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The Feasibility of Solar Panel Leasing in Finland

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The aim of this thesis was to analyse the feasibility of solar panel leasing in Finland. The research was conducted using the exploratory research design, utilizing both qualitative and quantitative data. The data was collected from secondary sources, e.g. industry reports, government publications, and newspaper articles. During the literature review, methods for answering the thesis question were recognized. The chosen method was to analyse the market and industry feasibility, product or service feasibility, and financial feasibility of the proposed model. Additionally, fundamentals of solar electricity production were research and explained in the thesis. To analyse the feasibility of the proposed model in Finland, three analytical tools we're chosen: PESTLE analysis, 4P Marketing Mix, and SWOT analysis. The return on investment (ROI) that an investor could expect to receive was used as a key factor in analysing the financial feasibility. The research brought up significant issues that the business would face, most notably climate-related challenges, as well as unfavourable market conditions, such as cheap electricity from the grid, and alternate financing methods for customers. The conclusion was that such model would not be feasible currently in the target market.

Keywords	Solar panel, leasing, Finland, exploratory research, secondary research, qualitative and quantitative data, industry and market, product or service, financials, PESTLE analysis, 4P Marketing Mix, SWOT analysis, ROI, climate

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1 Introduction

1.1 Background

The industrial revolution forever changed the way humans produce goods and services. Overtime it has fundamentally changed almost every aspect of our lives, and started a new period in history during which standard of living has been continuously rising, especially in the developed world. However, it also sparked the widespread use of fossil fuels, which when burned, release CO2 and other greenhouse gases to the atmosphere. At first the change was insignificant, but overtime as the use of fossil fuels grew and became more widespread, the composition of the atmosphere started to change on a global level. The change in the composition has increased the average global temperature, which in turn affects everyone and everything on this planet, mostly in a negative way. By the end of the 20th century, scientists had reached a consensus position and it became clear that greenhouse gases released by humans were heating up the planet, and that a change in how we produce energy was needed. Of all the alternatives, solar energy is considered as one of the best ways to help reduce our dependence on fossil fuels, therefore reducing the negative effects our actions will have in the future.

When looking at the situation from a national level, Finland is currently producing a little over a third of its electricity from renewable energy. Hydropower and wind power are considerably more utilized than solar energy, so there is still a significant market opportunity for solar energy in Finland (Energiateollisuus 2014). There are vast amounts of empty roof-space on top of Finnish homes, and I believe the high upfront cost of solar panel systems to be a significant contributor to this phenomenon. For example, Fortum Oyj offers a low-end system with installation for €5000 (Fortum Oyj 2015), which is a considerable sum for many Finnish households, especially as it takes years for the system to pay itself back. To overcome this issue, I propose a business model of leasing solar panels to customers. This would allow customers to reap the benefits of solar systems and provide an opportunity for a company to turn a profit.

As the research project is built around the idea of leasing solar panels in Finland, the elements included will focus on the most critical aspects to such business. According to basic economic principles, purchasing decisions for commodities are based on price. Investopedia defines commodities as products that are interchangeable with similar products, i.e. their quality is close to uniform across different providers (Investopedia). Commodities are also often used in production of other products or services, so they work as tools in achieving a desired result. In the case of solar panels, the desired result is production of electricity. As the proposed business model is leasing of solar panels, the price that customers pay for the service is a monthly subscription price. The monthly subscription is a predictable recurring cost, similar to that of usage based cost of purchasing electricity from the grid. Therefore, the source for competition can be viewed as traditional suppliers of electricity, and customers purchase decisions would be heavily based on the price per kWh.

1.2 Objective and Research Question

The objective of this research is to review the legal, technical, political, and business issues related to solar panel leasing in Finland. More specifically, the main issues under review will be leasing law and contract models, direction of solar energy industry, electricity demand in average households, pricing and supply of alternative electricity sources, special needs for solar systems imposed by the northern climate, building codes and regulations regarding solar systems, and Finland's national energy-policy.

The aim of this research is to analyse the feasibility of solar panel leasing in Finland.

2 Literature Review

As the aim of the thesis is to evaluate the feasibility of solar panel leasing in Finland, it is important to first investigate how a feasibility of a business is evaluated, and how the operating environment affects the feasibility of a business. To achieve this, existing literature must be studied and any important aspects, such as what analytical tools can be used to assess the feasibility, have to be identified.

2.1 Feasibility Analysis

Businesses start as ideas. However, an idea is usually not sufficient to produce a sustainable business. To assess an idea's value more deeply, a feasibility analysis should be conducted. A feasibility analysis aims to answer the question "Should we proceed with this business idea?" (Scarborough et al. 2007: 123). It is important to note that a feasibility analysis is not the same as a business plan. The feasibility analysis is used to investigate the potential of an idea, looking at several different aspects to determine whether resources should be allocated to develop a proper business plan or not (Scarborough et al. 2007: 123).

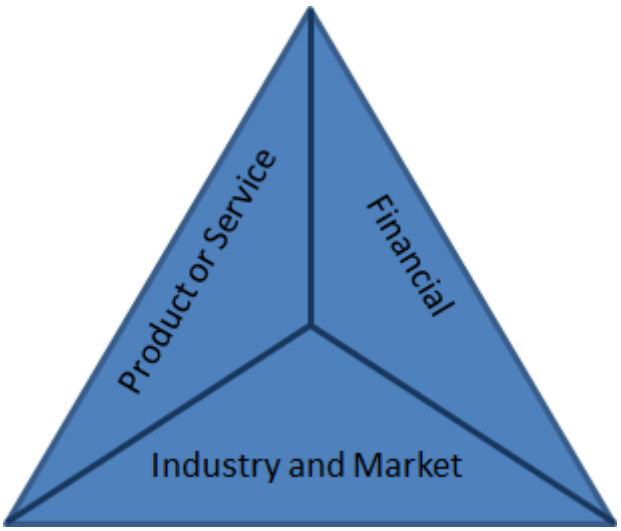

Figure 1 Feasibility Analysis, Adapted from (Scarborough et al. 2007: 124)

A feasibility analysis consists primarily of three different aspects portrait in the triangle above:

1. Industry and market feasibility
2. Product or service feasibility
3. Financial feasibility

2.2 Industry and Market Feasibility

Industry and market feasibility works as a good foundation for the feasibility analysis. It is used to answer two questions about the business idea: "(1) to determine how attractive an industry is overall as a "home" for a new business, and (2) to identify possible niches a small business can occupy profitably" (Scarborough et al. 2007: 123). Useful determinants to help answers the two main questions include aspects relating to e.g. the size of the market, its growth rate, existing trends in the industry, level of competition, and available opportunities.

