass by. The secondary use of the windmills as commercial monuments can not only provide Perpend with an additional revenue stream, it may also help them to fund the building of e.g. demo products that have been established as important for the early phases of the company.

5.11 Key resources

With Osterwalder and Pigneur's (2010) categorization of key resources in mind, Perpend's patents for the lightweight material and the technology in the products make up quite obvious physical assets. There are however other aspects that need to be considered. According to the respondent at Perpend they have the opportunity to rent facilities in which a production and demonstration site can be fitted. Thoughts about such a site have been spoken by Perpend and also (and maybe more importantly) by the interviewed companies as they found it important to be able to see the product in action before investing in it. Such a site would probably bring the customers closer to Perpend and make it possible to establish a closer relationship with them. A key resource, at least in the earlier phases of the company, would thus be a site enabling customers to get a close up on how the actual product operates and looks like.

Additionally, the human capital developed from the network with the electrical car business and well-known universities such as MIT and Cambridge was essential for the development of the product. These resources form the base of the know-how in the company and it seems that the future development of the products also to an extent depends on them, hence strengthening Perpend's need for staying in close contact.

Perpend's products are to a large extent made out of shelf stock components supplied by a number of European suppliers. This makes up an important physical resource for Perpend as they can acquire much of their components from a variety of different actors. Having standard components easily available at a lower price compared to if they were to be produced in-house, can help to meet a potentially increasing demand of the product without invoking too high costs for Perpend. A key resource thus lie in the high availability of components: suppliers can meet variations in demand easily as the components are "shelf stock".

5.12 Key activities

Devine-Wright (2005) highlight the importance of informing the market about the existence of a novel product in order to let potential customers know which solutions the product offers. Huber, Dimkova and Hamacher (2014) and Pflüger (2010) argue for flexibility of an energy system as one of the most important issues to be overcome for renewable energy producers. In the case of Perpend, it seems clear that how issues related to flexibility and storage of energy are solved by the product needs to be more clearly articulated and demonstrated to potential customers as several interviewees expressed related concerns. To inform the customers about how such problems have been dealt with is also important for puncturing certain myths surrounding renewable energy technology in general. For instance, Blomdahls mekaniska did not believe Perpend's products to have sufficient amounts of physical space for batteries and therefore did not think that the product would provide a solution to the mentioned flexibility issues with renewable energy technology. Such concerns might very well discourage a potential customer to invest in the product even though the product in fact can provide effective solutions. A key

activity for Perpend to consider is therefore the act of convincing customers that the product can perform as described. The earlier mentioned production and demonstration site would provide Perpend with the possibility to demonstrate that the product do have effective storage systems which could contribute to a more trustful relationship to customers.

Moreover, deciding on how to deal with operation and maintenance is important in order to secure the performance of Perpend's product. The responding companies saw reliability with regards to energy production as very important for deciding on who/what to trust as their energy supplier. Deciding who is responsible, for instance in case of a break down, might be hard if the ownership of the energy producing unit is not well established. Therefore, the ownership of the product is well worth thinking about for Perpend. It may for example be an option to consider some sort of operational licensing so that it is clear who should take care of potential problems with the operation of the energy system. The issue of incorrectly installed equipment is something Richter (2012) brings up, although he thinks the solution to the problem is to educate the market and by that securing that external maintenance workers are able to maintain the product correctly. Whatever approach that is taken by Perpend, it is of importance to develop a method for handling issues regarding ownership and maintenance.

5.13 Key partnerships

One important partnership for Perpend to be able to produce their energy systems is the electrical car market as that is where batteries for the energy storage systems comes from. With already established connections within the industry, maintaining the good contact is the most important thing at this stage. Perpend also want to outsource the distribution and installation of their products to another firm which quite clearly would make them a key partner as they would function as a type of middleman between Perpend and their customers. Such a partner, already established on the renewable energy market, could also help Perpend to ramp up their production in a later stage as they could help them access a wider market.

Devine-Wright (2005) speaks of the importance to include the local community in the development of renewable energy projects. That is something that does not apply very well to the case of Perpend as the development of the product and especially the patented lightweight material to a large extent has been done in close collaboration with universities and car companies. These two categories of partnerships has been essential for Perpend during the earliest phases of the product. However, the responding companies did express some concern regarding factors such as the size and noise of the product which gives reason to think that private households close to adopters of the energy systems might have similar thoughts. This might be something to consider for Perpend in later phases as the community in which their energy systems will stand might object to the building of them. The local community might therefore, as stated by Devine-Wright (2005), prove to be an important partner for the purpose of reducing

possibilities for resistance. It might thus be of importance to establish relationships with the local community for the later phases of Perpend's development.

In addition, future development of the renewable energy sector might be subject to lobbying activities and changes in legislation as there is a trend for increasing amounts of energy from renewables. Perpend might not actively work with such issues at the present time. However in the long run, establishing contacts/relationships with lobbyists might be an important part for the success of Perpend's business as that can help them both to make their energy systems more attractive and to increase awareness of the possibilities with renewable energy technology.

5.14 Cost structures

Perpend are most likely required to make quite heavy investments in order to get their business going. A production and demonstration site which probably would contain at least three energy systems (the three different module sizes) will be, as earlier explained, essential for Perpend's ability to reach out to the customers. Heavy investments are common in the energy sector according to Richter (2012) and Perpend do not seem to diverge from that. Not only in terms of the mentioned investments in physical assets but also immaterial assets as educating the market, attending fairs and hosting meetings etcetera can be both timely and costly. Perpend however stated that they, with help from the current sustainability trend, quite quickly will get into a phase where they do not need as much face to face contact with the customers.

With Osterwalder and Pigneur's (2010) proposed cost structures in mind, it seems that Perpend will have a value driven structure in the earlier stages of the company as the general goal is to get the first products onto the market. However, when that phase is passed, Perpend might in fact operate with a more cost driven approach as they want to lower the costs by efficient production and sales efforts. As mentioned, Perpend have also stated that they might want to introduce a web-based tool which would entail a more pull-based production as customers would contact Perpend to a greater extent than they would in the initial phase. It is though important to keep in mind that Perpend still is in an early phase and have not yet started to produce the products. It is therefore hard to further elaborate on which cost structure that will be most suitable in the future.

