Lappeenranta University of Technology
Faculty of Technology
Degree Program in Environmental Energy Technology

MASTER'S THESIS

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Date:
June 16, 2014

Comparative Analysis of Solar PV Business Models

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Abstract

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82 pages, 14 figures, 5 tables

Examiners: Professor Lassi Linnanen
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Keywords: case study, business model, SolarCity, Sungevity, solar business model

The goal of the thesis is to analyze the strengths and weaknesses of solar PV business model and point out key factors that affect the efficiency of business model, the results are expected to help in creating new business strategy. The methodology of case study research is chosen as theoretical background to structure the design of the thesis indicating how to choose the right research method and conduction of a case study research. Business model canvas is adopted as the tool for analyzing the case studies of SolarCity and Sungevity. The results are presented through the comparison between the cases studies. Solar services and products, cost in customer acquisition, intellectual resource and powerful sales channels are identified as the major factors for TPO model.

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List of Abbreviations

CSP	Concentrated Solar Power
EIA	Energy Information Administration
ESS	Energy Storage System
EPA	Environmental Protection Agency
GTM	Greentech Media
JV	Joint Venture
RSD	Remote Solar Design
TPO	Third-Party Ownership
kWh	Kilowatt-hour
NREL	National Renewable Energy Laboratory
PPA	Power Purchase Agreement
PV	Photovoltaic
VOST	Value of Solar Tariff
VC	Venture Capital

Solar glossary

Kilowatt hour	It is a unit of energy equal to 1,000 watt-hours, or 3.6 megajoules. Electric utilities and solar companies charge customers in kwh. (B. N. Taylor and Thompson 2008)
Net metering	When consumers install solar energy systems, the electricity production of solar systems and the energy consumption is monitored. Net metering enables consumers to distribute the electricity to grid to earn credit, but draws electricity back if the consumption is more than system production. The utility bills consumers based on the difference between the electricity generated and drawn from grid.
PPA	Power Purchase Agreement (PPA) is a contract that customers purchase solar power at a set rate that normally equally or lower than the price they pay for local utility electricity. Customers only pay for solar power through SolarPPA, not for the solar systems which is provided by solar companies.
Solar lease	Solar lease is one of solar company's financing solutions for customers. With zero to low upfront cost to get solar energy systems by paying monthly bills to solar companies. Solar providers guarantee the solar system production by paying the difference.
Solar panels	Solar panels are the major components of a solar energy system. They are usually made up of photovoltaic (PV) cells, which are installed on rooftop. They convert sunlight into direct current (DC) power. (SolarCity 2010)
Solar inverter	Solar inverter converts the DC from solar panels into alternating current (AC) power, or a standard electrical current as consumer desired.
Batteries	Batteries are used to power customer's home in a utility power outage.
The grid	Customers' homes are still connected with grid to draw electricity from utility company when they require more electricity than generated from solar energy system.
Utility	Customers purchase electricity from a local municipality or a power producer. They produce electricity and distribute it through grid.

1 Introduction

1.1 Solar Energy Background

Energy innovation emerged because of the shortage of conventional energy resources. Conventional energy utilization caused global energy crisis along with serious environmental issues. Renewable energy indicates the unexhausted energy resources from solar, wind and hydropower, etc. The purchase of renewable energy resources to fulfill the increasing demand is strongly proposed by electricity vendors and government to complete the transmission to a sustainable economy.

Conventional energy generation causes severe impacts including air pollution and climate change. The commission of government to improve environmental condition boosts the penetration of solar energy to energy generation. Renewable energy resources reduce the cost of electricity generation—electricity vendors no longer pay for carbon emission reduction credits. The price of emission allowance at 2020–2030 is expected to increase significantly which is decided by EU actions. Additionally, governments exposed incentives to encourage the utilization of renewable energy, which in return improves environmental quality. (Finnish Government 2013)

It is believed that solar energy never depletes. However, one critical disadvantage of solar energy is the high dependence of solar energy on weather as intermittent resource. The production of solar energy is reduced through solar radiation during cloudy and rainy day. Hence, energy storage devices are required for storing solar power in previously mentioned conditions. It brings challenges to solar energy system design and related energy technologies. Moreover, the importance of increasing storage conversion efficiency which makes solar energy more valuable is emphasized to ensure the future of solar energy.

During recent years, PV has shown impressive global growth. Particularly in U.S., it became the third-largest PV installer in 2013 after China and Japan. Lately reported by International Energy Agency that solar power now is around 1 percent of global electricity generation, tending to dominant as mainstream source of power. Commercial (20 kW–1 MW) and residential (under 20 kW)

are the main applications of PV business. However, the rapid growth of Solar market is considered as the result of growing utility scale (over 1 MW) projects. Presented by Solar Energy Industries Association (SEIA) and GTM Research, the U.S. Solar Market Insight Report offers the latest news of Solar industry trends in U.S, including Solar Photovoltaic (PV) and Concentrated Solar Power (CSP). The latest solar market analysis shows U.S. PV installations grew 41% in 2013, compared with 2012. Figure 1 below shows Solar keeps increasing of total electricity generation and became the second largest energy resources after natural gas in U.S. 2013, accounts for 29% of total electricity generation capacity. (EIA 2012; GTM Research 2013)

The competitive pricing of solar energy is the main reason to drive customers to go solar, solar energy has the largest market potential to deliver clean energy with affordable electricity to U.S. consumers through a new business model called third-party financing. Since some companies are limited to the owner-

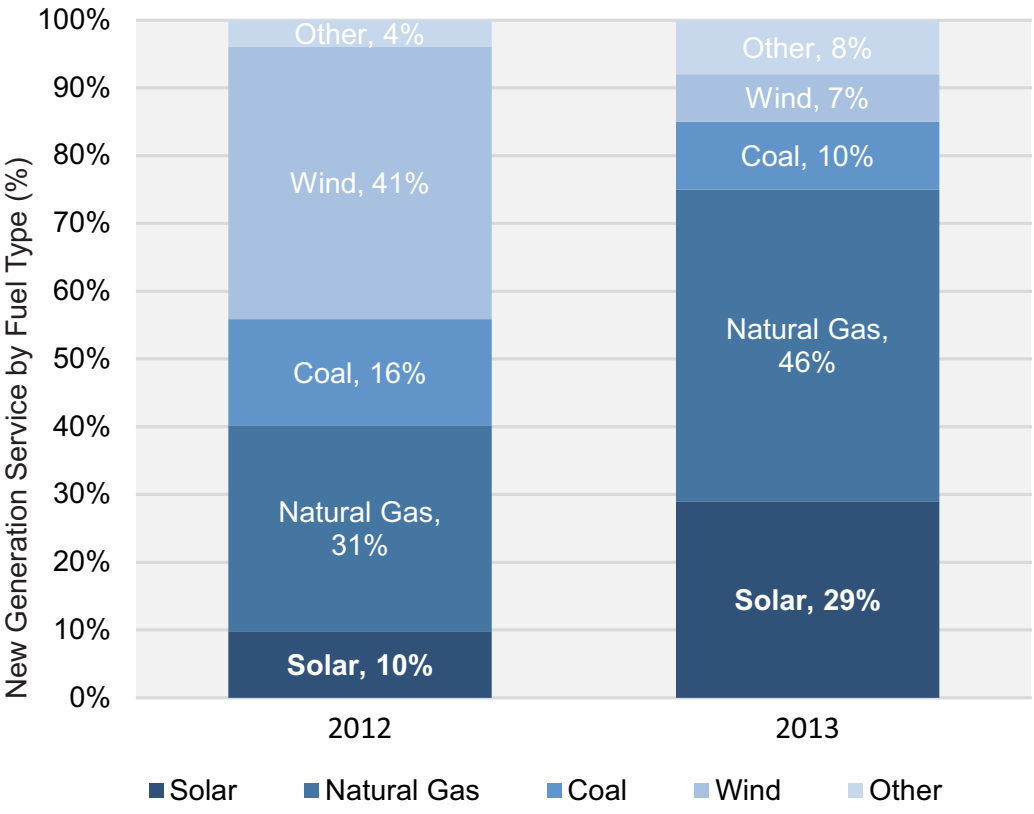

Figure 1: New U.S. Electricity Generation Capacity, 2012 vs. 2013. Source: GTM Research (2013)

ship of solar assets, but they provide financing and related services for system owners. California ranks as the top solar market sharing half of total installations in 2013. (Munsell 2014b) As shown in Figure 2 below, the PV installations grew slowly while there was slightly decrease in average system price before end of 2008. However, PV markets expand rapidly with a significant reduction of solar system price since 2009, to reach a total amount of 12,000 megawatts of PV installations in 2013. GTM and SEIA expect a continuous growth of 26% in U.S. solar market 2014, residential solar market accounts for the most rapid growth. (EIA 2012; GTM Research 2013)

1.2 Goals and Scope

On June 2, 2014, the Environmental Protection Agency (EPA) just announced carbon pollution regulations to cut 30 percent of 1,000 power plants in 2030 that will boost the share of clean energy in total generation. Solar energy is seen as one of the most efficient energy resources to cut the carbon emission. (Lacey 2014b) Third-party ownership model dominates current U.S. solar PV

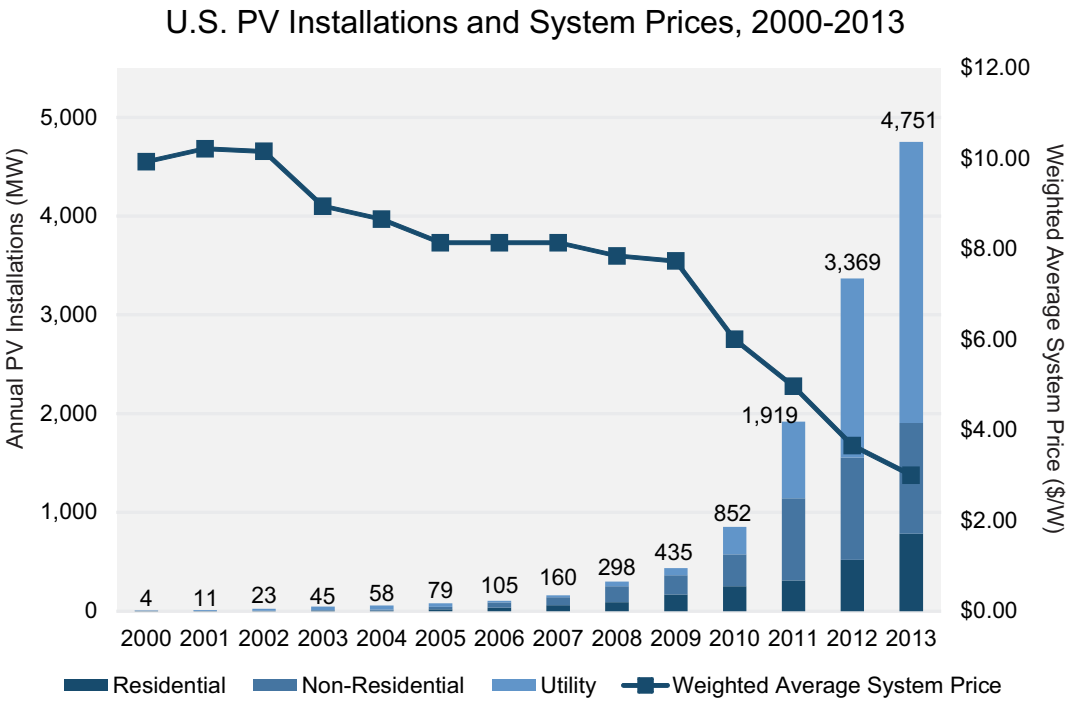

Figure 2: U.S. annual PV installations and annual average system price, 2000–2013. Source: GTM Research (2013)

market and is expected to maintain a continuous growth in residential market, it is essential to conduct a research of TPO to understand how TPO model is applied and differentiated in different solar companies. Therefore, the goal of this thesis is to identify the strengths and weaknesses of TPO by doing a case study research that the result of study can provide scientific proposals of how to improve the efficiency of PV business model.

As shown in the Figure 3 below, solar power provides abundance energy for heating, but mainly for electricity generation. Solar Energy Technologies are classified into two categories: passive and active. Passive solar provides light and heat for structures (EPA 2014). Active solar converts radiation into electricity directly by PV, or by Concentrated Solar Power (CSP) that produces electricity indirectly via turbine. Current solar market is dominated by Silicon based PV systems. The emergence of third-party financing enables more Americans to go solar by removing upfront cost. Hence, the research is focused on the analysis of TPO model from financial perspective over other PV business models, the technologies related in designing, operating and monitoring solar systems and other system components are not included.

1.3 Business Model Theories

Nowadays the increasing competition forces companies to build better business model that it exists as part of business strategy. This part focuses on the theoretical insight of business models. The understanding of the concept of

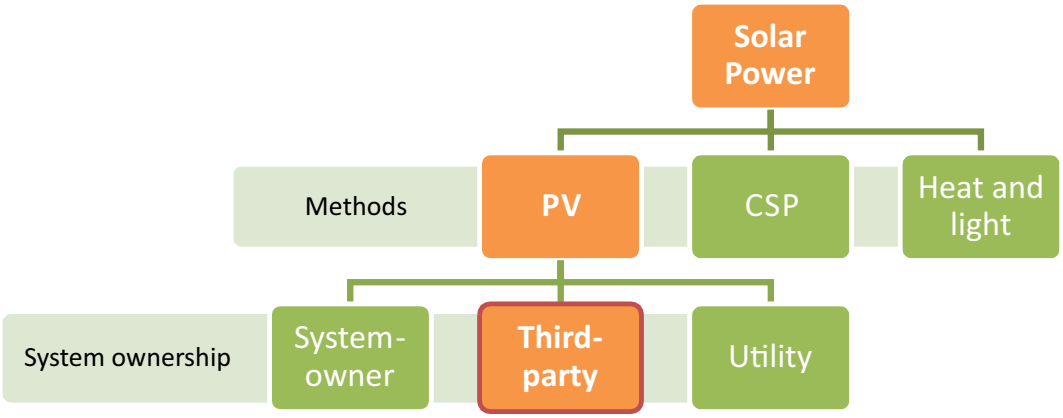

Figure 3: Mind map of solar power where the analysis of the thesis is focused on the third-party ownership.

business model is essential for beginner to start new business and enterprise to improve existing business model to a more powerful one. The theoretical review offers a general explanation of business model and helps audiences to understand the structure of case studies that how the cases are described separately in case study sections.

1.3.1 Definition of Business Model

A business model is the core for the growth of business. Generally speaking, business model describes the principles and logic how a company manages and operates business to generate revenues. It is difficult to take a comprehensive literature analysis of all business model definitions, as there are various definitions of business models, depending on how to categorize in different fields of application.

