

Exploring the Power of Consumer Attitudes & Actions on the Adoption of Solar & Wind Energy in Minnesota



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ABOUT THE AUTHOR

Dan Thiede leads communications, outreach, and engagement work for the Clean Energy Resource Teams (CERTs) at the University of Minnesota's Regional Sustainable Development Partnerships and Extension. CERTs is dedicated to connecting Minnesotans with the resources needed to identify and implement energy efficiency and clean energy projects. In his role with CERTs, Dan is responsible for everything from communications research, goal-setting and big-picture strategy to the daily management of websites, social media, outreach and marketing, public relations and publicity, design and publications, and communications interns. Dan has seven years of experience with content strategy and information design for the energy efficiency and renewable energy industries, translating complicated technical data into effective educational and action-oriented tools for diverse audiences.

Dan earned a Professional M.A. in Strategic Communication from the University of Minnesota School of Journalism and Mass Communication (2014), and earned undergraduate degrees from the University of St. Thomas in geography and English writing, as well as a minor in environmental studies (2007).

During his two years of study in the Professional M.A. in Strategic Communication program, adoption and interest in solar energy rose dramatically in Minnesota, making outreach and education about the technology a primary focus of CERTs programming. With the need to redevelop an online database of solar and wind companies called the Clean Energy Project Builder and demand rising for effective communications and targeted tools, the time was right to explore the attitudes and actions of Minnesota consumers.

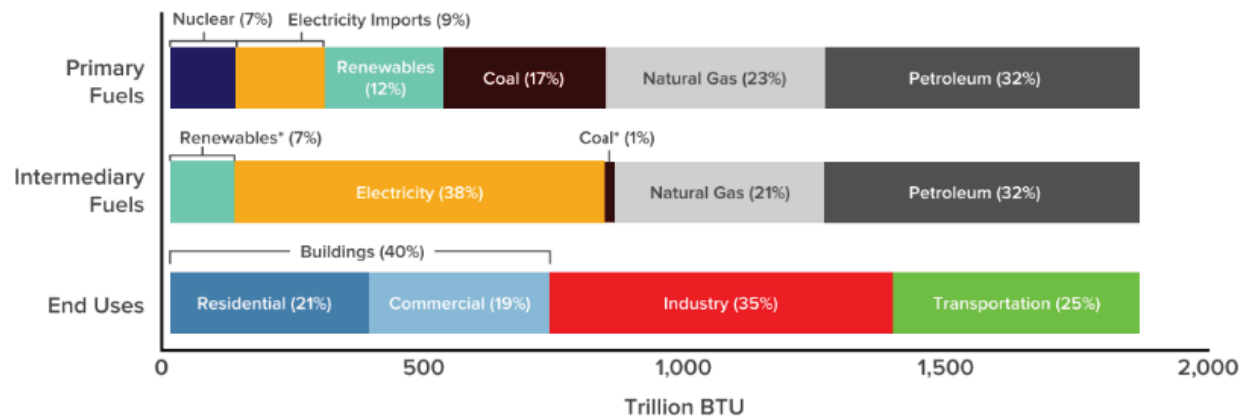
EXECUTIVE SUMMARY

In the path from attitudes to action, the decision-making process for consumers interested in adopting solar and wind energy systems are moderated by motivations and barriers. Previous research points to the importance of motivations like environmental concern and economic self-interest, as well as barriers of cost and complexity. This research, however, has not been focused on Minnesota consumers. The current paper reports analyses of two surveys—one of Minnesota consumers and another of solar and wind energy companies that serve Minnesota consumers, as well as interviews with partners of a Minnesota-based online directory featuring clean energy companies. The data show that care for the environment is the leading motivation for Minnesota consumers interested in solar or wind energy, followed by interested in reducing utility bills and hedging against future energy costs. The top barrier remains high up-front costs, followed by project complexity. The findings support deepened engagement of current solar and wind energy system owners, who were more likely to be interested in adopting new solar and wind projects, as well as any opportunities to advance social networking and peer effects around solar and wind energy to spur adoption. Data also shows that companies serving Minnesota have a good understanding of consumer motivations and barriers. The paper concludes with recommendations to improve an existing online directory of solar and wind energy companies, the Clean Energy Project Builder.

1 INTRODUCTION

The solar and wind energy industries are reaching a level of maturation across the world, with prices coming down and demand for clean sources of energy increasing. For instance, the U.S. installed 4,751 megawatts of solar PV in 2013, up 41% over 2012 and nearly fifteen times the amount installed in 2008. Twenty-nine percent of all new electricity generation capacity added in 2013 in the U.S. came from solar—with seven states getting 100% of their new generation from solar (Solar Energy Industries Association & GTM Research, 2014). Minnesota will need this new generation—both of the state’s nuclear plants will retire in 2030-2034, and 50% of Minnesota coal plants will be more than 40 years old by 2017. *Figure 1.1* shows fuel use in Minnesota, where one can see the current reliance on fossil fuels and nuclear.

Figure 1.1: Fuel Use in Minnesota



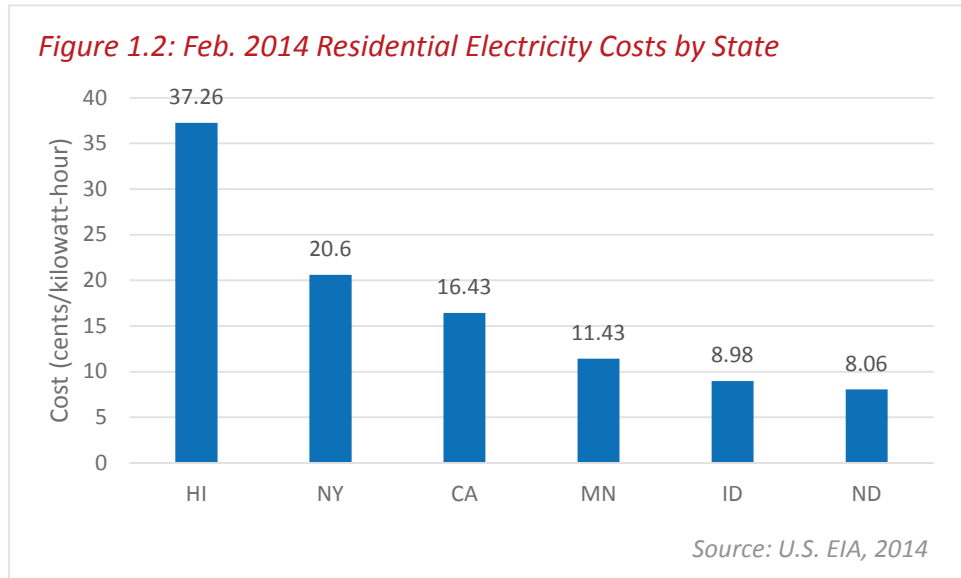
Source: Fitzgerald, Hansen, Lawrence & Maurer, 2013, p. 20

Clean energy will likely step up to fill in the gap left by aging nuclear and coal plants. In Minnesota, it’s now cheaper for Xcel Energy to install wind farms at \$30 per megawatt-hour than sign a new 20-year natural gas contract, solar module prices are down 75% since 2008, and a new suite of solar-boosting policies was passed by the Minnesota legislature in 2013. And Minnesota happens to be 23% more sunny than Germany, the global solar leader (Maurer,

2014). It’s also windy: in 2013, 15.7% of Minnesota's electricity came from wind energy, ranking it fifth in the nation (AWEA, 2014).

Aanesen, Heck, and Pinner (2012) suggest that a key market segment for growth is residential and commercial retail customers in areas with moderate sun

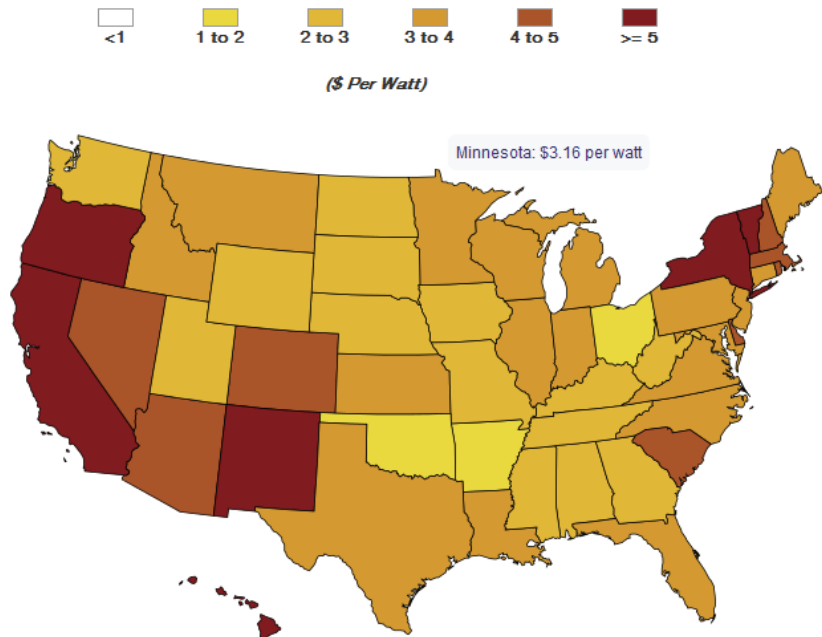
Figure 1.2: Feb. 2014 Residential Electricity Costs by State



conditions but high retail electricity prices (p. 6-8). This fits Minnesota quite well, as the state has the highest retail electricity costs in the Upper Midwest—though not nearly as high as other states in the U.S. (see *Figure*

1.2) It is believed that if states can reach a ‘breakeven’ point for solar—like wind energy has with natural gas—that they will open the floodgates for solar development (see *Figure* 1.3). High electricity costs, pro-solar policies, incentives, and financing are key drivers.

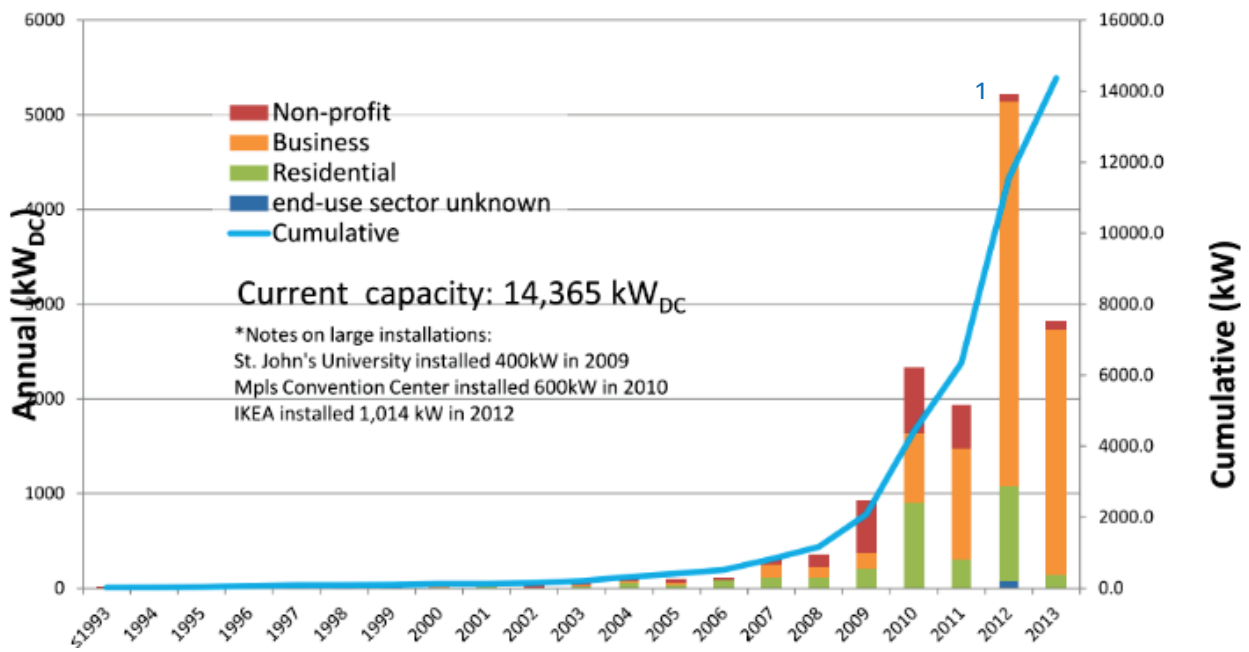
Figure 1.3: Breakeven Price for Residential Solar PV, 2012



Note: Model includes federal and local incentives, assumes availability of low-interest financing. Source: Open PV Project, 2012

Minnesota, for instance, recently enacted a policy that requires 1.5% of electricity generated in the state to come from solar by 2020. This will have a dramatic impact on the growth of solar in the state, with a rise to 400 MW of solar in 2020 from the current 14 MW. This is a 28-fold increase over today’s installed capacity, and it is estimated that 28 MW will be from consumer residential systems, an increase from the current 1,000 systems to 4,000 (Miller, 2014 p. 6, 10). This level of growth represents a boom from the relatively slow growth of solar adoption in previous decades (see *Figure 1.4*).

