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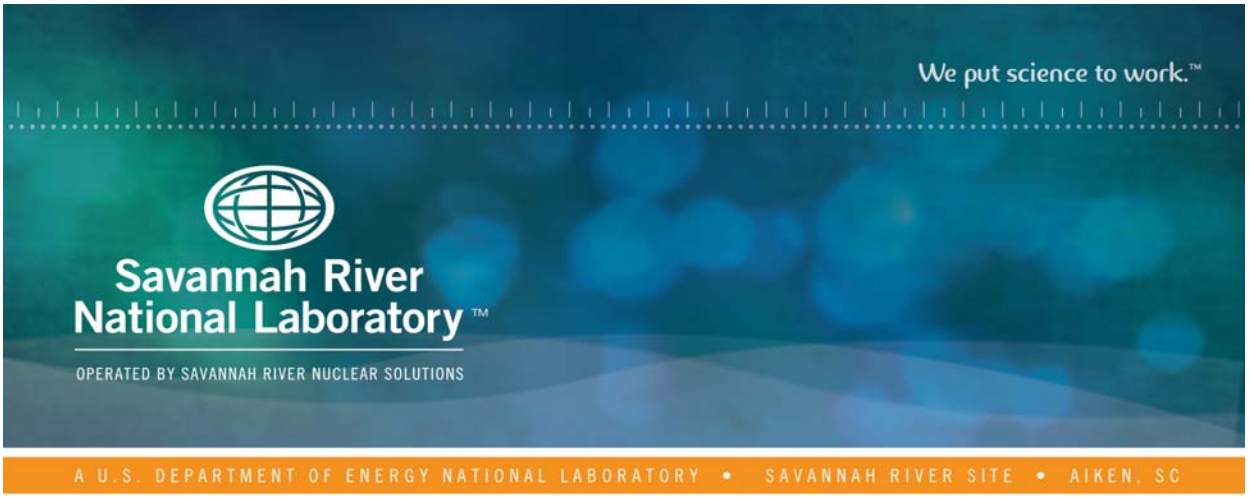

2016 End of Year South Carolina PV Soft Cost and Workforce Development

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

August 16, 2017
SRNL-STI-2017-00474, Revision 0

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EXECUTIVE SUMMARY

A solar industry survey was given to professional installers who serve the South Carolina market in order to determine trends in costing, work force needs, and business demographics at the end of 2016. It was found that 70% of the respondents serve the residential sector, while only 7% of the total exclusively serves the residential market. The average size of residential installations remain near 9 kW-DC, while the average size of commercial and utility scale installations continue to grow to 378 kW-DC and 14.8 MW-DC, respectively. The total cost of these residential systems has hovered around $3.50/W-DC since the end of 2015, while commercial installations have dropped to $2.45/W-DC and utility scale installations have dropped to $1.49/W-DC. It is expected that the cost of utility scale installations will continue to drop as there are publically reported utility scale installations with contracted PPAs for less than 4¢/kWh. 52-60% of the cost is associated with hardware only depending upon sector.

From 2014 to 2016, the soft cost of installation for residential and utility scale systems increased on both a $/W-DC and a percentage of total soft cost basis. Commercial system installation costs decreased in $/W-DC, but increased as a percentage of total soft costs. The soft cost category of profits, permits, and taxes decreased from 2014 in all three sectors. Likewise, marketing and sales costs decreased for all three sectors and this is the soft cost category where the effect of Act 236 is most apparent. Overall, marketing and sales costs decreased by 41% for residential systems, 64% for commercial systems, and an astounding 93% for utility scale systems over a two year period. Permitting, profits, and taxes costs remained flat for utility scale installations, by increased slightly for residential and commercial systems.

The solar industry continues to grow within South Carolina. 29% of the respondents reported operations in SC before 2014 while 10% started in 2014, the year Act 236 was signed into law. During 2015, the first year of implementation, one third of the respondents began operations and the remaining respondents began operations in 2016 or 2017. For these businesses, sales and marketing professionals as well as installers and electricians represent both the largest percent of current employees and the largest hiring needs over the 2017 calendar year.

Distributed installations increased slightly from 3.7 MW-AC in 2014 to 5.1 MW-AC in 2015, but as leasing options were officially available in 2016, the capacity jumped to 25.2 MW-AC. At the end of 2015 100% of the systems installed were resident owned, but only 62% were resident owned by the end of the reporting period in 2016. In the Midlands region, more systems were leased through a third party than owned by the homeowner. In the PeeDee region, over 98% of the systems are resident owned with only one PeeDee county having leased systems. In fact, 22 of SC's 46 counties, or 48%, do not have any leased systems installed. When you compare the number of system installed with percent poverty and median income in each county, you see the number of installations rapidly declines above 16% poverty and below a median income of $48,000. This indicates that additional policies need to be developed to ensure access to solar to low income and rural communities of the state.

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LIST OF ABBREVIATIONS

AC	Alternating current
DC	Direct current
EOY	End of year
IOU	Investor Owned Utility
kW	Kilowatt
MW	Megawatt
NABCEP	North American Board of Certified Energy Practitioners
PURPA	Public Utilities Regulatory Policies Act
PV	Photovoltaic
R^2	Coefficient of Determination
SE	Southeast Region of the United States
SRNL	Savannah River National Laboratory
SRNS	Savannah River Nuclear Solutions
SC	South Carolina
SuNLaMP	SunShot National Laboratory Multiyear Partnership
W	Watt

1.0 Introduction

Beginning in 2015, a study was initiated to understand the impacts of South Carolina's Act 236 on the economy and the penetration of solar in a state with relatively few solar installations. This report covers the third survey in the series, which is based on end of year 2016 data. Previously released reports examine the end of 2015 and mid-year 2016. The survey consisted of four parts of questions on soft costs, descriptions of installer business regions and segments, training and hiring needs, and several open ended topics designed to better understand the barriers to further growth of the solar industry.

2.0 Experimental Procedure

2.1 Data Collection

Surveys were distributed in the Fall meeting of the South Carolina Solar Council on November 2, 2016. The survey was also available electronically and closed in January 2017. A copy of the survey is provided in Appendix A. One response was recorded per business and twenty-nine completed surveys were received. Some questions were left blank by respondents. Data were analyzed using the statistical program JMP Pro Version 11.2.1 [1] and compared with previous survey results, where applicable. This enabled direct comparisons with the previous studies [2] for this project to detect trends in the South Carolina solar market since the enactment of Act 236 in 2015.

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

Results for the end of year (EOY) 2016 survey are summarized by sector served (residential, commercial, utility) within. Questions closely mirrored those within the first two surveys, though this survey included new questions identifying the year business began in SC, gauging interest in a new apprentice program for installers, and understanding leasing versus owning of residential systems in SC.

3.1 Solar Sector Served by Respondents

Respondents were asked to identify which business segments they serve: residential, commercial, and/or utility scale. The results are listed in Table 3-1 and by a pie chart in Figure 3-1. The largest percentage of respondents service the commercial sector with ~81%, followed by residential at ~70%, and ~52% for the utility segment. Few of the businesses served only a single segment with 2 out of 27 respondents or about 7% serving only the residential segment, 3 respondents or 11% serving only the commercial sector, and 3 respondents or 11% serving only the utility scale sector. Businesses that serve all three sectors represent 33% of respondents. The percentage of respondents serving the utility segment remains unchanged from our second survey. Residential installers dropped from 82% mid-year to 70% at year's end. Commercial installers increased from 63% to 82% in the six month period. This could indicate a shift in emphasis for some installers from residential to commercial systems and could be indicative of residential installers leaving the market due to increased competition, while installers who only served the residential market are expanding to serve the commercial sector as well.

Table 3-1. Solar PV Segments Served by Respondents

Segment Served	Number of Respondents	% of total responding
Residential	19	70%
Commercial	22	81%
Utility	14	52%
Total	27	100%

