



Rhode Island Clean Energy

2015 INDUSTRY REPORT

Prepared for Commerce RI and the
Rhode Island Office of Energy Resources (OER)
by BW Research Partnership



Rhode Island Sees Increase in Number of Clean Energy Jobs, Evidence of Continued Growth

The Executive Office of Commerce and the Rhode Island Office of Energy Resources (OER) are pleased to present the results of the *2015 Rhode Island Clean Energy Jobs Report*. As

a leader in energy efficiency, Rhode Island has taken bold action to support and grow clean energy jobs while reducing the state's carbon footprint. Governor Raimondo and the General Assembly have demonstrated visionary leadership by implementing local and regional policy initiatives that enable Rhode Island to support local clean energy sector and job growth opportunities; work with its neighbors in pursuit of longer-term energy infrastructure solutions; place energy efficiency and least-cost procurement at the heart of our energy supply strategy; create competitive processes that balance cost concerns with the expansion of clean energy resources needed to diversify supply; and advance important environmental goals.

The report finds that Rhode Island's clean energy economy currently supports 9,832 jobs, a remarkable fact considering that 40 percent of firms began providing clean energy services in just the last five years. This sector of the state's economy added 613 jobs over the last 12 months and should continue to grow -- with an additional 1,600 jobs new clean energy jobs projected in the next 12 months.

Small business is a pillar of our economy, and the clean energy sector illustrates the vitality of the small business sector within our borders: some 87 percent of clean energy firms in Rhode Island employ fewer than 25 employees.

Moreover, employment in the clean energy space is representative of Rhode Island's diverse population, with higher than average employment of ethnic and racial minorities, veterans, and older workers. Of clean energy hires in the past 12 months, 36.6 percent were ethnic or racial minorities, 21.8 percent were over the age of 55 and 14.6 percent were veterans. These impressive numbers reflect the diversity of our state and its workforce. However, as our state looks to support continued growth in the clean energy sector, we are mindful that there is room for improvement. Rhode Island is committed to gender equality and aims to attract more talented, skilled women to this important segment of the workforce.

We are grateful to Governor Raimondo and the General Assembly for their commitment to leading Rhode Island towards a secure, cost-effective, and sustainable energy future. Investments in this growing part of our economy will create jobs, expand opportunities for small businesses, and reduce our state's carbon footprint. We must also continue to work closely with private and public stakeholders to create clean energy jobs to spur economic growth, increase the reliability and security of our energy supply, reduce energy costs, mitigate price volatility, and improve environmental quality. Rhode Island is a leader in energy efficiency and renewable energy -- and we aim to enhance that reputation in the years ahead.

Sincerely,

Marion Gold
Commissioner
Office of Energy Resources

Stefan Pryor
Rhode Island Secretary of Commerce

Acknowledgements

The 2015 Rhode Island Clean Energy Industry Report is the result of an extensive research process that included a survey of more than 678 respondents (more than 4,400 potential respondents were contacted). The Rhode Island Office of Energy Resources and the Executive Office of Commerce would like to thank all of the respondents' for engaging with us to gather this important data. Researchers could only gather this data because of respondent's willingness to generously share their time and insights.

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I. Executive Summary

Although a recent addition to statewide business ventures, Rhode Island's clean energy economy already supports 9,832 jobs across 1,295 business establishments. The sector grew by 6.6% between 2014 and 2015, creating an additional 613 new jobs, significantly faster than overall Rhode Island employment growth of less than 1% over the same period.¹ While only 40% of firms began conducting clean energy services in just the last five years, the industry supports 2.1% of all jobs in Rhode Island and employers expect to add an additional 1,600 new workers, a nearly 17% increase by 2016.

Installation represents the largest value chain activity²; nearly 54% of clean energy employees, or 5,259 workers, support this clean energy subsector. The industry is largely involved in energy efficiency and building envelope retrofits, employing a majority (52.5%) of the clean energy workforce.³ Renewable energy accounts for 1,000 employees, or 11% of the workforce.

The sector is dominated by small businesses; a majority (87%) of establishments employ fewer than 25 employees and nearly 61% report five or fewer workers. Clean energy supports opportunities for firms in traditional industries, as many businesses do not earn revenue from clean energy activity alone. Only 24.1% of firms report earning 100% of their revenue from clean energy products and services and about one-third (33.5%) noted less than a quarter of business from clean energy activity.

The state has a significant export market. While more than two-thirds (68.1%) of clean energy firms report a primarily in-state customer base, nearly 32% export clean energy products and services outside the state. The Ocean State also has a fairly localized supply chain, as nearly 43% of firms support in-state vendors and suppliers and 30% report suppliers in other parts of New England.

Clean energy businesses overwhelmingly cite the importance of consumer financial incentives. Nearly 72% of firms note that financial incentives have the greatest impact on the adoption of clean energy goods and services; reported reasons for past growth similarly include customer rebates (17.6%) and other financial incentives (16.2%). About 22% of firms added that lack of consumer incentives are currently the greatest barrier to growth.

Rhode Island's clean energy industry supports employment across a range of experience and education. About 56% of new hires are experienced, but nearly 44% were entry-level workers. While 38% of new workers have a high school diploma, recent hires with a high school diploma, post-secondary certificate, or associate's degree comprise nearly 52% of the workforce. About 35% have a bachelor's degree and 13% have a graduate degree.

¹ Current Employment Statistics, Bureau of Labor Statistics.

² Value chain activities are defined as installation, engineering and research, consulting and finance, sales and distribution, manufacturing, and other.

³ Clean energy industry sectors include energy efficiency and building envelope (smart grid and energy storage), renewable and efficient heating and cooling, renewable energy (electric power generation), alternative transportation, and other.

II. Introduction

Rhode Island's clean energy economy highlights a promising future. This past year, the American Council for an Energy Efficient Economy (ACEEE) ranked Rhode Island the third most energy efficient state in the nation, an advancement from its ranking as number six in 2013. The State received high marks for energy efficiency policies and programs, particularly its stringent energy codes, effective enforcement, and high compliance rates. In 2013, the State adopted the latest 2012 International Energy Conservation Code (IECC) with mandatory statewide enforcement for commercial and residential buildings.⁴ This past May, National Grid named the Rhode Island number one in the nation for electricity savings as a percentage of demand.⁵

Statewide clean energy leadership is not limited to energy efficiency. In 1997, the state created a Renewable Energy Fund; currently under the direction of Commerce RI, the fund provides grants and loans for renewable energy projects and demand-side management.⁶ In 2014, the Rhode Island General Assembly passed the Renewable Energy Growth (REG) Program. The REG program launched in June 2015 and will be in place over the next 4 years. The program will provide long-term performance-based incentives for small- to large-scale renewable energy projects.⁷ The state's governor and treasurer, Gina Raimondo and Seth Magaziner, proposed the creation of the Rhode Island Infrastructure Bank (RIIB) in the FY2016 Rhode Island State Budget. The RIIB will finance both local job creation and the statewide shift to clean and efficient energy production. In June 2015, the Rhode Island General Assembly overwhelmingly passed and supported the budget article; RIIB and associated renewable and efficiency energy programs scheduled to launch in 2016 including the extension of the State's Least-Cost procurement law until the end of 2023.⁸

Given recent policy efforts, as well as existing and upcoming programs designed to foster clean energy growth, the Rhode Island Office of Energy Resources and Commerce RI commissioned a study to determine the size and scope of the state's clean energy industry. This report provides data on both business establishments and employees that are directly engaged in the research, development, manufacture, sale, distribution, installation, or maintenance of energy efficiency and building envelope (including smart grid and energy storage), renewable energy, renewable and efficient heating and cooling, and alternative transportation.

The data in this report was collected from a comprehensive and representative sample of businesses throughout Rhode Island. BW Research Partnership, an independent research organization that has conducted similar studies in eleven other states, placed 4,450 telephone calls and sent 679 emails. A total of 728 employers provided information

⁴ 2014 State Energy Efficiency Scorecard (www.aceee.org)

⁵ http://www.nationalgridus.com/aboutus/a3-1_news2.asp?Document=9493

⁶ <http://programs.dsireusa.org/system/program/detail/461>

⁷ <http://programs.dsireusa.org/system/program/detail/5523>

⁸ <http://www.ginaraimondo.com/sites/ginaraimondo/files/gina-raimondo-infrastructure-plan.pdf>

regarding their clean energy activities, resulting in a margin of error of +/-3.31% at a 95% confidence interval. For more detailed information, please see Appendix A.

III. Industry Overview

Rhode Island is home to a significant – and expanding – clean energy industry

At the end of the first quarter of 2015, Rhode Island’s clean energy industry employed 9,832 clean energy workers⁹ at 1,295 business establishments¹⁰. Between the first quarters of 2014 and 2015, clean energy employment increased by 6.6%, for an additional 613 new jobs. This growth rate was 3.6 times greater than Rhode Island’s overall employment growth of 1.8%. The state’s clean energy cluster supports 2.1% of all jobs in Rhode Island¹¹; this is the fourth highest percentage of the twelve states studied using BW Research methodology.¹² For comparison, the state’s two largest industries, healthcare and tourism¹³, respectively accounted for 16.9% and 11.5% of statewide employment in the first quarter of 2014. Between the first quarters of 2014 and 2015, the healthcare industry shrank by 0.1% and hospitality grew by only 0.2%.¹⁴

Of the more than 9,800 clean energy workers in the state, 69.6% spend a majority of their time on clean energy activities, while 63.7% spend all of their time delivering clean energy products and services, such as solar panels, air and ground source heat pumps, energy efficient lighting and building materials, wind turbines, and electric vehicles and components.