Figure 1.4: Minnesota’s Solar Capacity and Annual Installations



Source: Miller, 2014, p. 7

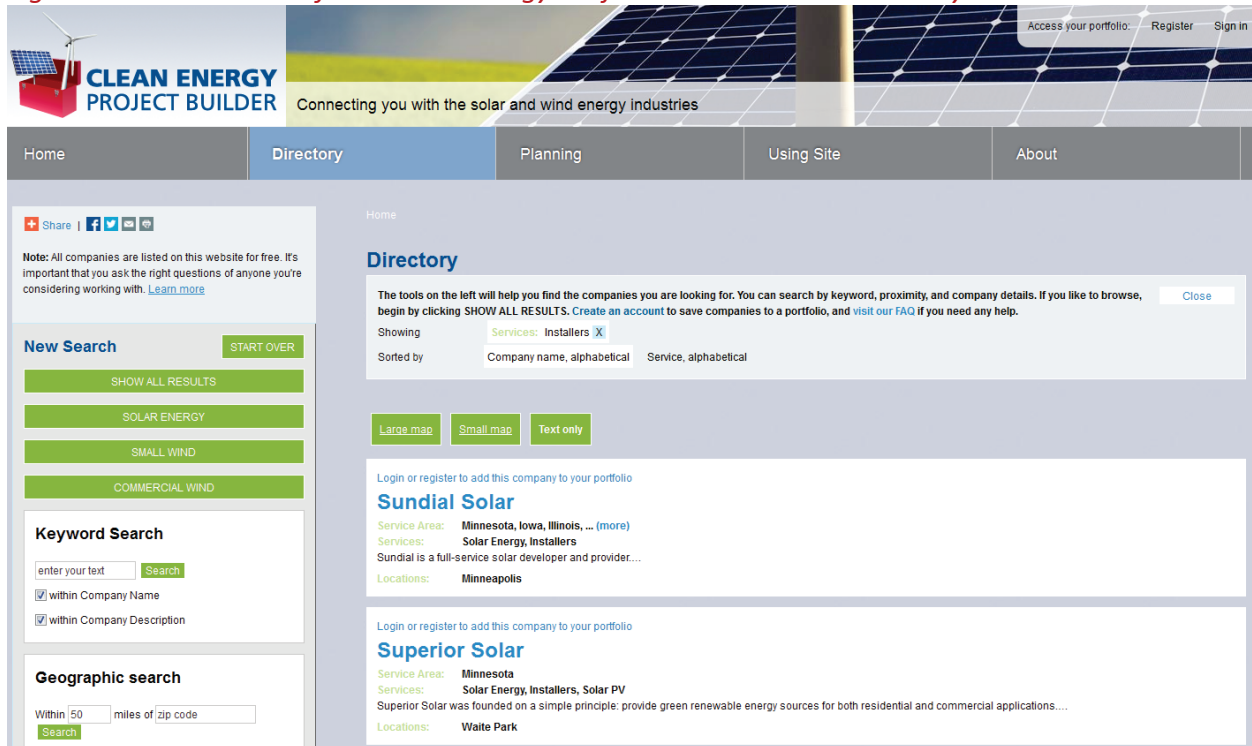
Clearly the time is right and the potential is great for manufacturers, installers, and those conducting outreach and education to build support for solar and wind energy and drive adoption among Minnesota consumers. If they’re to do a good job, they need to know more

¹ *Figure 1.4* shows the growth of Minnesota’s installed solar electric capacity from 1993 through 2013. There is not a definitive cause for the spike in 2012, though decreasing equipment costs and new utility incentives are thought to play a role, in addition to a large array (1kW) at IKEA that accounts for 20% of 2012 installed capacity.

about the experiences, interests, motivations, and barriers of consumers so that they can appropriately craft their products, programs, and marketing tools.

One of these marketing tools, in particular, is the Clean Energy Project Builder (CEPB) online directory at <http://thecleanenergybuilder.com> (see *Figure 1.5* below). The Clean Energy Project Builder website serves an essential function: to allow Minnesotans to find companies that can help them plan, implement, and manage solar and wind energy projects. The CEPB website partners would like to understand how the directory could be redesigned and marketed to best serve the decision-making needs of consumers considering solar and wind energy projects. The idea for this capstone study emerged from a CEPB strategic planning session about the future of the website. Notes from that planning session, which include more detailed background information about the CEPB website, can be seen in *Appendix IV*.

Figure 1.5: Screenshot of the Clean Energy Project Builder Online Directory



Source: <http://thecleanenergybuilder.com>

2 LITERATURE REVIEW

Promoting solar and wind energy as efficiently as possible requires a thorough understanding of the consumer and the factors influencing her or his decision to adopt these new technologies. This study will begin by reviewing existing research on the consumer decision-making process with regards to new technologies in general and renewable energy in particular. Which motivations and barriers have other researchers come across, and how do consumers make decisions about expensive purchases like solar and wind energy?

Attitudes & Behavior

A handful of studies have been done to analyze consumer attitudes and their willingness to engage in environmentally-beneficial—or ‘green’—activities. Faiers, Cook & Neame (2007) provide an overview of theories and models relevant to understanding these activities (see *Table 2.1*) that makes for an exceptionally useful outline for exploring the existing body of research. These theories and models help to

Table 2.1: Relevant Theories & Models

Consumer choice

- Post-Keynesian Theory
- Behavior Economic Theory
- Hierarchy of Needs

Needs, values and attitudes

- Personality Theory
- Control Theory
- Self-Discrepancy Theory
- Pro-social Behavior
- Perceived Consumer Effectiveness
- Collective Action Dilemma
- Willingness to Pay
- Value Belief Norm Theory

Learning

- Cognitive consistency
- Balance Theory
- Consistency Theory
- Cognitive Dissonance Theory
- Relational Discrepancy Theory

Social learning

- Social Exchange Theory
- Behavior Economic Theory
- Behavior Perspective Model

Buying process

- Rational Choice
- Theory of Reasoned Action
- Theory of Planned Behavior
- Hierarchy of Effects
- Innovation Decision Theory

Categorization of consumers

- Behavioral Economic Theory
- Diffusion Theory

Product attributes and categorization

- Attribute Theory (Diffusion Theory)

Source: Faiers, Cook & Neame, 2007

explain the cognitive and rational aspects of the decision-making process as well as emotional, societal, and cultural influences.

Faiers, Cook & Neame (2007) offer a useful assessment of attitude and its impact on consumer behavior:

Attitude is the way that an individual views, or behaves towards an object, often in an evaluative way (Moore, 2001). 'Social-psychological antecedents', or more generally 'attitudes' have been identified as a key determinant of environmentally conscious behavior over demographics (Stern, 2000); attitudes such as environmental concern, political orientation, and in particular 'perceived consumer effectiveness' (PCE) have been proven to be causal links to behavior (Roberts, 1996; Lee and Holden, 1999). There is also support for Batsons' Model of Pro-social Behavior to further understanding of these factors (Lee and Holden, 1999). Consumers can be influenced by their ethics and beliefs, for example if they are motivated by 'moral' or 'material' ethics. Where consumers are motivated on 'moral' grounds, they move away from material consumerism as moral issues conflict with material gain (Lavoie, 2004). p. 4384

Other studies have also looked at attitudes and attempted to measure the link between attitudes, intentions, and adoption. Claudy & Peterson (2013) applied Behavioral Reasoning Theory in the context of solar consumption among consumers in Ireland and found that the top three reasons for adoption were economic, environmental, and independence, and that the top three reasons against adoption were cost, risk (social and material), and incompatibility (lifestyle and mechanical). The same type of study was conducted for solar thermal (Schelly, 2010) with similar results. This has not changed much over time; some of the earliest studies of individuals who owned renewable energy systems (Sawyer, 1982; Tatum, 1990) found that strong environmental values and a desire for economic independence were the two driving motivators for technology adoption. Those studied in these early surveys exhibited a great deal of knowledge on renewable energy and were willing to pay a premium to install projects. Further research has found that those with more knowledge of environmental issues will have a higher willingness to pay for green technologies (Rowlands et al., 2002; Prakash, 2002). Claudy,

Michelsen, and Driscoll (2011) further explored willingness to pay for solar electric, solar thermal, wind energy, and biomass systems, finding that knowledge and other rational decision-making factors do not stand alone, but are influenced by other cost-benefit evaluations, perceptions of each technology, and social norms.

Social Learning & Norms

Societal norms and social learning and their relative impact on pro-environmental decisions have been studied, as well. It has been shown that people rely on their network of social connections to increase their justification to take a certain action and fill in gaps in their knowledge (Faiers, Cook & Neame, 2007, p. 4386). Another evaluation of peer effects by Bollinger and Gillingham (2012) looked at the diffusion of residential solar panels in California and found that 10 extra installations in a zip code increased the probability of adoption by nearly 8%. Further, if there was a 10% increase in the total number of people with solar panels in a zip code, there was a 54% increase in the adoption of solar panels. The study also showed that the visibility of the panels and word-of-mouth led to larger installations. In terms of societal norms, Rettie, Burchell, and Barnham (2014) learned that de-emphasizing the 'greenness' of environmentally beneficial actions helped increase adoption among a broader audience. This was because those studied did not want to adopt practices or purchase products that were *different*, they wanted instead to be *normal*. Social normalization of this sort tends to increase as adoption rates rise, but can be aided, the study found, by focusing more on more normalized goals like cost savings rather than differentiated goals like environmentalism. It has also been found that wind energy has suffered slower adoption rates because of societal

backlash toward the aesthetic quality of wind turbines (Wustenhagen, Wolsink & Burer, 2007), and that with both technologies, local socio-political, community, and market factors all impact acceptance.

Consumer Behavior

Much has been written about consumer buying behavior. Making the decision to purchase a solar or wind energy system is a high-involvement decision. Consider the amount of time and energy a person puts in to choosing a brand of toothpaste versus purchasing a new car. Solar and wind are much more similar to that new car, except people purchase renewable energy systems even less frequently. Many theorist believe that people make decisions rationally by considering product attributes and outcomes of adopting certain behaviors. The Elaboration Likelihood Model (ELM) by Petty and Cacioppo (1986) suggests that people are more likely to invest mental energy in the decision making process when they are highly motivated. The Theory of Planned Behavior (TPB) by Ajzen (1991), on the other hand, states that people adopt certain behaviors because of the relative importance of outcomes. The more that a behavior impacts a person's needs and lead to satisfaction, the greater cognitive effort they'll expend.

Because people are willing to invest more cognitive effort in the decision-making process for solar and wind, product attributes become even more important. High cost is almost always at the top of the list of barriers for people considering adoption of solar and wind energy systems. In a study of solar adoption in U.S. states, Black (2009) learned that good system performance, high electric rates, net metering, time-of-use rate structures, solar

renewable energy certificates (SRECs), and government incentives have all contributed to the financial viability of solar electricity. But it was discovered by Velayudhan (2003) that highlighting grants in product promotion focuses attention on high costs rather than other beneficial features that might have motivated the consumer. Furthermore, spikes in consumption due to incentives can also lead to drastically reduced levels of consumption when the incentive is withdrawn, because people have learned that they need the incentive to take action (Cabraal et al., 1998; Rogers, 1995). TPB—as well as the Theory of Reasoned Action (TRA)—have been studied specifically with regards to pro-environmental purchases (Jackson, 2004; Kalafatis et al., 1999; Kaiser et al., 1999) and lead to the conclusion that people's intentions are the best predictor for certain behaviors.

Other theorists believe that traditional consumer behavior models over-emphasize the rational side; these theorists have worked to incorporate affective and emotional influences. The Hierarchy of Effects is one such model wherein “an individual progresses along a ‘think-feel-do’ path, where they think about the purchase, develop a feeling about purchasing it based on their liking, preferences, and how convinced they have become, and finally either purchase or do not” (Faiers, Cook & Neame, 2007, p. 4387). Behavior difficulty has also been considered, as renewable energy systems can be quite complex. The Theory of Trying (Bagozzi, 1992; Bagozzi, Yi, & Baumgartner, 1990) expands on TPB to attempt to explain repeated efforts where a great deal of learning, trial, and re-trial may occur. Kaiser and Schultz (2009) tested three models of the attitude-behavior with regards to environmentally-beneficial actions to assess difficulty as a moderating factor, but their results were inconclusive.

Diffusion Theory

Jager (2006) delved much deeper into the specific difficulty of adopting solar PV using a diffusion model: “The speed and degree to which an innovation diffuses is related to several factors. Most of the variance in the rate of adoption is explained by five attributes of the innovation: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability. While it may be obvious to a consumer at a superficial level that a PV system provides a relative advantage in generating clean electricity and is compatible with the existing electrical installation, the operational choice presents a very complex situation” (p. 1937). Solar panels cannot be tried before they are purchased, so consumers are forced to move forward with a certain degree of uncertainty about actual compatibility. Because complexity is also high, a solar installer and other technical experts must be consulted, which also adds to the difficulty of adoption.

It has been found, however, that not all consumers are turned away by high levels of uncertainty when adopting new technologies. Diffusion Theory (Rogers, 1995) identifies five categories of adopters with which many people are familiar: Innovators (2.5% of population), Early adopters (12.5%), Early majority (35%), Late majority (35%), and Laggards (15%). Many studies (Sawyer, 1982; Tatum, 1990; Kinnear & Labay, 1981) found that those driven to adopt renewable energy projects fell within the early adopter category, where they are willing to accept a higher degree of uncertainty, do not need to try before they buy, do not rely on societal norms to take action, and are willing to pay more for products that are in line with their values. Some researchers believe that if costs can be brought down closer to a breakeven point and outreach and education programs can reach a larger percentage of the general public that

renewable energy adoption—particularly solar—will increase dramatically among the large early majority category. Demographics have also been seen to play a key role, with older, higher education, and higher income individuals being more likely to adopt renewable energy systems (Faiers, Cook & Neame, 2007, p. 4382).

3 RESEARCH QUESTIONS

The literature review surfaced several key insights that lay the foundation for an understanding of consumers and the reasons why they may choose to adopt solar or wind energy systems. This study will explore five key questions:

- RQ1:** What are the strongest consumer motivations for and barriers to adoption?
- RQ2:** How does previous ownership and experience affect interest?
- RQ3:** Do peers have a noticeable impact on interest?
- RQ4:** How do consumers' self-perceptions and company assessments of them differ?
- RQ5:** How can the CEPB online directory be redesigned to better serve consumers?

