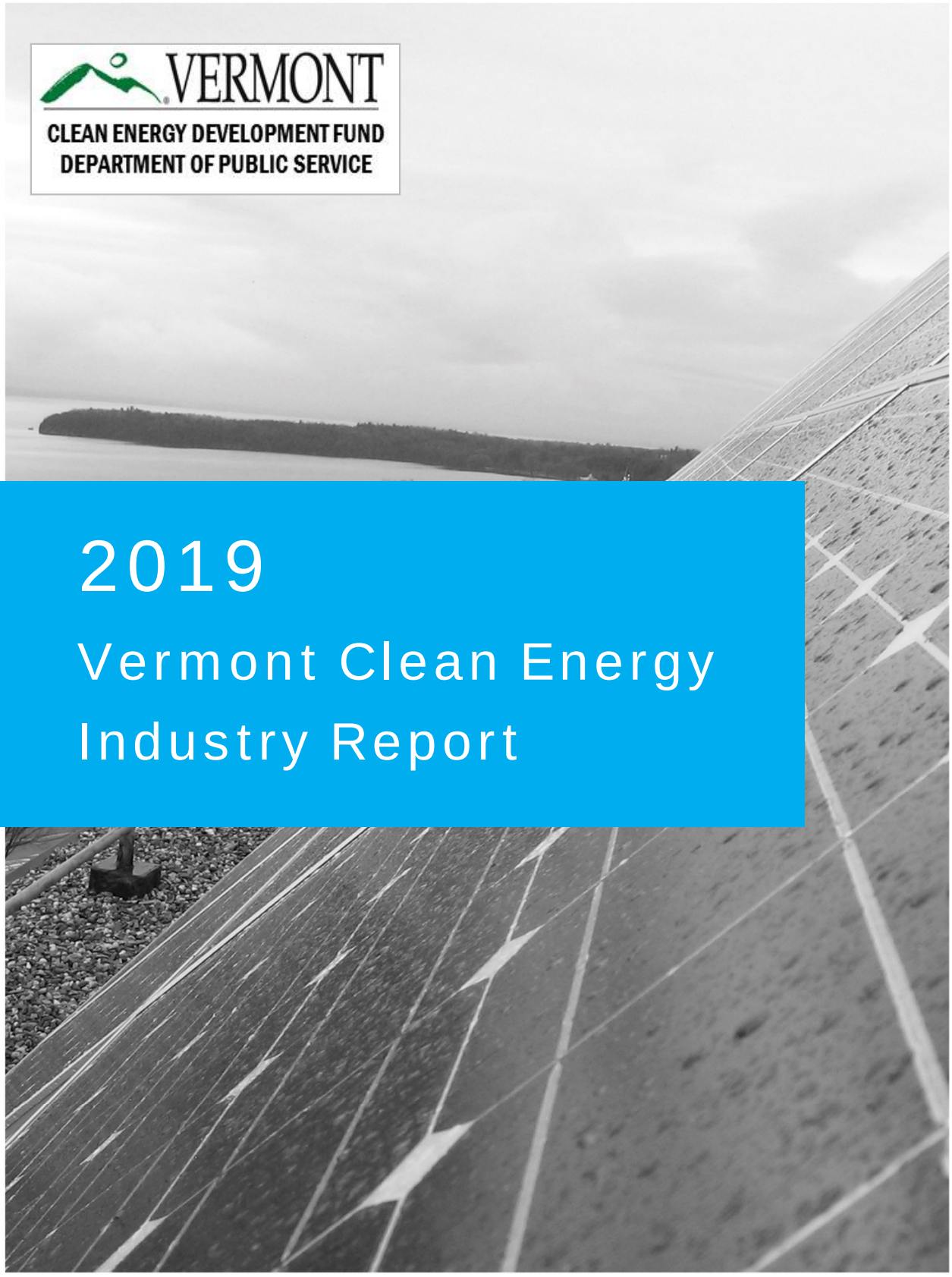
VERMONT
CLEAN ENERGY DEVELOPMENT FUND
DEPARTMENT OF PUBLIC SERVICE



2019
Vermont Clean Energy Industry Report

[bw] RESEARCH PARTNERSHIP

Opening Letter

Since 2014, the Clean Energy Development Fund at the Public Service Department has commissioned BW Research Partnership to conduct an annual clean energy job census to report on the state of the industry. The report has provided key insights and trends in Vermont's clean energy sector and how it compares to other states. For example, this 2019 report reveals that Vermont has the highest clean energy employment per capita in the nation at 5.7%.

With a total employment of almost 18,900 workers, the clean energy sector is a significant part of the Vermont economy, representing about 6% of all workers. However, this total has leveled off since 2017. In the first three years of the report employment expanded rapidly, growing by 29% from 2013 to 2017. In contrast, despite a 0.5% increase since 2018, the number of workers dropped 1% from 2017 to 2019.

The data in this report revealed a positive trend behind this plateau. Over 14,500 Vermont clean energy workers now have full-time jobs in the sector, up from just over 12,000 in 2017. These full-time workers are part of a new labor intensity metric introduced in this year's report, which rose 8% since 2018.

Also new to the 2019 report is a special analysis of the workforce development challenges and opportunities facing the clean energy sector. We learned that the lack of new talent created difficulty for clean energy employers and is likely constraining growth.

The total number of clean energy establishments grew by nearly 2% to 3,678. Given the uncertainties in the national clean energy policy environment, a scaling back of the State's net metering program, and persistent low fossil fuel prices, we are pleased to see the Vermont's clean energy businesses growing and proving resilient.

As the state's clean energy industry matures, this report helps to show the manifestation of state policy and changes in demand for clean energy goods and services. Clean energy is a vibrant part of the Vermont economy, helping to make our energy future more secure. We look forward to continued progress in this industry as the State works to make Vermont more affordable with increased economic opportunity while protecting Vermont's most vulnerable.

Sincerely

June E. Tierney, Commissioner

Andrew Perchlik, CEDF Manager

Acknowledgments

This Clean Energy Industry Report is the sixth in a series of reports conducted and written by BW Research Partnership, Inc. under commission by the Clean Energy Development Fund (CEDF) of the Vermont Department of Public Service (PSD).

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Introduction

The 2019 *Vermont Clean Energy Industry Report*, the sixth in a series dating back to 2014, is an annual assessment of the size and characteristics of Vermont's clean energy workforce. Vermont, a steadfast leader in the development of renewable energy and energy efficiency and innovator in clean energy policy, sponsors this research to provide meaningful insights into the economic opportunities and challenges present in the clean energy industry. The report allows Vermont to build a profile of the clean energy workforce year-over-year, developing a broader understanding of the industry over time as opposed to a single-year snapshot. This allows policy makers, employers, workers, workforce development organizations, and educational institutions to make informed decisions for their respective roles in the clean energy economy.

The 2019 report shows Vermont's continued leadership in per-capita clean energy employment. During 2018, Vermont witnessed both challenges and opportunities in the evolution of the state's clean energy industry. Even as national policies impacted certain subsets of the state's clean energy businesses (e.g., solar PV), other parts advanced (e.g., electric vehicles). Highlights for the year include successful compliance with the Renewable Energy Standard by all utilities[1], establishment of Vermont's VW Mitigation Trust Fund focused on clean transportation, and concluding recommendations of the Vermont Climate Action Commission. Activity continued at the community level with the Climate Economy Initiative supported by the Vermont Council on Rural Development, and sale of $37 million of Housing Revenue Bonds (sold as "sustainability bonds") by the Vermont Housing Finance Agency for use by the Vermont Housing Conservation Board to support affordable and efficient housing construction in the state.

This report provides the same detailed technology and value chain data as in previous years, but also includes a special analysis on workforce trends and issues with more geographic granularity. This year's report also introduces a new clean energy labor intensity metric to sharpen the employment picture. As with reports beginning in 2016, data were collected in collaboration with the National Association of State Energy Officials (NASEO) and the Energy Futures Initiative (EFI) for its U.S. Energy and Employment Report (USEER).[2] Solar data is sourced to The Solar Foundation's National Solar Jobs Census.[3]

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[1] *2019 Annual Report on the Renewable Energy Standard*. Vermont Department of Public Service, Jan. 15, 2019. https://publicservice.vermont.gov/sites/dps/files/documents/2019%20Annual%20Report%20on%20the%20RES.pdf

[2] *The 2019 U.S. Energy and Employment Report*. Mar. 6, 2019. https://www.usenergyjobs.org/.