Rhode Island employers are optimistic about the industry’s future growth, expecting 1,600 new workers by the end of the first quarter in 2016. This represents a 16.7% annual increase, pushing the state’s total clean energy workforce to a projected 11,474 employees.¹⁵

⁹ Defined as workers who are involved in the clean energy segment of business.

¹⁰ Defined as firms that are directly engaged in the research, development, manufacture, sale, distribution, installation, or maintenance of energy efficiency and building envelope (including smart grid and energy storage), renewable energy, renewable and efficient heating and cooling, and alternative transportation.

¹¹ Current Employment Statistics, Bureau of Labor Statistics

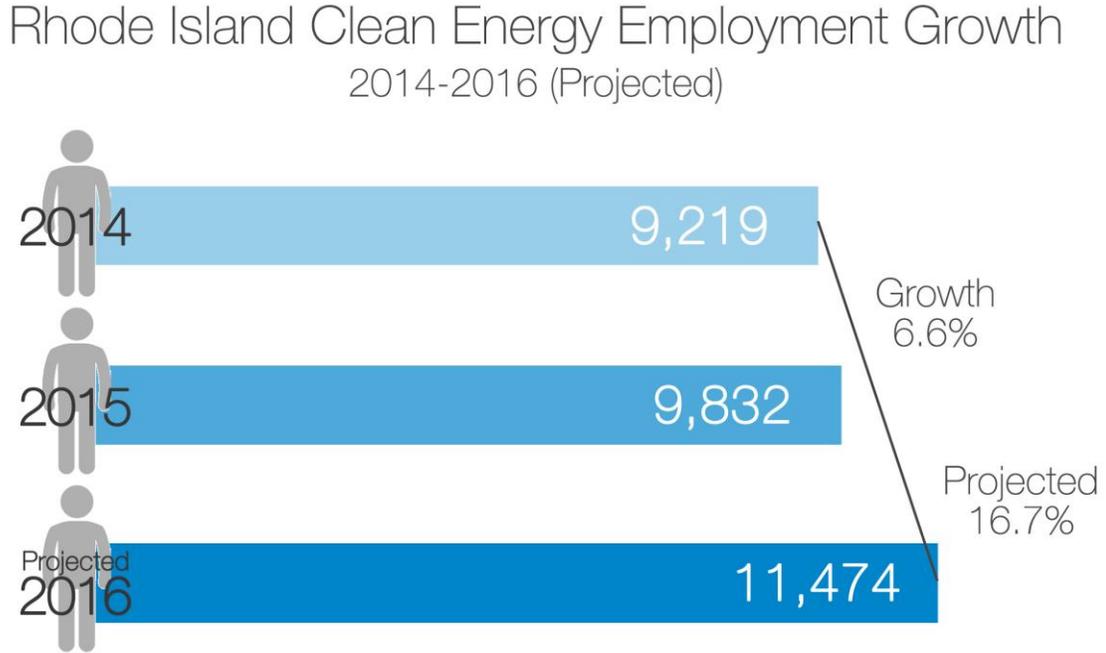
¹² Rhode Island ranks behind only Vermont, California and Massachusetts, but ahead of Florida, Ohio, Pennsylvania, Iowa, Missouri, Tennessee, and Illinois.

¹³ Defined as “leisure and hospitality”

¹⁴ Rhode Island Department of Labor and Training, Labor Market Information

¹⁵ While this represents employers’ best estimates of their growth over the coming year, many factors contribute to employment growth. The reported projections should therefore be seen as a general optimism among employers as opposed to a definitive projection.

Figure 1: Rhode Island Clean Energy Employment Growth, 2014 – 2016 (projected)

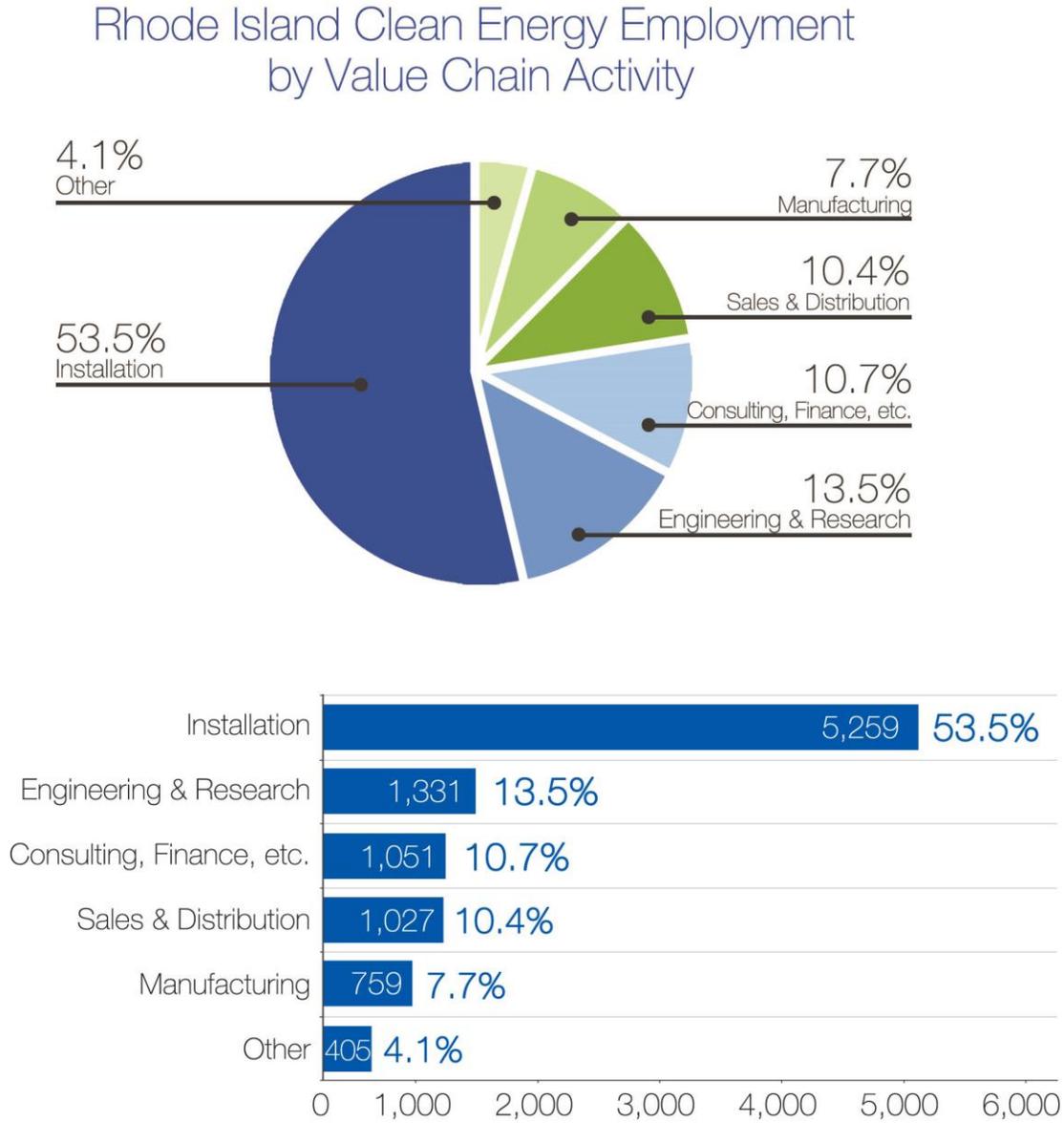


Clean energy installation accounts for a majority of the industry's workforce

Over 5,000 Rhode Island employees conduct work in renewable and efficient energy installations; comprising 53.5% of the state's clean energy workforce. This is significantly higher than Massachusetts (24.3%), which has a much greater focus on innovation and export industries, and Vermont (39%), but compares to Illinois (55.2%).¹⁶ Engineering and research accounts for 13.5% of workers, while consulting and finance and sales and distribution comprise 10.7% and 10.4% respectively.

