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Disclaimer:

2017 Alabama PV Soft Cost and Workforce Development

Elise B. Fox
Thomas B. Edwards
Michael D. Drory

March 2018
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The authors also wish to thank Rachel Baker for statistical review of the results provided within this document.

EXECUTIVE SUMMARY

In 2016, the first comprehensive analysis of the solar market in Alabama was conducted. The market was found to be immature, but price competitive with other parts of the Southeast and the nation. A second survey was completed one year later in 2017 to help understand the changes in trends and changes in the solar market in AL over the calendar. AL is one of three states without comprehensive net metering legislation, yet remains cost competitive with other states around the US and the Southeast. Residential systems average $2.4/W-DC, which is considerably lower than the nationwide median of $4/W. Commercial systems cost an average of $2.15/W-DC, which is also below the national median of $2.30/W for nonresidential systems over 500 kW.

In 2017, the overhead and profit category became this largest soft cost category for residential systems, accounting for 19% of the total cost of a residential system and 18% or the total cost for a commercial system. In 2016, installation was the highest soft cost in 2016. A 50% increase in FTE positions is expected, with primary needs in electricians, installers, and sales and marketing, which would further help the state inch up the national ranking list for solar jobs per capita from 49th. Though the solar market in AL remains small, there is some indication that falling costs of installed systems is enabling the market to slowly grow, even without comprehensive net metering legislation.

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LIST OF ABBREVIATIONS

AC	Alternating current
AL	Alabama
DC	direct current
DOE	Department of Energy
FTE	Full Time Equivalent
IOU	Investor Owned Utility
kW	kilowatt
MW	megawatt
PV	photovoltaic
SE	Southeast
SRNL	Savannah River National Laboratory
SRNS	Savannah River Nuclear Solutions
SC	South Carolina
SETO	Solar Energy Technologies Office
SuNLaMP	SunShot National Laboratory Multiyear Partnership
TVA	Tennessee Valley Authority

1.0 Introduction

In 2015, a study was funded by the United States (US) Department of Energy (DOE) Solar Energy Technologies Office (SETO) to better analyze solar in the Southeastern (SE) US and to develop and understand how state energy policies affect deployment and job growth. This is the second in a series of survey studies focusing on the state of Alabama (AL) and serves to follow up on findings from the 2016 report {Fox Elise, 2016 #1127}.

2.0 Experimental Procedure

2.1 Data Collection

Working with Energy Alabama, the 2017 survey was sent to eleven known in-state solar PV installation companies with a request for their participation. Responses were received from five, which indicates a 45% response rate. The analyses presented in this report were conducted using JMP Pro Version 11.2.1 [1].

2.2 Quality Assurance

Requirements for performing reviews of technical reports and the extent of review are established in SRNL Manual E7 2.60. SRNL documents the extent and type of review using the SRNL Technical Report Design Checklist contained in WSRC-IM-2002-00011, Rev. 2.

3.0 Results and Discussion

The survey was broken down into three parts focusing on: 1) establishing current costs of solar, 2) determining additional workforce needs, and 3) determining the focus and experience of the respondents. Detailed analysis of the survey is presented and discussed below and a copy of the survey can be found in Appendix A. Where possible, data are broken down by business sector: residential, commercial, and utility.

3.1 Solar Sector Served by Respondents

Respondents were asked to identify their sectors of business: residential, commercial and/or utility scale systems; results can be found in Figure 3-1. Of the five respondents, two filled out the survey for the first time in 2017. For the first time, a respondent installed utility scale systems. In 2016 all survey respondents served only within the residential and commercial sectors. Like 2016, one respondent served only the commercial sector and one respondent served only the residential sector. The addition of a local, utility scale installer increases the likelihood that AL businesses and local workforce will be able to benefit from utility scale systems installed by the TVA and Alabama Power, of which there has been approximately 85 MW of installations to date. [2]

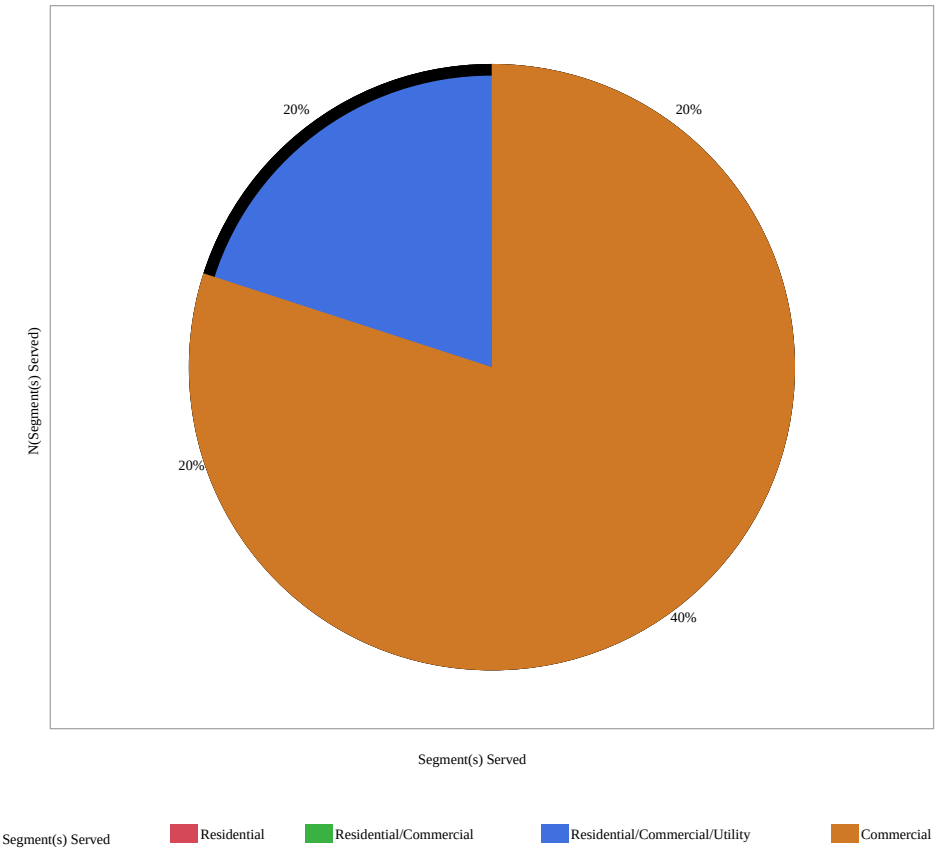

Figure 3-1. Solar PV segments served by respondents. Those that serve the residential sector are outlined in black.