As shown in Table 1 below, Henry Chesbrough defines business model by the functions that it must create value within the value chain and it must capture a piece of value for the focal firm in that chain (Chesbrough, Vanhaverbeke, and West 2008). Hence, the value creation and value capture is the base for a business model; it describes how a company delivers its services or products to attract values from customers. Amit emphasizes the creation of value: "A business model depicts the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities" (Amit and Zott 2001). Mark Johnson describes business model as the way how companies deliver value to customers and in return make a profit (Johnson 2010). It is difficult to draw a common concept to satisfy all researchers since interests differ from individual point of view (Zott, Amit, and

Table 1: Different concepts of a business models.

Source	**Definitions of business model**
Chesbrough, Vanhaverbeke, and West (2008)	Function to create and capture value
Amit and Zott (2001)	How to create value through business opportunities
Johnson (2010)	How to make profit by delivering value

Massa 2010). However, the concept of business model is flexible and versatile and is able to adapt to every company with the purpose of improving existing business models.

The thesis author follows the concept described as the rationale of how an organization creates, deliver and captures value (Osterwalder and Pigneur 2010). The business model concluded in the book is presented as Business Model Canvas including nine building blocks to show the logic how a company generates value which covers the main four areas of a business: Customers, offer, infrastructure and financial. This method is applied to solar PV business model and presented in Table 2.

1.3.2 Business Model Function

Why business models are emerging as an important object of analysis? The answer to the question relies on the functions of business model. As business model is considered as the core of business, it defines how a business tends to spend time and resources for a profit. A successful designed business model functions to create more values by improving the overall competitive strengths from all perspectives. It improves the products and services, expands markets, secures the resources, controls the costs with the final aim to maximize the profit through a serial of activities. Furthermore, business rules are decided by business model which guarantee proper business executions, thus it controls the whole organization. (Johnson 2010)

1.4 Operationalization of The Theoretical Background

This part explains how to apply the chosen business model theory—*Business Model Canvas* to the case studies. As SolarCity and Sungevity are chosen as two case studies based on their different expertise in solar business. It starts with describing nine basic building blocks of both companies' business models, including *Customer Segments* (CS), *Value Proposition* (VP), *Channels* (CH), *Customer Relationships* (CR), *Revenue Streams* (RS), *Key Resources* (KR), *Key Activities* (KA), *Key Partnerships* (KP) and *Cost Structures* (CS) (Osterwalder and Pigneur 2010). The nine building blocks are listed in Table 2

with the questions that help to understand each block of solar business and identify the corresponding answers. However, each block differs between companies according to different business strategies. For instance, SolarCity serves both residential and commercial customers, but Sugevity only has residential customer segment. Therefore, each building block of two case studies is recognized and described in detail separately in case studies. The same business model theory is applied to both cases to ensure they are analyzed fairly, which furthermore ensures the reliability of research results.

Table 2: Working group questions applied to solar business model building blocks.

Business Model elements	**Key Questions**
Customer Segments Who are Solar Business customers?	Residential and commercial application
Value Propositions What products and services do Solar Business provide for customers?	Solar energy products and services, finance solutions and services
Channels How do solar companies reach customers?	Social media, retail stores, sales team
Customer Relationships What type of relationship with customers?	Solar representative, online monitoring systems, community program
Revenue Streams What value a customer is willing to pay? and how?	Sales of solar energy systems, solar leasing, related products and services
Key resources What is the most important asset?	Human resources as key asset, additionally, technologies related to solar system design, installation and maintenance, financing
Key Activities What Key Activities are required to make Solar Business Model work?	Solar energy system monitoring and maintenance, employee training
Key partnerships	Electricity end-users, vendors, governments, investors
Cost Structure What are the most important costs inherent in Solar Business?	Production and delivery of PV systems, technology development, network operation and maintenance

1.5 Methodology

1.5.1 Literature Review of Case Study Method

Case study research is one of the most important research methods. Other methods are experiment, survey, archival analysis and history. Each method has its own logic in collecting, analyzing data and therefore, the advantages and limitations of each method depend on the situation that it is applied. Generally, different research methods are chosen according to three conditions as shown in Table 3 below. Correspondingly, case studies are selected when "how" and "why" are being questioned, the researcher has no control of events and the focus is about contemporary event in real-life. (Yin 2009)

Yin (2009) introduces a technical definition of case study which consists of two parts. The first part starts with the scope of a case study that the case study method is needed when the researcher wants to better comprehend a contemporary phenomenon under the circumstance of real life, but the ability to control the phenomenon and context is limited. Other technical characteristics forms the second part including data collection and data analysis. (Yin 2009) The definition of case study gives the features for the consideration of choosing a research method. However, more than one methods might be considered equally under some situations, it is possible to use multiple research methods at the same time. The researcher should be able to identify an op-

Table 3: Relevant situation.

	1)	2)	3)
Method	Form of research question	Requires control of behavioral events?	Focuses on contemporary events?
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival Analysis	Who, what, where, how many, how much?	No	Yes / No
History	How, why?	No	No
Case study	How, why?	No	No

timal research method. Despite the differences with other research methods, there is variations within case study research such as single- and multiple-case studies. The further purpose of understanding case study is to design case studies to collect, present and analysis data fairly. Case study can be used to meet various research motivations.

1.5.2 Implementation of The Methodology

The case study research method described by Yin (2009) is adopted for the implementation of this thesis work. The process of doing case study research is structured as below with the objective of identifying the weaknesses and strengths of PV business model. As shown in Figure 4 below, plan, design, prepare, collect, analyze and share are the main processes to compose a case study research. Each process is explained to present how the author accomplishes the study step by step.

Plan The first step of starting a research is to choose research method, depending on the questions being asked under certain condition as presented in Table 3. The goal of this thesis work is to improve business model for future by analyzing business models that dominate current solar market. It brings

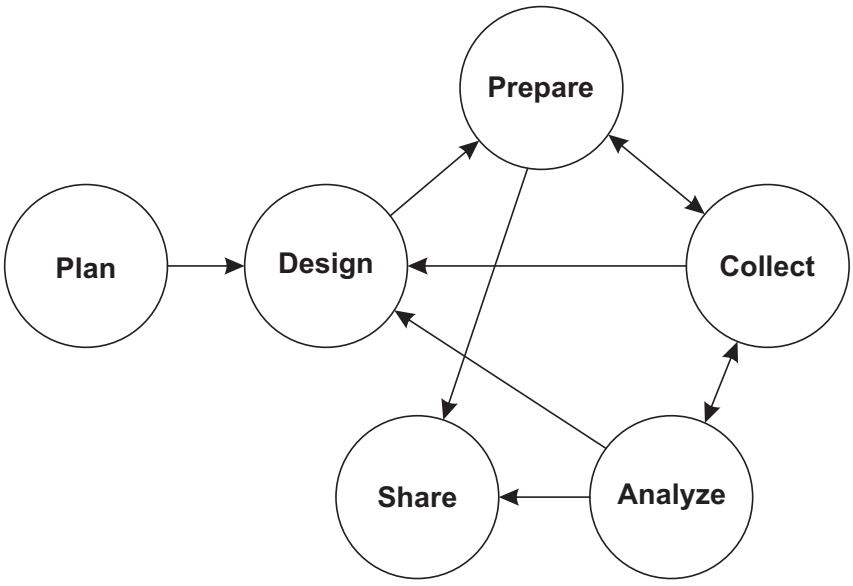

Figure 4: Flow chart of case study research process.
Source: *Case Study Research* (Yin 2009)

the questions that the necessities of why a better business model is needed and how to define, respectively meet the questions of "why" and "how". Furthermore, the desire of better understanding solar PV business models requires the study of multiple real cases to reveal the strengths and weaknesses of existing business models. Hence, instead of conducting a single-case study, a multiple-case study is chosen over other research methods in this thesis work. Two cases are selected and analyzed that SolarCity is chosen based on its leading position in the U.S. solar market and Sungevity is placed as another case based on its strength in residential market. Multiple-case study requires more efforts for collecting and analyzing data, the whole study however tends to be more rational compared with single-case study. (Yin 2009)

Design "Why" and "how" to define a better business model decides the case study method being adopted. The next step is to decide what to study and design how to perform the case study. It requires to illustrate and analyze some examples of the solar companies with same business model. As this thesis is a multiple-case study and each case represents as an individual unit of analysis, therefore, it requires to collect relevant information related to business model of both cases. (Yin 2009)

Additionally, the design should tell what needs to be done after the data is collected. The related information of each case is analyzed by Business Model Canvas, a tool to describe, analyze and design business model according to the handbook, *Business Model Generation* (2010) written by Alexander Osterwalder & Yves Pigneur, in case studies sections.

Prepare A proper preparation for the collection of data provides a firm base for the analysis of case studies. The primary skills required for this thesis indicate the activities engaged in the collection of extensive information of each company's business model from multiple resources. The evidence for the case study of solar PV business model refers all kinds of reliable information regarding to all aspects of solar business such as reports, news, magazines about solar project, markets & policy, solar finance & VC. (Yin 2009)

Following the theory of *Case Study Research*, the author of the thesis should

be able to ask questions continuously for the collected evidence and figure out why, which push the collection forward to search for more evidence. For instance, a news was released that SolarCity introduces energy storage for business through the partnership with Tesla, the author can pose questions as what is Tesla and its advantages in battery technology, the market potential of energy storage systems, etc. It offers a thorough evaluation of energy storage system such as the driving forces, limitations and advantages. Moreover, author needs to keep an open mind for gathering information with a critical sight, particularly the ability to focus on the latest updated information about solar market that there is always news of new fundings or projects or new solar products. In the meanwhile, the original purpose of this thesis is to identify the strengths and weaknesses through the case studies of two solar companies, the author needs to be able to deal with the unexpected result if the evaluation fails to satisfy the original plan.

Collect This thesis follows strictly to the rules and regulations during the data collection process with a rigorous scientific view, to ensure the quality control of the evidence collection which furthermore strengths the reliability of the analysis result. The sources of evidence related in the two case studies cover various channels: reports from solar company, articles released about solar, interviews such as conversations with the company CEO and customers, regulations exposed by government towards solar market. Overall, the collection strategy is to maintain a multiple sources to facilitate the analysis of all aspects of solar business model. (Yin 2009)

Analyze The case description analysis strategy is applied in the thesis by explaining each company's business model structure. It defines what should be included and how to analyze the data. The objective of case studies is to develop a better business strategy for future market development based on the data collected from current status, explanation technique therefore is used as the analytic technique. Furthermore, the two case studies are explained systematically by applying Business Model Canvas, even though each case differs in details. (Yin 2009)

Analytic process is taken as the most important section of whole thesis to

present a high quality research. Both case studies are analyzed sufficiently to reveal the advantages and weaknesses, to generate recommendations for future business models that meets the initial goal of research plan.

Share The final step of thesis is how to compose a report to present and share the study results with audiences, as for a thesis, the audience are probably only the thesis committee who grade thesis. For other nonspecialists, this thesis functions as a delivery of general information about solar business models and related solar market activities and potential trend. Multiple-case studies are used in the thesis however, each case study is discussed in separate sections with an additional section analyzing cross-case study and presenting results. Furthermore, the structure of case studies are following theory-building logic that what the business model are comprised to reveal each segment's arguments. (Yin 2009)

2 Solar Business Models

The global transformation to sustainable society enables the notable growth of solar energy penetration to electricity grid. Wholesale, retail utilities and nonprofit organizations are paying more attention to solar energy market. The developing technologies guarantee the accessible and stable connection with main grid network. PV markets tend to act as a major area of solar energy markets. The rapid growing PV market affects the planning and design of whole grid network, which has an impact on how utilities run business. Thus, an appropriate business model is the key to maximize a company's benefits to create more values from customers.

2.1 Current and Emerging PV Business Models

Figure 5 shows the evolution of PV business models that have transferred from zero generation business model to 1st generation model and up to 2nd generation model. Zero generation model refers to the original business model that the customer owns and finances PV systems, additionally, managing the operation and maintenance. Even though, 1st generation business model provides a broader market, but the emerging 2nd generation business model tends to be the dominant business model in future. (Frantzis et al. 2008)

Current PV business models are categorized by system ownership and application. Possible ownership of PV system can be system user, third-party or utility. Utility ownership only takes a minimum portion in whole PV market, as utility owners may not own the generation or are limited to certain generation by law (Frantzis et al. 2008). Different business models are adopted according to specific energy market situation, government policies and regulations. Currently global leading solar markets are U.S., Germany and Japan. Third-party ownership secures adequate financing support and is expected as dominant business strategy in recent years and future. (EIA 2013)

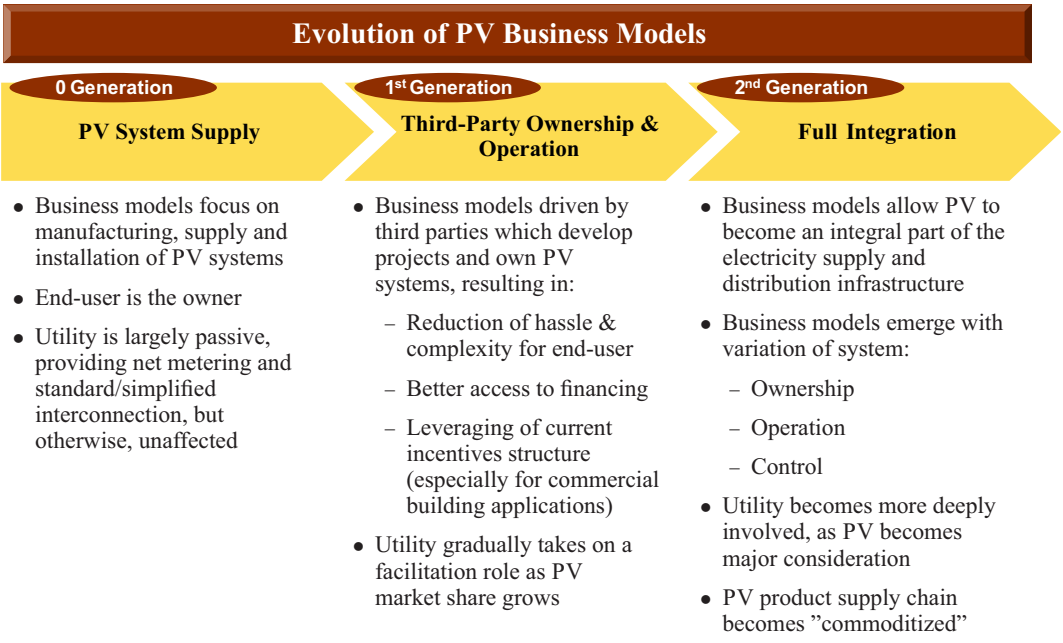

Figure 5: The evolution of PV business models from zero generation to 1st generation and up to 2nd generation PV business model.
Source: Graham et al. (2008)

2.2 Future PV Business Models

Many new business models are emerging, but still in development stage. In future PV markets, increasing electricity price, feed-in tariffs and cost reduction of PV systems may result in the market expansion in on-site consumption of self-generated solar power with a new solar business model. The significant penetration of solar power to grid draws more considerations from utilities about system placement, operation and control, which create new business models. (Graham et al. 2008) Third-party ownership provides consumers with affordable solar price while avoiding extensive energy system upfront costs and following maintenance and monitoring costs. Owners benefits by selling back electricity to consumers, which is generated by solar systems installed on consumers' rooftop (Graham et al. 2008). Third-party financing model satisfies consumers the desire of energy independence and economic electricity price. However, those changes in customer demands require additional solar services and products in future solar systems, such as energy storage systems, it brings challenges to system design and cost.

