

2018 North Carolina Clean Energy Industry Census



NC SUSTAINABLE
ENERGY ASSOCIATION



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About North Carolina Sustainable Energy Association

North Carolina Sustainable Energy Association (NCSEA) is a 501(c)3 non-profit advocacy organization driving policy and market development to create clean energy jobs, economic opportunities, and affordable energy. NCSEA has served as a respected, trusted, and collaborative resource to North Carolina and beyond since 1978. Our goal is to cultivate a robust clean energy system and energy economy that unifies and benefits all market actors: consumers, businesses, the Clean Energy Industry, and utility energy providers.

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A Message from the Executive Director



NCSEA pioneered the first state-based Clean Energy Industry census in 2008. The goal: create a baseline measurement of our Clean Energy Industry and repeat each year to determine whether the growing suite of recently adopted North Carolina clean energy policies are succeeding in driving the growth of our state's energy economy, measured in jobs, number of clean energy firms, and industry revenue.

NCSEA's annual census has documented the explosive beginning and accelerating transformation of North Carolina's energy economy – North Carolina's annual clean energy jobs have grown more than 550 percent and industry revenue has grown more than 300 percent over the last decade.


Celebrating our 10th industry census this year, we are grateful to the thousands of firms who responded to our survey. Because of them, we have been able to analyze the shifts and trends in industry presence and revenues against NCSEA's database of clean energy deployment, RTI's biannual clean energy economic impact analyses, and our surveys of residential consumers who have adopted clean energy.

As a result, NCSEA has provided North Carolina and similar Southeast states with something uniquely valuable – annual and decadal insight into how unprecedented shifts in law, regulation, energy resource costs, technological capabilities, and consumer interests have interacted to impact the growth of clean energy jobs and investments across our state economy. We now know that North Carolina's clean energy industry has been a consistent and meaningful contributor to growing North Carolina's Gross State Product and keeping electricity costs low, while bringing billions of out of state investment to every county and government district in our state.

The most significant insight NCSEA gained is that change has been an increasingly predictable and positive constant in the ongoing transformation of North Carolina's energy system and economy. Rapid innovation and nose-diving costs of clean energy resources continue to shift and blur the once steadfast lines separating technology, infrastructure, and transportation. The simple days of asking how much power we need and then choosing the cheapest way to generate and deliver it are gone. A new era of deeper savings, higher performance, lower emissions, and massive statewide and Southeast regional economic development opportunity is upon us.

Buildings, transportation, and infrastructure are leveraging electricity as a distributed, resilient, flexible, and affordable resource at all scales. However, as you review this report keep in mind that North Carolina and the Southeast still make relatively limited use of energy efficiency, renewable energy, electric vehicles, energy storage, energy data, integrated planning, and innovative grid solutions.





Consumers across all income levels and energy service needs are coming into awareness of the affordable opportunities distributed energy resources can offer. Large commercial and industrial consumers are frustrated with severely limited access to affordable clean energy. A diverse and growing number of consumers are installing multiple solutions in their homes and small businesses, such as rooftop solar, electric vehicle charging, battery storage, geothermal ground source heat pumps, and an array of energy and money saving technologies. The pace of consumer adoption, with or without utility involvement, is accelerating.

This blurring of traditional lines across our economy is ahead of state law, regulation, and utility business models, and the pace of affordable and reliable clean energy innovation is accelerating. Policymakers are at the beginning stages of updating state electricity regulations and utility leaders are beginning to explore ways to transform the business models of regulated utilities to realize the full cost saving, emissions reducing, and economic development potential of a clean, affordable, resilient, and equitable energy system and energy economy.

I look forward to continuing this work together.

Sincerely,



Ivan Urlaub
NCSEA Executive Director



Acknowledgements

NCSEA would like to thank all the companies, institutions, and organizations that responded to the 2018 North Carolina Clean Energy Industry Census. Their willingness to donate their time and insights allows NCSEA to capture and share important data about North Carolina's Clean Energy Industry with policymakers and market actors in North Carolina and beyond.

The final version of this report would not be possible were it not for the efforts of partner organizations, particularly the Center for Urban Affairs and Community Services at North Carolina State University for their assistance in programming and administering the Census. NCSEA pioneered the clean energy jobs Census in the United States in 2008. In the first few years, firms we believed to be in the Energy Efficiency sector, when surveyed, were opting out of the survey because they did not identify as energy efficiency or clean energy. In recent versions of the Census we chose to remove several hundred firms that had consistently responded this way, causing the economic impact of the Energy Efficiency sector to be under-reported. In the 2018 Census, we took extra care to ensure that companies who otherwise might not self-select as a Clean Energy Industry firm would now feel included and participate. To that end, some additional thanks are due to the North Carolina Building Performance Association (NCBPA) for helping our survey reach a wider audience by expanding the number of energy efficiency companies on our contact list, and to GreatBlue Research for assisting with survey programming and administration.





Sector and Activity Definitions

Sectors

Alternative Fuel Vehicles – This includes technologies and products that are used in vehicles that run on alternative fuels. This also includes the conversion of traditional fuel vehicles to run on alternative fuels.

Bioenergy – This includes both Agricultural/Forestry Bioenergy (such as animal waste and plant-based sources) and Municipal Bioenergy (such as municipal wastewater and municipal solid waste).

Energy Efficiency – This includes technologies products, and services that reduce the amount of energy required for buildings, processes, or tasks. This includes reduction in energy use by employing passive solar materials or design.

Energy Storage – This includes technologies and products that are used to store energy for later use.

Geothermal/Ground Source Heat Pumps – This includes both Geothermal Energy and Ground Source Heat Pump (GSHP) technologies. Geothermal Energy technology utilizes the thermal energy (heat) stored in the Earth to generate electricity, while GSHPs are central heating and cooling systems that increase efficiency by transferring heat to or from the ground.

Hydropower – This includes technologies or devices that harness the force of falling or flowing water, including marine waves, for useful purposes such as generating electricity or creating mechanical force.

Micro Grid and Smart Grid – Micro Grid technologies are a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. Smart Grid technologies include products related to updating current electricity grid infrastructure to increase multidirectional communication, data collection, and automation.

Solar – This includes technologies and products that harness sunlight to produce either heat or electricity, including solar thermal technology.

Wind – This includes technologies and products related to the harnessing of wind energy to produce electricity or mechanical force.



Activities

Advocacy – This refers to any action taken to advance clean energy or energy efficiency development or implementation that is not otherwise defined in any other activity.

Architecture – This refers to the design of buildings or landscapes, both new constructions and renovations, that are intended to incorporate any of the above technologies.

Building Component Sales – This refers to selling any parts or devices that are used to increase the efficiency or resilience of a building or building systems.

Educational Services – This refers to educating companies or individuals who could influence or be influenced by the implementation of clean energy or energy efficiency technologies.

Electricity Generation – This refers to using any of the above technologies to generate electricity with the intention of selling it.

Engineering – This refers to the design of products, equipment, or processes that are used in the installation, maintenance, or general operation of renewable energy systems or energy efficiency products.

Fuel Sales – This refers to the sale of fuels that are used to generate heat, produce electricity, or operate vehicles.

Installation and Construction – This refers to the construction or renovation of buildings or landscapes that incorporates clean energy or energy efficiency technologies and the installation of renewable energy systems into new or existing buildings.

Legal Services – This refers to providing legal services to companies performing the above technologies. Legal services refer to aiding in any legal processes but does not include engaging in lobbying activities.

Manufacturing and Production – This refers to activities related to any step of the manufacturing process for the above technologies.

Operation and Maintenance – This refers to any work required to ensure the technologies defined above remain functional and productive.

Professional/Consulting Services – This refers to providing expert advice and assistance to companies involved with the above technologies that does not involve legal, architecture, or engineering services.

Renewable Energy System Sales – This refers to the selling of any systems used to generate renewable energy or any parts associated with these systems.

Research and Development – This refers to any work intended to improve the above technologies or develop new technologies that would contribute to renewable energy or energy efficiency.



About the Census



Since 2008, NCSEA has surveyed companies, institutions, and organizations in the Clean Energy Industry to quantify their impact on the state's economy as well as inform where policies may or may not be achieving the results policymakers and market actors envisioned. The 2018 North Carolina Clean Energy Industry Census (Census) represents the 10th edition of this survey report.

