Georgia Clean Energy Industry

2015 Census

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Southface

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Southface

Since 1978, Southface has worked with consumers, the construction and development industry, and policymakers to forge market-based approaches for creating jobs, clean energy solutions, and sustainable communities. Southface is also committed to helping people live, work, and play in comfortable, healthy buildings that save money by conserving energy, water, and other natural resources. To accomplish these goals, Southface offers a wide variety of programs and services, all of which are based on sound science, to promote sustainable buildings and communities.

Acknowledgements

Southface would like to thank all of the companies, institutions, and organizations that responded to the 2015 Southeast Clean Energy Industry Census. The willingness of respondents to provide their statistics and insights allows Southface to share the success story of Georgia's clean energy industry with decision makers in the state and beyond.

Southface also appreciates the efforts of partner organization the North Carolina Sustainable Energy Association on the Southeast Clean Energy Industry Census. Additional thanks to Karen Eller, Donna Hughes, and everyone at the Center for Urban Affairs and Community Services at the North Carolina State University for their continued support of this project.

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Contents

Introduction

Georgia spends about $30 billion annually to import petroleum, natural gas, and coal.[1] The clean energy industry offers Georgia the opportunity to keep a larger portion of money spent on energy within the state. A majority of Georgia's clean energy jobs involve local activity that is difficult to outsource – such as building new, or retrofitting old, buildings to make them energy efficient, and installing renewable energy systems. In fact, 2015 Georgia Clean Energy Industry Census (Georgia Census) results show that 75% of all of clean energy goods and services stay within the state.

To understand the impact of the clean energy industry on Georgia's economy, Southface partnered with the North Carolina Sustainable Energy Association (NCSEA) on the third Southeast Clean Energy Industry Census (Southeast Census). The Georgia and Southeast Censuses share a common methodology and are collectively referred to as the "Census" in this report.

Key Findings

Georgia has at least 801 companies, institutions, and organizations (collectively referred to as "firms" in this report) in the clean energy sectors listed in Table 1 that perform the associated activities listed in Table 2. These firms provide 19,231 clean energy full-time equivalent (FTE) jobs.[2] To put that in perspective, Georgia has about the same number of active physicians.[3] Furthermore, Georgia's clean energy industry generates at least $3.3 billion of gross revenue.

The total economic impact of Georgia's clean energy industry is much greater than the direct count of jobs and revenue conducted via the Census. For example, benefits to suppliers of goods/services to Energy Efficiency and Solar firms generate an additional estimated 13,741 FTE jobs and $2.4 billion in gross revenues.

Figure 1: Key 2015 Census findings

Figure 2: Total estimated economic benefits of Energy Efficiency and Solar sectors

[1] U.S. Energy Information Administration. "State Energy Data System (SEDS): 2013." Accessed online: www.eia.gov/state/seds/seds-data-fuel-prev.cfm?sid=GA. Referenced on Dec. 21, 2015.

[2] FTE is representational of a single 30 hour per week block of employment.

[3] Georgia had 22,227 active physicians in October 2015. Henry J. Kaiser Family Foundation. "Total Professionally Active Physicians." Accessed online: http://kff.org/other/state-indicator/total-active-physicians. Referenced on Dec. 21, 2015.

Table 1: Clean energy business sectors analyzed for the Census

Business Sector	Examples of Types of Firms
Energy Efficiency (EE)[4]	Builders, architects, HVAC installers, HERS raters, manufacturers of energy efficient equipment and products
Solar	Manufacturers, installers, designers, professional service providers
Geothermal	Manufacturers, installers, designers, technical consultants
Biomass/Biofuels	Wood pellet or biogas producers, technical consultants
Energy Storage	Manufacturers, researchers, designers, technical consultants
Wind	Turbine component manufactures, professional service providers
Smart Grid	Manufacturers, researchers, designers, technical consultants
Alternate Fuel Vehicles	Manufacturers, researchers, designers, automobile servicers
Hydropower/Marine	Facility operators, technical consultants
Fuel Cells	Manufacturers, researchers, designers, technical consultants

The top sectors for 2015 are:

- EE: 11,858 FTE jobs and $2.1 billion
- Solar: 2,956 FTE jobs and $556 million
- Biomass/Biofuels: 1,467 FTE jobs and $262 million

Table 2: Clean energy business activities analyzed for the Census

Business Activity	Examples of Types of Activities
Design or Construction of New Buildings	Designing and building to energy/water efficient standards (e.g., ENERGY STAR, LEED, or EarthCraft)
Sale of Building System Components	Selling energy efficient systems, HVAC units, insulation, lighting
Sale of Renewable Energy Systems	Selling solar panels and component parts
Installation, Design, or Development of Renewable Energy Systems	Designing and installing systems, providing technical help
Installation or Maintenance of Building System Components	Installing energy efficient systems, HVAC units, insulation, lighting
Manufacturing/Production[5]	Manufacturing LED lights, solar panels, batteries; producing wood pellets and biogas
Power Generation	Operating biomass power plant, solar farm, hydropower plant
Professional Services, Education, or Consulting	Providing consulting, education, technical support, training, and professional services related to clean energy legal, finance, and tax issues
Research and Development	Engineering new solar panels, insulation, smart grid technology, batteries, fuel cells

[4] The 2014 Census referred to the Energy Efficiency sector as the Building Efficiency sector. Even though the label has changed, the scope of the sector remains the same.

[5] The 2014 Census referred to Manufacturing/Production activity as Manufacturing activity. Even though the label has changed, the scope of the sector remains the same.

The top activities for 2015 are:

- Activities related to making buildings more energy efficient: 9,094 FTE jobs and $1.9 billion
- Manufacturing/Production: 4,363 FTE jobs and $308 million
- Installation, Design, or Development of Renewable Energy Systems: 1,967 FTE jobs and $302 million

The Southeast Census

Since 2008, NCSEA has surveyed the clean energy industry in North Carolina in order to quantify its impact on the state's economy. Georgia joined an expanded Southeast Census in 2013.[6] Southface and NCSEA are collectively referred to as the "Partners" in this report. For the Southeast Census, the Partners surveyed firms to understand employment, revenue, and policy drivers of clean energy sectors within each state. This report presents the survey results and analysis that pertain to Georgia's clean energy industry. Please visit www.cleanenergyindustry.org information regarding all states included in the 2014 and 2015 Southeast Censuses.