3 Case Studies

U.S. solar market ranks as one of the top solar power countries. U.S. residential PV markets are transferring to a new model that most of the solar system are not owned by residents, but others which is referred as third-party ownership (TPO) (LaMonica 2013). Different companies have their unique business models. Third-party finance is estimated to propel the growth of residential market in U.S. from $1.3 billion into $5.7 billion in 2016. (SEIA 2013)

3.1 SolarCity

Founded in 2006, SolarCity is an American company delivering clean energy to homes and businesses. It ranks as America's No.1 full-service provider in demonstrating sustainable business model by providing solar energy. SolarCity has succeeded in reducing customers' monthly electricity bills by providing affordable solar systems. With extensive experience with companies, schools and businesses, SolarCity guarantees the production of solar system along with high standards based on customers' unique desires.

Customer Segments

SolarCity provides an alternative to lower utility bills for thousands of customers all-over 15 states with 31 operation centers throughout U.S. SolarCity generates revenues from individual customers, commercial and government entities with high credit through selling solar energy, other energy services and products. SolarCity offers customer-design solar system for customers with high engineer standards by taking a comprehensive look into customer's energy usages to identify possible improvements. A customer chooses SolarCity as solar provider every three minute.

Residential It includes all individual homeowners and homeowners who join in community solar program that are willing to switch to sustainable, clean energy with lower energy costs. Community solar programs enable communities collectively to adopt solar energy in partnership with local government

and organization without requiring any local government funds. More homeowners choose SolarCity as solar power provider over other providers to go solar. SolarCity takes leading place in U.S. residential solar market, with a market share of 32% in third quarter of 2013. It serves over 1,000 communities in Arizona, California, Colorado, Connecticut, Delaware, Hawaii, Maryland, Massachusetts, Nevada, New Jersey, New York, Oregon, Pennsylvania, Texas and Washington D.C. with the potential of expanding to more states. Through the connection of SolarCity with local building departments, SolarCity makes its easier for homeowner to go green by knowing in advance how to design solar system to meet or exceed city electrical and building codes. SolarCity encourages neighbours to join in solar systems, more green collar job opportunities are created in community solar offices which boosts local economy. (GTM Research 2013)

Commercial SolarCity has successfully installed solar systems for thousands of companies over the country. The client portfolio refers to several business sectors and is listed in Table 4. It includes areas such as high tech, manufacturing, nonprofit, multifamily housing, agriculture and retail.

Government SolarCity provides solar systems for universities, military and other government entities. However, commercial and government customers are generally considered as one customer segment. SolarCity has extensive experience with Fortune 500 companies, schools, government organizations and other international companies. The business is evenly taken by commercial and government customers based on the cumulative megawatts deployed.

Value Propositions

Value Proposition is a bundle of products and services that company meets customer's needs. SolarCity provides full service for customers to go green energy. SolarCity delivers Better Energy and energy-related products and services to customers at a reasonable price. With improved technologies and extensive experience, SolarCity guarantees the ability of delivering products and services to satisfy different customers' needs.

Table 4: Client portfolio of commercial and government customer segments.

Commercial	
Retail	Walmart, eBay, Walgreens
High Tech	eBay, EPRI, ARMLS, SpaceX, Bradford Technologies, National Semiconductor
Manufacturing	Heritage Paper, Greenwaste Recovery, High Point, Mayway
Multifamily housing	Campus Crest Communities, Essex Housing Complex, Sheridan Station
Government	
Nonprofit	Maui Arts and Cultural Center
Education	Los Angeles USD, lancaster School Districts
Military	Davis-Monthan Air Force Base, Hickam Air Force Base
Government	City of Lancaster, City of Sacramento

Full-service solution SolarCity is a leading solar provider with providing all-in-one service for both home and business customer segments as shown in Figure 6. It takes care of each step for clean energy revolution, including engineering, financing, permits, installation and ongoing monitoring. Solar system is managed throughout project beginning to end of the life of contract. Every three minutes one homeowner chooses SolarCity to switch to clean energy than other solar companies. (SolarCity 2014a; SolarCity 2014b)

Solar Energy Products

Solar Energy Systems Solar panels are the major components of solar energy systems. SolarCity only purchases best-in-class equipments from top-rated solar panels manufacturers to guarantee the high performance and quality of solar energy systems. The selection of optimal solar panels depends on customers' local weather, roof space, architectural, aesthetic and energy-production needs.

SolarPPA and SolarLease Finance Products SolarCity believes clean energy is affordable for everyone, it offers several financial options to fit different customer needs. SolarPPA and SolarLease are both great options for

Figure 6: Composition of SolarCity's full-service.
Source: SolarCity (2014a)

customers to purchase solar energy from SolarCity. They offer similar financial advantages to customers that SolarCity charges customers a monthly fee for the power produced by solar energy systems. However, the primary difference between Lease and PPA is that the monthly payment is pre-determined and includes a production guarantee in the Lease contract. In power purchase agreement, customers' payments are based on the amount of electricity is actually consumed by per kilowatt hour or kWh. SolarCity offers flexible payment options to fit customer's financial goals under both SolarPPA and SolarLease contracts. Customers can go solar with no upfront cost or prepay for some of the electricity to lower the ongoing monthly bills. Even option to go solar without any monthly payments by fully prepay for SolarPPA. With SolarPPA, customers can purchase solar system after year five.

SolarCity is responsible for all aspects of solar systems and guarantee for the production of solar electricity. Currently, SolarPPA and SolarLease have 20-year terms, compared with only 15 years before 2010.

Energy Efficiency Products and Services

Energy efficiency products and services aim to upgrade energy efficiency to reduce energy loss which lowers customer's electricity bills. It is about to

power customers' current lifestyle with less energy consumption but a higher energy efficiency. As part of the commitment with customers that SolarCity guarantees highest solar system performance and the best value. As shown in Figure 7 below, low energy efficiency is not only a problem of old homes, but also relatively new homes can have low efficiencies due to air leakage mostly through building envelope and duct system. The relationship between a home's efficiency with its age is not directly correlated as shown by years of home energy efficiency evaluation data. (SolarCity 2013)

Home Energy Efficiency Evaluation Every new SolarCity residential customers receives a home energy efficiency evaluation to provide the data for analysis. The analysis is done through SolarCity's proprietary software, evaluation result is shown as a detailed in-home diagnosis which identifies energy uses and loss to generate more valuable and actionable solutions with lower energy costs. Every customer can access the evaluation result through a self-guided tour of own personalized website.

Energy Efficiency Upgrades Base on the analysis of home energy efficiency evaluation, SolarCity identifies all possibilities of reducing energy lose,

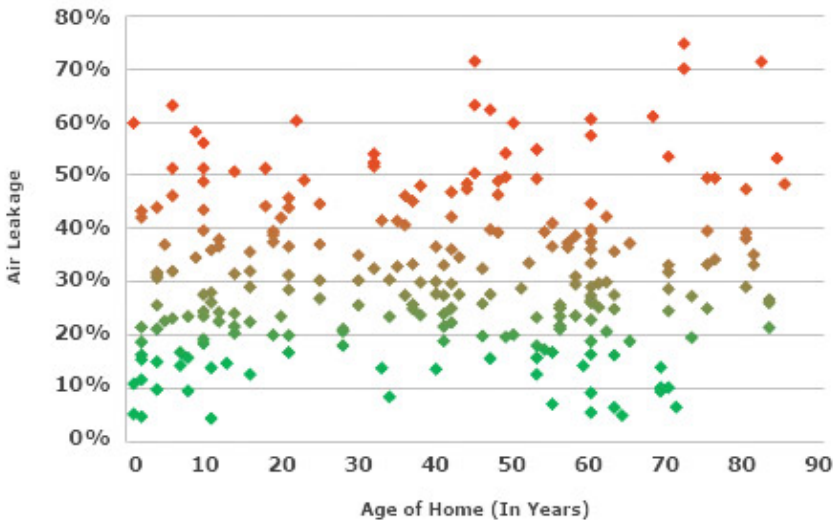

Figure 7: Air leakage through building envelope and duct system compared to age of home. No direct correlation indicates that air leakage is not only a problem of old homes; all homes can benefit from energy efficiency.
Source: SolarCity (2013)

it recommends energy upgrades and repairs to increase energy efficiency. SolarCity home energy improvements includes insulation, high efficiency water heaters, high efficiency heating/cooling systems, air sealing, duct sealing and repair, solar thermal, solar electric, pool pumps, energy star appliances and window replacement. As committed in SolarPPA or SolarLease, SolarCity takes care of all processes of efficiency improvement projects without additional payment.

Other Energy Products and Services

Energy storage SolarCity is making latest advancements in battery technologies to provide residential customers power during utility power outage. SolarCity designs storage system based on the consideration of customer' energy demand to offset peak load and provides backup power to support the most priority functions. A fully charged battery can power home's essential needs for a few days at an emergency, it can recharge the battery from the sun. Tesla Motors builds partnership with SolarCity by developing battery technologies, its long history of research and expertise brings a cost-effective, wall-mounted storage appliance but powerful and small with a 10 year warranty. (Clover 2013)

Electric Vehicle Charging Stations Customers become more sustainable when they choose to switch to electric vehicles or EVs powered by solar energy, which lowers their electricity bills. SolarCity installs EVs charging system that is offered by third parties. EV residential and commercial markets are achieved through retail partnerships with companies as The Home Depot, EV manufacturers and dealerships, such as the partnership with Telsa Motors, Inc.

Channels

It is crucial to reach customer segments to deliver updated products and services. The key is to integrate different channels to maximize customer benefits. SolarCity has flexible channels, direct or indirect channels, or a mixed channel by own channels and partner channels. SolarCity offers solar products and

services to reach all customer segments throughout a national wild sales organizations including direct outside sales force, a call center, a channel partner network and a robust customer referral program. (SolarCity 2014c)

Communication Channels Knowns as customer management software, SolarWorks functions as SolarCity's customer communication channel to raise customer's awareness of reduced costs, quality products and improved services.

Distribution Channels SolarCity continuously develops new technologies to simplify the process of delivering renewable energy and solar products and services, considered as an integrated approach—including sales, financing, monitoring and maintenance—together with solar energy systems, energy storage systems, energy efficiency evaluation and other related services and products. SolarCity maintains a long-term relationship with customers by delivering high-quality products and services to win a good reputation.

Sales Channels

Direct outside sales force Outside sales force normally resides and works within all market areas that SolarCity is serving. This direct channel allows sales force and regional customers to have a face-to-face interaction. Sales personnel educates customers solar knowledge and introduces SolarCity's products and services. (Edgar Online 2014) SolarCity addresses more support to increase sales force to expand customer base.

Door-to-door sales force Door-to-door sales force are comprised by trained salespersons to introduce customers SolarCity's products and services. Most importantly, its outstanding advantages rely on discovering families who have not considered solar energy.

Call center and virtual sales offices Call center makes customer service more convenient without visiting customer's home or company. SolarCity offers

solar energy systems and energy efficiency products for both new customers and existing customers. Every customer is different, the conversation starts with energy consultor talking about customer's energy needs and financial goals. The evaluation is based on customer's historical electricity usage and the amount of sunlight of customer's available rooftop. Salesperson provides an initial plan of whole project. If customers decide to join SolarCity to go green, the contract can be signed even with e-signatures. (Edgar Online 2014) The primary purpose of SolarCity is to simplify the process to get clean energy.

Channel Partner Work

SolarCity Network The SolarCity Network is a program that pays referral fees to business professionals and organizations who refers their customers or members to SolarCity. SolarCity provides easy-to-use outreach tools and marketing support to help spread clean, affordable energy to customers to save money on their energy bills. Typical network members include realtors, architects, contractors and insurance/financial services providers.

The Home Depot SolarCity currently provides solar products and services in following areas Arizona, California, Colorado, Connecticut, Delaware, Hawaii, Maryland, Massachusetts, New Jersey, Nevada, New York, Oregon, Pennsylvania, Texas, Washington D.C, Washington-Clark County. With the process of expanding into more new locations in coming future. Home Depot stores allow customers to purchase solar products in the stores with locally based management and solar installer team work to make customer's transition to clean power.

Best Buy First quarter of 2014, SolarCity signs up new partnership with Best Buy to sell residential solar products and services in over 60 Best Buy stores in New York, Oregon, Arizona, Hawaii and California. At Best Buy kioski, potential customers can access their home through satellite map. Within five minutes, SolarCity representative provides customers an initial assessment of their solar potential. As the largest consumer electronics retailer in United States, Best Buy makes it more accessible for customers to offer solar service

in-store. (Hales 2014)

Homebuilder partners SolarCity builds partnerships with new home builders to market solar products and services through partners' marketing strategies. Free solar energy acts as an extra selling point when some builders pre-pay the solar electricity that will be produced from the solar systems on new homes that they are selling. Certain evidence shows, new homes with solar systems sell faster than homes without. These partners market strategies include advertising within their model house, signage within their communities, realtor emails, newspaper, online banners and co-branded flyers.

Other channel partners Paramount Energy Solutions, LLC, dba Paramount Energy also provide SolarCity solar products. Paramount Energy advocates in residential customer segments with their own sales and marketing strategies.

Customer Referral Program SolarCity referral program offers cash for anybody who recommends their friend, customer or community member to go solar or become more energy efficient with SolarCity. The referral program is open for anyone, no need to be a SolarCity customer. SolarCity encourages customers to host a solar party where to invite friends, family and neighbours to check solar system out and how it works. Customer's solar consultant can present answers to questions and give free consultation. SolarCity rewards customers if any guest decide to sign up with SolarCity through the party.

Customer Relationships

The type of customer relationship varies according to different expectations of each customer segment. SolarCity distinguishes customer segments as home and business & government. SolarCity advocates to build and maintain long-term relationships with customers through offering full services together with energy efficiency products and services. Most customers choose 20-year contract term, it allows SolarCity to maintain the ongoing relationship with cus-

tomers for 20 years and provide additional energy-related products to lower further energy bills.

The long-term energy contract acts as a gateway to provide residential customers with energy efficiency evaluations and energy efficiency upgrades. Customer-design solar energy systems and energy efficiency services reinforce customer relationships and brand value. The future replacements and upgrades of major appliances are included since 20-year term exceeds average work life of major appliances. As SolarCity's solar energy systems are expected as 30 years of estimated life, SolarCity offers a possibility for customers to renew contracts at the end of the original contract term.