Unlike national reports that use industry classification codes to categorize companies from the broader economy, the Census uses confidential direct responses from North Carolina clean energy companies to report key findings and data trends from participant responses. As a result, the employment, revenues, and demographic findings in this report are inherently more conservative in nature than other state and national reports. For the purposes of this report, North Carolina clean energy jobs are defined as those employees that spend any portion of their time engaging in the Clean Energy Industry in the defined sectors and activities.

Responding firms classified themselves as engaging in the Clean Energy Industry in North Carolina among a selection of clean energy business sectors and activities, outlined below. NCSEA utilized this self-reported data to perform a thorough analysis of activities within North Carolina's clean energy economy.

To protect the privacy of responding companies, data in this report is presented in aggregate. NCSEA attempted to survey 2,368 firms and 1,495 responded to the survey, representing a 61 percent survey response rate. Additionally, several respondents were unable to, or chose not to, provide the distribution of their employees by sector. This report contains a conservative modeling of companies that did not respond to the survey but are anticipated to be active in North Carolina's Clean Energy Industry (see appendix for explanation of methodology).

Table 1: Clean Energy Industry Sectors

CLEAN ENERGY INDUSTRY SECTORS
ALTERNATIVE FUEL VEHICLES
BIOENERGY
ENERGY EFFICIENCY
ENERGY STORAGE
GEOTHERMAL/GROUND SOURCE HEAT PUMPS
HYDROPOWER
MICRO GRID AND SMART GRID
SOLAR
WIND

Table 2: Clean Energy Industry Activities

CLEAN ENERGY INDUSTRY ACTIVITIES
ADVOCACY
ARCHITECTURE
BUILDING COMPONENT SALES
EDUCATIONAL SERVICES
ELECTRICITY GENERATION
ENGINEERING
FUEL SALES
INSTALLATION AND CONSTRUCTION
LEGAL SERVICES
MANUFACTURING AND PRODUCTION
OPERATION AND MAINTENANCE
PROFESSIONAL/CONSULTING SERVICES
RENEWABLE ENERGY SYSTEM SALES
RESEARCH AND DEVELOPMENT



2018 Highlights

It has been a decade since NCSEA first reported a baseline measure of North Carolina's Clean Energy Industry in 2008. NCSEA's industry measurement and reporting over the last decade tells a tremendous story of statewide economic growth that few imagined in 2008. Over this time, clean energy has been a stable stalwart of investment, revenue, and employment growth for North Carolina – adding jobs in each year of the Great Recession and the economic recovery that followed.

The Clean Energy Industry in North Carolina now boasts participation by approximately 1,700 companies (up from 468 in 2008), provides more than 43,000 jobs (up from 6,470), and generates over \$14 billion in annual revenue (up from \$3.5 billion in 2009).¹

Figure 1: Clean Energy by the Numbers



Firms



The Clean Energy Industry in North Carolina is predominately led by companies involved in two sectors: Energy Efficiency and Solar. These represent a combined 63 percent of all companies in the North Carolina Clean Energy Industry, with 44 percent of respondent companies self-identifying as active in Energy Efficiency and 19 percent of respondent companies self-identifying as active in Solar.

Figure 2: Total Clean Energy Firms

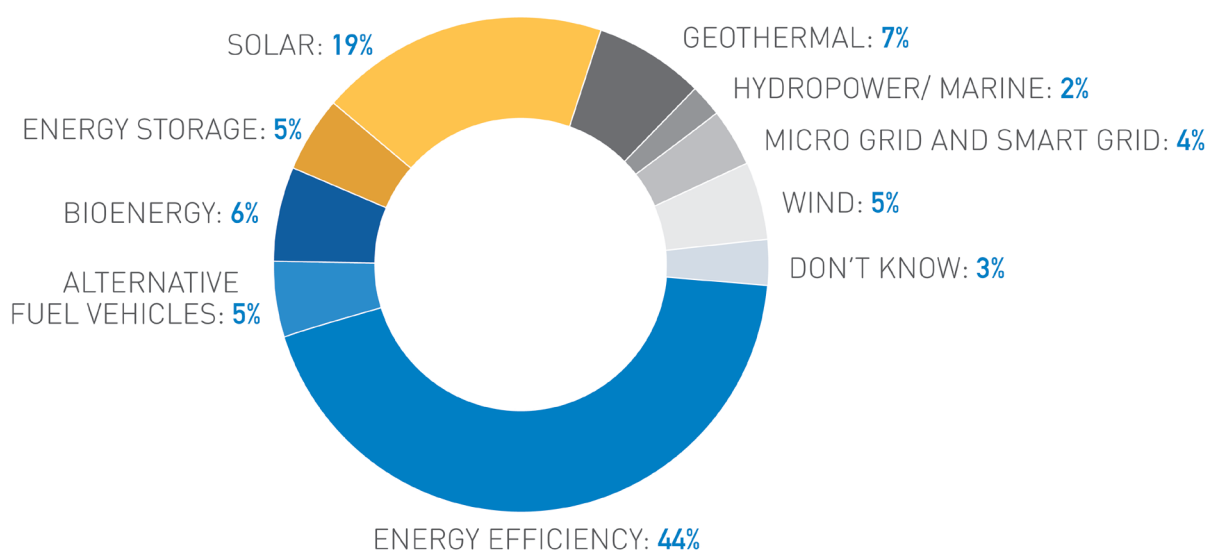


Table 3: Total Clean Energy Firms

SECTOR	COMPANIES IN SECTOR	% OF TOTAL RESPONSES
ALTERNATIVE FUEL VEHICLES	140	5%
BIOENERGY	180	6%
ENERGY EFFICIENCY	1,310	44%
ENERGY STORAGE	149	5%
GEOTHERMAL/GROUND SOURCE HEAT PUMPS	225	7%
HYDROPOWER	61	2%
MICRO GRID AND SMART GRID	131	4%
SOLAR	553	19%
WIND	136	5%
DON'T KNOW	98	3%

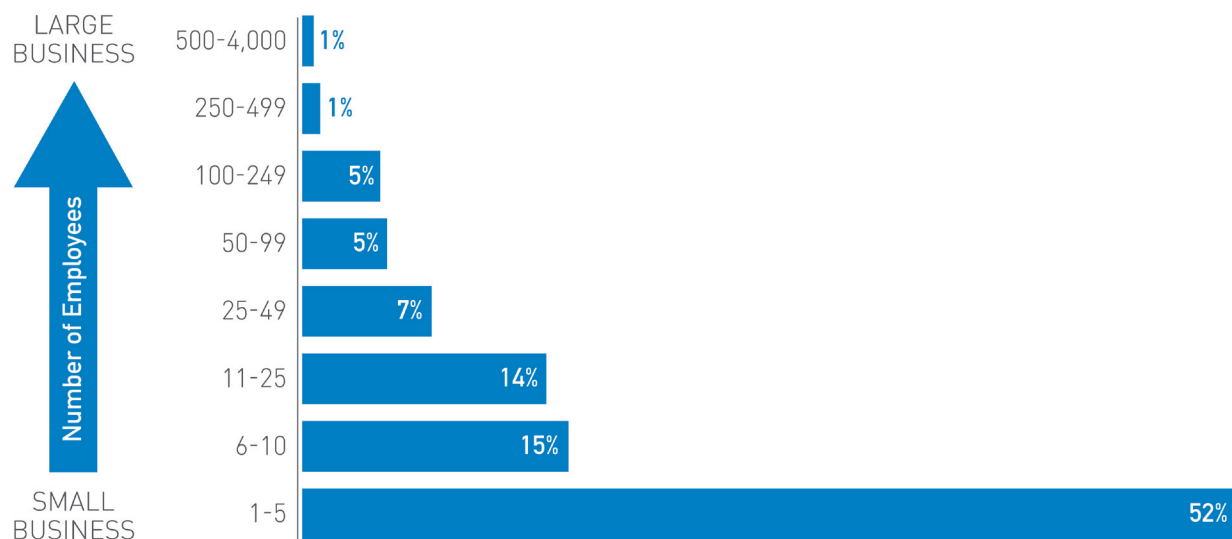


Our survey allowed firms to indicate all the sectors in which they are active, not just the one in which they spend the majority of their time. This means that each firm could indicate participation in up to nine sectors, which is why the number of firms active in each category is more than the total number of firms that are active in the industry. Of the 1,084 firms that responded to our survey, 442 indicated that they were active in at least two sectors (41 percent).