[3] *The National Solar Jobs Census 2018*. Feb. 2019. https://www.thesolarfoundation.org/national/.

All data in this report are based on a comprehensive survey of employers in Vermont and the Bureau of Labor Statistics Quarterly Census of Employment and Wages for Q2 of 2018.[4]

A note about clean energy workers and survey methodology: [5]

Employment data for this report captures, as the clean energy workforce, all employees from qualifying clean energy firms that spend ***any portion of their time*** supporting the research, development, production, manufacture, distribution, or installation of clean energy products and services. This includes support services such as consulting, finance, tax, and legal services related to clean energy technologies.

As such, employment totals in this report should not be equated to Full-Time Equivalents (FTEs), but instead taken as a total measure of the state's clean energy economy. To better describe labor intensity, survey data provides both a 50 percent and 100 percent employment threshold for workers that spend at least half of their time and those that spend all of their time supporting the clean energy portion of business. For more information please refer to Table 1 and Figures 2 and 3 of this report.

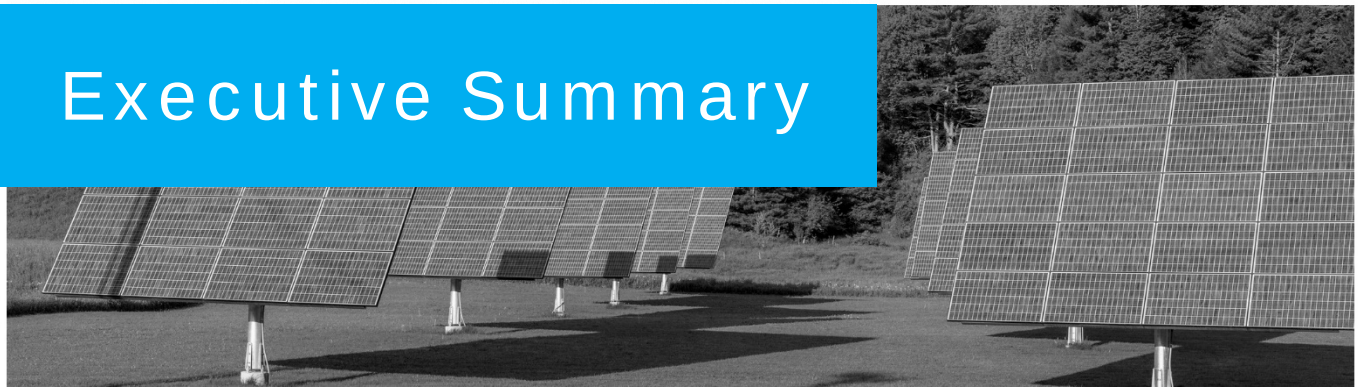
It is important to note that solar employment in this report will not match numbers reported in The Solar Foundation's (TSF) Solar Census. Where TSF uses the 50 percent threshold for their employment totals, VCEIR reports have always reported total solar employment; as a result, VCEIR solar employment totals will be higher compared to TSF reports.

It is also important to note that employment data excludes any retail employment focused on sales—i.e., motor vehicle dealerships, appliance and hardware stores, and other retail establishment workers are not included in the survey.

[4] *Quarterly Census of Employment and Wages, Bureau of Labor Statistics*, Private Ownership, 2018 Second Quarter, June Employment. https://data.bls.gov/cew/apps/table_maker/v4/table_maker.htm#type=2&st=50&year=2018&qtr=2&own=0&ind=10&supp=0

[5] *The 2019 U.S. Energy and Employment Report*. Mar. 6, 2019. https://www.usenergyjobs.org/.

Executive Summary



Vermont's clean energy industry continues to set an example for the rest of the nation. Employing 18,886 clean energy workers (up 0.5% from the 2018 report), Vermont has the highest clean energy employment per capita in the nation at 5.7%.[6] When adjusted for labor intensity, clean energy activity has increased much more rapidly, by 8% over the same period. Despite tepid overall clean energy workforce growth, clean energy work is increasing substantially due to workers spending more of their time on clean energy work. This intensity metric, new to this year's *Vermont Clean Energy Industry Report*, provides an additional layer of insight to the clean energy industry.

Energy efficiency remains the steady core of Vermont's clean energy industry, with renewable energy generation decreasing over 2018. Clean transportation workers experienced the largest growth over 2018. Given recent clean energy policy and goals, the energy efficiency and clean transportation sectors seem well-positioned for continued growth through 2019.

Hiring qualified workers has become more difficult in Vermont, reaching the highest levels of difficulty since it was first measured. Employers most frequently cite "lack of experience, training, or technical skills" and "insufficient qualifications (certifications or education)" as the top reasons for three of the past four years. These qualitative metrics highlight the need to support technical trainings, apprenticeship programs, career and technical education (CTE) offerings, high school equivalency programs, and certification programs throughout the state. Such programs are especially important when considering the high unemployment rates among young people and those with less than a high school diploma.

With respect to the location of clean energy jobs, this report identifies three geographic areas. The Burlington New England City and Town Area (NECTA)[7] is understandably the hub of Vermont's clean energy work—employing 8,300 clean energy workers—due to its 47% (5,000 workers) share of the state's energy efficiency workers. However, the North Balance[8] of the state employs 2,720 renewable energy generation workers, the most of the three substate regions. Chittenden, Essex, and Washington counties boast the highest amount of clean energy workers per capita. The northeast counties (Essex, Caledonia, and Orleans) have a high number of clean energy workers per capita and high unemployment rates, and therefore are home to a potential supply of workers that can be trained for jobs in clean

[6] Derived from BLS QCEW data and survey responses.
[7] Vermont Labor Market Information, Vermont Department of Labor (http://www.vtlmi.info/oesmap2015.pdf).
[8] Ibid.

energy. With training, these unemployed populations would have the opportunity to participate in Vermont's growing clean energy industry.

Employers in the clean energy industry are optimistic about Vermont's 2019 workforce growth. Employers expect 1,000 clean energy workers to be added to the workforce over 2019, growing the industry's workforce by 5%. However, based upon the difficulties with hiring cited by employers again this year, doing so may prove to be a challenge. With support from legislators and workforce development organizations, Vermont's clean energy industry can continue to make great progress towards meeting the state's climate and energy goals while creating more work opportunity for its residents.

Industry Overview

Vermont hosts nearly 18,900 clean energy workers, an increase of about one-half percent over 2018. This modest addition of 127 clean energy workers represents a bounce back from the decline of more than 300 clean energy workers in 2017. While the industry overview data shows a flattening growth curve, with additional context and analysis several important details reveal a more robust industry.

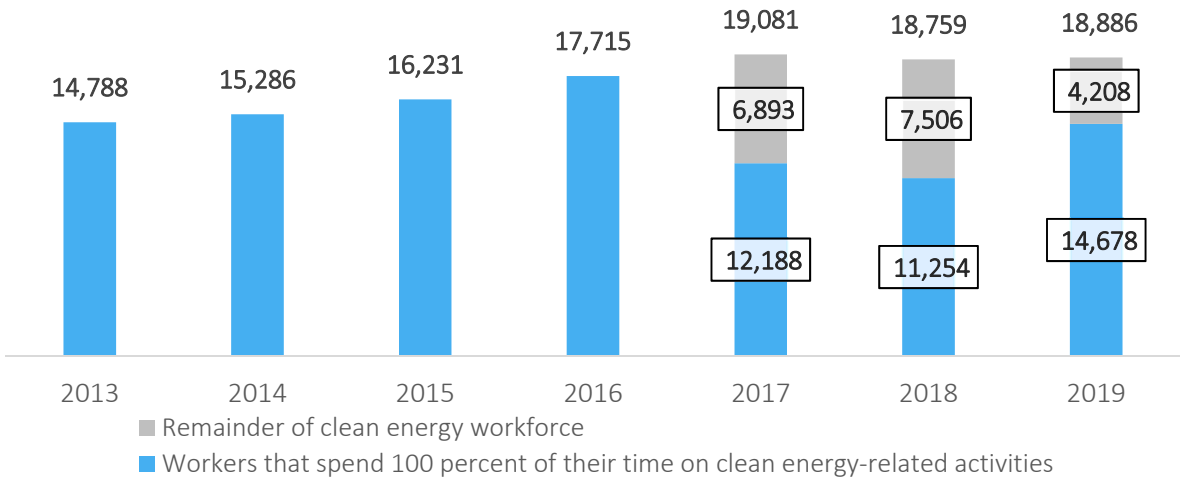
It is important to consider the underlying economic conditions in Vermont as context for clean energy growth. The clean energy sector grew despite the state losing jobs overall (a decline of 0.7% statewide). Despite the downturn in jobs, the unemployment rate also fell over the period, a demographic challenge that suggests that Vermont is facing a shortage of talent and an aging population, both of which are creating headwinds for clean energy employers in the state.[9] Employers report anticipated one-year growth of 5% or about 1,000 additional clean energy workers.[10] Given the labor shortages and difficulty hiring identified in this report, it is unlikely that employers will be able to hire at such a pace, and may be that talent shortages in key industries such as the construction trades are already hampering growth.