Personal assistance The interactions between customers and SolarCity involve from beginning to the end of a solar project. Customers can choose to start a free consultation by calling SolarCity' call center to talk with an energy advisor or have a face-to-face with outside sales person at the point of sale to discuss the potential to lower electricity costs in future. Customer care representatives coordinate SolarCity team and customers. They both offer ongoing services to all customer segments during project processing or even after the purchase to help customers at any time. Customers can reach them by phone call, email or face-to-face conversation. In addition, partnership with Best Buy offers an alternatives for customers to access SolarCity representatives at selected SolarCity kiosk in selected Best Buy retail stores from 2014.

Automated services SolarCity values intellectual properties developed by best engineering teams to improve the ability of managing solar systems more efficiently. All customers' private information are received, saved and updated automatically including names, address, credit status and energy usage information. With the help of advanced softwares, SolarCity is able to identify solar system issues and alert customers instantly; it can recognize each customer's characteristics in energy consumption to recommend suitable governmental incentives, possible system upgrading and other services. Customers can access the performance of their solar energy systems from online personal account, which makes it easier for customers to go solar.

Communities Online communities are utilized to support communications between community members. SolarCity currently maintains an online SolarCity blog to update latest news about SolarCity and deliver solar acknowledge to customers. Facebook, Twitter, Google plus and Linkedln are used as online communities for customers to share their solar experiences and solve their problems. It also offers SolarCity a channel to better understand customer's expectation and desires.

Revenue Streams

Revenue streams are generated through offering multiple solar energy products and services for both residential customers and commercial entities. Revenue streams represent different pricing mechanisms that SolarCity charges from each customer segment to create earnings. Long-term relationships with customers allow SolarCity to develop a type of revenue stream resulting from ongoing payments to either deliver solar energy products and services or provide post-purchase customer support. Generally, revenue streams generally are recognized as revenue created from the sale of solar energy systems to customers; revenue from the sale of energy under solar lease or power purchase agreement which are considered as operating leases and revenue from offer energy efficiency products and services. (Edgar Online 2014)

Sales of solar systems It includes revenues when customers choose to purchase and own solar systems or purchase solar energy systems under a long-term contract. The revenue from sales of solar system is recognized during the installation and it passes the examination of authorities to ensure the project quality. Revenue generated under a long-term sales contract is based on the ratio of labor cost incurred to date to total project labor costs. Some recognized revenue is allocated for monitoring service team.

Energy efficiency products and services Revenue from energy efficiency products and services are received on the completion of project. It is sold on a stand-alone basis or bundled with the sale of solar energy system or under solar energy purchase agreement. However, the revenue from delivering solar energy

efficiency products and services has not been compared with the revenue from solar energy systems since it was launched at second quarter of 2010.

Operating leases Customers' original motivation to switch to solar energy is driven by paying less for electricity. SolarCity's strategy to compete with utilities is to price solar energy slightly less than utility electricity. Therefore, the price of electricity customers currently purchase from SolarCity depends on the states and local utility. SolarCity offers multiple payment options to meet customer's financial plans including SolarLease and SolarPPA. Revenue generated from SolarLease and SolarPPA are based on different pricing mechanisms, lease customers purchase solar energy by paying a fixed monthly electricity bills with a production guarantee, while SolarPPA charges with a fee per kWh based on total electricity consumption. The fee for remote monitoring service is bundled within the agreements with customers, some of the revenue recognized is allocated to monitoring service team. The analysis of market structure shows the majority of residential customers choose SolarLease while commercial and government customers prefer SolarPPA.

Despite the free solar energy systems, SolarCity also provides energy efficiency products evaluation and upgrades at no additional cost to residential customers. It guarantees the commitment of providing high performance solar system and promised electricity production. With a lease or solar purchase agreement, customers go solar with none to little upfront cost with free solar energy systems offered by SolarCity. All-in-one service includes engineering, financing, permits, installation and ongoing monitoring. Customers get free solar energy products and services throughout their contract life, only by paying for the electricity purchased from SolarCity's solar energy systems.

However, the revenue from operating leases are potentially impacted by unpredictable seasonal weather condition. Due to the amount of electricity produced in a certain period by a solar energy system under a solar purchase agreement or by a system with energy output performance incentives depends on how much sunlight is available during this period. Thus, as more customers choose a solar energy system with a solar purchase agreement or with a performance-based incentives, the revenue from operating leases increase significantly. There is additional multiple factors that might affect the ability to

increase revenue in future, including the number of customer base, the possibility of attracting more funds from investors, capital cost, components costs of solar energy systems and reducing operating costs. The profitability depends on if revenues can cover all the costs. The majority of revenues are recognized as in United States.

Key Resources

SolarCity offers customers a more affordable approach to go solar with high-quality solar systems installed by experienced field teams with no to little up-front cost. The key resources involved in solar energy business models includes all aspects of resources: physical, intellectual, human and financial.

Physical resource It refers solar panels installed on rooftop, all equipments included in solar system and hardware. SolarCity chooses solar panels only from top-class panel manufacturers to guarantee high performance and quality of solar systems. In-house engineering team selects optimal solar panels for specific customer, considering customer's local weather, architecture and energy desires. SolarCity needs to build relationships with multiple suppliers to maintain adequate components sources to meet increasing customer base.

Intellectual resource The demand of delivering Better Energy to customers requires SolarCity to focus on the quality of energy products and services. Intellectual resources are required in all aspects of delivering services to customers such as brand, software, proprietary. SolarCity's knowledgeable energy consultants start to work with customers to understand their primary desires and original financial plans. Highly skilled in-house teams complete customer-design solar systems with highest engineering standards. The installation is carried out by professional and experienced solar installers which is supervised by NABCEP-certified employees to achieve SolarCity's high standards. A full in-house Customer Care team is responsible for project management during installation. It keeps customer updated with each step of the project status. Every customer now can get a personal online account to track their project status.

The high technology approach and software solutions allow SolarCity to manage each process efficiently. SolarGuard energy monitoring service allows customers to check their solar system production online. It continuously monitors solar system performance and shows the production of solar energy during a day, a week or a month. SolarCity will alert customers if solar system underperforms and help customers to get back to normal situation. Customers can read the environmental benefits of their solar systems through SolarGuard. SolarCity also offers another technology called PowerGuide to manage electricity production and consumption. It analyzes customer energy use pattern to help manage electricity use more intelligently. Those software solutions allow SolarCity in-house team manage thousands projects at different stages at the same time. For residential customers, SolarCity offers battery systems to satisfy homeowner's essential needs when an emergency occurs. The expertise of Tesla in battery technologies enables SolarCity to present cost-effective, wall-mounted storage appliances to customers with a 10 year warranty.

SolarCity has been dedicated to build an extraordinary company profile to present to investors. Adequate finance supports from investors enables a competitive solar pricing which helps to attract more customers. The satisfactory from customers brings benefits to build good reputation to attract more finance funds and increase brand value.

Human resources SolarCity's products and services are delivered by employees engaged in each process of a project. Until December 31, 2012, SolarCity had 2,510 full-time employees, including 661 in sales and marketing, 193 in engineering, 1,235 in installation, 248 in customer care and project controls and 173 others. 1,530 are located in California, the remaining employees are working in offices and warehouses in other marketing areas. SolarCity established strong incentives to attract best employees, programs are designed to reward employees with competitive salaries, equity ownership and more potential for career advancement. (Edgar Online 2014)

To compete other solar energy companies, SolarCity needs to keep expanding to more market areas. A large number of skilled employees are essential to support the growth, to fulfill the services efficiently for increasing customers. SolarCity decides to optimize their direct sales force to increase customer base.

If they fail to hire, train and retain skilled sales force or sales force are unable to achieve the planned productivity in a certain period and it is not able to reach the benefits as expected. As the market areas expand, a large number of installer are required to meet the growing customers. Shortage of skilled labor engaged in installation and delivery of other energy products and services can cause the delay of a project which increases project cost. Competition of skilled labors with homebuilding and construction industries forces SolarCity to offer wage with a relatively high standard which lowers benefits.

The consequences of failing to expand, train and manage employees include the failure of completing customer's project on time. It also ruins a company's reputation and limits the growth of the business which affects the profits.

Financial resources SolarCity needs to attract adequate finance support from third-party fund investor to finance solar energy systems. The strategy is to reduce the cost of capital to maximize margins or to offset future reductions in government incentives to help maintain the ability of providing competitive solar energy pricing. A portion of the funds received from investors are used for covering the cost during solar system installation. Adequate funds enable customers to purchase at no to little upfront cost. If SolarCity fails in the competition of raising funds from investors, it might have an adverse impact on the business as project delay which raises capital of cost. SolarCity expects to rely on raising more financing funds from investor now and in future. (Edgar Online 2014)

SolarCity also relies on financial incentives exposed by U.S. Government, state and local government towards end users, distributors, manufacturers to encourage the adoption of sustainable energy, including rebates, tax credits and other incentives. Government incentives lower the cost of capital and stimulate investors to invest. Adequate funds and lower costs enable SolarCity to lower the price charged from customers. Similarly, SolarCity's ability of providing competitive pricing is reduced if regulations and policies tend to favor other energy sources.

Key Activities

Production SolarCity has thousands of customers in 14 states. Such a great amount of projects require substantial quantities of solar components including panels and related equipments. SolarCity is not engaged in the manufacture stage, but purchases adequate components directly from multiple vendors to meet future needs with a competitive price. It enables SolarCity to lower capital cost which ensures to provide electricity at a reasonable price to customers. SolarCity chooses manufactures and components based on expected cost, warranty, ease of installation and other ancillary costs.

Up to December 31, 2012, the primary suppliers of solar panels were BenQ Corporation, Suniva Inc., Trina Solar Limited and Yingli Green Energy Holding Company Limited, primary inverter suppliers were Power-One, Inc., SMA Solar Technology, AG, Schneider Electric SA, Fronius International GmbH and SolarEdge Technologies. SolarCity design own tracking system, manufactured by contract manufacturers in the United States. Other components related to providing solar energy systems and energy efficient services are sourced from different international distributors. (Edgar Online 2014)

Problem solving SolarCity delivers solar energy systems and energy efficiency services to customers. To solve customer problems efficiently demonstrates the ability to guarantee solar system performance, increase company reputation and help to expand market share in future.

To ensure solar energy system runs smoothly, SolarCity covers a long warranty for customers who buy energy from SolarCity under a lease or solar purchase agreement within the period of contracts, typically 20 years. SolarCity also delivers warranties to customers directly from inverter and panel manufacturers, range from 5 to 25 years. Additionally, SolarCity takes the responsibility to fulfill obligations within contract if any of those third-party supplier are no longer able to serve that market.

Solar system failures and operational deficiencies affect electricity production. SolarCity repairs and replaces defective solar energy systems if any system component fail to function. It ensures the electricity production if solar sys-

tems run as expected. Online programs allow SolarCity to monitor and track solar system performance continuously and customers can view their electricity production through online private account. Solar service teams monitor system outputs to achieve expected electricity production. They quickly inform customers if solar systems underperform and help customers to remedy the issue. SolarCity compensates customers if their solar systems produce less electricity than guaranteed production in any given condition.

Platform/network SolarCity Network is a business program to refer customers, members and stakeholders a reliable solar provider to go for clean energy. SolarCity rewards business professionals and organizations for recommending customers for SolarCity. Typical network members include realtors, architects, contractors and insurance/financial services providers. SolarCity develops exclusive softwares to supervise and monitor all aspects of a project.

SolarCity demonstrates its effort to provide top-class engineering and high-quality services to customers which builds a reliable and recognized brand. More residential customers join SolarCity through referral programs. The reputation of SolarCity drives customers to consider them as a solution to go solar.

Key Partnerships

SolarCity has dedicated substantial effort in maintaining and expanding relationships with customers, suppliers and other third-parties to enlarge customer base and finance funds. Those partnerships allow SolarCity to provide best solar energy systems and services with economical pricing for customers. SolarCity encourages the participation of different expertise and experience partners (Retailers & Resellers). Companies with interests call reach SolarCity directly by submitting a form through official website for reviewing. Homebuilders participate as partners as well.

Third parties Partnerships with business partners are a key component of SolarCity's growth strategy. It allows SolarCity to reach more customers

through various channels, such as partnership with new homebuilders and retailers. Even though it takes significant expense to identify, build and maintain relationship with business partners however, it limits the growth of business by losing new customers if SolarCity fails to establish partnerships with them. The possibility of generating more revenue is eliminated with limited customer base and market area. Adequate financing sources guarantee the finance support for other business activities. Relationships with retailers and homebuilders allows SolarCity to generate more customers. They act as intermediate sources that sell SolarCity's products through their business strategies. For instance, SolarCity's products and services are available not only direct from home depot stores located in serving state, but also from many new homebuilders and retailers, such as SolarCity markets their electric vehicle products through retailers or EV manufacturers and suppliers.

Competitors SolarCity defines its primary competitors as traditional utilities offering electricity to potential customers. The strategy to compete with traditional utilities is offering electricity generated by solar energy system at a lower price than utility. SolarCity believes to compete other companies by acting as a full-service solar provider with lower cost and uncompromising services. SolarCity also encounters competition from other solar companies which only deliver part of solar services and products of solar business value chain. However, SolarCity relies on the strength of providing all-in-one service that takes care of each step of switching to solar energy including engineering, financing, permits, installation and ongoing monitoring.

Joint ventures SolarCity has established financing structure to attract funds from investors into joint venture. The partnership with investment partners strengths the financing funds and the ability of providing customers attractive financing options. Customers choose solar suppliers based on the economical pricing which requires SolarCity to get sufficient finance support from fund investors. SolarCity expects to benefit from those tax-advantage financing structure continuously. The success of establishing relationships with limited amount of fund investors depends on the ability of competing other solar suppliers. SolarCity are unable to provide solar energy systems with none to little up-front cost if they fail to raise funds from investors. SolarCity relies on funds

from investors to satisfy the increasing number of new customer in future. Investors share the benefits with SolarCity through the allocation of a portion of consolidated net income. They enjoy returns by long-term customer payments, investment tax credits, incentives. (Edgar Online 2014)

Buyer-supplier relationships SolarCity purchases solar system components directly from limited amount of suppliers. SolarCity may not be able to meet increasing demands if they fail to establish, maintain the relationships with suppliers. The pricing and services customers receive may be affected by any delay, shortage or price change of solar components. Multiple suppliers ensure SolarCity to offer adequate solar systems with economical and low price. Especially there are key components which require extensive capital invest and commodity materials to ensure the ability to meet anticipated demands. SolarCity purchases part of solar components from foreign suppliers. Any change in exchange rate could result in the fluctuation of solar system price. U.S. Government exposed tariffs towards solar component purchase which may increase capital cost and reduce profit.