3.2 Typical Size of Installation by Type

The survey respondents were asked about the typical size of their installations (residential, commercial, and utility scale) in Alabama. The installation size was provided in kilowatts of direct current (kW-DC), and in some cases, a range of sizes was provided by a respondent. Figure 3-2 provides a graphical display (including box plots[1]) of the installation sizes (low-end and high-end estimates) for both residential and commercial installations. The results are found in Figure 3-2. In 2016, residential installations in AL were all less than or equal to 8 kW-DC with an average size of ~6 kW-DC, but the average size of a residential jumped to 11.5 kW-DC in 2017. Since the last report, there has been no change in residential solar policies, so the increase in size can be attributed to the drop in cost of the systems. The average size of commercial installations in AL increased slightly from 52 kW-DC to 67.5 kW-DC in 2017. The only utility scale system average reported was 200 kW-DC, which may be associated with a community solar program, many of which are less than 1 MW in size. [3]

[1] A box plot is a descriptive display used for continuous data. The lower edge of the box is the 25th percentile, the upper edge the 75th percentile, and the horizontal line within the box the 50th percentile. Any points that fall beyond the lines extended from the box (i.e., points not connected to the box) of the box plot may be considered as potential outliers for the data set.

Figure 3-2. Average PV installation Size (kW-DC), by sector served.

3.3 Average Cost ($/W-DC) by Type of Installation

Respondents were asked to provide information on the total cost in dollars per watt of direct current ($/W-DC) by installation type. These data in $/W-DC for the total cost by solar segment served are plotted in Figure 3-3. Residential installs dropped from an average of $3.29/W-DC to $2.70/W-DC in 2017, or a drop of nearly 18%, which is considerably lower than the national median price for residential systems of $4/W found by Barbose et al. [4] During this time, the ranges of prices also narrowed from +/- $2.50/W-DC to $1.50/W-DC in the year. This could be due to increased competition in some area, or could be due to greater consumer information on appropriate cost. Commercial systems in AL also decreased from average cost of $2.44/W-DC in 2016 to $2.15/W-DC in 2017, or a 12% decrease in cost. The range of costs for commercial systems remained about $0.70/W-DC. Cost data for commercial systems is closer to the national median of $2.30/W for non-residential systems over 500 kW. [4] Cost data were not provided for utility scale systems by survey respondents.

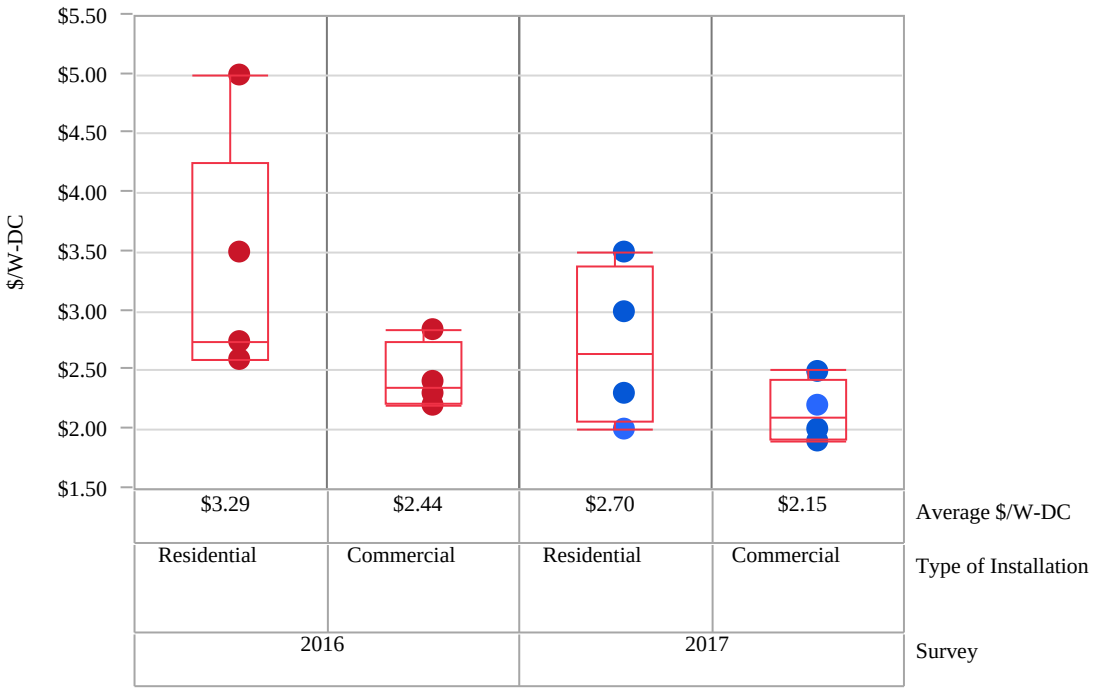

Figure 3-3. Variability plot for total cost data in $/W-DC.