¹⁶ <http://images.masssec.com/reports/Web%20Optimized%202014%20Report%20Final.pdf>;
[http://publicservice.vermont.gov/sites/psd/files/Announcements/Vermont%20Clean%20Energy%20Industry%20Report%20FINAL.p](http://publicservice.vermont.gov/sites/psd/files/Announcements/Vermont%20Clean%20Energy%20Industry%20Report%20FINAL.pdf)
[df; http://cleanjobsillinois.com/2015/#top](http://cleanjobsillinois.com/2015/#top)

Figure 2: Rhode Island Clean Energy Employment by Value Chain Activity



Clean energy installation jobs pay a small but significant premium

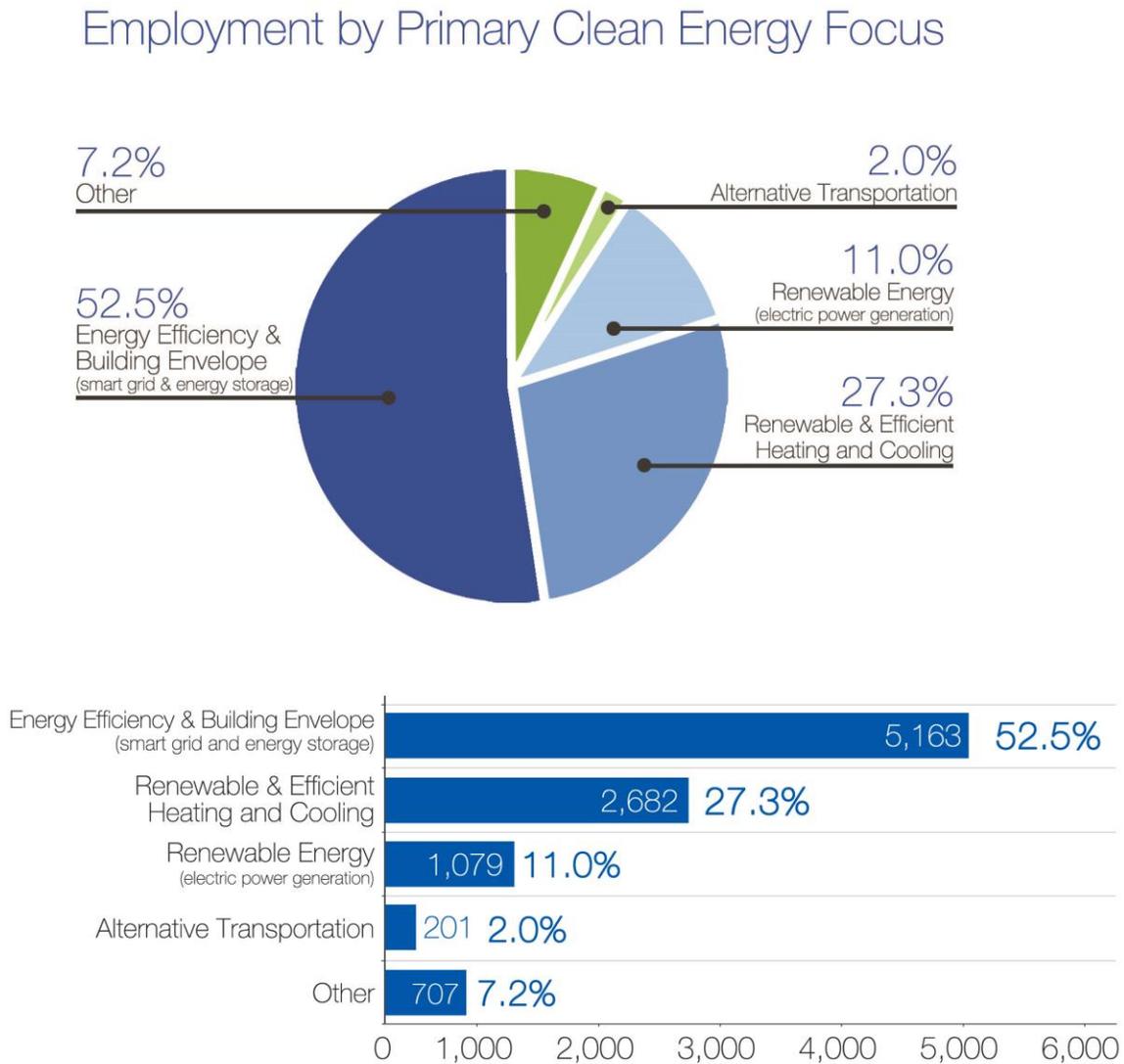
According to the Bureau of Labor Statistics, installation, maintenance and repair jobs pay an average of \$22.62 per hour. Clean energy employers report paying a premium of up to nearly \$3.50 per hour, with averages ranging from \$24-26 per hour.

Energy efficiency retrofits comprise the bulk of the state’s clean energy industry

The energy efficiency and building envelope sector¹⁷ employs 5,163 Rhode Island workers, or 52.5% of the clean energy workforce. More than a quarter (27.3%) of total employment in the state is found at firms whose primary service is delivering “renewable and efficient heating and cooling”.

Businesses whose primary clean energy sector was electric power generation from renewable energy (e.g. wind and solar) employ 1,079 workers, or 11% of the state’s clean energy industry.

Figure 3: Employment by Primary Clean Energy Focus

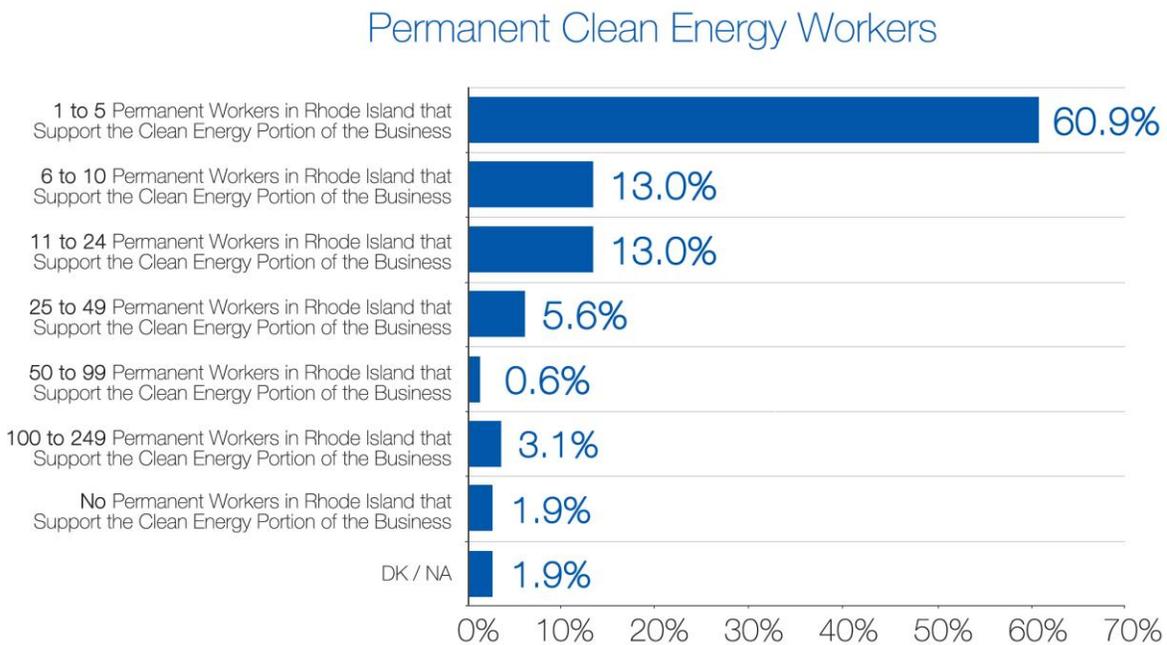


¹⁷ Includes smart grid and energy storage.

Clean energy creates opportunities for small businesses

The majority of clean energy establishments are small firms, with 87% employing fewer than 25 employees, and 60.9% reporting five or fewer clean energy workers. There are a few firms (3.1%) that have 100 to 249 clean energy workers. These numbers are comparable to other states in the northeast. Nearly 62% of Vermont's clean energy firms employ five or fewer workers; 87.5% employ less than 25.¹⁸ About 58% of Massachusetts' clean energy firms report five or fewer employees and nearly 85% employ less than 25.¹⁹

Figure 4: Permanent Clean Energy Workers



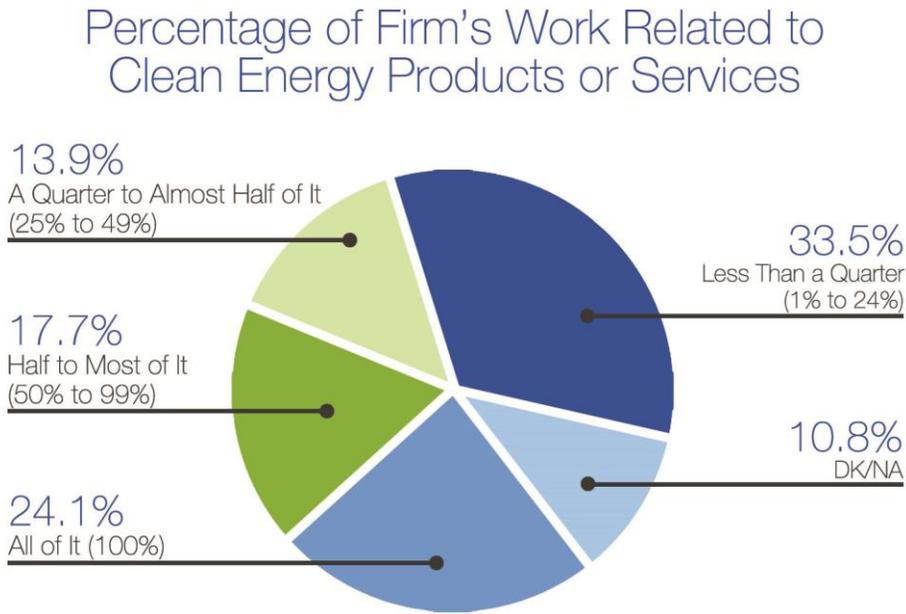
Clean energy provides new revenue opportunities for traditional industries

The industry strengthens in-state manufacturing, building trades, and professional services. Businesses rarely obtain total revenue from clean energy activity alone. In 2015, only 24.1% of surveyed firms reported that all of their revenue came from providing clean energy products and services. One-third (33.5%) of respondents said that less than a quarter of the firm's business came from clean energy activities.

