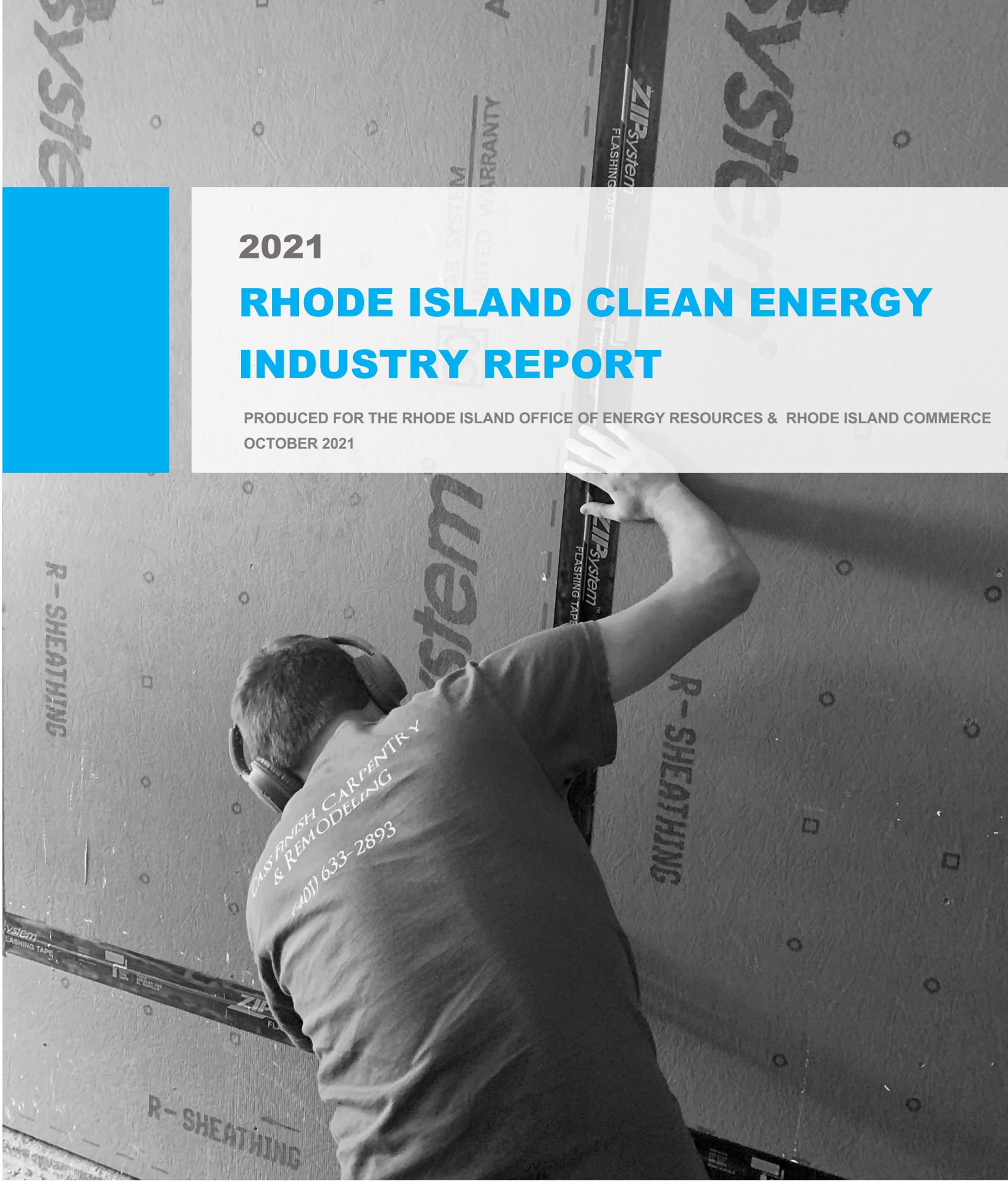
2021

RHODE ISLAND CLEAN ENERGY INDUSTRY REPORT

PRODUCED FOR THE RHODE ISLAND OFFICE OF ENERGY RESOURCES & RHODE ISLAND COMMERCE

OCTOBER 2021



[bw] RESEARCH PARTNERSHIP

NICHOLAS UCCI

STEFAN PRYOR

The Rhode Island Office of Energy Resources (OER) and the Executive Office of Commerce are pleased to present the 2021 Rhode Island Clean Energy Jobs Report.

The Clean Energy Jobs report is a valuable tool for government policy makers because it helps identify where growth is occurring and what barriers may impede this growth. It also provides information on what skills training is needed in order to build a pipeline of talent, what sectors have gaps in workforce development opportunities, and how to more effectively match qualified workers with employers.

The COVID-19 pandemic hit the Rhode Island and New England economies hard and the clean energy sector was no exception. Due to a reduction in demand, clean energy employers were forced to cut back on their labor forces for the first time since we began tracking sector jobs in 2014.

However, despite the challenges of 2020, overall state-level policy support and goals as well as federal legislative priorities point toward a continuation of historical job growth in Rhode Island's clean energy sector. For instance, despite economy-wide job losses, the state's wind sector grew by 8.7 percent or about 50 jobs, mirroring both nationwide and other statewide trends in wind energy employment. Nationally, wind capacity additions hit their highest annual installation rate in 2020.

Rhode Island continues to accelerate its adoption of clean energy resources. As of September 31, 2021, Rhode Island has more than 1,000 MW of clean energy generation capacity (1,017 MW).

With the addition of the 400 MW Revolution Wind offshore wind project, approximately 85% of Rhode Island's current clean energy portfolio is comprised of in-state renewables or projects scheduled for adjacent federal waters.

In April, Governor Dan McKee signed into law the 2021 Act on Climate, legislation which updates and accelerates Rhode Island's climate-emission reduction goals. Under the new act, the state will develop a plan to incrementally reduce climate emissions to net-zero by 2050. The plan will be updated every five years and will address areas such as environmental injustices, public health inequities, and a fair employment transition as fossil-fuel jobs are replaced by green energy jobs.

Additionally, Rhode Island continues to be ranked among the top four states in the U.S. for energy efficiency programs and innovation. Energy efficiency represents the least-cost means of reducing energy consumption and cost for local consumers, while shrinking carbon footprints and spurring economic opportunity.

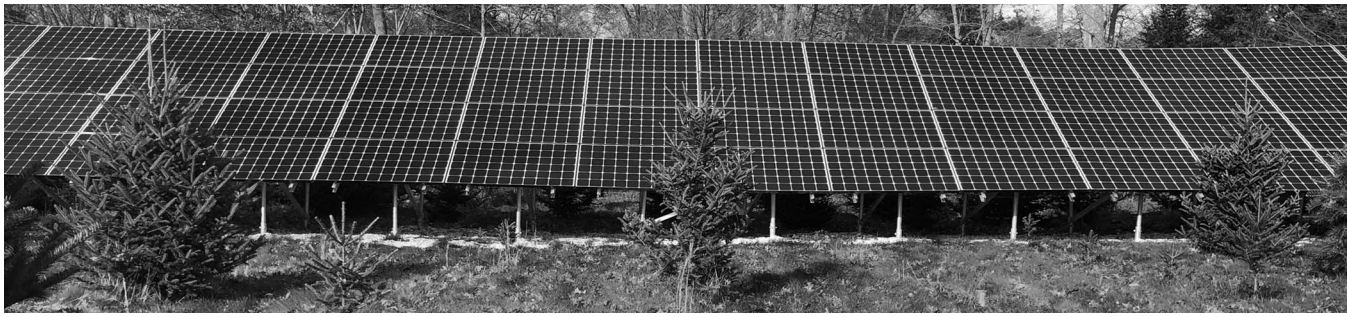
Despite the unexpected shock of COVID-19, Rhode Island's clean energy labor market is already showing signs of bouncing back. In our most recent survey of local clean energy firms, 75 percent of respondents said that they had already brought back their laid off or furlough clean energy staff. Working in tandem with industry partners, both the construction and manufacturing industries remained fully operational throughout the pandemic. With vaccinations now widely available and pandemic restrictions easing, clean energy job gains are predicted throughout the remainder of 2021 and into 2022.

We are thankful to Governor Daniel McKee and the General Assembly for helping to make Rhode Island a leader in clean energy and continuing to foster growth across this sector of our local economy.

Sincerely,

Nicholas Ucci
Energy Commissioner

Stefan Pryor
Rhode Island Secretary of Commerce



Acknowledgment

This Clean Energy Industry Report is the seventh iteration in a series of reports conducted and written by BW Research Partnership, Inc. under commission by the Rhode Island Office of Energy Resources and the Renewable Energy Fund at Commerce RI. Thank you to the stakeholders who responded to the survey which resulted in the data summarized in this report.