Würtenberger et al. (2012) state that one important reason for the slow development of renewable energy products is that the energy prices still are quite low. This is validated by the interviewed companies who indicated that energy issues are not top of their financial agendas. The fact that the interviewed companies were rather pleased with their current energy suppliers in terms of reliability and price proposes a significant hinder for Perpend to overcome. The low energy prices can be beaten by Perpend's products but the comfort of keeping the same old supplier as always still might outweigh both the economic and environmental benefits of a renewable energy product. It is therefore of even more importance to try and reach out to

potential customers with hard facts. For instance, by providing some sort of guarantee to customers that a significant reduction of energy costs will be made if they invest in one of their products.

5.15 Business model alternatives

The above analysis of existing theory and empirical findings point towards that Richter's (2013) arguments for that a BM can be constructed from different starting points also applies to this case. The fact that thoughts and ideas have been gathered both internally from the case company in question and externally from the interviewed companies generates two different perspectives on the matter: one that clearly focuses on identified customer needs and one more directed at the internal resources of Perpend. Richter (2012) similarly states that one type of BM is focused on the utility side of the company where maximizing value from existing resources is core. That argumentation is also very similar to Chesbrough and Rosenbloom's (2002) description of what a BM essentially should be. The second type of BM is, according to Richter (2013), a more customer centric one where the BM is created around the needs and preferences of the actual customers. The main difference between the two approaches is that the former concentrates the BM around resources whereas the latter is constructed in accordance to customer needs.

In the case of Perpend, the customer focused BM obviously emphasizes the needs of potential customers which is why the VP have been broken out from the BMC and illustrated in closer detail in the VPC. The utility focused model is conversely emphasizing the left side of the BMC as that is more focused upon the resources of the company. The two proposed models are further elaborated on in subsequent paragraphs and illustrated by *Figure 6* and *Figure 7*[3].

5.15.1 Utility focused business model

The interviewed companies expressed concerns with regards to the risks that an investment in an untested product would entail. The majority also stated that Perpend's product appeared like a good invention in theory but that they would require to see it in action before considering to make an investment. Perpend do, as stated, have the opportunity to set up a production and demonstration site where the product can be shown. Such a site would though require quite large investments from Perpend without any guarantee for its success.

An alternative to that approach could instead be a more utility focused approach where the product is utilized for producing electricity in a maximal quantity. Emphasis would in that case be on producing electricity and distribute it via the traditional electrical grid instead of selling the entire product to customers. In this way Perpend could work around the possible problems with capturing early adopters in the initial phases of their business. Instead of spending resources on hunting down and educating potential customers, Perpend could focus their attention on making the product as efficient as possible in places where they can sell purely renewable energy to a

[3] Larger, more highly defined versions of *Figure 6* and *7* can be found in *Appendix 3*.

broader customer group. In such a scenario, Perpend could put up multiple energy systems on geographical positions where conditions are optimal for their products. From these positions, they can sell their produced energy at the same time as their products would be fully visible for the public, hence solving problems with gaining awareness and interest of the energy systems. An additional argument for Perpend to put up their first energy systems in areas beneficial for the technology is the opportunity to sell advertisement spots on the body of the windmills. That would contribute to an additional revenue stream and make the products more visible to potential customers, something that also would be valuable for Perpend in the subsequently discussed customer focused BM.

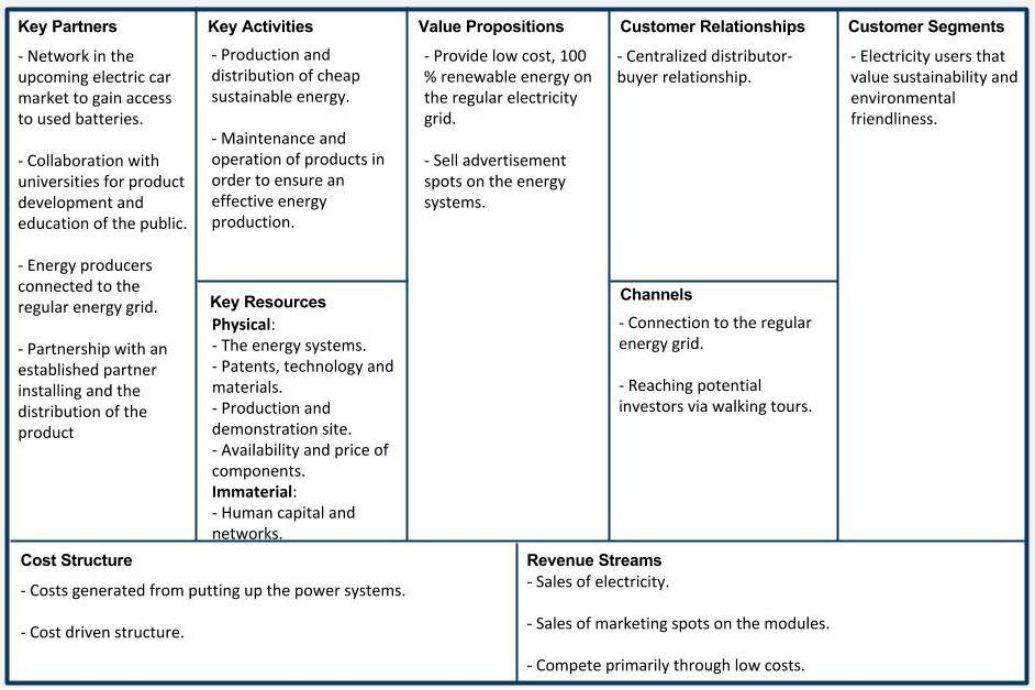


Figure 6 Utility focused BM.

When the first products are in place, Perpend could host walking tours on the sites to demonstrate how the product works. This would be an alternative step towards educating the market about the opportunities that the technology and the product actually can offer. In that way Perpend would be able to generate some money from the products right away by selling the electricity produced, without having to put up a lot of resources for the process of acquiring early adopters. In turn, that leads to a more pull-based customer approach compared to the subsequently discussed customer focused BM.