It is important to note that industry employment activity does not exist in a vacuum. When goals, policies, incentives, and subsidies influence one sector, positive and negative impacts to other sectors follow. This report counts direct clean energy jobs only; it does not address the additional positive impacts of that employment and associated wages to the state economy, nor does it address the potential negative impacts to other sectors of the economy.

[9] *Vermont Labor Force & Unemployment, 2018 – Seasonally Adjusted*. Mar. 11, 2019. http://www.vtlmi.info/Labforce.cfm?qperiodyear=2018&qareatype=01&qadjusted=Y.

[10] Projected employment is based on survey responses of employers' hiring expectations over the next 12 months. The metric is weighted with previous years' growth rates. This metric is not an economic forecast.

Figure 1. Clean Energy Employment Growth, 2013-2019 [11]



While the total number of clean energy workers—defined as those who spend any portion of their time with a clean energy technology—is largely unchanged since 2017, the intensity of clean energy as a proportion of those jobs has increased. Counting all workers who spend a portion of their time in clean energy provides critical data to education and training providers (how many people need skills is more important to education and training than how often those skills are used) and to understand how ubiquitous the jobs have become within specific industries in the state. However, intensity of labor—defined as the proportion of workers who spend a majority or all of their time as opposed to only some portion of their time—is helpful to understanding changes to overall clean energy activity statewide, particularly in cases of year-over-year analysis and state-by-state comparisons.

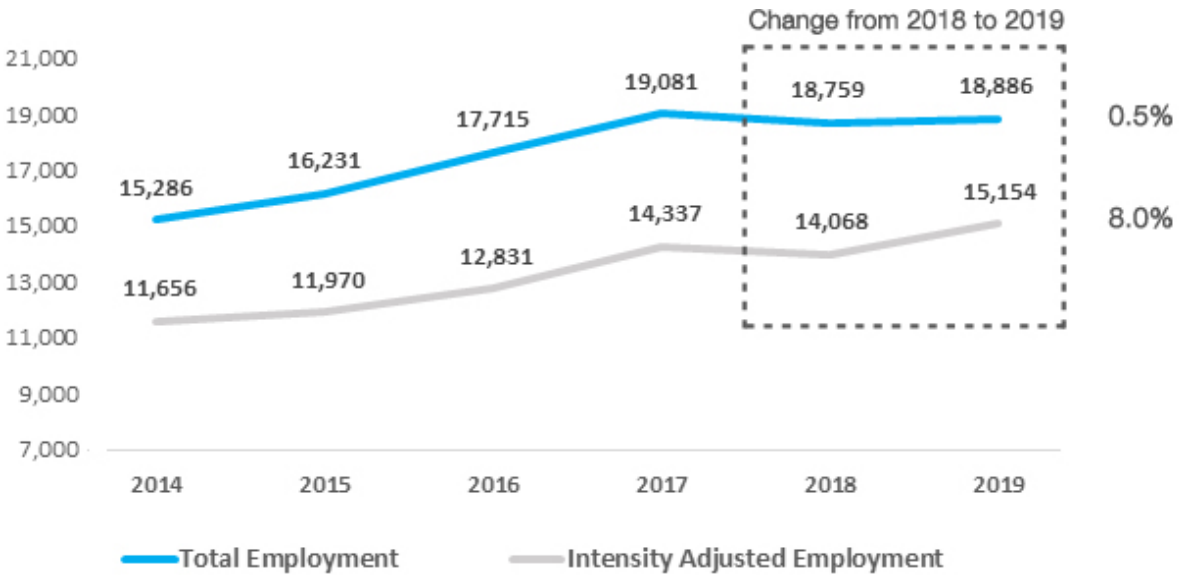
To illustrate the distinction between the total number and relative proportions of labor, Vermont is introducing a new metric to measure clean energy work intensity, which will be replicated in future reports to show how clean energy activity is changing over time. To do this, total clean energy workers are provided a weight based on whether they a) spend some but not a majority of their time on clean energy activities; b) spend a majority but not all of their time on clean energy activities; or c) spend all of their time on clean energy activities. For example, a heating, ventilation and air conditioning (HVAC) installer who spends all of her time installing heat pumps is weighted more heavily (1.0) than one who only occasionally does so (0.25). This weighting allows for more accurate comparisons to other states, but also allows for better tracking of activity. Because the survey used for this report has tracked these different levels of intensity since Vermont began its annual production, it's possible to apply these weights retroactively and see the changes over time.

When the new clean energy labor intensity metric is considered, different perspectives emerge. While clean energy employment grew only half a percent over 2018, intensity-adjusted employment grew 8% over the period. Figure 2 illustrates the more consistent growth curve when intensity is factored into the

[11] Previous editions of this report prior to 2017 did not split out 100% employment in clean energy vs. less amounts of time.

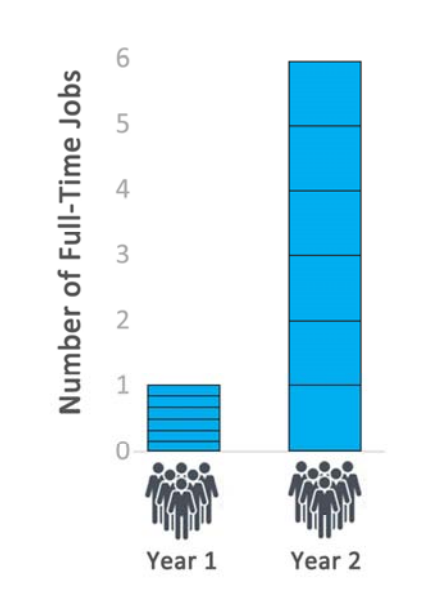
growth equation, counter to the flattening of labor hours that appears when looking only at total clean energy workers.

Figure 2. Intensity-Adjusted Employment, 2014-2019



An example can illustrate the importance of tracking labor intensity. If an HVAC firm had 6 installers in 2016 who occasionally installed heat pumps, and now has 6 installers who exclusively do so, there would be no change in the total number of clean energy workers reported. However, because the number of labor hours working with heat pumps has increased, the intensity metric would show a corresponding increase.

The data for 2018 show that workers that spend over 50% of their time supporting clean energy activities grew to 76%, and workers who spend all their time on clean energy work has reached 67%.[12] Vermont's clean energy employers are increasingly focused on clean energy technologies and workers are concentrating more on clean energy.

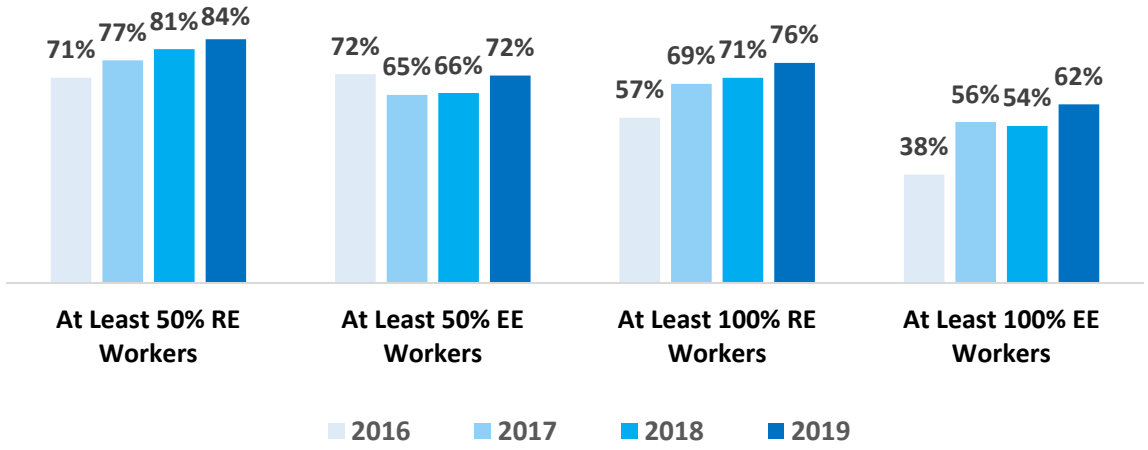


[12] Derived from survey responses.