2.3 Product or Service Feasibility

Once the industry and market feasibility study has been conducted, the entrepreneur can move on to considering whether the proposed product or service fits the market and industry or not. In this section research should focus on determining how much demand would exist for the proposed product or service, can the organization produce the product or service at reasonable costs that enable profit-making, and what resources are needed to produce the product or service. Ultimately two main questions should be answered: "1) Are customers willing to purchase our goods and services? 2) Can we provide the product or service to customers at a profit?" (Scarborough et al. 2007: 130). To answer these questions, the entrepreneur can use primary or secondary research depending on the proposed product and available resources. Prototypes are a useful tool in this stage, as they can be used to gather direct feedback from potential customers and that feedback can be then used to improve the product or service.

2.4 Financial Feasibility

The third and final aspect of the feasibility analysis relates to the broad financials of the proposed business. In this stage the main questions to answer are how much capital is needed to launch the business, how much earnings can be expected, and what is the return on investment.

A business needs capital to start producing goods or services, and the amount of capital required is highly dependent on the type of business. Capital is needed to purchase equipment and locations, as well as expertise and labour. Capital is also used to promote the business and establish a presence in the marketplace.

Earning estimates have to be calculated based on the findings from the previous stage, product or service feasibility. To calculate the earning estimates, both prices and costs should be determined, preferably for best- and worst case scenarios to reach a thorough understanding of the potential. To calculate the return on investment (ROI), the capital needs and earnings estimates should be combined. Capital needs relate to the cost of investment; i.e. how much capital is required to produce the profit. The profit is known as gain from investment. To understand how ROI works, the formula is displayed below.

$$ROI = \frac{(\text{gain from investment} - \text{cost of investment})}{\text{cost of investment}}$$

Figure 2 ROI formula (Investopedia.com 2003)

In order to understand what level of ROI is considered attractive, the S&P 500 index can be analysed to see what returns an investor can realistically expect in the long term. The index saw a yearly average return of 9,8% 1928 to 2014 (Merriman, 2015). Therefore, if the expected return on investment is lower than that, e.g. 2-3%, a high-risk business might not be feasible, as similar returns can be produced with much lower risks. However, if the estimates would show that the expected return on investment would be around 15-20% with a low risk, the business would seem much more finan-

cially feasible. A good return on investment can be used to attract investors to the business.

Even though the estimates at this point of a feasibility study are usually fairly rough, they work as a guideline in assessing whether the business is financially feasible or not. The rate of return should be compared to the amount of risk included in the business venture (Scarborough et al. 2007: 133).

2.5 Tools for a Feasibility Analysis

In order to answer the questions of feasibility in the three different stages, several tools can be used to assist the entrepreneur. These tools include PESTLE analysis, 4P Marketing Mix, and the SWOT tool.

The PESTLE analysis looks at the political, economic, social, technological, legal, and environmental aspects. The PESTLE analysis is especially useful for the industry and market feasibility, but also relates to both the product or service feasibility through technological factors, and the financial feasibility through political and economic factors (e.g. taxation and government subsidies for green energy technologies).

The 4P Marketing Mix focuses on the product or service feasibility and financial feasibility by analysing the requirements for the product or service, and suitable pricing strategies. These aspects relate directly to capital needs and earnings estimates for the product and therefore ultimately to the return on investment and feasibility of the proposed business.

The SWOT tool also relates to the industry and market feasibility through evaluating competition and market opportunities. It also analyses the product or service feasibility through evaluating the proposed product against competitors in the market, as well as financial feasibility through evaluating company resources. Its purpose is to help in identifying how well the business is able to sustain competitiveness in the marketplace.

2.6 PESTLE Analysis

A PESTLE analysis is used to analyse the macro environment of an organization. It focuses on analysing the political, economic, social, technological, legal, and environmental factors that have an effect on the organization. The PESTLE analysis can therefore be used to research and explain the opportunities and threats factors in a SWOT analysis (Downey 2007: 6).

P	E	S	T	L	E
Political: Government mandates	Economic: Economic situation of target market	Social: Culture and demographics	Technological: Past, present, and future technologies	Legal: Laws affecting the organization	Environmental: Effects of and on climate and geology

Figure 3 PESTLE Analysis

2.6.1 Political

Political factors are the government-mandated regulations, restrictions, and support systems that exists in the operating environment of the organization. These include for example labour laws, subsidies, environmental law, and taxation laws (Professional Academy).

In addition to the current political factors, organizations should try to analyse possible changes to applicable factors in the near future. This way, organizations can prepare themselves for changes that will have an effect on their operating environment.

2.6.2 Economic

Economic factors explain the economic situation of the target market. The economic situation has a large effect on the organization, as it explains the disposable incomes of consumers and businesses, expected economic growth, inflation, interest-rates and so on.

These factors can be further separated into macro-economic and micro-economic factors (Professional Academy). Macro-economic factors explain the management of overall demand in the economy, which is influenced by e.g. interest rates, inflation, government expenditure, and taxation levels. Micro-economic factors focus mostly on the purchasing power and behaviour in the target market.

Interest rates are a key element to be considered under economic factors. Interest rate is the amount that a lender charges from a borrower for the loaned assets, and is usually noted in annual percentage rate (APR) (Investopedia.com 2003). Interest rates have an effect on both the potential customer, as well as the business through its effects on costs for leasing an asset. If the business has to loan capital, interest rate costs are included in the total cost for the product or service, and therefore affect the price the customer is charged for the use of the product or service.

2.6.3 Social

The social factors explain e.g. the attitudes, common beliefs, demographics, religious aspects, and social movements of the target market (Professional Academy). These factors can be analysed to determine any existing trends within the market. The information retrieved from analysing the social aspects is important, as trends can have a significant effect on the buying behaviour of the population. Analysing social factors is usually done by market research, which when done extensively requires large amounts of resources. Considering the commodity-like nature of the business, the author believes in-depth market research for social factors is not necessary at this stage of the feasibility analysis.

2.6.4 Technological

As the name suggests, technological factors focus on any and all opportunities and threats that the existing and future technologies bestow upon the organization. These include for example communication technology, production technology, advances in the core technologies of the product/service, as well as developments and emergence of new competing technologies (Downey 2007: 6).

Due to the rapid development of new technologies, many industries are going through fundamental changes to the traditional ways of doing things. These changes are called disruptive innovations, and they have the power to change the entire industry. Because of disruptive innovations, all organizations should carefully analyse the technological factors in order to understand new possibilities and business models.

2.6.5 Legal

Legal factors are dependent upon each nation the organization operates in, and can change dramatically from one country to the next. Therefore, each market should be analysed separately. The legal factors include for example advertising standards, product safety and labelling regulations, contract law, and consumer rights regulations. Without a clear understanding of existing laws, an organization takes significant risks as its operations and practices could be illegal and therefore suspect to lawsuits or become banned from operating in the first place.

2.6.6 Environmental

The environmental factors relate heavily to the sustainability of the organization. Factors to consider are for example greenhouse-gas emissions and energy-consumption of the organization. In addition, climate and geology should also be considered under environmental factors. These factors have seen a large growth in interest in the recent years (Professional Academy), and are currently changing the practices of many nations and organizations worldwide.