This kind of BM could be beneficial for the earliest phases of the company, as getting the products recognized by a market have been established as crucial for getting the business going. The utility focused BM could then be replaced or complemented by the customer centric one in later phases of the product when the first energy systems are operational. That transition is though

dependent on the level of interest the product generates and if the customers actually are interested in owning a product of their own.

5.15.2 Customer focused business model

A second alternative would be to construct a BM based on what have been established as most important for the customers. The BM would thus revolve around the VP that we developed with the help of customer insights. With that approach, Perpend should focus their business further on adaptability in order to meet the needs from customers with different energy needs, for instance Hållanders sågverk who had an energy demand of 3.6 MWh/year or Ray Metallfabrik with a demand of 1000 MWh/year. This model would also require Perpend to take on a more decentralized approach compared to the previously discussed utility focused BM as closeness to customers are established both in theory and empirical findings as important for a company like Perpend. Further reasons for staying in close connection to customers is that it would make it easier for the company to fulfill specific customer needs by adapting the modular products. This is further strengthened by the respondents (Blomdahls mekaniska and Götessons) who ideally wanted to integrate the product with the existing energy network and by that to some extent avoid the usage of batteries. Meeting that specific need would also mitigate problems with variability in energy demand during days and seasons by allowing the companies to sell residual energy and buy off the grid when the demand cannot be covered by Perpend's energy system. Other potential customers, such as Ray metallfabrik, would still want to have batteries for energy storage as a buffer to cope with their shifting electricity needs which further strengthens the argument that adaptability should be a key element in a customer centric BM.

Additionally, due to differences in the environment and availability of wind/sun, Perpend still need to construct their products differently depending on what is optimal for the specific location of the customer. Perpend's product is developed to be built upon different modules which should make it possible to fulfill such needs for adaptability. However, only relying on the already established modular product approach might not be enough as Perpend also need to consider other ways to adapt the product to shifting needs of the customers. For instance, the preferences stated by interview respondents regarding integration of batteries and the electricity grid. It was further mentioned during the interviews that cooperating with other nearby companies for the purpose of reducing risks could be an attractive alternative when investing in Perpend's product. This is something that would require an alternative cost structure for Perpend in which several companies geographically close to each other can share one or several products.

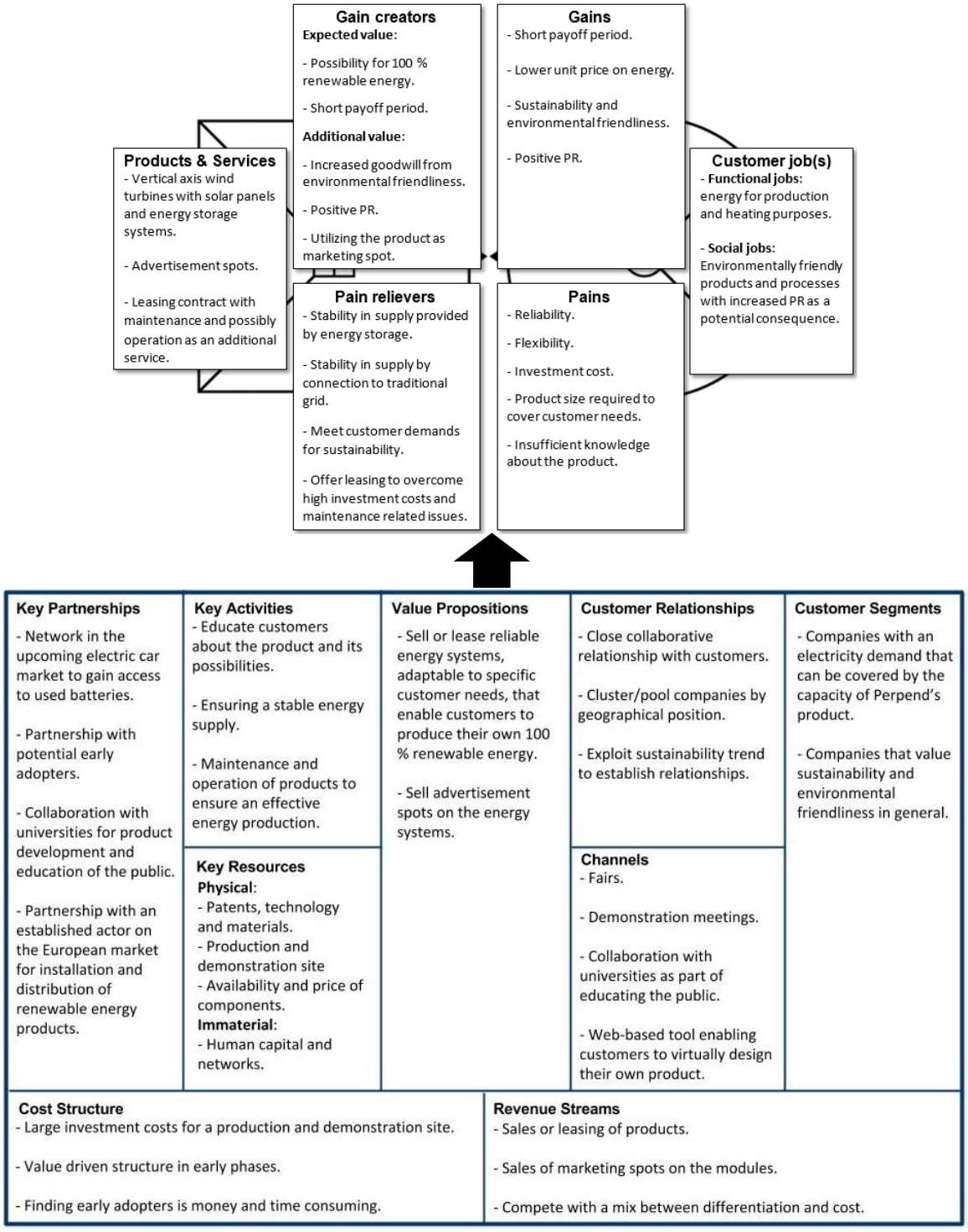


Figure 7 Customer focused BM.