Table 1. Clean Energy Employment Thresholds, 2016-2019[13]

	WORKERS THAT SPEND AT LEAST 50 PERCENT OF THEIR TIME				WORKERS THAT SPEND 100 PERCENT OF THEIR TIME				
	2016	2017	2018	2019	2016	2017	2018	2019	
Renewable Energy	71%	77%	81%	76%	84%	57%	69%	71%	67%	76%
Energy Efficiency	72%	65%	66%		72%	38%	56%	54%		62%

Figure 3. Clean Energy Employment Thresholds, 2016-2019



Clean energy labor efficiency—defined as the amount of labor hours for equivalent goods and services over time (e.g. time it takes to install a 5kW PV system)—is an important metric to consider when analyzing the clean energy workforce. Solar energy generation installations are valuable as a case study while illustrating these national trends. While clean energy labor intensity has risen dramatically, solar labor hours per 5kW install has fallen 12% each year since 2014.[14] Due to technological advancements and increases in productivity, workers spend much less of their time installing the same amount of solar generation capacity compared to a few years ago. This is also evident in national solar employment data, solar installed capacity is up 87% from 2014-2018, while solar installation workers are up only 39%.[15]

The total number of establishments working in the clean energy industry has risen nearly 2% over 2018, from 3,612 establishments in 2018 to 3,678 in 2019. Clean energy establishments are up 46% since 2015, with most establishments operating in the energy efficiency sector. More than 1,300 establishments conduct clean energy construction work, and more than 1,000 establishments support the engineering, research, and professional services value chain.

[13] An error in last year's report claimed 70% of workers spent 100% of their time supporting clean energy activities; it should have been 60%. Note: Prior to 2016, the data was not broken out into renewable energy and energy efficiency segments.
[14] Based on BW Research Partnership labor market analysis using national-level, USEER data.
[15] *The Solar Foundation National Solar Jobs Census Series*.

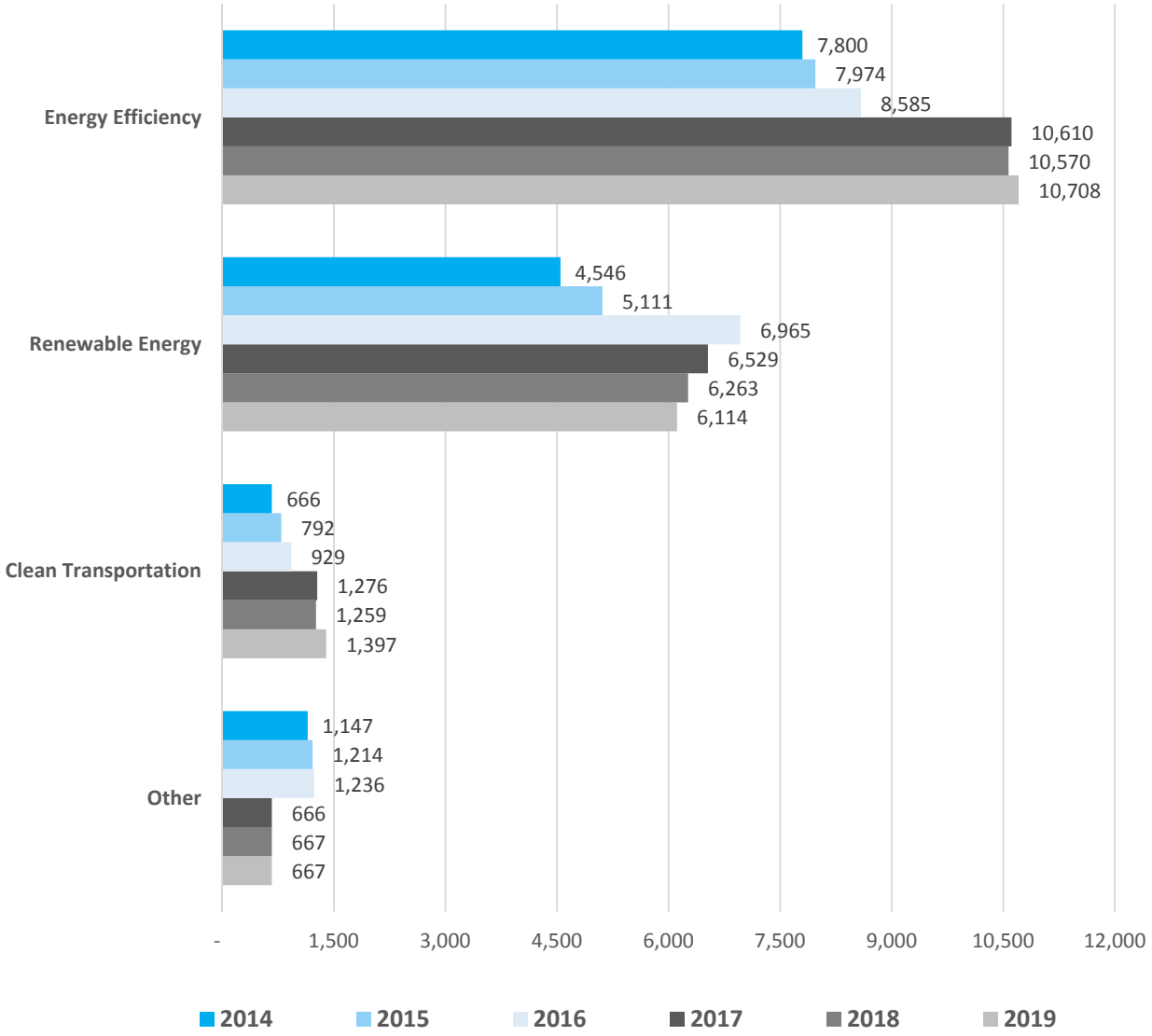
Clean Energy Technology Analysis

Energy Efficiency—the largest clean energy technology in Vermont—added the most clean energy workers over 2018 and now represents 57% of all clean energy workers in the sector. Clean transportation continues to grow, an important finding considering that transportation accounts for 43% of emissions in Vermont, which is more than 50% greater than the US average of 28% (Vermont is currently about 16% above 1990 levels of carbon emissions).[16] Clean transportation employment growth is a positive indication that the state will see future emission reductions in this important segment.

The number of clean energy workers engaged with renewables declined for the third year. Both increased labor efficiency and changing business models led to slower growth of clean energy workers across the U.S.[17] A greater share of utility-scale solar employment,[18] which requires less labor per megawatt than residential applications, as well as fewer retail sales positions in the solar sector[19] and national trade policies are reasons for the continued decline nationwide.[20] However, as reported in the National Solar Jobs Census, employers are optimistic that the industry will bounce back significantly in 2019.[21]

[16] *Vermont Greenhouse Gas Emissions Inventory Update: Brief 1990-2105; June 2018*. Vermont Department of Environmental Conservation. https://dec.vermont.gov/sites/dec/files/aqc/climate-change/documents/_Vermont_Greenhouse_Gas_Emissions_Inventory_Update_1990-2015.pdf.
[17] Based on analysis by BW Research Partnership of USEER data since 2015.
[18] *The Solar Foundation National Solar Jobs Census Series*. Utility-scale solar is defined by project size and the sale of electricity to wholesale utility buyers as opposed to end-use consumers.
[19] https://www.greentechmedia.com/articles/read/solarcity-halts-door-to-door-residential-pv-sales-to-focus-on-retail-and-on#gs.3e5t9x
[20] *The National Solar Jobs Census 2018*. Feb. 2019. https://www.thesolarfoundation.org/national/
[21] Ibid.