4 METHODS

Three original research sources were employed in this study, two of them online surveys and one of them interviews with Clean Energy Project Builder partners. The primary survey targeted Minnesota consumers, while a supporting survey focused on solar and wind energy companies that serve Minnesota. The interviews asked questions about CEPB website relevance, features, and promotion, as well as target audiences and perceived consumer needs.

Consumer Survey Method

The primary survey was an online questionnaire sent to Minnesota consumers to understand their interest in and experience with solar and wind energy, with a focus on factors motivating them to adopt one or more of the technologies and barriers keeping them from taking action (see complete survey in Appendix I). Motivations and barriers included in the survey were sourced from previous surveys and reports on renewable energy, as well as shared experience with solar and wind among the Clean Energy Resource Teams staff. The consumer survey was emailed to a random convenience sample of 3,000 of the 12,000 people who have opted in to receive updates from the Clean Energy Resource Teams. The initial email invitation was sent on Thursday, May 1, 2014 at 4:00pm CST. A reminder email was sent to all non-responders on Monday, May 5, 2014 at 6:00am CST. The survey closed on Thursday, May 8, 2014 at 4:00pm CST, which gave individuals exactly one week to take the survey. Of the 3,000 people emailed, 724 opened the email (25% open rate) and 140 started the survey (19% start rate). Of the 140 that started the survey, 118 completed it (84% finish rate). Overall, the 118 completed surveys constitutes a 4% response rate from the original panel of 3,000 people.

In regards to survey design, the consumer survey began by asking individuals if they currently owned a solar and/or wind energy system. If they said 'yes', they were asked to answer a series of questions about their experience, but if they said 'no' they were taken to the next section. Those who said 'yes' to owning a system were first asked which technology or technologies they owned. Then they were asked to identify the greatest benefits from and biggest challenges with their projects. Next they were asked to rate their level of satisfaction, if they would recommend that others pursue projects, and if they had advice for others. The second section of the consumer survey was about interests, and it is where those who owned systems continued and those who did not began. For those who said they were interested in solar and/or wind energy, the questions asked which technology or technologies they were interested in, how soon they'd like to install a project, what motivations were driving them forward and what barriers were holding them back. The page concluded by asking if they knew anyone with solar or wind and if they would consider being involved in a community-shared solar project. If they said at the beginning of the page that they were not interested in installing a solar and/or wind energy system, they were only asked about barriers and the final two questions about peers and shared solar. The third page asked about information sources and the Clean Energy Project Builder (CEPB).

The fourth page asked a series of demographic questions. The survey was open to people over the age of 18 with any income level and housing type. In general, 2% were aged 18-24, 25% were 25-44, 56% were 45-64, and 17% were 65 or older. Eighty percent lived in a one-family house and 89% owned their dwelling. For income, 18% made under \$49,999 a year, 46% made between \$50,000 and \$99,999, 22% made between \$100,000 and \$149,999, and 13%

made \$150,000 or over. Taken a different way, 81% made \$50,000 or more each year. The results section will detail the impact of demographic differences on respondents' experience, interest, motivations, and barriers.

Company Survey Method

The supporting survey was an online questionnaire sent to companies that serve Minnesota who are currently listed in the CEPB directory to understand their marketing practices, experience with the website, and their perception of the factors motivating their customers to adopt solar or wind energy and barriers keeping them from taking action (see complete survey in Appendix II). The company survey was emailed to the complete population of all of the 195 companies who have added themselves to the CEPB online directory. An invitation to take the survey was initially emailed on Thursday, April 24, 2014 at 4:00pm CST. A reminder email was sent to all non-responders on Monday, April 28, 2014 at 11:00am CST. The survey was closed on Thursday, May 1, 2014 at 4:00pm CST, which gave individuals exactly one week to take the survey. Of the 195, 60 opened the email (31% open rate) and 25 started the survey (42% start rate). Of the 25 that started the survey, 19 completed it (76% finish rate). Overall, the 19 completed surveys constitutes a 10% response rate from the original panel of 195 companies. Companies were given one week to take the survey, with a reminder email after three days to those who had not yet completed it.

In regards to survey design, the company survey began by asking if the company served Minnesota, and continued by asking the companies to rank the strongest motivating factors for their customers considering a solar or wind energy system and also to rank the strongest

barriers to adoption. They were then asked about their marketing practices and to provide feedback about the CEPB website and its usefulness and functionality. Demographics and company characteristics were not collected, but because all companies are in the CEPB online directory, they must work on solar or wind energy (or both) and must serve the state of Minnesota.

Partner Interviews Method

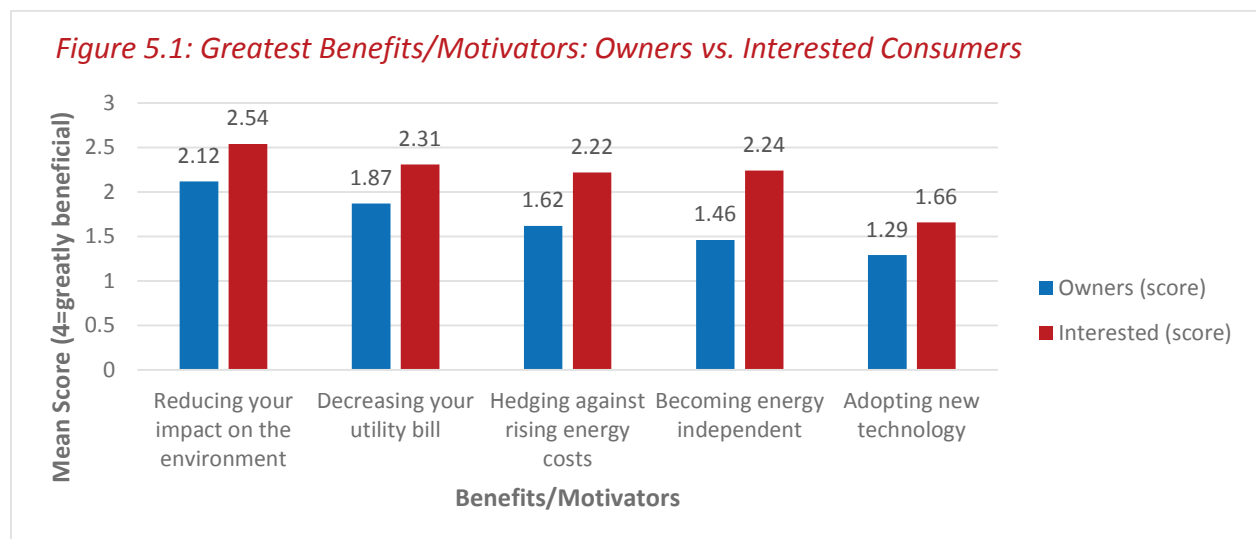
Interviews were conducted with five key Clean Energy Project Builder partners both on the phone and in person. Interviewed partners include: Southwest Initiative Foundation (SWIF), Clean Energy Resource Teams (CERTs), Minnesota Department of Commerce (DOC), Minnesota Solar Energy Industries Association (MnSEIA), and Minnesota Renewable Energy Society (MRES). Questions were asked about CEPB website relevance, features, and promotion, as well as target audiences and perceived consumer needs. Interviews were all conducted by Dan Thiede between January 10, 2014 and May 1, 2014 (see full list of interviewees and questions in *Appendix III*).

5 RESULTS

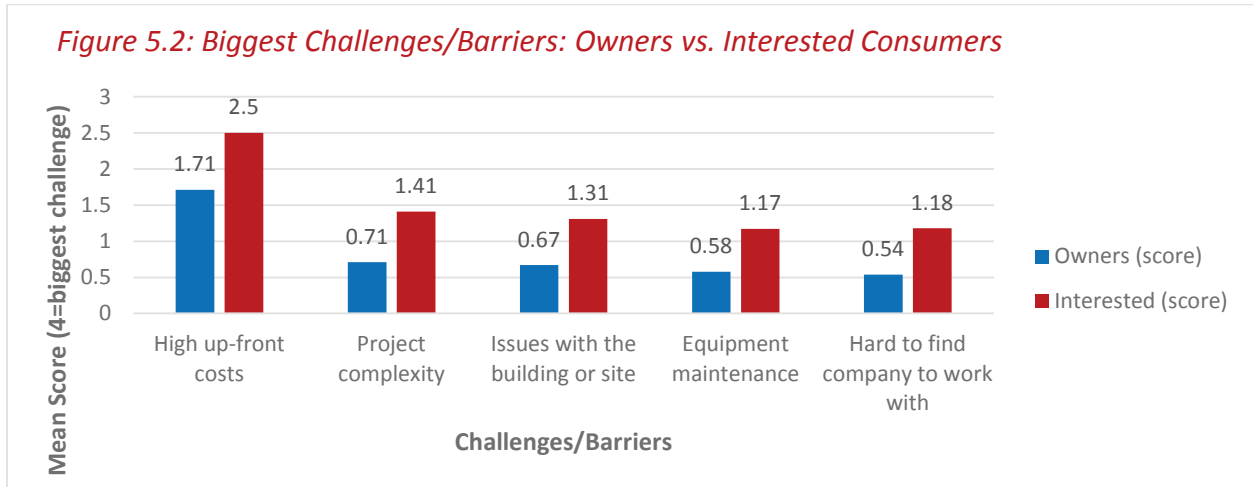
The results of the survey of Minnesota consumers about solar and wind energy projects are the most illuminating. Owners will be reviewed first, followed by those interested in projects. Next, results of the company survey will be revealed, and interviews with CEPB partners will be covered briefly at the end of the section.

Those who owned a solar and/or wind energy system accounted for 17% of those surveyed. Among them, 75% owned solar PV systems, 42% wind, 25% solar hot water, and 17% solar air heat. Satisfaction was very high: 96% were satisfied or very satisfied with their projects. And 100% of the owners would recommend that others pursue similar projects.

As can be seen in *Figure 5.1*, when owners were asked to identify the greatest benefits provided by their projects, the value ‘reducing your impact on the environment’ was scored highest, with economically-focused ‘decreasing your utility bill’ and ‘hedging against rising energy costs’ second and third. ‘Becoming energy independent’ was fourth, and ‘adopting new technology’ came in last.



As for challenges in the project development process, owners cited ‘high up-front costs’ as the greatest barrier by far. In order, ‘project complexity,’ ‘issues with the building or site,’ ‘equipment maintenance,’ and ‘hard to find company to work with’ were next (see *Figure 5.2*).



When asked, “Do you have any interest in installing a solar or wind energy project at some time in the future?” Eighty-five percent of all respondents said ‘yes.’ Interestingly, 88% of those who reported knowing someone else with solar or wind projects selected ‘yes,’ an increase that could be attributed to peer effects. Furthermore, 90% of those who already owned solar and/or wind energy systems responded ‘yes,’ suggesting that previous experience is a strong indicator of future action. When asked which solar and/or wind technologies they were interested in, 88% selected solar PV, 54% solar hot water, 39% solar air heat, and 29% wind. Among all respondents, 14% said they would like to install a project in under a year, 37% in 1-2 years, 35% in 3-5 years, 11% in 6-10 years, and 3% in 10 or more years. Timelines were shortened among those who already owned systems, 26% of whom wanted to install a project in under a year, 53% in 1-2 years, and 21% in 3-5 years. Comparing them directly, 51% of all

respondents wanted to install a project in 2 years or less, while 79% of owners wanted the same turnaround.

When interested consumers were asked "What factors are motivating you the most to install a project?" the most popular motive by far was 'reducing your impact on the environment,' followed by 'decreasing your utility bill.' Nearly tied at third were 'becoming energy independent' and 'hedging against rising energy costs,' with 'adopting new technology' lagging behind (see *Figure 5.1* on pg. 18). The strongest perceived barrier to installing a project was 'high up-front costs' by a landslide, followed by 'project complexity' and 'don't own suitable property.' The fourth and fifth barriers were nearly tied: 'hard to find company to work with' and 'worried about maintenance' (see *Figure 5.2* on pg. 19).