Survey Process and Data Analysis

Each Partner compiled a list of firms active in its state's clean energy sectors. Each state-level Census relied on a common questionnaire developed by the Partners, as well as an online survey tool and phone-banking system managed by North Carolina State University Center for Urban Affairs and Community Services (NC State).

Firms were asked to self-identify as being involved in the clean energy industry by indicating they had at least one employee dedicating a portion of his/her time to one of the nine activities in one of ten clean energy sectors. Each activity within a sector is defined as a clean energy business unit (e.g., Research and Development / Solar). Therefore, the Census has 90 business units. This level of granularity allows for the analysis of the activities being conducted within each clean energy sector of Georgia's economy. However, we present data in this report by sector and activity totals, not by business unit. Readers interested in additional analysis on Census data and related market intelligence should contact Southface directly at sarora@southface.org.

Conservative Approach

In the three years of this Georgia Census, Southface has identified about 1,000 firms believed to be in Georgia's clean energy industry. This report presents direct findings from self-reported data provided by 468 of those firms. Using the reported data, we have conservatively modeled an additional 333 firms in the industry for a total of 801 (see Appendix B). These 468 responding firms and 333 modeled firms represent a significant portion of the state's clean energy industry, but certainly do not cover all activity. Moreover, because two employees who spend 50% of their time on clean energy are counted as 1 FTE, the actual number of people directly engaged in Georgia's clean energy industry is greater than 19,231 FTE identified in this report. The conservative nature of the analysis means that the economic benefits of Georgia's clean energy industry are greater than what is presented in the 2015 Census.

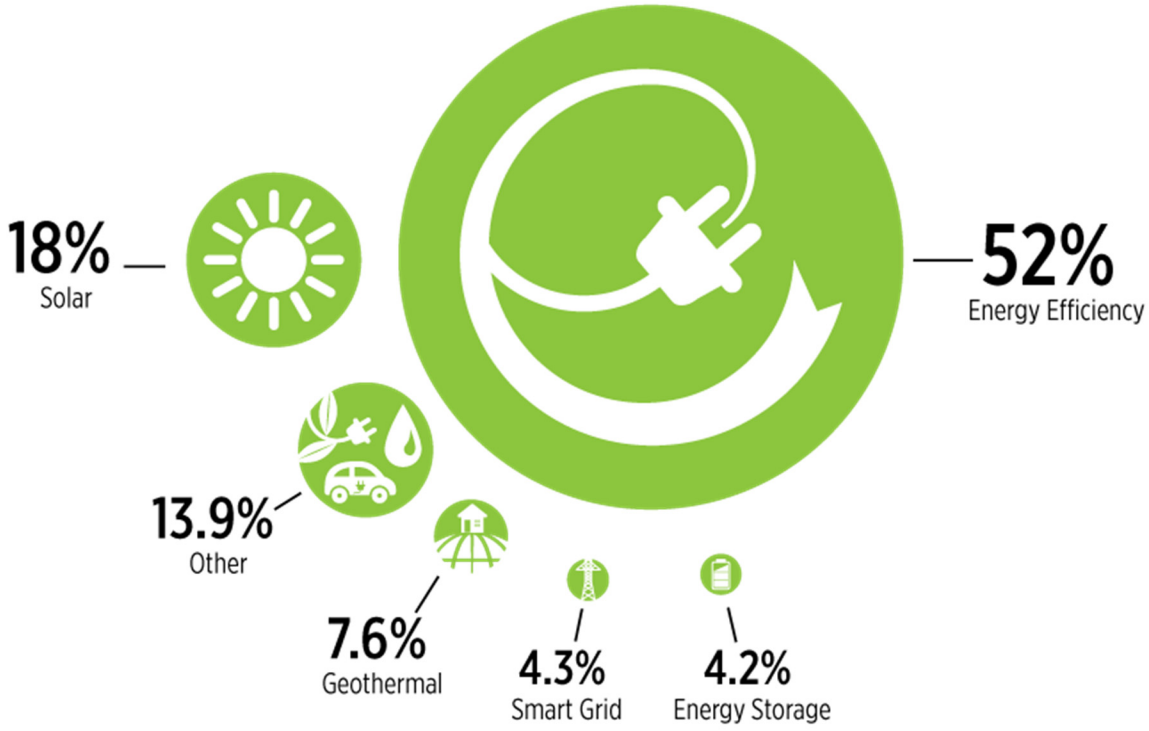
[6] The 2013 and 2014 Censuses included South Carolina and Virginia. Due to staffing changes in those states, the 2015 Census only includes Georgia and North Carolina.

Firms

Georgia has at least 801 clean energy firms.[7] For the Census, firms reported on the multiple clean energy sectors and activities in which they engage. For example, a firm could identify itself in both the Solar and Energy Storage sectors, as well as list multiple activities within the sectors such as Power Generation and Manufacturing/Production. As a result, the total number of firms by sector or activity is greater than the 801 firms identified as being in Georgia's clean energy industry.

Firms active in the EE sector represent 52% of Georgia's clean energy industry. Georgia's Solar firms represent 18% of the industry. Firms that are active in Georgia's Geothermal sector represent another 7.6% of all firms.[8]

Figure 3: Firms by sector



[7] The 2014 Census analysis identified 678 clean energy firms.

[8] In 2014, firms active in the Building Efficiency sector represented 44% of Georgia's clean energy industry, Solar firms represented 19% of the industry, and Geothermal firms represented another 10% of the industry.

Table 3: Clean energy firms by sector

Sector	Number of Firms	% of Total[9]
EE	654	52%
Solar	231	18%
Geothermal	96	7.6%
Smart Grid	55	4.3%
Biomass/Biofuels	53	4.2%
Energy Storage	53	4.2%
Wind	53	4.2%
Alternate Fuel Vehicles	31	2.4%
Hydropower/Marine	19	1.5%
Fuel Cells	17	1.4%

Given that 52% of the respondents are in the EE sector, it is not surprising that 48% are engaged in activities directly related to making buildings more energy efficient, which are:

- Design or Construction of New Buildings,
- Sale of Building System Components, and
- Installation or Maintenance of Building System Components.