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Executive Summary

The 2021 Rhode Island Clean Energy Industry Report is the seventh annual report on clean energy employment in the state. The findings in this report are based on data taken from the comprehensive 2021 U.S. Energy and Employment Report (USEER), an annual nationwide survey of roughly 35,000 energy employers in the United States. The USEER provides a rich, comprehensive, and historical dataset of energy job trends dating back to 2015.[1]

Over the years, the Rhode Island Clean Energy Industry Reports have provided valuable, year-over-year data on clean energy employment in the state, both by technology sector and value chain segment. This year's iteration of the Rhode Island Clean Energy Industry report comes amidst the global Coronavirus (COVID-19) pandemic and its impacts on the state's economy, including the clean energy labor market. These historical datapoints now provide additionally useful context that can help policymakers and other clean energy stakeholders in the state identify the impacts of the COVID-19 pandemic on Rhode Island's clean energy economy.

The report shows that employment across clean energy businesses declined by over 2,500 jobs—or 15.5 percent—between the last quarters of 2019 and 2020. By comparison, the overall statewide labor market declined by 7.4 percent during the same time. Clean energy job losses represented about seven percent of all jobs lost in Rhode Island's overall labor market in 2020. This decline marks the first year of job losses since the state began tracking clean energy employment in 2014. The economic aftermath of COVID-19 resulted in the loss of roughly four years of clean energy job growth, sending Rhode Island's clean energy economy back to 2016 employment levels. In addition to overall clean energy job losses, total full-time equivalent clean energy workers also declined over the course of 2020. As of the last quarter of 2020, there were 11,158 clean energy workers that dedicated all of their labor hours or work week to support clean energy goods and services—a 16 percent decline compared to last year's report.[2]

Despite the unexpected shock of COVID-19, Rhode Island's clean energy labor market already appears to be bouncing back. For instance, of surveyed clean energy firms in Rhode Island in the fourth quarter of 2020, four in ten indicated that they had laid off, furloughed, or reduced pay for their clean energy workers as a result of COVID-19. However, as of the end of 2020, three-quarters of these firms indicated that they had already brought back their laid off or furloughed clean energy staff. Indeed, job losses in 2020 were concentrated in March through May, with steady monthly job gains in June through December. With vaccinations on the rise and pandemic restrictions lifting, clean energy job gains are likely to continue throughout the remainder of the year.

[1] For more information on the U.S. Energy and Employment Report, please visit https://www.energy.gov/us-energy-employment-jobs-report-useer.

[2] The 16 percent decline in full-time equivalent clean energy workers represents a subset of the overall clean energy workforce that spends all of their labor hours on clean energy-related tasks and services. This metric is different from the 15.5 percent decline in total clean energy employment.

In 2020, the majority of pandemic-driven job losses were installation, maintenance, and repair jobs in the energy efficiency and renewable and efficient heating and cooling sectors. This is not surprising, as energy efficiency-related installations and upgrades typically require tasks to be completed within homes or businesses and were thus unable to maintain the social distancing guidelines during 2020. Clean energy installation and maintenance firms lost almost 1,500 jobs, for a decline of 15.7 percent compared to the end of 2019. At the same time, employment in the energy efficiency technology sector declined by almost 19 percent, or 1,800 jobs, while renewable and efficient heating and cooling firms shed 17 percent of the labor force—roughly 750 workers.

By contrast, the state's wind energy labor segment grew by almost nine percent, creating about 50 new jobs and mirroring both national and other statewide trends in wind energy employment growth. Nationally, wind energy employment grew by just under two percent, resulting in about 2,000 new wind energy jobs across the U.S. in 2020. Wind energy employment growth in 2020 is not surprising, given the nation's overall significant increase in wind capacity in 2020. The U.S. installed 14.2 gigawatts (GW) of wind capacity, the highest capacity addition in a given year.[3] This trend is expected to continue; for example, in March 2021, President Biden established a target of employing tens of thousands of workers to deploy 30 Gigawatts (30,000 megawatts) of offshore wind by 2030.

Despite the pandemic-induced job losses in 2020, Rhode Island's clean energy labor market is well-supported by policy mechanisms and decarbonization goals, putting it on-track for long-term job growth. For example, the state's adoption of mandatory greenhouse gas emission reduction goals (e.g., net-zero emissions by 2050), the continuation of robust renewable energy programs and policies, and an overall shift in federal clean energy priorities—particularly for the offshore wind industry—point toward a positive future of continuing the historical clean energy job growth in Rhode Island over the coming years.

The remainder of this report provides additional detail on clean energy employment by technology and sub-technology, clean energy labor intensity, value chain employment, and employer-reported hiring difficulty and COVID-19 impacts.

[3] U.S. Energy Information Administration. The United States installed more wind turbine capacity in 2020 than in any other year. March 2021. https://www.eia.gov/todayinenergy/detail.php?id=46976.

Industry Overview

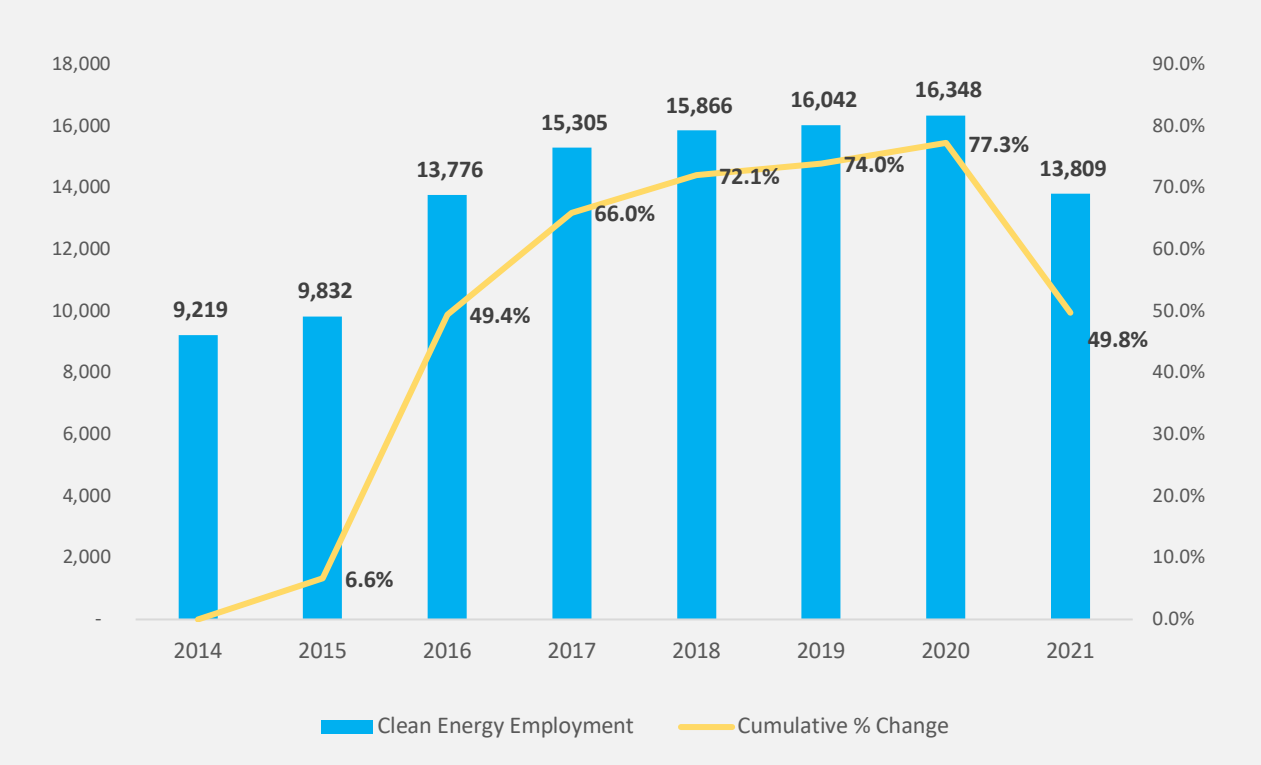
Due to COVID's impact on state, national, and global economies, it is not surprising that the 2021 Report marks the first year of clean energy job losses in Rhode Island since this analysis commenced in 2014. As of the last quarter of 2020, clean energy employment in Rhode Island totaled to just over 13,800 jobs, the majority of which—roughly six in ten—are concentrated in the energy efficiency technology sector.[4] This is compared to about 16,350 jobs reported at the end of 2019. Nearly all clean energy technology segments lost jobs during the economic recession, with the exception of the wind industry. Mirroring both nationwide and other state-level trends, wind energy employment in Rhode Island grew by about two percent, despite economywide job losses.

Between the last quarters of 2019 and 2020, clean energy businesses shed just over 2,500 jobs. These job losses represent a 15.5 percent decline compared to last year's report. By comparison, the state overall lost over 36,000 jobs between 2019 and 2020—a decline of 7.4 percent.[5] Clean energy job losses accounted for seven percent of total job losses in Rhode Island and about three percent of total employment at the end of 2020. It is likely that Rhode Island's clean energy sector was harder-hit during the pandemic compared to the statewide average due to the high proportion of energy efficiency jobs. The energy efficiency sector accounts for about six in ten clean energy jobs in the state, and this sector shed the largest number of workers, not just in Rhode Island, but nationwide. This is not surprising, as many of the jobs in this labor segments require the in-person and/or on-premises delivery of goods and services, which became especially challenging due to COVID-related closures.