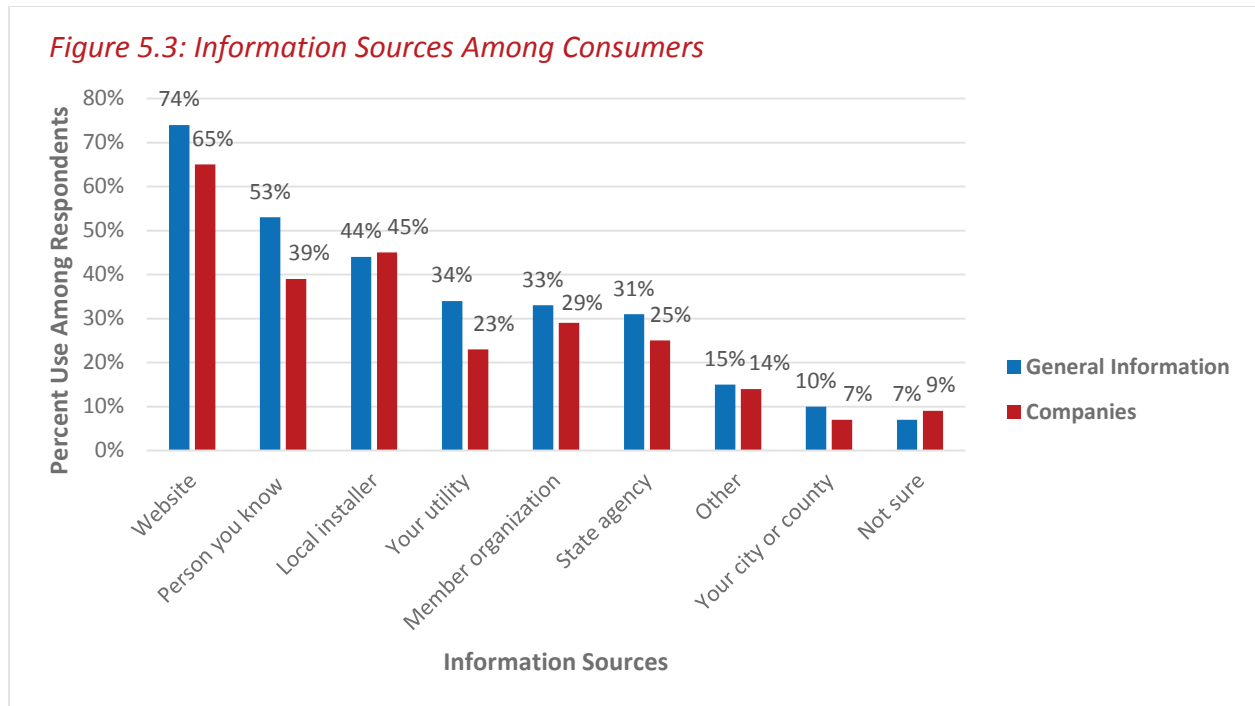
Curiously, when comparing the benefits/motivators and challenges/barriers between those who own systems and those who are just interested, those who are interested provide more extreme responses in both cases (see *Figures 5.1 and 5.2* on pgs. 18 and 19). This may suggest that experience has a moderating factor on reaction to both benefits and challenges.

When asked if they would be interested in being involved in a community-shared solar project, over half of the respondents (56%) said 'yes,' that they would want to subscribe to a small portion of a much larger project that was not located at their property. Twenty-eight percent indicated that they were 'not sure,' which means that there is a need for more education on community-shared solar. With regards to interest in community solar, there was no significant difference between the percentage of general responders and those who identified 'don't own suitable property' as a strong barrier. The same was true for those who indicated 'high up-front costs' as a strong barrier. Surprisingly, 43% of those surveyed who

owned systems were interested in being part of a community-shared solar project, suggesting that on-site ownership does not preclude participation in off-site community-shared solar.

When asked if they knew someone who owns a solar or wind energy system, 71% of those surveyed said ‘yes,’ 23% said ‘no,’ and 6% said they were ‘not sure.’ This is a relatively high proportion of people with renewable energy-owning peers, but it is most likely higher than the general public being that this is a convenience sample of people already interested in clean energy, and a group that self-selected to take a survey on solar and wind.

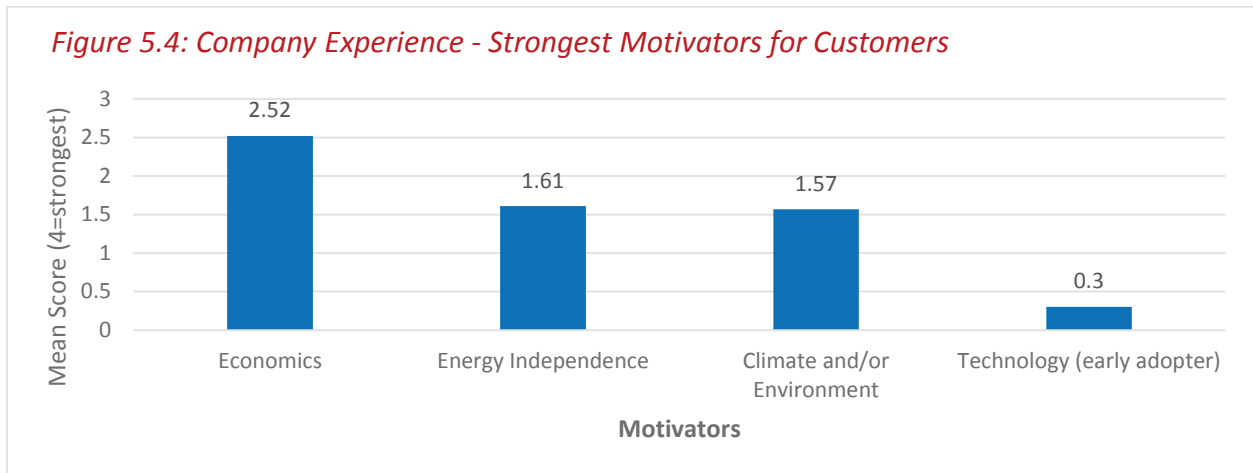
Sources of information were roughly the same regardless of whether people were looking for general information or trying to find companies (see *Figure 5.3*). Websites, people



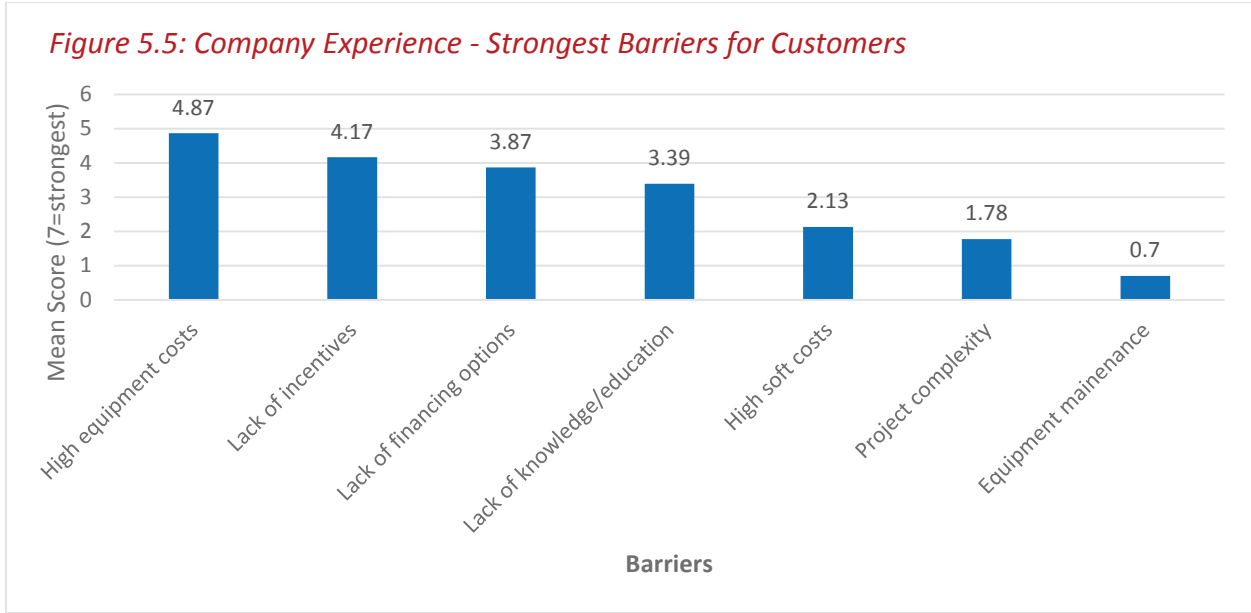
they knew with experience, and local installers were the highest ranking as both general and company information sources, in that order. Among websites, Google was the most commonly mentioned. People were slightly more likely to turn to their utility rather than a state agency for

general information, while the opposite was true for company info. According to survey results, cities and counties are clearly not places where people turn for this sort of information.

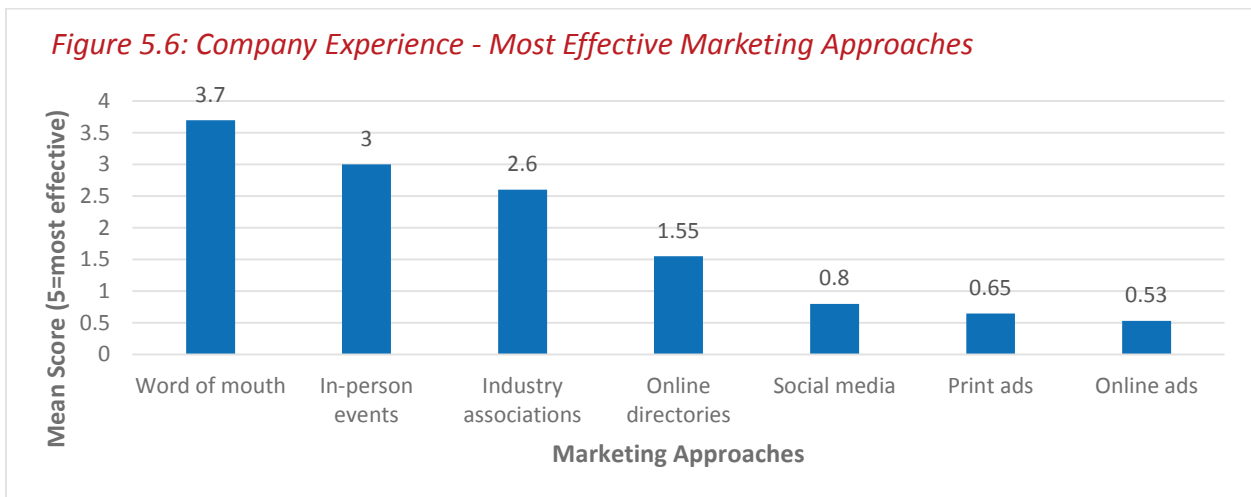
Switching gears, the most informative results from the survey of solar and wind energy companies had to do with their perception of customer motivations and barriers, and also the marketing methods that they found to be most effective. *Figure 5.4* shows customer motivators



as identified by the surveyed companies. Companies believed that economics were far and away the biggest motivating factors for their customers. This differs from the consumer survey where concern for the environment was the top motivating factor for both owners of solar or wind and those simply interested. This may represent a disconnect between companies and consumers, or it may speak to experience on the part of the company dealing with consumer reactions to high up-front costs, which were identified as the top barrier by all parties—companies and consumers (see *Figure 5.5* on next page for barriers). It is also possible that consumers feel better saying they are driven by their concern for the environment than concern for their pocketbooks, creating a self-serving bias. Furthermore, the sample may be more environmentally-conscious than the public. For the most part, company perceptions of their customers' motivations and barriers were very close to the actual consumer responses.



The other stand-out data from the company survey is the perceived effectiveness of various marketing activities among companies. As can be seen in Figure 5.6, ‘word of mouth’ and ‘in-person events’ were ranked the highest. This has a lot to say about the perceived strength of peer effects and social interaction for convincing consumers to take complex and expensive behaviors like adopting solar and wind energy systems. Industry associations and online directories fall in the middle for effectiveness, with social media, and both print and online ads being rated poorly.



Interviews with Clean Energy Project Builder partners yielded a handful of responses that are helpful in this study. Cheryl Glaeser at the Southwest Initiative Foundation (SWIF), the owner of the website and the organization responsible for its creation, are keen to see the Clean Energy Project Builder online directory service continue as a useful resource for Minnesotans and a legacy of their wind energy programming. Lissa Pawlisch at the Clean Energy Resource Teams (CERTs), the partnership responsible for managing the CEPB website, is interested in redesigning the website so that it appeals most strongly to the motivations of Minnesota consumers and provides them with resources to overcome key barriers. Stacy Miller at the Minnesota Department of Commerce (DOC) was pleased that the CEPB website exists, as it provides Minnesota consumers with lists of solar and wind energy companies that can assist them with projects—a service that DOC once provided on its own. Further, DOC is curious about adding solar installations to CEPB so that consumers could see existing projects near them, and also adding community-shared solar as a service category so that consumers can find companies who develop that type of project. Lynn Hinkle at the Minnesota Solar Energy Industries Association (MnSEIA) thought that the service categories for companies in the directory were overwhelming for consumers and that they should be simplified into key market segments. Laura Cina Burrington with the Minnesota Renewable Energy Society (MRES) said that they do not promote the CEPB website widely to their audiences because they provide their own list of reputable solar companies to consumers from among their membership—it's one of the benefits for those members. Laura did, however, see CEPB as a useful tool for identifying wind companies for consumers.

6 DISCUSSION & RECOMMENDATIONS

The results of this study are sufficient to satisfy all five of the research questions posed. Each question will be discussed here along with associated recommendations.

RQ1: What are the strongest consumer motivations for and barriers to adoption?

Some of the strongest findings of this study have to do with the motivations and barriers for consumers who are considering the adoption of solar and wind energy systems. It was found that environmental concern is of the highest importance among those who own projects and those considering projects. Economics and independence were ranked next highest. These areas should be highlighted in marketing efforts. Speaking about new technology and being an early adopter were the least popular motivators, so less emphasis should be placed on these aspects. It was also found that those who already own solar and/or wind energy systems are more likely to be interested in other projects, and also have more aggressive timelines for installing new systems. This bodes well for the idea that experience increases an individual's likelihood of taking further action. These individuals would also make for excellent spokespeople and ambassadors for solar and wind energy.

As far as barriers are concerned, the results of this study support the efforts of government and those in the renewable energy industry working to reduce up-front and equipment costs, as these were the highest barriers to adoption. If this can be done through a mix of efficiencies, incentives, low-interest financing, and/or innovative ownership models, then the key barrier to adoption would be greatly reduced. Project complexity was also a

dominant barrier, so efforts to streamline and simplify the process would be beneficial. This creates an opportunity for companies looking to provide ‘turn-key’ services to consumers.

RQ2: How does previous ownership and experience affect interest?