The most common sector combinations were:

- Energy Efficiency and Solar
- Energy Efficiency and Geothermal
- Energy Storage and Solar
- Solar and Geothermal
- Energy Efficiency and Energy Storage

Figure 3: Clean Energy Employment by Firm Size



Jobs



North Carolina's Clean Energy Industry provides 43,238 jobs in the state, constituting almost one percent of the 4,536,400 jobs in North Carolina in 2018, according to the Bureau of Labor Statistics.² The Clean Energy Industry is larger than 52 other industries active in North Carolina including: chemical manufacturing (43,155); furniture and related product manufacturing (39,099); and telecommunications (31,437).³

Figure 4: Total Clean Energy Jobs

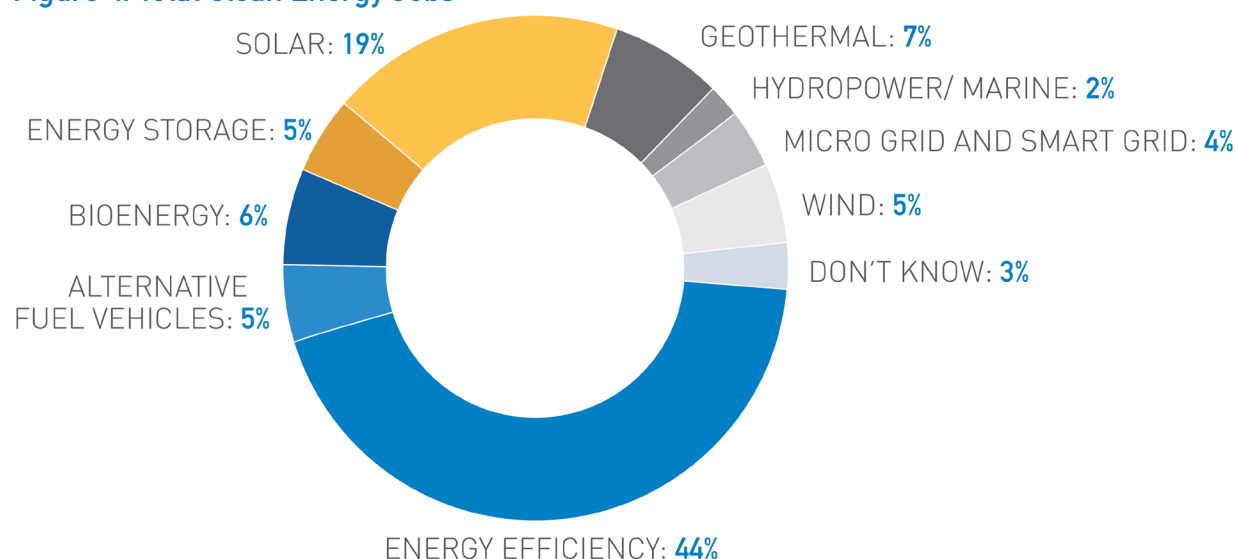


Table 4: Total Clean Energy Jobs

SECTOR	JOB IN SECTOR	% OF TOTAL JOBS
ALTERNATIVE FUEL VEHICLES	2,542	6%
BIOENERGY	1,629	4%
ENERGY EFFICIENCY	23,892	55%
ENERGY STORAGE	1,749	4%
GEOTHERMAL/GROUND SOURCE HEAT PUMPS	1,075	2%
HYDROPOWER	689	2%
MICRO GRID AND SMART GRID	746	2%
SOLAR	6,457	15%
WIND	1,062	2%
DON'T KNOW	3,396	8%



Revenue



In 2016, NCSEA reported that the Clean Energy Industry accounted for approximately \$6.4 billion of North Carolina's annual revenue. The Clean Energy Industry in North Carolina now represents approximately \$14.2 billion in annual revenue—representing a 124 percent increase from 2016 to 2018.

The Energy Efficiency sector was the highest earner among the clean energy sectors surveyed, bringing in over \$6.3 billion. The Solar sector accounted for the second-highest earnings, with almost \$3 billion in total revenue.

The largest increase in revenue occurred in the Energy Storage sector, which increased by 216 percent from 2016 to 2018. Other notable increases include Energy Efficiency, which increased by 152 percent from 2016 totals and Solar, which increased 103 percent from 2016 totals.

Figure 5: Total Clean Energy Revenue

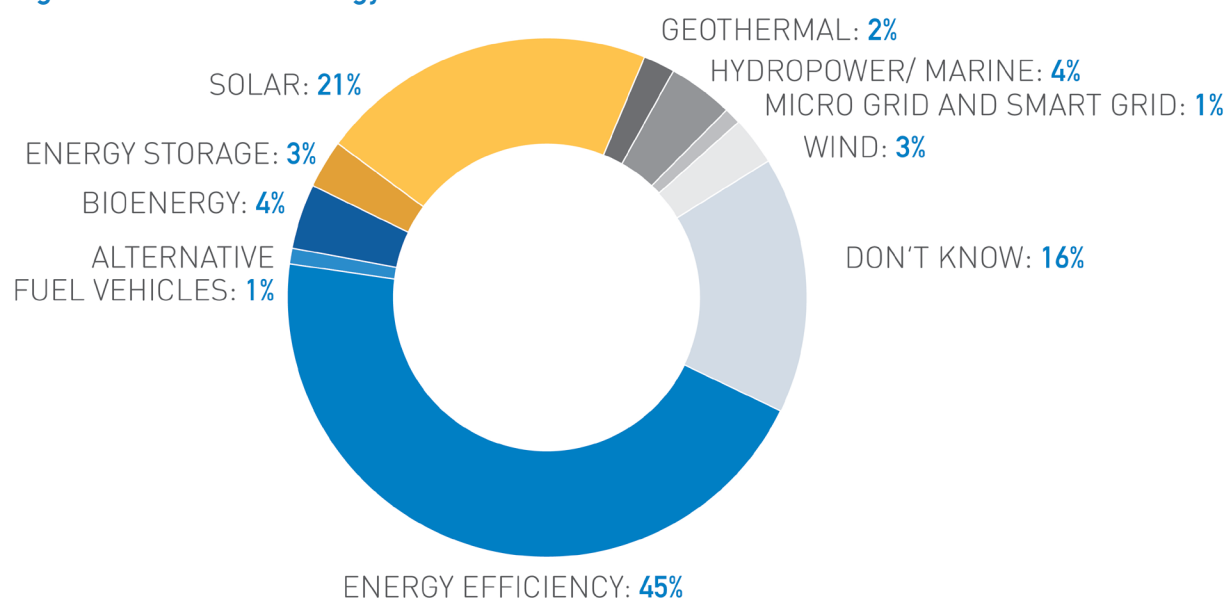
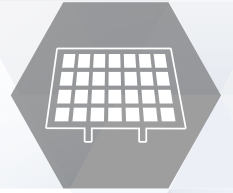


Table 5: Total Clean Energy Revenue

SECTOR	REVENUE IN SECTOR	% OF TOTAL REVENUE
ALTERNATIVE FUEL VEHICLES	\$148,978,544	1%
BIOENERGY	\$613,753,036	4%
ENERGY EFFICIENCY	\$6,359,876,709	45%
ENERGY STORAGE	\$436,022,427	3%
GEOHERMAL/GROUND SOURCE HEAT PUMPS	\$252,928,606	2%
HYDROPOWER	\$580,381,074	4%
MICRO GRID AND SMART GRID	\$148,816,554	1%
SOLAR	\$2,939,070,419	21%
WIND	\$440,216,609	3%
DON'T KNOW	\$2,333,002,772	16%
TOTAL	\$14,253,046,751	