3.4 Average Hard and Soft Cost ($/W-DC) by Type of Installation

Respondents were asked to provide the percent of the total cost attributable to hardware by installation type. The resulting estimated costs of hardware as a percentage of the total costs are provided in Figure 3-4. Using these percentages, the total costs were further broken down into hardware and soft costs, and these values are provided in Figure 3-5 for residential systems and in Figure 3-6 for commercial systems. Hardware costs for AL residential installations average $1.40/ W-DC for hardware equaling on average 53% of the total costs in 2017. This represents a drop of $0.43/W-DC or 13% overall from 2016. Commercial installation hardware averaged $1.24/ W-DC equaling on average 56.5% of the total costs in 2017, representing a drop of $0.22/W-DC or 3.7% total from 2016. This closely mirrors the percentages of hardware costs of 52% for residential and 54% for commercial reported for the state of South Carolina at the end of 2016. [5]

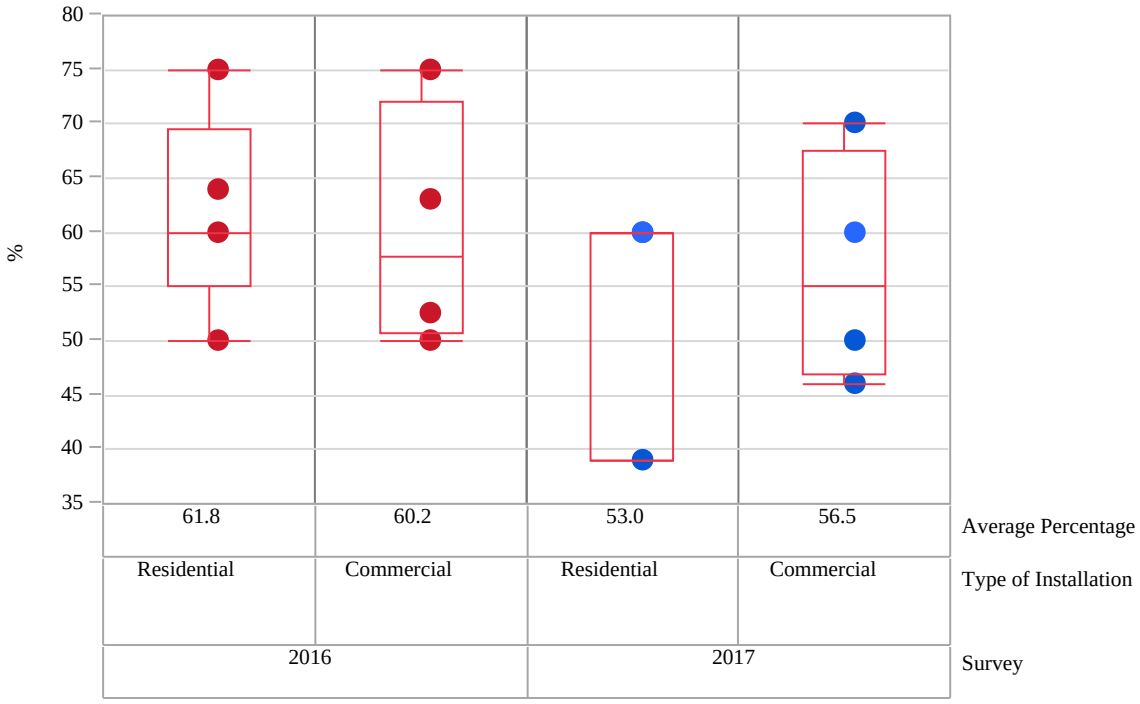

Figure 3-4. Reported percent of total cost attributed to hardware only, by respondent.

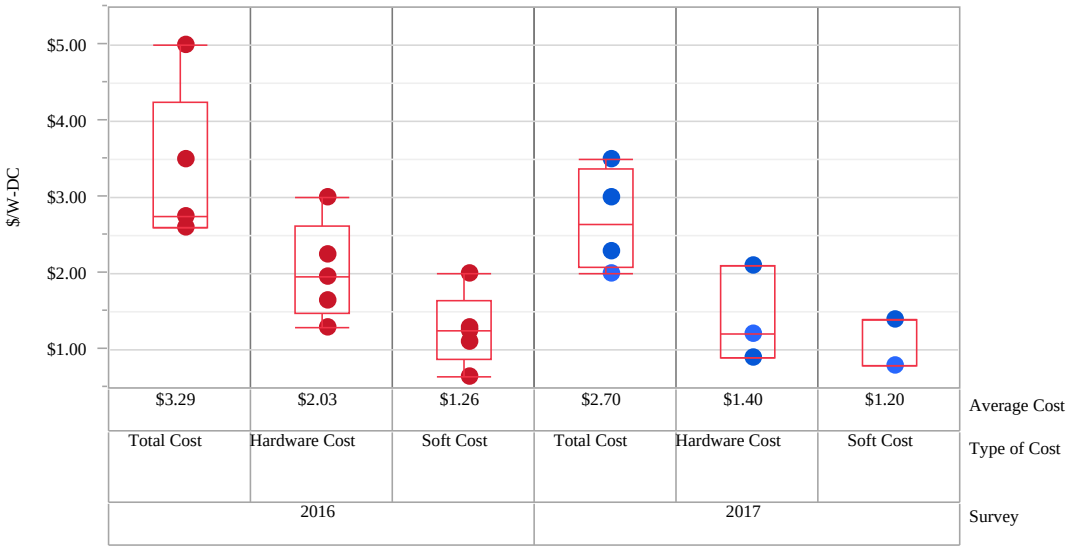

Figure 3-5. Breakdown analysis of total costs into hard and soft, per sector for residential systems.