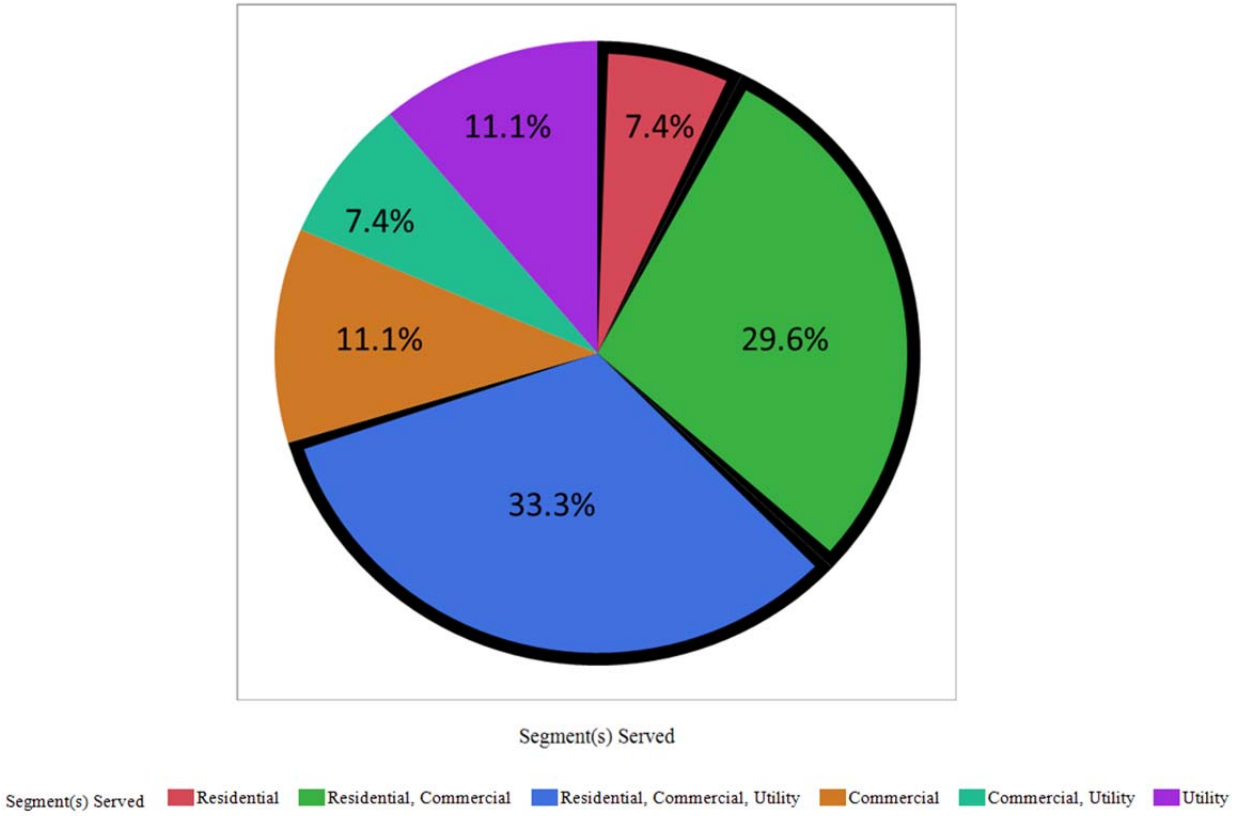

Figure 3-1. Solar PV Segments Served by Respondents

3.2 Typical Size of Installation by Type

Respondents were asked to provide the average size system they installed, in kW-DC, for each segment in 2016. The results from this survey, as well as previous surveys, are provided in Figure 3-2 for direct comparison. Though the individual respondents and the companies they represent may change from survey to survey, the general trends match well with anecdotal evidence through press releases and from a comparison with data reported by the South Carolina Energy Office (SCEO). The SCEO data are unique

in that they represent every distributed, interconnected system around the state. These data are required through annual reporting by the state's Investor Owned Utilities (IOUs) and through voluntary compliance by the Cooperatives and Santee Cooper. There was a sharp increase in reported residential size between the end of 2014 and 2015. The average residential installation size remained constant from 2015 to the end of 2016 at 9 kW-DC. This closely mirrors available data from the SCEO, which reports an average installation size of 6.3 kW-DC in 2014, 8.7 kW-DC in 2015, and 12.0 kW-DC in 2016[1]. The average commercial installation size has continuously increased since 2014. Between 2014 and 2015, average commercial installation size doubled to 167 kW-DC, with a 125% increase between 2015 and 2016. Comparing 2014 with year-end 2016, the average size of commercial installations displayed a 350% increase from the 84 kW-DC to 377 kW-DC in a two year period. This is likely due to a combination of falling prices for PV systems and utility incentives for commercial and industrial customers.

The average size of utility installations also increased dramatically in the same two-year period from 2.3 MW-DC in 2014 to 14.8 MW-DC by year-end 2016, a greater than 500% increase. Between 2014 and 2015, the utility installation size grew from 2.3 MW-DC to an average of 11.1 MW-DC.[2] There is a drop in the average utility installation in mid-2016 to about 4 MW-DC, but it drastically increases by the end of 2016. It is important to note that at the end of 2016 the price of PV panels dropped dramatically and that several large scale facilities were announced that are being built under Public Utilities Regulatory Policy Act (PURPA) and outside of Act 236 requirements.

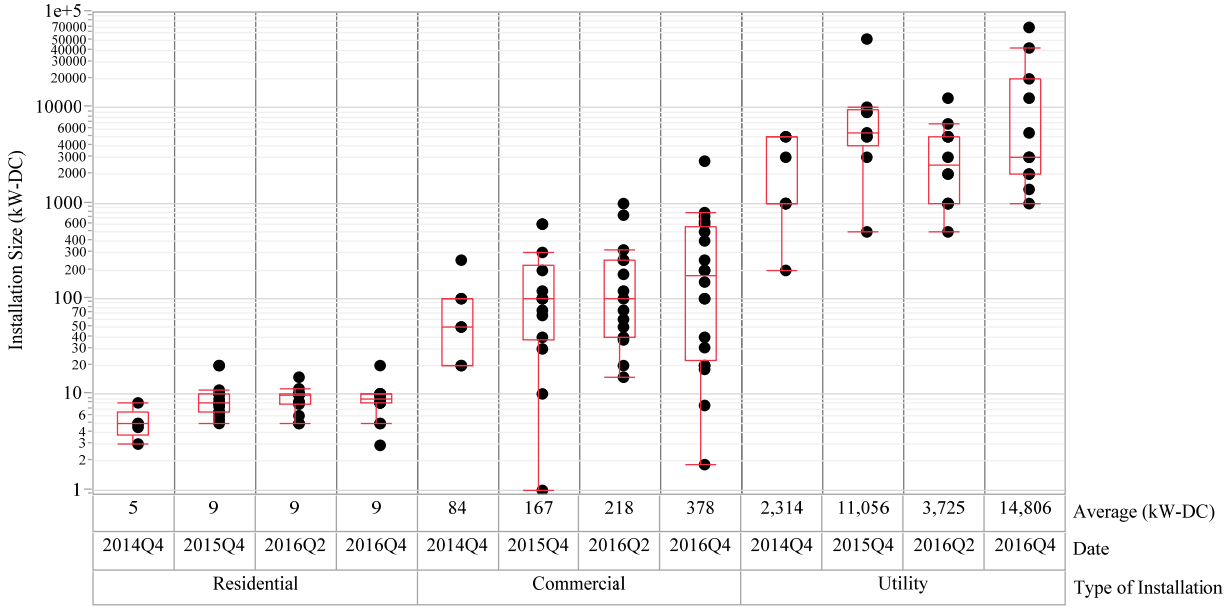

Figure 3-2. Mean PV Installation Size (kW-DC) by Sector Served from 2014 through Year-End 2016.

[1] Data reported by the SCEO are in kW-AC. An assumption of a 70% conversion from DC to AC is used.
[2] In 2014, a 3 MW system in Colleton County and a 2.6 MW installation at Boeing's North Charleston site were the only utility scale systems in the state. Additional systems reported here may include projects in planning in 2014, but not built or installations in a neighboring state.

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

The average total costs for residential, commercial, and utility scale systems were reported by the respondents and are found in Figure 3-3. Between the end of 2014 and 2016, residential installation cost dropped from $4.40 to $3.44/W-DC, 22% or roughly $1/W. For a residential home owner installing a 9 kW system, this drop would lead to a price decrease of $8640 in the two year period. Prices dropped quickly between 2014 and 2015, likely due to the signing of Act 236 and a sudden increase in competition for the residential solar market. Those prices have remained relatively flat since 2015. Likewise, commercial installation cost dropped 25% between 2004 and 2016, a majority of the price decrease occurring between 2014 and 2015, though the average reported cost continues to decline. Utility scale systems had the steepest decline in costs from $2.39 to $1.49/W-DC or 38%. Recently, there have been reports of utility systems that were installed for under $1/W [3] and some utility scale systems are able to sell the electricity for below avoided cost [4].

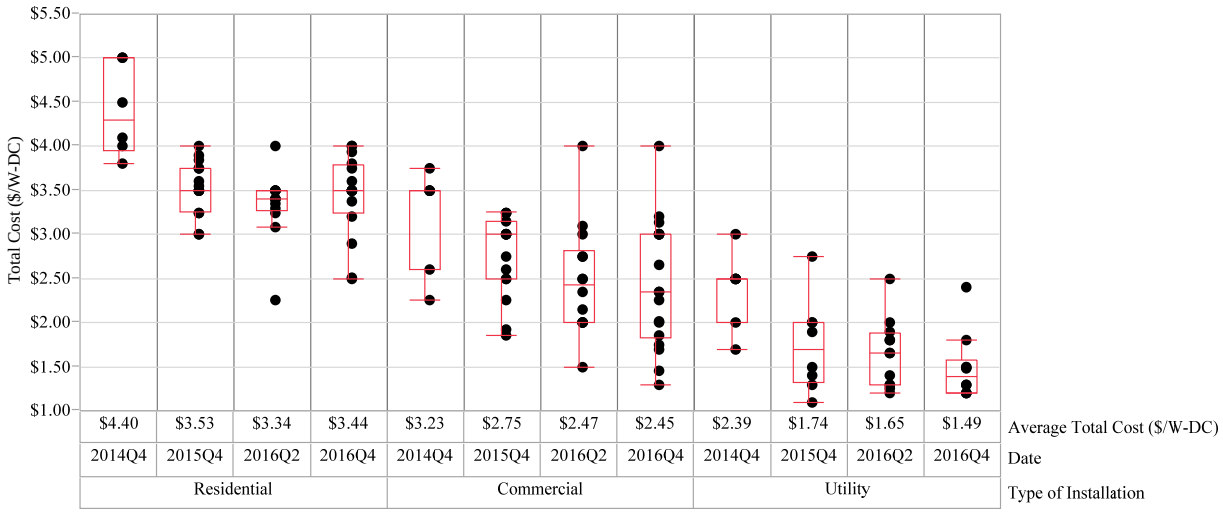

Figure 3-3. Total Cost of PV Installations in $/W-DC from 2014 through 2016.