Sectors



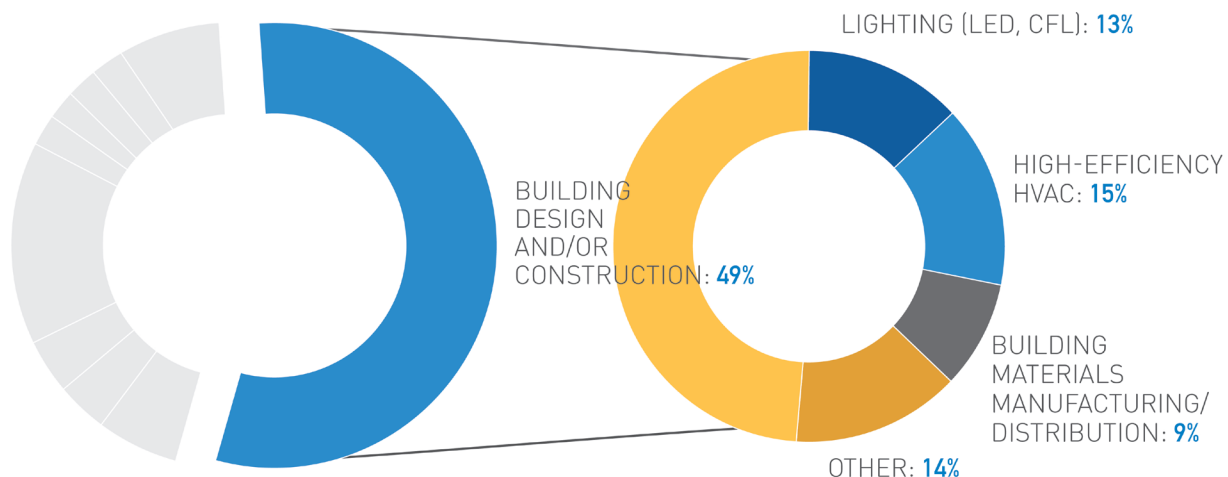
Energy Efficiency and Buildings

North Carolina's Clean Energy Industry shows 1,310 companies (44 percent) active in the Energy Efficiency sector, providing 23,892 jobs (55 percent) and \$6.35 billion in revenue (45 percent).

As the largest sector in North Carolina's Clean Energy Industry, the Energy Efficiency sector presented a challenge for surveying. To create more clarity, we divided the sector into five sub-sector groups: building design and/or construction, lighting, high-efficiency HVAC, building materials manufacturing/distribution, and other.

Figure 6: Energy Efficiency Sub-Sector Percent of Total Jobs

Energy Efficiency sector employment is primarily concentrated in Building Design and/or Construction (49 percent), with High-Efficiency HVAC at a notable 15 percent. Energy Efficiency accounts for 55 percent of the clean energy jobs in North Carolina.



Continued market interest in high performance buildings, recent innovations in electric cooperative utility efficiency programs, and possible policy actions will likely combine to further the sector's growth through 2019. If 2019's House Bill 330, *Efficient Government Buildings and Savings Act*, becomes law, all state-owned buildings would be required to reduce electricity use 40 percent from the 2003 baseline by 2025.

Energy Efficiency has been the single greatest annual contributing sector to North Carolina's Clean Energy Industry since 2008, and we expect this dominance to continue. Readers may note the significant difference between our 2018 jobs numbers and the jobs numbers from the last iteration of the Census (2016). NCSEA attributes nearly all of the increase in Energy Efficiency sector jobs to this year's more accurate reporting from NCSEA's efforts to work with the energy efficiency industry to accurately identify itself.



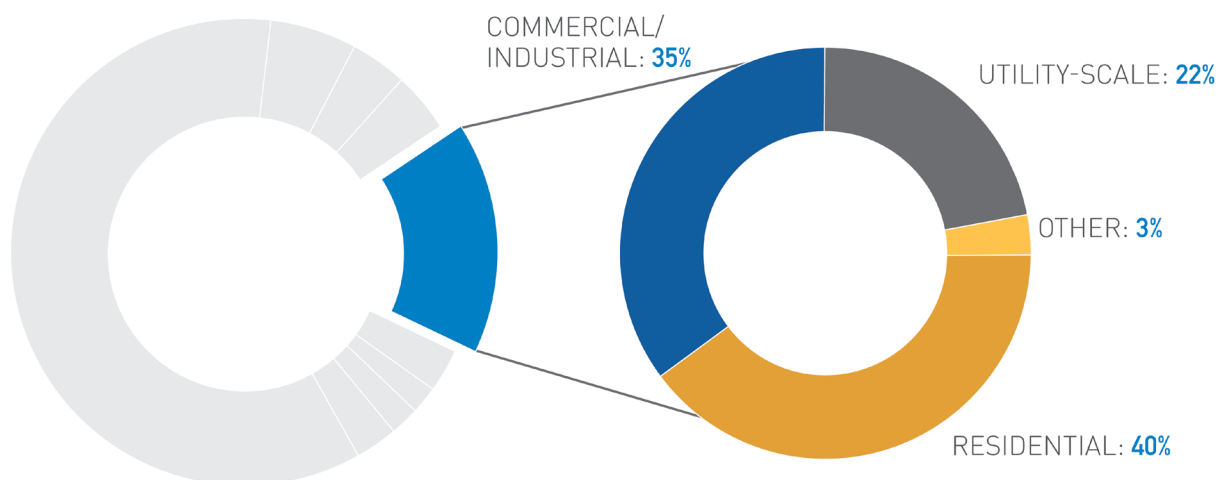
Solar

Solar is the second largest contributing sector in the Clean Energy Industry, with 553 companies (19 percent) providing 6,457 jobs (15 percent), and generating \$2.9 billion in revenue (21 percent). Just under 30 percent of the time in this sector is spent performing installation and construction.

Work in the Solar sector is greatly dependent on the size of the systems involved, so we divided this sector into the following sub-sectors: residential, commercial or industrial, and utility-scale, for additional clarity.

Figure 7: Solar Sub-Sector Percent of Total Jobs

Solar accounts for 15 percent of the clean energy jobs in North Carolina. This chart represents the breakdown of that 15 percent.



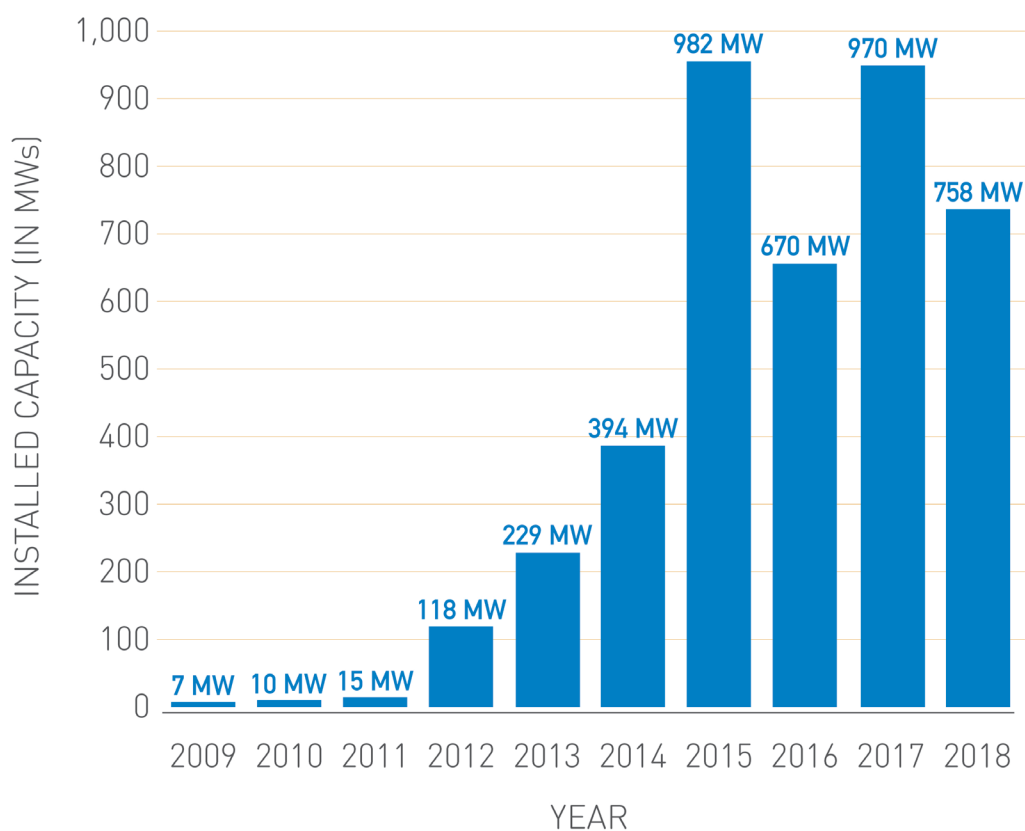
Although the Solar sector has flourished in North Carolina in the past, mostly based on growth in the utility-scale sub-sector, that growth has slowed in recent years. Structurally, the passage of North Carolina's House Bill 589 in 2017 shifted much of the utility-scale solar development in Duke Energy's service territories to a competitive procurement process, in place of the PURPA market that had enabled North Carolina to become second in the nation for installed solar capacity and the state's utilities to rank high for the presence of solar generating capacity in their territories.