The bulk of remaining EE firms engage in Professional Services, Education, or Consulting activities. Nineteen percent of all firms provide Professional Services, Education, or Consulting. Thirteen percent are engaged in Installation, Design, or Development of Renewable Energy Systems.[10]

Table 4: Clean energy firms by activity

Activity	Number of Firms	% of Total
Professional Services, Education, or Consulting	286	19%
Design or Construction of New Buildings	255	17%
Installation or Maintenance of Building System Components	255	17%
Sale of Building System Components	209	14%
Installation, Design, or Development of Renewable Energy Systems	200	13%
Sale of Renewable Energy Systems	123	8%
Research and Development	74	5%
Manufacturing/Production	65	4%
Power Generation	39	3%

[9] Percentage total greater or less than 100% is due to rounding.

[10] In 2014, firms engaged in activities related to making buildings more energy efficient represented 42% of Georgia's clean energy industry. Twenty percent provided Professional Services, Education, or Consulting. Fifteen percent were engaged in Installation, Design, or Development of Renewable Energy Systems.

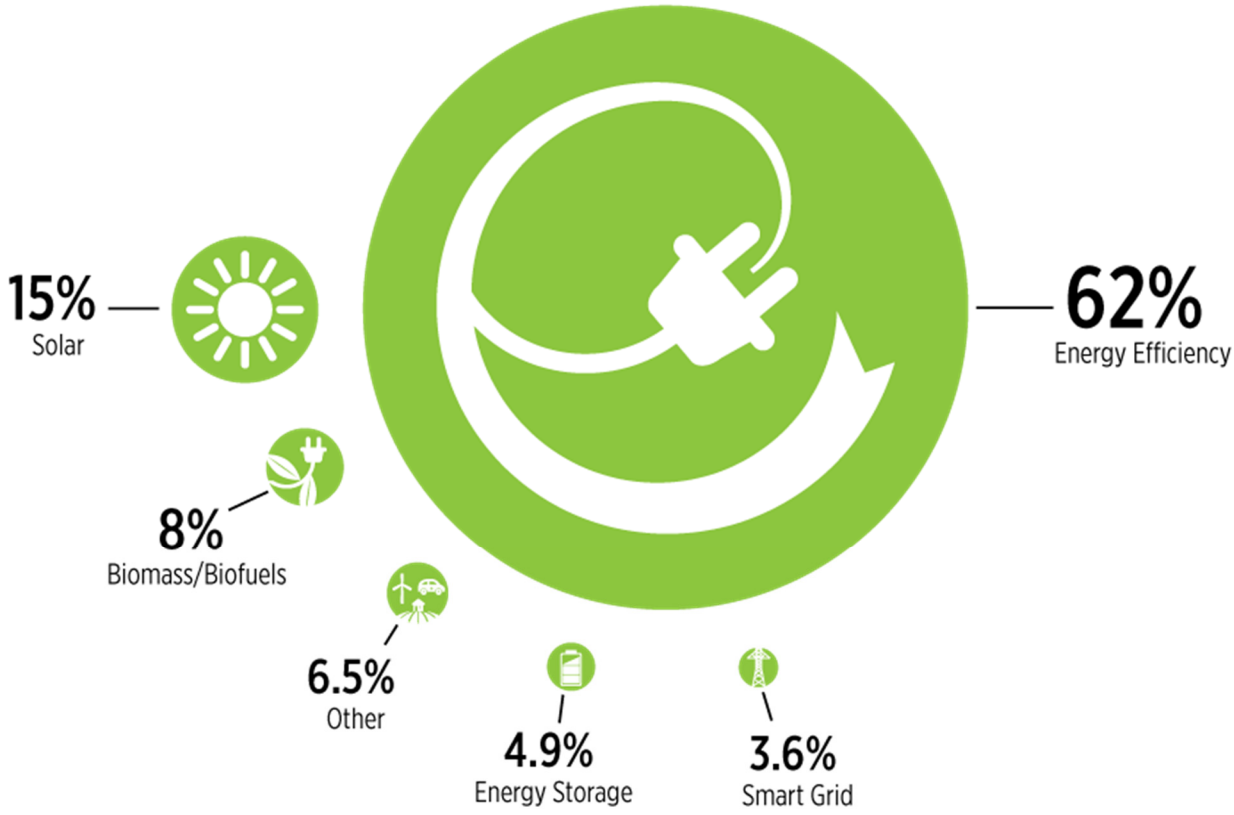
Employment

Georgia has at least 19,231 clean energy FTE jobs.[11] Firms in the EE sector employ 11,858 full-time professionals thereby accounting for 62% of Georgia's clean energy industry employment. This is a 1,056 FTE jobs (9.8%) increase from the 2014 results, which indicated 10,802 full-time building efficiency professionals accounting for 55% of 2014 Georgia clean energy industry employment.

Georgia continues to be one of the fastest growing solar markets in the country. Therefore, it is not surprising that the state's Solar firms rank second in employment with 2,956 FTE jobs representing 15% of clean energy industry employment. This is a 273 FTE jobs (10.2%) increase from the 2014 results, which indicated 2,683 full-time solar professionals accounting for 14% of 2014 Georgia clean energy industry employment. Biomass/Biofuels firms rank low in the number of firms at 53, but are third in employment with 1,467 FTE jobs representing 8% of clean energy industry employment.[12]

Note that while 7.6% of Georgia's clean energy firms are active in the Geothermal sector, the intensity of that activity is relatively minor because the Geothermal sector only has 370 FTE jobs representing two percent of all clean energy jobs in Georgia.

Figure 4: Employment by sector



[11] This is effectively the same result as the 2014 Georgia Census, which identified 19,663 clean energy FTE jobs. The slight difference is attributable to a decrease in Biomass/Biofuel FTE jobs.

[12] This is a 2,054 FTE jobs decrease from 2014 results, which indicated 3,521 FTE jobs. The difference is primarily the result of one biomass firm reducing its 2015 FTE jobs as compared to its 2014 FTE jobs.

Table 5: Clean energy employment by sector

Sector	FTE Jobs	% of Georgia FTE Jobs[13]
EE	11,858	62%
Solar	2,956	15%
Biomass/Biofuels	1,467	8%
Energy Storage	943	4.9%
Smart Grid	697	3.6%
Geothermal	370	1.9%
Fuel Cells	301	1.6%
Alternative Fuel Vehicles	243	1.3%
Wind	208	1.1%
Hydropower/Marine	188	1%

The three activities related to making buildings more energy efficient collectively account for 9,094 FTE jobs representing 47% of the clean energy industry employment.[14] Manufacturing/Production is also a healthy part of the industry. The relatively few clean energy firms engaged in Manufacturing/Production activities provide 4,363 FTE jobs, which is 23% of the workforce identified through this Census. Clean energy manufacturers in Georgia make a wide variety of items including lighting, water heaters, refrigeration units, solar panels and accessories, batteries, biofuels, and insulation. Firms engaged in Installation, Design, or Development of Renewable Energy Systems provide 1,967 FTE jobs representing 10% of total clean energy jobs.