The customer centric BM could beneficially be used at later stages of Perpend's product as a natural step forward from the more utility focused BM. That two-phase approach would enable Perpend to get some of their products up and running at locations on which the technology in the energy systems can be utilized for its full potential. These locations would also help them to demonstrate and explain the product for potential customers, something that was established as crucial during the interviews as potential customers to a large extent were skeptical about investing without seeing the product fully operational. After this initial utility focused phase, in

which a greater recognition of the product have been reached and potential customers actually have been given the opportunity to get a real life look at the operational energy systems, Perpend can make the transition towards the customer focused BM. On the other hand, if they were to start with the recommended utility focused BM, Perpend would require large initial investments compared to the customer centric one in order to build a business solely around selling electricity. With the customer centric BM, Perpend would build the products to order and get the costs of producing the products much faster as lump sum revenues from selling the actual product would replace income from produced electricity.

Perpend do ultimately want to sell their energy systems to companies that can utilize them for their own production of 100 % renewable energy. A dynamic approach where the utility focused BM functions as a precursor to the customer focused BM can help Perpend to make this happen at the same time as they will be able to educate potential customers and create a higher awareness of their products on the way.

6. Conclusions

This study was set out to explore how the concept of BMs can be applied to a case company focused on renewable energy technology and how a novel product within that field can be offered to potential customers in an efficient way. To answer our main research question:

What could be a suitable BM for Perpend's novel technology for renewable energy production?

We have found two potential BMs to be suitable for the specific case of Perpend and their products. The first one is focused on the company's existing resources, in which the energy systems are utilized by Perpend for the production of low cost, fully renewable energy. The energy produced is sold on the regular energy grid, generating revenues without Perpend having to sell the actual products. In turn, Perpend can focus on utilizing the products to their full potential and make sure that the energy systems work as desired. This utility focused model is most suitable for the earliest phases of the company as issues with acquiring early adopters to a large extent can be avoided by the application of it. The second, customer focused BM is more concentrated on the VP, in which the explicit needs of the customers are reflected. The product is here either sold or leased to customers who will use the energy systems for production of their own renewable energy. In contrast to the aforementioned, the customer focused BM is deemed most suitable at later stages of the company when the first products are operational and visible.

These two models can be used independently or in connection to each other where the former mentioned precedes the latter. If used by Perpend in the proposed dynamic fashion, issues with availability of the products can be mitigated mainly for two reasons that also provide the answer to our first sub-question:

1) How can the benefits of Perpend's renewable energy systems be easily available for potential customers?

Firstly, the utility based BM will enable Perpend to quickly get their first products onto the market and provide customers with 100% renewable energy via the regular energy grid. Secondly, by application of the utility focused BM in which emphasis is laid upon internal resources, Perpend can concentrate on making the product as efficient and attractive as possible to potential investors. Additionally, when the first energy systems are up and running, Perpend can make their products more accessible by physically showing them in full operation to customers. Being able to demonstrate the products to potential customers is an important step towards educating the market and creating interest for the energy systems, which leads us to the answer to the second sub-question:

2) How can potential customers gain awareness of Perpend's systems for renewable energy production?

Display of the products is preferably done at a production and demonstration site positioned at an easily accessible location where conditions are optimal for the technology. At such a site, the sheer existence of the products will most likely attract attention from the public. However, Perpend can use the site to generate even greater awareness of their energy systems by hosting guided tours in which the products can be demonstrated in greater detail to potential investors.

In sum, there are two potential BMs that Perpend can utilize for creating, delivering and capturing value from their novel products for renewable energy production: a utility focused and a customer focused. If applied in two phases, the models can contribute to higher awareness as well as higher availability of the products as the utility focused model will help Perpend to educate potential customers about the benefits of the products. The customer focused BM will subsequently help Perpend to deliver their products in accordance to specific customer needs. In turn, that could help Perpend to reach their goal of providing a wide variety of customers with a product that enables them to produce their own 100% renewable energy.

This study have thus contributed with an application of existing frameworks on BMs, especially the BMC, to the field of renewable energy technology – an area still relatively untouched by BM-research. With the help of empirical material gathered from internal sources to the case company as well as external sources in the form of their potential customers, we have been able to provide an explorative research perspective on how BMs can be created for a novel renewable energy product. Additionally, we have highlighted the challenges with establishing a spot for a product yet unknown on any market and provided potential solutions to related problems. With that, we have contributed to BM-theory by adding a more dynamic approach, explicated in the proposed implementation timeline and its connection to the use of BMs for renewable energy products. Consequently, this study have initiated the process of closing the academic gap between the two fields.

The two BM alternatives presented in this thesis are tailored after the established needs of Perpend and their potential customers, hence also most suitable to the case company. However, the provided insights on how theoretical and empirical material on renewable energy technology can be combined with prominent BM-frameworks also makes this research study greatly applicable to other companies intended to create BMs for comparable products.

6.1 Recommendations for Perpend

1 We suggest that Perpend concentrate on getting the production and demonstration site operational as soon as possible. Firstly, in order to make the product visible and secondly to be able to obtain revenues from selling the produced electricity. We believe that starting with such a site is the most suitable approach to getting the business up and running as the channels needed for selling the electricity already are established (the regular energy grid). When the first products are operational, we suggest that Perpend approaches potential

customers who are willing to purchase advertisement spots on the products. This will enable Perpend to start building up their reputation and increase the interest of the products at the same time as they will be able to generate a second stream of revenues. At this stage, it is important for Perpend to decide whether they should continue with the utility focused BM or start to adapt to the more customer centric one.

If Perpend choose to proceed with the customer focused BM, we suggest that their attention should be redirected to the process of obtaining early adopters – preferably using the production and demonstration site for walking tours, providing evidence for the efficiency of the products. When these early adopters are established it will be of utmost importance to investigate how the product is perceived by the users and to discuss potential development areas of the energy systems.

Furthermore, education of the market is an important aspect to consider at this stage. Attending fairs and collaborating with universities with the purpose of making the company and their products visible on the market is here of essence. After a while when the market is ready, Perpend could launch the earlier discussed web-based tool in order to make the product even more accessible for new potential customers. The web-based tool could possibly make the process of acquiring new customers less resource intense which in turn can make resources available for other areas of the company.

