

Solar Energy Demand: Survey Design & Implementation Proposal

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Solar Energy Demand - Survey Proposal

We are an independent market-research firm recruited by the executive board of Generic Energy Provider (GEP). GEP supplies electric service to Kitsap, Skagit, Thurston, and Whatcom as well as parts of Island, King, Kittitas, and Pierce counties in the State of Washington. GEP operates in a regulated market through agreements with the state, and is guaranteed a rate of return on its business (Garskof, 2016). However, with the growth of solar power, GEP is concerned that its revenues and agreements will be negatively impacted. With ever lower costs and continuously improving technology, solar power is expected to grow at exponential rates, potentially tripling over the next five years (Rapier, 2017; SEIA, 2017).

This research project will investigate the stated intent of current GEP customers to switch to solar generation methods within the next three years. Currently, GEP understands that 1,500 customer residential households they serve use solar power (0.15% of all accounts), with households being defined as a single or multi-family home (up to 4 units). Should that proportion surpass 3.75%, GEP will need to propose an amendment to its contract with the State of Washington (Garskof, 2016). This research project will investigate whether 3.75% or more of GEP current customers intend to switch to solar energy generation methods in the next three years.

Survey Target Population & Sampling Frame

GEP currently provides electric power to an estimated one million residential households. Our survey target population will consist of GEP customers who will remain residents of the region for at least the next three years, are aged 18 or older, live in owner-occupied homes, or rent with plans to own a home within the same time. Households that work or have worked in the energy industry are out of scope.

The sampling frame for this survey is a list of all current GEP customers, with registered email addresses on file, contained in their database. GEP maintains databases to support the many functions of its business, accordingly it stores account information for all customer records. We can utilize these databases to obtain the pertinent records on current customers. We will sample from the subset of current GEP customers in our database for whom GEP has a recent email address. It is estimated that GEP has email addresses for 78% or 780,000 of its residential households (Daly, 2015).

Sampling Approach

Our sampling approach will be a simple random sample of current customers in our database with recent email addresses (780,000 emails). We will specify quotas to make sure that we have a representative sample. Given the level of investment required to commit to a residential solar energy system, it is hypothesized that household income will correlate with intent to install solar power over the next three years. Cost estimates for an installed photovoltaic power system, which represents most residential solar systems, are between USD \$30,000 and \$70,000 (Thompson, 2017; Sullins, 2017; Google, 2017). Our quota will be based on household income (band) distributions using U.S. Census data available for the zip codes that GEP services. Responses to a household income question in the survey will allow for monitoring of quota fulfillment.

To estimate sample sizes, we start with estimating sampling requirements, then scale up for likely email response and survey completion rates. Using a 95% confidence and 0.2% margin of error (MOE) we estimate minimum sample size requirement of 33,189 or ~33k using:

$$n = \frac{N \times X}{(X + N - 1)}$$

Where, $N = 780,000$, $X = \frac{Z^2 \times p \times (1-p)}{MOE^2}$, $Z = 1.96$ ($\alpha = 0.05$), and $p = 3.75\%$ (Israel, 1992).

To ensure that we receive representative responders across household income bands, the survey will remain active until all the following quotas are met:

Table 1

Survey Reported Household Income	Distribution (U.S. Census)	Quota Requirements
Under \$50K	34.9%	11,591
\$50K - \$100K	31.6%	10,472
\$100K - \$200K	24.7%	8,193
\$200K +	8.8%	2,934
Totals	100.0%	33,189

Note: Band population per household income figures obtained from U.S. Census Bureau (2016).

Survey Medium and Instrument

We will use a web-based survey and grant access through unique email invitations to customers selected from the list of customers with registered email accounts. Notices of the survey will be sent a week prior to the email invitation to increase the response rate compared to other web-based methods. This approach has been found to lead to an expected survey response rate of 59.7% from web-based format (Millar & Dillman, 2011). The minimum number random sample of emails will be 33,189/59.7% or 55,594. The unique link provided in each email will prevent duplicated completions by the same customers by restricting access once a survey that is assigned to that invitation has been completed. Reminder notices will not be sent to participants encouraging them to complete the survey as this tactic has not produced significant results in prior studies (Kaplowitz, Hadlock, & Levine, 2004).

Survey Design

Our goal is to keep the survey within a two to five-minute range, or three to ten questions, while minimizing response burden. With this survey length, we expect to achieve the target completion rate of 59.7% as outlined above (Overbay, 2015). A survey respondent must be a GEP customer who does not or has not worked in the energy industry, owns or intends to

purchase a home, and plans on remaining in the area for next three years. We will ask the key question of intent to install solar power within the next three years. If intent is positive, a follow up question will be posed with an estimate of the investment range being considered for solar power. A range of household income will be collected as well as motivation for considering or not considering solar power. Finally, we will close with optional questions on traditional household demographics. A copy of the survey can be found in appendix A.