Cost Structure

SolarCity's financial strategy is to generate revenue from residential customers, commercial and government entities with the lowest cost of capital. (Edgar Online 2014) Customers share the same benefit of low capital cost by paying lower electricity price. The profitability of SolarCity depends on whether the revenue can cover the costs-variable and fixed costs occurred by installation and the related solar energy systems. SolarCity needs to manage compensation under their expected margins to cover the cost of project. Component materials, third-party appliances and direct labor are the major costs in solar business.

U.S. federal, state and local governments carried out various incentives to end users, distributors, system integrators and manufacturers including tax credits, cash grants, rebates, tax abatements and net energy metering, or net metering programs to stimulate the adoption of solar energy. SolarCity expects to rely on government regulations to reduce cost of capital and maintain the ability

to provide competitive solar price for customers. Any change of government policies towards encouraging electric utilities or reducing governmental incentives would affect the growth of company adversely by increasing capital cost and losing financing funds from investors, which increases the prices of solar products and services that charge from customers.

Labor costs SolarCity are required to provide more finance support for the expansion of business as installation, engineering, administrative, sales and marketing staffs. SolarCity established various programs to increase customer base. To complete current projects and support the growth of demand in future, SolarCity needs to hire a large number of skilled employees to avoid the delay of a project. The reduction of profit is due to significant time and expense for training a qualified personnel and the increasing labor costs raised by the competition of skilled employees involved in solar industry. Additionally, SolarCity is paying a relatively high wage to attract technical and engineering employees. Even though, qualified employees are the key resources to ensure to provide customers with high-quality services and products through exceptional customer services to improve reputation, business and financial results. Operating cost is reduced by optimizing system design and installation and supply chain logistics by qualified engineers. Including a cost for protecting intellectual property-software, information,processes. To avoid the exposure of customer's privacy that incurs significant cost from claims or litigation.

Components costs The cost of acquisition of solar system components consist of solar panels and related raw materials for manufacturing solar energy systems, which affects the price that customers buy from solar companies. SolarCity imports significant amount of components directly from foreign suppliers and manufactures. Any price change of solar panels and other system components might cause sale reduction and loss of market share. Any change in exchange rate in U.S. dollars with any other foreign currency from component suppliers would increase components price. Foreign regulatory and government support allowed SolarCity to purchase solar panels at a competitive price from China. However, U.S. Government established tariffs for solar cells manufactured by China, forcing SolarCity to purchase solar panels and other system components at a higher price or from other high-price suppliers.

Obviously, the profit will be affected in future if more components is purchased from China. SolarCity only benefits from regulatories that favors the declining cost of solar panels. (Edgar Online 2014)

Additional costs SolarCity offers lengthy warranty for customers that could bring substantial expense to project cost such as the necessities of maintenance, repair and replacement of any damaged solar system components and later solar system upgrading. The production of solar energy system might be reduced by unfavorable weather condition, SolarCity even offers customers with performance guarantee expenses to meet the promised production of solar energy systems. SolarCity provides customers solar services and products based on estimated maintenance costs without extra compensation. SolarCity relies on property and business interruption insurance to cover such risks. Nevertheless, it may not be enough to cover the loss under extreme weather such as earthquake. With the obligation of removing solar energy systems from roof at end of the lease term. It is unpredictable that how much it costs in future for the removal, disposal and recycling of solar energy systems. If the residual value of solar systems is under expected, the financial results are difficult to be estimated.

There is possibility that customers might get injured by solar energy systems which are comprised by electrical devices during installation, defects and other circumstances. An extensive expense is required to defend if SolarCity is exposed to product liability claims. SolarCity relies on general liability insurance to cover the cost of product liability claims. The consequences of a successful assertion of product liability claim against solar provider including a significant amount of payment which adversely reduces company's profit, reputation and other financial results. (Edgar Online 2014)

3.2 Sungevity

Sungevity is an Oakland-based solar energy company, founded in 2007, specializes in remote solar design and provides residential solar solutions with rooftop solar systems. It provides a full-service together with customers personalized solar solution by starting with a free online iQuote. It serves nine states in

United States with a "Solar for All" global strategy. Sungevity announced international launch on Nov. 2011, that it became the first U.S. residential solar company to expand internationally to Netherland, Zoline. Later on April 2012, Sungevity continued to expand global footprint to Australia solar market presented as Sungevity Australia.

Customer Segments

Sungevity currently serves homeowners in California, Arizona, Colorado, Connecticut, New York, New Jersey, Massachusetts, Maryland, and Delaware with additional international markets including Netherlands (Zoline) and Australia (Sungevity Australia). Sungevity has a good market share in the U.S. and is growing rapidly in Netherlands and Australia. Australia has almost as much as twice residential solar than in the U.S., which promises a huge potential for Sungevity to fulfill the residential customers. (Gifford 2012b) However, Australian consumers differ from U.S. consumers in a way that the solar market in Australia takes time to get customers, instead of easier acquisition at mature solar market in U.S., due to a higher awareness of solar. Sungevity focuses on residential market in U.S., but a different approach is launched in Australian solar market that the strategy is changing slowly into commercial market, based on the forsee of the huge potential in commercial market. (Morris 2013) More consumers take solar as a great option as the electricity price keeps going up in Australia.

Sungevity developed incentives to stimulate customer numbers such as Referral Program. Most of Sungevity's customers are located in California, while it is referred that the sunshine network refers 1/3 of new customers. Moreover, Sungevity explores and builds partnerships with various organizations to enlarge their customer base. To date, Sungevity and Sunrun forged solar alliance to attract 10,000 new residential customers over the next two years since 2014, Sungevity provides customers while Sunrun offers financing support. (Wesoff 2014d)

As a remarkable moment, Sungevity succeeded in persuading Celebrities to go solar including White House in October 2010. White House announced the installation of solar energy system on the roof of White House residence

including American-made solar panels and a solar water heater. Sungevity's Kennedy said, "I applaud the president for his actions but my praise is much more resounding for the hundreds of thousands of American households whole example he has followed." (Hull 2013) Sungevity expects to generate more customers by offering free solar array for celebrities to go solar.

Value Propositions

The main purposes of Sungevity to deliver their products and services to homeowners include lower electricity bills together with a chance to improve environmental impact and energy independence. Sungevity uses highly trained and knowledgeable professionals in solar industry to deliver the best solar experience. Generally, Sungevity has unique processes to go solar in three easy steps as shown in Figure 8 below. The first step is to get a free iQuote online to generate a personalized home solar solution with Sungevity's consultant team, then homeowners choose an affordable financing option from Sungevity's solar finance products and lastly customers start to enjoy savings while Sungevity completes all the work such as paperwork, financing and installation. (Sungevity 2014b)

Solar systems Sungevity solar systems are custom-design by experts with high quality panels. Based on the review from iQuote, designers use remote proprietary design to generate a solar solution based on customer's past 12

Figure 8: Sungevity's unique solar processes.
Source: Sungevity (2014b)

months and future energy demands. It ensures the accuracy of the potential of the reduction in electricity bills by going solar. Sungevity assigns private Project Manager to take care all works in every step of a solar project. The installation is carried out by excellent local solar experts. Solar systems are monitored after installation for maximum performance. Sungevity offers performance guarantee for solar systems which brings more faith to consumers. Sungevity sells 5 kW solar systems in U.S. while the smaller home loads result in smaller solar systems in Australia. (Gifford 2012b)

Solar PPAs and Solar lease finance products As shown in Figure 9 below, Sungevity's finance products enable customers to save year after year that the total payment for solar lease and new electricity bill is less than the old elctricity bill. Most importantly, Sungevity guarantees the performance of solar system to ensure the reduction in customer's monthly energy bill is greater than what they pay for solar lease.

Sungevity offers multiple affordable payment options for customers to finance their home solar systems, including zero down lease, a pre-paid lease, or fixed payment lease. Sungevity is moving to offer solar power purchase agreement. Customers can choose the best option based on the comparison of all solar options as shown in Figure 10. Sungevity zero-down solar lease makes solar more affordable for homeowners by avoiding the extensive upfront cost. With

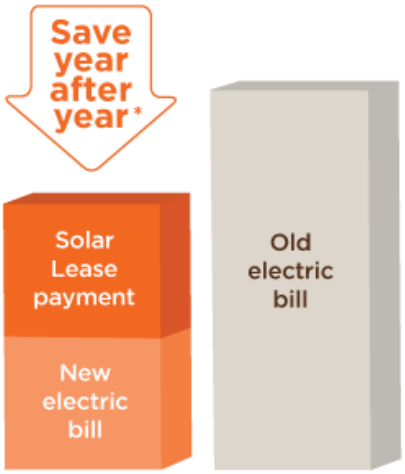

Figure 9: Savings with Sungevity's solar lease.
Source: Sungevity (2014a)

	Zero down lease	Down payment lease	Prepay lease	Purchase
Financial Considerations				
Upfront Cost	$0 down	Customer choice	Discounted lease price	Price of system
Monthly Payments	✓	✓	–	–
Government Rebates & Credits	✓	✓	✓	✓
Federal Investment Tax Credit (included)	✓	✓	✓	✓
Integrated services				
24/7 Monitoring	20 years	20 years	20 years	10 years
Repair Services	20 years	20 years	20 years	10 years
Insurance	✓	✓	✓	–
Performance Guarantee	✓	✓	✓	–
Increase Home Value	✓	✓	✓	✓
Borrowing Requirements				
Minimum Credit Sore - FICO	700	700	600 or 700 FICO*	

* Ask your solar consultant for details

Figure 10: Comparison of Sungevity's solar options.
Source: sungevity.com

a solar lease, Sungevity pays for all system design and installation and are responsible for system operation, monitoring and maintenance. Customers lock in low electricity rates over the life of contracts while utility electricity continues to go up. Solar Lease commitment lasts for 20 years with a possibility to renew the contract for extra five years, or remove the system at the end of the agreement.

According to the experience of Sungevity U.S., Sungevity Australia launched 0$ down pay-as-you-go solar including RoofJuice Solar Leasing and Solar Loans for the first time in Australia. Consumers choose a suitable finance solution through the discussion with finance providers between a RoofJuice Solar Lease or Solar Loan, with a fixed monthly rate for the purchase of solar power. The benefits for solar provider and consumers are shown in Figure 11. Pay-as-you-go succeeds in Australian solar market by removing the upfront cost which allows consumers to go solar with zero upfront cost; Customers start to save right after the installation of solar energy systems at a lower price than grid power without considering the maintenance of solar systems. In another hand, Sungevity maintains a steady revenue source as long as the contract periods with customers.

Benefits to the industry		Benefits to the consumer
Ongoing relationship with the customer		$0 upfront cost = accessibility
Greater control over the solar performance		Solar power is cheaper than grid power
Creates a greater market reach		Immediate savings
Steady return on investment		Warranty & maintenance handled by Sungevity

Figure 11: Benefits of pay-as-you-go.
Source: sungevity.com

Moreover, Sungevity's customers in Connecticut buy solar energy systems instead of choosing leasing options. Sungevity expects to expand lease offering to international markets such as Netherland and Australia, even most of customers in those countries choose to buy solar systems from Sungevity. (Herndon 2013)

Solar loan Sungevity entered Australia market first by providing a seven-year loan product that allows direct ownership of rooftop. The new financing plan loans the full purchase price of solar system with affordable interest rates and payment. As reported by GTM Research, the first emerging trend in residential solar market is the shift from third-party ownership through solar leases and PPAs to solar loans (GTM Research 2013).

Channels

Communication and Distribution Channels Sungevity's business strategy is to deliver solar energy to consumers through multiple channels. However, it is important for Sungevity to deliver solar products and services through the most cost effective channels, to bring down the price that charges from customers. Sungevity has succeeded in offering solar energy completely online. The official website of Sungevity is the main channel to present all products and services to potential and existing consumers. Once customers sign up with Sungevity, Sungevity may email customers offers, discounts and product alerts to fit customer's interests. Customers preserve the right not to receive these communications that they will be removed from communication list. Sungevity has the right to inform third-party organizations customers' names,

contact information and customer status if customers are referred by those organization.

Through email, consumers can follow Sungevity blog which works as both a communication channel to share solar experience of choosing Sungevity as solar provider and a distribution channel to deliver Sungevity's promotions. It also functions as a channel to rise customers' interest in going solar by releasing related solar industry news. Educating customers about solar is the key to expand solar industry. Additionally, Sungevity keeps Facebook and Twitter as platforms for people to join the social network and spread news of solar. One dollar is donated to The Solar Foundation for every new "like" Sungevity gets on Facebook. All channels are aimed to offer solar products and services to customers in a more efficient and effective channel.

Sales Channels

Retail stores Retail stores are the most cost-effective way for Sungevity to reach nationwide homeowners to accelerate the adoption of solar energy. Sungevity engages with potential customers at partners' retail stores. For instance, the partnership with Lower allows Sungevity to reach customers at more than 1,750 retail locations, the Retail Solar Advisor (RSA) educates customers and increases their interest towards requesting a free iQuote from Sungevity's homepages and discusses a solar solution for customer's home. Retail partnerships are believed to be the most important emerging trends in customer acquisition of the residential solar market. (Trabish 2014a)

Sunshine Network

Sungevity believes their referral program for customer acquisition are cost effective. Sungevity's efficient customer acquisition is based on social media, online advertising and community based work. (Morris 2013) A third of Sungevity's new customers are generated from referral program.

Sunshine Network Customers (Superstar Members) $500 savings is issued in the form of a credit card to the referee's solar system. The referring

party is issued with $1,000 in the form of a cash gift card after the referee's solar system is fully operational and connected to the utility.

Sunshine Network Non-Customer Referrers (Star Members) Sungevity rewards $500 in form of a credit to their solar system. The referring party who recommends Sungevity as solar provider to their friends and family will be rewarded with $500 in form of a cash gift card which will be fulfilled after the referee's solar system is fully operational and connected to utility. More money is awarded without limit as more friends go solar through referral program.

Other sales channels Sungevity may email or provide customers offers, discounts and other offers through social media and other community based work, presenting with various forms at Sungevity's sole discretion. All promotions are non-transferable and not able to be combined with other offers.

Customer Relationships

Personal assistance To provide customers with best solar experience is Sungevity's strategy for customer acquisition. Sungevity's unique process simplify the steps to go solar by doing all paperwork, installation and financing. Customers receive assistance during each step. Starting from the communication with sales person at retail stores or through phone call, to deliver knowledge about solar; once customer decides to go solar with Sungevity, a dedicated project manager will engage in every step of going solar including permits, financing, shipment and installation of solar panels, assign a qualified local solar installer as well as the final inspection after installation.

Self-service Sungevity takes care of all steps of going solar. Homeowners can monitor solar systems with online tracking tools provided by Sungevity for free from anywhere at anytime from project beginning to end. With advanced monitoring system, customers can follow the up-to-date project progress to

check solar system installation and output, carbon saving, even with the possibility to check friend's solar project process and $1,000 referral rewards.