[4] For more information on clean energy technology sectors, please see the Clean Energy Technology Analysis section of this report.

[5] Statewide employment totals are from the Bureau of Labor Statistics, Quarterly Census of Employment and Wages. Data was extracted in May 2021.

Figure 1. Clean Energy Employment, 2014-2021

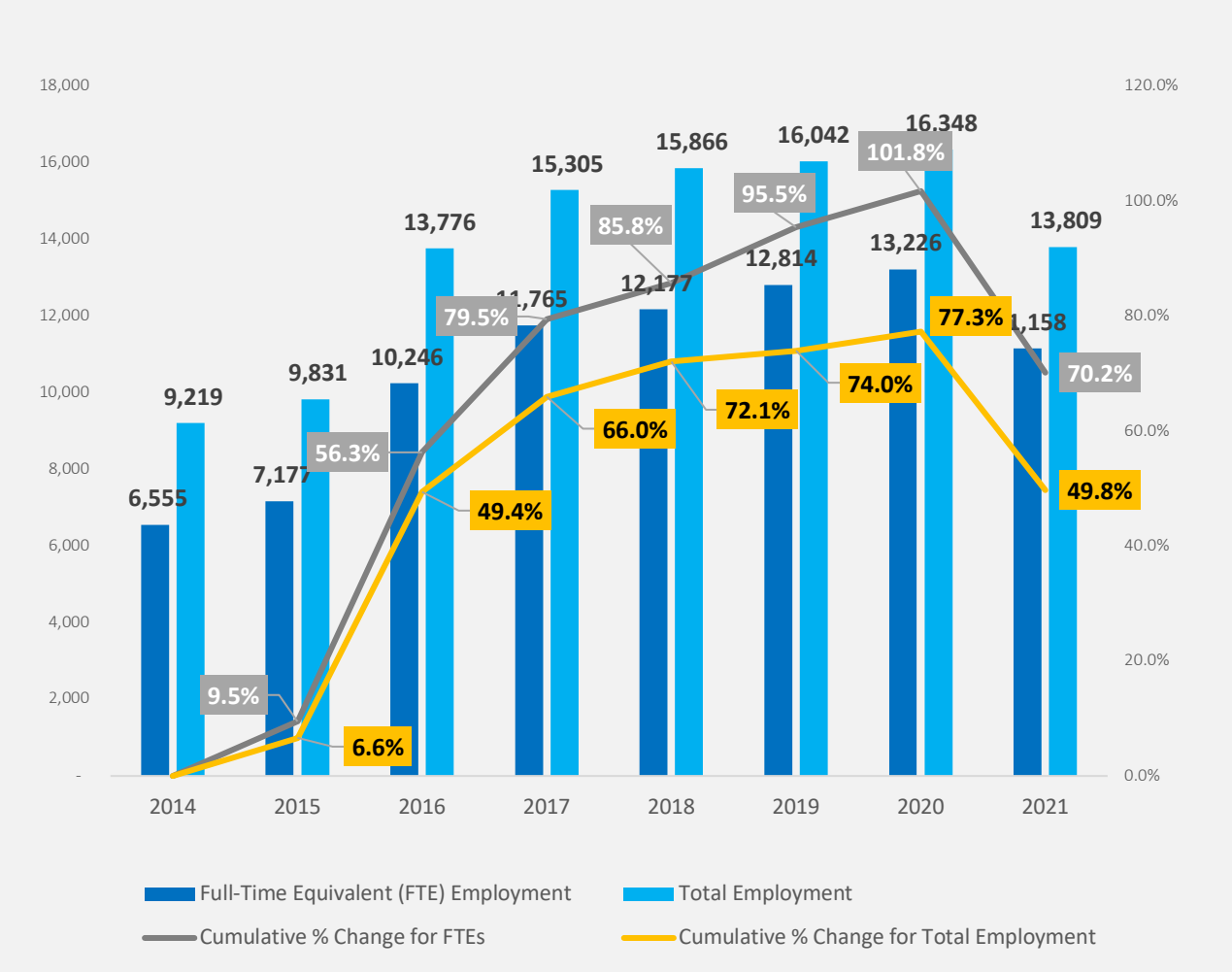


Alongside overall job losses, the number of full-time equivalent (FTE) clean energy jobs has also declined.[6] Over the last several years, FTE clean energy jobs had been growing faster than the overall clean energy labor market, indicating that while total jobs were growing, clean energy workers were also spending more of their work week or labor hours dedicated to clean energy-specific tasks.

This year's Clean Energy Industry Report shows that overall FTE clean energy jobs also declined by 15.6 percent between the last quarters of 2019 and 2020. As of the end of 2020, there were 11,158 full-time equivalent clean energy workers in Rhode Island; this indicates that there are fewer clean energy workers overall that spend their full work week dedicated to clean energy tasks and activities.

[6] Full-time equivalent (FTE) clean energy jobs are extrapolated by weighting each clean energy worker based on what proportion of their labor hours are spent on clean energy-related activities (0-49 percent, 50-99 percent, or 100 percent). It should be noted that this metric measures the proportion of total labor hours dedicated to clean energy activities and is unrelated to the total number of hours worked in a week. A part-time clean energy employee who works 20 hours a week with 100 percent of these hours dedicated to clean energy activities would be counted as one FTE clean energy job.

Figure 2. Full-Time Equivalent (FTE) Clean Energy Employment, 2014-2021



Clean Energy Technology Analysis

Pandemic-induced clean energy job losses occurred within the energy efficiency and renewable and efficient heating and cooling sectors. This is not surprising, as many of the jobs in these labor segments require the in-person and/or on-premise delivery of goods and services, which became especially challenging due to COVID-related closures.

Despite both clean energy and overall economy-wide job losses, wind energy firms in Rhode Island saw slight employment growth over 2020. Between 2019 and 2020, the wind energy sector grew by 8.7 percent, or 47 jobs. Wind industry job growth in Rhode Island mirrors both national and other state wind energy employment growth trends. Nationwide, wind energy employment grew by just under two percent, for an additional roughly 2,000 wind jobs across the U.S. in 2020. Wind energy employment growth in 2020 is not surprising, given the nation's overall significant increase in wind capacity in 2020. The U.S. installed 14.2 gigawatts (GW) of wind capacity, the highest capacity addition in a given year.[7] As offshore wind projects, such as Revolution Wind, continue to advance in their permitting and construction phases, and as federal support for this industry expands, it is likely that wind energy employment in Rhode Island will continue to grow over the coming years.[8] Importantly, employment growth for offshore wind in Rhode Island will come not only from state-specific projects and demand, but also from regional procurements in Massachusetts, New York, Connecticut, and other jurisdictions. The interplay of offshore wind supply chains and demand in the Northeast region overall will likely contribute to both direct and indirect job gains in Rhode Island in support of the regional offshore wind industry.

Energy efficiency firms experienced the most significant job losses during the pandemic, declining by 18.8 percent between the last quarters of 2019 and 2020—roughly 1,800 lost energy efficiency-related jobs. At the same time, renewable and efficient heating and cooling firms shed 750 jobs for a 17.1 percent decline.

All energy efficiency sub-sectors experienced job losses over 2020. Most significantly, the advanced building materials and other energy efficiency sub-sector[9] declined by 52 percent in 12 months—a loss of about 1,140 workers. The efficient lighting sub-sector shed 430 jobs for a decline of 26.1 percent, followed by ENERGY STAR® appliances with 120 jobs lost and a 15.3 percent decline.

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[7] U.S. Energy Information Administration. The United States installed more wind turbine capacity in 2020 than in any other year. March 2021. https://www.eia.gov/todayinenergy/detail.php?id=46976.

[8] For example, see President Biden's goal of deploying 30 GW of offshore wind energy by 2030: https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/29/fact-sheet-biden-administration-jumpstarts-offshore-wind-energy-projects-to-create-jobs/.

[9] Advanced building materials includes all materials that represent advanced in insulation or efficiency over traditional materials. Other energy efficiency technologies include variable speed motors, other design services not specific to a sub-technology, software not specific to a sub-technology, energy auditing, rating, monitoring, metering, and leak detection, energy efficiency policy not specific to a sub-technology, LEED certification, consulting not specific to a sub-technology, and phase-change materials.