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

The percent of costs attributed to hardware is found in Figure 3-4, while the average hardware costs in $/W is reported in Figure 3-5. Over the two year period the percent hardware decreases for residential systems from 60% to 52%. Both commercial and utility segments the percent hardware costs also saw a slight drop, though utility scale systems saw an increase in hardware percentage of the total cost between 2014 and mid-2016. For all three segments, hardware costs decreased on a $/W-DC basis. The cost of residential systems dropped $0.77/W-DC, while commercial and utility scale systems dropped by $0.50 and $0.55/W-DC, respectively, over two years.

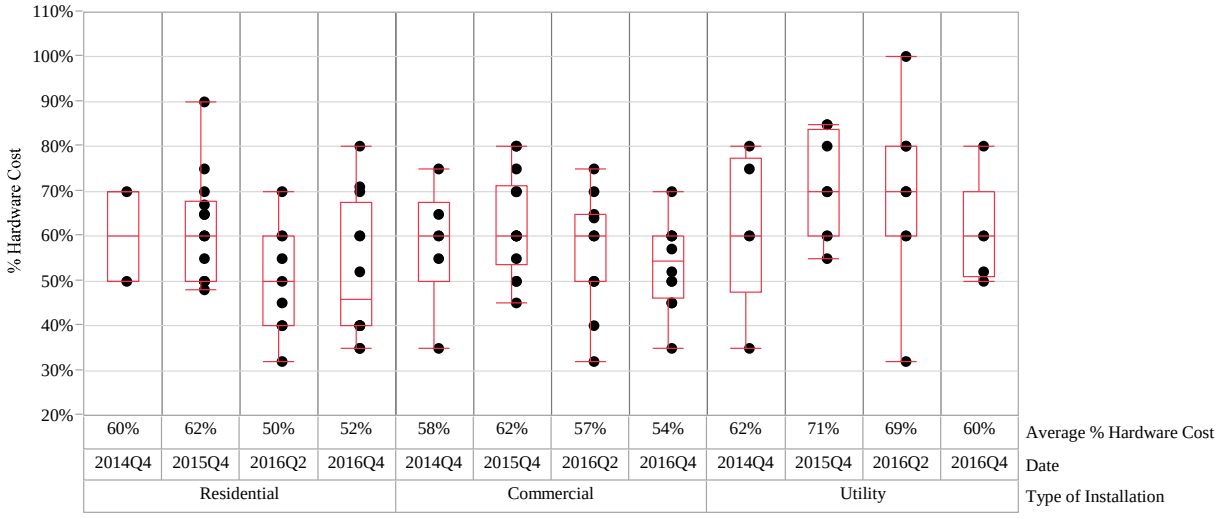

Figure 3-4. Percent hardware cost by sector and date.

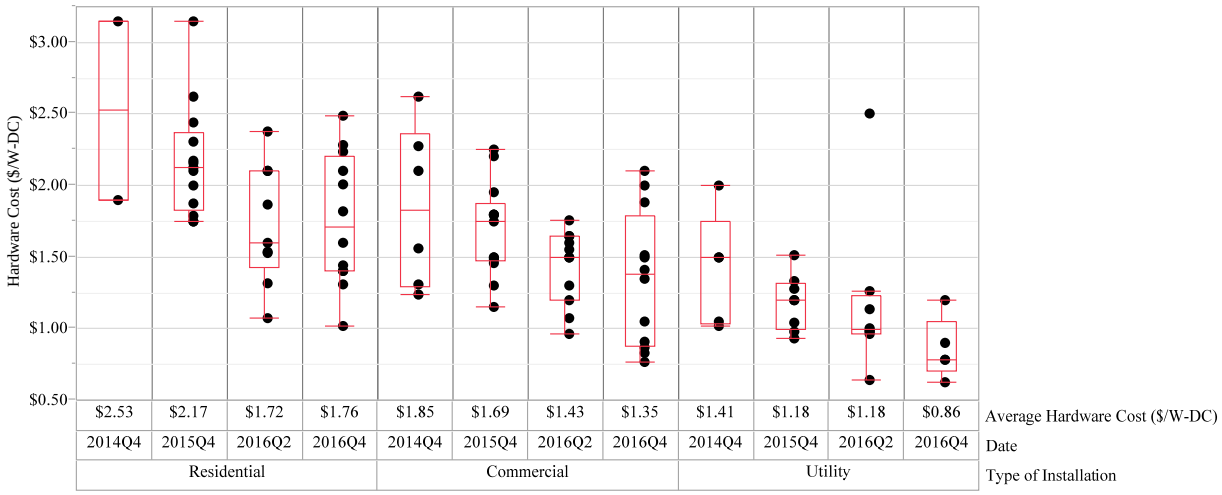

Figure 3-5. Cost Attributed to Hardware Only for 2014 to 2016 in $/W.

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

In order to determine how soft costs affect the total cost and to assess how they have changed as Act 236 unfolds, respondents were asked to specify cost for four soft cost categories: a) marketing, lead generation, and/or sales, b) installation (including design, engineering, and construction labor), c) permitting, interconnection (incl. fee and administrative labor cost), and d) profit, overhead and taxes. The variability plot for 2016 is found in Figure 3-6. For all three sectors, installation was the largest soft cost in 2016. For the residential sector, the cost of installation increased both on a $/W-DC and as a percentage of total soft costs, from $0.31/W-DC (19%) in 2014 to $0.68/W-DC (37%) at the end of 2016, see Figure 3-7. In the commercial sector, installation costs decreased from $0.68/W-DC to $0.42/W-DC, but increased as a percentage overall from 30% to 39%. Utility scale installation increased on both a $/W-DC basis and as a percentage of total soft costs from $0.22/W-DC or 24% in 2014 to $0.39/W-DC or 61% of total soft costs in 2016.

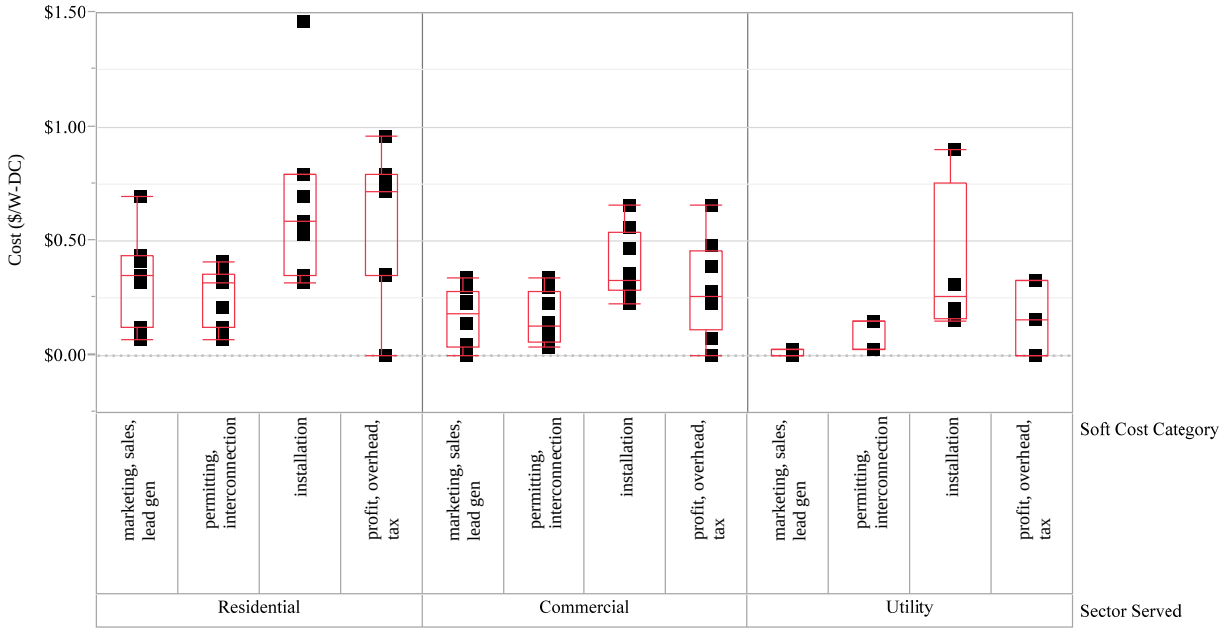

Figure 3-6. Variability chart for soft cost by sector in $/W-DC.