Communities Sungevity Community offers more than a fundraising opportunity to homeowners, but also a network of support. A biodiesel, solar powered ice pop truck is used to support partner events for free to generate more fun. Partnership with Sungevity creates a chance to bring solar powered light to school kids in Zambia, which is supported by the partnership with Empowered by Light. Leading in rooftop revolution, Sungevity works with industry partners to show how solar improves economy. Sungevity employees are deeply involved in the corporation with partners to offer support.

Revenue Streams

Sungevity generates revenues from local residential solar market in United States and international solar markets, Australia and Netherlands. As presented by PV Solar Report, over 70% of homeowners in California choose to go solar with solar leasing to avoid the extensive upfront costs, instead of purchasing own solar systems. Hence, the majority of Sungevity's revenue comes from solar leasing offers. Sungevity's sales in the U.S. doubled in 2013 according to a company release. More funds are required to support the further expansion to European markets. Sungevity joins the new trend that now offers solar loan as an alternative option to allow direct ownership for customers.

Sales of solar systems Sungevity meets customers needs to own solar systems, if they can afford up front cost. Almost 10% of residential homeowners in U.S. purchase solar systems through cash sale. (Morris 2013)

Solar Leases and PPAs Sungevity is moving part of leasing business toward Clean Power Finance platform and the deal platform. Meanwhile, it also moves to offer power purchase agreement. (Wesoff 2014a)

Key Resources

Intellectual resources Sungevity successes in making solar energy completely online, easily available just like ordering anything online with their proprietary web-based technology. It uses satellite imaging and proprietary software to offer a quick online quote of customer's home within 24 hours to reduce the time and costs of designing a solar system, which saves time and money by bringing all steps online. Sungevity believes their strength lies in efficient customer services: to offer iQuote online within 24 hours. It is estimated that Sungevity Remote Solar Design Software can save up to 10% from equipment and labor cost of a solar system due to the fewer site visits. (M. Taylor 2008)

Sungevity offers advanced online monitoring system for free that customer can access at anytime, anywhere. Customer can track the entire installation process from first visit to customer's home to the final inspection. There is other online tracking tools to monitor solar system production 24/7, even with a tool to track customer's referrals progress and the $1,000 referral rewards coming to your way. Online tracking tools update to show weekly production, monthly reports for monitoring utility saving and yearly reports of total production.

Human Resources Sungevity believes employees are the core to make the business success. To provide customers with practical, simple and creative solar solutions, Sungevity chooses best specialists for all positions including Customer Service, Engineering, Finance, Information Technology, Marketing, Construction Management, Sales, Software Developer.

Even Sungevity works with subcontractors for installation. Sungevity insists to choose their installers through rigorous due diligence and quality assurance to confirm the quality of installation. Expert solar installers with high qualifications work on the projects with current best practices under the review and inspection of Sungevity. Experienced and knowledgeable installers enable Sungevity to deliver solar systems with highest quality techniques. Those local installers know customer's local ordinances and will be able to help whenever in future.

Sungevity offers a multicultural work environment and opportunities for development and career growth for employees. More than paying benefits for employees, Sungevity provides competitive salary and stock options to attracts qualified specialists to join Sungevity.

Moreover, Sungevity's president Mr. Kennedy developed SfunCube as a founding sponsorship, the world's only solar incubator-accelerator program. The purpose of SfunCube is to support solar entrepreneurs by reducing the soft costs engaged in solar business, the final aim is to offer solar for all by supporting solar industry with thousands of solar professionals through incubator program. SfunCube, an invitation-only community provides solar entrepreneurs an opportunity to be surrounded by national leading early stage solar companies.

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Finance resources Sungevity requires extensive venture financing and equity financing as their finance resources to support their leasing services. Adequate fundings allow Sungevity to diversify their business by developing new service offerings. To date, Sungevity continuously receives new investments from various partners in venture capital and project financing. Lately, Sungevity attracted $70 million funding by Jetstream Ventures, including the investment from E.ON, GE Ventures and other investors. (Wesoff 2014a) To date, Sungevity has raised over $200 million in VC. As the sales in U.S. doubled

in 2013, Sungevity expects to expand business to Europe and Australia, thus, some of the fund will be used for the new office in Australia. Together with the improvement of online customer-acquisition service. (Vorrath 2014)

However, some issues emerged with Sungevity's finance timing that result in a significant number of solar systems are not yet activated after the installation on rooftop of homeowners, due to the lack of funding. Hence, Sungevity claimed the importance of maintaining multiple open funds. (Wesoff 2014a) It may harm company's reputation by keeping customers waiting.

Brand Value Sungevity is known as reputable company who earned Diamond Certification from the prestigious American Ratings Corporation, Certification from North American Board of Certified Energy Practitioners, perfect record with the Better Business Bureau, Bay Area Green Business, 2009 Green Business Award, Green Jobs Award 2011 and etc. Sungevity is the first U.S. residential solar company who launched international market expansion to Netherlands and Australian to demonstrate the company's best-in-class customer services and global growth, presenting Sungevity's success of their business model in residential solar market. It is extremely important for Sungevity to build an extraordinary brand to maintain the competitiveness among other thousands of solar companies in Australia. Sungevity expects to help more homeowners to benefit from solar energy in future through their global partnership strategy.

Sungevity even developed the "Every Child Has a Light" program through the partnership with Empowered By Light. It enables customers in Zambian communities to go solar and improve their lives with advanced energy technologies. The mechanism is that Sungevity donates one solar light kit to a school in Zambia for each solar project completion in U.S. Sungevity's effort of improving lives demonstrates the "Solar for All" strategy that solar is available in spite of geographic location. Customers who choose to go solar with Sungevity generate more environmental impacts in addition to lower electricity bills.

Key Activities

Production Sungevity is a solar retailer approved by Clean Energy Council which ensures customers quality products under customer protection laws. Solar panels and inverters are the major components of a solar energy system. Sungevity maintains partnerships with a multiple solar panel manufactures and retailers. For instance, Canadian Solar is one of the world leading solar manufacturers with manufacturing facilities in Canada and China. GermanSolar's speciality is development, implementation, operation and control of large PV systems, relying on German engineering and quality control to ensure the product quality. Additionally, Sungevity chooses Trina Solar and Solar Juice for Australia solar market that have developed as leaders throughout Australia. Solar inverters as key component of solar energy systems, Sungevity purchases inverters from international leading inverter providers, such as Italian based Power-one, well-known for quality inverter for residential and commercial application; Samil Power, an expert for PV Grid-tied Inverters; SMA Solar Technology, a leader in the development, manufacture and sales of inverters; and KSTAR, specializes in R&D and technology innovation.

Problem Solving Sungevity takes care of maintenance and insurance. It requires Sungevity to continuously maintain and update intellectual properties, to guarantee the performance of solar energy systems. The personal representative helps customer to solve problems during the project process and even after the project is completed.

Network/platform Sungevity makes the purchase of solar energy completely available online. It requires the management and update of Sungevity's software and website of sungevity.com. Sungevity's online service has been received favorably among markets in Netherlands, Australia as well as in United States. Best-in-class customer support platform includes a dedicated representative web-based solar analytics. To design solar systems remotely by satellites without the inconvenience of visiting customer's home is the main advantage of Sungevity, which makes going solar as easy as ordering anything online. It enables the possibility of designing an accurate solar systems in 24 hours. (Gifford 2012b)

Key Partnerships

Non-profit partners Sungevity builds partnerships with all different sizes of non-profit organizations and raises funds to support their work. Sungevity provides solar solutions through organization's network: customers get $1000 credit if they choose to go solar with any partner; correspondingly, partners get $750. Sungevity hopes to spread solar solutions to more customers within those states that Sungevity is serving through partnerships with different organizations. To date, hundreds of partners participated sungevity.org to benefit from Sungevity's fundraising program.

Sungevity encourages all organizations to enroll as a partner through four simple steps. Welcomed organization sets up their unique landing page by filling basic informations, Online Guide and Toolkit provide all materials related which simplify the process of starting a solar fundraising. Lastly, partners can share the benefits if any customers go solar through their organizations. Partners can continue their partnerships with Sungevity after fulfill one year contract. Sungevity provides outreach materials such as sample emails, social media posts, graphic and flyer templates to maximize the fundraising results from supporters.

Sungevity Community provides partners network of support in addition to the opportunities of raising funds. Sungevity supports partner events with a biodiesel at any time for free. The relationship with Empowered by Light enables Sungevity to donate a solar powered light to school children in Zambia for every solar energy system they sell. Sungevity is working with industry partners and allies on Rooftop Revolution to present lawmakers how solar can improve economy. As a part of Sungevity Community, Sungevity employees work with partners through volunteerism to support their business.

Retail partnership The ability to attract more customers decides the growth of a solar company. Retail partnership is the most cost-effective approach to attract customers. Sungevity saves customer acquisition costs by relying on partner's extensive resources in customers at retail stores. Sungevity announced a new agreement with Lowe on offering homeowners more affordable solar solutions, May 16, 2011. Based on the agreement, Lowe provides cus-

tomers with Sungevity's iQuote to generate a solar solution by using satellite images which eliminates the cost of a home visit. Lowe takes an equity position in Sungevity through the agreement. Andrew Birch, CEO of Sungevity said, there is huge potential of spreading Sungevity's services through Lowe's extensive customers and their retail locations. (Sungevity 2011)

Joint Ventures Sungevity is looking for new financing methods to raise funds and expand their services including asset-backed securities. However, Joint venture is the mainstream financing funds structure, both Sungevity and investors contribute assets or funds into venture. Sungevity uses those funds to develop their customer services to strengthen their customer acquisition. Lately, Sungevity announced partnership with Sunrun to sign up at least 10,000 homeowners through 2016. Sungevity acquire customers, while Sunrun takes care of financing and owns the systems under the agreement. (Baker 2014)

Sungevity has attracted investment from various funders to accelerate the adoption of solar energy. To date, Sungevity reached a total amount of more than $200 million in venture capital after $70 million was raised in new equity financing from new and existing investors including E.ON and GE Ventures, according to the news released by Sungevity April 4, 2014. More importantly, JV enables Sungevity to expand to international solar markets. Sungevity has invested in ventures in Australia through the partnership with Nickel Energy in 2012 to spread its business market to Australia homeowners with the pay-as-you-go solar option, after the first global expansion step with Dutch Solar firm, Zoline in 2011, after buying a stake. With Sungevity's innovative software tools, it enables partners to offer local households more affordable and competitive energy choice.

Competitors Sungevity is responsible for solar energy system design, financing for residential customers, but the installation is subtracted to local installation companies. Sungevity faces the competition from other larger solar companies who does everything themselves, such as SolarCity is a full-service provider that dominates residential solar market in the U.S; SunPower is also a solar-panel manufacturer. In order to guarantee top-class customer services,

Sungevity chooses highly trained local installers who know better about local ordinances and will be available to help at anytime in future. It creates local jobs within the community. Sungevity takes this as special force to compete with other solar companies in U.S.

Cost structure

Solar providers bear same risks and costs engaged in solar energy system design, monitoring and maintenance. Labor cost and components cost comprise the major costs in solar business. Sungevity already noticed customer acquisition is the key area to reduce cost and the cost in installation. One advantage of Sungevity is to design solar energy system with satellite image that allows Sungevity to reach customers without door-to-door visits at consulting step and design. It enables Sungevity to lower the cost in customer acquisition. However, Sungevity has a relatively high cost in customer acquisition customer due to the referral program. It exists as an efficient channel to reach new customers, but the cost keeps growing as the customer base expands. Sungevity therefore is looking for more sales channels with a lower cost in attracting potential customers.

4 Analysis

Two cases are analyzed with the same methodology in case study sections, this section continues the study by applying a cross-case analysis to display the major similarities and differences of each building block between two solar companies. It furthermore reveals the strengths and weaknesses of analyzed solar business models and helps to present the result of case studies research.

4.1 Cross-Case Analysis

The methodology of *Case Study Research* has been applied to the analysis of SolarCity and Sungevity in former studies. Two cases are analyzed separately, it facilitates the conduction of a cross-case analysis to draw the final results. Cross-case analysis includes the analysis of each building block of both cases to reveal the differences and similarities between two solar providers' business models.

Customer Segments

The analysis below is conducted by analyzing the differences between SolarCity and Sungevity in serving customer groups and market areas.

Residential vs Commercial Solar energy tends to be the mainstream energy source in the U.S., based on the significant increasing contribution of overall generation capacity. U.S. reached a 4.2 GW in 2013 with a growth 15% since 2012. Geographically, California generates nearly half of the capacity added in 2013, with a mandate for 33% renewable energy by 2020. SolarCity, as national leader in delivering solar energy to homeowners and businesses across the U.S. California, Arizona, and Colorado comprise 90% of SolarCity's total customer portfolio. The top five states are ranked according to the growth in solar capacity in 2013 are shown in Figure 12. Obviously, SolarCity has the advantage of possessing a huge expansion to top solar markets including California and Arizona. (Tweed 2014)

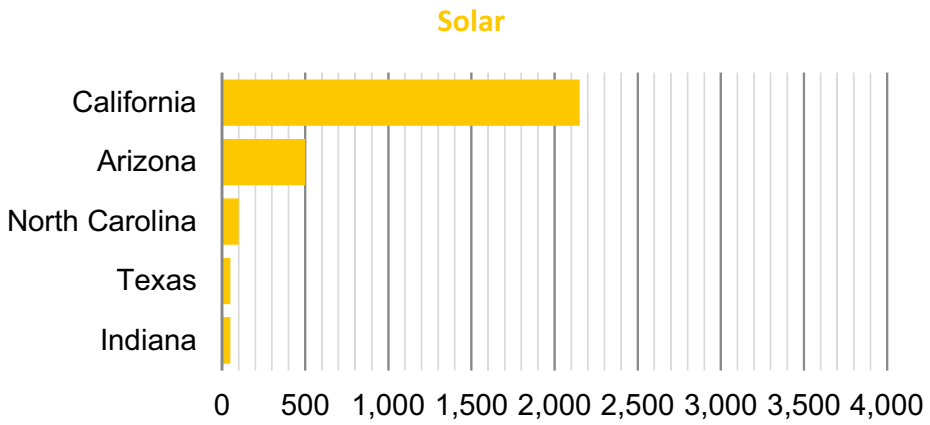

Figure 12: Solar capacity additions in 2013, top five states, units in megawatts. Source: Tweed (2014)

SolarCity delivers solar energy not only to home, but also commercial and government customers. However, Sungevity favors residential solar market and believes it overtakes the growth of commercial market in future. SolarCity is in a leading position with approximate one third of U.S. residential PV markets as illustrated in Figure 13, it expects a steadily growing in 2014 with bottlenecks in project finance, component costs or regulation. (Johnston 2014) According to GTM report, there will be continuous growth in all customer segments but most rapid in residential market with the possibility of overtaking the growth of commercial and utility market segments in 2014. The goal of SolarCity is to reach 1 million solar rooftop customers by July 4, 2018 and will be partly accomplished through the acquisition of Paramount Solar. (Tweed 2014)

Besides the thousands of residential customers, SolarCity's commercial customer segment includes more than 100 schools, cities and Fortune 500 companies, such as eBay, Walmart and Intel. SolarCity owns nationwide field teams to support each step of a project. Companies prove their environmental leadership by installing solar to promote as a Green Business, the partnership with world's largest companies strength the brand value of SolarCity. Furthermore, federal, state and local government establish incentives to encourage businesses to adopt renewable energy. All promise SolarCity an extensive market share in long term market.