Table 6: Clean energy employment by activity

Activity	FTE Jobs	% of Georgia FTE Jobs[13]
Design or Construction of New Buildings	4,369	23%
Manufacturing/Production	4,363	23%
Sale of Building System Components	2,857	15%
Installation, Design, or Development of Renewable Energy Systems	1,967	10%
Professional Services, Education, or Consulting	1,952	10%
Installation or Maintenance of Building System Components	1,868	9.7%
Power Generation	835	4.3%
Sale of Renewable Energy Systems	535	2.8%
Research and Development	484	2.5%

[13] Percentage total greater or less than 100% is due to rounding.

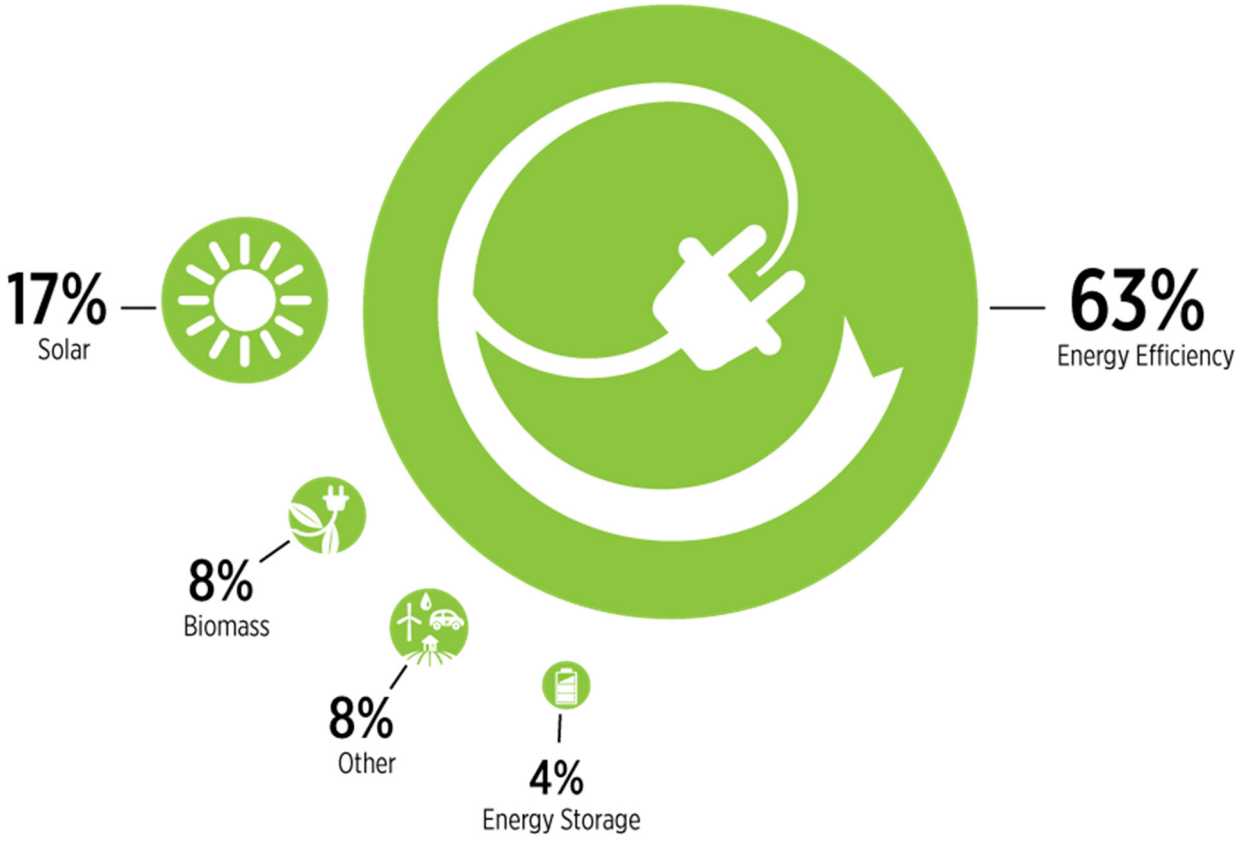
[14] The three activities related to the Building Efficiency sector are Design or Construction of New Buildings; Sale of Building System Components; and Installation or Maintenance of Building System Components. The bulk of remaining Energy Efficiency full-time professionals engage in Professional Services, Education, or Consulting activities.

Revenue

Georgia's clean energy industry generates at least $3,333,211,625 of gross revenue. This is $395 million more than the $2,937,758,507 identified through the 2014 Census. The increase is largely attributable to responses by firms in the EE sector. Because not all firms that provided employment data also provided their revenue, clean energy revenue is likely larger than what is presented in the 2015 Georgia Census report.

Revenue tracks employment with the EE sector accounting for $2.1 billion, followed by the Solar sector accounting for $556 million, and Biomass/Biofuels accounting for $262 million.[15] Firms in these three sectors generate 88% of Georgia's clean energy revenues.

Figure 5: Revenue by sector



[15] In 2014, the Building Efficiency sector accounted for $1.3 billion, followed by the Solar sector at $610 million, and Biomass/Biofuels sector at $297 million.

Table 7: Clean energy gross revenue by sector

Sector	Gross Revenue	% of Georgia Gross Revenue[16]
EE	$2,103,854,232	63%
Solar	$556,112,648	17%
Biomass/Biofuels	$261,817,500	8%
Energy Storage	$136,702,513	4.1%
Smart Grid	$86,751,887	2.6%
Wind	$65,329,441	2%
Hydropower/Marine	$56,293,869	1.7%
Geothermal	$43,154,800	1.3%
Alternate Fuel Vehicles	$13,707,316	0.4%
Fuel Cells	$9,487,420	0.3%

The three activities related to making buildings more energy efficient collectively generate $1.9 billion representing 58% of the clean energy industry gross revenue.[17] Firms engaged in providing Professional Services, Education, or Consulting generate $336 million representing 10% of the industry's gross revenue. The relatively few clean energy firms engaged in Manufacturing/Production activities generate $307 million representing 9.2% of the industry's gross revenue.