If the abovementioned steps (illustrated by *Figure 8*) are followed, Perpend will most likely enter a phase in which focus can be shifted from educating the market and obtaining early adopters to the scaling up of production. In order to increase production at this stage, we suggest that Perpend concentrate on making the production of in-house parts as efficient as possible. Additionally, it is of importance for Perpend to make sure that suppliers of shelf stock components and the ones assembling the products are ready for a potential increase in production volume. When volumes are increasing, it is however important for Perpend to not settle down. Instead, they should continue to reevaluate and develop their BM in order to ensure a dynamic model changeable in accordance to the specific challenges of Perpend.

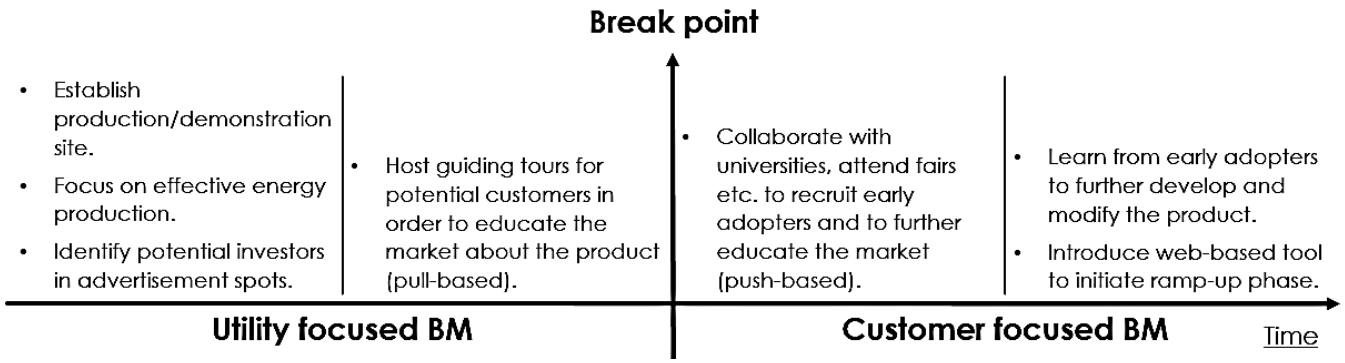


Figure 8 Implementation timeline

2 Perpend should keep optimizing and improving the BM in order to continually meet the demands of the changeable reality and different phases of the company. We have proposed two different models which can be used together or separately depending on the needs of the company. Either way, it is important to see the BM as a dynamic model that might have to be changed along the course of the product's life cycle. The break point between the two BM alternatives in *Figure 8* should thus function as a reminder for when Perpend can start changing their business from utility to customer focused. It is though important to have in mind that the process illustrated by the implementation timeline might fit very well with how Perpend's situation looks like today. Their situation might however be very different in the future as the renewable energy sector is evolving fast and new promising technologies for the production and storage of energy most certainly will emerge within short. The break point between the two BMs should therefore be considered as rather fluid so that the transition towards the customer focused BM is done at a point in time when both Perpend and the market is ready for it. Looking at a longer-term perspective, Perpend should not limit themselves to a fixed BM but rather keep optimizing it to align their business with both the development of the market and the existing resources of the company.

3 Perpend need to be careful when establishing ownership of the products. Appropriate installation and maintenance is vital for securing utilization of the product's full potential. Therefore, different alternatives to offering the products in a pure buyer-seller relationship should be considered. Leasing out the energy systems might for instance be a beneficial way for Perpend to reach out to potential customers and ensure that their products will be properly utilized.

   Several of the interviewed companies did express their concerns with regards to the potentially large investment that one of Perpend's products would entail. Perpend will most likely be able to alleviate such concerns with a leasing alternative as the initial capital required for an investment will be lower compared to a traditional sales. Additionally, Perpend can retain the ownership of the product meaning that installation and maintenance will be Perpend's responsibility, further reducing the customer's vulnerability. However, Perpend can most likely also benefit from a leasing arrangement as it is of importance that the early adopters are satisfied with the product and the effectiveness of it – especially in the early phases so that Perpend can get positive references for later affairs.

   Another aspect of leasing worth mentioning is the natural relationship between the lessor and the lessee. This relationship will help Perpend to extract information from the customer about how the product is perceived. Such information might provide Perpend with the possibility to get valuable modification suggestions on the products, helping them to further

develop the energy systems in closer connection to the needs and requirements of the customer.

4 It is of great importance to potential customers that they can trust the product to provide a secure and reliable supply of energy. Several of the companies did express concerns regarding this and indicated a sense of insecurity about the functionality of the product. It is therefore of utter most importance for Perpend to provide either explicit proof of the reliability of the energy systems or solutions that mitigates such concerns. This can for instance be accomplished by offering demonstrations of the actual products or providing investing companies with a connection to the regular energy grid as a safety back up.

6.2 Future research

Throughout this study, several opportunities for future research have been identified. Firstly, our research connects prominent BM-literature to the field of renewable energy technology. However, to establish what implications our findings might have for the renewable energy sector as such, further testing of the models developed in this thesis is needed. The renewable/sustainable energy sector is evolving fast and new actors such as Perpend are discovering novel ways to create, deliver and capture value on the market. The development of BMs in the renewable energy sector is thus in need of further examination. Research dedicated to finding out what success factors that exist for BMs in such a developing market could for instance provide companies with valuable guidelines for the future growth of the industry.

Secondly, a potential objective for future research would be to investigate how a product such as Perpend's would be approached on a governmental level for example in Sweden. Especially with regards to the set EU-target for that 20% of the produced energy should come from renewables before 2020. It would be interesting to see if the government would be willing to provide for instance tax-benefits with the purpose to encourage further utilization of similar products and to investigate what implications that might have for companies such as Perpend.