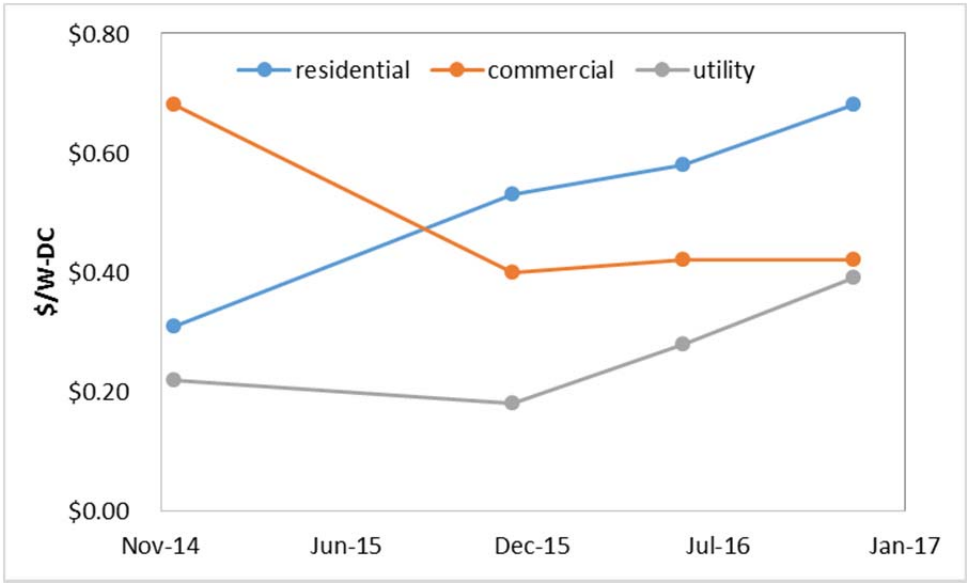

Figure 3-7. Installation, Design, Engineering, and Construction Labor Soft Cost In $/W-DC.

The effect of Act 236 is most apparent when comparing marketing costs across all sectors, see Figure 3-8. Residential marketing costs dropped from $0.49/W-DC (30% of soft costs) in 2014 to $0.34/W-DC (18%) in 2016, representing an overall drop of 41%. Commercial marketing costs dropped 64% from $0.45/W-DC (34% of soft costs) to $0.16/W-DC (16% of soft costs). The most dramatic decrease in marketing costs was seen in the utility sector where they decreased from $0.37/W-DC (40%) to $0.02/W-DC (3%), or a drop of 93%. The utility scale requirement of Act 236 enabled installers to actively bid in the new solar economy and drive down costs considerably, while increased consumer knowledge due to

favorable press and utility initiatives helped drive the cost down in the residential sector. The drop in marketing costs for utility installations is responsible for 70% of the total cost decrease in this sector.

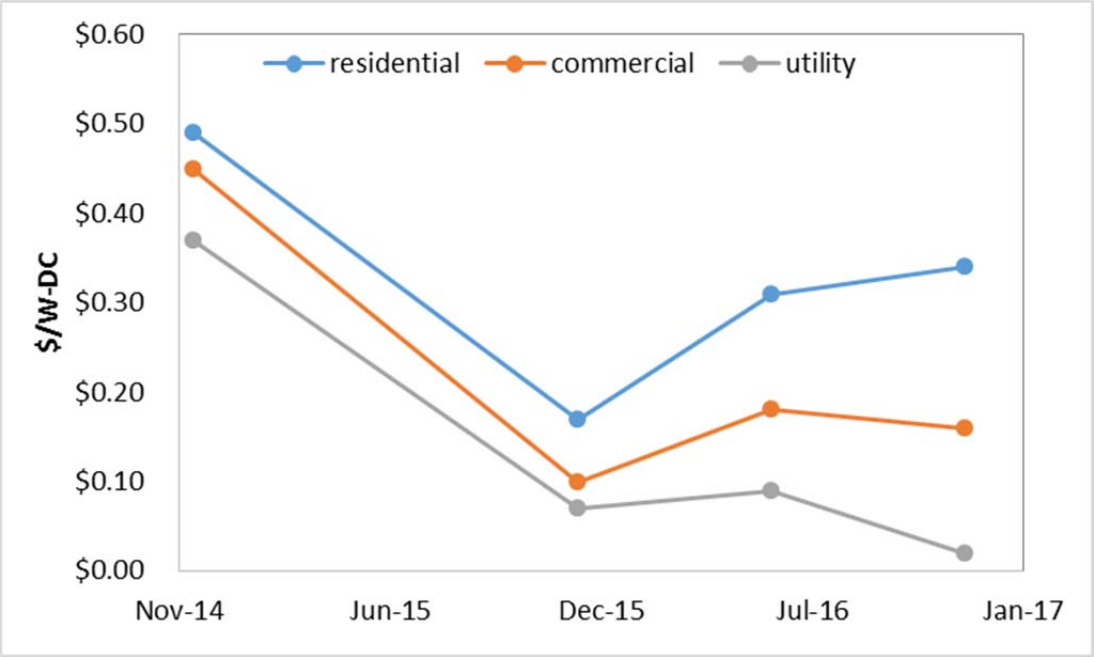

Figure 3-8. Marketing, Lead Generation, and Sales Soft Cost in $/W-DC.

Permitting costs increased slightly for residential and commercial installations from 2014 to the end of 2016, while the permitting costs for utility scale installations remained flat on a $/W-DC basis, see Figure 3-9. The residential sector saw an increase from $0.18/W-DC to $0.26/W-DC, while the commercial sector saw an increase from $0.10/W-DC to $0.16/W-DC. Utility scale permitting costs were approximately $0.07/W-DC over the two year period. Permitting remains the lowest soft cost category for all sectors, but also remains the category that a majority of installers would like to see improved.

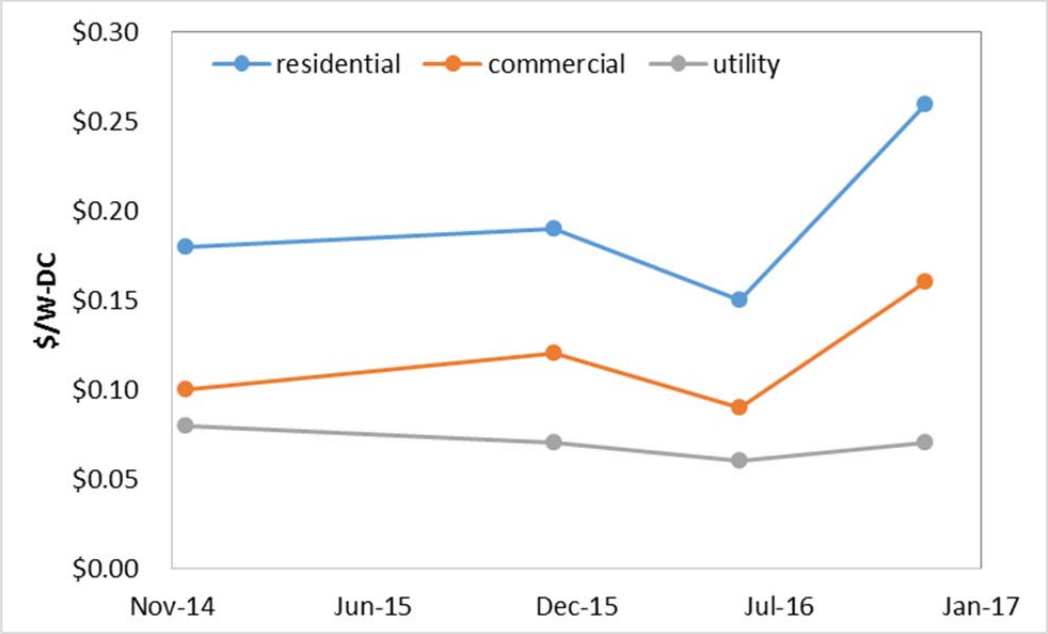

Figure 3-9. Permitting, Interconnect Fees, and Administrative Labor Soft Costs in $/W-DC.

Profits, overhead, and taxes have decreased from 2014 levels in all sectors, though the three sectors experienced similar trends where soft costs in this category drastically decreased in 2015, increased to at or above 2014 levels at the end of 2015 and decreased again at the end of 2016, see Figure 3-10. This is believed to be the result of intense competition between installers for market share at the end of 2015, which resulted in some cases of businesses installing at below cost in order to preserve or build that share. It the middle of 2016, as some limits for utility incentives were reached, businesses were able to recoup some of that lost income during 2015 and shore up finances.

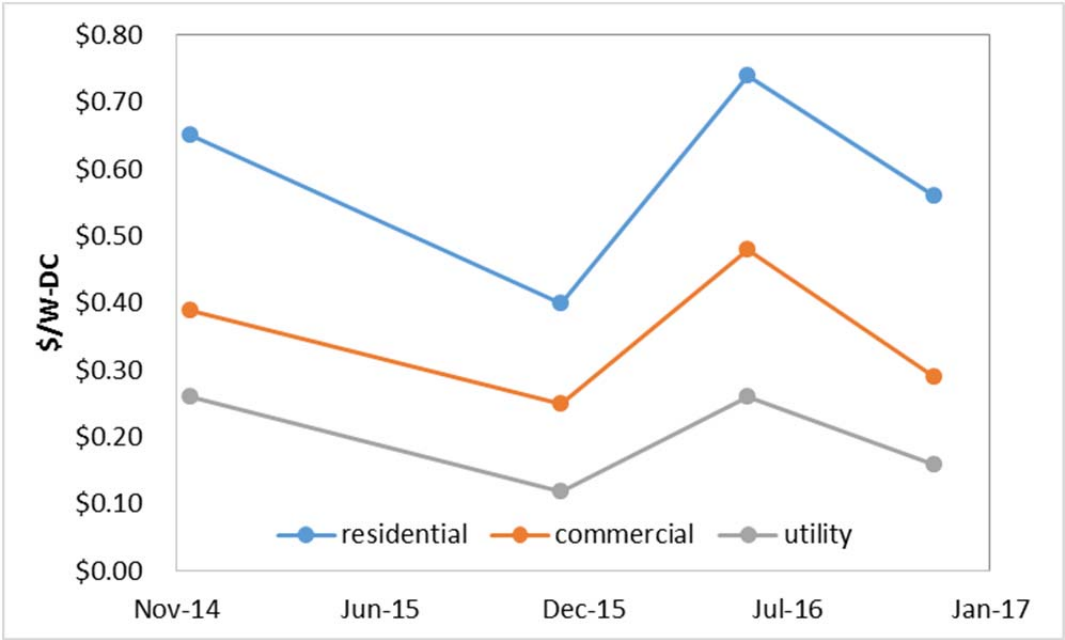

Figure 3-10. Profit, Overhead, and Taxes Soft Cost in $/W-DC.