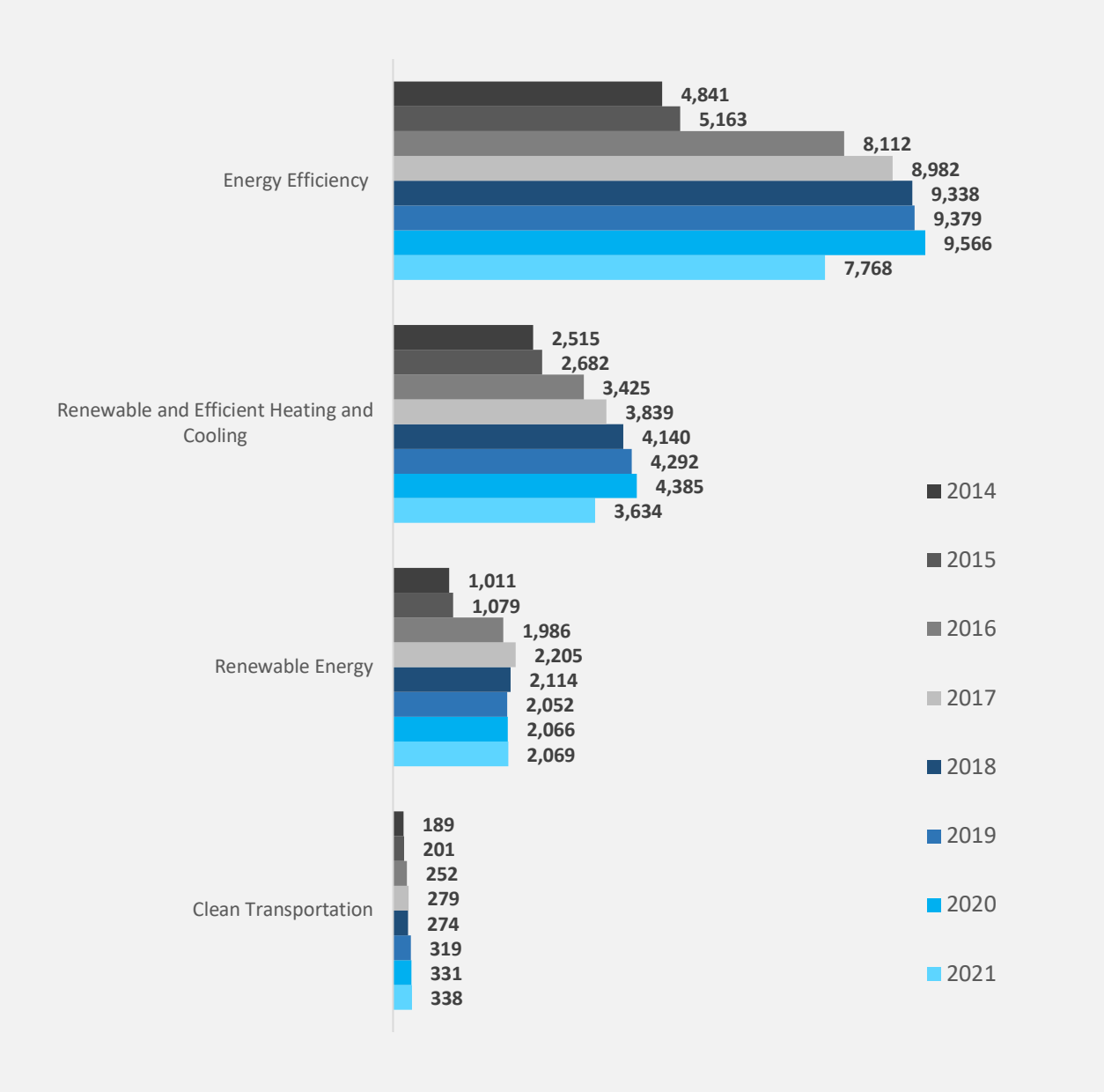
The microgrid[10], clean storage[11], and smart grid[12] sub-sectors together shed 110 workers, with the majority of job losses experienced across microgrid firms. Within the renewable and efficient heating and cooling sector, both high-efficient HVAC and traditional HVAC employers shed the greatest number of jobs, respectively declining by about 370 and 250 workers or just over 17 percent each. The renewable heating and cooling sub-sector declined by 12 percent or 93 jobs, due to project delays as a result of social distancing measures and supply chain interruptions.

[10] Microgrids are a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that act as a single controllable entity with respect to the grid.

[11] Clean storage includes pumped hydropower, battery, mechanical, thermal, and biofuel storage. Hydroelectric energy storage is used by electric power systems for load balancing. This method stores the gravitational potential energy of water pumped from a lower elevation reservoir to a higher elevation. Battery storage includes storage for solar generation and lithium batteries, lead-based batteries, other solid-electrode batteries, vanadium redox flow batteries, and other flow batteries. Mechanical storage includes flywheels and compressed air energy storage, while thermal storage is temporary storage of energy for later use when heating or cooling is needed.

[12] A smart grid is an electricity supply network that uses digital communications technology to detect and react to local changes in usage.

Figure 3. Clean Energy Employment by Technology, 2014-2021[13]



[13] Other employment totaled to 707 jobs in 2015 and 663 in 2014; improved methodologies have since allowed the research team to categorize all employment into a major technology. It should be noted that 2014 and 2015 employment will not sum to 9,219 and 9,832 respectively in this chart because the "other" category is not displayed.