Those who owned projects were almost unanimously satisfied with their solar and wind energy systems, a factor that could have some influence on the fact that they had a higher than average interest in installing additional solar or wind energy projects (mostly solar) in a faster than average period of time. These findings suggest that previous ownership and experience increases a person’s likelihood to install more projects. This may seem counterintuitive to many installers, who think that solar or wind energy systems are once-in-a-lifetime purchases and therefore spend most of their resources marketing to consumers that don’t already own systems. Ownership also had a moderating influence on both motivations and barriers—owners were less effusive about the potential benefits of projects, and were also less stymied by common barriers. In sum, it may behoove installers to focus more of their efforts on existing and past customers and others who already own systems as their attitudes will be well-aligned for solar, their motivation will be high, and their perception of barriers will be lower. Ownership also did not preclude survey respondents from being interested in community-shared solar, meaning that they could be good targets for promotion of these types of systems, as well.

RQ3: Do peers have a noticeable impact on interest?

All of those surveyed who already own solar or wind energy projects said they recommend that others pursue projects. These are the sorts of neighbors and community

members that are sharing their experiences with others in their social networks and getting them excited about installing their own projects. The literature review indicated that these peers can have an impact on interest in renewable energy, which is supported by the present study—indeed, more than 70% of those interested in solar or wind knew someone else who owned a project. To further the influence of these experienced solar and wind energy owners, opportunities should be created to get them in front of interested consumers, whether through neighborhood and community gatherings, local tours, or workshops at relevant meetings and conferences. More work should also be done to shine a light on the extent of all installations in a given area, perhaps through a statewide map of all (or most) solar and wind installations that people can explore online. This could be a fitting addition to the CEPB website.

With regards to community-shared solar—a particularly social model for solar implementation—it was learned that there is a substantial amount of interest among those who do and do not already own systems. A high response of ‘not sure’ to community-shared solar, a new model whereby individuals can own a share of a solar electric system not located on their property, indicates that there is a great need for outreach and education on the topic.

An overall recommendation for increasing the impact of social norming on consumers is to conduct broad, frequent, and extremely public storytelling about solar and wind energy success stories, as well as the growing industry. This can be done through local and statewide renewable energy tours, publishing stories in local media outlets, publicizing incentive, funding, and financing opportunities, and doing general outreach and education with pro-renewables and pro-business partners across the state. The more these stories can highlight falling system costs and ease of installation, the more adoption of solar and wind energy will be normalized.

RQ4: How do consumers' self-perceptions and company assessments of them differ?

Overall, company perceptions of their customers' motivations and barriers were very close to actual consumer responses. Companies believed that economics were most motivational for their customers, while the consumers identified concern for the environment as their top motivating factor. As mentioned earlier, this may represent a disconnect between companies and consumers, but it more likely speaks to company experience dealing with consumer reactions to high up-front costs. It is also possible that consumers feel better saying they are driven by their concern for the environment than concern for their pocketbooks, creating a self-serving bias. Based on these findings, it seems prudent for companies and other organizations promoting solar and wind energy to remember that values like care for the environment hold a primary place among consumer motivations, even if up-front cost and economics end up being the bottom line, make-it-or-break-it factors at play.

RQ5: How can the CEPB online directory be redesigned to better serve consumers?

Recommendations for this research question will be covered in the Conclusion.

7 LIMITATIONS & FUTURE RESEARCH

There are two key limitations to this study. First, the consumer survey was conducted using a convenience sample of Minnesota consumers who can already be assumed to have pro-clean energy values. Future studies should assess a broader array of Minnesota consumers to better understand motivations and barriers among consumers generally for the purposes of broader education and outreach efforts. Second, this study was not statistically rigorous and

does not add to the body of research on the causal linkages between attitude and behavior.

Future academic studies should be built more specifically to test theories and models around consumer decision-making with regards to solar and wind energy systems.

8 CONCLUSION

In general, this study will prove influential for companies looking to install projects as well as organizations charged with conducting outreach, education, and technical assistance around solar and wind energy. The study helps to answer the overarching question: How we can design programs and tools to best drive adoption? Minnesota is on the verge, in particular, of a solar energy boom, and more finely-tuned resources will lead to even greater market response and industry growth. More specifically, based on consumer, company, and partner responses in the primary research for this study, there are several recommendations for ways to improve the Clean Energy Project Builder online directory to better serve consumers interested in solar or wind energy systems.

- 1.** First, there should be some effort taken to prominently display information about incentive, funding, and financing opportunities. This was mentioned in open-ended responses from both consumers and companies, and echoed by CEPB partners. Including these details will help people better understand how they can overcome the barrier of price.
- 2.** Second, site content could be updated to ease use of the website and better reflect the solar and wind industries. Company service categories should be simplified to make the industry seem less complex, and categories could be added for the new and expanding community solar industry. Furthermore, clear and concise project planning tools should be

added that guide consumers through the process of planning and installing a solar or wind energy system. Even the basic layout of the site, from the homepage to the content strategy, could more directly follow a project planning workflow that helps people understand where they are in the project planning process and how the CEPB can help.

3. Third, existing solar installations should be added to the website so that people looking for companies can also see other projects near them that they could go visit. Providing short interviews or case studies about these completed projects in print and video could enhance the peer effects of these project listings. This recommendation surfaced in both surveys and in the partner interviews.
4. Allowing consumers to provide feedback for companies that they've worked with—much like Angies List and other directories—is something that could help consumers learn from others, and shine a light on those companies that are doing standout work. Not surprisingly, this was a request from consumers so that they know who is or is not reputable. When surveyed, 68% of the companies listed on the CEPB website who responded were in favor of adding a rating feature. This means that there would not be a great deal of company opposition to ratings. This feature would, however, require diligence on the part of the Clean Energy Resource Teams to ensure that reviews were appropriate and civil.
5. One of the companies surveyed, several consumers, and two CEPB partners thought that the website could be improved with different branding. There is a general sense that the website is not providing a full suite of project-building tools, and that instead it is offering a connection to the solar and wind energy industry. Shifting to a 'connecting' theme from a 'building' theme could prove beneficial and ease marketing and consumer understanding.

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Appendix I: Consumer Survey on Solar & Wind Energy

SURVEY TEXT & QUESTIONS

Page 1: Instructions

Thanks for taking a few minutes to complete this anonymous survey about solar and wind energy! What's it for? The survey will help the Clean Energy Resource Teams (CERTs) better understand resources needed for people considering solar and wind projects

Directions: Click the "Get Started" button below to begin.

Page 2: Ownership

Do you currently own a solar or wind energy system?

- Yes
- No

Which solar and/or wind technology do you own? Choose all that apply.

- Solar photovoltaic (PV)
- Solar air heat
- Solar hot water
- Wind

What are the greatest benefits of your project(s)?

	Greatly Beneficial	Beneficial	Somewhat Beneficial	Not Beneficial
Decreasing your utility bill	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hedging against rising energy costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing your impact on the environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Becoming energy independent	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adopting new technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Share the greatest benefits in your own words.

What were the biggest challenges of the project(s)?

	Very Challenging	Challenging	Somewhat Challenging	Not Challenging
High up-front costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Issues with the building or site	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Equipment maintenance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hard to find company to work with	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project complexity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Share the biggest challenges in your own words.

How satisfied are you with your project(s)?

- Very Satisfied
- Satisfied
- Neutral
- Dissatisfied
- Very Dissatisfied

Would you recommend that others pursue solar or wind?

- Yes
- No

Do you have any advice for others considering a project?

Page 3: Interest

Do you have any interest in installing a solar or wind energy project at some time in the future?

- Yes
- No

Which solar and/or wind technologies are you interested in? Choose all that apply.

- Solar photovoltaic (PV)
- Solar air heat
- Solar hot water
- Wind

How soon would you like to install a project?

- Under a year
- In 1-2 years
- In 3-5 years
- In 6-10 years
- 10 or more years

What factors are motivating you the most to install a project?

	Greatly Motivational	Motivational	Somewhat Motivational	Not Motivational
Decreasing your utility bill	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hedging against rising energy costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing your impact on the environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Becoming energy independent	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adopting new technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Share what motivates you in your own words (optional).

What are the strongest barriers for you to installing a project?

	Strong Barrier	Moderate Barrier	Slight Barrier	Not a Barrier
High up-front costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Don't own suitable property	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Worried about maintenance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hard to find company to work with	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project complexity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Share the barriers in your own words (optional).

Would you be interested in being involved in a community-shared solar project, where you would pay to get your electricity from a portion of a larger solar project that is not located at your residence?

- Yes
- No
- Not sure

Do you know anyone who owns a solar or wind energy system?

- Yes
- No
- Not sure

Page 4: Information Sources

Where would you go to find GENERAL INFORMATION about solar or wind energy projects? Choose all that apply.

- Neighbor or person you know with some experience
- Your city or county
- Your utility
- State agency
- Organization of which you are a member
- Local installer or contractor
- Website
- Other _____
- Not sure

Where would you go to find COMPANIES that could help you plan solar or wind energy projects? Choose all that apply.

- Neighbor or person you know with some experience
- Your city or county
- Your utility
- State agency
- Organization of which you are a member
- Local installer or contractor
- Website
- Other _____
- Not sure

If you've used the Clean Energy Project Builder directory, how useful was it?

- Very Useful
- Useful
- Neutral
- Useless
- Very Useless
- Have not used the website

Do you have any suggestions for how the Clean Energy Project Builder website could be improved?

Page 5: About You

What is your age?

- Under 18
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65-74
- 75 or older

Which best describes the building where you live?

- One-family house
- Multi-family house (e.g. duplex, triplex)
- Apartment building
- Mobile home
- Other _____
- Condominium building

For your housing, do you own or rent?

- Own
- Rent
- Neither

What type of utility provides your electricity?

- Investor-owned (e.g. Xcel Energy, Minnesota Power, Otter Tail Power Company)
- Cooperative (e.g. Connexus, Kandiyohi, Dakota)
- Municipal (e.g. New Ulm Public Utilities, Rochester Public Utilities)
- Don't know

Please select your annual household income level.

- Under \$25,000
- \$25,000 to \$49,999
- \$50,000 to \$74,999
- \$75,000 to \$99,999
- \$100,000 to \$124,999
- \$125,000 to \$149,999
- \$150,000 to \$199,999
- \$200,000 to \$249,999
- \$250,000 or over

Page 6: Thank You!

We really appreciate the time you've spent today! Click 'Done' below to complete the survey.

SURVEY RESULTS

Note: Specific references to companies and people made by survey respondents have been replaced with generic terms like [COMPANY] and [INDIVIDUAL] to protect the identity of those entities.

1. Do you currently own a solar or wind energy system?

#	Answer	Response	%
1	Yes	24	17%
2	No	115	83%
	Total	139	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.83
Variance	0.14
Standard Deviation	0.38
Total Responses	139

2. Which solar and/or wind technology do you own? Choose all that apply.

#	Answer	Response	%
1	Solar photovoltaic (PV)	18	75%
2	Solar air heat	4	17%
3	Solar hot water	6	25%
4	Wind	10	42%

Statistic	Value
Min Value	1
Max Value	4
Total Responses	24

3. What are the greatest benefits of your project(s)?

#	Question	Greatly Beneficial	Beneficial	Somewhat Beneficial	Not Beneficial	Total Responses	Mean
1	Decreasing your utility bill	14	5	3	2	24	2.13
2	Hedging against rising energy costs	12	5	5	2	24	2.38
3	Reducing your impact on the environment	16	4	3	1	24	1.88
4	Becoming energy independent	10	8	3	3	24	2.54
5	Adopting new technology	8	10	3	3	24	2.71
Statistic	Decreasing your utility bill	Hedging against rising energy costs	Reducing your impact on the environment	Becoming energy independent	Adopting new technology		
Min Value	1	1	1	1	1		
Max Value	5	5	5	5	5		
Mean	2.13	2.38	1.88	2.54	2.71		
Variance	2.11	2.24	1.77	2.17	1.95		
Standard Deviation	1.45	1.50	1.33	1.47	1.40		
Total Responses	24	24	24	24	24		

4. What were the biggest challenges of the project(s)?

#	Question	Very Challenging	Challenging	Somewhat Challenging	Not Challenging	Total Responses	Mean
1	High up-front costs	5	10	6	3	24	2.29
2	Issues with the building or site	0	5	6	13	24	3.33
3	Equipment maintenance	1	1	9	13	24	3.42
10	Hard to find company to work with	1	2	6	15	24	3.46
12	Project complexity	2	1	9	12	24	3.29
Statistic	High up-front costs	Issues with the building or site	Equipment maintenance	Hard to find company to work with	Project complexity		
Min Value	1	2	1	1	1		
Max Value	4	4	4	4	4		
Mean	2.29	3.33	3.42	3.46	3.29		
Variance	0.91	0.67	0.60	0.69	0.82		
Standard Deviation	0.95	0.82	0.78	0.83	0.91		
Total Responses	24	24	24	24	24		