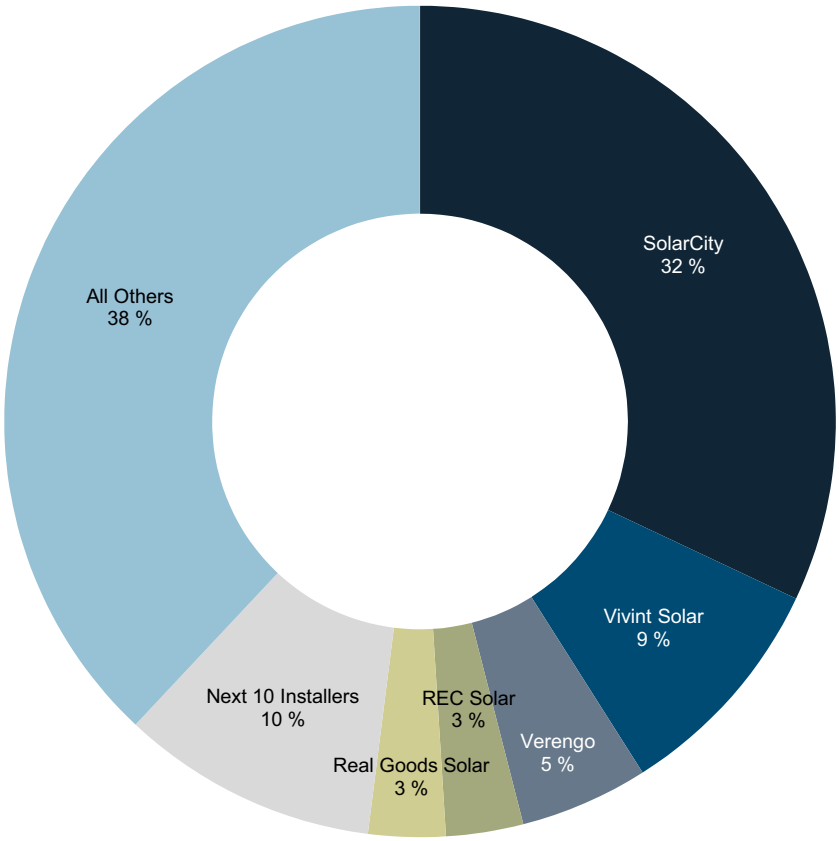

Figure 13: GTM Research's U.S. PV Leaderboard, Q4 2013
Source: GTM Research (2013)

Solar markets (U.S. and Abroad) Currently, SolarCity serves in 15 states at a national scales in the U.S. As recorded by the first quarter in 2014, SolarCity hit a record 136 megawatts after it is vertically integrated which results in 34% over the previous quarter (residential comprises 80%), which brings 17,664 new customers. Hence, the guidance for 2015 is renewed to 1,000 megawatts from 900 megawatts. The CEO of SolarCity comments, "At the midpoint of guidance, we estimate we would exit next year with more than 2 gigawatts cumulatively deployed and annualized electricity production of 2.8 terawatt-hours. This would put us on a path to fulfill our goal to become one of the largest suppliers of electricity in the United States". SolarCity is estimated to accelerate the growth of the U.S. residential market. (Wesoff 2014e)

Sungevity focuses on residential PV markets in the U.S. and international launches in Australia and Netherlands—an opportunity to introduce Sungevity to European solar markets. About two thirds of Sungevity's business is located

in the U.S. Australia has raised attention to solar energy. By 2020, 90% of energy needs will be generated by renewable energy sources, announced by The Australian Capital Territory (ACT) Government. (Gifford 2012a) Solar energy is considered as one of the key methods to achieve the ambitious goal that ACT government plans including the installation of 90 MW of large scale solar and 72 MW of small and medium scale rooftop solar systems by 2020. Australia has twice as much residential solar as in the U.S., the growing electricity price and increasing understanding of PV that all facts drive the adoption of PV as an energy option. To date, 99% of Australian PV market is residential solar which offers Sungevity a huge business growth potential to fulfill all customers. (Gifford 2012b) Sungevity relies on the strength of extraordinary customer service and solar innovation that help with penetration into the market, the customer acquisition strategy of expanding to international markets guarantees Sungevity a bright future.

Value Propositions

Solar Service As shown in Figure 14 below, one strength of SolarCity as an industry leader is to offer full service by taking care of all steps of going solar. Sungevity shares the same mission to make solar easy and affordable to customers, but the installation is completed through the partnership with local installers. It brings the issue to the accountability of solar systems if the installation is done through subcontractors. Even though the customer relationship stays with Sungevity under the term of contract. (Gifford 2012b) Unlike Sungevity, SolarCity offers a single point of contract including solar panel installation which is completed by SolarCity's professional solar installers. However, Sungevity uses local installers who know local ordinances and is available to help at any time in future, more importantly it generates local jobs which brings

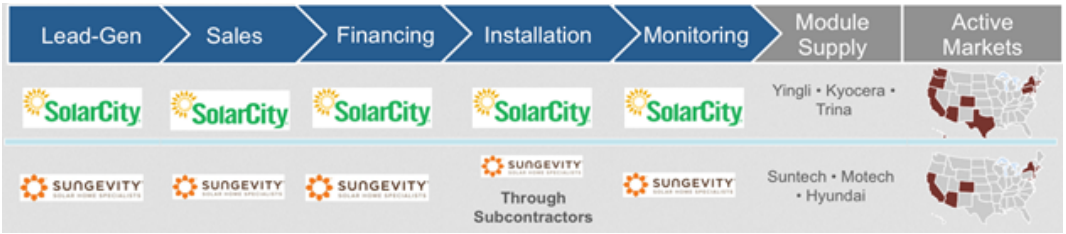

Figure 14: Comparison between SolarCity and Sungevity solar service. Source: greentechmedia.com

back money to customer's community by choosing Sungevity as solar provider.

Finance products Both SolarCity and Sungevity are supported by third-party financing to offer solar leases and PPAs to residential customers. (Trabish 2014c) Recently, an emerging financing plan brings the challenge to third-party ownership, recognized as solar loan with opportunities to the direct ownership of solar systems. Sungevity is moving to offer loans to homeowners as well as the solar panel manufactures SunPower and Canadian Solar, after it was originated by Sungage and Mosaic. The benefits of solar loans versus TPO decide the future trend in residential solar market that if solar loan overtakes TPO to be the mainstream finance solution. (GTM Research 2013)

Energy storage system (ESS) The energy storage industry is expected as a new paradigm for future electricity supply even experts from solar industry cleared the necessity of better regulatory framework based on the recent rapid worldwide development. (Dusseldorf 2012) The project is estimated to increase to reach 40 GW by 2022 in United States. It indicates a significant potential of raising revenue from energy storage systems. Furthermore, SolarCity wants to offer customers more than a twenty-year contract as the focus is changed recently from energy efficiency to energy storage, after they noticed the efficiency services are not profitable. Tanguy Serra, the chief operating officer of SolarCity said "Our focus right now is putting as many megawatts (of solar) on as many rooftops as we can. Our second focus is how we can address power consumption between 6 p.m. and 10 p.m." (Lacey 2014a) Currently, residential battery systems are used for power basic needs during emergency, while commercial battery installations are for reducing electricity demand at peak hours to lower electricity bills.

Tesla is considered to be able to drive energy storage price revolution with a technology leadership in energy storage systems. The partnership between SolarCity and Tesla (the most advanced battery manufacturer) brings the possibilities for customers to be energy independence from utility. However, Sungevity believes there is no necessity of combining batteries with grid-tied system, as the grid provides electricity if solar system runs under performance. The inverter will shut down automatically during a blackout for safety reason.

There is no electricity available until the utility grid is back to work. (St. John 2014a)

More project developers and vendors favor a cost-effective way to combine storage system with PV in their new business models. United States is expected to be the largest region for grid-connected energy storage market between 2012 and 2017, according to IHS. However, commercial market in grid-connected energy storage system is limited to a small number of regions due to the high upfront costs of storage technologies, lack of standards and knowledge of storage advantages. IHS points out that the availability of financial incentives to reduce the upfront costs of ESS will create more business opportunities to boost the adoption of storage systems. (Meza 2014a)

Channels

Sales channels An efficient business model represents the most cost effective way in customer acquisition. According to GTM Research, current customer acquisition accounts for 10% of total residential solar system costs. Both SolarCity and Sungevity reach customers through multiple channels such as social media, retail stores and referral programs. However, Sungevity's outstanding online services makes solar energy easily available which meets the future trend towards purchasing everything online. Sungevity's innovation in measuring rooftops online with satellite images without visiting homes brings convenience to both designers and customers, most importantly, it reduces the costs in customer acquisition which enables Sungevity to charge customers at a more affordable price. (Gifford 2012b)

SolarCity has national sales organizations including a door-to-door sales team. Door-to-door sales is suspected to be less efficient even it can be effective to allow sales personnel to offer solar by visiting customer's home. It costs between $1,000 and $2,000 for the acquisition of each customer which makes door-to-door as one of the most expensive sales approaches. (Krause 2013) Provided by GTM Research's report, the residential solar customer acquisition costs will decrease from $0.49/W to $0.35/W over the next four years, which saves up to $619 million for solar industry. (Litvak and Kann 2013) SolarCity as a market leader intends to increase sales teams and new approaches to

bring down the high acquisition costs for residential solar. The acquisition of Paramount Solar is a big move for SolarCity to a new sales strategy that primarily phone- and direct-marketing-based strategy to sell solar products and services without face-to-face meeting, which lowers customer acquisition costs. (Wesoff 2013)

Customer Relationships

Personal assistance SolarCity and Sungevity offer similar assistance for customers available in all steps through multiple communication channels. Consultation with Energy Advisor helps to identify customer's energy needs and financial goal; Project Manager takes care of all works and updates customers with the latest project progress. Both solar providers employ customer representative to help customers through phone call, email as well as retail stores. SolarCity signed up with Best Buy to setup SolarCity kiosk at over 60 Best Buy stores in New York, Oregon, Arizona, Hawaii and California that allows SolarCity representative to offer solar services, since the first quarter of 2014. Whereas Sungevity team up with Lowe's to display at Lowe's all stores in states where Sungevity currently serves.

Automated services For the customers' convenience , SolarCity and Sungevity offer online monitoring systems that can be accessed with any internet-enabled device at anytime anywhere for free. Both monitoring systems provided by those two solar suppliers display solar system production during day, week, month and year. However, there are minor differences in the function of monitoring services. SolarCity's monitoring services continuously monitor system production and alert customers if system underperforms; it can recommend customers a smarter energy usage pattern based on the monitoring of energy consumption accomplished by innovative technology. Sungevity's advanced monitoring system also function as a tool to track the progress of customer's referrals through Referral Program.

Communities Online communities may help to attract new customers by allowing existing customers to exchange their solar experience and comments

towards going solar. SolarCity and Sungevity notice the importance of maintaining online communities through social media such as Facebook and Twitter. It also helps solar providers to improve solar services and products by the communication betweens customers.

Revenue Streams

The sales of solar energy systems and solar leasing are the major revenues streams for SolarCity and Sungevity. Yet, SolarCity creates more revenues by providing energy-related products and services than Sungevity. However, SolarCity can not promise the success of generating extensive revenues from complementary products and services in future (Edgar Online 2014). The differences in the market sizes and customer numbers result in the huge differences in revenues. All revenue of SolarCity is generated by customers located in the United States and Sungevity's revenue is generated by solar market in U.S, Netherlands and Australia. Most of the customers in Australia choose to purchase and own solar systems to create cash sales, while U.S. customers perfer to go solar through solar leases and solar PPA to avoid the upfront costs.

In 2013, the revenue of SolarCity from operating lease and solar energy systems incentives nearly doubled to $82.85 million, however, the revenue from solar system sales remained unchanged at 81 million, while cash sales comprise less than 10% of solar system installations. (Edgar Online 2014)

Key Resources

Intellectual Resources The competitive pricing that solar providers charge from customers depends on the electricity production of solar energy system. The design and monitoring of solar energy system decides the system performance which affects solar electricity production. SolarCity and Sungevity rely on advanced intellectual properties to offer customer-design solar systems and maintain the best performance of solar energy system. Yet, Sungevity possesses the Remote Solar Design strategy to design solar system by using satellites. It enables Sungevity to give customer a quick online quote within 24 hours and has received favorably among customers.

Financial Resources Fund raising is crucial for third-party financing companies to attract funds from limited number of investors. Fundings enable consumers to go solar without paying extensive up-front cost. Any failure in raising funds may adversely impact the business. SolarCity allocates the funds from investor to cover fixed and variable costs associated in the project and to boost the growth of company. Additionally, SolarCity is looking for more financing resources to fund the operation, such as debt, equity, secularization.

Recently, Sungevity announced $70 million in new equity financing to reach a total amount of $200 million since it started in 2007. However, SolarCity as the largest solar supplier in the U.S. residential solar market, is more competitive in raising funds. May, 2014, Capital One Bank announced the partnership with SolarCity by investing $100 million fund. It allows SolarCity to offer thousands of American residential customers with affordable price. So far, SolarCity has raised funds more than $4 billion to finance solar power systems. (Wesoff 2014c)

Key Activities

Production and Problem Solving Both SolarCity and Sungevity purchase solar panels and other components from multiple suppliers with a high standard to guarantee the best-in-class solar systems. SolarCity provides all-in-one service, including a problem solving at any time if customer's solar energy system under performance. To compete with other solar providers, Sungevity also guarantees the performance of solar systems and is responsible for the maintenance.

Platform Solar business models require to continuously innovate and develop new technologies to function as a platform to deliver solar products and services. Advanced technologies in software development enable solar providers to offer services more efficiently by reducing design time, accelerate project progress and installation management. SolarCity developed various softwares to simplify process of going solar and enhance the ability to deliver solar, including SolarBid Sales Management Platform, Solar Works Customer Management Software, Energy Designer, SolarGuard and PowerGuide Proactive

Monitoring Solutions and Zep Solar Mounting Systems.

