



MKT 3300.0U1 – Principles of Marketing

Group 2

Jeremy Edwards

Phi Vo

Trang Vu

Hussain Inam

J.D. Pearson

2014, July 2

Professor Jong Min Kim

Table of Contents

Executive  
Summary..... 3

Introduction..... 5

Situational  
Analysis..... 6

*SWOT*  
*Analysis*..... 7

*Competition and*  
*Industry*..... 8

*Consumer*  
*Analysis*.....10

Marketing  
Objective.....11

Target  
Market..... 13

Marketing  
Strategy..... .. 15

*Marketing*  
*Mix*..... 15

Evaluation  
Methods..... ..18

Conclusion..... ..20

### **Executive Summary**

Solar Roadways is a pioneering technological startup reinventing solar energy. Currently in the developmental stage of production, the company aims to penetrate the solar energy market. Prospective customers could include everyone in the near term would include both local governmental municipalities and established businesses wishing to reduce their carbon footprint and energy costs. As production and demand increases, the solar panels will be implemented as parking lots, sidewalks, bike paths, and recreational courts, with the eventual goal of using the panels for road use.

Throughout the United States, public opinion is increasingly shifting towards the use of more renewable energies and reducing the global carbon footprint. This provides Solar Roadways an advantage in penetrating the market. However, public perception of solar energy is that the

initial costs are too great for mass use. While the overall price of solar technology has steadily decreased over the years, this company is at a disadvantage. Low production numbers and development costs transfer to the customers. Educating potential consumers of the multiple uses, convenience, and diversity of the roadway panels would alleviate customer's concerns over initial price.

With a superior product compared to traditional solar panels, a campaign to educate potential customers is key in developing customer relationships. This is achieved in a variety of fashions. A strong online presence is the easiest way to deliver a message across the country and globe. After a successful crowdsourcing campaign for funding the second developmental stage, further crowdsourcing campaigns may be used. Social media's role in everyone's life offers another strategic platform for delivering information and keeping people up-to-date on the latest news and development. This is vital to building customer relationships, generating enthusiasm, and overcoming the initial price of installation.

Current estimates of sales and budgets are too early to rationalize. As development continues, Solar Roadways continues to refine the manufacturing process. In addition, as production increases, the ability to order direct materials in bulk becomes feasible. As it stands, production is ordering in low numbers. These processes have driven the cost of manufacturing to roughly \$10,000 per panel. Despite the costs, there is interest from numerous businesses, universities, and government agencies. Realistically, in two years, production costs will lower and revenue

will be positive. At that point, the company should be producing a small profit and operating efficiently.

After customers have installed panels, maintaining those relationships and evaluating the product is critical. Several methods can be used in maintaining relationships and understanding public perception. Through the use of social media, data mining, surveys, and conducting panels and experiments, Solar Roadways will be able to gather insight on their product. They will also gather important technological information, which will help further refine the product and lower costs to the consumers.

## Introduction

Just a few years ago, Solar Roadways was an idea that sprung from the current issues facing the globe such rising energy costs, climate change, and an aging national infrastructure. In 2009, the Federal Highway Administration awarded Solar Roadways a contract to build an initial prototype for a photovoltaic panel that could be a viable substitute for current roads and pavements (Brusaw, 2014). The idea for such a panel developed as a solution to the increasing levels of pollution, rising energy costs, and increasing prices of oil. Solar Roadways is now in the second developmental phase of industry-first highly resistant hexagonal solar panels used for road use. The mission is to replace all United States roadways with these durable photovoltaic panels and create energy independence (Brusaw, 2014).