5. Share the greatest benefits in your own words.

Text Response	
The interest other businesses have shown by seeing what we have done and how we've done it. And we have had many interested folks want to see how the [COMPANY] system works, etc.	
Be an example for community	
Am happy when the wind blows. Love not having utility bills. Feel righteous about putting clean energy on the grid.	
Offsetting carbon energy	
One small step to begin the process of creating a distributed energy producing system while reducing the monthly utility bill.	
The first three benefits you listed are primary with the environmental benefit being primary. I've worked in RE (big wind) for several years and wanted to learn more about pv technology, which was a big factor for purchasing the system. At the time there were incentives available and pv was quite a bit more expensive. One can do it with much less capital now (as you no doubt know).	
Made me really conscious of my energy use	
I personally don't own it, it is a school project for Shakopee High School Environmental Learning Center. The benefit is educating our students on alternative energy sources. Also, we partnered with the local utility company and used their expertise when planning and installing the project.	
Off set a portion of my electric bill which allows me to better budget and hedge against rising costs.	
We have a reached our goal of operating with net 100% renewable energy and have paid the majority of our power costs for the next several decades.	
Our Minnesota made products which include a [COMPANY] 10kw wind turbine and [COMPANY] thermal panel work great, help us to lower our carbon footprint and will save us money over the long term.	
Vision in action, living the world I want to be in	
We have a 1.5 KV wind generator. Working with permitting w/ county. Plan to use with our greenhouse in conjunction with Solar hot water and PV for heating.	
Just a small solar cell to charge batteries while fishing and hunting. Nice to have a slow trickle charge	
I have invested in solar heat and PV, as well as other changes in my life, to reduce my impact on the environment. I am now a net energy producer and will be buying an electric car in the next few months.	
it gives our business a chance to protect us from higher energy costs, and we love knowing that we are putting energy in to the grid and saving money besides!	
Being net energy zero; being a visible statement and advocate in the community; using solar energy for my fuel.	
For us the greatest benefit is to decrease our impact on the planetary environment.	
Becoming energy independent at a low cost is what is important for me.	
Statistic	Value
Total Responses	19

6. Share the biggest challenges in your own words.

Text Response	
Changes in Xcel and Federal Tax credits programs on solar PV.	
Our installer did all the leg work, including getting things rolling for state and fed rebates	
Figuring out which turbine to buy. Getting hooked up with an iffy group of wind developers. Finding a cowboy who put up our turbine and put it up well. But now is out of business.	
Financing pjts	
size of the PV system limited by roof geometry and area	
I purchased a system that incorporated dual axis tracking and there've been some issues; ie; one of the (two) trackers is/was sort of a lemon and I've spent a lot of time on some of the problems. However, the manufacturer has honored the warranty after 4 years.	
My solar hot water system integrates into my hot water heating system and it complicated and has unforeseen value and switching issues which have been very hard to resolve to my satisfaction when switching from domestic hot water to heating hot water.	
It was a learning experience, permits, timelines of construction, and managing the installation.	
Being on a budget with 4 kids, it was difficult to put the money aside to cover the costs, we didn't want to take out a second mortgage to pay for it.	
Finding knowledgeable and reputable vendors who are locally available	
I did most all of the installation work myself, so it was all a minor challenge.	
Not challenging, as I've been installing solar and wind for more than a decade	
County permitting. and ready resources for budgeting etc.	
The initial cost it the greatest deterrent to solar energy but the cost has decreased dramatically since I put in my PV system in 2011.	
We worked with [INDIVIDUAL] from Chokio, MN. [INDIVIDUALS] were beyond excellent to work with.	
Lack of local resources and incentives.	
The biggest challenge was understanding the technology and options available. This was followed by what we needed to do to the house in terms of water issues, insulation and roofing before installing any solar system.	
Efficient and reliable hardware at a low cost.	
Statistic	Value
Total Responses	18

7. How satisfied are you with your project(s)?

#	Answer	Response	%
28	Very Satisfied	13	54%
29	Satisfied	10	42%
30	Neutral	1	4%
31	Dissatisfied	0	0%
32	Very Dissatisfied	0	0%
Total		24	100%

Statistic	Value
Min Value	28
Max Value	30
Mean	28.50
Variance	0.35
Standard Deviation	0.59
Total Responses	24

8. Would you recommend that others pursue solar or wind?

#	Answer	Response	%
1	Yes	24	100%
2	No	0	0%
Total		24	100%

Statistic	Value
Min Value	1
Max Value	1
Mean	1.00
Variance	0.00
Standard Deviation	0.00
Total Responses	24

9. Do you have any advice for others considering a project?

Text Response

Do your homework and find a solar PV system that can be turned off to allow the fire department onto your roof in case of fire. [COMPANY] is the only system today that readily meets this criteria. Also be sure to notify your insurance provider you have added solar to your roofs. If you don't they may not cover. We always notify them but when the north Minneapolis tornado of a few years ago moved east it traveled directly over two of our solar systems in Fridley. The [COMPANY] panels did not move but the pebbles in the funnel left chips, etc. in the solar glass which resulted in the insurance company totaling nearly 70% of our system. It was amazing how fast word spread through the solar community to notify their customers of this insurance issue. BTW, [COMPANY], our solar installer, found a solution from the auto windshield industry to seal our damaged panels and today they again sit on the roof producing energy!

Know your site, be very comfortable with your installer and have your goals for the project very clear

Get a site survey completed and look at the cost and potential payback period before committing to the project. Understand that the financial incentives are a critical part of the project feasibility.

I discourage people from purchasing a small wind turbine. There is too much maintenance and, from my experience, some manufacturers have been difficult with respect to warranties, parts and labor. Solar pv is much more straightforward, you can purchase warranties, for example, on inverters (micro, dc optimizers or central) that can go beyond 15 years. There are no moving parts in a "fixed" system. BUT I would not discourage folks from making a purchase on a dual axis system if they have the space. Also, I likely would encourage people to take a serious look at installing systems on roofs. They can be problematic for several reasons, and I think that solar gardens and investment vehicles along that line would be much better because of the leverage due to economies of scale. I also encourage people to learn about RE and distributed benefits vs central station generation, coal, LNG and transmission costs. I encourage people to connect with their utilities as well as their legislators because democracy works.

Check first w/ your power supplier to see if they have a positive attitude about renewables (\$) before you get married to doing something. The tax rebates only work if you owe income taxes.

If you are doing a project, have all of the budget planned and money available for any changes to the project that may occur.

Don't purchase on price, invest in an unbiased site assessment before contacting an installer.

We have experienced problems with vendors over-selling performance and not standing behind their products when problems occur. This has particularly been the case with our small-wind installation. Before purchasing, make a point of talking with several people who have purchased similar technology from the vendor you are considering. Hopefully you can talk to people who have experience with the vendor and with the equipment for a period of 3-5 years.

Look at what financial incentives are available for each project.

Understand that this is a mature technology, solar anyhow. There are improvements to be made for certain. And I'm sorry to say, don't do small wind. The technology doesn't work at a small scale. We really should stop selling it.

Don't attempt to work with [COMPANY] as they don't seem to encourage private solar projects.

This is a very small solar cell with connectors straight to a 12v battery. Simple, portable, and it works!

Financial planners would not tell you to do it but an investment in solar/wind energy is an investment in the common good and your children's future.

Hire a good grant writer and keep trying. Make sure your contractor is reputable.

Really think about how you live and try to minimize energy consumption by passive solar and sheltering design; talk to people that have RE systems and see what they would do differently; take a class in RE to better understand options that would make sense for you.

When installing solar in Minnesota, consider the slope of your roof and the maintenance you are willing to do in order to keep the system running December through March. We have a very gentle slope to our roof and the panels do not clear themselves very well. They need to be raked off in order to keep the system running in the winter. Others I have spoken to with steeply pitched roofs do not have this problem.

Purchasers need to count the total cost of the system including maintenance.

It makes sense and "payback" should be the last thing on their mind.

Statistic	Value
Total Responses	20

10. Do you have any interest in installing a solar or wind energy project at some time in the future?

#	Answer	Response	%
1	Yes	107	85%
2	No	19	15%
	Total	126	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.15
Variance	0.13
Standard Deviation	0.36
Total Responses	126

11. Which solar and/or wind technologies are you interested in? Choose all that apply.

#	Answer	Response	%
1	Solar photovoltaic (PV)	94	88%
2	Solar air heat	42	39%
3	Solar hot water	58	54%
4	Wind	31	29%
Statistic		Value	
Min Value		1	
Max Value		4	
Total Responses		107	

12. How soon would you like to install a project?

#	Answer	Response	%
1	Under a year	15	14%
2	In 1-2 years	40	37%
4	In 3-5 years	37	35%
5	In 6-10 years	12	11%
6	10 or more years	3	3%
Total		107	100%
Statistic		Value	
Min Value		1	
Max Value		6	
Mean		3.00	
Variance		2.00	
Standard Deviation		1.41	
Total Responses		107	

13. What factors are motivating you the most to install a project?

#	Question	Greatly Motivational	Motivational	Somewhat Motivational	Not Motivational	Total Responses	Mean
1	Decreasing your utility bill	51	41	12	3	107	1.69
2	Hedging against rising energy costs	44	47	12	4	107	1.78
3	Reducing your impact on the environment	75	19	9	4	107	1.46
4	Becoming energy independent	61	21	15	10	107	1.76
5	Adopting new technology	30	30	28	19	107	2.34
Statistic	Decreasing your utility bill	Hedging against rising energy costs	Reducing your impact on the environment	Becoming energy independent	Adopting new technology		
Min Value	1	1	1	1	1		
Max Value	4	4	4	4	4		
Mean	1.69	1.78	1.46	1.76	2.34		
Variance	0.61	0.63	0.65	1.03	1.15		
Standard Deviation	0.78	0.79	0.80	1.02	1.07		
Total Responses	107	107	107	107	107		

14. Share what motivates you in your own words (optional).

Text Response

I would like to see a transformation in how energy is generated from fossil fuels to non-polluting renewable sources.

Really want to reduce the amount of wood we have to cut, haul, stack, load into our backyard wood boiler. We're going to connect the solar hot water to the water jacket in the boiler. Seems like a no brainer. A big "ah ha!" Also, I hate having wood smoke blow in my clothes line drying laundry.

Clean energy, clean up the CO2 (or at least contribute to cleaning it up), cost control

Continue to increase the amount of distributed power production on the grid.

Will never recover the cost but need to make a statement, visible house and roof. Encourage others

I thought you asked these questions so I won't go there other than to say that I am in the process of designing a dual axis and open source tracker.

Understanding of the true implications of using renewables vs current carbon path.

Avoid creation of CO2

Want to be less depend on fossil fuels to be good to the environment.

I now do about 55% of my electrical needs, I would like to move up to about 75-85% on my electrical needs and would also like to find a scaled down technology for hot water powered air conditioning as I have excess energy generated during the warm months.

The property is an investment property that has two rental units. So, I wouldn't financially really benefit much, but tenants would. I also anticipate the value of the property to go up a bit with RE. Really though, the main motivator is reducing the energy footprint.

[INDIVIDUAL]

Solar is clean, there is a TON of "real estate" on top of roofs, etc, and there is no reason why we should not have been using solar ages ago. Unfortunately, politics and ignorant people "run the show" and have kept the brakes on solar use having the capabilities to move forward.

Knowing my niche.

Cheaper living and potential to continue to operate if Electric is cut off

High cost of power when peaking. Higher transmission rates and capacity charges.

I am very much interested in cutting the cost of my winter heating bills.

Helping my community keep energy \$ and jobs here, and protecting our planet for our children.

Having our house/cabin energy independent before retirement.

We currently use natural gas for domestic hot water and heat, solar does not compete well with NG, would do it because it is the right thing to do and NG won't stay cheap forever.

Reducing environmental impacts, demonstrating sustainable technology for our visitors and students, reducing long term operating costs.

Try to wean myself from fossil based energy production provided by the grid.

A solar pv setup would work great in conjunction with our wind turbine

I have a cabin that only has a single heat source, electric. In the winter I pay a very high rate for not being dual sourced.

We need to catch up to other countries with respect to solar energy.

It just makes sense to us.

My interest is for my church that is currently actively working in energy efficiency projects.

Just to be clear, I am thinking about community solar so one of the biggest motivators is enabling many people from the community to get involved and have ownership in a community sustainability project.

I believe large employers/institutions should provide leadership and vision when dealing with carbon footprints, and as a tax-supported institution, I believe our facility should be run in a way that reduces its burden on taxpayers. Reducing energy costs and dependence will help achieve this goal.

Smart use of energy in the home and the need to keep cost down while helping deter climate change.

I think that solar is the energy source of the future. We need to get going on it as soon as possible.

I want to reduce my future energy costs to extend my future fixed income when I retire. I also want to reduce my work load so that if I heat with wood I won't have to cut and handle as much.

Reducing or eliminating dependence on the current system. I will not allow misguided capitalistic monopolies to destroy the progress I have made over the last 8 years. Never again.

Stewardship

I would like to be able to get off the grid as much as possible and reduce my carbon footprint.

Both personally and professionally, I know I can do better with my "carbon footprint" than I currently am doing. I would like to change that.

Might be a better energy alternative and more cost effective than in the past.

Doing my part

reduced monthly utility bills, and knowledge of new technology in use

environment

we are still looking to build a small turbine. The problem is finding one that will work! The turbines are so visible, when they aren't working everyone knows it!

Sign of the times

I already have a 7 kW PV system, but want to add solar thermal (air and hot water) to better use solar fuel!

I am not an installer/building owner but work with cities and others. My interest is to have the tools to help motivated owners build RE projects.

We currently have a PV system sized for our house. We now have an electric car. We would like to increase the system size to handle the increase in our power usage.

I am building an energy efficient home and it would not take much to make it energy free.

Statistic	Value
Total Responses	46

15. What are the strongest barriers for you to installing a project?

#	Question	Strong Barrier	Moderate Barrier	Slight Barrier	Not a Barrier	Total Responses	Mean
1	High up-front costs	79	36	6	5	126	1.50
2	Don't own suitable property	30	28	19	49	126	2.69
3	Worried about maintenance	21	26	33	46	126	2.83
10	Hard to find company to work with	15	34	36	41	126	2.82
12	Project complexity	20	43	32	31	126	2.59
Statistic	High up-front costs	Don't own suitable property	Worried about maintenance	Hard to find company to work with	Project complexity		
Min Value	1	1	1	1	1		
Max Value	4	4	4	4	4		
Mean	1.50	2.69	2.83	2.82	2.59		
Variance	0.59	1.48	1.22	1.05	1.06		
Standard Deviation	0.77	1.22	1.10	1.02	1.03		
Total Responses	126	126	126	126	126		

16. Share the barriers in your own words (optional).

Text Response

I'm not a decision maker for my organization, and this so far hasn't been on their radar.