Table 8: Clean energy gross revenue by activity

Activity	Gross Revenue	% of Georgia Gross Revenue[16]
Design or Construction of New Buildings	$1,068,936,208	32%
Sale of Building System Components	$618,441,170	19%
Professional Services, Education, or Consulting	$336,085,921	10%
Manufacturing/Production	$307,520,523	9.2%
Installation, Design, or Development of Renewable Energy Systems	$302,303,098	9.1%
Sale of Renewable Energy Systems	$262,766,094	7.9%
Installation or Maintenance of Building System Components	$253,910,191	7.6%
Research and Development	$111,129,328	3.3%
Power Generation	$72,119,091	2.2%

[16] Percentage total greater or less than 100% is due to rounding.

[17] The three activities related to the Building Efficiency sector are Design or Construction of New Buildings; Sale of Building System Components; and Installation or Maintenance of Building System Components.

Further Analysis of Energy Efficiency and Solar Sectors

The EE and Solar sectors are the drivers of Georgia's clean energy industry, accounting for 77% of all clean energy employment and 80% of all revenue. In past years, the analysis stopped here and did not assess the indirect benefits for other businesses that provide goods/services to clean energy firms, and induced benefits for the rest of the economy.

For the 2015 Census, we used a standard IMPacts for PLANing (IMPLAN) modeling technique that converts our direct counts for the EE and Solar sectors to total jobs and revenue impact on Georgia's economy.[18] The IMPLAN model used for this analysis, developed by Dr. Benjamin Deitchman,[19] divides Georgia's economy into 536 sectors. Prior research conducted by Dr. Deitchman and his colleagues establishes the key impact coefficients relevant to the EE and Solar sectors in Georgia (see Appendix C).

In addition to the 11,858 direct Energy Efficiency FTE jobs counted via the 2015 Georgia Census, the IMPLAN model estimates another 10,637 FTE jobs supported across Georgia's economy for a total of 22,495 FTE jobs. The model shows that the $2.1 billion direct EE annual gross revenue counted via the 2015 Georgia Census generates another $2.1 billion annual gross revenue across Georgia's economy for a total of $4.2 billion.

Figure 6: Total estimated economic benefit of Energy Efficiency sector

In addition to the 2,956 direct Solar FTE jobs counted via the 2015 Georgia Census, the IMPLAN model estimates another 3,104 FTE jobs supported across Georgia's economy for a total of 6,060 FTE jobs. The model shows that the $556 million direct Solar annual gross revenue counted via the 2015 Georgia Census generates another $391 million annual gross revenue across Georgia for a total of $947 million.

Figure 7: Total estimated economic benefit of Solar sector

The IMPLAN model estimates that just Georgia's EE and Solar sectors provide almost 29,000 FTE jobs and generate an economic impact of $5.1 billion across Georgia's economy. To put this in context, Georgia's lauded film industry generated an economic impact of $6 billion during fiscal year 2015.[20]

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[18] IMPLAN is an econometric modeling system developed by applied economists at the University of Minnesota and the U.S. Forest Service. Currently in use by more than 500 organizations, IMPLAN models the trade flow relationships between businesses and between businesses and final consumers.

[19] Benjamin H. Deitchman PhD, Visiting Assistant Professor of Public Policy – Rochester Institute of Technology.

[20] State of Georgia press release. "Film Industry Generates $6 Billion for Georgia's Economy." July 9, 2015. Accessed online: http://www.georgia.org/newsroom/press-releases/film-industry-generates-6-billion-for-georgias-economy. Referenced on Dec. 28, 2015.

Location of Customers

Firms were asked to identify what percentage of their clean energy goods and services for each business unit, i.e., activity/sector cross-section, was delivered to customers in the following markets:

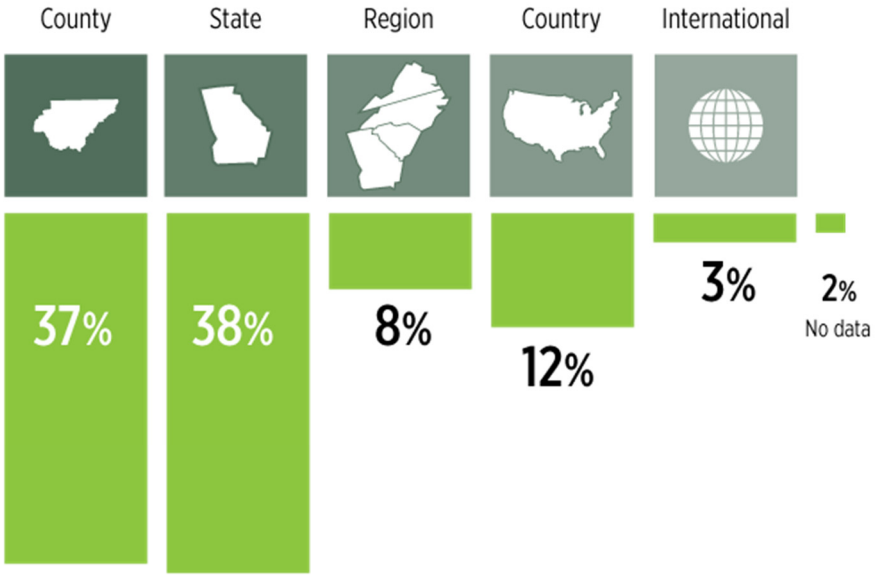
- Within the county of the providing location.
- Within the state but outside the county of the providing location.
- Within the four-state region (Georgia, North Carolina, South Carolina, and Virginia) but outside of the state of the providing location.
- Within the country but outside of the four-state region.
- International.

Based on responses, Georgia's clean energy industry is predominately local with 37% of clean energy goods and services delivered to customers within the county in which the provider is located. Another 38% is delivered to customers within the state, but outside the county in which the provider is located. Therefore, 75% of all of clean energy goods and services stay within the state.

The industry's local nature is due in part to sectors such as EE where business activities are conducted close to the providing firm's location. Indeed, 80% of EE goods and services are delivered to customers in Georgia. The Solar sector is also mostly local with 75% of goods and services delivered to customers in Georgia. The Biomass/Biofuels sector delivers 65% of its goods and services to in-state customers. These are the three largest sectors in Georgia in terms of both employment and revenue.