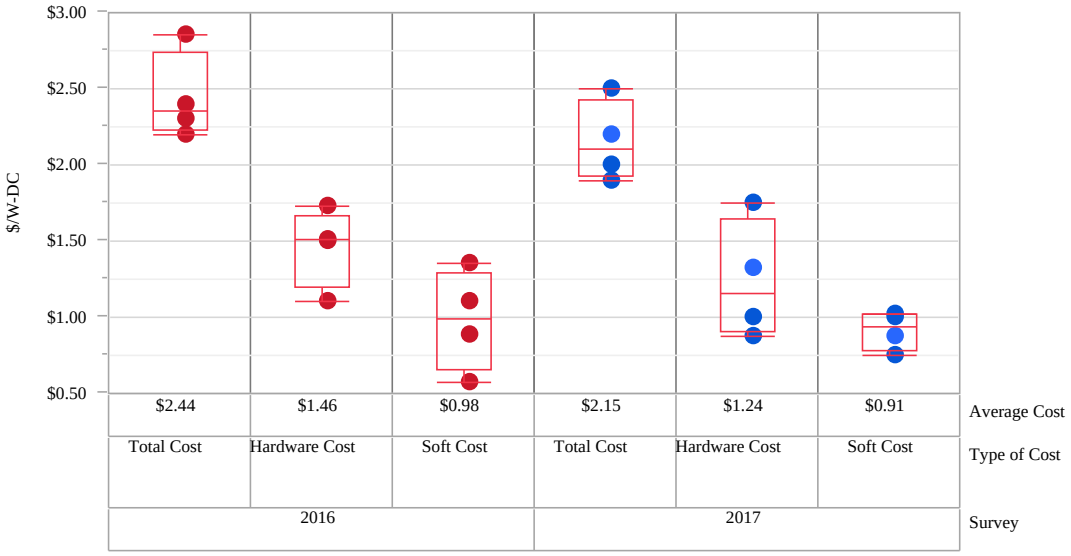

Figure 3-6. Breakdown analysis of total costs into hard and soft, per sector for commercial systems.

3.5 Average Soft Cost ($/W-DC) by Category by Type of Installation

To better determine the largest contributor to soft costs, respondents were asked to provide information on the percent of the total cost attributable to several soft-cost categories by installation type. Four categories of soft costs were considered: 1) marketing, lead generation, and sales, 2) permitting and interconnection, including all fees and administrative labor costs, 3) installation, including design, engineering, and construction labor, and 4) profit, overhead, and taxes. This applied to both residential and commercial total costs. The results are presented in Figure 3-7 for residential systems, Figure 3-8 for commercial systems, and as average percentages and dollar values in Table 3-1. The largest soft cost is attributed to overhead>installation>marketing>permitting for residential installations in 2017. One very noticeable change from 2016 to 2017 was the increase in percentage of soft costs attributed to overhead and profit for residential systems. In 2016 overhead and profit accounted for 25% of all soft costs, but this jumped to 58% of soft costs (19% of total cost) in 2017. This may be partially attributed to the limited data set provided from respondents for residential systems. Commercial systems held the same trend to 2016 where overhead=installation>marketing>permitting. Though base cost for installation and overhead increased slightly, permitting costs decreased.

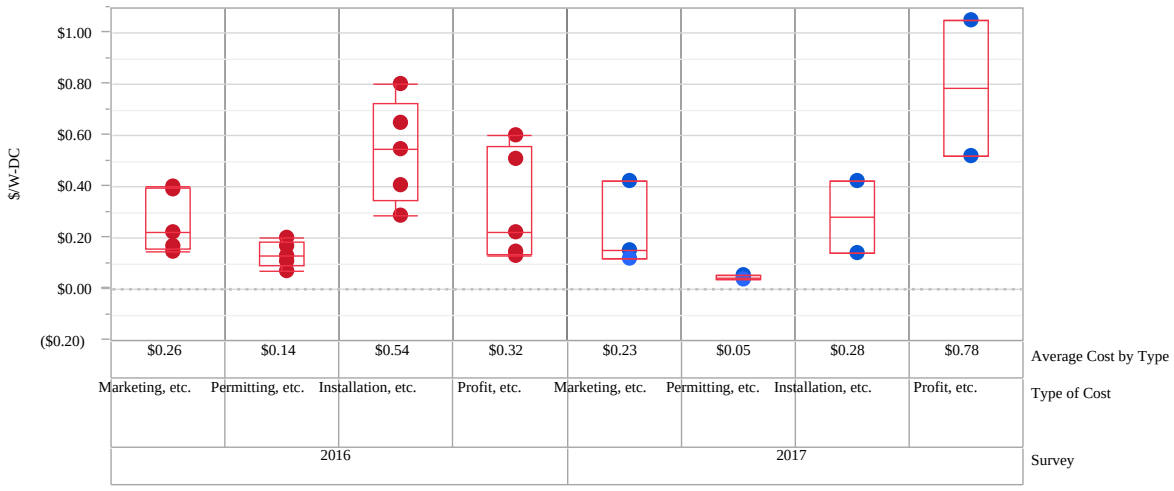

Figure 3-7. Breakdown analysis of soft costs in four categories, for residential systems.