2.7 Marketing Mix – The 4P Model

The 4P model is a marketing tool that is used to find the correct positioning for the organizations products/services. The four P's in the marketing mix refer to product, price, promotion and place. Each of the four P's should be considered with the customer in mind, i.e. the results should describe what is the best way to offer the most appropriate product to the targeted customers. Each of the four factors also affect each other, and should therefore be designed to work together in the most appropriate and efficient manner.

Figure 4 4P Marketing Mix

2.7.1 Product

The product refers to the actual product/service that the organization offers, as well as any and all goods/services and other attributes that are bundled with the main product. The bundled products or services can be for example warranty, maintenance services, and packaging. Other attributes include things such as perceived quality, options, and brand name.

The product should always be tailored to the needs and wants of the targeted customer. In addition, the product along with its supportive elements should be created with a holistic view, and focus on meeting all the needs of the customer. The holistic view requires that e.g. luxury products are sold in attractive packaging from premier locations with great service, so that the customers purchase experience matches the luxurious image of the product (Ehmke et al. 2005: 1).

2.7.2 Price

The price refers to the price the customer is asked to pay for the product. There are several methods for determining the price, but as a general rule the price should cover the total cost of the product, as well as an acceptable profit margin. The image of the product should also be considered when defining the price, so that the two are communicating a uniform message. In addition, the price should reflect the pricing of competing products, as well as other products offered by the organization (Ehmke et al. 2005: 2).

The pricing is also dependent on other factors, such as the distribution method, type of product, and offered payment methods. For example, if the organization does not sell its products itself, it has to take into consideration the margin required by the retailer. Some products also experience seasonal changes in demand, and those changes should be considered by e.g. having prices change throughout the year. These are just two of many examples of many different ways pricing strategies can vary between products.

Several pricing strategies have been created to assist in choosing an appropriate price. One of these strategies is called cost-plus strategy. The cost-plus strategy considers the total cost of the product, and adds a standard percentage as a profit margin. Another common strategy is called the value-based, which is based around the customers perceived value of the product instead of the costs incurred by the organization. Competitive pricing strategy is also a commonly used strategy, in which the price of the product is based on what the competition is charging (Ehmke et al. 2005: 2). As discussed in earlier chapters, electricity is a commodity and purchasing decisions are

therefore heavily based on prices. Therefore, competitive pricing strategy seems like a suitable strategy for a company focused on solar panel leasing.

Competitive pricing is based on prices of competing products. It is often used when products in the market do not have many differences in the eyes of the consumers. In competitive pricing, the price can be set at the level of competition, below it, or above the prices of competition. Each of the three different levels must be justified, e.g. when setting the price higher, some additional benefit must be offered, e.g. more flexible payment terms. Setting the price below competition is often used in order to attract a larger customer base in hopes that the increased volume will offer larger profits than would be achieved with higher prices and fewer customers (Investopedia.com 2010).

2.7.3 Place

The third P, place focuses on distribution of the product. One of the most important decisions is to decide whether to sell directly to the customer, or use an intermediary (Ehmke et al. 2005: 3). Methods for selling directly to the customer include ecommerce, brand stores, and telemarketing. Wholesalers and retail locations are examples of distribution channels that include intermediaries. Using intermediaries can help in reaching large masses of customers, but they require the original manufacturer to share some of the profit margin. However, distribution decisions are not critical in evaluating the feasibility of the business at this stage.

2.7.4 Promotion

Promotion refers to the set of practices the organization uses to let potential customers know what the product/service is, what is it useful for, why the customer should purchase it, and where it is available. Effective promotion requires that the target market is correctly identified, and that the promotion reaches the specified target (Ehmke et al. 2005: 4).

There are several channels that can be used for promotional activities. For example, an organization can use television advertisement to reach large masses, cold calling to reach promising individuals, word-of-mouth to reach acquaintances of existing custom-

ers, or the organizations website to more deeply inform potential customers. Selecting the right set of promotional tools is crucial, as it can help keep costs at a reasonable level and still provide wanted coverage. However, as is the case with distribution strategies, promotional decisions are not critical at this point of the feasibility study.

2.8 SWOT

A SWOT (Strengths, Weaknesses, Opportunities, Threats) tool is an analytical tool used to assess the internal strengths and weaknesses, and the external threats and opportunities of a company. Created in mid 1900s, it draws information about the external factors from the PESTLE analysis, and information about the product's/service's appeal from the 4P Marketing Mix. It aims to help in developing a good fit between a company's resource capabilities and its external situation (Thompson, Jr. and Strickland III 2003: 117). A proper SWOT analysis aids in creating a strategy that is based on the reality of the company and its environment. When such an analysis is done poorly, the company faces a risk of having incorrect assumptions, which will in turn harm the long-term success of the company. The value of a SWOT arises from objective analysis of the company's situation, helping to find the needed actions to achieve sustainable competitiveness. Therefore, the findings from the SWOT analysis must be used to guide future actions, as no value can be created from simply listing the relevant factors (Thompson, Jr. and Strickland III 2003: 127).

A SWOT analysis is traditionally performed on a 2x2 matrix, with each tile representing one of the four factors (Strengths, Weaknesses, Opportunities, and Threats) of the analysis.

SWOT Tool	Internal	External
Positive factors	Strenthgs: Experience, expertise, and resources withing the organization. These factors offer competitive advantage within the industry	Opportunities: Positive factors found in the PESTLE analysis, e.g. favorable taxation or subsidies.
Negative factors	Weaknesses: Lack of experience, expertise, and resources within the organization. These factors offer competitive advantage to competitors within the industry	Threats: Negative factors found in the PESTLE analysis, e.g. import duties or disruptive technologies.

Figure 5 SWOT Tool

2.8.1 Strengths and Weaknesses

Internal capabilities of a company represent the strengths and weaknesses part of the SWOT analysis. They take in to account aspects such as the experience and expertise of its employees, access to capital, brand value, or any other aspect that affects the company's capability to produce value, such as innovation and state of physical assets. It is important to objectively consider not only the presence of these aspects, but the lack of them as well. By analysing both, the company can find areas that most need improvement, and those areas where success can be built upon (Thompson, Jr. and Strickland III 2003: 118).

The internal capabilities can have very diverse origins, ranging from having specific technical expertise, to originating from truly effective cooperation between different people and departments. For this reason, it is very important to consider the internal capabilities as objectively as possible and avoid over- or undervaluing important aspects. Additionally, if a company's strengths arise from factors that most companies in the industry share, no competitive advantage can be found from them. Every company has weaknesses and strengths, and only by properly considering its strengths and weaknesses can the company build sustainable success against its competitors. Success within the industry is achieved by having and further developing resources that

customers prefer over the competitions resources (Thompson, Jr. and Strickland III 2003: 125).

Analysing the internal capabilities can only help in informing how well the company can function within its industry. The state of the industry the company operates in is analysed in the two remaining categories, the opportunities and threats, which help identify the market conditions.