3.6 Workforce Needs and Business Demographics

Since the local solar industry rapidly grew after 2014, respondents were asked which year they began installing in South Carolina. Results are found in Table 3-2 below. A majority of the respondents began working in SC in 2014 or later, which covers the time period when Act 236 was announced, signed into law, and enacted. One third of the respondents began working in SC the year it was signed into law. This shows a direct effect between the law and the growth of the industry.

Table 3-2. First Year of Business Operations in SC.

First Year of Business	Percent of Total Responses
Prior to 2014	28.6%
2014	9.5%
2015	33.3%
2016	19.5%
2017	9.5%

In order to determine if the solar industry was continuing to grow, survey respondents were asked how many employees they currently have and how many they expect to hire over the next year in each category: designer and engineer, electrician and installer, general business, and marketing and sales. These results are summarized in

Table 3-3. Responses to this survey covered 494 employees, with a mean of 27 employees per business. More installers and sales and marketing professionals are needed over the next year than designers or general business employees and the employment at each business was expected to grow by about 33%. This closely mirrors the projected growth in the six month period between June 2016 and the end of 2015.[5] This could indicate slowing growth of the market and we know at least two residential installation companies in the state that have since exited the market.

Table 3-3. Hiring Trends in South Carolina Solar PV

	Current (EOY 2016)	Current mean per employer	Expected Hires in 2017	Mean expected hires per employer	Total % Increase per Category	Mean % Increase per employer
designer & engineer	27	2	12	1	44%	50%
electrician & installer	196	11	68	4	35%	36%
general business	60	3	22	1	37%	33%
sales & marketing	211	11	52	3	25%	27%
total	494	27	154	9	31%	33%

Currently, there is a nearly equal percentage of sales and marketing employees as percentage of employees as there are electrician-installers, see Figure 3-11. Twelve percent of the workforce involves general business activities with only 5% of the total number of employees as designers and engineers.

Survey respondents expect to increase in overall staffing by a third in the twelve month period between 2016 and the end of 2017.

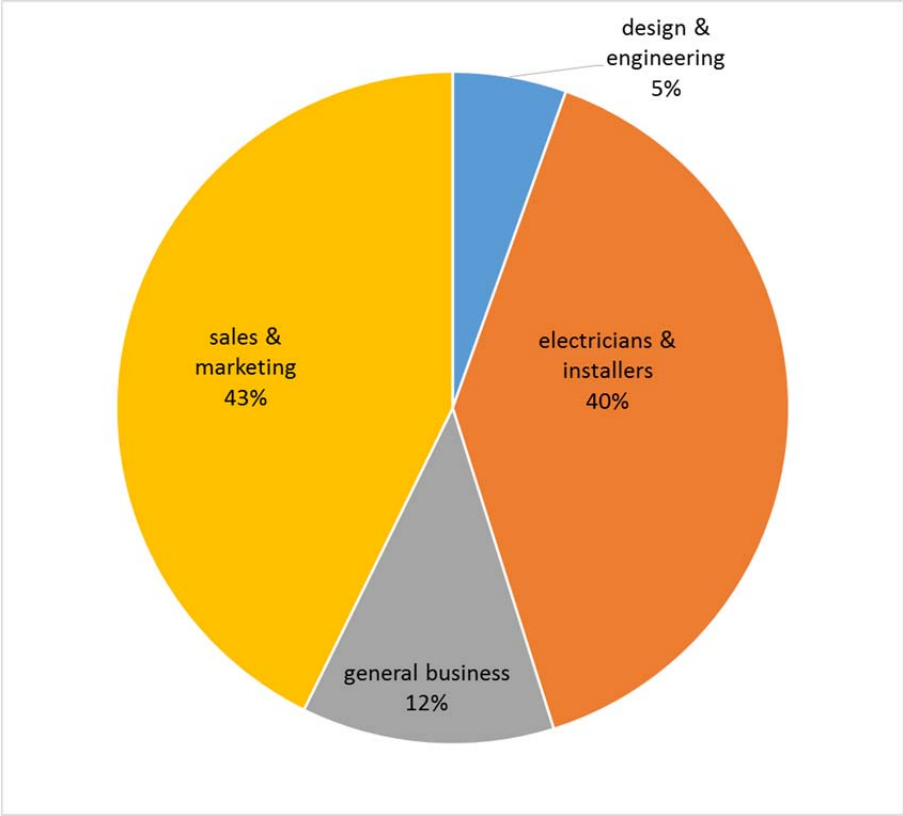

Figure 3-11. Employee Skill Categories as Reported at the Year-End 2016.

One challenge for a quickly growing workforce sector is a company's limited ability to find qualified workers. In an effort to help train and retain a solar workforce within the state, an apprentice program is under development with the aid of a local installer and the Apprenticeship Carolina program. Respondents were asked if they would have interest in participating in an apprentice program for installers once it is developed. 41% would be interested in participating, while 28% would not, see Figure 3-12. Another 31% thought the program would not be applicable to them. Of the respondents that replied "No" and provided a reason why, one felt that the North American Board of Certified Electrical Practitioners (NABCEP) is the standard and other programs should not be developed, one subcontracted their labor and is not responsible for training, and one did not know about the program. This indicates that once the program is developed, an effort will be needed to help bring installers to the program and to education them on its benefits.

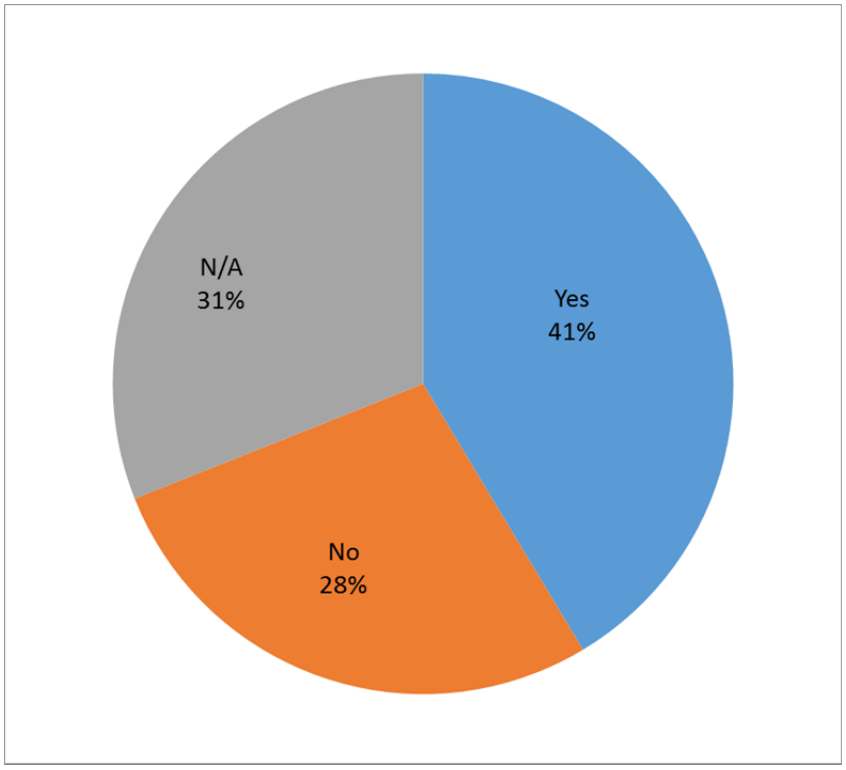

Figure 3-12. Distribution of interest in participating in an apprentice program.

Respondents were asked to identify within which states in the southeastern U.S. they currently install. The results are found in Figure 3-13. Unlike the previous survey, every state in the Southeast has at least one installer who also installs in SC. In addition, the percentage of installers who also work in each state grew. Installers working in both Georgia and Florida grew by 16%, but the largest growth was seen in TN, where 37% of the installers now work in TN. NC, AL, and MS only grew by four percentage points. This may indicate that installers are branching out to neighboring states as they grow. GA and NC have robust utility scale markets, but their residential markets have been slow in gaining ground.