The recent slowing is due to a variety of factors, including:

- Delays and shifting requirements and utility practices in the interconnection process;
- Utility concern over operational control and location of generating capacity;
- Changing power purchase agreement terms, rates, and conditions;
- Litigation, disputes, and settlements between independent power producers and utilities;
- Utility opposition to solar plus storage projects that are owned and operated by independent power producers; and
- Import tariffs on components such as solar panels and steel.

Figure 8: North Carolina Installed Utility-Scale Solar PV Capacity by Year⁴



While the competitive procurement process and standard contracts for qualifying facilities might have changed due to House Bill 589, the law also re-started a solar rebate program for residential, commercial, and non-profit customers in Duke Energy Carolinas and Duke Energy Progress territories and expressly authorized the leasing of rooftop solar. In 2018, the rebate programs led to record amounts of residential solar PV system registrations and new net energy metering customers, though still not on the order of magnitude seen in other U.S. states. Additionally, in both 2018 and 2019 the rebate programs were fully subscribed in less than three days.

However, it is unclear how much of this growth will include solar plus storage. When NCSEA surveyed residential solar PV consumers in 2017, 65 percent were interested in energy storage, but most cited cost as the reason they have not yet installed storage. As the cost of storage continues to decline, more customers are investing, and given the impact of self-generation on the interests of utility shareholders, we anticipate that the issue of rooftop solar plus storage could surface in an upcoming docket required by House Bill 589 to examine net energy metering.

In the commercial and industrial sub-sector, however, those looking to add storage to their solar array have a lack of cost-effective applications that meet the sub-sector's requirements. These requirements, such as elimination of gas generators; peak shaving to reduce demand charges; self-consumption of stored power to further meet corporate sustainability goals; and monetization of their stored solar generation each require advanced technical support and training for engineering, procurement, and construction (EPC) services interested in providing storage solutions for commercial and industrial clients. If these EPCs do not have the staffing scale to effectively provide these services, solar plus storage for commercial and industrial clients will continue to be a difficult market to reach.



Figure 9: Net Energy Metering Customers by Year⁵

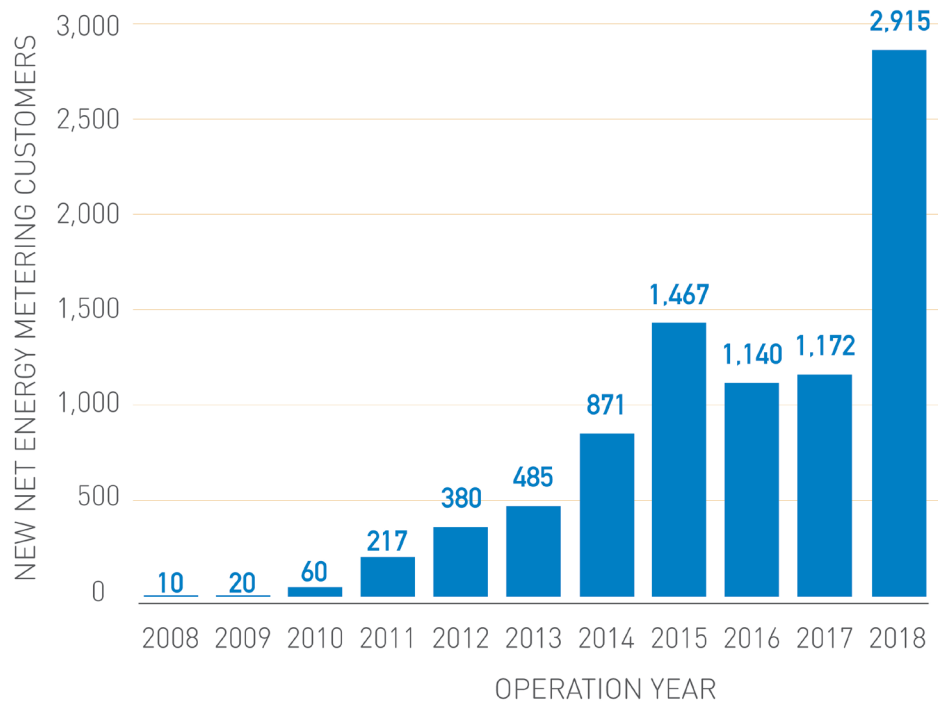
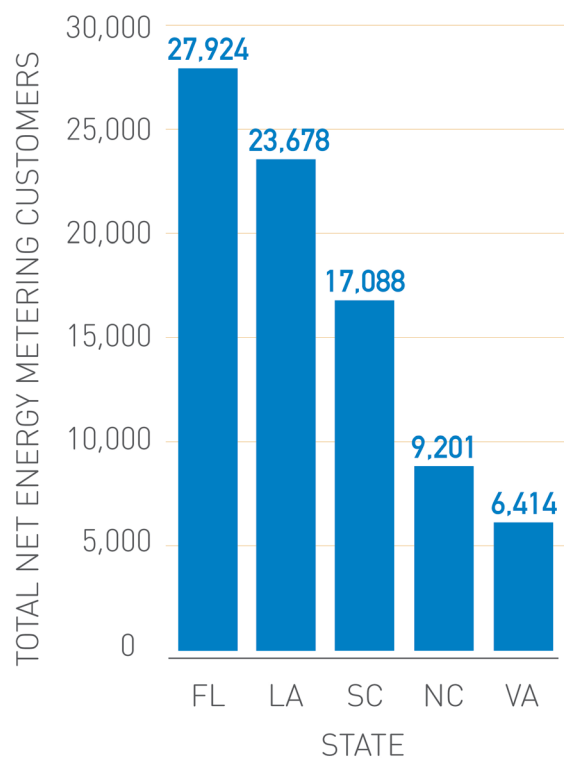


Figure 10: Net Energy Metering Customers by State⁶



Alternative Fuel Vehicles

There are 140 companies (five percent) active in the Alternative Fuel Vehicles (AFV) sector, that provide 2,542 jobs (six percent of industry total) and generate \$148 million in revenue (one percent of industry total). Almost half (47 percent) of the time spent in this sector is in engineering work. Since 2016, the number of firms participating in the sector more than doubled, and jobs in the sector nearly tripled. But results suggest the increased market presence and jobs in 2018 have not yet translated into sector revenue growth.

Declining battery costs, expanding vehicle options, and expanding charging infrastructure continued positive sector trends in 2018. Further, concern about fossil fuel emissions from non-electric forms of transportation continue to rise. In 2018, North Carolina Governor Roy Cooper issued Executive Order 80 (EO80) which, among other things, set a goal of 80,000 zero-emission vehicles (ZEV) on North Carolina roads by 2025. With a 2017 registration rate of approximately 0.94 ZEVs per 1,000 people⁷, North Carolina will need to increase the ZEV registration rate to 7.00 ZEVs per 1,000 people by 2025 (a 645 percent increase from current annual ZEV adoption) in order to achieve the transportation and emissions goals set in EO80 through ZEVs.

Such a large increase can be possible with the right policies and incentives, such as the approved allocation of over \$90 million to support electrification from the Volkswagen Settlement⁸, and House Bill 329 that would allow charging stations to directly charge EV users for the electricity they provide. Threats that could dampen ZEV growth include ongoing uncertainty in electricity regulation and the possibility of excessive increase in annual North Carolina vehicle registration fees for ZEVs. We anticipate continued near-term growth in this sector, led primarily by electric vehicles, that could accelerate as policy barriers are resolved.