2.8.2 Opportunities and Threats

Opportunities and threats arise from aspects outside the company. So called PESTLE (Political, Economic, Social, Technological, Legal, and Environmental) factors should be considered in the opportunities and threats part of the SWOT analysis. The PESTLE factors are significant drivers for any industry as a whole, and usually have a large effect on whether the industry grows or stagnates. These factors can create opportunities that are so valuable that each competitor should pursue them, or only so mildly valuable that companies who can easily pursue them should do so. Therefore, it is advisable to conduct a proper PESTLE analysis before completing a SWOT analysis, as it feeds valuable information directly to the SWOT analysis.

When companies evaluate their opportunities and threats, close attention should be placed on which opportunities or threats relate to the industry as a whole, and which directly to the company (Thompson, Jr. and Strickland III 2003: 126). For example, a significant opportunity can rise in the markets, but if the company does not have the required resources to benefit from that opportunity, it cannot be regarded as a company opportunity, but only as an industry opportunity. The same idea applies to threats as well. For example, if a threat of higher import tariffs arises, but the company's entire supply chain is domestic in nature, it should not be considered as a threat.

3 How Solar Electricity Works

Solar energy is radiation from the sun that reaches the Earths surface. According to current estimates, approximately 274 million GWyears of solar energy reaches the Earth's surface every year (Ecoworld 2006). The suns energy can be harnessed by certain chemicals, called semiconductors, which are used in photovoltaic devices, more commonly referred to as solar panels.

The amount of energy available on the surface is highly dependent on the location on Earth. The amount of energy that reaches Earth's surface gradually changes between the equator and the poles. The change happens due to the angle at which the sunlight hits the surface, as it has an effect on the concentration of sunlight. Significantly higher amounts of sunlight hit each square meter at the Earth's equator than on either the north- or south poles. This effect is illustrated below. Each dotted line represents a ray of sunlight, which has to cover a larger area when moving north or south from the equator.

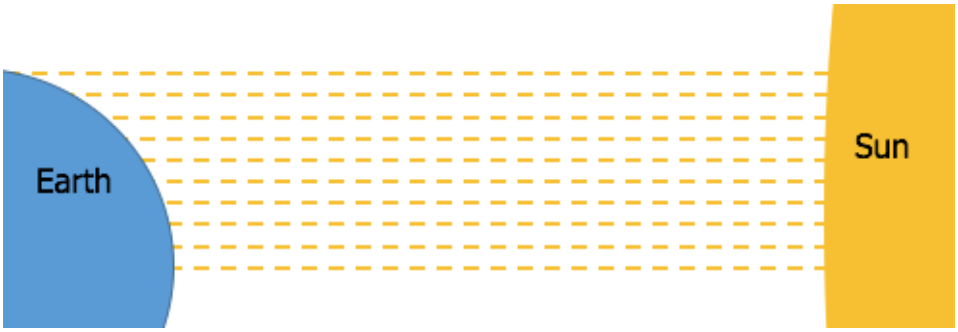

Figure 6 Sunlight Reaching the Earth

Due to the Earth's tilt, the angle at which sunlight hits the earth changes throughout the year as well. This effect is magnified by moving north or south from the equator, and its effects can be more commonly recognized through seasonal changes. Another consideration has to be made on the local climate, as clouds are able to block out of some of the energy that would otherwise reach the solar panel.

To collect and turn the suns energy into electricity, a solar panel system is needed. A solar panel system consists of several parts, with the main element being the solar panels. However, solar panels can only convert a part of the energy that reaches the

Earth's surface into electricity. In December 2014, Soitec and CEA-Leti, France, together with the Fraunhofer Institute for Solar Energy Systems ISE, Germany published a world-record efficiency of 46% for their new technology (Fraunhofer ISE 2014). However, the average solar panel is not able to reach such high efficiency rates. For example, top of the line Maxeon solar panels by SunPower, one of the largest manufacturers in the industry, only reach an efficiency in excess of 20% (PV Magazine 2012).

As in the case of location on Earth, the angle at which sunlight reaches the panel has an effect on the amount of electricity the panel is able to produce through changing the concentration of light. The illustration below describes why the amount is altered by the angle of the solar panel.

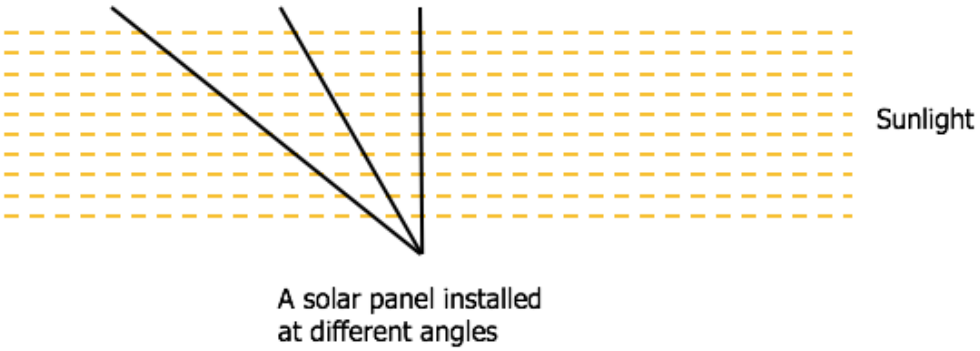

Figure 7 The Angle of a Solar Panel

In the illustration, the amount of sunlight remains constant. When the angle of the solar panel changes, the surface area needed to cover the fixed amount of sunlight changes as well. This means that the concentration of the sunlight is greatest when the panel is perpendicular to the source of the light, i.e. the Sun, and becomes diminished when the angle changes. It is important to remember that the angle has an effect in both east-west orientation and up-down orientation. Therefore, to produce the largest amount of electricity, the panel should face the Sun for as long as possible.

In addition to the solar panels themselves, a solar panel system includes mounting mechanisms, an inverter that changes the electric current to the desired format, and cables for connecting the system to the building's electricity system.

The size of the solar system is described in its capacity to produce electricity, and the unit of measurement is peak kilowatts (kWp). Depending on the location and orientation of a solar panel, a 1 kWp panel produces a variable amount of electricity, which is typically measured in kilowatt hours (kWh). One kWh equals to amount of energy needed to operate a 1000-watt machine for one hour.

4 Research Methods

The thesis focuses on answering the question of whether solar panel leasing can be a feasible business model in Finland. The study focuses further on industry and market feasibility, product or service feasibility, and financial feasibility of the proposed model. Business problems can be researched using different research designs, which can be categorized into three different types: exploratory, descriptive, and causal. Choosing the most suitable research strategy is an important decision, as it guides the researcher to obtaining useful results from the study.

Exploratory research is often used when the research question is vague and existing theories are of little help in developing a hypothesis (Hair et al. 2011: 147). Exploratory research is meant to discover e.g. new patterns, ideas, or themes, and should not be used to test a specific hypothesis. Therefore, it is often used in researching business problems or opportunities.