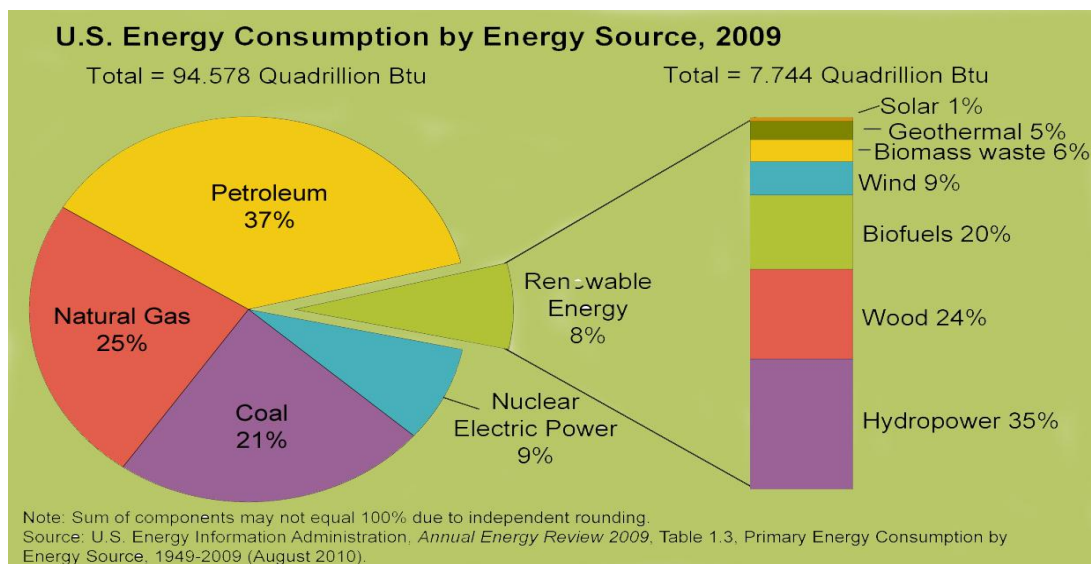
This analysis serves as a guideline into the market penetration and rollout of the solar roadways. As a startup company, overcoming market barriers and penetrating a well-established market is a difficult challenge. However, as businesses and homeowners are becoming more conscious of energy prices and climate change they are slowly looking towards alternative and cost-saving energy sources. Solar Roadways is attempting to fill the need of those potential customers by offering a product that not only meets their needs, but also offers several additional benefits to the consumer.

### Situational Analysis

Solar Roadways is in their second development phase, with the target to build a prototype parking lot for testing (Brusaw, 2014). Their idea has received strong demand from initial investors, governmental agencies, and the public. Marketing will be critical to generate significant demand for the products. The basic market need is for intelligent renewable energy, reduced carbon emissions, and lowered energy costs.

According to U.S. Energy Information Administration, solar power used as an energy source accounted for only 1-percent of all the energy consumed in the United States in 2009.

Renewable energy in total accounted for 8-percent (Stevens, 2012).



Source: U.S. Energy Information Administration, Annual Energy Review 2009, Table 1.3, Primary Energy Consumption by Energy Source, 1949-2009 (August 2010)

This is in vast contrast to Germany, who is the world's leading user of renewable energy sources. As thinkprogress.org reports, "In the first quarter of 2014, renewable energy sources met a record 27 percent of the country's electricity demand, thanks to additional installations and favorable weather (Kroh, 2014)." However, the United States is only taking moderate steps to increase the use of renewable energies nationwide when there are many areas suitable for development.

Solar Roadways aims to penetrate this sizeable market with an innovative new approach. With current solar technology, many consumers, both private and commercial, have concerns over the economic feasibility and usability of solar technology. Solar Roadways is attempting to address these concerns by providing a product that provides an array of benefits to accompany the energy output of solar power. However, this startup company faces many challenges.