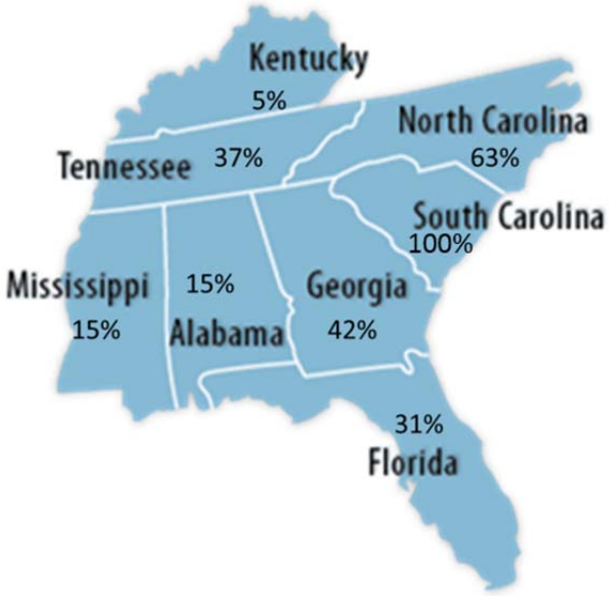

Figure 3-13. Southeastern Service territories of surveyed companies.

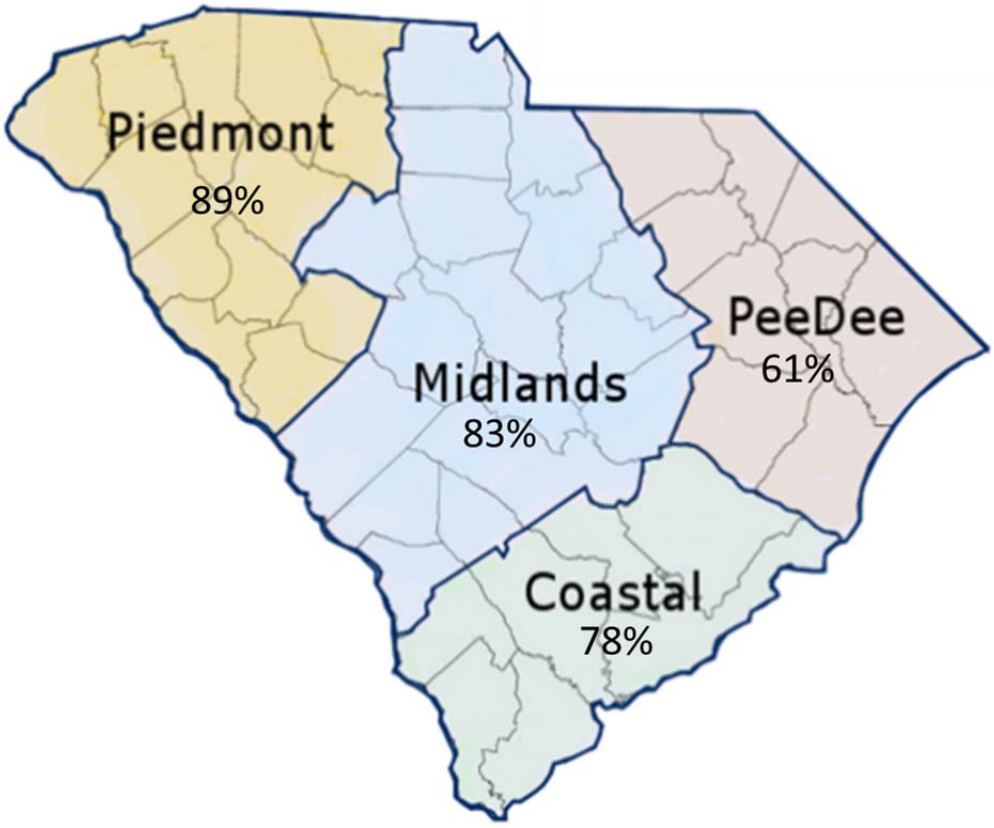

Figure 3-14. South Carolina Business Service Territories of Respondents.

Understanding the distribution of solar installers across the state is important in understanding solar adoption rates, costs, and accessibility, see Figure 3-14. Since 2015, there has been little change in service to the Midlands, Coastal, and PeeDee territories of plus or minus 3-5%. However, the Piedmont region saw a 22% increase in installers, which suggests this region of the state is actively growing, most of it likely in the Greenville/Spartanburg area.

Respondents were asked in 2015 and at the end of 2016 how much PV capacity they have installed in their career and in SC. Results from 2016 are found in Figure 3-15. In 2015, not a single respondent had installed over 5 MW within the state. Only a year later, 27% of the respondents have installed over 5 MW. Likewise, only a year ago only 37% had installed over 5 MW in their entire career. That number jumped to 67% in 2016.

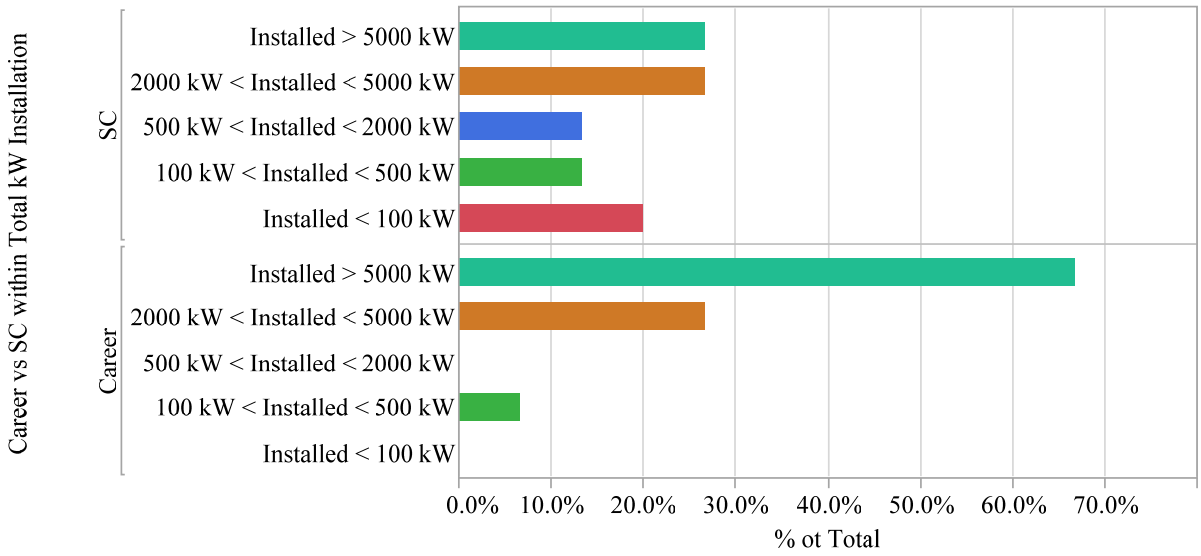

Figure 3-15. Career and SC installation history.

Beginning in 2016, third party leasing began in SC. Prior to this date, all installations were owned by the homeowners. To help understand how leasing is spurring the growth of residential installations in the state, installers were asked to identify if they sold or leased PV. Of respondents that either sold and/or leased PV systems, 28% leased and 72% sold systems. In 2016, 20.1 MW of distributed systems were added to the grid. This is a 400% increase over the 5.1 MW that were interconnected in 2015. If you compare the number of installations in a given county with the percent poverty, see Table 3-4 and Figure 3-16, the number of installs in a county drops significantly at 16% and approaches near zero as poverty rates increase over 20%. When you compare the number of installations to median income for a county, you find that below a median income of $40,000 there is little solar penetration, see Figure 3-17.

Table 3-4. Demographics of Each Region in SC as Compared to Installed Capacity

	# of Counties	[1]Population	[1]Average Median Income	[1]Average Percent living in poverty	[2]Percent capacity customer owned installations	[2]Total capacity/kW-AC
Piedmont	13	1,498,315	$40,251	18.4%	71.0%	6,511.5
Midlands	17	1,674,976	$39,801	22.2%	49.7%	10,213.0
Coastal	7	1,030,614	$45,607	17.8%	68.5%	7,821.6
PeeDee	9	757,214	$34,842	24.3%	98.5%	664.6
State Total	46	4,961,119	$45,483	16.6%	62.3%	25,210.6

1. Calculated from U.S Census Bureau Data, 2016; median income and % in poverty were determined using a weighted (by population) average
2. Calculated from S.C. Energy Office Data, August 2016

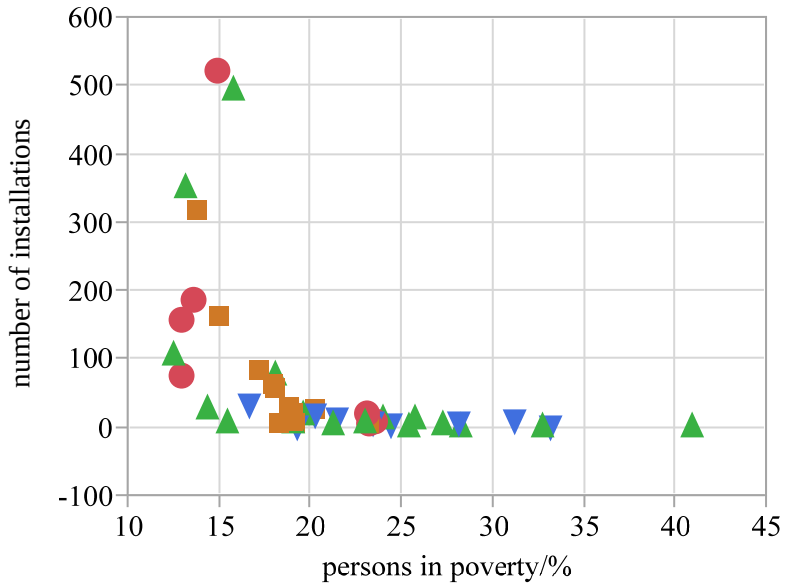

Figure 3-16. Comparison of Number of Installations in a County and the Percent Poverty for 2016.