Descriptive research focuses on describing the characteristics of e.g. objects, people, environments, and organizations (G.W. Zikmund et al. 2013: 53). Current population surveys are an example of descriptive research. Descriptive research is often directed at specific issues found in exploratory research.

Causal research tests whether one event causes another (Hair et al. 2011: 153). Causal research is difficult and time consuming to conduct, as extra focus is required to ensure the cause and effect are related and that they are not affected by other events. It is most often used to reach a deep understanding of an issue, and based on findings from exploratory and descriptive research (G.W. Zikmund et al. 2013: 55).

In addition, both qualitative and quantitative data can be used in either of the three research designs. Quantitative research focuses on data that can be counted, and answers for example questions "when", "where", "how often", and "how many" (InterContinental, 2016). This type of data can be used in to predict future performance or identify trends. Qualitative data on the other hand answers the questions "why" and

"how" (InterContinental, 2016). In qualitative research the data is gathered via e.g. interviews, observations, and reviews. It produces descriptions of behaviours or events, and is often used in social sciences.

4.1 Research Design

Considering the three different types of research and how they are often used, exploratory research can be chosen as the most appropriate type to answer the research question presented in this thesis. Not much theory exists about the topic, nor can a specific hypothesis be formed before conducting the research. The paper is not aiming to find a causality between separate events, and therefore causal research is not a suitable design. Descriptive research requires a more specific goal for the research, and therefore is not suitable either.

Both qualitative and quantitative research are used in this thesis. Both types of data are used in all three sections, i.e. market and industry feasibility, product or service feasibility, and financial feasibility. Quantitative data is required especially in determining the financial feasibility of the proposed model, as the financial feasibility is primarily determined by calculating the ROI and related factors. Qualitative data is required mainly in answering the market and industry, as well as product or service feasibility, as the data in those sections relate heavily to the PESTLE factors, which are described mostly through qualitative data.

4.2 Data Collection

The thesis is focused on a business problem, more precisely the feasibility of specific business model in a specific industry with no previous academic research available. However, substantial amounts of industry and market research is freely available for the use of the author. Considering the topic of determining the broad feasibility of the proposed model, and assumptions about its commodity-like nature, the data gathered comes primarily from industry reports and other available public sources, such as competitor websites and government agencies. Some information is also acquired through observation. The observed information relates to the leasing industry, and is acquired during the authors employment at a large multinational vehicle leasing company.

4.3 Limitations

The research was limited by time and resources. Solar panels are a fairly new and unpopular product in Finland, and not much research of their long-term suitability in the Finnish climate has been conducted. The proposed model of leasing the solar panels has also not been tested in Finnish markets. In addition, leasing contracts are typically 3-6 years long, and not much industry experience exists for the longer contracts required by the proposed product. Also, no market research about consumer preferences to installing solar panels on the roofs of their homes were conducted by the author due to time restrictions. In addition, researching the more in-depth technical factors would require substantial amounts of time and other resources, which were not available to the author.

4.4 Reliability

Due to the several limitations described in the previous chapter, the reliability of the study could be questioned. Ultimately the reliability of the study can be verified by replicating the study and seeing whether the results are similar in nature. No such previous study has been conducted, and therefore the reliability is difficult to verify. However, the data in this study was collected from reliable sources. The research was also conducted according to the feasibility analysis described in the literature review, which provides a sound basis for analysing the feasibility of a new business proposal. Due to these reasons, the study can be considered as fairly reliable, but more in-depth analysis and similar studies should be conducted in order to reach a definite verdict.

5 Results

During the literature review several important aspects that help answer the thesis question were recognized. Most notably the model of feasibility assessment by assessing the industry and market feasibility, product or service feasibility, and the financial feasibility. The research also brought up three business tools that can be used when conducting the analysis. These tools are the PESTLE analysis, 4P Marketing Mix, and the SWOT tool.

5.1 PESTLE

The PESTLE analysis is used at this stage to describe the Political, Economic, Technological, Legal, and Environmental issues related to leasing solar panels in Finland. Social factors are left out as they would require in-depth market research, and the author believes the findings would not provide crucial information at this stage of the feasibility analysis.

5.1.1 Political

The Finnish Ministry of the Environment states that Finland's energy policy is based on the goals of EU's climate and energy policy (Finland Ministry of Employment and the Economy 2015). The goals state that greenhouse gas emissions should reach a level 20% lower than that of 1990 by the year 2020.

Finland's local energy and climate policy has three main focuses: energy, economy, and the environment. When it comes to greenhouse gases, the policy states that by 2020, the percentage of energy coming from renewable sources should reach 38%. The government is currently supporting investments that focus on clean energy sources. For example, in 2014, the Finnish government offered a 30% support for investments into solar electricity production. These investments include investments and projects that advance the use or production of renewable energy. Therefore, solar

panel leasing seems to benefit from this incentive. The incentive however, was limited. For example, new construction projects received a total support of €1 million, excluding any residential construction (Motiva 2014).

Statistics Finland has published figures portraying the different sources and their market shares for electricity production in year 2012. The combined production capacity was 67,7 TWh, which consisted primarily of hydropower (16,7 TWh), wind power (0,5TWh), nuclear power (22,1TWh), condensing power (5,2TWh), and combined electricity and heat production (23,3TWh). In addition, Finland imported 17,4TWh of electricity to reach a combined amount of 85,1TWh (Statistics Finland 2013). In 2013, renewable energy sources accumulated to 36% of electricity production (Energiateollisuus 2014). Due to the figure already being close to the goal set in the energy policy, there is very little pressure for large-scale changes in energy policy of Finland, including increases in possible subsidies. However, importing 17,4TWh of electricity shows that there is still demand that cannot be met by current domestic electricity production, but official energy policies at the moment do not focus on improving Finland's energy autonomy. Instead, according to a report published by the Ministry of Employment and the Economy, improvements in energy autonomy are considered to be a welcomed side-effect of improvements in energy efficiency and increased use of renewable energy (Ministry of Employment and the Economy 2014: 23). However, the report claims a long-term goal that states that Finland should be able to annually produce enough electricity to cover its yearly electricity demand, but even in this case, actual autonomy would be dependent on seasonal, climate, or other market aspects (Ministry of Employment and the Economy 2014: 25).

5.1.2 Economic

The Finnish economy is currently growing very slowly. In 2016, the expected economic growth is only 0,7%. However, the harmonised index of consumer prices fell by 0,1% in 2015, and is expected to grow by 0,3% in 2016 (Kilponen et al. 2015). In addition, interest rates in Finland are currently very low. As table 1 illustrates, data from the Bank of Finland shows the Euribor interest rates at negative levels on 21.04.2016 for all time periods from 1 week to 12 months.

Table 1 Euribor Interest Rates (Suomen Pankki 2016)

	1 week	1 month	3 month	6 month	12 month
21.04.2016	-0,361	-0,342	-0,249	-0,143	-0,011

These effects coupled with recent labour market agreement means that real earnings rise slightly in the near term (Kilponen et al. 2015). Public finances are also seeing an unusual period, as amount of public debt will continue to rise up to 68% of GDP in 2017. This effect is being driven by 3% annual deficit (Kilponen et al. 2015).