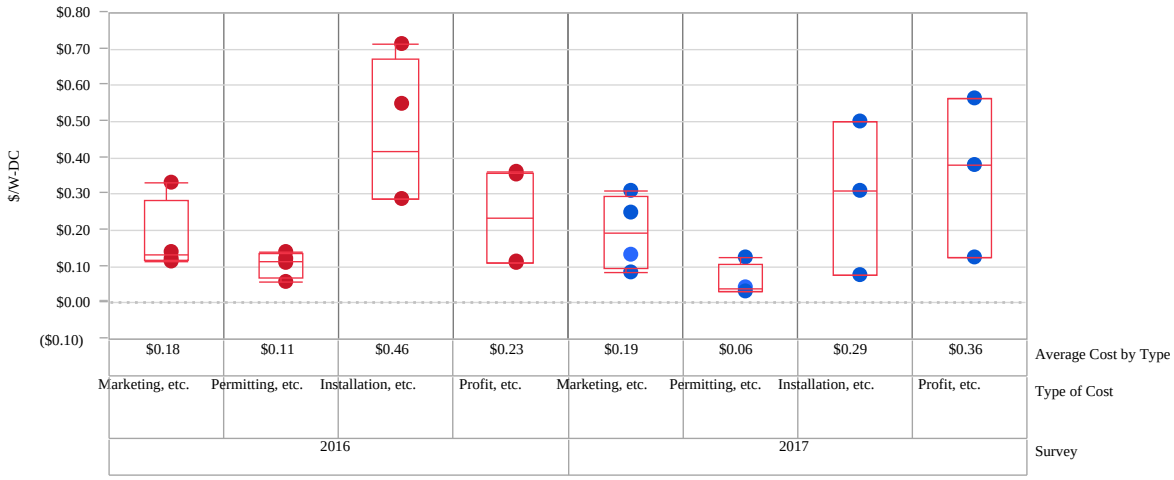

Figure 3-8. Breakdown analysis of soft costs in four categories, for commercial systems.

Table 3-1. Total Cost Separated into Hardware and Soft Costs, based on average percent reported of the total cost.

Type of Cost	Residential Mean($/(W-DC))	Commercial Mean($/(W-DC))
Total Cost	$2.70	$2.15
Hardware Percentage	$1.43 (53%)	$1.24 (58%)
Installation, etc.	$0.37 (14%)	$0.29 (13%)
Marketing, etc.	$0.25 (9%)	$0.19 (9%)
Overhead, etc.	$0.52 (19%)	$0.36 (17%)
Permitting, etc.	$0.13 (5%)	$0.09 (4%)

3.6 Workforce Needs

Survey recipients were asked to report on the number of their current employees and how many they anticipated hiring over the next year in four job categories: engineering and design, electricians and

installers, sales and marketing, and general business. The five reporting businesses had 44 full time equivalent (FTE) employees in 2017 and an additional 23 employees were expected to be hired over the next year, or a 50% increase, as seen in Figure 3-9. A majority of job growth continues to be in electricians and installers, AL is currently ranked 49th in the nation for solar jobs per capita and 44th for total solar jobs by The Solar Foundation [6], up one spot from 50th and 44th, respectively, from 2016. [7]

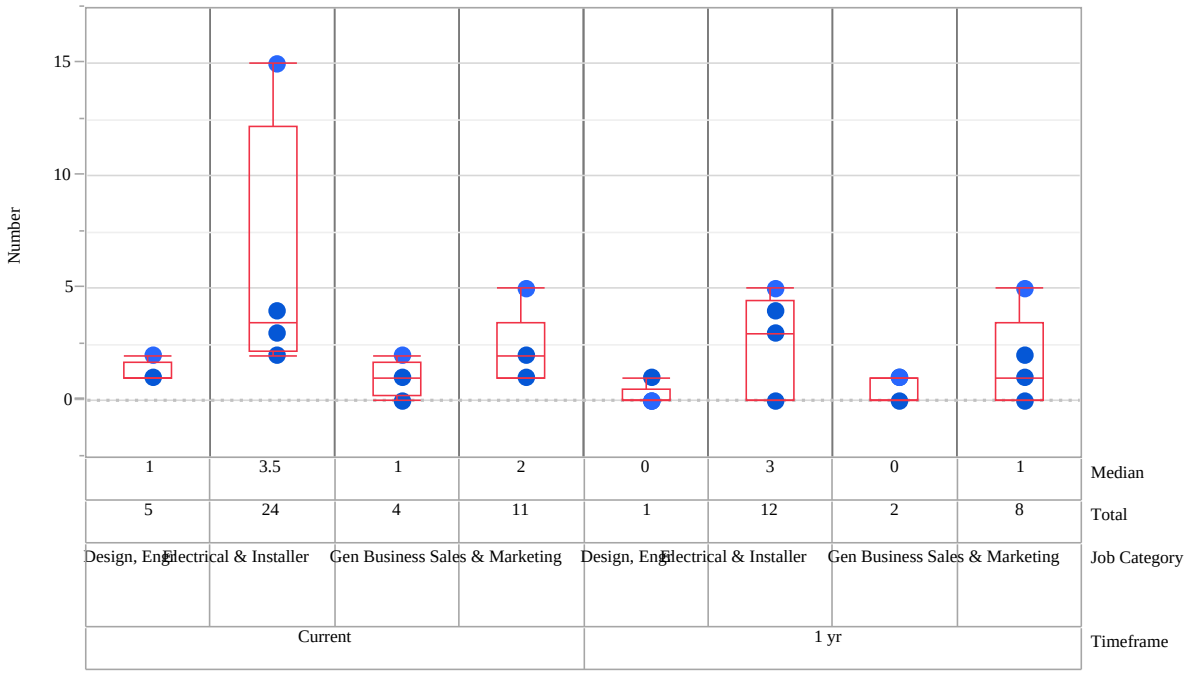

Figure 3-9. Current employment and expected short term job needs as reported by job type for both residential and commercial needs, per employer.

3.7 Biggest Opportunity to Reduce Soft Costs

Respondents were asked to describe what they viewed as the biggest opportunity to reduce non-hardware soft costs in Alabama. The responses, in a random order, are:

1. Standardization of permitting fees
2. Educating the solar market
3. Allowing net metering would reduce grid interconnection costs
4. Rescind the "Reservation Fee" as implemented by the PSC in 2013 for various rate classes, which doubles the payback time
5. Condense the sales cycle and streamline the interconnection process

In the prior survey, the largest area of concern for installers was the lack of net metering enabling legislation. This was only directly mentioned by one respondent, though a second mentioned the rider fees that could add up to as much as $30 a month. [8] It is likely that since the costs of residential ownership have decreased precipitously in the last year, this addition $30 a month becomes a smaller barrier to home ownership.