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Appendix 1. Interview template

1. The company

- Information about the company:
  - Geographical position
  - Surroundings
  - Area information: size of the property etc.
  - Competition

- Sustainability and renewable energy as part of the company profile (business model and/or value proposition of the interviewed company):

  - Current energy usage
  - Source of energy
  - Energy volume
  - Energy supplier information
  - Potential pains/gains with current energy supply

2. Renewable energy production

- Pressure for sustainability and environmental friendliness (intrinsic such as company profile/reputation and extrinsic such as legislation).
- How the company works with sustainability.
- Future increase of energy prices (transmission from nuclear power etc. towards more sustainable sources).
- Future plans for dealing with the above.

3. Perpend's energy systems

- Thoughts on Perpend's energy systems with regards to factors such as esthetics, price, investment costs, sustainability, sound, reliability, permissions, possibility to lease or share the energy system with other companies etc. Example question: what would be required for an investment of this type and which attributes are important?

- Marketing opportunity (possibility to use the energy system module as a spot for advertising).

Business Models for renewable energy technology

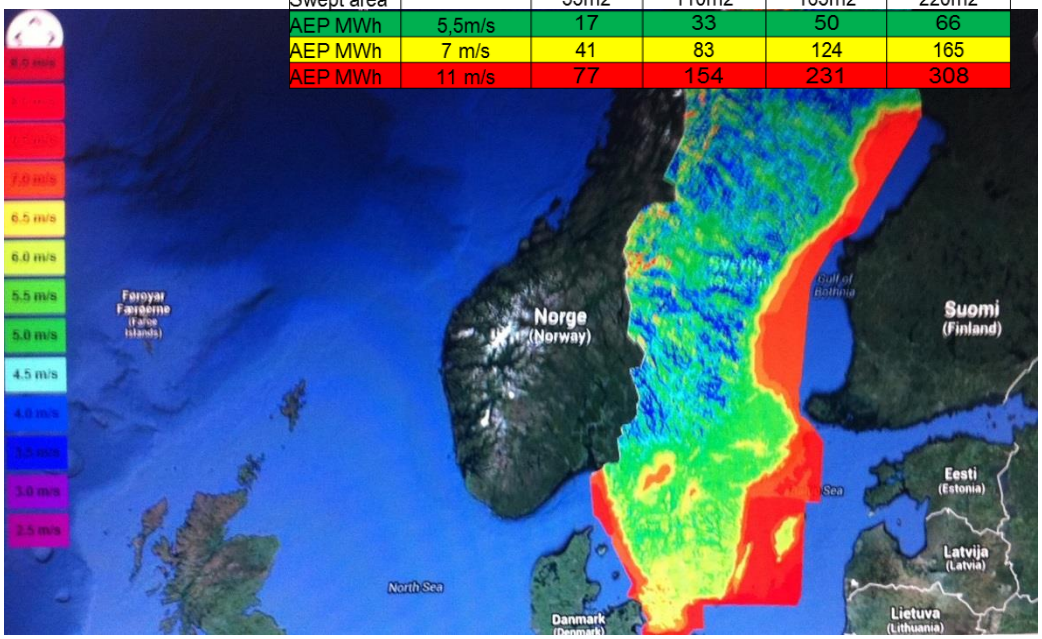
– A case study of Perpend AB

Wind energy production in Sweden

Sweden with its extremely long coast has the best possible conditions for distributed renewable energy generation in all parts of the country where demand for electricity is at its greatest with respect to industry and population.

Picture: Renewable Energy Production – Sweden

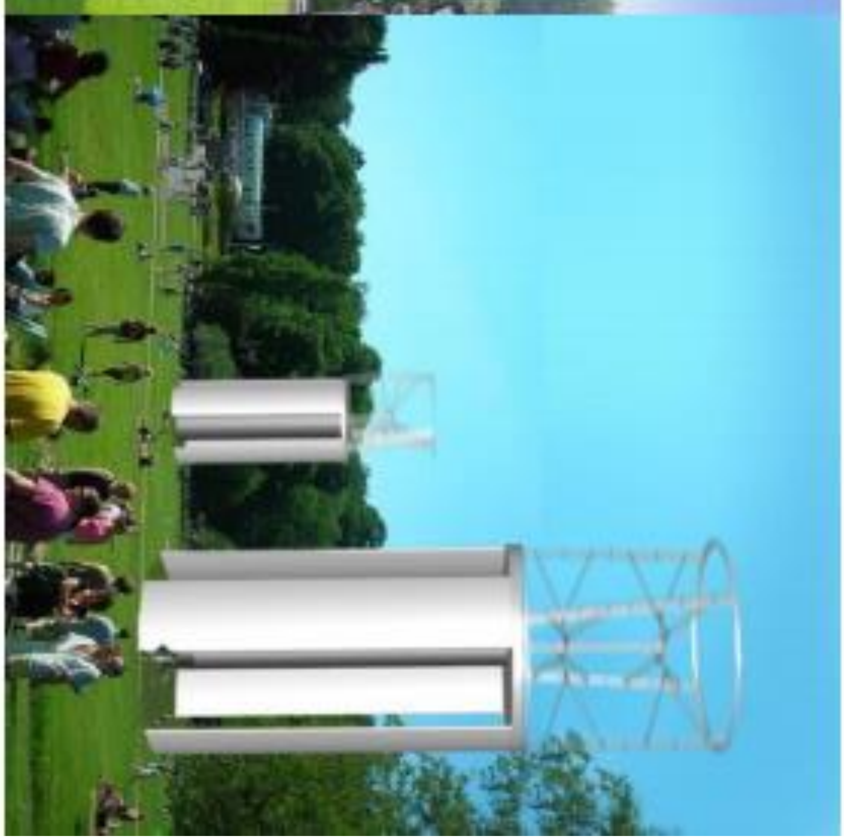
	av. wind speed	LeanWinds 55	LeanWinds 110	LeanWinds 165	LeanWinds 220
Swept area		55m2	110m2	165m2	220m2
AEP MWh	5,5m/s	17	33	50	66
AEP MWh	7 m/s	41	83	124	165
AEP MWh	11 m/s	77	154	231	308