Looking at the economic factors more closely related to solar panel leasing, it is important to review energy prices. Electricity is one of the key infrastructural elements that affect the overall economy of a nation. In Finland, the price of electricity from the grid is made up of two parts, which are the actual cost of electricity per kWh, and the cost of transferring the electricity. According to the Finnish Electricity Authority, the average cost including taxes and transfer rates for electricity from the grid with a 2-year contract was approximately €0,14/kWh for the time period 04/2014 - 04/2015 (Energiavirasto). This information is confirmed by Eurostat, who claims that Finland consumer prices for electricity are approximately €0,15/kWh compared to EU-28 average of approximately €0,20/kWh (Eurostat 2015). Therefore, on economic basis, Finland's current electricity prices are at a relative cheap level.

In addition to cost of electricity production and competition in the industry, current interest rates should be considered as they affect consumer decisions. The low interest rates provide a good basis for financing the business-model, as the current low interest rates could be used to attract investors if the ROI for solar panel leasing will prove to be sufficient. However, the low interest rates also mean that potential customers would be able to secure a loan with low margins in order to finance the purchase of a solar panel system.

5.1.3 Technological

In order to understand the type and efficiency needed from a solar panel system, it is important to understand how much electricity a typical household consumes in a year. The Finnish Ministry of Employment and the Economy published a research report titled Household Electricity Consumption 2011 on 26.2.2013, which describes energy consumption patterns for the year 2011 in Finland. Adato Energia Oy conducted the research in cooperation with several Finnish energy companies from 2011 onwards. The same research project was conducted previously in 1993 and 2006.

The research separated electricity consumption based on three types of living. The types were: 1) apartment buildings, 2) row houses, and 3) houses. Due to the fact that solar panels are usually installed on the roof of a building, all further considerations are based on the energy consumption of houses, as installation of solar systems becomes problematic in apartment buildings and row houses due to multiple households sharing the roof-space of a single building. Therefore, the preliminary market segment also becomes clear, the business would focus on providing solar panel systems to house-owners.

The report presented average electricity consumption for households with both 2 and 4 persons. Both examples are presented for houses that use district heating as their primary source of heating. The average electricity consumption for a 4-person household living in a house in 2011 was 7300kWh/year, and the same figure for a 2-person household was 5500kWh/year (Finland Ministry of Employment and the Economy 2013: 39, 40).

It is important to note that these figures are for the average household, and the actual electricity consumption for a single household is highly variable, depending on what appliances and how much of them the household uses.

As noted earlier, the efficiency of solar panels is still relatively low. As the efficiency increases and prices become lowered, the solar panel industry will become more attractive in Finland as the price per kWh becomes lower. The high rate of increase in efficiency suggests that the global solar panel industry is advancing at a fast rate, and

therefore other advances besides increased efficiency are also possible. Together these improvements could make the industry much more attractive in Finland.

5.1.4 Legal

As discussed earlier, the research in the legal section is focused on two of the main concerns relating to solar panel leasing, i.e. laws regarding leasing and laws regarding installation permits.

No specific leasing laws exist in Finland, but it is mentioned in other laws, such debt restructuring laws. According to Fondia, there are 3 main types of leasing in common use in Finland. In rahoitusleasing (finance leasing), a finance company purchases an asset and rents it to a customer. Another method is käyttöleasing (usage leasing), in which the producer/seller of on asset rents it directly to a customer, and thirdly huoltoleasing (maintenance leasing), in which maintenance of the asset is included in the leasing contract.

Because no formal law exists, the business and the customer are free to create their own terms and conditions for the lease of the asset. The contract can therefore be of any length, but typically 3-6 years. The contract can include an option for the customer to buy the asset after the contract term has reached its end, and possible fines can be written into the contract if either of the parties fails to fulfil their responsibilities, e.g. maintenance or payments. A leasing contract should include the information of both the business and the customer, the asset that is leased, length of the contract, payment frequency and amount, reference rate, maintenance and insurance details, exit procedures once the contract term reaches its end, and grounds for termination of contract (Fondia).

The fact that leasing contracts can be formed freely and that they are not stipulated by law means that the business would be able to construct them based on customer and business needs. This freedom allows significant opportunities, as the business would be free to design the most suitable contract and not be limited in contract lengths or terms.

According to FinnWind, a Finnish manufacturer and marketer of small wind-turbines and solar systems, solar panel systems that are installed on the roof or on the walls do not require installation permissions from the local government in most cases, but some cities still require it (FinnWind). Helsingin Sanomat confirms this information in an article published on 15.3.2015 about solar panels (Janne Toivonen 2015).

The freedom from having to acquire installation permits in most cases is a highly positive factor for the business, as it would allow for quick deployment of solar panel systems and limit the amount of time and resources that dealing with bureaucracy would require. However, the business would have to have strong knowledge of which cities it is free to do so without permits, and which cities still would require them. The cities that would require permits would be more difficult areas for the business. Therefore, this information would require more in-depth research and interviews with different city officials to confirm the facts for each individual city.

5.1.5 Environmental

Due to Finland's northern location, the amount of solar energy available for solar panels to use is somewhat limited. According to Motiva, the amount of energy on a horizontal level is approximately 1000kWh/m2 per year in southern Finland. Solar panel capacity is rated at peak kilowatts (kWp). 1 kWp produces approximately 800-1000 kWh/year in southern Finland and 600-700 kWh/year in northern Finland. The monthly amount varies due to changes in temperature and hours of sunlight, and during the months of December and January when the sun is at its lowest, barely any solar energy can be harnessed (Motiva 2015).

In order to asses the effects further, data is needed to present monthly electricity production capacity for solar panel systems. ArevaSolar Oy offers a calculator for estimating the expected monthly electricity production for different sizes of solar systems. Based on average electricity consumption for 2 and 4 person households described earlier, the systems chosen for the analysis were 5,5kWp and 8kWp. As the location and direction of the solar panels also have an effect on their electricity production capacity, the analysis was conducted for a system installed in Helsinki at a 40-degree

angle facing south. The figures are presented monthly from January to December in kWh.