#### *SWOT Analysis:*

##### **Strengths:**

- Extensive knowledge on current technologies involving photovoltaic energy
- Wide spread support for development
- Ability to obtain funding from outside sources, either governmental or private

##### **Weaknesses:**

- Rare earth materials that may be needed for production may deem challenging to obtain in quantity
- Return on investment is long term and may be a problem for the private sector



- Engineers are needed to further refine the concept, streamline the process, and help lower costs
- Only volunteers are helping manufacture prototypes
- Ordering parts and materials in low volumes drives up price per unit

**Opportunities:**

- Energy dependence for most of the United States
- Reduction of carbon emissions through the reduction of oil dependency
- Decreased maintenance costs and lowered repair time for infrastructure
- Easy and quick configuration of road and parking lot markings
- Removal of ice and snow through heating elements, reducing costs and accidents

**Threats:**

- Producing a cost-effective working product
- Current photovoltaic panels for homes and businesses already proven effective
- Not enough economic growth to fund new innovative infrastructure projects
- Current use of concrete and asphalt already inexpensive
- Other means of renewable energy already implemented

*Competition and Industry*

According to ENF Solar, there are currently seventy-four solar panel manufacturers with headquarters in the United States (“Solar Panels Manufacturers from United States”, 2014).

These manufacturers would seem to provide direct competition to panels used for roadways.

However, while these companies produce a similar product that serves some of the same need to the customer, they are not the primary competition. The greatest hurdles to overcome are public perception of renewable energy, economic factors limiting the implementation and use of solar energy, and introducing a product that is not as limited in scope.

According to the Institute for Energy Research, “Today, solar energy provides two-tenths of 1 percent of the total energy consumed in the United States. While the amount of solar electricity capacity in the US has increased in recent years—rising from 334,244 kilowatts in 1997 to 1,488,500 kilowatts in 2011 , it still only accounts for 0.1% of net electricity generated in the United States – the least among the renewable sources of hydroelectric, biomass, wind and solar (Solar – IER, 2014).” As is shown, the current market for solar energy is quite inconsequential given the United States’ total energy demands. Although the demand has been slow to gain traction in the U.S., there are, however, dozens of companies located globally that manufacture and distribute photovoltaic panels.

The largest issue current solar manufacturer’s face globally is the economic feasibility and price of photovoltaic panels. Ucilia Wang, a contributor for Forbes magazine, noted that in the first quarter of 2011, First Solar, the United States’ largest manufacturer, saw revenues became flat and showed lower earnings (Wang, 2012). This trend has increased throughout all companies in the solar market and does not appear to reverse course. China, however, in recent years has grown to become the world leader in solar manufacturing using state owned banks and utilities to increase domestic demand (Wang, 2012). The United States has not followed suit.

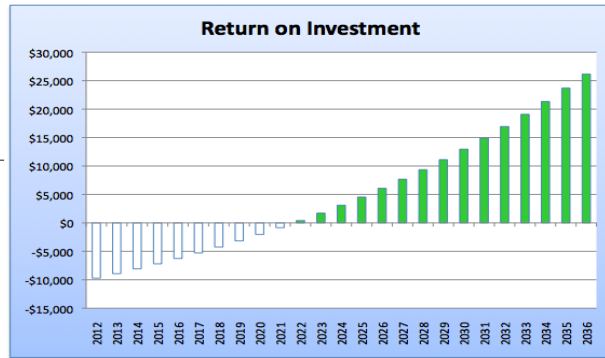
### *Consumer Analysis*

A detailed consumer analysis would include governmental, business, and residential consumers, each with differing motivations and financial constraints. Governmental agencies, such as local municipalities and state controlled areas, are a difficult market to penetrate due to legislative challenges, budget limitations, and restraint towards shifting energy reliability. Progress is occurring, as was shown in Sacramento, California. The local government began construction on four sites in 2011, and adding two other sites afterward. These sites included the city hall, police department, and water treatment facilities. Estimates of energy savings annually calculated to be 4.2 million kWh (“Commercial Solar Panel Installation and Power”, 2014). For Solar Roadways, as a startup company, it would be local municipalities that would be the target market as larger governmental agencies, such as the state and federal level, would be too large in scope.