Energy Storage

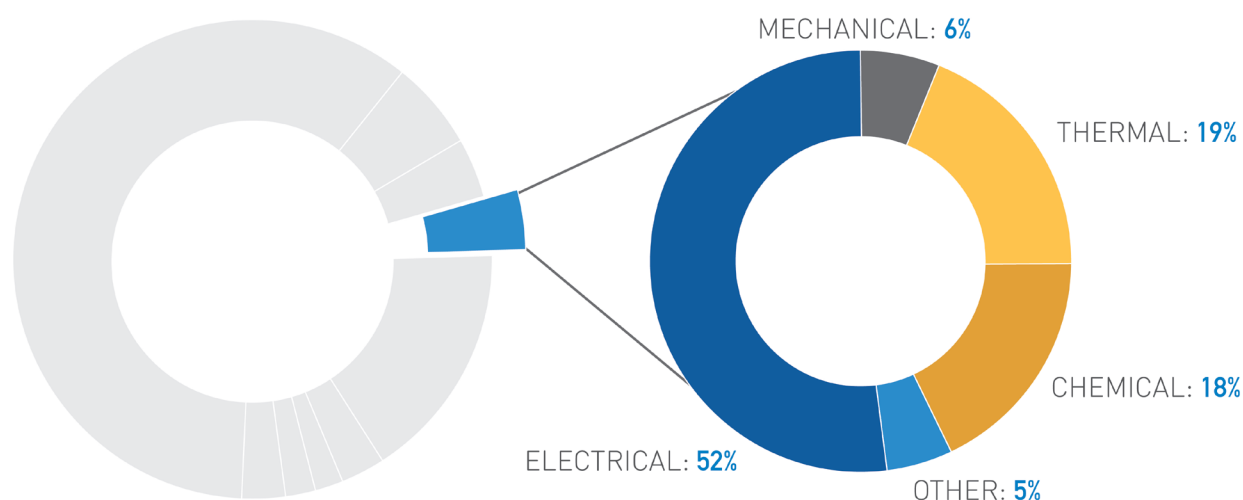
From our survey, 149 companies (five percent) work in the Energy Storage sector, accounting for 1,749 jobs (four percent) and \$436 million in revenue (three percent). Almost a third (31 percent) of time in this sector is spent in manufacturing and production.

Based on different energy storage technologies, the Energy Storage sector was divided into sub-sectors: chemical, electrical, mechanical, and thermal.



Figure 11: Energy Storage Sub-Sector Percent of Total Jobs

Energy Storage accounts for four percent of the clean energy jobs in North Carolina. This chart represents the breakdown of that four percent.

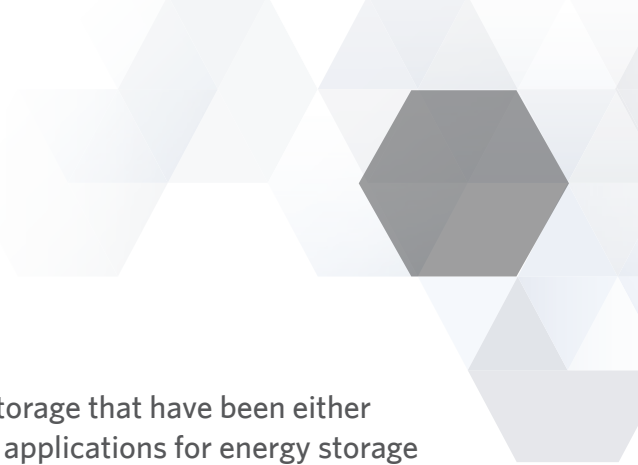


Energy storage is a rapidly evolving sector in North Carolina, with several factors presenting significant growth potential in 2019 and 2020. The steady cost decline in electrical storage, such as batteries, is now being advanced by both the electric vehicle market and deployment on both sides of the electricity customer's meter. NCSEA shows in our Southeast Storage Systems map⁹ that electrical, thermal, and chemical storage systems are installed throughout the region across a diversity of customer situations.

Recent North Carolina studies with a priority focus on electrical storage calculate the potential amount and cost of integrating gigawatts of storage capacity into the existing transmission and distribution grids, including stand-alone storage, storage with renewable energy systems, and in existing and new buildings.^{10, 11}

A significant constraining factor in North Carolina is regulatory uncertainty over how storage will be allowed and valued in terms of avoided cost¹² and interconnection, and lack of clarity as to how regulated utilities will impact deployment through both process and power purchase agreements. The combination of contentious issues and a lack of rules for pricing grid services presents a challenge for all market actors to accurately price the services storage can provide in North Carolina.





Nevertheless, there are approximately 32.9 MW of energy storage that have been either announced or commissioned in North Carolina.¹³ Residential applications for energy storage are becoming more common, too. Recent extreme weather events have accelerated an already increasing number of homeowner inquiries into storage and rooftop solar plus storage to maintain access to reliable and clean electricity service. NCSEA Members Yes! Solar Solutions and Southern Energy Management became the first certified installers of the Tesla Powerwall in the state.

Interest across all market actors is anticipated to accelerate for electrical storage as battery costs decline further and concerns over weather, comfort, social values, and rising utility bills intensify. How North Carolina regulatory rules and utility business practices take shape may be the most significant near-term factor affecting cost-effective deployment and use of storage and related energy services across all types of consumers and utilities in 2019 and 2020.

Bioenergy

Bioenergy in North Carolina is supported by 180 companies (six percent) that provide 1,629 jobs (four percent) and generate \$613 million in revenue (four percent). The two most highly reported activities in this sector were in electricity generation at 24 percent and fuel sales at 23 percent. NCSEA's biogas working group and participating stakeholders made some progress in 2017 and 2018, but significant barriers remain for interconnection, directed biogas, and corporate procurement in addition to concerns about environmental performance and societal impacts.



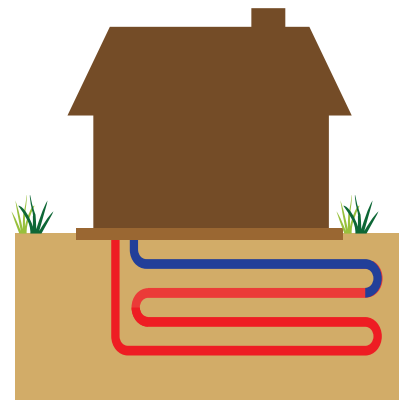
Although North Carolina's Renewable Energy Portfolio Standard (REPS) has a specific carve out for electric generation derived from hog and poultry waste, meeting the requirements has proven difficult, due to ongoing regulatory issues, cost, unresolved environmental justice concerns, and utility business practices. In March 2018, following an extensive utility pipeline interconnection wait, the Optima-KV system in Duplin County, developed by NCSEA member Cavanaugh and Associates, began delivering biogas produced from five hog farms to two Duke Energy power plants. This project was the first instance of renewable biogas feeding into the North Carolina pipeline system.



Thanks to the efforts of advocates of the recycling of undervalued or under-utilized organics into renewable natural gas, the pathway for developing biogas projects and resources in North Carolina has progressed, albeit slowly. In mid-2018, the North Carolina Utilities Commission enacted rules to slow and cap the pace of biogas development in North Carolina, at least with respect to the largest gas pipeline utility operating in the state, despite the same rules requiring complete parity of renewable natural gas with geologic-derived natural gas.¹⁴ The regulatory hurdles and lack of natural gas infrastructure in areas showing the greatest promise for biogas resource development will continue to slow development in North Carolina, and artificially raise the floor on the minimum size of a project that can likely be economical; leaving many biogas resource managers, such as most North Carolina farmers, incapable of participation in the market.

Geothermal

The proportion of companies (225 or eight percent) active in the Geothermal sector is far greater than the sector's 1,075 jobs (three percent) and nearly \$253M in revenue (two percent). The Geothermal sector spends almost a third of its time performing installation and construction. Because North Carolina does not have deep geothermal vents commonly used elsewhere in the world to generate electricity, North Carolina's geothermal sector is technologically focused on geothermal ground source heat pumps. Geothermal systems have a relatively quick payback on investment and geothermal system owners are most likely among clean energy consumers to consider future electricity costs as "very important" in their buying decision.¹⁵ We provide a description of how geothermal ground source heat pumps in North Carolina work on our [website](#).¹⁶



The Geothermal industry activity captured in our survey is primarily the result of energy efficiency and renewable energy installation firms that offer geothermal products in addition to other energy efficiency and renewable energy options.

We see three likely reasons for the increase in number of companies reporting activity in the geothermal sector. First, NCSEA's *2018 Consumer Adopter Survey* showed that across consumers who adopted either solar PV, solar thermal, electric vehicle, energy storage, and/or geothermal systems, the greatest proportion of geothermal customers made major energy efficiency improvements ahead of or at the same time as their geothermal installation, and are most likely to be in the economic middle class.¹⁷



Second is the increase in number of energy efficiency firms surveyed this year. Third is due to the large up-front capital cost of a geothermal installation. Once the North Carolina tax incentive for geothermal installations expired at the end of 2015, the regulated utilities' ongoing lack of priority on reducing winter and summer peak electricity demand has made it difficult for a firm to maintain a dedicated geothermal well drilling and system installation business model in North Carolina. These factors also help to explain the disproportionately small number of jobs and revenue compared to the number of companies active in the Geothermal sector.