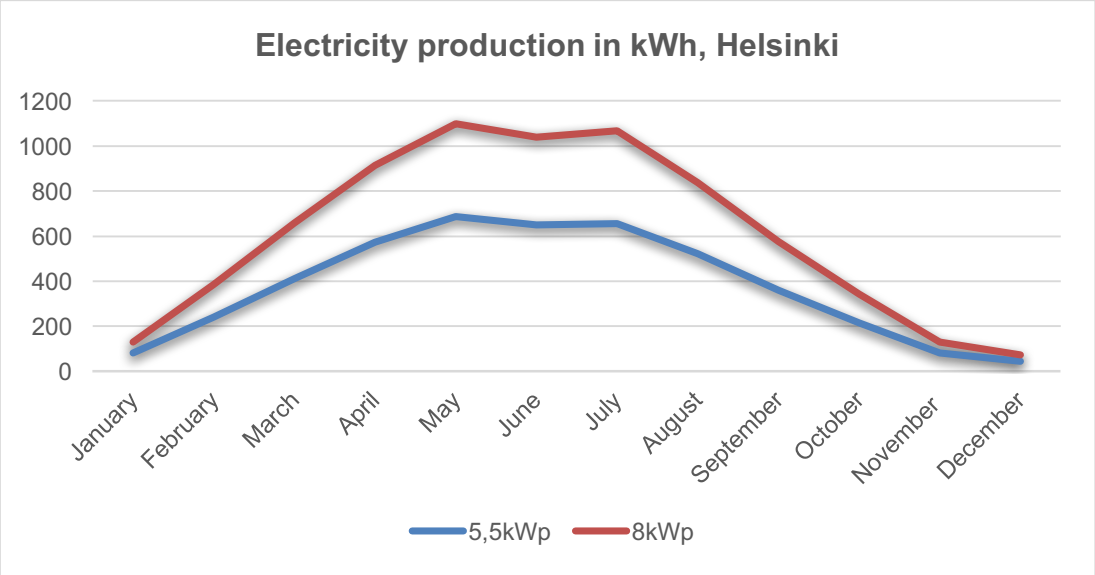

Figure 8 Monthly Electricity Production (ArevaSolar 2015)

As we can see from the figures presented, there is a great variance in the monthly output, reaching significantly higher values during the summer months and gradually decreasing towards the winter months. Therefore, if the system size is chosen so that it produces sufficient electricity during the winter months, large quantities of electricity are wasted during the summer months as the electricity cannot be stored efficiently with current technology. Additionally, if the system is designed so that close to no electricity is wasted during the summer months, then the electricity production would be highly insufficient during the winter months. The smaller 5,5kWp system produces approximately 45kWh in December, enough to only heat a typical sauna 4-7 times (Energiateollisuus 2010), or run 5 40-watt light bulbs for 7,5 hours each day.

5.2 4P Marketing Mix

The 4P Marketing mix is used to analyse the four aspects that customers directly see. These four aspects are product, price, place, and promotion. However, at this stage in the feasibility analysis only the most critical, i.e. product and price are considered. The

place and promotion activities would be analysed at a later stage when the basics of the proposed model are analysed and deemed feasible.

5.2.1 Product

As the basic idea behind the business is to provide solar panels to customers in a way that makes it easy for the customer, the business would only offer total packages that include everything needed in a solar panel system. The packages also should be customized in accordance to the customer's specific needs. The size of the solar system should be designed in a way that provides sufficient electricity to the user, but not have much extra capacity as electricity from solar panels cannot be stored efficiently with todays technology. Additionally, the larger the system, the higher the costs of building one become. Therefore, in order to reach lowest cost-to-benefit, the capacity should be designed fairly specifically to the user in question.

However, at this point product packages can be designed to the needs of an average household as described earlier. The described examples were a 2-person household and a 4-person household, both equipped with district heating. For simplicity's sake, the costs are calculated by using systems from local established solar panel vendors. The costs for the systems and their installation used in this research include profit margins of the established corporations.

SolarShop Bergman Oy offers a 5kWp ready to install system using 20 Q-Cells 250w panels for €7999 (SolarShop 2015). When the system is installed facing south, it has an expected yearly output of 4400kWh, which is 1100kWh below the average electricity consumption of 5500kWh/year for a 2-person household with district heating. They also offer a 7.5kWp ready to install system with 30 of the same panels for €11980 (SolarShop 2015). It has an expected yearly output of 6600kWh when installed facing south. Such a system provides close to the average yearly consumption of 7300kWh for a 4-person household with district heating.

Installation costs are based on the prices portrayed by Fortum Oyj, and are only used as a base for rough estimates at this point. Fortum Oyj charges €2910 for installation of a 4,5kWp, and €4250 for a 7,5kWp system (Fortum 2015).

5 kWp:

System cost: €7999 + Installation: €2910 = Total cost €10909

Yearly electricity production: 4400kWh

7,5 kWp:

System cost: €11980 + Installation: €4250 = Total cost €16230

Yearly electricity production: 6600kWh

5.2.2 Price

Based on the system and installation costs presented in the previous chapters, calculations are now presented for determining the contract length based on competitive pricing. The required ROI of 9,8% as per S&P 500 average return is added to the costs of the business. The contract term length is then determined by calculating how much an average household pays for electricity annually, matching that price per year, and dividing the total costs by the yearly price.

5 kWp system:

Total cost for the solar panel system and installation: €10909
Required ROI: 9,8% as per S&P 500 average return
Cost including required ROI: €10909*1,098 = €11978,08
Yearly electricity production: 4400kWh
Current average electricity price from the grid: €0,14/kWh
Current average cost for 4400kWh of electricity: 4400kWh*€0,14/kWh = €616

Contract term length to reach a price of €616 per year:
€11978,08 / €616 per year = 19,44 years

7,5 kWp system:

Total cost for the solar panel system and installation: €16230
Required ROI: 9,8% as per S&P 500 average return
Cost including required ROI: €16230*1,098 = €17820,54
Yearly electricity production: 6600kWh
Current average electricity price from the grid: €0,14/kWh
Current average cost for 6600kWh of electricity: 6600kWh*€0,14/kWh = €924

Contract term length to reach a price of €924 per year:
€17820,54 / €924 per year = 19,29 years

It is important to remember that the calculations present rough estimates, and are simply used to get a preliminary idea of the contract length needed to be able to compete with price. The 30% support from the government could help reduce the contract length by 30%. However, even with the support, the contract lengths would have to be close to 14 years, which is a very long commitment period considering typical leasing contract length of 3-6 years as noted earlier.

5.3 SWOT

The SWOT analysis is based on the findings from research in the previous chapters. The data is analysed in regards to market and industry conditions and price and product considerations. The SWOT analysis also describes competition in the industry under the threats section.

SWOT Tool	Internal	External
Positive Factors	**Strengths** Renewable energy source New method for consumers to acquire a solar panel system	**Opportunities** Government subsidies Increasing awareness of need for renewable energy Freedom to formulate suitable contracts Advances in core technology
Negative Factors	**Weaknesses** High initial cost Requires long-term commitment from customers	**Threats** Challenges imposed by the climate Competition in electricity production Competing methods for financing solar panel systems

Table 2 SWOT Analysis for Solar Panel Leasing

5.3.1 Strengths

Renewable energy source:
Electricity produced by solar panels is renewable energy, and can be considered a long-term solution for energy needs.

New method for customers to acquire a solar panel system:
At this point, the author is not aware of any business providing solar panels as a leasing product in Finland. Therefore, if a customer would want to lease a solar panel system, the new business would be the only opportunity.