¹⁸<http://publicservice.vermont.gov/sites/psd/files/Announcements/Vermont%20Clean%20Energy%20Industry%20Report%20FINAL.pdf>

¹⁹ <http://www.masscec.com/content/2014-clean-energy-industry-report>

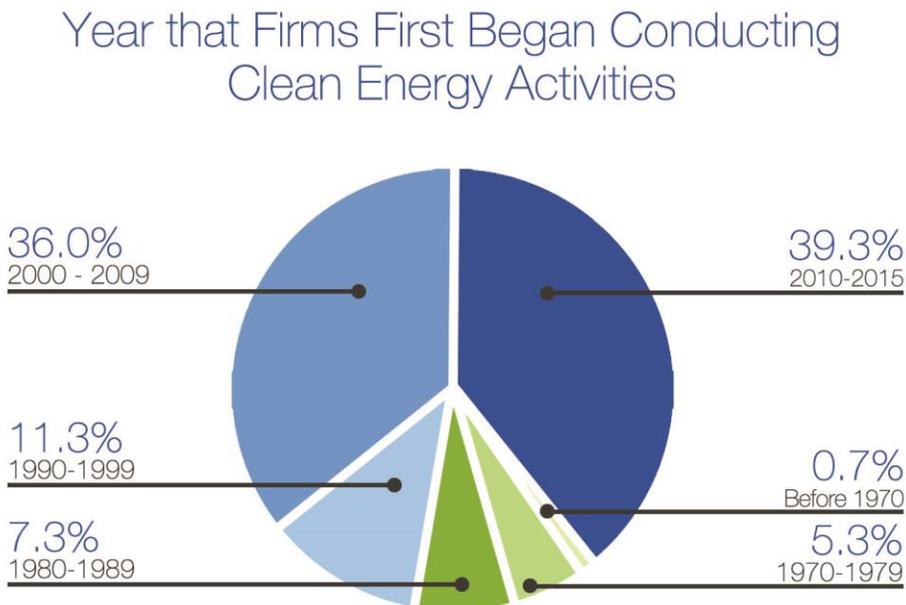
Figure 5: Percentage of firm's work related to clean energy products or services



Clean energy is a recent addition to statewide business ventures

Nearly 40% of firms began conducting clean energy services in just the last five years. Another 36% began work in the sector within the past 15 years.

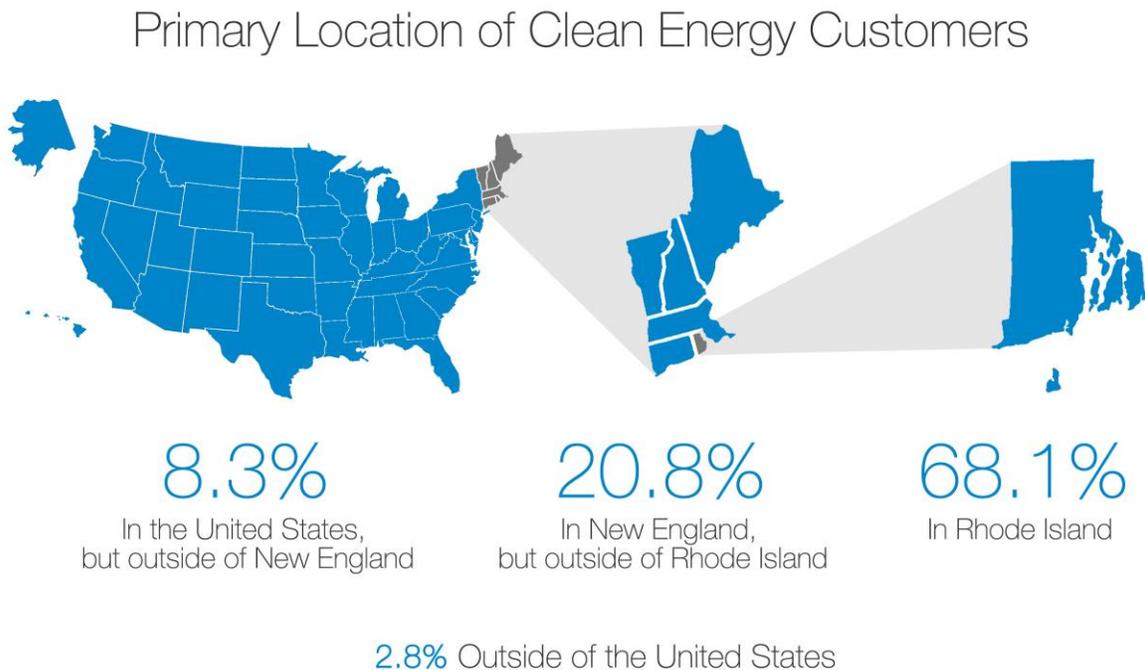
Figure 6: Year that firms first began conducting clean energy activities



Rhode Island has a significant clean energy export market

While over two-thirds (68.1%) of the state's clean energy firms report primarily in-state consumers, nearly 32% export clean energy products and services outside the state. Primary customer base is comparable to other states in the northeast. About 69% of firms in Vermont reported primarily in-state customers.²⁰ Similarly, 67% of energy efficiency firms and 61.3% of renewable energy firms in Massachusetts have primarily in-state customer bases.²¹

Figure 7: Primary location of clean energy customers



Rhode Island has the opportunity to grow its export and innovation cluster

Installation may provide the most number of jobs, but industries that export goods and services direct revenue from out-of-state markets into Rhode Island's economy. Thus, export industries, often focused in research and development, finance, manufacturing, and wholesale trade and distribution can access larger markets and provide greater economic multipliers than firms supporting in-state consumption.

Just over a third (34.6%) of the industry workforce in the state is distributed almost equally among engineering and research, consulting and finance, and sales and distribution. Clean energy manufacturers employ 759 workers, or 7.7% of the state's clean energy industry.

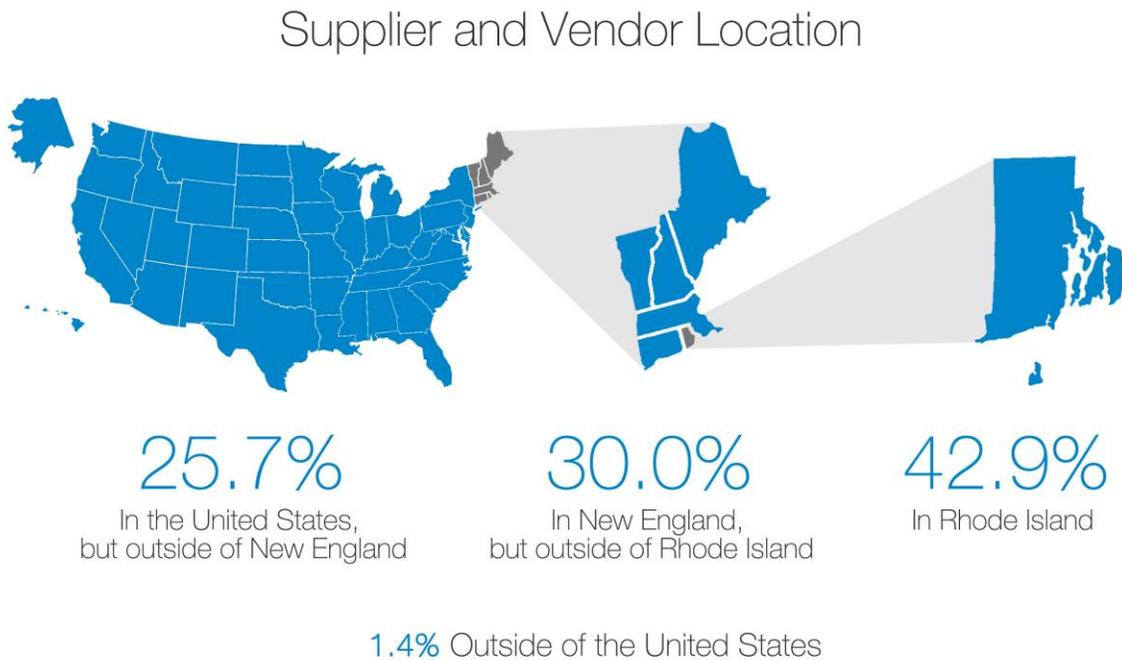
²⁰<http://publicservice.vermont.gov/sites/psd/files/Announcements/Vermont%20Clean%20Energy%20Industry%20Report%20FINAL.pdf>

²¹ <http://images.masscec.com/reports/Web%20Optimized%202014%20Report%20Final.pdf>

Clean energy strengthens the local ecosystem of vendors and suppliers

Many clean energy firms (42.9%) report their vendors and suppliers to be primarily in Rhode Island; 30% of businesses have suppliers in other parts of New England and 25.7% are supporting vendors in other parts of the nation. This compares to both Tennessee (43.6% support in-state suppliers) and Massachusetts (49%), but is significantly higher than Vermont (22.2%)

Figure 8: Supplier and vendor location



Rhode Island's location, culture, landscape, and quality of life are advantages

Nearly 48% of firms report state size and location as the main advantage for operating in Rhode Island, noting particularly the ease of networking opportunities within the state. Nearly 20% indicated culture, landscape, and quality of life as the greatest advantage and 6.3% cited access to markets and supply chains.