We do not anticipate that regulated utilities will focus on program offerings to significantly reduce winter and summer peak load using geothermal, or in general. Instead, we anticipate subsequent electricity rate and bill increases could translate into price-responsive expansion of geothermal consumer demand across all electricity and natural gas customer types. There are already slightly more installed geothermal installations in North Carolina than solar PV, according to the RTI 2019 Update report.¹⁸ If North Carolina were to significantly reform electricity regulation to align consumer and utility shareholder interests, geothermal has the potential to continue to be as prevalent as rooftop solar PV installations.

Wind

Currently, 136 companies (five percent) in the Clean Energy Industry are active in the wind sector. In addition, the wind sector boasts 1,063 jobs and \$440 million in revenue. Almost 80 percent of the time spent in this sector is in manufacturing and production.

When both technical potential and cost of construction are combined, North Carolina has the largest offshore wind potential on the Atlantic Coast at 37,900 MWs, and potentially up to 1,000 MWs of total coastal onshore wind potential.¹⁹ However, recent growth has been stymied by an 18-month wind permitting moratorium that expired at the end of 2018 that a handful of legislators are attempting to renew.



Amazon Wind Farm US East, Elizabeth City, NC



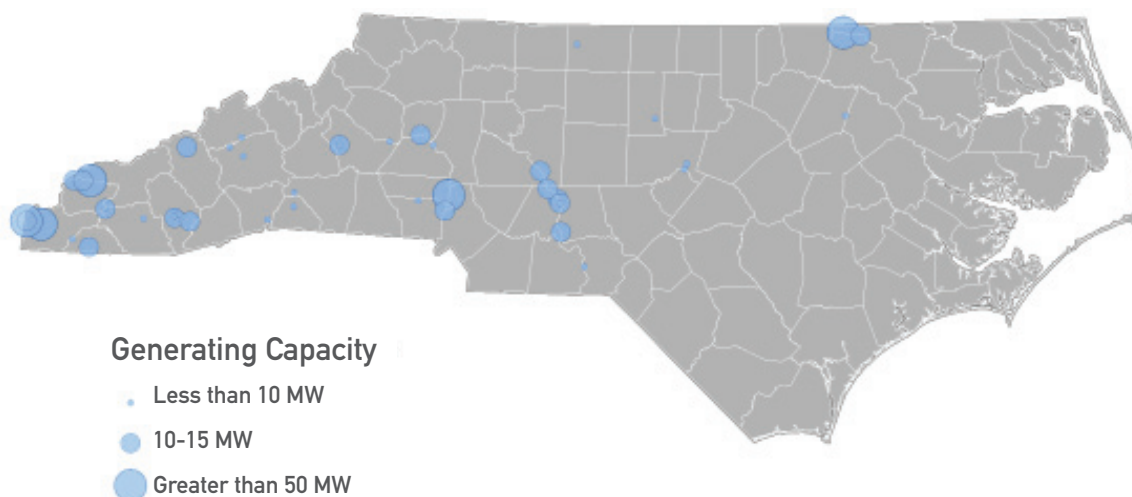
Despite these barriers, the Amazon Wind Farm US East, located in Pasquotank and Perquimans counties and owned by Avangrid Renewables, is the largest wind installation in the Southeast. In addition to the Amazon wind project, 27 North Carolina companies play a role in wind component manufacturing.²⁰

If policymakers allow the sector to take advantage of the decreasing costs of the technology and favorable natural resources that our state has to offer, we expect the number of companies, jobs, and revenue to increase substantially in the near- and mid-term. The installed cost of offshore wind power generation continues to decline. Phase two of the Vineyard Wind project off the coast of Massachusetts, scheduled to begin construction in 2019, anticipates a levelized cost of energy around \$65/MWh.²¹ Now that offshore wind lease blocks could be developed within the next five to eight years, initial, but very limited, market activity could begin in North Carolina.

Hydropower

Our survey identified 61 companies (two percent) active in the Hydropower sector, accounting for 689 jobs (two percent) and \$580 million in revenue (four percent). Currently, almost 37 percent of time in this sector is spent in manufacturing and production. We do not expect much further growth in the Hydropower sector. While North Carolina hydroelectric sources produced the second largest amount of electricity from a clean source in 2018,²² any future sector growth will likely not be driven by power production as there is little to no additional potential for utility-scale hydropower electric generating capacity to be added in North Carolina, and small run of river hydropower generation applications can be similarly limited.

Figure 12: Map of North Carolina Hydropower Locations



Micro Grid and Smart Grid

The Micro Grid and Smart Grid sector of the Clean Energy Industry accounts for 746 (two percent) jobs and \$148 million in revenue (one percent). Our survey indicated that 131 companies (five percent) reported being active in the Micro Grid and Smart Grid sector. Professional or consulting services account for 35 percent of the time spent in this sector.

Micro grids are currently being deployed by individuals, such as at Butler Farms in Harnett County; for communities, such as on Ocracoke Island and in Hot Springs, North Carolina²³; and by the military, all to ensure that electricity service is sufficiently reliable and resilient.

NCSEA acknowledges that we collected limited data on the Micro Grid and Smart Grid sectors in the 2018 survey and will consult with partners to determine how best to address this under-reported area moving forward.

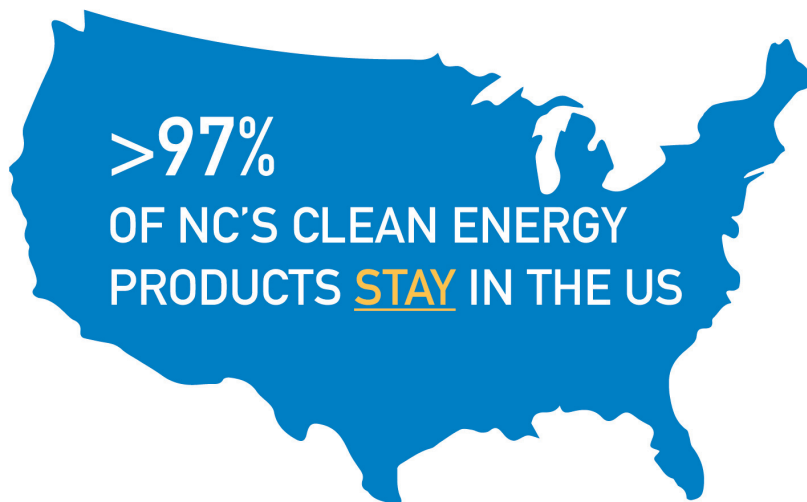


Exports



While a vast majority of firms indicated that they did not export anything outside of the United States, a few firms indicated that they engaged in international exports. These firms represent a small but important piece of our Clean Energy Industry.

Figure 13: North Carolina's Clean Energy Products



Demographic Data



In the 2018 North Carolina Census, NCSEA measured demographic data of respondents for the first time. NCSEA believes that demographic data is integral to a holistic understanding of North Carolina's clean energy economy. We believe that for the North Carolina Clean Energy Industry to realize its full market potential, the demographics of each firm's workforce and those who hold financial ownership and influence in the firms should be increasingly representative of the markets they serve. We look forward to continuing to work with our members and partners to achieve a more demographically representative Clean Energy Industry.

It is important to note that the demographic questions on the survey were not required. 1,040 respondents answered the survey question about race, and 1,045 respondents answered the question about sex. Due to the nature of the data, we are unable to report modeled demographic information (as we are for jobs and revenue numbers). As such, we can only report on demographic data that respondent companies volunteered.