5.3.2 Weaknesses

High initial cost:
Currently solar panels are still an expensive product that pay themselves back only after years of use. This means that the business would require large sums of capital at the beginning, and wouldn't see profits for many years to come.

Requires long-term commitment from customers:
The need for a long contract length means that customers have to commit to the product for a very long time, which can be considered as a deterrent as uncertainty of the future might scare customers.

5.3.3 Opportunities

Government subsidies:
The government offers a 30% support for investments in renewable energy. This support could be used to lower the prices for the customers.

Increasing awareness of need for renewable energy:
Public discussion is becoming more concerned with climate change and need for renewable energy, which can affect public opinion and consumer behaviour in the long term quite significantly. The increased public discussion can be seen for example in media coverage of 2015 Climate Change Conference, which took place in Paris.

Freedom to formulate suitable contracts:
The freedom for the business to formulate the contract based on needs of the customer and the business allows flexibility for the business to compete more effectively than it would if contracts were heavily regulated.

Advances in core technology:
The industry is advancing at a fast rate and will become more competitive with other electricity sources in the future.

5.3.4 Threats

Challenges imposed by the climate:

Due to the variance in climate, solar energy does not work as the only source of electricity in Finland, but can be used as an additional source to the typical grid electricity. The type of system a customer would need and lease is therefore dependent mostly on the consumption of electricity in the household and how much the customer is willing to pay, as larger systems that are able to produce sufficient electricity even in the winter are naturally more expensive. The seasonal changes present another challenge as well; solar panels are not able to provide sufficient electricity during the time of year when electricity is most needed, i.e. during the coldest and darkest months of the year, and provide much more electricity during the summer months when consumption is lower due to a drop in heating and lighting costs. Therefore, finding the most efficient size for the system is difficult.

Competition in electricity production:

Competition is also a large threat to the proposed business model. Electricity production is a heavily competitive industry, and there are multiple established corporations. In addition to grid electricity providers, there are also currently multiple corporations offering solar panels for private customers who are willing to pay the total cost of the system. These corporations range from large national electricity providers to smaller companies focusing purely on solar panel systems, but none of them offer a service based on leasing contracts.

In order to assess competition in the solar panel industry, three companies offering solar panel systems were chosen for a quick analysis. The companies were chosen as they all represent different types of companies.

Fortum Oyj, a large multinational energy provider that operates in Finland, Sweden, Norway, Russia, Estonia, Latvia, Lithuania, Poland, and India. In 2014, their revenue was €4751 million, with profit of €3428 million, employing 8592 people. The core business of Fortum is producing, selling, and distributing electricity and heat, and offering expert services in the energy industry (Fortum 2014).

Solareon Oy was founded in 2014 in Espoo to promote the use of solar energy in Finland. They operate as an importer of solar panels, and offer installation services, solar panel packages, and parts needed to build a customizable system (Solareon).

Ruukkikatot is a subdivision of SSAB AB, a publicly traded corporation listed in the NASDAQ OMX Nordic Stockholm. Ruukkikatot offers multiple roof-related products, such as renovations, metal roofing, water drainage systems, and solar systems (Ruukki 2015).

These three companies show that solar energy as an industry is attracting many players, and the market is still very segmented. In addition to corporations offering solar panels, grid-based electricity that is also 100% renewable can be considered as direct competitor to solar panels, as it can attract roughly the same environmentally conscious group of customers that would be willing to lease solar panels for environmental reasons. For example, HelEn Oy offers a possibility to purchase electricity that is sourced only from wind energy. The cost for pure wind energy is 6,26c/kWh + transfer fees, therefore very close to the total cost average of 0,14c/kWh (HelEn Oy 2016). This competition is a severe threat to the business model due to also being 100% renewable, as is solar electricity.

Competing methods for financing solar panel systems:
The current low interest rates offer an attractive alternative to leasing for customers, as they can negotiate a cheap loan with a traditional financial institution such as a bank to finance the solar panel system.

6 Conclusion and Discussion

The research conducted has brought up significant issues that the business model would face in Finland. The first issue is that Finland's climate has too much variance. The amount of electricity produced by the solar panels varies greatly between each month, as the change in output capacity varies over 10-fold between the dark and cold winter months and the long and light summer months. Due to the variance in electricity production, the size of the solar system cannot be designed in a way that no output is wasted during the summer months and enough output is acquired during the winter months. This leads to two options, either a system that is far too large in the summer months or far too small in the winter months, and both options would reduce the systems efficiency throughout the contract term. In order for the solar system to be efficiently designed, it should only be used during the summer months when output is relatively high and demand is somewhat lower than during the winter months. As many Finnish people own a summer cabin that is mainly used during the summer months, the author believes that summer cabin owners could provide a much more potential customer segment, as the size of the system could be designed in a much more efficient way.

Another problem for the business-model is that the cost of electricity from the grid is very affordable in Finland. At €0,14/kWh, the cost is considerably lower than that of the EU-28 average of €0,20 as discussed in chapter 5.1.2. For example, Denmark and Germany, both countries that have large quantities of solar electricity see average prices of close to €0,30/kWh, over twice that of Finland (Eurostat 2015). This is partly driven by the German and Danish governments focus on adopting renewable energy, as well as heavy taxation of consumer electricity.

The lack of environmental pressure for adopting solar electricity in Finland also raises its own issues. Political decision-making is not as likely to start pushing legislations that would make solar panels more desirable to private customers. As discussed in chapter 5.1.1, the goals for usage of clean-energy are almost reached already 5 years prior to the deadline for the goals, which would also support the assumptions that no signifi-

cant changes are required in this area. Finland's current political discussion is also currently focused on other issues, most prominently the slow growth of economy and increasing debt burden. The solutions discussed in public media revolve more around the issues involved in social- and health services, labour market changes, and infrastructure changes. Even though Finland imports quite a large portion of its electricity, it is not considered as an issue large enough to warrant public debate, and is unlikely to reach that state before the other issues are solved.

The established corporations also present an issue for launching a business based on the proposed model. Companies such as Fortum Oyj have access to very large amounts of capital and already have acquired experience and connections in the industry. The author believes it is safe to assume that if the proposed business model would be feasible and the business could launch its service, the large multinational companies would enter the market quickly and use their greater economies of scale and access to finance to their advantage and push out a smaller start-up.

Current low interested rates present an issue for the proposed business model as well. The customer could negotiate a loan with a bank to finance the purchase of the solar system, pay higher amounts each month for a shorter period of time and then own the system entirely.

Before the research was conducted, the author had an assumption that the business model would be feasible. The assumption was based on the success of SolarCity, which has attained considerable success in the United States of America. SolarCity was founded in 2006 and has since acquired over 275,000 customers (SolarCity). Their business model was based on the idea that customers could save money on their electricity bills by switching to solar panels. Another idea that supported the assumption was that Finland's housing would provide lots of empty roof space that could be used for installing solar panels. After having conducted the research, the author of this paper no longer believes the business model would be feasible in the current market.

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