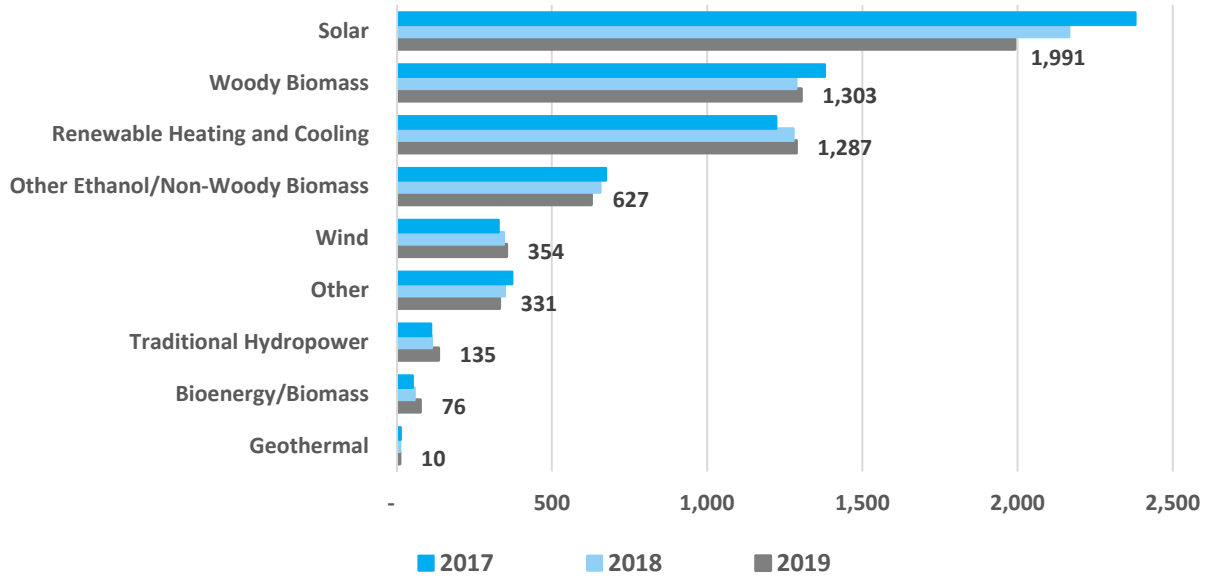
Figure 4. Clean Energy Employment Growth by Technology, 2014-2019[22]



The decline in solar employment over 2018 is 8%, or 175 clean energy workers. Despite recent employment declines the state remains a leader in solar employment per capita, and solar energy generation workers still constitute nearly 33% of renewable energy generation workers in Vermont, at almost 2,000 solar workers. Modest increases in woody biomass (16 clean energy workers), bioenergy/biomass (19 clean energy workers), hydropower (22 clean energy workers), and wind (9 clean energy workers) offset some but not all of the solar worker losses.

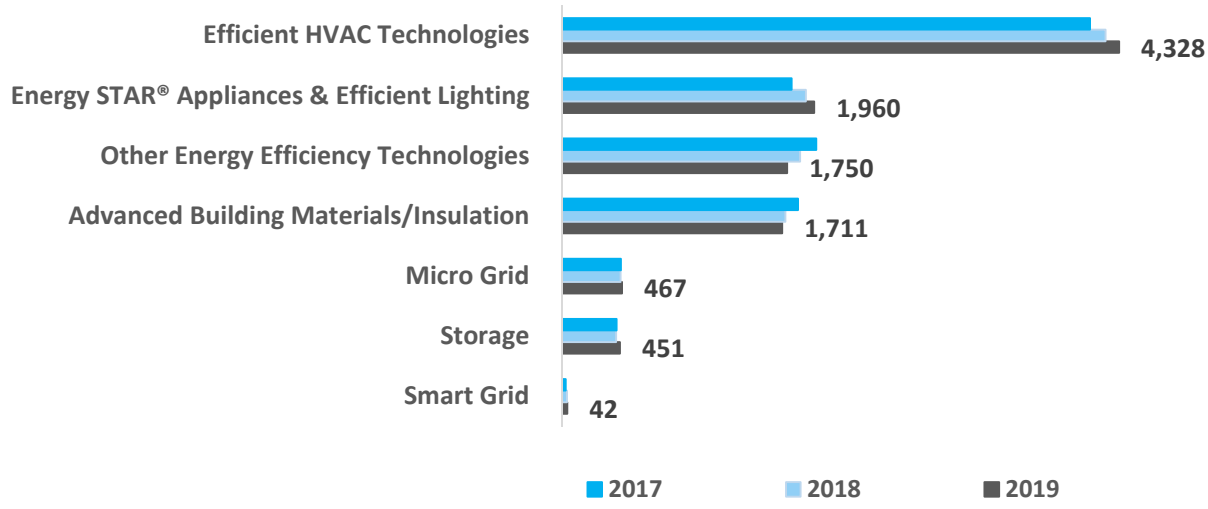
[22] "Employment" is used instead of "jobs" as this is a measure of the number of workers employed in clean energy industry roles, not the number of jobs within the industry.

Figure 5. Renewable Energy Generation Employment by Sub-Technology, 2017-2019



Efficient HVAC technologies currently employ more than 40% of energy efficiency workers and have been relatively stable over the past several years, with an added 106 clean energy workers over 2018. Energy efficiency subtechnology trends suggest continued growth heading into 2019, with employment increases in EnergySTAR® appliances & efficient lighting (65 clean energy workers) and clean storage (29 clean energy workers). Other efficient technologies[23] saw a 5% drop in employment over 2018, losing 100 clean energy workers, and advanced building materials/insulation also experienced a loss of 25 clean energy workers.

Figure 6. Energy Efficiency Employment by Sub-Technology, 2017-2019



[23] Includes variable speed pumps, other design services not specific to a subtechnology, software not specific to a subtechnology, energy auditing, rating, monitoring, metering, and leak detection, EE policy not specific to a subtechnology, LEED certification, consulting not specific to a subtechnology, and phase-change materials.

Lithium batteries are found to be most ubiquitous among clean energy storage firms in Vermont, while lead-based, vanadium redox flow, and other flow batteries are rarer. Most of the battery storage in the state is used for storing energy for the electric grid, buildings or industrial facilities. Battery storage for use in transportation vehicles does not constitute a large amount of clean energy storage activity in Vermont.

Figure 7. Battery Types Used by Vermont Storage Companies [24]