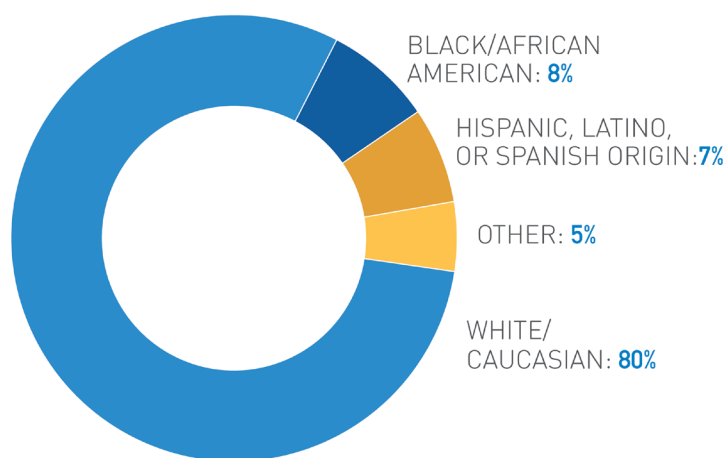
We are confident that there is more information to be gleaned from respondents about the demographic make-up of the Clean Energy Industry. First, we need to improve our own demographic surveying methods and we look forward to working with our members and partners to further enhance our line of questioning. Next, we need more firms to respond and provide that data so we may more fully understand the demographics of the industry. NCSEA is excited to work with companies in the Clean Energy Industry to increase response rate to our demographic questions and provide analysis that will help strengthen businesses through more diverse and inclusive teams and practices.

Race

The companies that provided demographic information reported that approximately 80 percent of their employees were White/Caucasian, eight percent were Black/African American, seven percent Hispanic, Latino, or Spanish origin, and five percent Other. The Bureau of Labor Statistics (BLS)²⁴ has slightly different reporting categories for race and ethnicity, so it is difficult to perform a side-by-side analysis of all our data with their data. However, the 2018 annual workforce averages for North Carolina, according to BLS preliminary data, show that the overall workforce is 72 percent white and 22 percent Black/African American.



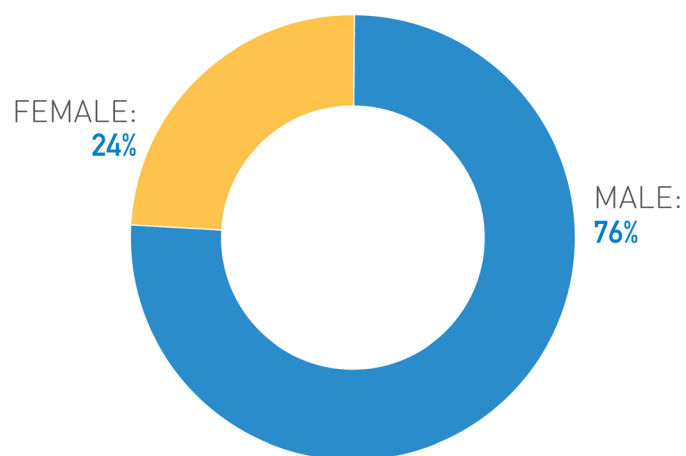
Figure 14: Race Breakdown at North Carolina Firms




Sex

Based on BLS data from 2018, the workforce in North Carolina is 52 percent male and 48 percent female.²⁵ Based off respondents who volunteered this information in our survey, North Carolina's Clean Energy Industry employs a higher proportion of males (76 percent) than the overall workforce in our state. The difference between the overall workforce data and Industry data is most impactful when looking at female employment—the population of females employed by the Clean Energy Industry is just 24 percent.

Figure 15: Sex Breakdown at North Carolina Firms





These results indicate that the Clean Energy Industry in North Carolina is demographically similar to other Science, Technology, Engineering, and Math (STEM) fields. According to data from Pew Research Center²⁶ on the representation of women in STEM jobs, physical science jobs, and computer jobs have a female representation rate average of 39 percent and 25 percent respectively. With our survey showing only 24 percent of women in the Clean Energy Industry in North Carolina, it is clear that the importance of programs and policies designed to encourage women to join the Industry and support those already in the field cannot be understated. NCSEA's Women in Clean Energy project aims to move this goal forward by providing a space of camaraderie and support for women in North Carolina's Clean Energy Industry.



Appendix



Methodology

Advances in relevant clean energy technologies lead to a rapidly evolving Clean Energy Industry. To account for these evolutions, NCSEA made slight modifications to the sector and activity categories from previous Census surveys. These changes involved reorganizing the sector and activity categories to more accurately represent the current state of the industry in North Carolina. Additionally, this year's Census included voluntary demographic questions about a company's employees.

In previous surveys, NCSEA reported employment totals by full time equivalents or FTEs. This year, for ease of reporting and comparison, NCSEA chose to use a straight job count. A significant contributing factor to this decision is the belief that any time spent working in the Clean Energy Industry should be acknowledged.

Previous iterations of the survey involved a combination of phone banking and online survey completions. These strategies historically resulted in successful data collection, and NCSEA employed these same strategies for the 2018 survey.

Methodology to model firms that did not respond to the survey

While most of the companies that NCSEA contacted responded and completed the survey, some did not. NCSEA is confident that the contact list we generated is inclusive of the entire North Carolina Clean Energy Industry, and to report on metrics representative of the entire industry, we modeled responses from non-responsive firms that are assumed to be active in the industry and combined those with data collected directly from responding firms.

Total Companies Involved in the Industry

NCSEA took the total number of companies that responded to the survey and identified the proportion that indicated that they were in the Clean Energy Industry. To estimate the number of companies that we were unable to reach that would also be active in the industry, we applied that proportion to the number of companies that did not respond at all. The total number of firms reported is the result of combining the companies that initially indicated that they were in the industry plus the estimated number.



Calculating Annual Revenue of Responding Firms

The survey asked firms to report their total annual gross revenue which is attributable to the Clean Energy Industry in North Carolina, by selecting from the following ranges:

- Less than \$100,000
- \$100,000 to less than \$250,000
- \$250,000 to less than \$500,000
- \$500,000 to less than \$1 million
- \$1 million to less than \$2.5 million
- \$2.5 million to less than \$5 million
- \$5 million to less than \$10 million
- \$10 million to less than \$25 million
- \$25 million to less than \$50 million
- \$50 million to less than \$100 million
- \$100 million to less than \$250 million
- \$250 million to less than \$500 million
- \$500 million or more
- Prefer not to answer

Firms were then assigned a revenue number equal to the median value of the range they selected. Firms falling in the “less than \$100,000” bracket were classified as \$50,000. Firms in the “\$500 million or more” bracket were classified as \$500 million.

Total Firm Distribution

NCSEA took a systemic sample of non-responding companies from the list of all the companies that did not respond to the survey. Then, for each company in the sample, NCSEA identified if the company was active in the Clean Energy Industry and if so, the sectors the company was active in based on the information available online about them. After collecting that information, NCSEA calculated the distribution of the sampled non-respondents across all sectors in the industry. The overall firm distribution numbers are based on the sum of the number of companies that indicated they were active in each sector in the survey and the distribution of the firms that were modeled to be active in each sector based on our sample of non-respondents.



Jobs

To estimate the number of jobs for each sector, NCSEA calculated a 90 percent trimmed mean of jobs per responding company that is active in each sector based on the actual responses collected. This trimmed mean was then multiplied by the number of responding firms in the modeled sector distribution to estimate the total number of jobs in each sector from the firms that did not respond but are expected to be in the industry. The total number of jobs is this calculation plus the sector totals from the actual responses.

Revenue

To estimate revenue, NCSEA used the same methodology as estimating jobs and a 90 percent trimmed mean of revenue per responding company.

Survey Design

The 2018 North Carolina Clean Energy Industry Census consists of 13 questions and requests information on North Carolina businesses engaged in any of the identified sectors in North Carolina. This information ranges from questions about the sectors in which the businesses work to demographic information about employees that work for those businesses. Together, these help to create a more comprehensive understanding of the companies in North Carolina's Clean Energy Industry.

Performing the Survey

First, NCSEA compiled a preliminary list of companies, organizations, and institutions potentially conducting business in the Clean Energy Industry in North Carolina. This list was compiled from the following sources:

1. List of firms maintained by NCSEA
2. Lists maintained and shared with NCSEA by other organizations
3. Publicly available industry websites
4. Online searches

For firms deemed to be within the scope, NCSEA identified a primary and secondary contact along with their contact information. The list was then delivered to GreatBlue Research and North Carolina State University Center for Urban Affairs and Community Services (CUACS) to conduct outreach. GreatBlue Research performed the initial automated outreach and data collection, while CUACS conducted phone interviews to complete the survey. The survey closed on January 30, 2019.



Thank You

NCSEA thanks our partners and foundation supporters, whose support was vital to ensuring this project's success.

Coastal Credit Union

Energy Foundation

Z. Smith Reynolds Foundation



Z. Smith Reynolds
FOUNDATION

NCSEA is grateful for the participation and support of our members that helped make this research possible, including but not limited to our advanced industry members.



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