Key Partnerships

Third parties Partnership with third parties plays as an extension channel to generate more customers. The ability to build and maintain relationships with third party may affect the potential growth of solar business whether they succeed in increasing customer base. SolarCity and Sungevity establish their own strategy in accessing third parties. SolarCity develops different programs to attract business partners to refer customers, including realtors, architects, contractors, and insurance/financial services providers. Similarly, the partnerships with non-profit organizations allow Sungevity to expand customer base through partners' network, partners get finance support from Sungevity and the opportunities to join in the network of Sungevity Community.

Retail store is an alternative channel to introduce solar products to customers with a face-to-face conversation. SolaCity's retail stores include the Home Depot stores located in every state that SolarCity is serving, as well as approximate 60 Best Buy stores accomplished through the partnership with Best Buy. Sungevity also establishes partnership with Lower to deliver solar products in over 1,750 retail stores. Both companies contribute in establishing and maintaining relationships with third parties as it is treated as one of the most important strategies in acquiring customers.

Joint Ventures Joint Venture is the major financing funds strategy for SolarCity and Sungevity. Solar company and investors both contribute assets or funds to joint venture. There has been significant funding joining in residential solar finance recently. A recent residental solar finance news released that CPF/Credit Suisse announced a $200 million fund for residential finance. (Wesoff 2014b) SolarCity as a leader in residential solar market, announced a $100 million investment from Capital One Bank, May, 2014. Sungevity raised $70 million funds from Jetstream Ventures. SolarCity and Sungevity both contribute effort to increase JV to maintain the competitiveness of providing solid solar pricing to customers. Sungevity additionally uses JV as a gateway to expand market areas to Netherlands and Australia.

Competitors Both of SolarCity and Sungevity face competition of attracting potential customers from utility. Utility's investment in solar boomed in 2013, up from 73% in 2012 to 82% in 2013 of new solar capacity. (Trabish 2014b). According to GTM research, the utility-scale PV is estimated to reach 55% of U.S. total PV installation in 2014, where the residential market and non-residential market take 26% and 19% respectively. (Munsell 2014a) The continuous growth of utility solar threatens other U.S. solar providers that might replace rooftop solar in future.

Cost Structures

Solar business recognizes fixed costs and variable costs associated with all processes of a solar project. SolarCity and Sungevity bear the same kinds of costs engaged in solar projects. It requires solar companies to manage growth in a cost-effective and efficient manner to make solar business profitable.

U.S. residential solar PV customer acquisition accounts for 10% of total cost of a solar project, indicating a huge potential in cost reduction. (Litvak and Kann 2013) Leading solar providers noticed the importance of reducing customer acquisition cost, such as SolarCity succeeded in reducing operating cost and capital expenditure per megawatt deployed in 2013 indicated by latest news, resulting in a higher cost due to the door-to-door customer service strategy. (Meza 2014b) Cost structures generally include solar system hardware costs and soft costs. PV hardware costs indicate the cost of purchasing solar system components from manufacturers. Soft costs accur when Solar installers need to visit homes to measure and fit the panels, or even just for a quote. Sungevity uses satellite and aerial imagery to deliver a free quote within 24 hours. It reduces 10% costs than other installers. (Miller and Stone 2008) It makes solar energy easy and efficient by saving money and time for both installers and customers.

4.2 Results

The cross-case study of SolarCity's and Sungevity's business models reveals different strengths and limitations of two solar providers. Moreover, the analysis of nine building blocks of the business model ensures the business model is evaluated from all perspectives. Based on the analysis and comparison of two companies' unique business models, Table 5 below lists each company's strengths and weaknesses. Other solar companies can take the results into consideration to improve their current business model by combining all strengths but minimizing weakness aspects. The most potential and typical features are outlined and explained to emphasize the result.

4.2.1 Strengths

SolarCity dominates U.S. solar market as an industry leader which demonstrates the efficiency of its business model. Compared with SolarCity, Sungevity only takes a small fraction of U.S. residential solar market with continuous growth relies on its strength in residential market.

Table 5: Strengths and weaknesses of SolarCity and Sungevity.

SolarCity	**Sungevity**
Strengths • Significant size and scale • Full service (all-in-one) • More products and services • Multiple sales channels • Innovative technology • Extensive investment from investor	 • International launch • Remote design • Creates more jobs by using local installers • Rooftop revolution • Solar for all
Weaknessess • More customer acquisition costs • Cost of solar energy system installations	 • Financing issue • No energy storage systems

Diversified services and products SolarCity offers all-in-one service that takes care of each process of switching to solar, while Sungevity works with subcontractors for installation. However, it is difficult to draw a conclusion whether to choose solar provider with a full-service solution or part of the solar energy value chain. From another point of view, it creates more local jobs by subcontracting installation to local installers who know local ordinance and available to help at any time which may increase the competitiveness of Sungevity.

SolarCity provides additional solar products such as energy efficiency products and ESS while Sungevity not. Most importantly, ESS offers a huge potential in reducing energy cost and is predicated to expand in all customer segments. More customers have seen the necessity of choosing a solar energy systems with ESS. SolarCity's advances in offering more diversified products and services will show stronger strength in attracting potential customers.

Sales channels The purpose of exploring new sales channels is to deliver solar products and services to more customers, to meet the final goal of a company to create more values. Therefore, customer segment is the most potential portion of solar energy value chain. SolarCity as market leader in the U.S., has multiple sales approaches with national sales teams, covering various channels to reach customers. Sungevity's strength is demonstrated by the eploration through different sales channels in additional international markets, Netherlands and Australia.

Reputation Sungevity specializes in residential solar market. The founder, Danny Kennedy published a book *Rooftop Revolution* that focuses on the economic and environmental benefits of solar power. It not only explains what is solar energy, but also presents how solar can change people's life by explaining solar projects based on Sungevity's own experience. (Schroeder 2012) Sungevity demonstrates its leadership in residential market by the success of *Rooftop Revolution* to bring more people cheaper power with the sun. The faith of Solar For All enables Sungevity to help improve people's lives by providing renewable energy through the partnership with Empowered by Light. Consumers who choose to Sungevity as solar provider participate in the pro-

gram that Sungevity donates a solar power light for each solar system they sell. It builds the reputation of Sungevity, meanwhile it functions as a sale approach that consumers have more motivation to choose Sungevity.

Remote design Sungevity's leadership in residential market also relies on the Remote Solar Design (RSD) to design solar systems remotely with satellite that reduces the cost in customer acquisition. In addition, it allows solar representative to offer a firm quote efficiently within 24h. It exists as a solution to reduce the cost together with improving the service efficiency. The intellectual resources are required in each process of a solar project, a reliable intellectual resource not only improves the performance of solar energy system, it furthermore reduces extensive costs resulted by any system breakdown, under-performance. Hence, the success of Sungevity by remote design presents other solar providers the importance of improving their intellectual resources.

4.2.2 Weaknesses

Customer Acquisition Cost It covers 10% of the total cost of a solar project. SolarCity has a powerful sales strategy but with a high cost in acquiring new customers due to a door-to-door sales team, the total amount of acquisition cost keeps growing as the customer numbers expand. It is necessary to look for new sales approaches with lower costs. For instance, SolarCity is trying a new approach–Groupon that allows $400 discount for the contract with SolarCity at a limited period, with an expectation to decrease customer acquisition costs and open new sales channels. (St. John 2014b) The reduction in the cost of customer acquisition not only maximizes the profit margin, it also presents the competitiveness in attracting potential customers that companies with lower cost has stronger advantage to compete others.

Financing resources SolarCity and Sungevity depend on the fundings from third-party to offer customers an affordable electricity price. Adequate fundings from investors ensure the quality of solar services and the competitiveness between solar providers. There has been some financing issues with Sunge-

vity, some customers complained that they needed to wait for a long period to generate solar power after the installation of solar panels, due to the lack of funding. The lack of fundings may harm the business such as to delay solar project which brings extra costs and ruins the company reputation. Solar companies therefore need to maintain a multiple funding resources to support every step of a solar project with adequate fundings.

4.3 Reliability of The Result

The reliability of final solar business model constructed in this thesis can be testified from different aspects of the report. First, the structure of thesis is presented in an academic way including sections, sections and subtopics to deliver information about solar business step by step from the business background, literature review to final analysis process. Audiences therefore understand the study systematically. Secondly, the methodology of analysis is following the fourth edition of *Case Study Research* (Yin 2009) to complete thesis with the best research method. The book has been accepted widely by specialists and researchers as a tool to conduct scientific research. With the guide of the book, the author is able to define the goal of thesis and how to choose and apply case study method. Besides the structure of thesis, the case studies are described separately by the business model canvas according to the handbook of *Business Model Generation* (Osterwalder and Pigneur 2010). Both books provide an academic framework for the composing of thesis to ensure two case studies are described and analyzed by same method fairly.

SolarCity is a leader in U.S. solar market, providing all-in-one service for both residential and business customers. Compare with other solar companies that are only delivering part of the products and services of the solar value chain, the selection of SolarCity ensures the analysis covers all aspects of solar value chain that the analysis result is applicable for all solar companies with different customer groups. Sungevity specializes in residential solar market. The future trend in solar market is expected to grow most rapidly in residential segment. Therefore, the study of Sungevity emphasizes and represents the features and characteristics of residential solar market. Thus, SolarCity and Sungevity are chosen as representative cases that the analysis result can be also applied to other solar companies.

Furthermore, the evidence collected for case studies are from multiple sources to ensure the cases are described sufficiently. For instance, magazines are used as one of the most important sources in the thesis, solar specialists and researches publish abundant articles, reports and updated news of all aspects of solar including solar projects, market & policy, solar finance, inverts and other components with an academic point of view; the news and annual report released directly from solar company are the most authority and reliable sources; government regulation and incentives are also used for analyzing current market and the foresee of future market trend.

5 Discussion

5.1 Strengths and Weaknesses of The Study

Third-party ownership model is still in its early stage and tends to dominate future residential solar market. The analysis of TPO solar companies helps to understand the logic how TPO decides business decisions and activities. United States as one of global top solar markets, the research of U.S. solar market shows current market situation and potential trend in future. Especially, SolarCity is the leader in U.S. solar market with full services and complementary solar products, any new approach released by SolarCity may represent a new trend in U.S. solar market.

The evaluation of an analysis is based on the collection of relevant evidence from multiple sources, adequate resources provide a firm base for analyzing sufficiently. This thesis is structured according to the *Case Study Research* as shown in Figure 4, however, the author encounters difficulties in the process of collecting evidence for Sungevity that some resources are classified and not available due to the access limitation. There is only general information available, the lack of detailed evidences decide the analysis of case studies can not be conducted precisely and completely. Unlike Sungevity, despite the articles and reports released by public media, SolarCity publishes and updates their latest business activities in the forms of news and reports. Hence, the case study of SolarCity contains more data and evidence than Sungevity, the analysis of SolarCity is more precise and thorough than Sungevity.

There are nine building blocks for each business model as shown in Table 2, each building block contains extensive information that there is not enough time to study each thoroughly. Hence, some perspectives of each building block is explained generally without harming the case studies. Additionally, the analysis is based on current situation of solar market, some factors may change unsuspected which is out of control. For instance, government regulations towards solar market affect the business strategy if government favors solar energy or limits the growth of solar energy. Thereby, any change in government incentives is unpredictable and out of the control of any solar company, the business strategy has to be adjusted to respond the government regulations

and policies. The results concluded in this thesis may not be applicable if solar market background changes. Lastly, this research only focuses on TPO solar PV business model, other business models such as utility-scale solar is not included. However, companies' strengths differ in different area of the business, the results can not fulfill a company's desire in the pursuit of a better business model.

5.2 Implementation of The Study

According to the topic selected, it requires the author to conduct an investigation at current solar market: government policies and regulations towards solar market, impressive solar projects, particularly a comprehensive look at business strategies for solar PV market. The general understanding of overall market trend provides basic knowledge to consider how to conduct the study of solar PV business model. The topic indicates at least two cases needs to be chosen to reveal different business strengths and weaknesses.

After the two cases are decided, it comes to the question of how to conduct the analysis, case study research is adopted as the theoretical methodology to conduct the research. Case study research explains the process how to conduct a research academically and fairly, as shown in Figure 4, to draw a reliable result. Specifically for the analyze process, Business Model Canvas is used to describe the framework of solar company's business model. In order to tell the differences and similarities two cases, it is necessary to have a separate section to discuss/compare each building block of the business model. The analysis identifies strengths and weaknesses in both companies' business models that offers an implication for how to improve the efficiency of solar PV business model.

5.3 Applicability of The Methodology

Multiple-case studies with a cross-case analysis is applied for this thesis. Why to choose case study method over other research methods? The first thing to start a study is to choose the right method by understanding the topic. The topic of the thesis is to compare and analyze solar PV business models. The

research question can be asked as "How to analyze?" and "Why study solar PV business model?". The questions correspond the relevant situation in Table 3 to choose between experiments, history and case study. When the methods overlap, it is necessary to distinguish between different methods for the best solution. The topic focuses more on current business models and the future trend, instead of analyzing old business models. The experiment method can be applied if the researcher can control the the variables in study. However, the author of thesis is supposed to explain business model and it is out of author's control. Therefore, case study method is selected and applicable for the thesis.

Case study research is distinguished from other research methods, but there is variations within case studies. Business models vary between companies because of different business strategies. The evaluation of individual case is not able to represent all the features of various business models to give a result that can be approved for all. However, multiple cases can ensure the analysis covers different perspectives and therefore, is applicable to meet the objective of thesis.

Lastly, the analysis of case studies presents the logic of how solar companies run their business which furthermore reveals the similarities and differences. The strengths and weaknesses are obtained by the comparison between cases. Therefore, the conduction of a cross-case study is necessary and applicable.

6 Conclusion

The objective of this thesis is to identify the strengths and weaknesses of solar PV business model through the description with the framework of Business Model Canvas to explain how solar company creates and captures values. The thesis answers the research questions proposed in the beginning of starting the research that case study method is applied as the methodolgy of how to conduct the thesis study, solar PV business model is studied due to the incredible rapid growth in U.S. solar market.

Business models of case studies are described with the evidence collected from reliable resources to present the similarities and differences in building blocks. A cross-study analysis furthermore delivers the results by analyzing the strengths and weaknesses through the comparison between two cases and the reliability of results have been discussed and approved in this thesis. Due to the access limitation in the evidence collection process, unfortunately it is unable to present each building block of a business model completely with precise data. However, the results of cross-case study are still able to present the major advantages and disadvantages of solar PV business model, indicating the key factors that affect the efficiency of business model, but there is still more factors have not been released.

The results of this thesis is based on the case study of SolarCity's and Sungevity's current business model. However, there is always new fundings, technologies, pricing mechanisms booming the solar market to change the market background. The results present the key factors can be taken into consideration to improve a business model for solar market. The goal of a company is to generate more values: every company should develop own business model, relying on the expertise in solar business to maximize profit margins. Overall, a useful business model can provide approving solar products and services to customers, meanwhile it must serve investors' interests to ensure a multiple funding resources to reach the final goal of offering solar system with competitive price.

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