Figure 4. Renewable Energy Generation Employment, 2016-2021

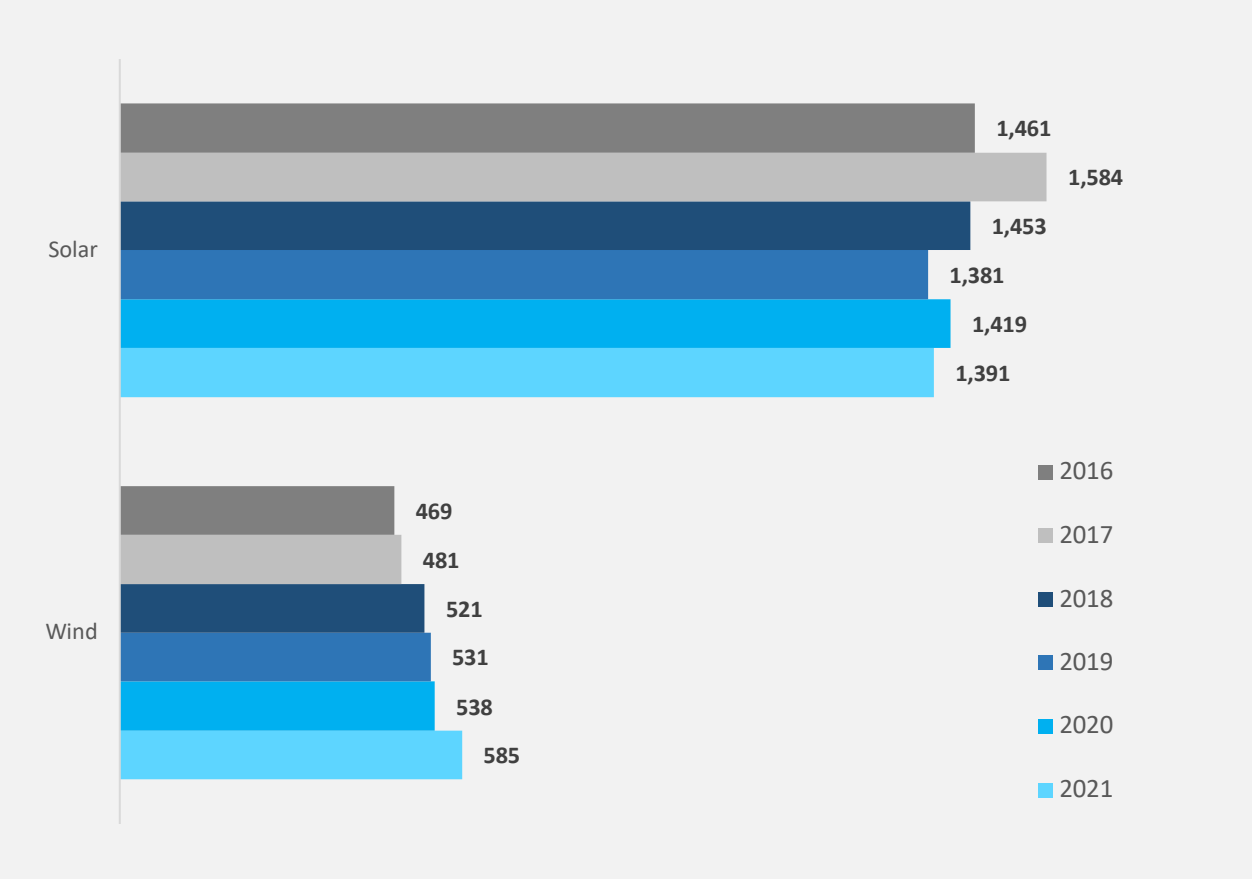
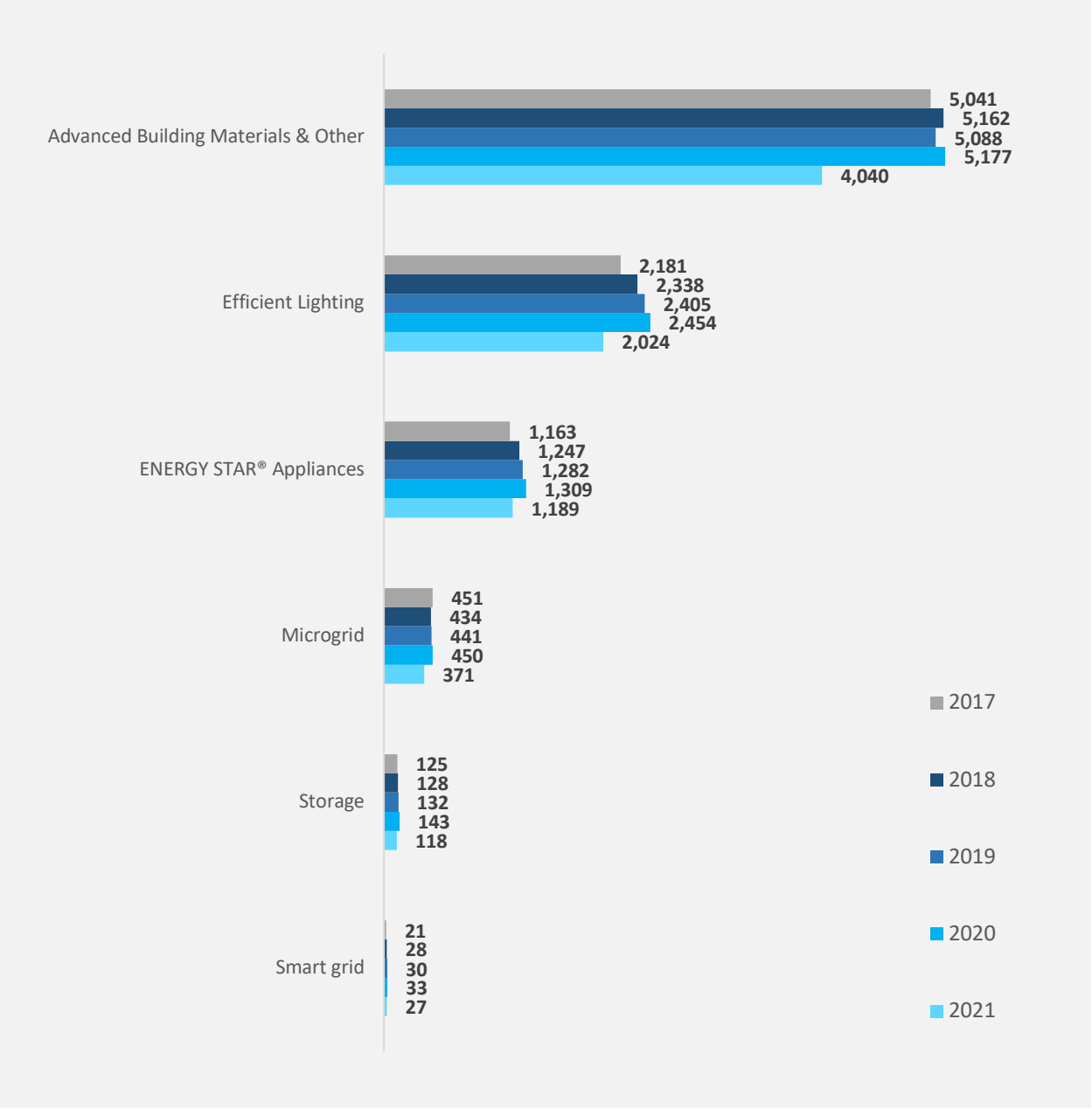
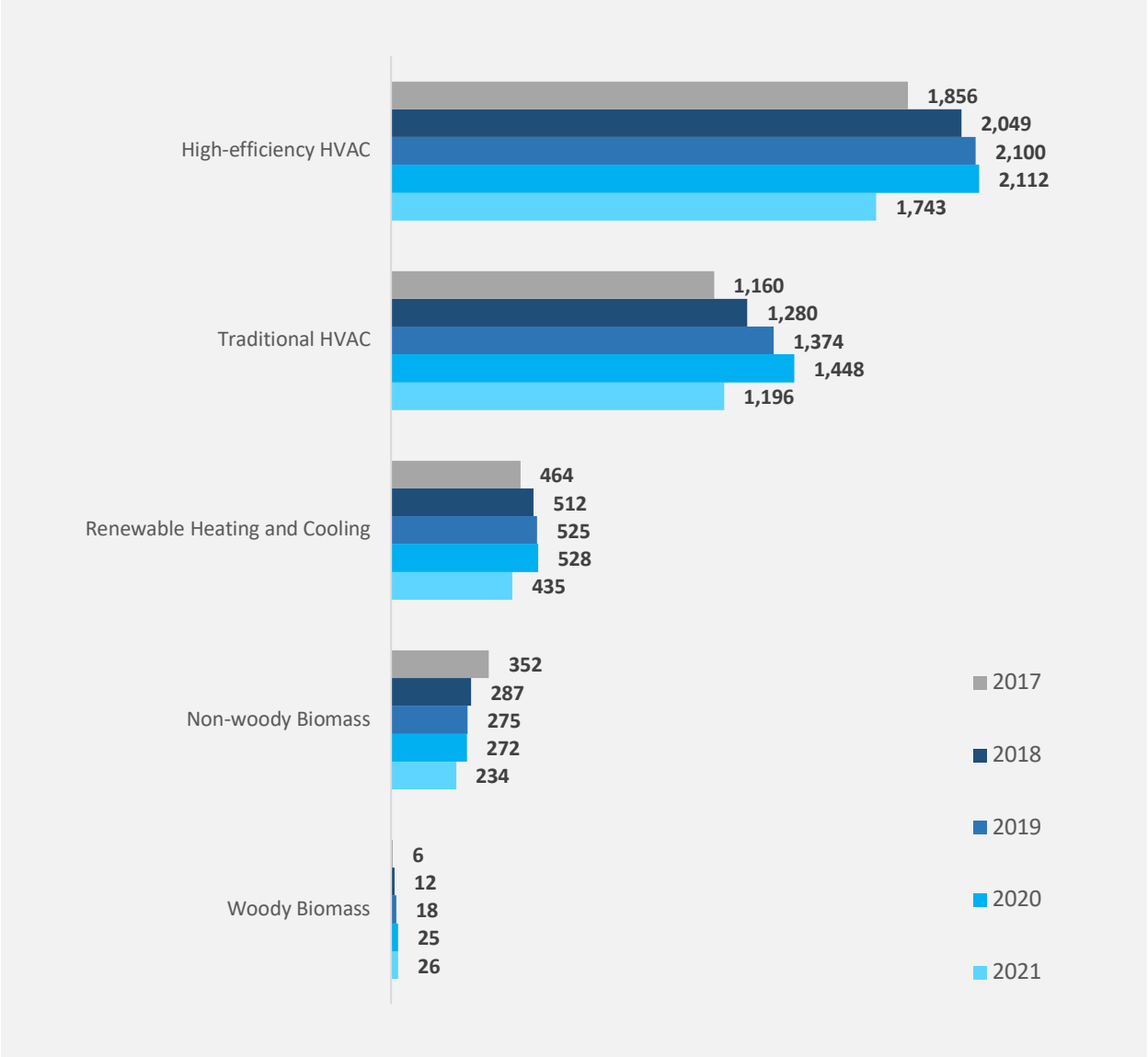


Figure 5. Energy Efficiency Employment, 2017-2021[14]



[14] While microgrid, storage, and smart grid are typically included under the "transmission and distribution" or "clean grid and storage" sectors for USEER and other Clean Energy Industry Reports, they are included in the energy efficiency sector for this report per Rhode Island's clean energy technology definition. "Other" energy efficiency includes variable speed pumps, other design service, software, energy auditing, rating, monitoring, metering, leak detection, policy or non-profit work, and consulting that cannot be specific to a detailed sub-technology.

Figure 6. Renewable Heating and Cooling Employment, 2017-2021



Clean Energy Value Chain Analysis

Value chain jobs examine the clean energy economy by identifying the industries in which clean energy activities are concentrated. Doing so provides context for what type of policy or workforce development assistance is needed to support clean energy employers across the state. For example, a state with a high concentration of research and development activity in the alternative transportation sector might signal the need for more early-stage investment funding to support continued prototype development and technology testing.