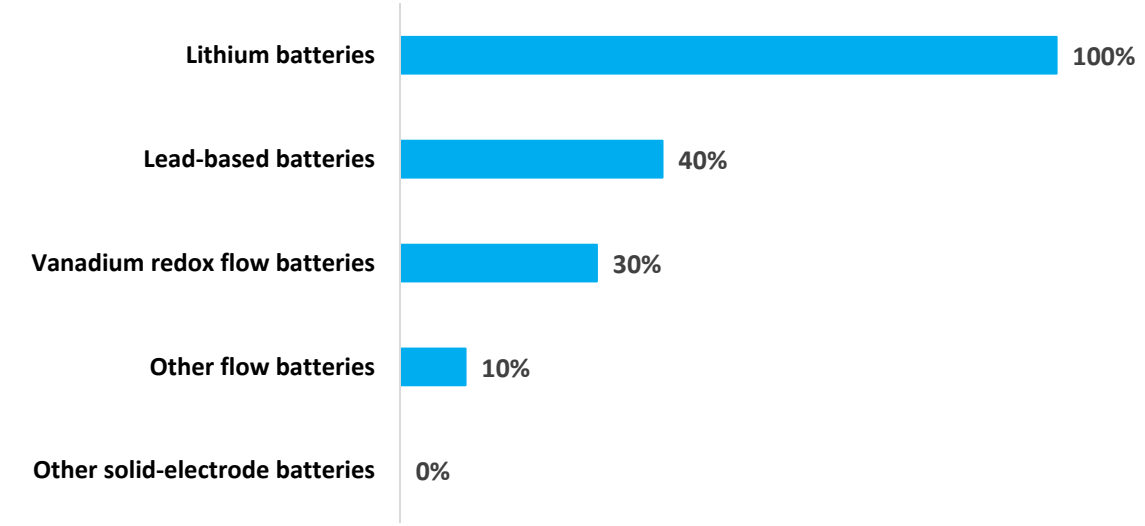
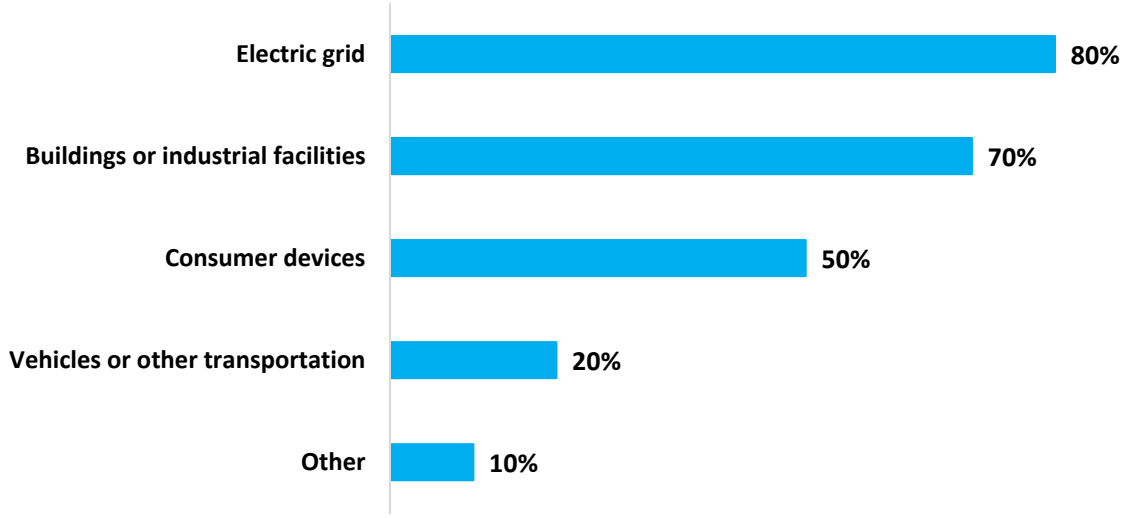


Figure 8. Battery Storage Applications Used by Vermont Storage Companies[25]



[24] This was a multiple choice question; percentages do not sum to 100 because respondents could select more than one response.
[25] This was a multiple choice question; percentages do not sum to 100 because respondents could select more than one response.

Clean Energy Value Chain Analysis

The number of clean energy firms across the value chain has remained largely stable. This suggests that the increases over time in clean energy employment are based on hiring by existing firms and less on new company entrants. Employment increases in professional services is good news for Vermonters, as jobs in these fields typically pay well. Slight decreases in manufacturing, wholesale trade and distribution, and utilities employment are not a cause for significant concern, as they likely are symptomatic of the overall decrease in employment in Vermont over 2018. Clean energy construction remains the juggernaut in the clean energy industry, employing 8,330 people, or 44% of clean energy employment, while wholesale trade is the next largest, with more than 4,100 workers, making up 22% of industry employment.

Figure 9. Clean Energy Establishments by Value Chain, 2019

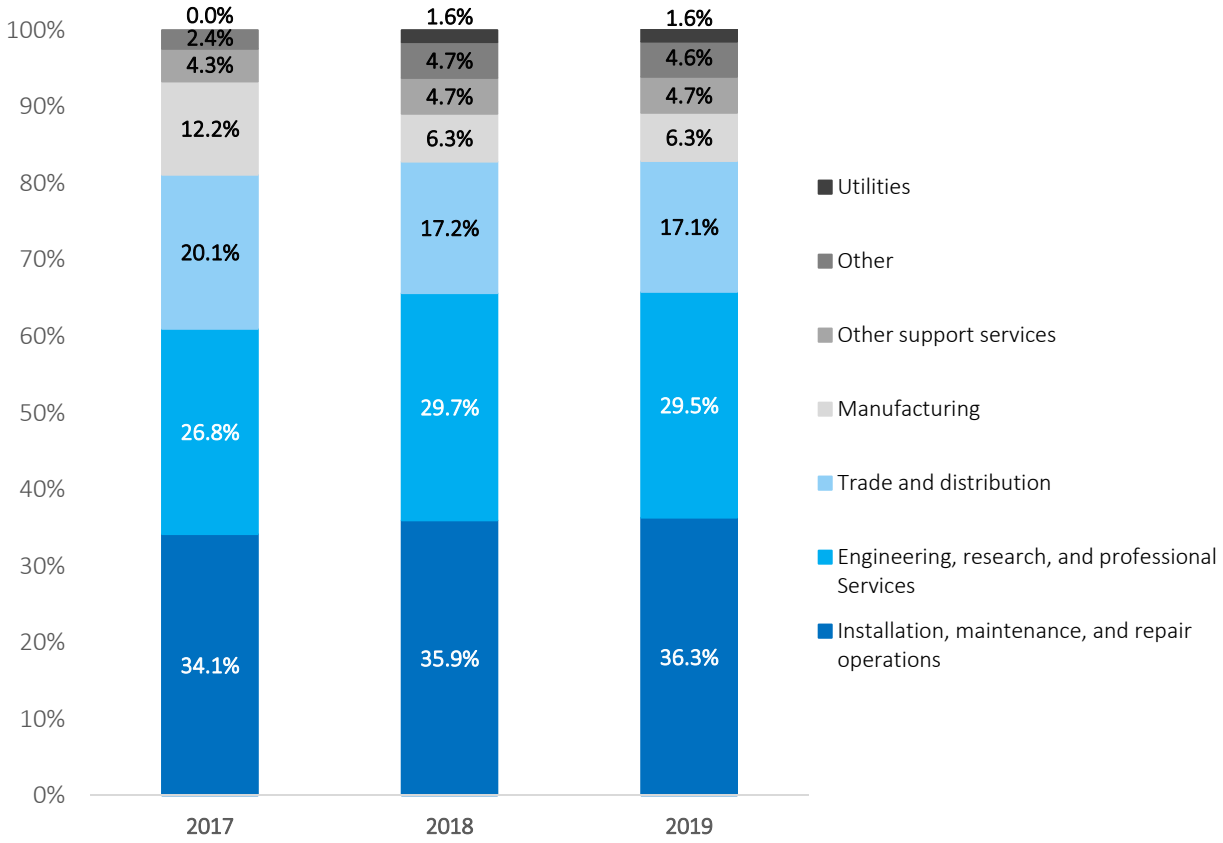
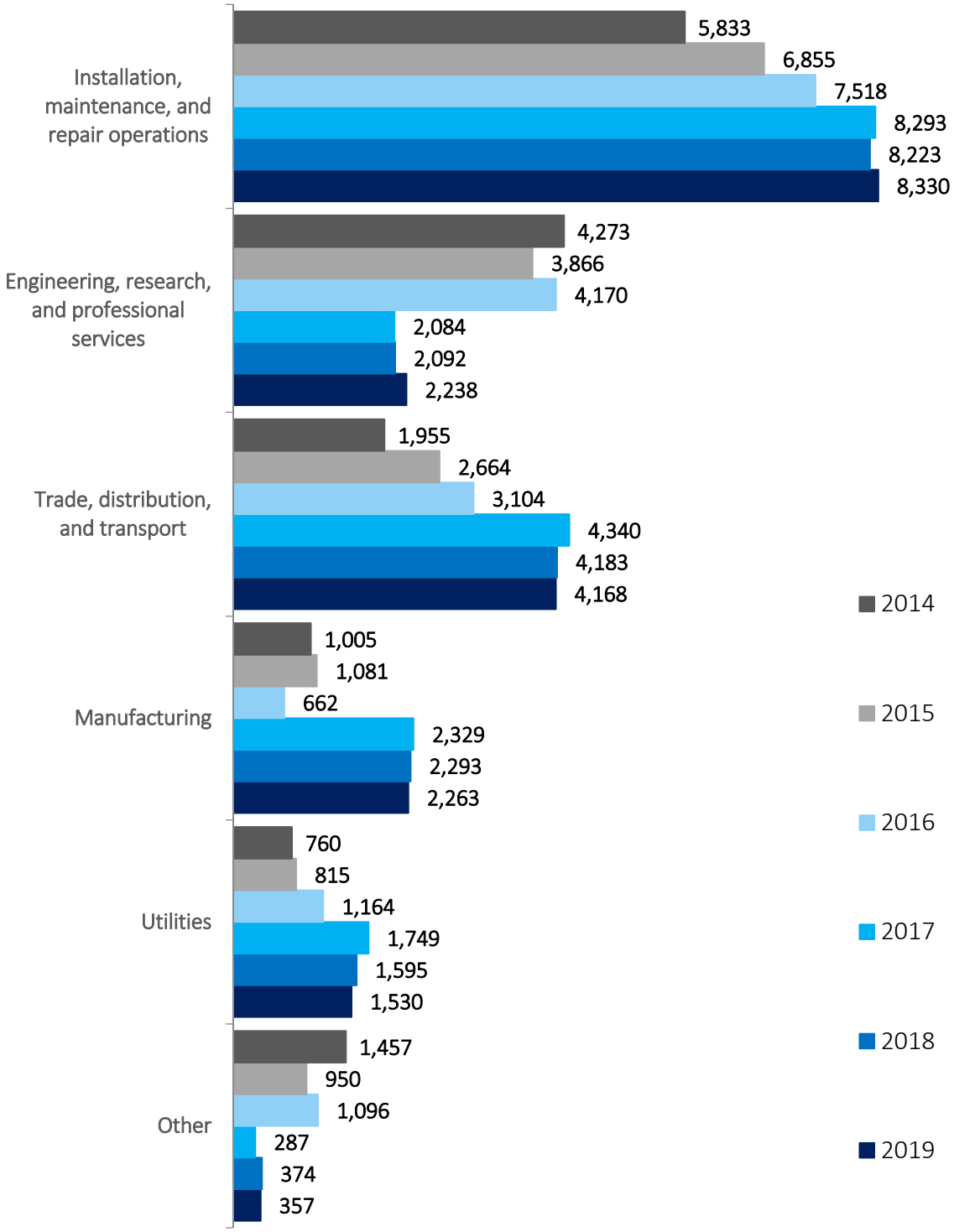