Survey Error

We address two key survey errors: data quality and bias. Starting with data quality, we plan to perform basic data checks, but most of the focus will be on bias. Despite taking a quota approach to make sure that we get a representative response from households across the income spectrum, we plan to check again to ensure that responders reflect the household income in the service area. Holbrook, Krosnick, and Pfent (2007) found that response rates varied across income brackets which could bias our results. To deal with unit non-response bias, we will consider weighing responses by household income. Another potential source of bias is likely to arise due to the fact that GEP only has emails for 78% of its customers. To mitigate the bias associated with the 22% of customers without emails, survey reported household income will be compared with U.S. Census reported household income as a ratio to calculate the weight for each income bucket (Groves, et al., 2011). These weighted responses, when applied to the survey results, will help to appropriately represent the target population.

We also recognize that there may be some positivity bias and social desirability bias (Groves, et al., 2011) as it relates to people's desires to appear positive about environmental concerns. We will leverage response to motivation for considering (or not considering) solar power as a way for controlling for this potential bias (Survey question 6).

Interpreting Survey Results

The key question of interest in the survey is likelihood to install solar power in the next three years. Responses of “Very likely” and “Likely” will be considered as positive intent to purchase solar power. Intent will be balanced through the respondent’s answer to the level of investment that they are willing to consider, suggesting some experience or familiarity with solar energy systems. Using a directional test proportion with 95% confidence, we will estimate the likelihood that 3.75% or more of GEP’s residential households will convert to solar power in the next three years. Demographic responses will help to ensure that the income band quotas are achieved and will aid in the analysis.

Conclusion

This survey will help GEP proactively assess risks to its regulated revenue streams by estimating the likely conversion of its residential households to solar energy in the next three years. Should the survey results indicate that this likelihood is more than 3.75%, it will allow GEP to preemptively start evaluating options for how it should renegotiate its contract with the State of Washington and its regulators so that it can continue to ensure profitable returns for its business. In either outcome, it is expected that GEP will continue to invest in this research to continuously measure interest in their geographic footprint and compare their findings with regional and national trends.

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Appendix A

Regional Solar Demand Survey

Survey Introduction:

We are Dynamic Marketing Company, and we are conducting research on solar energy in this region on behalf of GEP.

As a GEP customer, we appreciate you taking a moment to complete this brief survey about solar energy. Your information will remain anonymous. Thank you in advance for sharing your opinion today!

Survey Questions:

1. Do you currently work in, or have in the past worked in, the Energy industry?
[Y] -> Exit Survey
[N] -> Continue
2. How likely are you to remain a resident in the Puget Sound area in the next 3 years?
[Very likely:Likely:Neutral:Not likely:Uncertain]
3. Do you currently own this residence?
[Y] -> Continue to question 5
[N] -> Got to question 4
4. How likely are you to purchase a home within the next 3 years?
[Very likely: Likely:Neutral:Not likely:Uncertain] -> Remove if Neutral or less
5. How likely are you to consider installing solar power at your residence in the next 3 years?
[Already Have Solar:Very likely: likely:neutral: not likely:uncertain]
6. Please tell us the primary reasons for considering, or not considering, using solar energy.
(Select all that apply)
 - 6a. Reasons for using solar energy, or to consider using solar energy:
[Preserve the environment:Reduce carbon footprint:Reduce dependency on fossil fuels:Take advantage of tax credits:Interested in investing in new technology:Save on electric bill:Other{ Open Text}]
 - 6b. Reasons for not using solar energy, or to consider not using solar energy

[I don't own a home:Seems too expensive:Not interested:Don't know enough about it: Difficult to maintain/manage:Power limitations/Outages:Other{ Open Text}]

7. What is the maximum dollar amount you'd be willing to invest in solar energy for your residence?

[0-999:1k-10k:11k-25k:26k-75k:76k+] [] I'm not interested in solar energy.

8. Please select the household income that applies:

[0-25k:26-50k:51-100k:101-250k:251-500k:500k+]

9. Please tell us more about your household (optional):

(7a.) Age: [18-24:25-33:34-44:45-54:55-60:61+]

(8b.) Employment status: [Full Time:Part-time:Retired:Unemployed:Homemaker]

(8c.) Level of education: [High school or less:2-year college:4-year college: or Professional or higher]

(8d.) Number of adults residing in your household: [two digits]

Exit Survey Messages

Not qualified zip:

Unfortunately, the zip code you entered is not in our area of interest today.

Thank you very much for your participation!

Not qualified energy worker:

Unfortunately, we're unable to include energy workers in our survey.

Thank you very much for your participation!

Completed Survey:

You have reached the end of our survey.

Thank you very much for taking the time to share your information with us today!

Appendix B

Question Count	Average Seconds Spent Per Question*	Total Survey Completion Times
1	75	1 min 15 sec
2	40	2 min
3-10	30	2 - 5 min
11-15	25	5 - 7 min
16-25	21	7 - 9 min
26-30	19	9 - 10 min

** Rounded and grouped for illustrative purposes*

Chart via SurveyMonkey

Appendix C

Table 2

Population Strata based on Household Income		
Household Income	Sum of Band Population	Portion of Population
\$200K+	378,829	8.85 %
\$100K-\$200K	484,233	24.68 %
\$50K - \$100K	135,660	31.55 %
Under \$50K	535,944	34.92 %
Total Band Population 1,534,666		

Note: Band population per household income figures obtained from U.S. Census Bureau.