For businesses and residential consumers, there are hurdles to overcome initially. According to a national survey carried out by Solar City, Clean Edge, and NASDAQ, 62% of homeowners said



System size (kW)	5
Sqft:	625
Cost per watt:	\$5.00
<b>Out of Pocket Cost</b>	<b>\$25,000</b>
State Rebate	-\$10,000
SREC payments year 1	\$0
30% Federal Tax Credit (no cap)	-\$4,500
Annual Electricity Savings	-\$768
<b>Cost after 1 year</b>	<b>\$9,732</b>
<hr/>	
Home Value (tax free):	<b>\$15,368</b>
Profit 2022 - 2037:	<b>\$27,009</b>
Monthly Bill Savings:	<b>\$64</b>
Same as Planting:	<b>117</b>
System Payback:	<b>10 Years</b>



that they wanted solar panels for them home (“U.S. Homeowners on Clean Energy: A National Survey”, 2010). While this statistic is generally favorable, solar companies are having difficulty in terms of sales and revenue. The decision buying process of the consumers and public perception regarding price has an effect. For the traditional homeowner or business, the initial cost is generally the determining factor that turns prospective customers away. Initial costs for traditional solar panels can cost up to \$20,000 (Simon & Mosey, 2013).

Source: Solar Power Rocks: Florida Solar Power for your house - rebates, tax credits, savings

To aid in the primary cost, there are there are programs that drive down those costs. However, these do not factor because most prospective customers are unaware of the aid. For instance, in many areas, federal, state, and local municipalities offer tax credits and rebates, some of which reduce the initial cost by up to thirty percent (Florida Solar Power for your house - rebates, tax credits, savings, 2014). Another factor driving the consumer is the decision buying

process itself. Given the complexity of solar panels, the decision-making cycle can last up to two years, which stagnates customer inertia.

### **Marketing Objective**

Solar Roadways is a startup company looking to capitalize on the current emphasis of clean energy and climate change within consumer markets in the United States. However, market penetration is difficult given consumer perception regarding the value equation associated with purchasing solar technology (The Renewable Energy Picture, 2013). Upfront costs most often deter potential customers, despite the value and eventual cost savings each year (The Renewable Energy Picture, 2013). A potential concern of this company mirrors those of the public. While the price of solar technology is steadily decreasing and production increasing, this company is producing a panel that is technologically progressive. Initial costs of production currently are higher than traditional markets due to the low volume of panels produced. These higher costs will have an impact on any potential purchaser. However, Solar Roadways aims to add value and usability to traditional solar panels.

Given the response to the company's idea, many prospective customers have expressed interest. With considerable interest, Solar Roadways is on track to continue development of the panels and begin distribution and installation. Now, it would be beneficial to establish an objective to achieve the first functioning roadway. Construction would initially begin by installing test projects in smaller markets, such as parking lots and sidewalks, to measure

feasibility, costs, and durability. If tests prove successful, this company should have its first functioning roadway within 5 years. The company should also consistently measure both its manufacturing costs and energy output from the panels to ensure economic feasibility. Current estimates of production of one solar panel at \$10,000 (Brusaw, 2014). This is incredibly expensive compared to a tradition rooftop solar panel, which costs the consumer an average of \$300 to purchase. Increasing production, streamlining the manufacturing process, and using high volume parts purchasing should lower production costs. Within the same 5 years, Solar Roadways should achieve a per-panel cost of \$1000. The company will not be able to achieve the same low cost as traditional panels, however, due to additional technology and low order rate. To accomplish its marketing objectives, Solar Roadways should develop benchmarks to measure progress. Regular annual reviews should provide adequate feedback and assist in performing any corrective action in a timely manner.

### **Target Market(s)**

The most feasible market to penetrate would most likely be large businesses and governmental agencies. Given current pricing, most homeowners would not be able to finance the road panels. However, as manufacturing costs decrease through continued development, a typical homeowner would be able to utilize federal, state, or local subsidies and tax credits to aid in initial installation costs (Commercial - CS City of Sacramento, 2014).

Source: U.S. Solar Market Insight: Yeah in Review (GTM Research and SEIA)

Due to cultural shifts within the United States toward more energy efficient and greener energy sources has opened the door for companies to gain a foothold in the market. As is shown above, utility and commercial markets dominate the solar power market, largely due to financial flexibility (SEIA, 2012). It is for this reason that Solar Roadways intends to focus its efforts at attracting business from these segments. This company has several strategic advantages that differentiate itself from not only tradition solar technology companies, but traditional roadways as well.