Figure 9: Greatest advantage to operating in Rhode Island²²

Greatest Advantage to Operating in Rhode Island

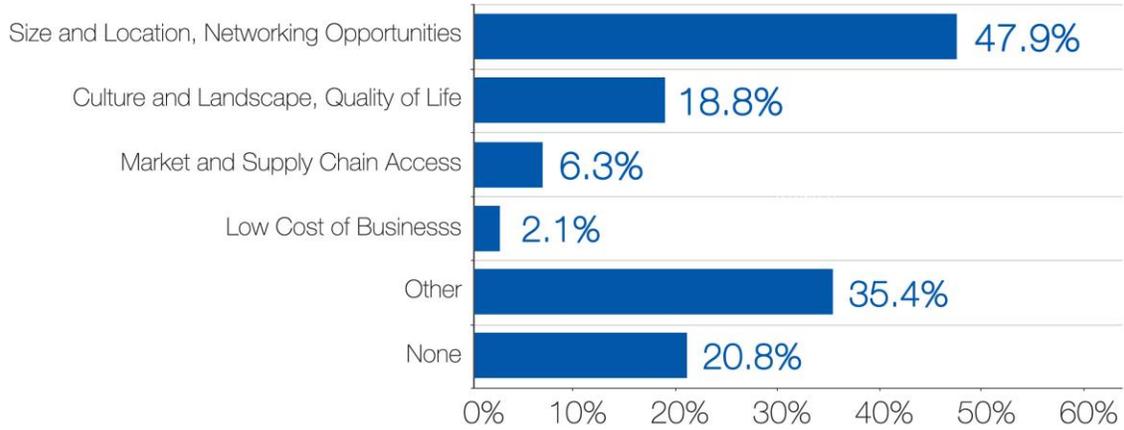
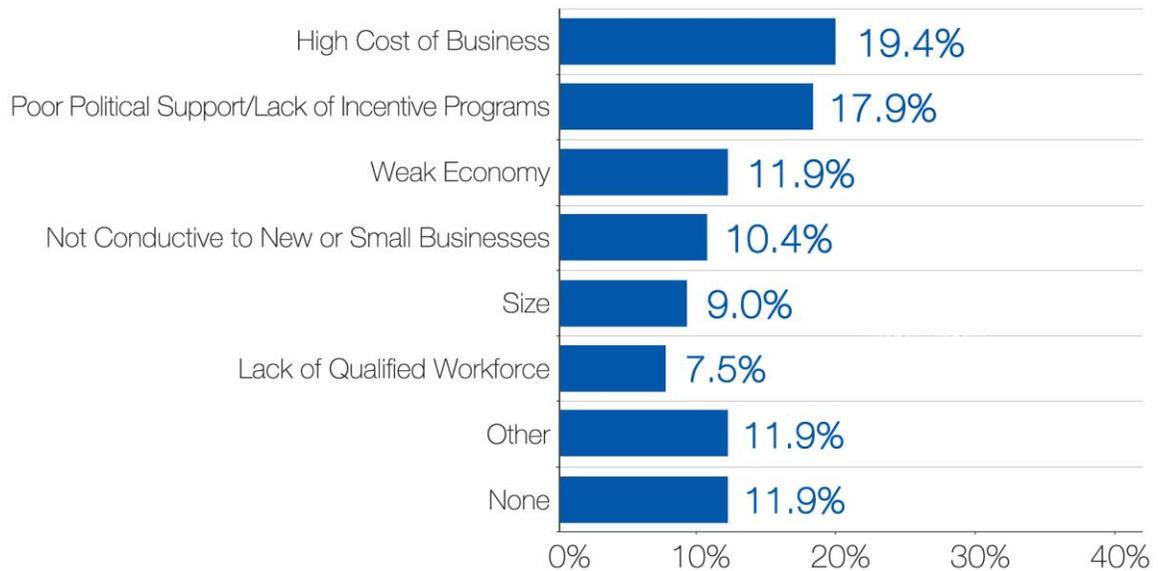


Figure 10: Greatest disadvantage to operating in Rhode Island

Greatest Disadvantage to Operating in Rhode Island



Clean energy businesses benefit from consumer financial incentives

Nearly 72% of firms cite financial incentives to have the greatest impact on adoption of clean energy goods and services. Reported reasons for past growth similarly include customer rebates (17.6%) and other financial incentives (16.2%).

²² For “Other” category, no single subcategory is greater than 2%

Figure 11: Policy or program that would have “greatest impact” on adoption of clean energy

Policy or Program that Would Have “Greatest Impact” on Adoption of Clean Energy

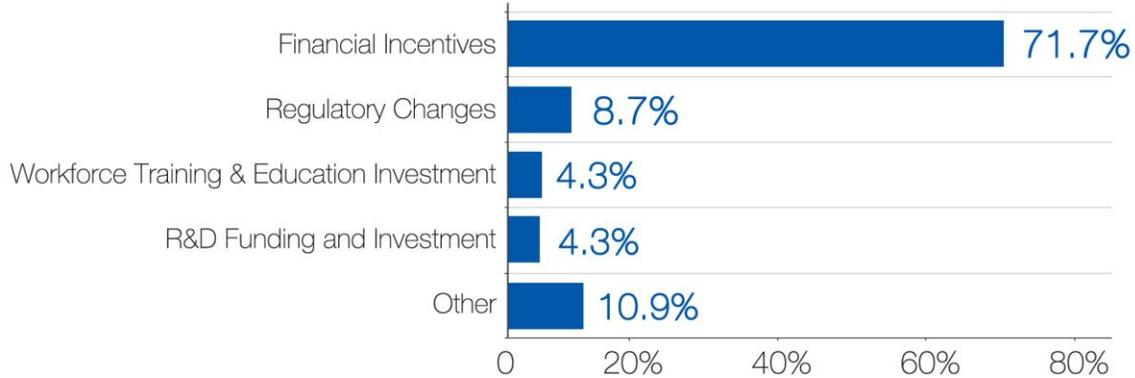
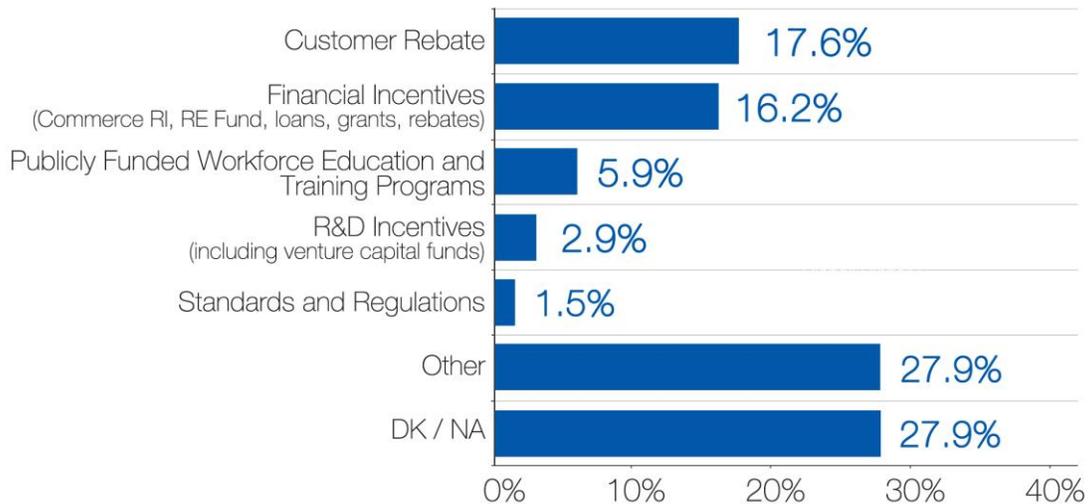


Figure 12: Reported Reasons for Past Growth²³

Reported Reasons for Past Growth



Disadvantages to operating in Rhode Island include the high cost of business and lack of incentive programs or political support (Figure 10). Nearly three-quarters (71.7%) of clean energy businesses reported that financial incentives for consumers would best accelerate the adoption of clean energy goods and services (Figure 11); 22.1% added that lack of consumer incentives are currently the greatest barrier to growth (Figure 13).