Some clean energy sectors have a sizeable customer base outside the state. Georgia's Wind sector leads in exports with 61% of its goods and services delivered to customers outside Georgia. Biomass/Biofuels delivers 35% of its goods and services to customers outside Georgia, including 9% that goes to international destinations. Energy Storage and Smart Grid also have a large out-of-state customer base. Energy Storage firms export 34% of their goods and services and Smart Grid firms export 28% of their goods and services. The cutting-edge technology Full Cell sector has the highest proportion of international sales at 17%. Furthermore, firms engaged in clean energy Manufacturing/Production deliver 44% of their goods to out-of-state customers.

Figure 8: Goods and services by location of customer / destination market



Respondent Comments

The 2015 Census included an open-ended question: *What is the most important policy issue affecting the success of your firm*. While responses were varied, the majority fall into the broad categories listed below.

Incentives and rebates

The most frequent comment pertained to the need for tax incentives or utility rebates to balance the upfront cost of clean energy upgrades and purchases with long-term savings. Some respondents suggested that the incentives/rebates be contingent upon actual energy efficiency performance.

Many respondents suggested the Public Service Commission continue supporting utility rebates for energy efficiency improvements. They commented that these utility rebates provide an incentive for homeowners and businesses to invest in energy efficiency, as well as help with marketing the benefits of energy efficiency to consumers. Educating consumers is a major concern for many respondents and is discussed below.

Codes and enforcement

Another top theme was the need for improved energy efficiency of buildings. Many firms suggested that improved energy efficiency can be achieved through more stringent building codes. However, others prioritized the enforcement of existing building codes. Firms also commented that some codes officials do not fully understand the latest energy efficiency building practices and that lack of knowledge can result in delays.

Quality of service/product

While the quality of service/product is not necessarily a policy issue, it was a top response. This comment sums up the general sentiment expressed by these respondents: “Workmanship. I don't know about the policy issue. Doing the job right with no callbacks.” These respondents suggest that integrity, quality control, customer satisfaction, and reputation are key factors in their firm’s success.

Educating customers

Many firms commented that customers do not understand clean energy products, services, or benefits. This lack of understanding negatively impacts their business.

Issues specific to the solar sector

Some Solar firms expressed concerns about interconnection fees and access to the grid. Another concern was punitive tariffs on the importation of solar panels, which is a national policy issue. Several commented that the recently enacted Solar Power Free Market Financing Act is going to help their firm grow.

Other comments

Two concerns indicated by many respondents are the lack of skilled labor and the difficulty in obtaining funding.

High Points and Policy Drivers

Georgia has a robust and diversified clean energy industry that has at least 801 firms. Located throughout the state, these firms engage in a wide array of business activities, and represent a diversity of revenue and full-time employment levels.

Georgia clean energy firms generate at least $3.3 billion in gross revenue and provide 19,231 FTE jobs based on a direct count, which does not factor indirect benefits for other businesses that provide goods/services to clean energy firms, and induced benefits for the rest of the economy. Using an IMPLAN model shows that just Georgia's EE and Solar sectors provide almost 29,000 FTE jobs and generate an economic impact of $5.1 billion across Georgia's economy.

With regards to sector, Energy Efficiency firms lead the way in terms of direct employment and revenues, followed by firms in Solar and the Biomass/Biofuels sectors. With regards to activity, firms engaged in making buildings energy efficient, either in new energy efficient design and construction or energy efficiency retrofitting of existing buildings, collectively have the highest direct employment and revenue figures. Firms that manufacture clean energy goods or produce biomass/biofuels come in second in terms of direct employment and revenue, followed by firms that install, design, or develop renewable energy systems.

Clean energy projects reach all corners of the state and bring with them jobs and investment in local communities; 75% of all clean energy goods and services stay within the state. Furthermore, income enters the state through the sale of clean energy goods and services that originate here and are exported to regional, national, and international markets. Sixty-one percent of Georgia's Wind goods and services are delivered to customers outside Georgia and firms engaged in clean energy Manufacturing/Production export 42% of their goods out-of-state.

Georgia's clean energy industry is impacted by policies and market factors. Responding firms indicate the need for tax incentives or utility rebates to balance the upfront cost of clean energy upgrades and purchases with the long-term savings. Many firms suggest that more stringent building codes will increase building energy efficiency, while others prioritize the enforcement of existing building codes and training of codes officials regarding the latest energy efficiency building practices. The lack of understanding by customers regarding clean energy products and services is negatively impacting the business of many respondents. However, many respondents state that success can be achieved through superior customer satisfaction. Addressing the policy considerations identified by the respondents can fuel the continued growth of Georgia's already impressive clean energy industry.

Appendix A – Sector Definitions

For the Census, the clean energy industry contains the following ten business sectors:

1. **Alternative Fuel Vehicles** – Alternative Fuel Vehicles are those that run exclusively on alternative fuels, including electricity, or a blend of traditional petroleum fuels and alternative fuels. These include, but are not limited to:
    - Hybrid electric vehicles
    - Electric vehicles
    - Flexible-fuel vehicles
    - Biofuel vehicles
    - Natural gas vehicles

    This sector also includes firms involved in the conversion of traditional fuel vehicles to run on alternative fuels.

2. **Biomass/Biofuels** – This sector relates to the generation of heat or electricity from either the combustion of organic and waste materials, or their conversion to biofuels. These organic and waste materials include, but are not limited to:
    - Plant-based sources (e.g., wood, grasses, or natural oils)
    - Municipal wastewater
    - Municipal solid waste

3. **Energy Efficiency** – This sector employs technologies, products, and services that reduce the amount of energy required for processes, tasks, or buildings. Examples of firms in this sector, include, but are not limited to:
    - Developers or installers of more efficient lighting technologies or HVAC systems
    - Producers or installers of other energy conservation technologies for buildings
    - Energy Star, LEED, or EarthCraft builders
    - Developers of more efficient manufacturing processes

4. **Energy Storage** – This sector covers energy storage devices or physical media that are used to store energy, in various forms, for use at a later time. Technologies and products currently included in the sector are:
    - Batteries
    - Mechanical storage mechanisms such as compressed air or flywheels
    - Thermal storage

5. **Fuel Cells** – This sector includes technologies or devices that convert chemical energy from a fuel source into electricity through an oxidizing reaction. Fuel sources may include:
    - Hydrogen
    - Hydrocarbons such as natural gas, methanol, or other alcohols

6. **Geothermal** – This sector includes both Geothermal Energy and Ground Source Heat Pump (GSHP) technology. Geothermal Energy utilizes the thermal energy (heat) stored in the Earth to generate

electricity, while GSHP is a central heating and cooling system that transfers heat to or from the ground.