Figure 10. Value Chain Employment Growth, 2014-2019



2018 Special Analysis:
Workforce Development Challenges and Opportunities

HIRING DIFFICULTIES

Prior Vermont Clean Energy Industry Reports have not provided details about the characteristics, skills, and quality of clean energy jobs in the state. Frequently, individual job seekers, policy makers, and education and training providers wish to know more about clean energy occupations, including what employers are looking for (Tables 4 & 5), where jobs are located, and the education, experience, and training required for positions. This special analysis provides some new data about the nature of clean energy work in Vermont.

"Lack of experience, training, or technical skills," "insufficient qualifications (certifications or education)" and "location" are the top 3 reasons cited for hiring difficulties in 2018. For three of the past four years, "lack of experience, training, or technical skills," and "insufficient qualifications (certifications or education)" have been the top 2 reasons for hiring difficulty.

Hiring difficulty is a good barometer of the match between talent supply and demand in the general economy. Overall hiring difficulty in the clean energy industry increased again this year for the third year in a row. As with the U.S. as a whole, the largest category of clean energy jobs in Vermont is construction-related energy efficiency workers.[26] These same national trends show that specialty trade contractors in energy efficiency are the most difficult for employers to hire for. Analysis of national and state data suggest that there are shortages of construction tradespeople with the appropriate energy efficiency skills and certifications.

[26] Most energy efficiency work falls under construction (installation, maintenance, repair activities). Energy efficiency is the largest technology and construction is the largest value chain in Vermont's clean energy industry.

Figure 11. Hiring Difficulty, 2016-2019

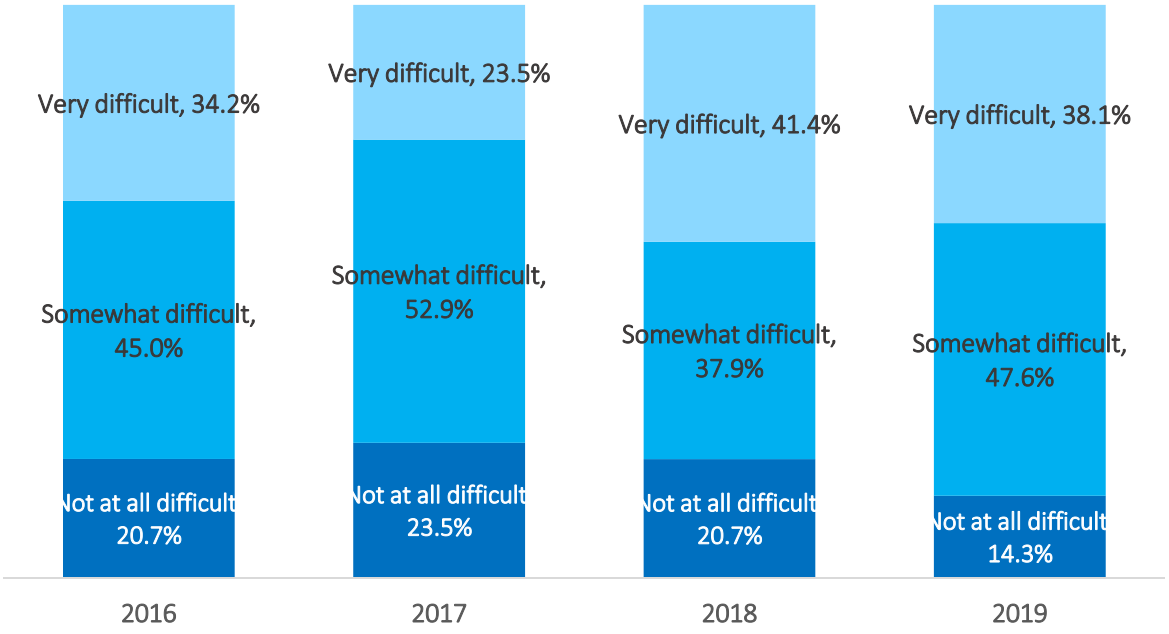
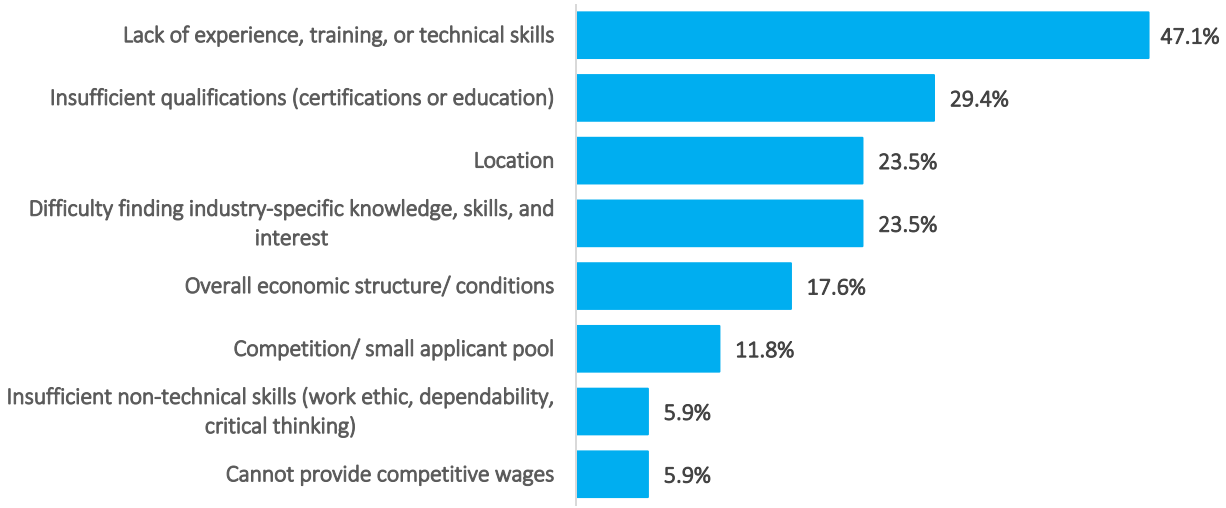


Figure 12. Reasons for Hiring Difficulty, 2019[27]



Location is the third most cited area of hiring difficulty, which highlights challenges of job access. As shown in the geographic analyses provided in this report, there is a potential mismatch between labor and opportunity, particularly in the northeast counties of the state. The following sections explore the

[27] This was a multiple choice question; percentages do not sum to 100 because respondents could select more than one response.

connections between unemployed populations that appear available to work but may lack access to gainful employment.