The major value chain segments examined include installation, maintenance, repair, and operations[15]; manufacturing[16]; trade, distribution, and transport[17]; engineering, research, and professional services[18]; and other.[19]

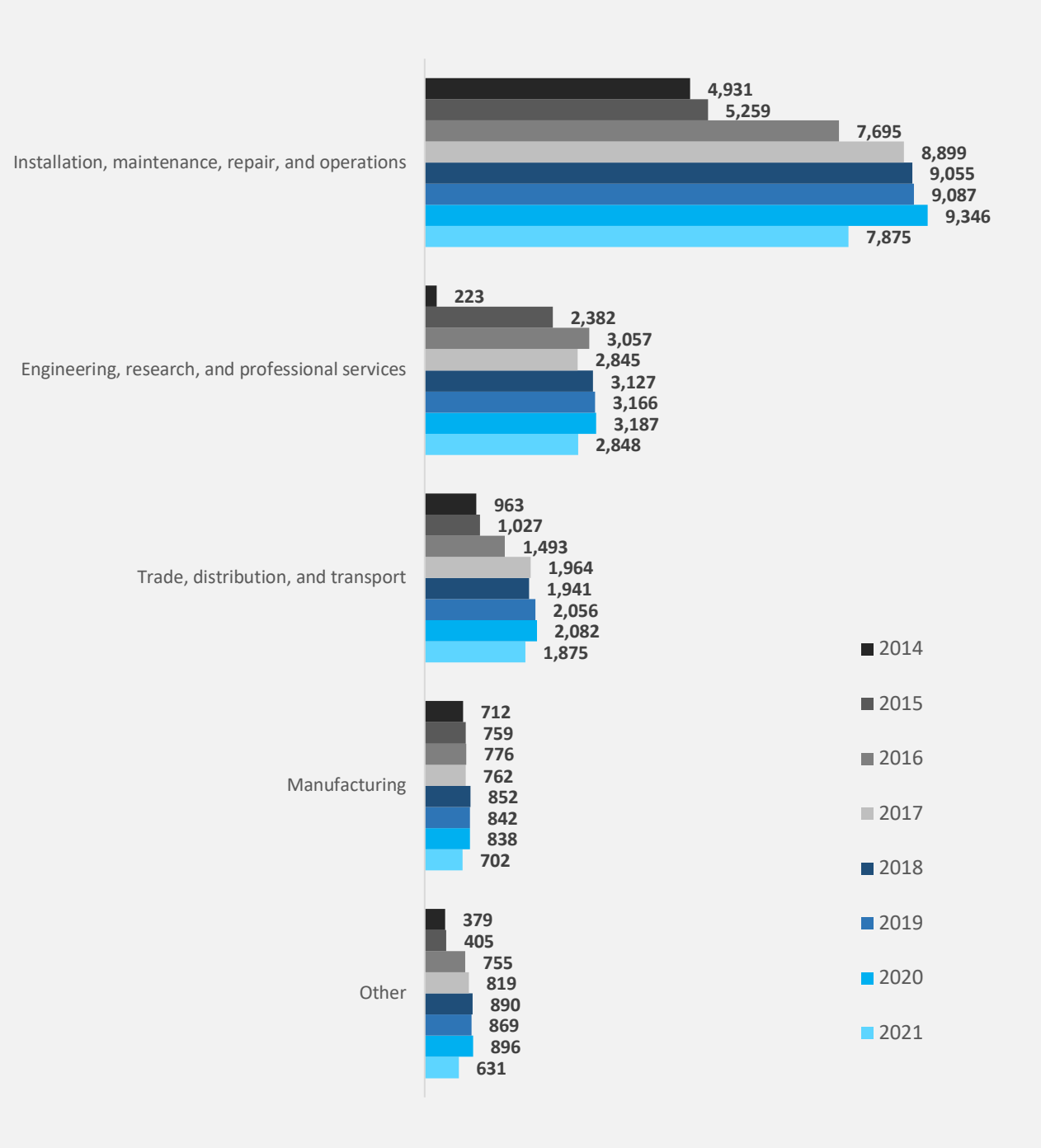
All value chain sectors suffered employment losses between 2019 and 2020 due to business closures during the pandemic. Clean energy installation, maintenance, repair, and operations firms shed the largest number of workers. Over 12 months, these businesses lost almost 1,500 jobs—a decline of 15.7 percent. This is most likely due to the high job losses in the energy efficiency and renewable heating and cooling sectors, which largely consist of installation and other construction-related jobs.

Engineering, research, and professional services shed jobs too, at a rate of 10.6 percent, or about 340 workers, followed by clean energy trade, distribution, and transport; these businesses reduced payrolls by about 200 workers, for a decline of 9.9 percent.

The manufacturing and other value chain segments collectively lost 400 jobs, a respective decline of 16.2 and 29.6 percent.

[15] Installation, maintenance, repair, and operations is comprised of all workers engaged in residential, commercial, and industrial building construction, contracting and electrical work, insulation and weatherization, or plumbing and heating, air conditioning, and ventilation work.
[16] Manufacturing encompasses heating and air conditioning equipment manufacturing, engine and compressor manufacturing, semiconductor manufacturing, and energy efficient product, appliance, or lighting manufacturing, as well as motor vehicle and parts manufacturing.
[17] Trade, distribution, and transport includes motor vehicle and parts wholesalers, electrical equipment and household appliance wholesalers, and other wholesale trade and distribution related to clean energy products and technologies.
[18] Professional services include all finance, legal, consulting, engineering, research, or architectural support.
[19] Other includes utilities, organizational and non-profit work such as environment and conservation organizations, business associations, or advocacy organizations.

Figure 7. Clean Energy Employment by Value Chain, 2014-2021



Clean Energy Hiring

About seven in ten surveyed clean energy employers (67.5 percent) indicated that they had an adequate number of qualified clean energy employees to meet their current needs at the end of 2020. Only 28.8 percent reported that they did not.

Figure 8. Adequate Workers to Meet Current Needs, 2021

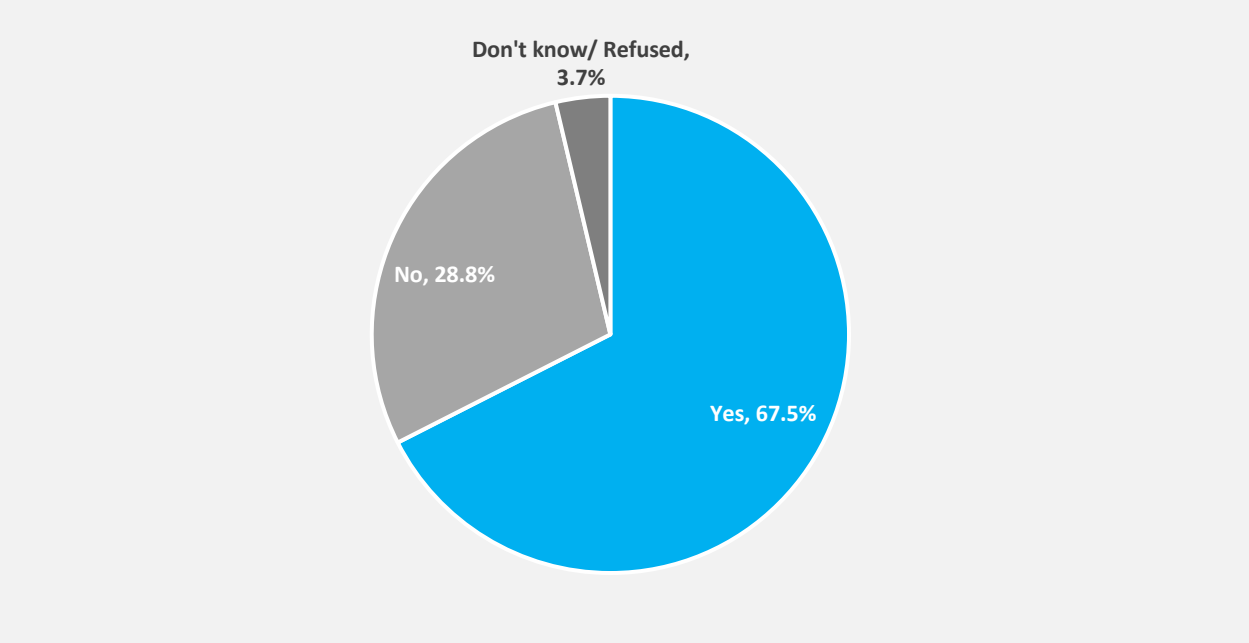


Table 1. Adequate Workers to Meet Current Needs by Sector or Sub-technology, 2021