7. **Hydropower/Marine** – Hydropower refers to harnessing the force of falling or flowing water, including marine waves, for useful purposes such as generating electricity or creating mechanical force.
8. **Smart Grid** – This sector incorporates technologies and products related to updating the current electricity grid infrastructure with increased multidirectional communication, data collection, and automation. This includes, but is not limited to, digital metering equipment, sensors, controls, and related software.
9. **Solar** – This sector includes technologies and products related to the conversion of sunlight either directly into electricity through photovoltaic cells or indirectly through concentrated solar power. The sector also includes solar thermal products that harness sunlight to meet thermal requirements for residential, commercial, or industrial processes.
10. **Wind** – The wind sector includes products related to the harnessing of wind energy. This includes, but is not limited to, wind turbines for the creation of electricity, wind pumps for pumping and drainage power, and windmills for mechanical power.

To qualify as being active in a specific sector, a firm must perform at least one of the following nine activities with that sector:

- Design or Construction of New Buildings
- Sale of Building System Components
- Sale of Renewable Energy Systems
- Installation, Design, or Development of Renewable Energy Systems
- Installation or Maintenance of Building System Components
- Manufacturing/Production
- Power Generation
- Professional Services, Education, or Consulting
- Research and Development

Appendix B – Methodology

The 2015 Southeast Census is a collaboration between the North Carolina Sustainable Energy Association (NCSEA) and Southface in Georgia. These organizations are collectively referred to as the Partners. Each Partner compiled a list of clean energy companies, organizations, and institutions (collectively referred to as firms) in its state. Each state-level Census relied on a common questionnaire developed by the Partners, as well as an online survey tool and phone-banking system managed by North Carolina State University Center for Urban Affairs and Community Services (NC State). NCSEA performed the data analysis of all Census data with input from Southface.

Results in this report are specific to clean energy business conducted within Georgia. Please see *www.cleanenergyindustry.org* for information regarding all states included in the 2014 and 2015 Southeast Censuses.

Conservative Approach

The Partners utilized the approach taken by NCSEA during the first five iterations of the North Carolina Clean Energy Industry Census from 2008 – 2012, and again in 2014. In the three years of this Georgia Census, Southface has identified about 1,000 firms believed to be in Georgia's clean energy industry. The 2015 Georgia Census Report presents direct findings from self-reported data provided by 468 of those firms. Using the reported data, we have conservatively modeled an additional 333 firms in Georgia's industry for a total of 801 firms. These 468 responding firms and 333 modeled firms represent a significant portion of the state's clean energy industry, but certainly do not cover all activity. The conservative nature of the analysis means that the economic benefits of Georgia's clean energy industry are greater than what is presented in the 2015 Census.

Moreover, because two employees who spend 50% of their time on clean energy are counted as 1 FTE, the actual number of people directly engaged in Georgia's clean energy industry is greater than 19,231 FTE identified in this report. The conservative nature of the analysis means that the true economic impact of the clean energy industry in North Carolina is larger than what is presented in the 2015 Census.

Identifying Clean Energy Firms

1. Southface reviewed the 2014 list of clean energy firms and removed firms that are no longer in Georgia's clean energy industry.
2. Southface compiled an updated list of Georgia firms potentially in the clean energy industry from the following sources:
    a. Lists of firms maintained by Southface.
    b. Publically available industry websites.
    c. Lists maintained by other organizations.
    d. Online searches.
3. Southface assessed whether each firm is involved in a clean energy sector included in the Census.
4. For firms deemed to be within the scope, Southface identified primary and secondary contacts and obtained their email and telephone information.
5. Southface shared its preliminary list of clean energy firms with other Partners to eliminate duplicate entries.
6. Southface delivered its list of Georgia clean energy firms to NC State. NC State conducted the online survey and follow-up phone interviews.

Performing the Survey

1. Each Georgia firm received an email from Southface that included a hyperlink to the online survey, as well as unique login and password credentials.
2. Southface sent multiple reminder emails to those Georgia firms that had not completed the survey.
3. NC State conducted phone interviews with Georgia firms that had not yet completed the online survey.

4. The Partners closed the survey on October 1, 2015.

Identifying Business Units

Firms were asked to self-identify as being involved in the clean energy industry by indicating they had at least one employee dedicating a portion of their time to one of the nine business activities in one of ten clean energy business sectors. Each activity within a clean energy industry sector is defined as a clean energy business unit (e.g., Research and Development / Solar). The 2015 Census has 90 activity/sector cross-sections resulting from combinations of the following activities and sectors:

Activities	Sectors
Design or Construction of New Buildings	Alternative Fuel Vehicles
Sale of Building System Components	Biomass/Biofuels
Sale of Renewable Energy Systems	Energy Efficiency
Installation, Design, or Development of Renewable Energy Systems	Energy Storage
Installation or Maintenance of Building System Components	Fuel Cells
Manufacturing/Production	Geothermal
Power Generation	Hydropower/Marine
Profession Services, Education, or Consulting	Smart Grid
Research and Development	Solar
	Wind

Through this selection process, each responding firm indicated its clean energy business unit(s). Firms were asked to provide their total full-time equivalent (FTE) employment and total gross annual revenue at all locations. Firms were also asked to complete metrics for each of their clean energy business unit(s), including:

- Percentage of total staff time allocated to each business unit;
- Percentage of that work occurring in Georgia and/or North Carolina; and
- The percentage of goods and services delivered to each geographic market for each business unit.

Calculating Full-Time Equivalent Employees of Responding Firms

The Partners used full-time equivalent employees, or FTEs, as opposed to the number of individual employees. FTE is representational of a single 30 hour per week block of employment. NCSEA calculated clean energy FTE employees by multiplying a firm's total number of FTE employees at the time of the survey by the percentage of total staff time that the firm dedicated to each of its clean energy business units in Georgia. FTEs provide a high degree of flexibility for accurately modeling the equivalent man-hours spent working on clean energy. For example, two employees who spend 50% of their time on clean energy would be calculated as a clean energy FTE of 1.0.