We are moving so cannot contemplate project until after we find a new place

I need more personal resources to be able to install a solar system.

New idea. Only one guy doing it. He seems to busy to connect with us. Another installer told us it wasn't 'proven technology.' I can live with that as long as it doesn't damage our wood boiler. That wood boiler has saved us many thousands of dollars in propane. That was a good investment!

Pricey to get into the market, and I have no clue how to maintain the equipment

Cost and the cyclical nature of the incentive programs are major impediments to new projects.

The billing changes to greater share being service make the recovery longer and less certain. Proposed changes from net metering also introduce uncertainty.

none other than time.

I am a young, recent college graduate. It will be a ways in the future before I will own a home which I can amend to be more energy independent. But I will, one day!

I don't know the process

Initial costs are a concern. I would find it appealing to have an ongoing maintenance option at a reasonable fee. I would prefer to own the system rather than lease.

Will I be picked by the lottery by my investor owned utility?

Wooded lot & I'm broke

Neighborhood Associations!!!!!! They have the power to completely rule over not allowing solar power in their "jurisdiction". We are unable to put solar panels on our roofs for "aesthetic" reasons..... and yet, there still are 15 ft diameter Christmas wreathes hanging over garages in our neighborhood on the first day of May! Please, someone hire a lawyer and bring Neighborhood Associations to court in order to define the word "aesthetic". Those of us wanting, willing, and capable of installing solar are being unfairly limited by Minnesota's NOA's interpretation of this word!!!!

Little time. Numerous demands

wife wants to be on grid

Large investment how long would it last

We sent out RFP's for 2MW's and received 8 proposals. Interviewed four companies, most were not prepared or involved in the industry enough to answer intelligently. Used car salesman are all of a sudden becoming solar developers. It was not pretty.

As of right now the costs involving solar energy is very prohibitive.

Up front capital costs are the barrier, along with the suitability of our personal property.

Systems are not cheap and space is limited for storage, in my case I would have to do some modification to my utility room to make it work.

Cost is a major factor as well as finding local contractors who have experience and training. We have had difficulty finding qualified, reputable people to maintain our systems.

There seems to be a high technological level of understanding systems that makes decisions hard to arrive at.

A purchase is currently not in our budget at this time, but hopefully soon.

Devalue my property

Everyone I have spoken to is under the my (solar) way or nothing.

I don't know much about solar energy. How does a kwh relate to kw? This is foreign to me. How do the solar panels compare to each other. What are the trouble spots? Again, this is foreign to me.

Cabin distance

Our power provider is [COMPANY] and they don't care about small users.

For a community solar project -- how/where to start.

I have an 8 year old home and could do rooftop solar but do not plan to live here long enough to recoup the cost either through my use of resale value

Not quite ready (or able) to spend the money at this point.

I just don't know where to begin.

The property I own is not the property I will be living in when I retire.

Not enough options to ensure reliability.

Very limited on time right now to do the work involved.

Primarily cost, some technical. I want to install it myself.

I have 40 acres in the country. Would like solar heat but have too many trees for that to work well. Could do windmill but cost is high.

The up-front costs are extremely off-putting as there is NO guarantee for a return on investment. Hopefully some decent rebates will become available. Both at home and at work, I have a good south-facing roof to work with.

Time constraints to figure it all out

I am still worried about what if I see my house in the next five years. I am just not 100% convinced I'll be there for long enough to make it make financial sense

Would rather build a new construction (home) and integrate versus retro fit. Seems also the neighbors might dislike the look of equipment

I am not interested because I already have a 6.6 kW PV system and solar heat.

capricious subsidies and tax benefits

I think we have a good developer, still worried about turbine maintenance.

There are now so many companies and not a lot of installations to get good referrals.

I worry about two issues. I am more concerned that this addition to our PV make economic sense than I was on our 1st PV project. I am also concerned about keeping the snow off twice as many panels as we now have.

Last question about barriers, not answered because I have not looked.

Statistic	Value
Total Responses	48

17. Would you be interested in being involved in a community-shared solar project, where you would pay to get your electricity from a portion of a larger solar project that is not located at your residence?

#	Answer	Response	%
1	Yes	70	56%
2	No	21	17%
3	Not sure	35	28%
	Total	126	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	1.72
Variance	0.76
Standard Deviation	0.87
Total Responses	126

18. Do you know anyone who owns a solar or wind energy system?

#	Answer	Response	%
1	Yes	89	71%
2	No	30	24%
3	Not sure	7	6%
	Total	126	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	1.35
Variance	0.34
Standard Deviation	0.58
Total Responses	126

19. Where would you go to find GENERAL INFORMATION about solar or wind energy projects? Choose all that apply.

#	Answer	Response	%
1	Neighbor or person you know with some experience	66	53%
2	Your city or county	13	10%
3	Your utility	42	34%
4	State agency	38	31%
5	Organization of which you are a member	41	33%
6	Local installer or contractor	55	44%
7	Website	92	74%
8	Other	18	15%
9	Not sure	9	7%

Other

CERTs

I go primarily to conventions like spi and intersolar..to meet people, etc.

I'm an installer of solar PV and Solar thermal products I will go to myself.

my self

[COMPANY]

CERTs!

the infamous Google search

Certs

For Community Solar -- CERTs

Presentations and workshops

CERTs, Clean Energy Project Builder

Minnesota Renewable Energy Society

Personal Research

public library

Local Hardware Store	
CERTs	
Northwest Tech College	
CERTs!	
Statistic	Value
Min Value	1
Max Value	9
Total Responses	124

20. Where would you go to find COMPANIES that could help you plan solar or wind energy projects? Choose all that apply.

#	Answer	Response	%
1	Neighbor or person you know with some experience	48	39%
2	Your city or county	9	7%
3	Your utility	29	23%
4	State agency	31	25%
5	Organization of which you are a member	36	29%
6	Local installer or contractor	56	45%
7	Website	81	65%
8	Other	17	14%
9	Not sure	11	9%

Other

google

CERTs

I lean DIY

My great grandson

State fair

[COMPANY]

CERTs; MRES; MREA

the infamous Google search

community info gatherings

CERTs

Environmental Consultant

CERTs

RREAL

industry shows

I'm taking classes at Northwest Tech	
Google	
Haven't tried	
Statistic	Value
Min Value	1
Max Value	9
Total Responses	124

21. If you've used the Clean Energy Project Builder directory, how useful was it?

#	Answer	Response	%
40	Very Useful	1	4%
41	Useful	12	50%
42	Neutral	10	42%
43	Useless	0	0%
44	Very Useless	1	4%
	Total	24	100%
Statistic	Value		
Min Value	40		
Max Value	44		
Mean	41.50		
Variance	0.61		
Standard Deviation	0.78		
Total Responses	24		

22. Do you have any suggestions for how the Clean Energy Project Builder website could be improved?

Text Response	
None at this time.	
Haven't seen it .. can't comment. I do think you need to advertise though .. I'd never even heard about it before I got to this webpage.	
Not familiar, never heard of it.	
don't know.	
Publicize it.	
Include feedback from clients about the installers you have listed.	
N/A-- but I definitely will look at it when I have an opportunity now that I know it exists!	
Let more people know that it exists.	
I'll look and get back to you.	
Ensure that those on it are reputable. I believe for a long time the site had a wind turbine company on it that was selling turbines that didn't work and had been shut down by the AG's office.	
Include the Made in Minnesota incentive on the site, and update the Xcel Solar Rewards info for the upcoming production based incentive levels.	
not familiar with this website.	
Don't know.	
the name is clunky. could be friendlier sounding.	
NO!	
Don't see much about Community Solar.	
N/A	
Help installers & quality equipment dealers get established in rural areas. Promote alternative energy in areas outside of the Twin Cities also.	
No	
not applicable	
Ads on the internet, pay per click	
I'll need to check it out!	
Shows the pro and con in using solar, samples of completed projects	
Not at this time	
Statistic	Value
Total Responses	24

23. Browser Information (omitted from report)

24. What is your age?

#	Answer		Response	%
1	Under 18		0	0%
2	18-24		3	2%
3	25-34		14	11%
4	35-44		16	13%
5	45-54		27	22%
6	55-64		42	34%
7	65-74		15	12%
8	75 or older		6	5%
	Total		123	100%

Statistic	Value
Min Value	2
Max Value	8
Mean	5.30
Variance	2.00
Standard Deviation	1.41
Total Responses	123

25. Which best describes the building where you live?

#	Answer	Response	%
1	One-family house	99	80%
2	Multi-family house (e.g. duplex, triplex)	7	6%
3	Apartment building	5	4%
4	Mobile home	1	1%
5	Other	9	7%
6	Condominium building	2	2%
	Total	123	100%

Other	
Large warehouse buildings	
Rural farm	
Townhome	
Cabin	
Farm	
Public K-12 School	
Townhome	
Farm with greenhouses	
farm	

Statistic	Value
Min Value	1
Max Value	6
Mean	1.54
Variance	1.59
Standard Deviation	1.26
Total Responses	123

26. For your housing, do you own or rent?

#	Answer	Response	%
1	Own	110	89%
2	Rent	12	10%
3	Neither	1	1%
	Total	123	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	1.11
Variance	0.12
Standard Deviation	0.34
Total Responses	123

27. What type of utility provides your electricity?

#	Answer	Response	%
1	Investor-owned (e.g. Xcel Energy, Minnesota Power, Otter Tail Power Company)	73	60%
2	Cooperative (e.g. Connexus, Kandiyohi, Dakota)	34	28%
3	Municipal (e.g. New Ulm Public Utilities, Rochester Public Utilities)	14	12%
	Total	121	100%
Statistic		Value	
Min Value		1	
Max Value		3	
Mean		1.51	
Variance		0.49	
Standard Deviation		0.70	
Total Responses		121	

28. Please select your annual household income level.

#	Answer		Response	%
4	Under \$25,000		6	5%
13	\$25,000 to \$49,999		15	13%
14	\$50,000 to \$74,999		27	24%
15	\$75,000 to \$99,999		25	22%
16	\$100,000 to \$124,999		17	15%
17	\$125,000 to \$149,999		8	7%
18	\$150,000 to \$199,999		7	6%
19	\$200,000 to \$249,999		3	3%
20	\$250,000 or over		4	4%
	Total		112	100%

Statistic	Value
Min Value	4
Max Value	20
Mean	14.67
Variance	9.56
Standard Deviation	3.09
Total Responses	112

Appendix II: Clean Energy Project Builder Company Survey

SURVEY TEXT & QUESTIONS

Page 1: Instructions

Thanks for taking a few minutes to complete this survey about your work experience and about using the Clean Energy Project Builder website! Your feedback will help us make improvements.

Confidential: We won't share your responses. They will be kept completely confidential.

Directions: Click the get started button below to begin.

Page 2: Your Company & Experience

Does your company do work in Minnesota?

- Yes
- No

In your experience, what are the strongest barriers for your customers to adopt clean energy? Rank the following 7 choices (1 = strongest barrier; 7 = weakest barrier).

- _____ High equipment costs
- _____ Lack of incentives
- _____ High soft costs (license, permitting, etc.)
- _____ Lack of knowledge/education
- _____ Lack of financing options
- _____ Equipment maintenance
- _____ Project complexity

In your experience, what are the strongest motivating factors for your customers to adopt clean energy? Rank the following 4 choices (1 = strongest motivator; 4 = weakest motivator).

- _____ Economics
- _____ Climate and/or Environment
- _____ Energy Independence
- _____ Technology (early adopter)

Which approaches to marketing do you find to be the most effective for your company? Rate the following.

	Very Effective	Effective	Ineffective	Very Ineffective	Not applicable
Online directories	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online ads	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In-person events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Word of mouth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Print ads	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industry associations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Page 3: The Website

Use: Have you ever used the Clean Energy Project Builder website?

- Yes
- No

Benefit: Does your company see a benefit in being listed on the Clean Energy Project Builder website?

- Yes
- No

Directories: Does your company participate in any other online directories? Select all that apply.

- No others
- MRES
- MnSEIA
- Angie's List
- MREA
- AWEA
- SEIA
- DWEA
- Other _____
- Other _____

Ratings: Do you think that the Clean Energy Project Builder should add the ability for customers to rate companies who have done work for them (like Angie's List)?

- Yes
- No

Features: Are there any features that you think should be added to the Clean Energy Project Builder website?

Recommendations: Include any ideas you have for improving the website.

Page 4: Thank You!

We really appreciate the time you've spent providing feedback about your experience and the Clean Energy Project Builder website! Click 'Done' below to complete the survey.

SURVEY RESULTS

Note: Specific references to companies and people made by survey respondents have been replaced with generic terms like [COMPANY] and [INDIVIDUAL] to protect the identity of those entities.

1. Does your company do work in Minnesota?

#	Answer	Response	%
1	Yes	20	87%
2	No	3	13%
	Total	23	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.13
Variance	0.12
Standard Deviation	0.34
Total Responses	23

2. In your experience, what are the strongest barriers for your customers to adopt clean energy? Rank the following 7 choices (1 = strongest barrier; 7 = weakest barrier).