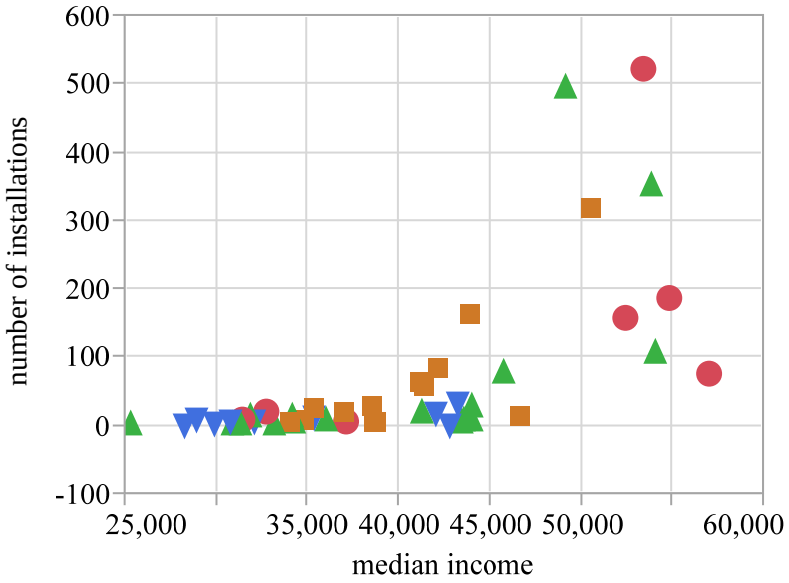

Figure 3-17. Comparison of Number of Installation Versus Median Income for 2016.

In order to better understand leasing around the state, the percentage of leased installations per county was determined and mapped in Figure 3-18. Twenty-two counties or 48% of SC counties do not have a single leased installation. The largest portion of leased systems is located near major metropolitan centers; Richland and Lexington Counties, in the Midlands around Columbia, have the largest portion of leased systems, 70% and 66%, respectively. The next highest percentages are found in the Greenville/Spartanburg area and around North Charleston. Rural and low income areas, such as the PeeDee region have very few to no leased installations. This indicates that specific policies may need to be developed to increase deployment in low income and rural areas, particularly environmental justice (EJ) communities in the PeeDee and portions of the Midlands and Coastal communities. The low to no upfront cost associated with leased systems should enable more deployment of solar to these communities. Instead, we see that high income, densely populated areas are being targeted by leasing companies.

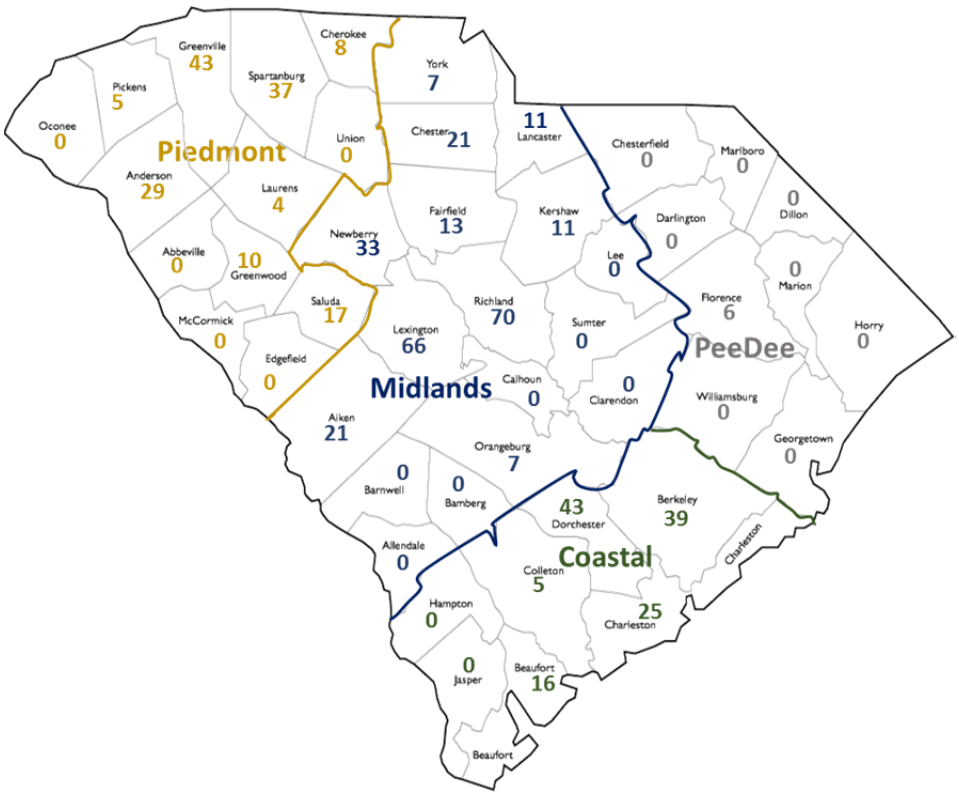

Figure 3-18. Percentage of Residential Installations that are Leased, by County.

3.7 Soft Cost Reductions

Soft costs account for nearly 40% of all installation costs and can be directly affected by state, local, and national policies. Respondents were asked for their opinion on the best method to facilitate the expansion of solar in SC and what is their largest barrier to growth. These questions were directed at providing insight into concerns and future focus of soft costs in the Southeastern solar PV market. Several respondents emphasized changing net metering rules to avoid a 'hard stop' or by extension of the current program would aid the expansion of the solar industry. Though net metering is available until 2025, there are caps in net metering capacity, and it has been suggested that those limits can be met within the next eighteen months or in some cases by the end of 2017. Unless legislative action occurs soon, the residential solar market could experience sever disruptions. This uncertainty creates significant barriers to future planning. Additional concerns were focused on the need for more marketing and education for solar, for the reduction in state and local taxes, and finally barriers to installations by home owner associations (HOA). Local variation in regulations is a continuing area of frustration, which includes HOA's, rule variations between utilities, and variation in local permitting processes.

4.0 Conclusions

In 2016, significant progress was made towards the implementation of Act 236. Over 20 MW of distributed systems were interconnected, a fourfold increase over the same time in 2015. This, in part was spurred by third party leasing of distributed systems, which began in January 2016. The installations were most likely to occur in counties and urban areas with less than 16% poverty rates, and in order to

increase solar in areas with a median income above $40,000, and in IOU territory. This suggests that in order to increase access to rural, cooperative, and lower income areas, specific policy recommendations need to be implemented. The cost of installed residential systems is largely unchanged over the past six months on a $/W-DC basis. As a percentage of the total, hardware ranges between 52-60% of the cost, depending upon the sector served. Installation remains the largest soft cost category, and though permitting continues to be the smallest soft cost category, it is the largest area of concern for installers.

Act 236 has had a clear impact on the industry within the state. Only 29% of the business surveyed worked within SC before 2014. The reporting businesses project to grow by an average 1/3 before the end of 2017, with the largest business needs in installations and in sales. In order to help meet demand for qualified installation professionals, an apprentice program is under development, which will provide participating business with state tax credits to participate in a recognized Department of Labor program. As business gain experience and expand their service territories to neighboring states programs such as the Apprentice program will be integral to training and retaining a qualified workforce within the state.

5.0 References

1. SAS Institute, I., JMP Pro Version 11.2.1. SAS Institute, Inc.: Cary, North Carolina.
2. Fox, E.B. and T.B. Edwards, 2015 South Carolina PV Soft Cost and Workforce Development Part 1: Inital Survey Results, DOE Technical Report SRNL-STI-2016-00177, May 2016.
3. https://pv-magazine-usa.com/2017/06/12/utility-scale-solar-falls-below-1-per-watt/.
4. http://www.aikenstandard.com/news/adger-solar-launching-aiken-county-solar-development-bringing-million-of/article_d22d4c14-4c74-11e7-8621-5f242fbd7d14.html.
5. Fox, E.B. and T.B. Edwards, 2015 South Carolina PV Soft Cost and Workforce Development, Part 2: Six Month Confirmation of Anticipated Job Growth, DOE Techical Report SRNL-STI-2016-00039, January 2017.