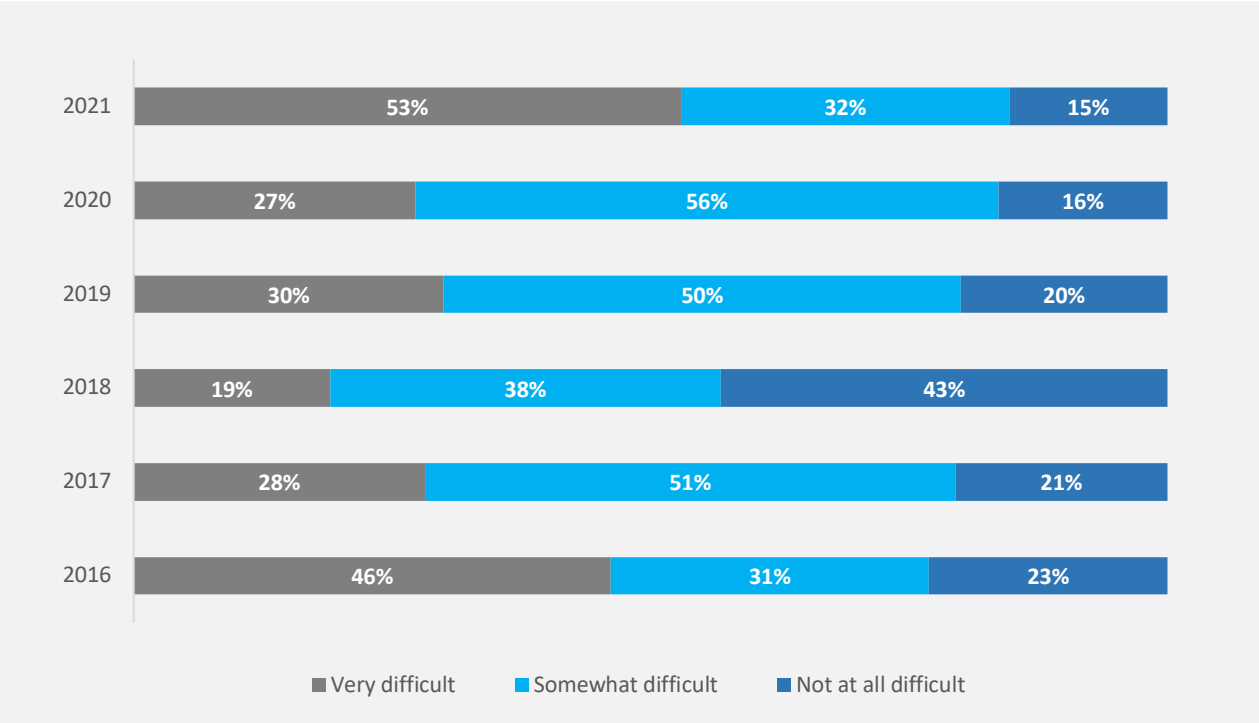
	Yes	No	Don't know/ Refused
Renewable Energy	70.6%	26.5%	2.9%
Energy Efficiency	68.8%	27.5%	3.6%
Solar	66.7%	29.8%	3.5%

Of the 28.8 percent of employers that reported they did not have an adequate supply of clean energy workers, just over three-quarters (76 percent) reported either currently searching or having recently searched for new employees to fill open positions.

Of these employers that were hiring in 2020, 85 percent indicated some level of hiring difficulty. Just over half of businesses that were seeking new hires (53 percent) reported that hiring was "very" difficult in 2020.

It should be noted that while it appears as if the rate of hiring difficulty increased, these findings are based on the small sample size of firms that indicated they both (a) had an insufficient supply of workers and (b) were currently searching or had recently searched for new employees to fill open positions.[20] Given the unique circumstances and realities of employment and hiring in 2020 and the relatively small percentage of firms that reported hiring activity, it is best to take the hiring difficulty data for this year's report as a point-in-time estimate and refrain from comparisons to previous years.

Figure 9. Employer-Reported Hiring Difficulty, 2016-2021



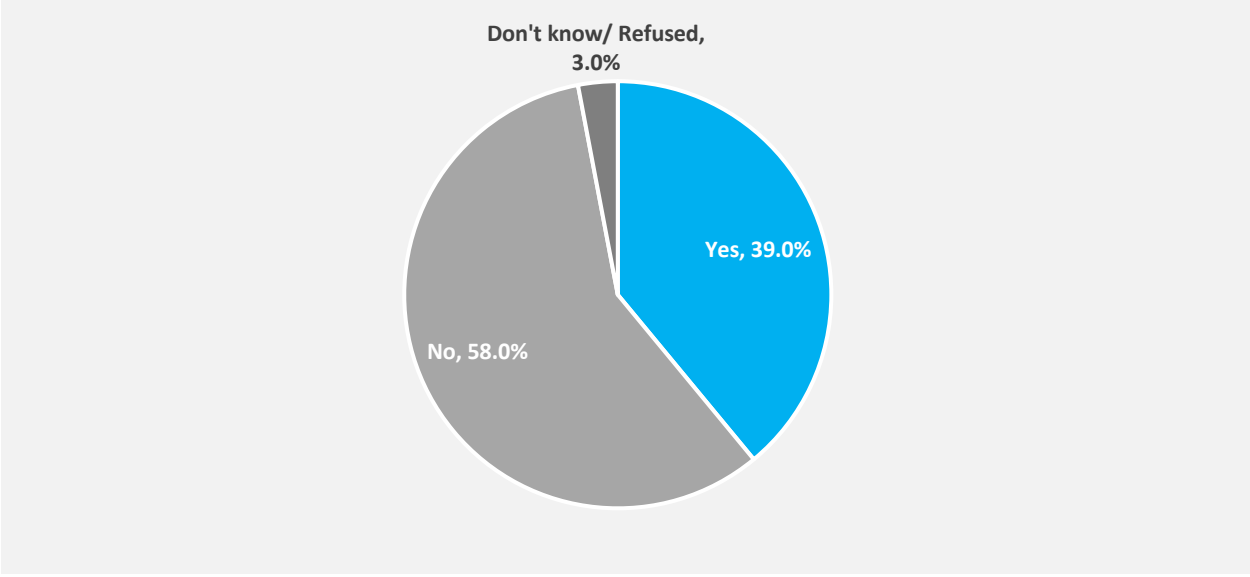
[20] Fewer than 20 firms indicated they were hiring in 2020.

COVID-19 Impacts

The following section and survey questions provide a snapshot of how COVID-19 impacted clean energy firms in Rhode Island. Nearly 40 percent of surveyed clean energy firms in Rhode Island indicated that they had to layoff, furlough, or reduce the pay of their workers as a result of COVID-19. Of those businesses that had to take these measures, about a third (32 percent) indicated that they had to reduce work hours, 21 percent reported temporary layoffs, 18 percent reported furloughing their clean energy employees, another 18 percent indicated a reduction in pay or benefits, and seven percent of employers reported that they had to permanently layoff their clean energy workers.

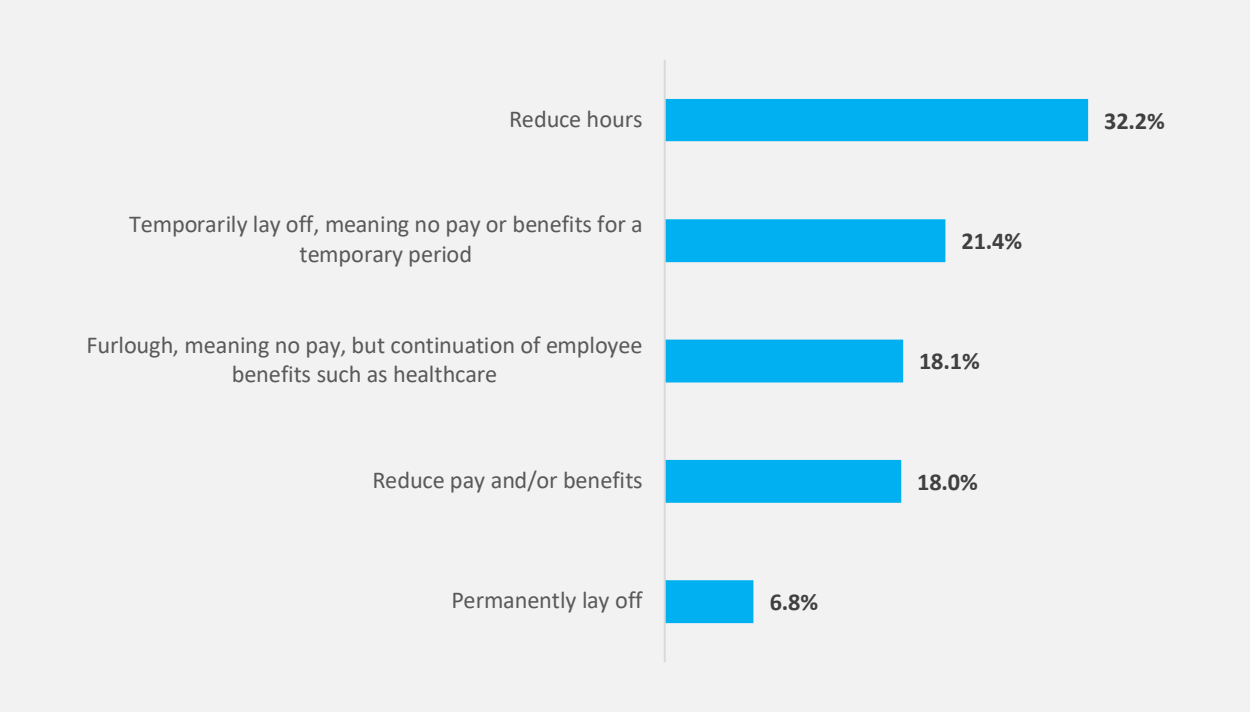
Notably, nearly three-quarters (74 percent) of firms that had laid off or furloughed clean energy workers indicated that they had since brought back these employees by the last quarter of 2020. In fact, with the majority of job losses concentrated in March through May, the clean energy labor market has been making steady job gains throughout the remainder of 2020 from June through December. Though not back to peak employment levels at the end of 2019, with vaccinations on the rise and pandemic restrictions being lifted, these job gains are likely to continue throughout the remainder of 2021 and into 2022.[21]