3.8 Business service territories in Alabama and in the Southeastern US

The survey respondents were asked a number of questions to help better define the business climate and potential growth. Unlike 2016, a majority of the respondents also work outside of AL, see Figure 3-10. All three companies with out of state business work in TN, and only one works in other states (GA, NC, and KY). At the last survey, none of the responding businesses worked in KY.

When comparing the service territories of the survey companies in Figure 3-11 it is seen that the consumers in the Northern Central regions have the largest selection of installers, when in 2016 the largest selection of installers was found in the Central region. This region is primarily under Alabama Power jurisdiction (see Appendix B-1 for service territory map). The changes seen are likely due to the difference in respondents from the previous survey. Only three companies participated in both 2016 and 2017. Though one company that installed in the Gulf Coast in 2016 did not install there in 2017, which suggests some change in business and marketing practices. The three major metropolitan areas of Huntsville, Birmingham, and Montgomery are located in the Northeast, Central-East, and Mid-East regions, respectively.

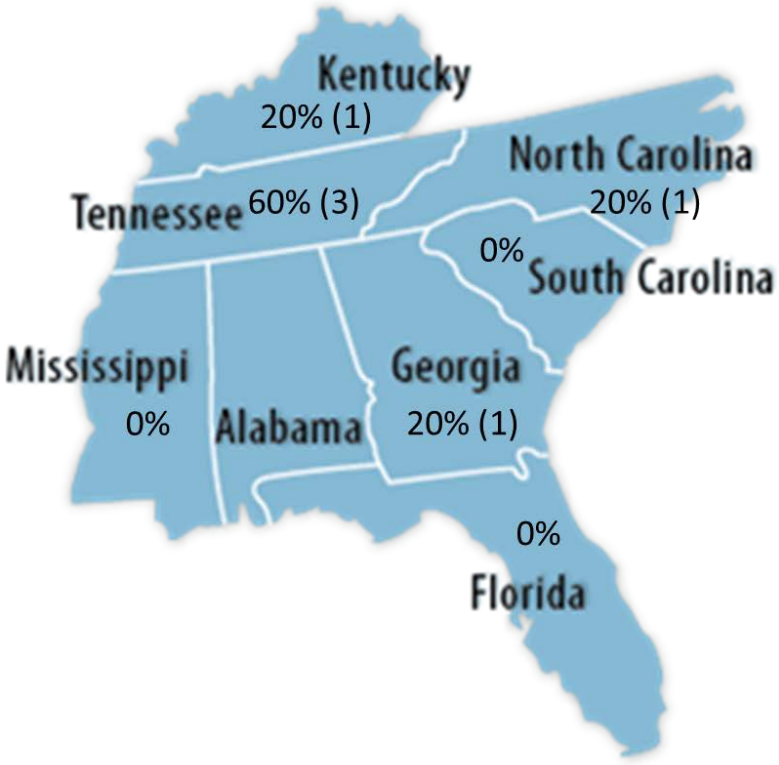

Figure 3-10. Service territories in the Southeastern US of companies surveyed. The number of Alabama installers is represented by percentage of total respondents and total number in parenthesis.

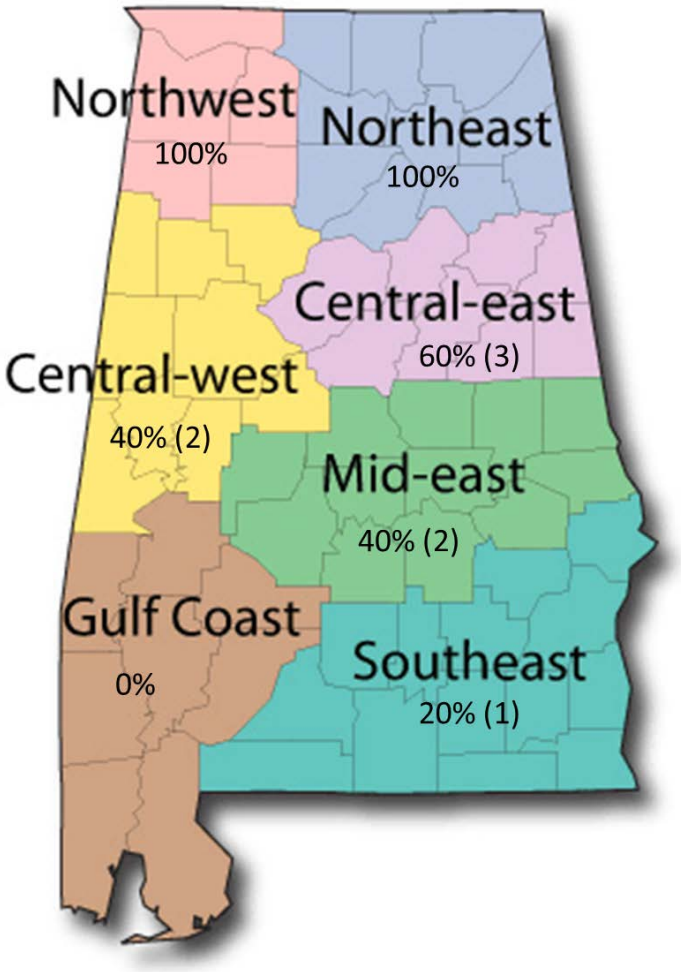

Figure 3-11. Alabama business service territories of respondents.

3.9 Installation Experience: Overall Career and within AL

Respondents were asked to provide a measure of their experience in terms of their career total installed kW and their Al installed kW. Their career installation histories are provided in Figure 3-12. In 2016, almost 60% of the respondents had installed less than 100 kW-DC in both AL and throughout their careers. In 2017, only one installer had less than 100 kW-DC installed. This indicates that though small, the AL solar market is active. Potential growth in the community should be closely tracked as prices continue to fall to help better understand if there is a pricing threshold that will encourage distributed installations even without comprehensive net metering legislation.