²³ For “Other” category, no single subcategory is greater than 2%

Figure 13: Biggest barriers to company growth (can name up to 2)

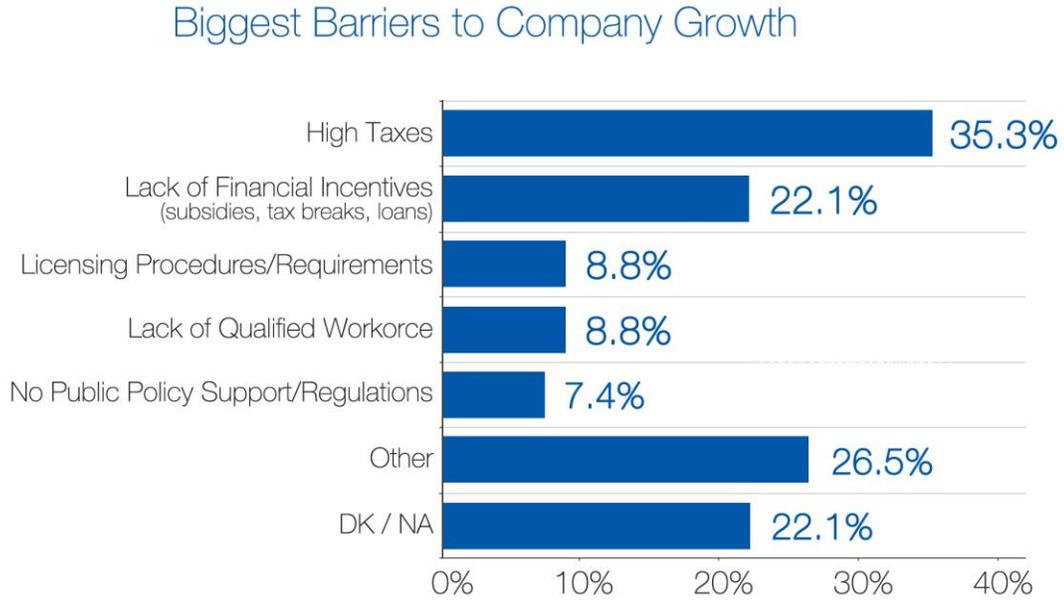
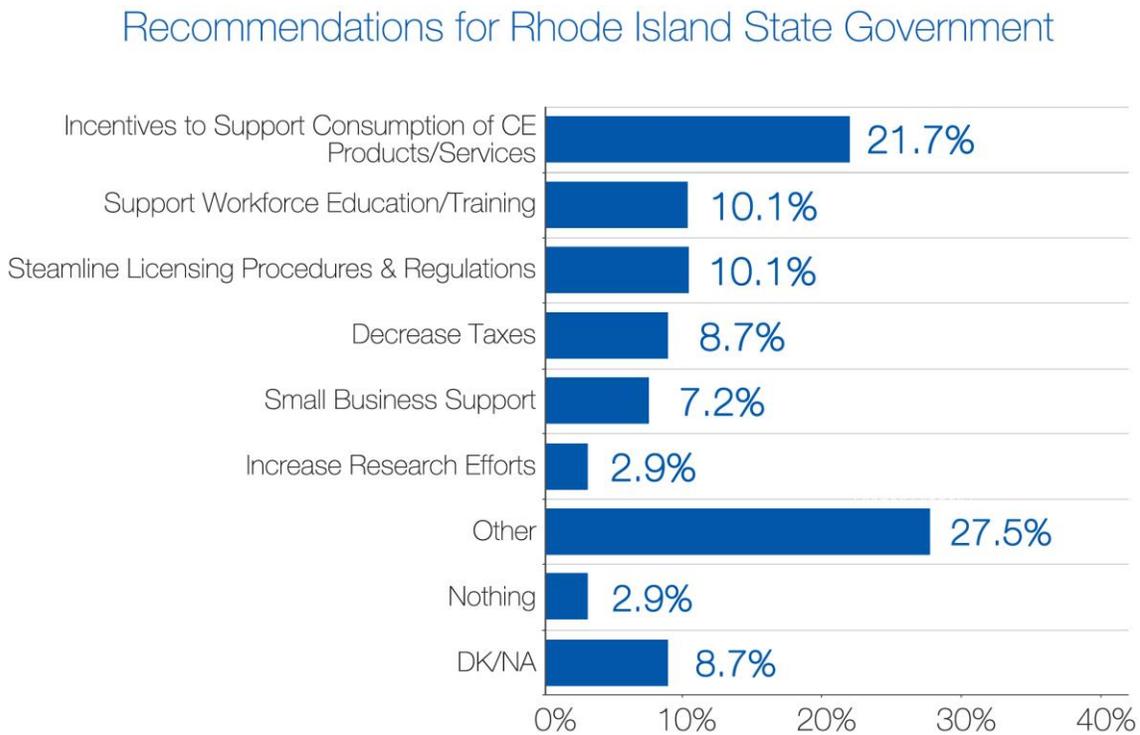


Figure 14: Recommendations for Rhode Island State Government



IV. Hiring, Workforce Development and Training Needs

Statewide clean energy employees represent a wide range of demographic profiles

Firms reported employment across various backgrounds including race, age, and gender; 36.6% of recent hires are ethnic or racial minorities, 21.2% are women, 14.8% are 55 and over, and 14.6% are veterans of the U.S. Armed Forces. Roughly 28% of all clean energy employees are ethnic or racial minorities, 24% are over 55, 20% are women, and 15% are veterans.

Numbers are moderately comparable to Massachusetts where ethnic and racial minorities account for 22% of clean energy hires and 26% of new employees are women.²⁴

Figure 15: Clean energy new hire demographics

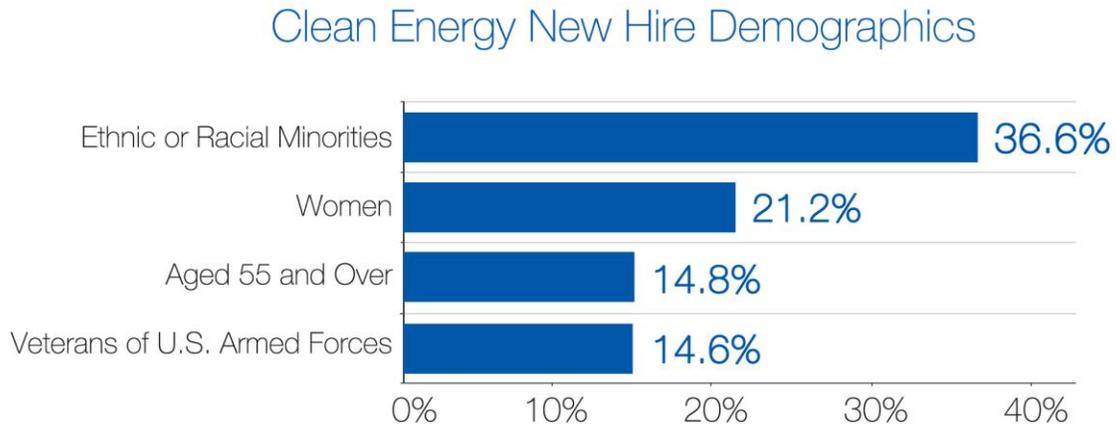
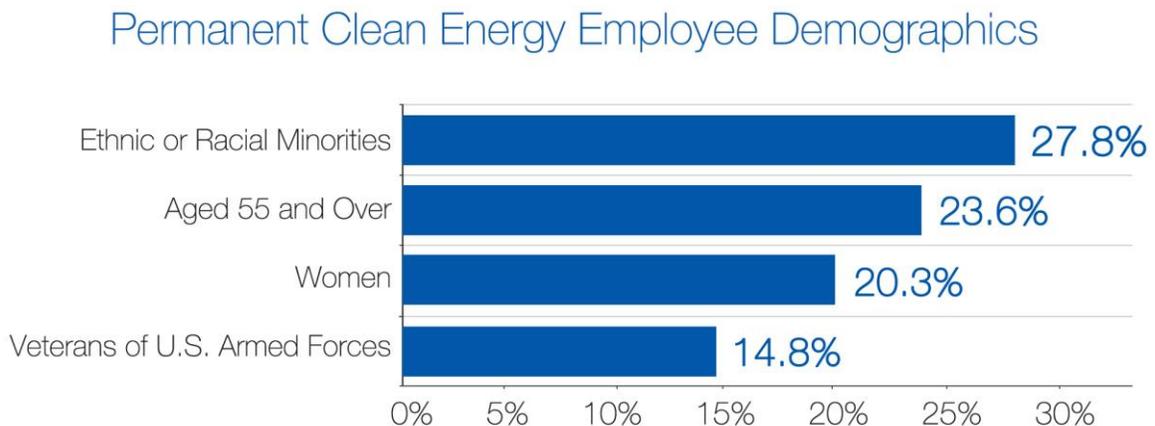


Figure 16: Permanent clean energy employee demographics



²⁴ <http://images.masscec.com/reports/Web%20Optimized%202014%20Report%20Final.pdf>

Clean energy supports employment across a range of experience and education

A majority (56.3%) of new hires have experience, while 43.8% were entry-level employees.

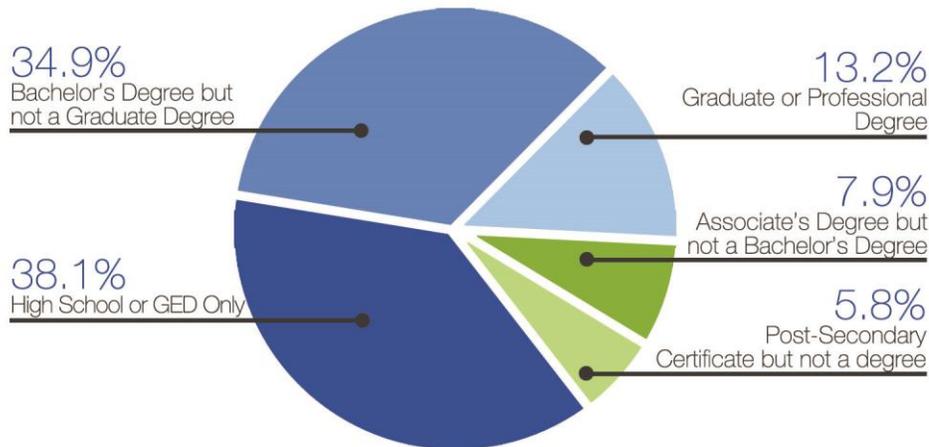
Among the types of experience employers were looking for, companies specifically noted that some of the “feeder” industries and sources for recent hires were:

- Construction (including carpentry, plumbing, heating technicians, etc.)
- Electricians (including energy efficiency and solar-specific knowledge)
- Engineering
- Apprenticeships and training programs

Clean energy provides opportunities for individuals across the education spectrum. About 38% of new hires have a high school diploma or GED. Recent hires with a high school diploma, post-secondary certificate or associate’s degree comprise 51.9% of the workforce; 34.9% have a bachelor’s degree and 13.2% have a graduate degree.