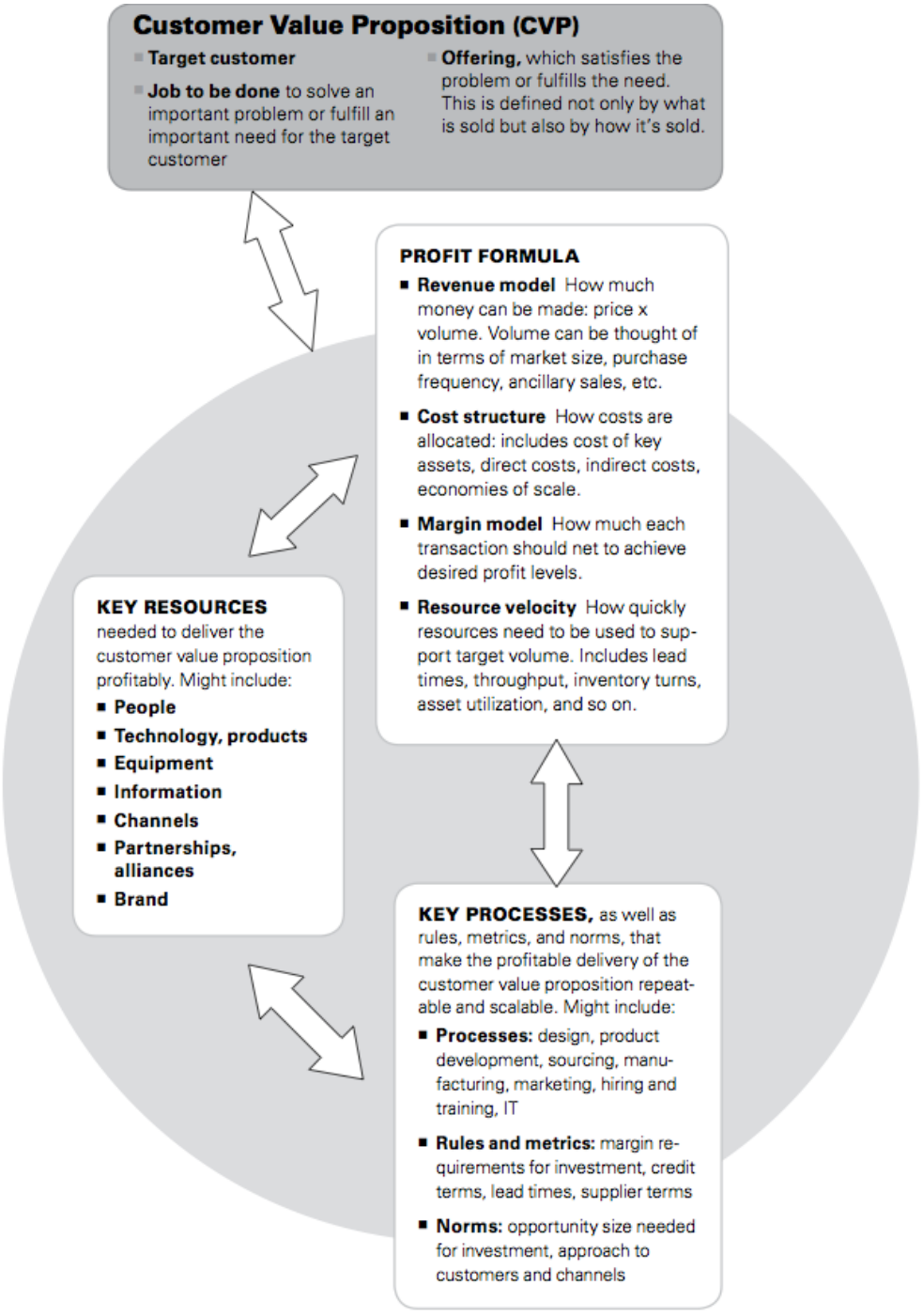
The objectives for PERPEND Energy Systems™ is to offer its customers a price of 25 – 50 öre/kWh with high availability (70%) in regular wind modes and to reach even lower costs/kWh and increased accessibility in favorable wind conditions.

Target Price/kWh - LW55/LW110/LW165/LW220

		LeanWinds 55	LeanWinds 110	LeanWinds 165	LeanWinds 220
	Annutiet	300 month	300 month	300 month	300 month
	Interest rate	4%	4%	4%	4%
Area	Unite	LeanWinds 55	LeanWinds 110	LeanWinds 165	LeanWinds 220
Budget sales price	kSEK	375	700	950	1400
Tower 3*10m	50	150	150	150	150
Installation on site	50	50	50	50	50
Solar panels	*30*	*30*	*30*	*30*	*30*
Energy storage	*100*	*100*	*100*	*100*	*100*
Est. investment	kSEK	705	1030	1280	1730
Residual Value	kSEK	180	280	370	500
		LeanWinds 55	LeanWinds 110	LeanWinds 165	LeanWinds 220
Investment/MWh	5,5m/s	616 kr	456 kr	387 kr	420 kr
Price /kWh		0,62 kr	0,46 kr	0,39 kr	0,42 kr
		LeanWinds 55	LeanWinds 110	LeanWinds 165	LeanWinds 220
Investment/MWh	7 m/s	411 kr	304 kr	258 kr	280 kr
Price /kWh		0,41 kr	0,30 kr	0,26 kr	0,28 kr
		LeanWinds 55	LeanWinds 110	LeanWinds 165	LeanWinds 220
Investment/MWh	11 m/s	103 kr	76 kr	64 kr	70 kr
Price /kWh		0,10 kr	0,08 kr	0,06 kr	0,07 kr



Appendix 2. Customer Value Proposition framework



Customer Value Proposition (Johnson, Christensen and Kagermann, 2008).

Appendix 3. Business model alternatives

Utility focused BM

<table>
<tr>
<td rowspan="2">Key Partners
- Network in the upcoming electric car market to gain access to used batteries.

- Collaboration with universities for product development and education of the public.

- Energy producers connected to the regular energy grid.

- Partnership with an established partner installing and the distribution of the product</td>
<td>Key Activities
- Production and distribution of cheap sustainable energy.

- Maintenance and operation of products in order to ensure an effective energy production.</td>
<td rowspan="2">Value Propositions
- Provide low cost, 100 % renewable energy on the regular electricity grid.