- Embedded LED light bulbs provide safer nighttime driving conditions
- Provides a decentralized power system
- Heating elements embedded prohibit formation of ice and snow
- Recycled glass used for surface impervious to potholes
- Programmable system enables the LED bulbs to customize parking lot/road configuration and provide warnings to drivers ahead
- Pressure sensors can be used to illuminate the LED bulbs to warn drivers of pedestrians or wildlife

For businesses looking to use the panels for use as a parking lot, the programmable LED system would allow for any parking space changes without further costs for hiring contractors for painting. The heating elements would also provide an ice-free parking lot, preventing any accidental injuries to customers who may slip on the ice (Brusaw, 2014). For governmental agencies, an addition benefit includes the tunnels that accompany the roadways. These tunnels

would collect and filter rainwater, house electrical and telecommunication lines, thereby eliminating need for power lines and drainage ditches. In addition, given the amount of discretionary spending needed by the government to improve current infrastructure, funding for upgrades and improvements would be easier to secure (Gregory, 2013).

The benefits of the panels themselves are certainly intriguing; however, the real benefit is the energy output. According to the Energy Information Administration, the United States (all 50) used 3,741 Billion Kilowatt-hours of electricity in 2009 (U.S. Department of Energy, 2010). If Solar Roadways were to cover the entire road system network throughout America, the energy output would equate to 13,385 Billion Kilowatt-hours (Brusaw, 2014). These figures are looking long-term however. In the next few years, governmental agencies could initiate testing in smaller areas such as public sidewalks and parks.

### **Marketing Strategy**

Solar Roadways can begin to address the issue of reliability by ensuring that solar energy is as visible as possible in its markets and presents this information as a powerful source of energy, one that will help fuel and build a stronger economy.

#### *Marketing Mix*

The classic elements of marketing- Product, Price, Place, Promotion- offer a useful matrix to assess our solar program.



The company can evaluate the Product from the perspective of consumers' rational and emotional attitudes towards solar technology. These attitudes affect the desire to the states' purchases. Consumer reaction to solar technology informs marketing and communications approaches by identifying both the opportunities- the strengths and positive attributes that should be marshaled- and the barriers- the concerns and "issues" that prevent sales.

Price is one of the biggest barriers to growing the solar marketplace. A primary marketing challenge for us to address is to ensure that the marketplace hear the positive message about the value equation for solar. We also must ensure that states are addressing the financing of solar to help overcome consumer price concerns.

The Place through which solar is sold also is an area where solar programs have an important role through our work with installers, developers. Building a strong network is critical in keep up with rising demand; ensuring that it can easily find an installer is part of this task.

Promotion of solar should be a primary focus as we seek to increase the visibility of solar installations and broaden the appeal of our solar incentive programs. Using communications and promotional strategies to favorably present solar in the marketplace and ensuring that the right messages are presented to the public will help build a stronger market for solar technologies.

Solar Roadways is in their second development phase, with the target to build a prototype parking lot for testing. Their idea has received strong demand from initial investors, governmental agencies, and the general public (Brusaw, 2014). Marketing will be critical to generate significant demand for the products. The basic market need is for intelligent renewable energy, reduced carbon emissions, and lowered energy costs.

Solar roadways could be the highway of the future; these solar roadways also contain heating elements. These heating elements would consistently be energized by the sun, and could be initiated whenever a snow or ice storm strikes. The roadways would then be heated to a moderate temperature, preventing the roads from developing ice or sustaining snow. This would eliminate the need for snowplows or de-icing machines, prevent accidents, and prevent traffic buildups. Security is of the most importance with all intelligent systems. Therefore, we need to hire the best and brightest cyber-security team to keep our system safe and secure. Our road surface is heated: that means no more freeze/thaw cycles or frost heaves. Potholes will become outdated.