Appendix A. Follow-up Survey Completed November and December 2016

2016 South Carolina PV Soft Cost and Workforce Development Survey

We have received funding from the Department of Energy's SunShot Initiative to help reduce PV soft costs in South Carolina. Your assistance will help us identify your most pressing needs and provide recommended solutions along with hard data that can be used to support future policy initiatives. 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 South Carolina, 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 South Carolina, 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

Appendix A (continued)

Part II. Solar workforce needs, workforce training needs

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

2. **How many employees do you currently have working in solar industry in South Carolina:**

#	#	#	#
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 South Carolina? 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:**

_____

_____

_____

Appendix A (continued)

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 South Carolina have you focused your business so far? Circle all that apply.**

3. **Do you primarily lease or sell PV systems (circle one)?**

   Lease Sell

4. **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

5. **How much solar PV capacity have you installed <u>in South Carolina</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

Appendix A (continued)

6. Do you have any suggestions to facilitate expansion of the solar industry in SC?

7. What is the largest barrier to the growth of your business?

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 Data and Figures

Table B-1. Soft Cost by Survey, Segment and Category

Installation Type	Timing	installation (incl. design, engineering, and construction labor)	marketing, lead generation, and/or sales	permitting, interconnection (incl. fees and admin. labor cost)	profit, overhead, tax
Residential	2014Q4	$0.31	$0.49	$0.18	$0.65
Residential	2015Q4	$0.53	$0.17	$0.19	$0.40
Residential	2016Q2	$0.58	$0.31	$0.15	$0.74
Residential	2016Q4	$0.68	$0.34	$0.26	$0.56
Commercial	2014Q4	$0.40	$0.45	$0.10	$0.39
Commercial	2015Q4	$0.42	$0.10	$0.12	$0.25
Commercial	2016Q2	$0.42	$0.18	$0.09	$0.48
Commercial	2016Q4	$0.39	$0.16	$0.16	$0.29
Utility	2014Q4	$0.22	$0.37	$0.08	$0.26
Utility	2015Q4	$0.18	$0.07	$0.07	$0.12
Utility	2016Q2	$0.28	$0.09	$0.06	$0.26
Utility	2016Q4	$0.35	$0.02	$0.07	$0.16

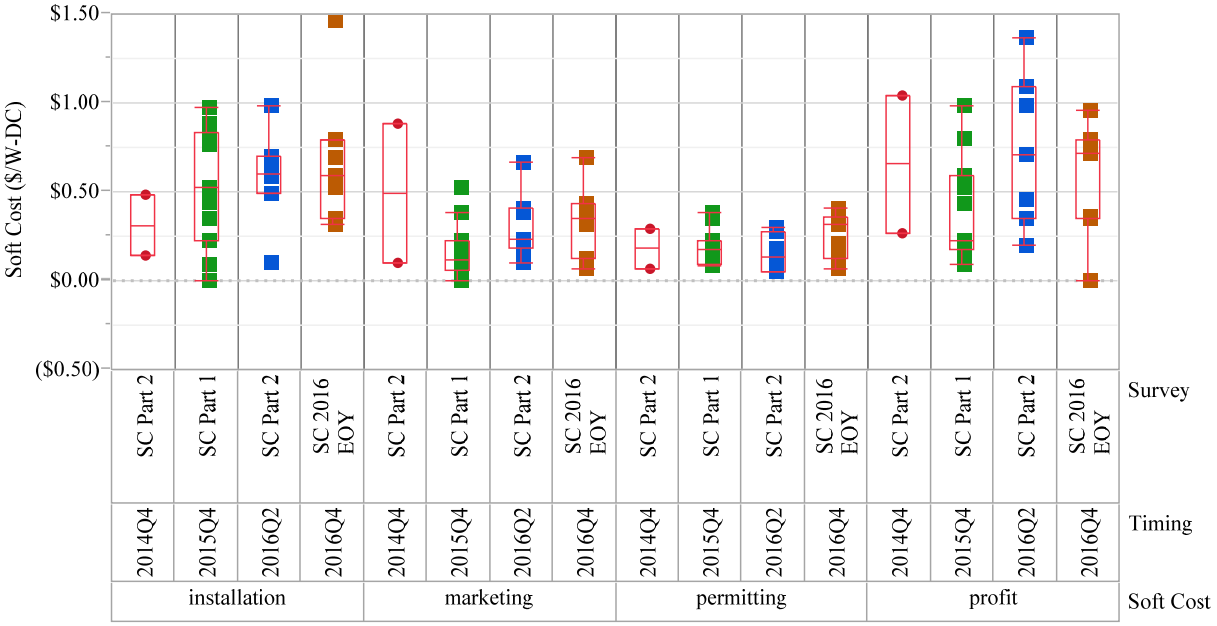

Figure B-1. Soft Cost by Survey Timing and Category for Residential Installations

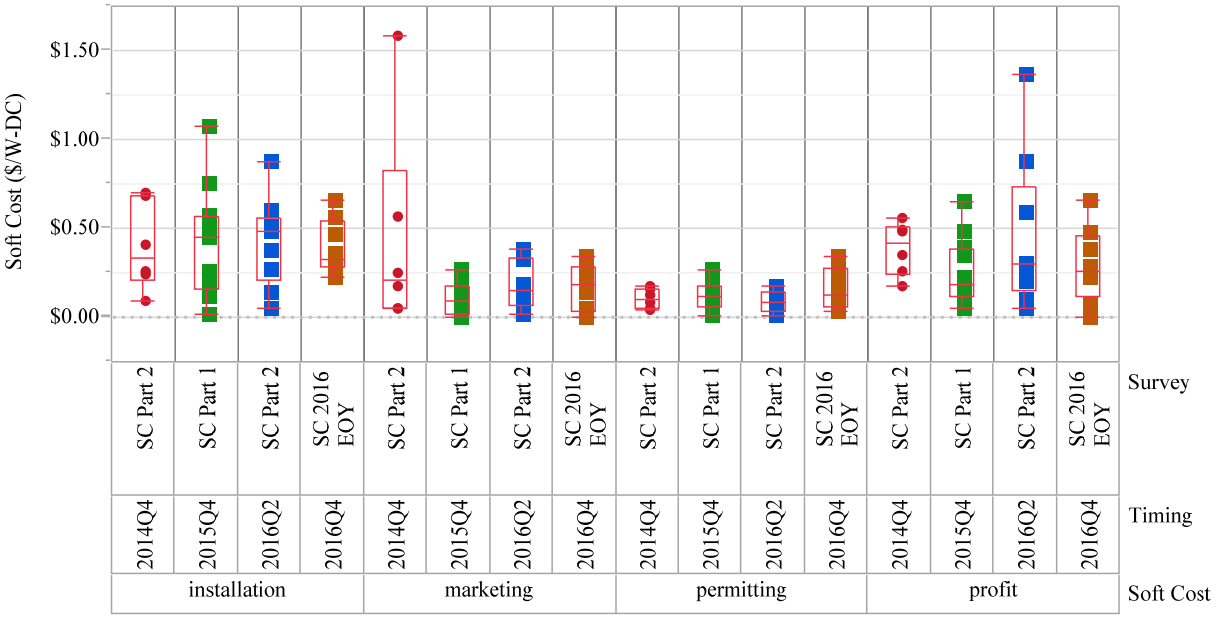

Figure B-2. Soft Cost by Survey Timing and Category for Commercial Installations

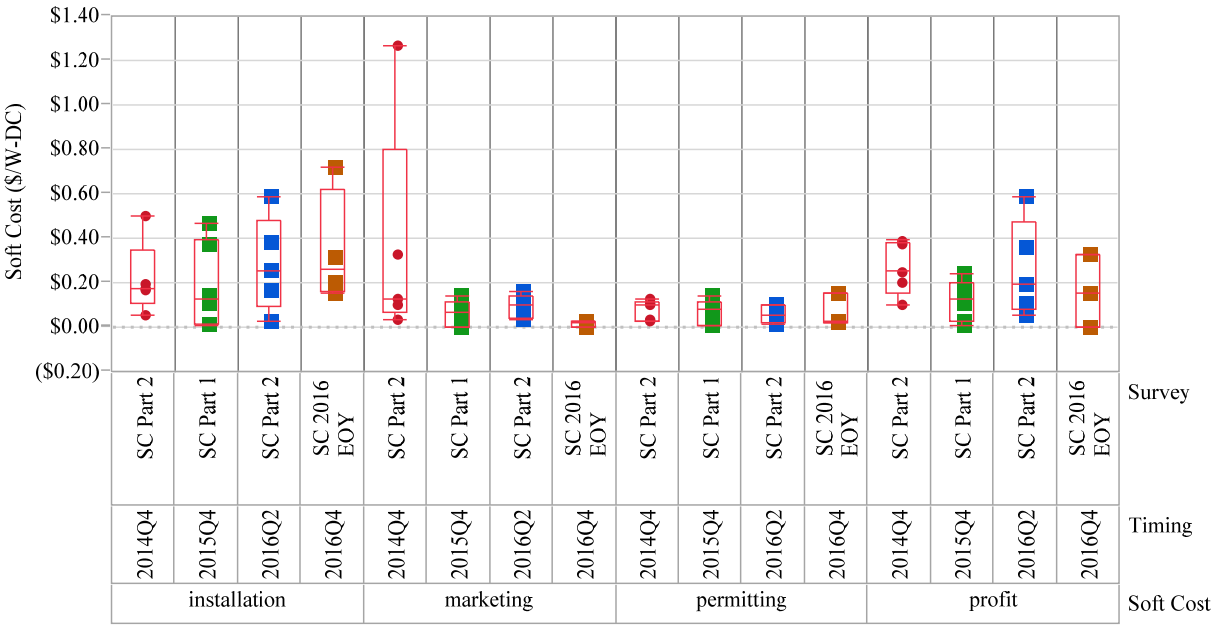

Figure B-3. Soft Cost by Survey Timing and Category for Utility Installations