#	Answer	1	2	3	4	5	6	7	Total Responses
1	High equipment costs	9	7	3	3	1	0	0	23
2	Lack of incentives	4	8	7	0	1	2	1	23
3	High soft costs (license, permitting, etc.)	1	1	3	3	5	7	3	23
4	Lack of knowledge/education	5	4	1	4	5	2	2	23
6	Lack of financing options	4	3	8	5	0	3	0	23
7	Equipment maintenance	0	0	1	0	4	4	14	23
8	Project complexity	0	0	0	7	7	6	3	23
	Total	23	23	23	22	23	24	23	-

Statistic	High equipment costs	Lack of incentives	High soft costs (license, permitting, etc.)	Lack of knowledge/education	Lack of financing options	Equipment maintenance	Project complexity
Min Value	1	1	1	1	1	3	4
Max Value	5	7	7	7	6	7	7
Mean	2.13	2.83	4.87	3.61	3.13	6.30	5.22
Variance	1.48	2.79	2.66	4.07	2.30	1.13	1.09
Standard Deviation	1.22	1.67	1.63	2.02	1.52	1.06	1.04
Total Responses	23	23	23	23	23	23	23

**3. In your experience, what are the strongest motivating factors for your customers to adopt clean energy?
Rank the following 4 choices (1 = strongest motivator; 4 = weakest motivator).**

#	Answer	1	2	3	4	Total Responses
1	Economics	16	3	4	0	23
2	Climate and/or Environment	4	7	10	2	23
3	Energy Independence	2	11	9	1	23
4	Technology	1	2	0	20	23
	Total	23	23	23	23	-

Statistic	Economics	Climate and/or Environment	Energy Independence	Technology (early adopter)
Min Value	1	1	1	1
Max Value	3	4	4	4
Mean	1.48	2.43	2.39	3.70
Variance	0.62	0.80	0.52	0.68
Standard Deviation	0.79	0.90	0.72	0.82
Total Responses	23	23	23	23

4. Which approaches to marketing do you find to be the most effective for your company? Rate the following.

#	Question	Very Effective	Effective	Ineffective	Very Ineffective	Total Responses	Mean
1	Online directories	1	13	7	1	22	3.45
2	Social media	1	8	10	1	20	4.20
3	Online ads	0	7	8	2	17	4.47
4	In-person events	12	8	3	0	23	2.00
5	Word of mouth	16	7	0	0	23	1.30
7	Print ads	0	9	8	3	20	4.35
8	Industry associations	4	13	3	0	20	2.40
Statistic	Online directories	Social media	Online ads	In-person events	Word of mouth	Print ads	Industry associations
Min Value	1	1	2	1	1	2	1
Max Value	7	7	7	6	2	7	6
Mean	3.45	4.20	4.47	2.00	1.30	4.35	2.40
Variance	4.35	4.69	4.64	2.73	0.22	4.87	2.57
Standard Deviation	2.09	2.17	2.15	1.65	0.47	2.21	1.60
Total Responses	22	20	17	23	23	20	20

5. Use: Have you ever used the Clean Energy Project Builder website?

#	Answer	Response	%
1	Yes	12	55%
2	No	10	45%
	Total	22	100%
Statistic		Value	
Min Value		1	
Max Value		2	
Mean		1.45	
Variance		0.26	
Standard Deviation		0.51	
Total Responses		22	

6. Benefit: Does your company see a benefit in being listed on the Clean Energy Project Builder website?

#	Answer	Response	%
1	Yes	19	86%
2	No	3	14%
	Total	22	100%
Statistic		Value	
Min Value		1	
Max Value		2	
Mean		1.14	
Variance		0.12	
Standard Deviation		0.35	
Total Responses		22	

7. Directories: Does your company participate in any other online directories? Select all that apply.

#	Answer	Response	%
1	No others	6	27%
2	MRES	7	32%
3	MnSEIA	8	36%
4	Angie's List	4	18%
5	MREA	9	41%
6	AWEA	4	18%
7	SEIA	4	18%
8	DWEA	1	5%
9	Other	4	18%
10	Other	1	5%

Other	Other
NABCEP	
Univerdant	
ASES	BBB
SDWEA	
Statistic	Value
Min Value	1
Max Value	10
Total Responses	22

8. Ratings: Do you think that the Clean Energy Project Builder should add the ability for customers to rate companies who have done work for them (like Angie's List)?

#	Answer	Response	%
1	Yes	15	68%
2	No	7	32%
	Total	22	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.32
Variance	0.23
Standard Deviation	0.48
Total Responses	22

9. Features: Are there any features that you think should be added to the Clean Energy Project Builder website?

Text Response
Info about new rebates in MN and put pressure on utilities that do of offer rebates.
Comparative analysis of what really works to save energy and our environment. Like best bang for the buck.
we have not utilized the website other than to be listed. Not sure what benefits can come from it unless it is advertised more. I have not had any customers come from the listing, so not sure it currently benefits us other than having external links for SEO.
Need the ability to provide unique descriptions for each company office.
Financing Institutions

Statistic	Value
Total Responses	5

10. Recommendations: Include any ideas you have for improving the website.

Text Response
Feature people in the projects. How they like their solar system or whatever. Personalize it.
I seem to be unable to add new projects.

Statistic	Value
Total Responses	2

Appendix III: Clean Energy Project Builder Partner Interviews

Interview Questions:

1. How has your organization been involved in the past as a partner in the Clean Energy Project Builder online directory?
2. How are you currently involved as a partner in the Clean Energy Project Builder?
3. How do you promote the Clean Energy Project Builder, if at all?
4. What are the most common questions you are asked by people interested in planning a solar or wind energy project?
5. Do you find the Clean Energy Project Builder to be a useful tool in serving your audiences? Why or why not?
6. What are the most important features of the Clean Energy Project Builder?
7. What could be done to improve the Clean Energy Project Builder?
8. Do you have any specific feature requests for Clean Energy Project Builder that should be considered if the website is redesigned?

Interview Summaries:

Southwest Initiative Foundation (SWIF) – Cheryl Glaeser:

- Interviewed in person by Dan Thiede and Lissa Pawlisch January 10, 2014 at 3:00pm CST.
- Cheryl Glaeser at the Southwest Initiative Foundation (SWIF), the owner of the website and the organization responsible for its creation, are keen to see the Clean Energy Project Builder online directory service continue as a useful resource for Minnesotans and a legacy of their wind energy programming. They promote the directory on their website and through their programming with youth and businesses when they are interested in pursuing renewable energy projects.

Clean Energy Resource Teams (CERTs) – Lissa Pawlisch.

- Interviewed in person by Dan Thiede January 13, 2014 at 11:00am CST.
- Lissa Pawlisch at the Clean Energy Resource Teams (CERTs), the partnership responsible for managing the CEPB website, is interested in redesigning the website so that it

appeals most strongly to the motivations of Minnesota consumers and provides them with resources to overcome key barriers. CERTs finds most often that people come to solar because they are concerned about the environment and oftentimes want to reduce their dependence on fossil fuels. Saving money on their utility bill seems like icing on the cake. Economics have come into play more as the cost of installing solar comes down, but cost is still a primary concern and barrier. CERTs would like to have a CEPB website that is less buggy—repetitive website maintenance has consumed resources that would otherwise have been used on marketing and development new features. CERTs would also like to see a map of installed projects added to the CEPB website as they think this could enhance the peer learning impacts for website visitors and create the sense that others are already doing it and Minnesota is a great place for solar and wind development. CERTs is also considering including service categories for the emerging community solar industry to the directory and inviting companies to identify themselves as players in that space.

Minnesota Solar Energy Industries Association (MnSEIA) – Lynn Hinkle.

- Interviewed by phone by Dan Thiede March 28, 2014 at 1:45pm CST.
- Lynn Hinkle at the Minnesota Solar Energy Industries Association (MnSEIA) uses CEPB to help the solar companies that they serve get noticed through the directory, by encouraging them to sign up. They have also worked with DEED to promote the directory to other businesses and companies thinking about locating in Minnesota. For this reason, they have an interest in making sure that the directory has enough companies to be fairly representative of the major players in the industry. In terms of changes to be made, Lynn thought that the service categories for companies in the directory were overwhelming for consumers and that they should be simplified into key market segments. MnSEIA also has expressed an interest in adding service categories for others in the supply chain that produce components for solar.

Minnesota Renewable Energy Society (MRES) – Laura Cina Burrington.

- Interviewed by phone by Dan Thiede April 16, 2014 at 1:00pm CST.
- Laura Cina Burrington with the Minnesota Renewable Energy Society (MRES) was involved early on with CEPB when solar was added to identify service categories for the technology. Laura said that they do not promote the CEPB website widely to their audiences because they provide their own list of reputable solar companies to consumers from among their membership—it's one of the benefits for those members.

Laura did, however, see CEPB as a useful tool for identifying wind companies for consumers.

Minnesota Department of Commerce (DOC) – Stacy Miller.

- Interviewed by phone by Dan Thiede January 28, 2014 at 3:00pm CST.
- Stacy Miller at the Minnesota Department of Commerce (DOC) was pleased that the CEPB website exists, as it provides Minnesota consumers with lists of solar and wind energy companies that can assist them with projects—a service that DOC once provided on its own. Like Lissa at CERTs, DOC is curious about adding solar installations to CEPB so that consumers could see existing projects near them, and also adding community-shared solar as a service category so that consumers can find companies who develop that type of project.

Appendix IV: Overview of Clean Energy Project Builder Online Directory

The Clean Energy Project Builder (CEPB) website at <http://thecleanenergybuilder.com> serves an essential function: to allow Minnesotans to find companies that can help them plan, implement, and manage solar and wind energy projects. We would like to understand how the online directory should be redesigned and marketed to best serve the decision-making needs of consumers considering solar and wind energy projects.

1) SITUATIONAL ANALYSIS:

a) History:

- i) Rural Energy Development Initiative: The Rural Energy Development Initiative (REDI) helped to maximize rural economic development and stabilize rural economies by building renewable energy capacity, expertise and leadership throughout Minnesota, specifically targeting rural wind energy development. In 2008 and 2009, input from REDI stakeholders and industry professionals indicated the need for the development of a directory or “one-stop shop” of players in the wind industry.
- ii) REDI Resources: Developed in 2009 and launched in March 2010, our answer to the above demand was to develop “REDI Resources”, a dynamic online directory focused on commercial wind players.
- iii) Adding Solar Energy: In summer 2011 we met with members of MRES, MnSEIA, Minnesota Solar, and MN Department of Commerce to talk through necessary steps to add solar.
- iv) Clean Energy Project Builder: In summer 2011 REDI Resources was changed to the Clean Energy Project Builder to make the mission of the website clearer moving forward.
- v) Minnesota Department of Commerce: In the Spring of 2012 Commerce officially transitioned their lists of installers to the Clean Energy Project Builder so that they could rely on our tool for this service rather than managing their own list.

- b) **Industry**: REDI Resources was originally created to help people navigate the commercial wind energy industry. To do this, a directory was needed because of the complexity of the planning process and the various players involved. Small wind and solar energy projects are considerably less complex. Community interest in commercial-scale wind has diminished in recent years as larger developers take control of the industry. The growth of the solar energy industry has made it more and more of a primary focus for the tool, and small wind still has a presence in MN and should not be left behind.

c) **Technology:**

- i) Origins: When the REDI Resources website was built in late 2009, Drupal 6 was the most current release of Drupal. At the time it was necessary to create a custom directory because Drupal did not have out-of-the-box functionality for the level of searching and filtering we needed to properly represent the players in the commercial wind energy industry.
- ii) Management: Over time, with Drupal software updates, the complexity of the custom-built directory moved from an asset to a liability, with frequent errors and bugs that required fixing. This situation was made more cumbersome with staffing transitions on the part of the website developer and their unreliable contracted help.
- iii) Software: Drupal 6 may be phased out as early as October 2014, at which time the development community will stop making software and security updates. This requires that the website be upgraded or rebuilt using the most recent version of Drupal, or transitioned to a different platform.
- iv) Brand: The Clean Energy Project Builder brand is not terribly well recognized, though it provides more clarity about site purpose than the former REDI Resources name. There has been some confusion over the 'project builder' aspect of the brand since the website just helps people find companies. Some have suggested rebranding around 'connection'.

2) STAKEHOLDER REVIEW:

- a) **Owner**: Southwest Initiative Foundation – SWIF managed the REDI program and worked with CERTs to create REDI Resources. They own the website and are keen to see the service continue.
- b) **Manager**: Clean Energy Resource Teams – CERTs does a lot of work to get communities and individuals interested in solar and wind energy, and CEPB is a useful tool for helping them find companies during the project planning process.
- c) **Partners**: The Minnesota Department of Commerce was not a founding partner of REDI/CEPB, but they joined the team when we began to add solar energy in 2011, and decided in 2012 to solely use the website as their place to direct consumers. They must continue providing this service. Windustry and The Minnesota Project are the two other founding partners of REDI/CEPB (in addition to CERTs and SWIF). Both direct interested consumers to the site. MnSEIA and MRES helped add solar and recruited companies. DEED promotes it occasionally.
- d) **Companies**: 205 companies have added themselves to the CEPB directory as of July 31, 2014.

3) AUDIENCE REVIEW:

- a) **Primary:** People in and near Minnesota interested in planning solar and wind projects.
- b) **Secondary:** People interested in learning about the solar and wind industries.
- c) **Secondary:** Companies and organizations in and near Minnesota that want to reach consumers.
- d) **Tertiary:** Companies and organizations that want to find and connect with one another.

4) SERVICE & FUNCTIONALITY REVIEW:

- a) **Directory:** This is the primary function of the site and must be preserved and even easier to use.
- b) **Mapping:** While REDI/CEPB did not focus on mapping as a key interface, we'd like it to be central.
- c) **Searching:** People need to be able to do basic keyword and proximity searches of the database.
- d) **Filtering:** People need to be able to see companies by technology and a limited set of services.
- e) **Projects:** We'd like to be able to show people installed projects on a map in addition to companies.
- f) **Portfolio:** The portfolio functionality of REDI/CEPB was never well utilized and seems unnecessary.