Figure 10. COVID-19 Workforce Impacts, 2021



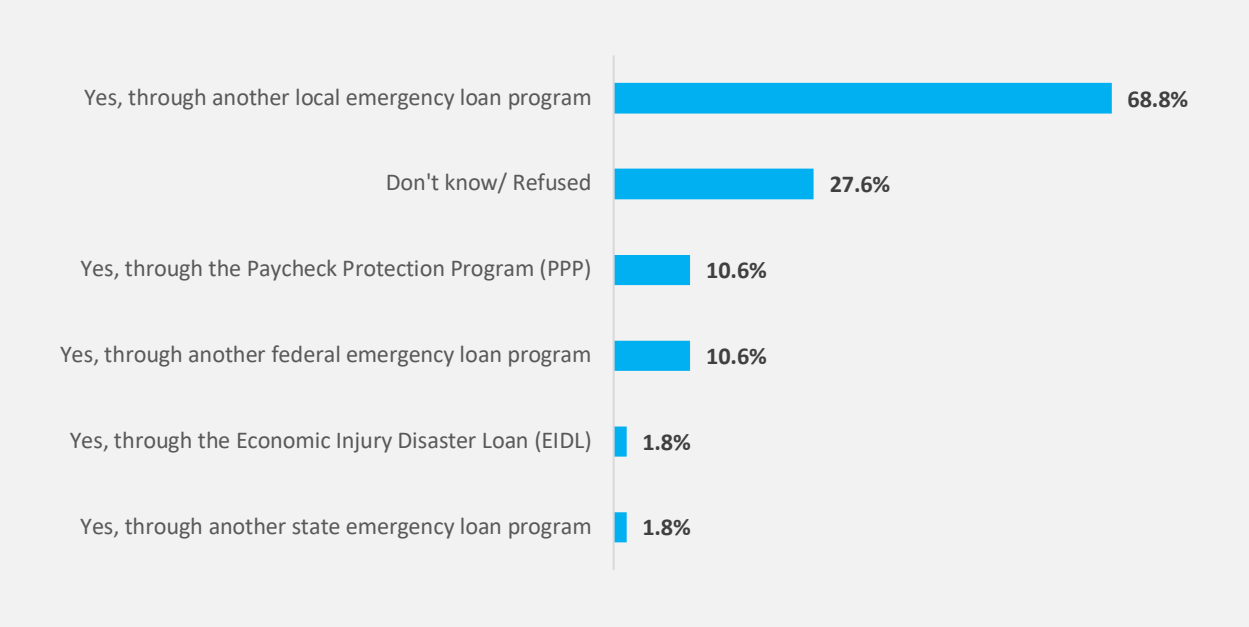
[21] Rhode Island to life pandemic restrictions by Memorial Day. April 2021. https://apnews.com/article/health-coronavirus-d43e9fc1b61417d1e57bdb573b4acb55.

Figure 11. COVID-19 Detailed Workforce Impacts, 2021



About seven in ten surveyed clean energy employers (69 percent) reported receiving financial support through a local emergency loan program. Less than 11 percent of businesses indicated using federal programs such as the Paycheck Protection Program (PPP) or other federal emergency loan programs.

Figure 12. COVID-19 Relief Programs and Assistance, 2021



Conclusions

Despite the unforeseen impacts of COVID-19, Rhode Island still remains a national leader in clean energy policy. Numerous policy initiatives, including the Act on Climate, Least Cost Procurement, and various renewable energy programs, continue to support the clean energy sector. With promising growth in the region's offshore wind industry combined with statewide commitments to economy-wide greenhouse gas emissions reductions across electricity generation, transportation, and building efficiency, and other clean energy investments and innovation, economic activity across the clean energy sector is bound to not only recover from the economic recession but will also likely see continued job growth from the state's clean energy businesses into the future.

Most importantly, over the next several months to a year, the clean energy economy may require continued monitoring, including additional feedback from employers in key sectors like solar, wind, and energy efficiency. In order to identify how the state can continue to support the recovery of lost jobs and the continued creation of more clean energy jobs, future Clean Energy Industry reports may seek to add additional metrics that track skill and workforce needs or perceptions of policy and financial support. Such additional data could help inform in-state clean energy training and education program development or track the success of current clean energy policy goals and initiatives.

Appendix A: Geographic Distribution of Clean Energy Jobs

County	2016 Employment	2017 Employment	2018 Employment	2019 Employment	2020 Employment	2021 Employment
Bristol County	444	638	439	457	466	372
Kent County	2,282	2,586	2,756	2,840	3,105	2,645
Newport County	1,313	1,603	1,461	1,515	1,501	1,331
Providence County	8,046	8,424	9,058	9,492	9,564	7,977
Washington County	1,690	2,054	1,762	1,738	1,748	1,606

Appendix B: Survey Methodology

This year's Clean Energy Industry Report is based on the data collected for the 2021 United States Energy and Employment Report (USEER). The 2021 USEER utilizes data from the Bureau of Labor Statistics Quarterly Census of Employment and Wages (BLS QCEW 2019 Q2) and Current Employment Statistics (CES Table B-1), as well as survey data. The survey was designed and implemented by BW Research Partnership. For the past decade, national, state, and local energy-related data collection and analysis efforts have used this survey methodology.

The survey uses a stratified sampling plan based on industry code (North American Industry Classification System or NAICS), establishment size, and geography to determine the proportion of establishments that work with specific energy related technologies, as well as the proportion of workers in such establishments that work with the same. These data are then analyzed and applied to existing public data published by the BLS QCEW, effectively constraining the potential universe of energy establishments and employment.

The survey was administered by phone and by web, with 7,472 outbound calls (to 3,986 business establishments – some called up to two times) and 688 emails sent to participants across Rhode Island. The phone survey was conducted by ReconMR with follow-up interviews by BW Research's in-house call center. The web instrument was programmed internally, and each respondent was required to use a unique ID in order to prevent duplication.

The sample was split into two categories, the known and unknown universes. The known universe includes establishments that have previously identified as energy-related, either in prior research or some other manner, such as membership in an industry association or participation in government programs. These establishments were surveyed census-style, and their associated establishment and employment totals were removed from the unknown universe for both sampling and for resulting employment calculations and estimates. Over the summer of 2020, BW Research cleaned, deduplicated, added to, and refined its database to reflect churn (companies out of business, moved, no longer in energy), unverified (no answer, answering machine, fast-busy, disconnect, etc.), verified, and other available demographic tags (industry, technology, sub-technology, size, etc.).

In addition to cleaning the original known energy database, BW Research also supplemented with industry association contact lists by technology (biofuels, coal, oil, and gas, energy storage, energy efficiency, solar, and wind), new companies from the unknown database that took the 2020 survey, and contact lists from subcontractors. BW Research also appended contact information, including six-digit NAICS codes, contact, employment, and location information.

The unknown universe includes hundreds of thousands of businesses in potentially energy-related NAICS codes, across agriculture, mining, utilities, construction, manufacturing, wholesale trade, professional services, and repair and maintenance. Each of these segments and their total reported establishments (within the BLS QCEW) were carefully analyzed by size (employment – provided by the Census Bureau's County Business Patterns) and state to develop representative clusters for sampling.

In total, 105 business establishments in Rhode Island participated in the full survey effort (a response rate of 11.6%). Another 386 establishments provided information (no to "energy involvement"). These responses were used to develop incidence rates among industries (percent "clean" vs percent "not clean") as well as to apportion employment across various industry categories in ways currently not provided by state and federal labor market information agencies. The margin of error for incidence is +/- 4.82 percent for Rhode Island at a 95 percent confidence interval. The margin of error for responses to the full survey is +/- 9.48 percent at a 95 percent confidence interval.

With clean data files in place, BW Research developed a general methodology for state employment estimation that has a few variations depending on sub-technology. Steps in the process are listed below.

100% NAICS A
These are NAICS codes where 100% of the reported employment is energy related AND 100% are allocated to a specific sub-technology. Examples include solar electric power generation, hydroelectric power generation, and motor vehicle manufacturing.

Actual Survey Responses
These include the reported sub-technology employment totals by company location. Responses from establishments in 100% NAICS codes are excluded.

Known Database
Employment is allocated by location for verified establishments in the known when the following conditions are met: 1) Have InfoUSA or DatabaseUSA appended data; 2) did not take survey (or actual survey response would be used), and 3) are not in a 100% NAICS.

Remainder
This represents remaining employment based on statistical extrapolation.

Industry Mix
Industry mix is the national proportion of industries that contribute to sub-technology employment. The mix of these industries (by 6-digit NAICS) is used to create proportions by state and remainder employment is allocated by these proportions. This "industry mix" was developed by analyzing completed survey incidence nationally for all clean energy sub-technologies over five years.

BW Research provided additional analysis of the publicly released Department of Energy data that included data from the Bureau of Labor Statistics, the Energy Information Administration, the U.S. Census Bureau, Emsi, the BW Research Partnership Energy Employment Index, historical data from prior Rhode Island Clean Energy Industry Reports. Of important to note, the USEER excludes any employment in retail trade NAICS codes—motor vehicle dealerships, appliance and hardware stores, and other retail establishments.