Because Census analysis is based on direct responses of firms, any FTE job modification or lack of participation by major employers will have a more pronounced impact on FTE job totals of smaller sectors (e.g., Biomass/Biofuels and Energy Storage) than larger sectors (e.g., Energy Efficiency and Solar).

Calculating Annual Revenue of Responding Firms

The Partners asked firms to report their total gross annual revenue from the most recent fiscal year (2014/2015 in this case) by selecting from the following revenue ranges:

1. Less than $100,000	9. $25 million to less than $50 million
2. $100,000 to less than $250,000	10. $50 million to less than $100 million
3. $250,000 to less than $500,000	11. $100 million to less than $250 million
4. $500,000 to less than $1 million	12. $250 million to less than $500 million
5. $1 million to less than $2.5 million	13. $500 million or more
6. $2.5 million to less than $5 million	14. Prefer not to answer
7. $5 million to less than $10 million	15. Do not know
8. $10 million to less than $25 million	

Firms were then assigned a revenue number equal to the median value the range they selected. A firm falling in the "less than $100,000" bracket was classified as "$50,000." Firms in the "$500 million or more" bracket were classified as $500 million. To calculate a firm's revenue by clean energy business unit, NCSEA multiplied the firm's total revenue by the percentage of total staff time that the firm dedicated to each business unit active in Georgia. As with the FTE jobs analysis, any revenue modification, lack of providing revenue data, or lack of participation by major firms will have a more pronounced impact on revenue totals of smaller sectors than larger ones.

Modeled Firms

NCSEA used survey response data to estimate the total number of clean energy firms active in Georgia. This included firms that responded to the Census survey as well as additional firms that were modeled based on the data from responding firms. NCSEA used the following process for estimating the total number of clean energy firms and assigning them characteristics:

1. Southface compiled an updated list of firms potentially involved in Georgia's clean energy industry. All of these firms were contacted via email and/or telephone and a percentage of them provided complete survey responses. NC State placed all of the firms, regardless of whether they provided a responses, into the following categories:
    a. Completed Interviews – Firms that completed the survey through a phone interview with NC State.
    b. Completed Online – Firms that completed the survey online via the email link.
    c. Respondent Will Do Online – Firms that indicated to NC State over the phone that they would take the survey online, but did not complete the survey.
    d. Respondent Ineligible – Firms that self-identified as not being involved in the clean energy industry.
    e. Duplicate ID – Firms that appeared on the initial list twice.
    f. Attempts Exhausted – Firms that NC State was unable to contact over the phone and did not complete the survey online.
    g. Wrong Number – The provided phone number was incorrect.
    h. Out of Service – The provided phone number was no longer in service.

i. Refused – Firms that indicated they were not willing to participate in the survey but did not self-identify as being ineligible.

2. NCSEA identified the firms in the Completed Interviews, Completed Online, Respondent Will Do Online, and Refused categories as active in the Georgia clean energy industry.
3. NCSEA identified the firms in the Respondent Ineligible, Duplicate ID, Wrong Number, and Out of Service Categories as not active in the Georgia clean energy industry.
4. NCSEA estimated the percentage of the remaining firms, those in the Attempts Exhausted category, that are active in the Georgia clean energy industry using the following calculation:

$$\frac{\text{Completed Interviews, Completed Online, Respondent Will Do Online, and Refused Categories}}{\text{Total Number of Firms Contacted}} \times \text{Attempts Exhausted} = \text{Additional Firms Active in GA Clean Energy Industry}$$

5. NCSEA added the firms in Step 2 and 4 to determine the estimated number of firms active in Georgia's clean energy industry.
6. NCSEA determined the number of modeled firms by subtracting the number of Completed Interviews and Completed Online responses from the total number of firms in the industry.
7. NCSEA calculated an 80% trimmed mean for the FTE employment and revenue in each business unit (activity/sector cross-section) by removing the upper and lower 10% of the reported FTE employment and associated revenue.
8. NCSEA applied the resulting trimmed means of FTE employment and revenue for the 90 activity/sector cross-sections to the modeled firms based on their relative percentages in the direct response data, i.e., information provided through the Completed Interviews and Completed Online responses.

A Note about Removed Firms

The Partners assessed all responses and identified firms that provided data that clearly appeared to overstate employment or revenues. These firms were contacted again in an effort to validate their responses. The Partners kept in the dataset corrected responses from firms who retook the Census and eliminated from the dataset responses from firms that could not be reached.

Appendix C – IMPLAN Model

The prior research conducted by Dr. Deitchman and his colleagues that establish the key impact coefficients relevant to the EE and Solar sectors in Georgia are:

- Deitchman, B. (2011). Energy Efficiency and Conservation Block Grants in Georgia: Opportunities for Growth through Local Government Energy Savings. Atlanta, GA: Enterprise Innovation Institute.
- Deitchman, B. (2012). Changing the State of State-Level Energy Programs: Policy Diffusion, Economic Stimulus and New Federalism Paradigms. World Energy Engineering Congress, November 2012.

- Deitchman, B. (2014). Beyond Recovery- Policy Options for Energy Efficiency Financing. World Energy Engineering Congress October 2014.
- Deitchman, B. (2015). Jobs, Jobs, Jobs: Energy Efficiency and Growth through State and Local Implementation. Deil Wright Symposium (American Society for Public Administration), March 2015.
- Deitchman, B., Brown, M., & Baer, P. (2011). Green Jobs from Industrial Energy Efficiency. Energy Productivity in Industry: Partners and Opportunities, 2011 American Council for an Energy Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Industry. Washington, DC: ACEEE.

The table below contains the estimated indirect and induced results of the IMPLAN analysis.

2015 Economic Impact of Georgia's EE and Solar Sectors					
		Direct Count (via 2015 Census)	Estimated Indirect (via IMPLAN Model)	Estimated Induced (via IMPLAN Model)	Estimated Total
EE	FTE Employment	11,858	5,704	4,933	22,495
	Annual Gross Revenue	$2,103,854,232	$1,115,042,743	$967,772,947	$4,186,669,922
Solar	FTE Employment	2,956	1,321	1,782	6,060
	Annual Gross Revenue	$556,112,648	$189,634,413	$201,312,779	$947,059,840