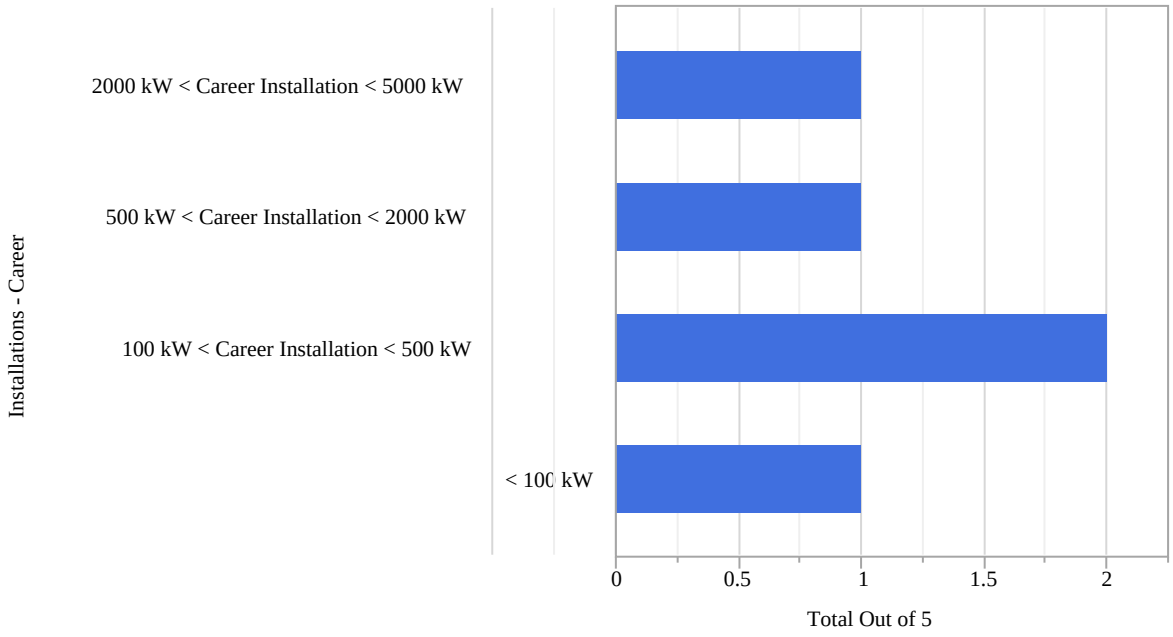

Figure 3-12. Career installation history.

4.0 Conclusions

In 2016, the first comprehensive analysis of the solar market in Alabama was conducted. The market was found to be immature, but price competitive with other parts of the Southeast and the nation. A second survey was completed one year later in 2017 to help understand the changes in trends and changes in the solar market in AL over the calendar year. AL is one of three states without comprehensive net metering legislation, yet remains cost competitive with other states around the US and the Southeast. However, residential deployment remains negligible, and the state has less than 100MW of utility scale installations, 75MW of which was built by TVA for the River Bend Solar Energy Center, which came on line in early 2017. Interestingly, the lack of net metering policy was only mentioned by two respondents as the largest opportunity to reduce soft costs in AL. It is possible, that costs are reaching a low enough threshold that the lack of policy is not as much of an inhibitor. However, having a cohesive statewide policy would enable better public understanding of policies and how solar installations could potentially benefit homeowners and businesses across the state.

5.0 References

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Appendix A. Survey

Alabama PV Soft Cost and Workforce Development Survey- Part 2

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The Savannah River National Laboratory (SRNL) has received funding from the Department of Energy's SunShot Initiative to help reduce PV soft costs in the Southeastern over the next three years. In order to help develop cost reduction strategies and recommendations, we must first adequately define current estimates, which are unclear for the SE US. Your assistance will help us identify your most pressing needs along with recommended solutions. Please direct questions or concerns about this survey or this project to Elise Fox at SRNL (elise.fox@srnl.doe.gov or 803-507-8560). *All information provided will be kept confidential and is considered business sensitive. Thank you for your assistance with this survey.*

Part I. Estimation of Soft Costs

1. **What segment of the solar PV industry does your company serve? Circle all that apply.**

   Residential Commercial Utility Not Applicable

2. **What is the typical size of type of installation in Alabama now?**

watts-DC	watt-DC	watt-DC
Average Residential	Average Commercial	Average Utility-Scale

3. **What is the typical total installed cost (in dollars per watt-DC) for each segment in Alabama now?**

$ per watt-DC	$ per watt-DC	$ per watt-DC
Residential	Commercial	Utility-Scale

4. **What percent of the typical installed cost is attributable to hardware only, now?**

%	%	%
of Residential installed cost is hardware	of Commercial installed cost is hardware	of Utility-Scale installed cost is hardware

5. **Of the remaining, non-hardware costs, what percent of the cost is:**

%	%	%	%
of non-hardware cost is marketing, lead gen, and/or sales	of non-hardware cost is permitting, inter-connection (incl. fees and admin. labor cost)	of non-hardware cost is installation (incl. design, engineering, and construction labor)	of non-hardware cost is profit, overhead, tax

Part II. Workforce and workforce training needs

1. What year did your company begin solar operations in AL? _____

2. How many employees do you currently have working in solar industry in Alabama:

#	#	#	#
a. Sales and marketing FTEs now	b. Electrician and installer FTEs now	c Business admin FTEs now	d. Design, engineering FTEs now

3. What are your longer term business needs over the next year in solar operations in Alabama? Specifically, how many additional full-time hires do you expect to need in the following areas to meet business expectations in one year:

#	#	#	#
a. Additional sales and marketing FTEs needed in 1 year	b. Additional electrician and installer FTEs needed in 1 year	c. Additional general business admin FTEs needed in 1 year	d. Additional design, engineering FTEs needed in 1 year

4. Have you or would you consider participating in a Dept. Of Labor Apprentice program administered by the Technical College system as an alternative to NABCEP certification (circle one)?