Figure 17: Education levels of recent clean energy industry hires in Rhode Island

Education Levels of Recent Clean Energy Industry Hires in Rhode Island



Firms are struggling to fill new clean energy positions

The rising industry is creating jobs across Rhode Island, but firms cite difficulty finding qualified workers; 61.2% of clean energy employers reported difficulty in finding new employees. Many of these firms (35.5%) note lack of experience and skill as the main

reason for difficulty. While the majority said they had hiring difficulties, over a third of employers (36.7%) reported no problems.

These results are roughly comparable to clean energy employers in Pennsylvania; 80% encountered challenges, 20% of which identified lack of experience or knowledge as the main reason.²⁵ In Florida, nearly 76% of businesses reported hiring challenges.²⁶

About 66% of Massachusetts renewable energy firms reported difficulty finding entry-level workers and 79% reported difficulty finding experienced employees. These numbers are comparable to energy efficiency firms; 63% reported challenges filling entry-level positions and 73% had difficulty finding experienced candidates.²⁷

Figure 18: Level of difficulty in hiring new workers

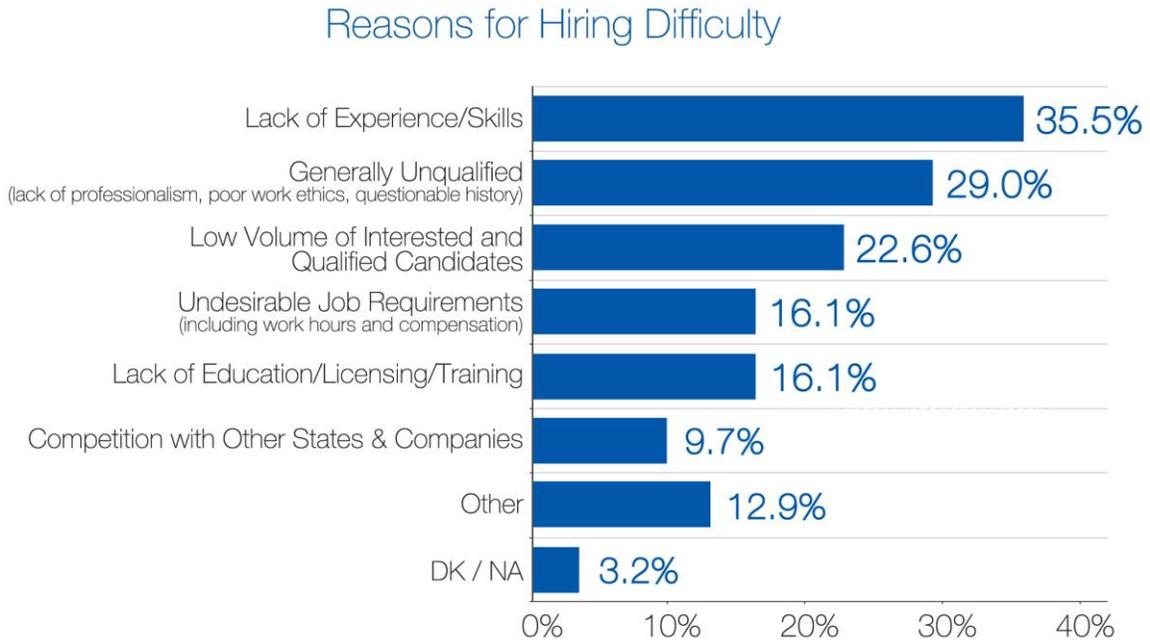


²⁵ <https://www.e2.org/ext/doc/CleanJobsPennsylvania.pdf>

²⁶ <http://cleanenergyworksforus.org/wp-content/uploads/2014/10/CleanJobsFlorida.pdf>

²⁷ <http://images.masscec.com/reports/Web%20Optimized%202014%20Report%20Final.pdf>

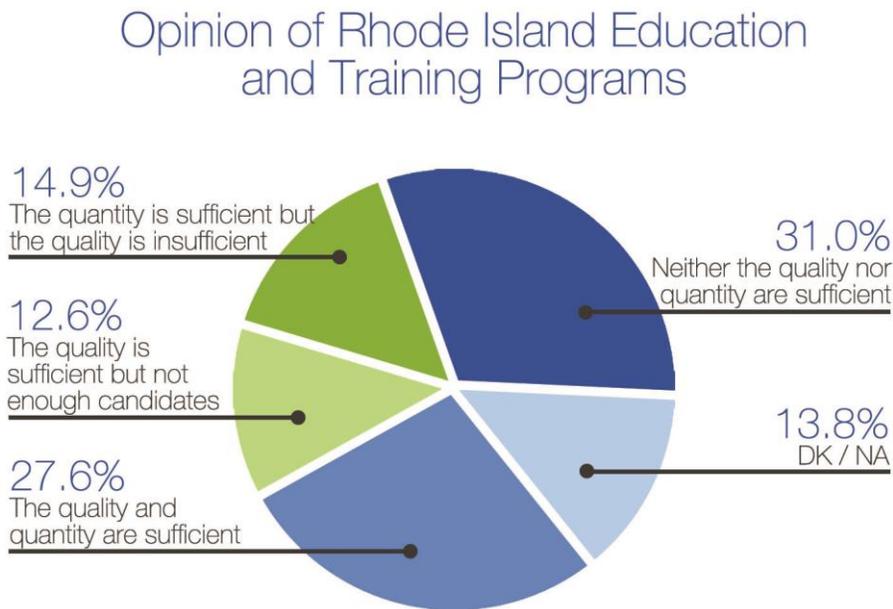
Figure 19: Reasons for hiring difficulty



Current education and training programs do not meet employer standards

Only 27.6% of respondents said that both the quality and quantity of Rhode Island graduates was sufficient, while a majority (58.5%) had issues with either quality, quantity, or both. This is significantly higher than other statewide clean energy studies.²⁸

Figure 20: Opinion of Rhode Island Education and Training Programs



²⁸ See generally, Massachusetts Clean Energy Industry Report; San Diego County Clean Energy Priority Sector Report

V. Conclusions and Recommendations

This study is the first comprehensive analysis of the size and composition of Rhode Island's clean energy industry. It is based on detailed surveys received from clean energy establishments in every part of the state and every sector of the clean energy economy.

The survey responses provide evidence that the Ocean State has a significant – and rapidly growing – industry of clean energy firms. The sector is a vital part of the overall Rhode Island economy, and its jobs pay sustainable wages across the state.

Statistics from this inaugural study are encouraging. At the end of the first quarter of 2015, Rhode Island's industry employed 9,832 clean energy workers at 1,295 establishments. The industry's annual growth rate of 6.6% was more than 3.6 times better than the state's overall employment growth of 1.8%. Clean energy employers support 2.1% of all jobs in Rhode Island.

More than half of Rhode Island's clean energy workers (52.5%) were employed in energy efficiency related jobs, with 27.3% involved in renewable and efficient heating and cooling, and 11% working in renewable energy electric power generation. The remaining 9.2% is divided among other small sectors.

Rhode Island's clean energy firms prosper under financial incentives that promote cost-effective clean energy decisions for residents, businesses and government consumers. Firms report that the primary reason for past growth are strong consumer incentives and other policy support, citing incentive programs as the single most important action that can strengthen the industry and create jobs. **To maintain this growth, Rhode Island could focus on continuing and expanding programs that incentivize clean energy technologies among consumers.**

The industry draws from a strong in-state customer base and supports an equally strong group of in-state vendors and suppliers. Clean energy businesses also draw a significant percentage of customers from other states in New England, and beyond. Alternatively, business directed to out-of-state suppliers might signal opportunity for in-state vendors to serve this growing sector.

Given limited in-state market potential, **Rhode Island might consider developing export and innovation segments of its clean energy economy.** Innovation is critical; early-stage firms attract investment dollars and generate economic activity. Supportive policies may signal global firms to establish business operations in Rhode Island, while existing in-state manufacturing and sales could benefit from increased access to out-of-state markets. A network of clean energy trade could significantly impact the local economy, expanding revenues for Rhode Island's businesses.

Rhode Island could examine its strategic opportunities in manufacturing, professional services, and research to leverage regional strength. With proximity to

dozens of highly regarded engineering, science, and technology-focused educational institutions, **the state could maximize talent potential by developing incubators, facilitating technology transfer, and assisting start-ups.**

This baseline study illustrates strong employment, but Rhode Island clean energy firms maintain opportunities for growth. A major challenge to growth is the availability of adequate talent. Over 60% of firms report difficulty finding and hiring candidates; many note a shortage of people with appropriate experience and skills. Clean energy firms are less than pleased with both the quality and quantity of graduates from the state's educational and training institutions. **This is an opportunity to collaborate with local employers and develop meaningful career pathways and training programs. Talent development will serve the growing industry's needs and provide sustainable careers for under or unemployed residents.**

Results from the 2015 survey of clean energy businesses in Rhode Island reveal an industry that is strong, growing, and very optimistic about the future. Survey respondents project employment growth at 16.7% for the following year.