It would be incredibly expensive, as you would still have to pay for our current road systems. We plan to use the money already budgeted for roads for the replacement Solar Roadways. When you are prototyping, you are buying parts in very low quantities, which is the least cost efficient way possible. When you go into production, you order your parts in the 10's of thousands, greatly reducing the costs. Thanks to our funding, we are now going to hire a team

of engineers this summer, which will help us make tweaks to the design, streamline production and get costs down. At that point, we will be able to release cost information.

### **Evaluation Methods**

When finished with a project, the next logical step is to evaluate how the project is doing after implementation. Listed below will be ways as to how we will evaluate the project:

- 1) Social Media – Social media will of huge importance. Since a lot of marketing is done through social media today, we need to be at the forefront of this to make it a success, so that it does not hurt us. When people use the roadways, they will use Facebook, Instagram, Twitter, blogs, forums, and other social media avenues to either promote or condemn the solar roadways. We can use social media to communicate directly with our customers to answer any questions or concerns they may have, as well as start hashtag trends to encourage our users to spread the good word of how solar roadways benefits them. Social media will also be the easiest way for our company to conduct mass population feedback. The feedback may not be as organized or directed as we would like, but it can still be used to get a general consensus on how solar roadways are doing with the public.
  
- 2) Panels and Experiments – This would be a much more in-depth look into the opinions of the users of solar roadways. We will choose a select number of people to allow us to

track their progress as they use the roadways. This will allow us to see how their behaviors change as they interact with the different features of the solar roadways. With social media, we may only see how a user feels at that one moment, which may be bad or good. With our experiments and panels, we can see the difficulties of the roadways and adjust when adjusting is needed. We can use this to see the glitches in the technology, as well as innovate in areas that the user seems fit to innovate. One issue we may run into with panels is when users drop out. Given that situation, we will have to add new members to the panel, and hopefully we can find new people to help us conduct the experiment that have similar lifestyles to the people who dropped out. This should not be a major issue to consider though, as we hope to have plenty of members on our panels for our experiments.

- 3) Surveys – Issuing and collecting surveys will be taken through many routes, but these will portray a very part of our evaluation. Directed surveys will allow us to receive feedback on questions that we get to ask, as opposed to someone voicing their opinion on issues of less relevance. We will issue these surveys via social media, email, mail, as well as other routes. We see this as a chance to collect a wide variety of responses, while still receiving information on questions that we deem to be of importance to the research of our product and our continued efforts in marketing the solar roadways.
- 4) Data Mining – Since solar roadways are still in the R&D phase, we have yet to assert many potential candidates on the idea of retrieving data. However, one potential

candidate that would greatly benefit us would be Google and their access to roadway satellites. We can use their data on information such as the amount of car accidents on solar roadways to see if solar roadways can play a role in limiting these accidents. This is just one example of the many ways that data mining can be and will be useful to the evaluation of solar roadways and how we market them. If we can factually prove that solar roadways are beneficial to people on the road, it makes for a great marketing scheme in how we market the roadway's safety features and usefulness.

The main reasons for all these different uses of evaluation methods are to help us as a company improve how we market and implement our product. We understand that how the public portrays solar roadways will be either the victory or demise of our product and company. Given that, we will use all the resources we can to make sure that we are in touch with our users to deliver them a product that they find useful in the most efficient way possible. We must stay on top of how we market solar roadways to ensure that the public is aware of what solar roadways have to offer.

### **Conclusion**

Our plan is to continue in the R&D phase to make sure that solar roadways are not only practical from an idea standpoint but from a price standpoint as well. We will continue to focus on the "four P's" as we try to make this idea into a reality. We will improve on our weaknesses, such as pricing and promotion, and continue to advertise our strengths, which are the

long-term benefits from solar roadways, such as heated roadways and usable electricity. We know that solar roadways are not practical unless we use our marketing strategies to convince the public that solar roadways are the roadways of the future. The long-term benefits outweigh any petty concerns that critics have. Therefore, as we work to continue to make solar roadways a reality, we must use strategies like SWOT Analysis, the “four P’s”, and evaluation methods to work towards making solar roadways a product and not just an idea.