- Sell advertisement spots on the energy systems.</td>
<td>Customer Relationships
- Centralized distributor-buyer relationship.</td>
<td rowspan="2">Customer Segments
- Electricity users that value sustainability and environmental friendliness.</td>
</tr>
<tr>
<td>Key Resources
Physical:
- The energy systems.
- Patents, technology and materials.
- Production and demonstration site.
- Availability and price of components.
Immaterial:
- Human capital and networks.</td>
<td>Channels
- Connection to the regular energy grid.

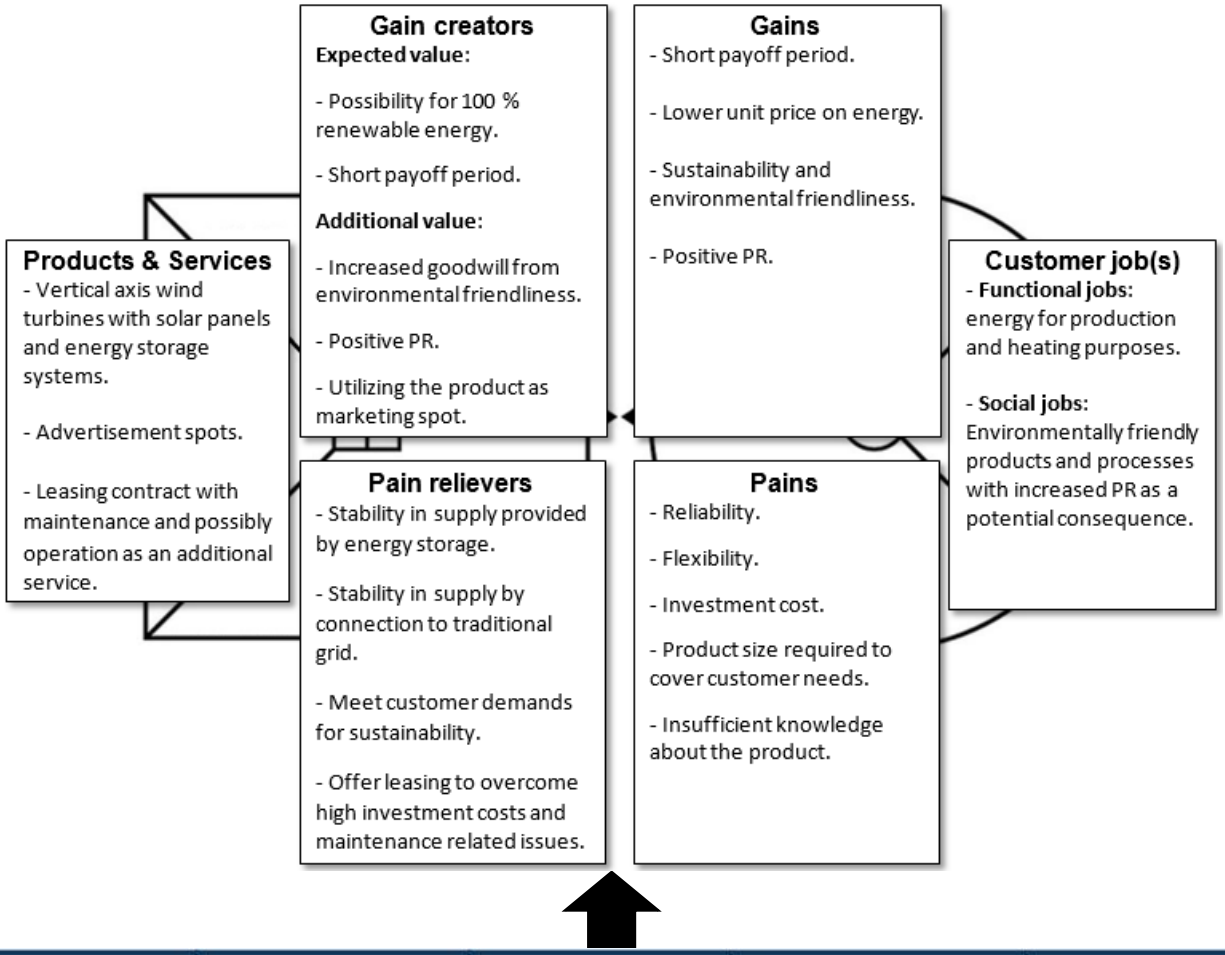
- Reaching potential investors via walking tours.</td>
</tr>
<tr>
<td colspan="3">Cost Structure
- Costs generated from putting up the power systems.

- Cost driven structure.</td>
<td colspan="2">Revenue Streams
- Sales of electricity.

- Sales of marketing spots on the modules.

- Compete primarily through low costs.</td>
</tr>
</table>

Customer focused BM



Key Partnerships	Key Activities	Value Propositions	Customer Relationships	Customer Segments
- Network in the upcoming electric car market to gain access to used batteries. - Partnership with potential early adopters. - Collaboration with universities for product development and education of the public. - Partnership with an established actor on the European market for installation and distribution of renewable energy products.	- Educate customers about the product and its possibilities. - Ensuring a stable energy supply. - Maintenance and operation of products to ensure an effective energy production. **Key Resources** **Physical**: - Patents, technology and materials. - Production and demonstration site - Availability and price of components. **Immaterial**: - Human capital and networks.	- Sell or lease reliable energy systems, adaptable to specific customer needs, that enable customers to produce their own 100 % renewable energy. - Sell advertisement spots on the energy systems.	- Close collaborative relationship with customers. - Cluster/pool companies by geographical position. - Exploit sustainability trend to establish relationships. **Channels** - Fairs. - Demonstration meetings. - Collaboration with universities as part of educating the public. - Web-based tool enabling customers to virtually design their own product.	- Companies with an electricity demand that can be covered by the capacity of Perpend's product. - Companies that value sustainability and environmental friendliness in general.

Cost Structure	Revenue Streams
- Large investment costs for a production and demonstration site. - Value driven structure in early phases. - Finding early adopters is money and time consuming.	- Sales or leasing of products. - Sales of marketing spots on the modules. - Compete with a mix between differentiation and cost.