Recent passage of the governor's budget added powerful tools to grow the economy. Rhode Island has an opportunity; clean energy can be a significant economic engine to create jobs and build an ecosystem of innovative exporters that will expand the state's economy. The state can capture this opportunity with renewed investment in consumer incentives, programs to support start-up activity and enterprise expansion, and a commitment to developing local talent. With these programs in place, **Rhode Island is poised for economic growth and job creation.**

Glossary of Terms

Activity

For the purposes of this report, an establishment's activity refers to the primary value-chain industry to which it most associates its work. Activities include research, development and engineering, manufacturing, sales and distribution, installation and maintenance, legal, finance, and other professional services, and other.

Alternative Transportation

Alternative Transportation includes non-fossil fuel related vehicles, including electric rail and electric vehicles. This includes:

- **Electric Vehicles**
Passenger or freight cars, trucks or buses that use electric drive systems and electric motors for propulsion.
- **Electric Rail**
Passenger or freight trains or trolleys that operate with electric motors for propulsion.

Clean Energy Industry

The aggregate of establishments that are directly involved with researching, developing, producing, manufacturing, distributing or implementing components, goods or services related to Renewable Energy, Energy Efficiency or Conservation, Smart Grid, Energy Storage, Carbon Management and/or Electric or Hybrid Vehicles.

Clean Energy Firm

For the purposes of this report, an establishment or firm that is involved with an activity related to the clean energy industry.

Clean Energy Worker

Full-time and part-time permanent employees who support the clean energy portion of the business, including administrative staff, excluding interns and other temporary workers.

Cluster

A geographic concentration of interconnected businesses in related industries.

Energy Efficiency

Goods and services that reduce energy demand. Energy Efficiency includes the following technologies:

- **Lighting**
Light emitting sources that use less energy to operate than traditional incandescent or halogen bulbs. Includes fluorescent, LED and other lower-energy light bulbs and fixtures.
- **HVAC and Building Controls**
Heating, ventilation, and air conditioning systems (HVAC), including building retro-commissioning and retrofits connected to heating and cooling.
- **Energy Efficient Appliances**
Development, production, sale, installation and maintenance of ENERGY STAR or other similarly designated appliance that uses less energy than traditional models.
- **Energy Efficient Processes and Machinery**
Energy saving measures and production equipment. Most typically applicable to manufacturing and data centers.
- **Energy Storage**
Devices or physical media that store energy.
- **Demand Response Services**
Operations that balance energy supply and demand. Include offering time-based rates such as time-of-use pricing, critical peak pricing, variable peak pricing, real time pricing and critical peak rebates. It also includes direct load control programs which provide the ability for power companies to cycle air conditioners and water heaters on and off during periods of peak demand in exchange for a financial incentive and lower electric bills.
- **Smart Grid**
Automated, computer-based electricity delivery, including smart computing and software.
- **Weatherization Services**
Energy Efficiency improvements to a building's envelope, including air-sealing, caulking, window repair/replacement and insulation
- **Energy Efficient Building Materials**
Any materials that reduce total building energy use.
- **Water and Wastewater Technologies related to Conserving Energy**
Products related to reducing energy for water purification, distribution or treatment.

Establishment

For the purposes of this report, a business location in Rhode Island with at least one employee.

Greenhouse Gas Emissions Accounting and Management

Primarily includes carbon capture and storage, secondary carbon markets (such as RGGI) and coal gasification. This includes:

- **Carbon Capture and Storage**
The process of capturing waste carbon dioxide from large point source emitters and depositing it in a location that cannot enter the atmosphere, such as in deep geological formations. Also referred to as sequestration.

- **Secondary Carbon Markets**
Trade of carbon credits in a cap and trade or similar system.
- **Coal Gasification**
The production of synthetic gas from coal via thermo-chemical processes.

Pre-Commercial

Work that has yet to reach market or products that are in the development phase.

Production/Technician Hires

Workers in the field or on the floor, generally working in assembly, installation, or other technical, non-managerial tasks.

Pure-Play

Refers to a company or establishment that has or is very close to possessing a single business focus, i.e. a “pure-play” Energy Efficiency firm would be only associated with Energy Efficiency work.

Renewable Energy (Renewable Electricity Generation)

Renewable Energy refers to electricity and/or heat generated from sustainable sources. Renewable Energy primarily includes the following technologies:

- **Solar**
Electricity, heat, or cooling provided by the sun. Includes photovoltaic (PV), thermal and concentrated (CSP)
- **Wind Power**
Conversion of wind energy to electricity.
- **Fuel Cell**
Device that converts fuel to electricity via chemical conversion.
- **Woody and Non-Woody Bioenergy**
Energy produced from organic, biological sources.
- **Hydropower or Hydrokinetic**
Electricity generated from the movement of water. Includes river, wave and tidal sources.
- **Geothermal**
Production of electricity from subsurface heat. Differs from ground-source heat pumps, which are considered Energy Efficiency products for the purposes of this study.
- **Hydrogen Generation**
Production of energy using hydrogen as a fuel source.
- **Thermal to Energy Conversion**
Production of electricity by using temperature differential. Includes ocean, solar and chemical sources.
- **Renewable Combined Heat and Power**
Production of electricity and usable heat from renewable sources. Also called cogeneration.

Renewable and Efficient Heating and Cooling

Refers to establishments that are involved with heating, ventilation and air conditioning (HVAC) from Renewable Energy sources or work that increases the Energy Efficiency of HVAC systems.

Retrocommissioning

Refers to the process of improving a building or structures operating process by increasing occupant comfort and saving energy usually through Energy Efficiency measures (weatherization, lighting, etc.).

Technology

For the purposes of this report, technology refers to the primary application or end use of a firm's produced goods or services. Technologies include Energy Efficiency, Renewable Energy, alternative transportation, greenhouse gas management and accounting, or other.

Sub-Technology

For the purposes of this report, sub-technology refers to the specific technologies with which an establishment works, within each technology area. The sub-technologies for Energy Efficiency and Renewable Energy are listed under the respective definitions.

Survey Methodology

The primary data included in this study are derived from a comprehensive survey of business establishments in Rhode Island. Surveys were administered online and by telephone to a list of known employers as well as to a representative, clustered sample of companies from the North American Industry Classification System (NAICS) identified by the Bureau of Labor Statistics (BLS) and BW Research Partnership as being potentially related to the Renewable Energy, Energy Efficiency and alternative transportation technologies. The research methodology employed for this report has been used increasingly as a tool for measuring clean energy industry jobs and businesses, including in Massachusetts, California, Florida, Illinois, Iowa, Missouri, Ohio, Pennsylvania, Tennessee, and Vermont.

In 2015, the research team placed 4,406 telephone calls and sent 679 emails to employers in Rhode Island. The survey effort, with a combined margin of error of approximately +/-3.44% at a 95% confidence interval, yielded 678 survey responses. The survey fielded from April 15 to May 1 and averaged 14.2 minutes in length.

In addition to providing overall totals; survey respondents were asked to select the technology to which their firm's work is most closely associated, from a list including Renewable Energy, Energy Efficiency, alternative transportation, or greenhouse gas emissions accounting and sequestration. Based on their selection(s), respondents were offered lists of specific sub-technologies that fit within each technology. Respondents were provided the following descriptions upon request.

“Known Universe” – Firms Previously Identified by Researchers as Clean Energy Companies

The original list, developed from previous work efforts and databases from the Commerce Rhode Island, the Rhode Island Office of Energy Resources, and partner organizations (including utilities), contains companies that are more likely to be active in the clean energy economy. After duplicate cleaning and applying estimates from the survey data to account for companies that are no longer in business, do not have at least one Rhode location or do not identify as in the clean energy industry, as well as improvements and additions since the first survey effort, the 2015 “known universe” of firms is estimated at 732 companies.

All firms in the database with addresses were sent a letter from Commerce RI and OER with respondent-specific instructions for taking the survey. In addition, all businesses with email information were sent multiple online invitations. Firms in the database that did not complete an online survey and those without email information were called up to six times and asked to complete by telephone.

Of the estimated 732 firms in the known universe, 161 completed a survey. The 2015 data show that there are 6,793 workers in the known universe.

“Unknown Universe” – Firms Not Previously Identified by Researchers as Clean Energy Companies

This database for the “unknown universe” was drawn from BLS NAICS industries and InfoUSA business listings. The incidence rates (i.e., the percentage of firms that identified as clean energy) for the 18 NAICS industries were calculated by surveying the previously unknown 443 firms (that indicated whether or not they were in clean energy).

In addition, 66 firms from the “unknown universe” identified as clean energy and completed full surveys. Compared to the known universe, the mean number of clean energy employees at “unknown” establishments is lower by a significant margin, depending on the specific industry.

Surveys were administered in accordance with the Code of Standards and Ethics for Survey Research (CASRO), which includes stringent guidelines for maintaining respondent confidentiality. As a result, employer lists and disaggregated data are not available for public release.