### References

Brusaw, S. (2014, January 1). Introduction. *Solar Roadways* -. Retrieved August 4, 2014, from <http://www.solarroadways.com/numbers.shtml>

Brusaw, S. (2014, January 1). The Numbers. *Solar Roadways* -. Retrieved August 4, 2014, from <http://www.solarroadways.com/numbers.shtml>

Commercial - CS City of Sacramento | SolarCity. (n.d.). *Commercial Solar Panel Installation and Power*. Retrieved July 22, 2014, from <http://www.solarcity.com/commercial/government-solar-projects/city-of-sacramento>

Florida Solar Power for your house-rebates, tax credits, savings. (n.d.). *Solar Power Rocks*. Retrieved July 15, 2014, from <http://www.solarpowerrocks.com/florida/>

Gregory, P. (2013, April 1). Infrastructure Gap? Look at the Facts. We Spend More Than Europe. *Forbes*. Retrieved July 27, 2014, from <http://www.forbes.com/sites/paulroderickgregory/2013/04/01/infrastructure-gap-look-at-the-facts-we-spend-more-than-europe/>

Kroh, K. (2014, May 13). Germany Sets New Record, Generating 74 Percent Of Power Needs From Renewable Energy. *ThinkProgress RSS*. Retrieved August 1, 2014, from <http://thinkprogress.org/climate/2014/05/13/3436923/germany-energy-records/>

SEIA. (2012, March 14). *New Report Finds U.S. Solar Energy Installations Soared by 109% in*

*2011 to 1,855 Megawatts*. Retrieved August 2, 2014, from

<http://www.seia.org/news/new-report-finds-us-solar-energy-installations-soared-109-2011-1855-megawatts>

Simon, J., & Mosey, G. (2013, April 1). Feasibility Study of Economics and Performance of Solar

Photovoltaics at the VAG Mine Site in Eden and Lowell (Report No. NREL/TP-7A30

57766) Vermont: National Renewable Energy Laboratory. Retrieved July 23,

2014, from <http://www.nrel.gov/docs/fy13osti/57766.pdf>

Solar City and Clean Edge. (2014). *U.S. Homeowners on Clean Energy: A National Survey*.

Retrieved from <http://www.cesa.org/assets/Uploads/Resources-pre-8-16/CEG-Solar-Marketing-Report-2009.pdf>

Solar Energy Tax Credit & Rebates for Solar Panels | SolarCity. (2014, January 1). *Solar Panels,*

*Solar Tax Credit & Rebates*. Retrieved July 13, 2014, from

<http://www.solarcity.com/residential/solar-energy-tax-credits-rebates>

Solar Panels Manufacturers from United States. (n.d.). In *ENF Solar*. Retrieved August 3, 2014,

from <http://www.ensolar.com/directory/panel/United%20States>



Solar - IER. (n.d.). *IER*. Retrieved July 16, 2014, from

<http://instituteeforenergyresearch.org/topics/encyclopedia/solar/>

Stevens, B. (2012, July 25). Natural Gas: The Logical Alternative. *The Daily Energy Report RSS*.

Retrieved August 3, 2014, from <http://www.dailyenergyreport.com/natural-gas-the-logical-alternative/>

The Renewable Energy Picture. (2013, January 1). Retrieved August 2, 2014, from

[http://www.thesolarandwindexpo.com/The\\_Renewable\\_Energy\\_Picture](http://www.thesolarandwindexpo.com/The_Renewable_Energy_Picture)

U.S. Department of Energy, U.S. Energy Information Administration, Office of Energy Markets and End Use. (2010). Annual Energy Review 2009. Retrieved August 2, 2014, from

<http://www.eia.gov/totalenergy/data/annual/archive/038409.pdf>

Wang, U. (2012, October 16). Report: 180 Solar Panel Makers Will Disappear By 2015. *Forbes*.

Retrieved August 3, 2014, from

<http://www.forbes.com/sites/uciliawang/2012/10/16/report-180-solar-panel-makers-will-disappear-by-2015/>