Yes No

5. If no, please explain why:

_____

_____

_____

Part III. Tell us about your business today

1. **In what Southeastern states have you focused your business so far? Circle all that apply.**

2. **In what regions of Alabama have you focused your business so far? Circle all that apply.**

3. **How much solar PV capacity have you installed <u>in your career</u>? Circle one.**
   a. Not applicable, I do not install PV
   b. Less than 100 kW
   c. At least 100kW, not more than 500 kW
   d. At least 500kW, not more than 2,000kW
   e. At least 2000kW, not more than 5,000 kW
   f. 5,000 kW or more

4. **How much solar PV capacity have you installed <u>in Alabama</u>? Circle one.**
   a. Not applicable; I do not install PV
   b. Less than 100 kW
   c. At least 100kW, not more than 500 kW
   d. At least 500kW, not more than 2,000kW
   e. At least 2000kW, not more than 5,000 kW
   f. 5,000 kW or more

5. **Do you currently offer energy storage products to your residential customers (circle one)?**

   Yes No

6. **Please provide your contact information so that we may contact you in the future. Again, all information provided will be kept confidential and is considered business sensitive. Thank you for your assistance with this survey.**

Name _____

Company _____

Title/Role _____

Mobile # _____

Email _____

All information provided will be kept confidential and is considered business sensitive.
Thank you for your assistance with this survey.

Appendix B. Supplemental Information

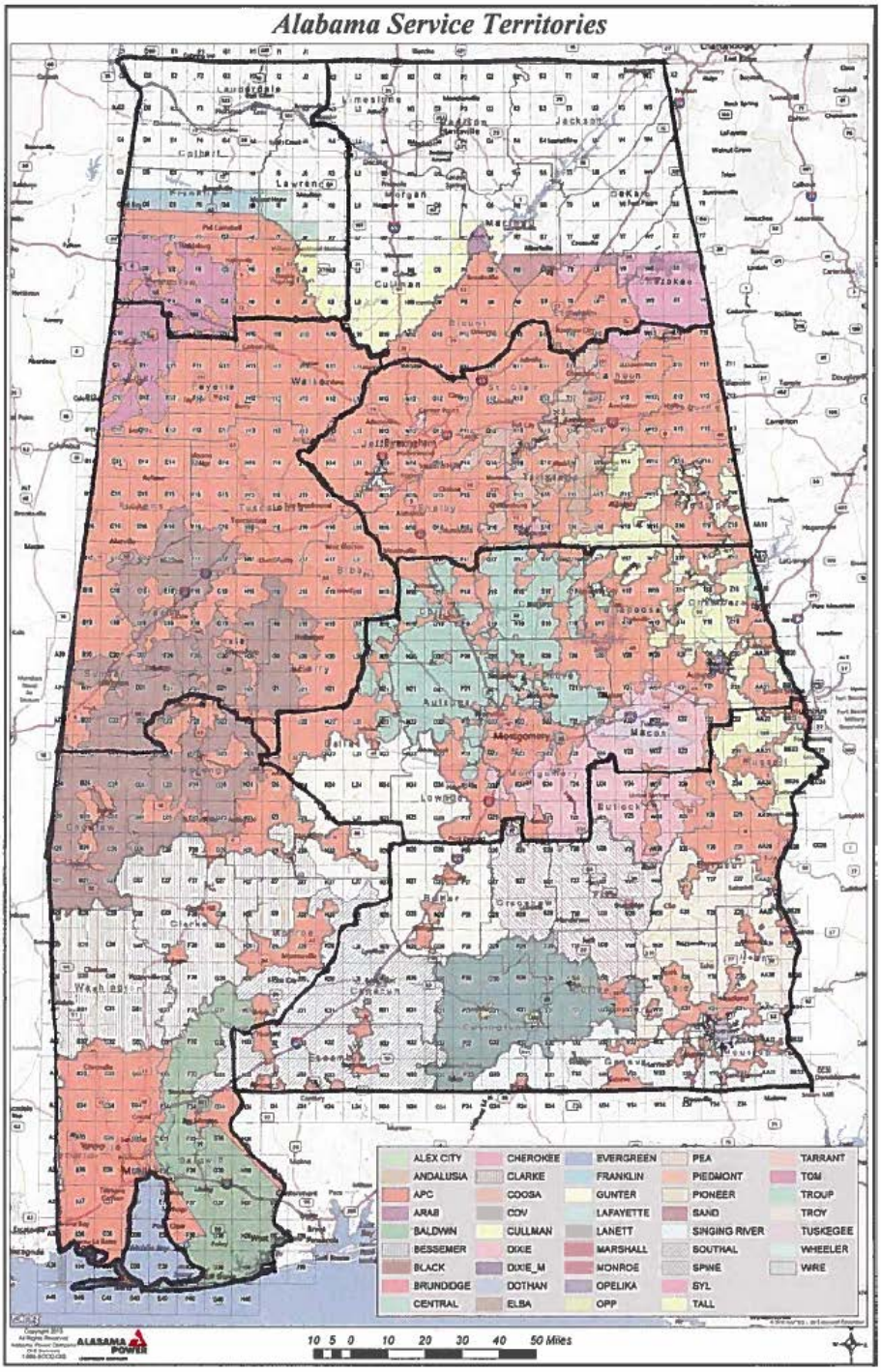

Figure B1. Power provider map with overlay of AL regions. Modified from [9].