WAGES, BENEFITS, AND OTHER QUALITY METRICS

The most difficult to fill occupations in Vermont's energy industry are technicians/mechanical support, engineers or scientists, and electricians/construction laborers.[28] Some specific occupations from these broader categories include electricians; HVAC mechanics; installation, maintenance, & repair occupations; and engineers. For the sake of occupational variety, this report examines sales representatives along with the aforementioned roles. These occupations are diverse in their requisites, responsibilities, wages, and other qualitative metrics and allow insight into the many career options in the clean energy industry.

Table 2. Vermont Median Hourly Wages[29]

	RENEWABLE ENERGY			ENERGY EFFICIENCY		
	Entry	**Mid**	**High**	**Entry**	**Mid**	**High**
Electricians	$13.57	$19.43	$28.89	$18.91	$25.47	$32.95
HVAC Workers	$13.10	$20.77	$32.66	$18.43	$25.15	$35.05
Installation, Maintenance, and Repair Occupations	$13.10	$20.77	$32.66	$14.84	$20.72	$30.23
Sales Representatives	$17.60	$28.71	$56.74	$30.55	$39.57	$68.70
Engineers	$24.99	$37.21	$56.61	$23.78	$39.38	$57.98

Wages for clean energy occupations in Vermont are often at a premium compared to the typical worker. For example, an electrician working in energy efficiency industry sector in Vermont making mid-level pay makes on average about $5.38/hour (28%) more than the average electrician in Vermont. These premiums are even higher for entry level positions.

[28] *The 2019 U.S. Energy and Employment Report (USEER) State Reports*. https://www.usenergyjobs.org/2019-state-reports

[29] Derived from BLS and survey responses. Vermont-specific wage data.

Table 3. Vermont Clean Energy Industry Premiums[30]

	RENEWABLE ENERGY PREMIUM			ENERGY EFFICIENCY PREMIUM		
	Entry	Mid	High	Entry	Mid	High
Electricians	39%	31%	14%	34%	28%	13%
HVAC Workers	41%	21%	7%	36%	17%	6%
Installation, Maintenance, and Repair Occupations	13%	0%	-7%	9%	-4%	-8%
Sales Representatives	74%	38%	21%	54%	27%	11%
Engineers	-5%	6%	2%	-5%	4%	-4%

Some education and workforce professionals have characterized construction trade occupations, like electricians or HVAC mechanics, as low- or middle-skill jobs because they require more than a high school diploma and less than a Bachelor's degree. However, this perspective conflates skills with education. Construction trades occupations, which make up a substantial portion of clean energy employment in the U.S. and in Vermont, are highly skilled occupations that do not necessarily require a college education. Critical thinking or troubleshooting are also among the top skills needed along with knowledge of mathematics, mechanics and construction for success in the clean energy industry.

Table 4. Necessary Areas of Knowledge for Clean Energy Occupations[31]

Electricians	HVAC Workers	Sales Representatives	Installation, Maintenance, and Repair Occupations	Engineers
Building and Construction	Mechanical	Customer and Personal Service	Mechanical	Engineering and Technology
Mechanical	Building and Construction	Sales and Marketing	Building and Construction	Design
Mathematics	Customer and Personal Service	Mathematics	Education and Training	Mathematics

[30] Derived from BLS and survey responses. Vermont-specific wage data.
[31] O*NET Occupations, EMSI Q1 2019 National Data set, Skills Transferability.

Table 5. Necessary Skills for Clean Energy Occupations[32]

Electricians	HVAC Workers	Sales Representatives	Installation, Maintenance, and Repair Occupations	Engineers
Troubleshooting	Troubleshooting	Speaking	Installation	Reading Comprehension
Installation	Repairing	Reading Comprehension	Quality Control Analysis	Mathematics
Repairing	Equipment Maintenance	Persuasion	Critical Thinking	Critical Thinking

Table 6. Important Activities Performed by Clean Energy Occupations[33]

Electricians	HVAC Workers	Sales Representatives	Installation, Maintenance, and Repair Occupations	Engineers
Plan layout of construction, installation, or repairs on	Repair pipes to stop leaking	Develop content for sales presentations or other materials	Inspect plumbing systems or fixtures	Create graphical representations of energy production systems
Install electrical components, equipment, or systems	Test electrical circuits or components for proper functioning	Develop proposals for current or prospective customers	Inspect industrial or commercial equipment to ensure proper operation	Provide technical guidance to other personnel
Test electrical equipment or systems to ensure proper functioning	Service heating, ventilation or air-conditioning (HVAC) systems or components	Prepare sales or other contracts	Test electrical equipment or systems to ensure proper functioning	Recommend technical design or process changes to improve efficiency, quality, or performance

While formal higher education is typically not a necessity for the positions above, many require specific training, certifications, licenses, significant work experience, and/or a high school diploma or equivalency. In order to maximize earning potential in the clean energy industry, electricians working in solar often need to be certified by the North American Board of Certified Energy Practitioners (NABCEP) and HVAC workers often need U.S. EPA certification and North American Technician Excellence (NATE) certification. With these certifications come pay raises, as seen in Table 7 below. These jobs and the skilled and knowledgeable workers that fill them are important for the viability of the clean energy industry.

[32] O*NET Occupations, EMSI Q1 2019 National Data set, Skills Transferability.
[33] O*NET Occupations, National Summary Reports.

Table 7. National Energy Industry Certification/Licensure Premiums[34]

	Average Hourly Pay Premium
HVAC EPA Certification	$1.99
HVAC NATE Certification	$5.73
Manufacturer Specific Installation Certifications	$3.97

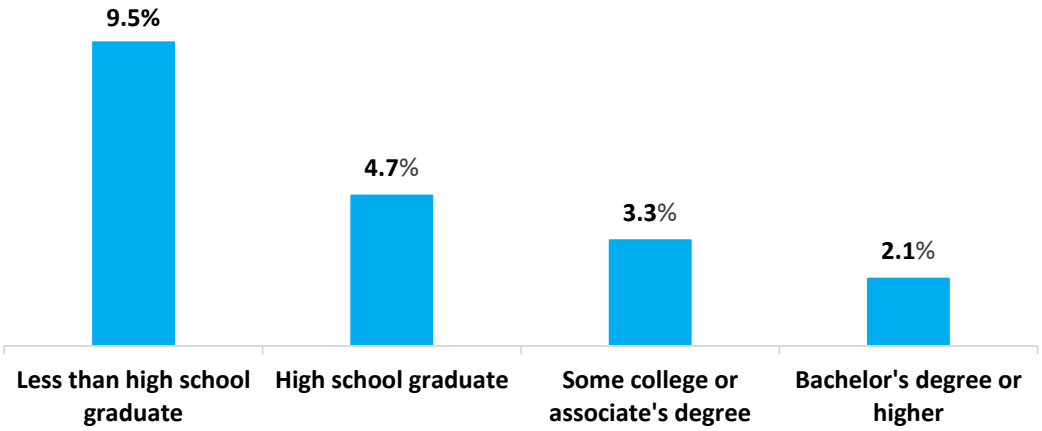
TALENT SUPPLY

While Vermont currently has a historically low unemployment rate statewide of 2.3%[35] compared to 3.8% nationally,[36] the state faces some demographic workforce challenges. These include an aging population[37] and a shrinking labor pool.[38] Additionally, employers have reported increased hiring difficulty, with "lack of experience, training, or technical skills," and "insufficient qualifications (certifications or education)" as the top reasons for hiring difficulty for three of the past four years. Helping employers fill clean energy jobs will require actions targeted to individuals who are either currently out of the labor force or face barriers to employment. This report assesses talent supply by reviewing demographic data, pockets of unemployment, and existing training centers in clean energy. This section includes analysis at the statewide level with an exploration regarding geography.

Individuals that did not graduate high school or complete an equivalency experience a 9.5% unemployment rate in Vermont. This is more than double the unemployment rate of high school graduates and more than triple the overall unemployment rate statewide. These individuals are often navigating job opportunities without relevant skills and are facing limited career options. Adult basic education is important for this specific population and includes high school equivalence, skills for construction trades and other high demand fields (i.e. automotive tech), pre-apprenticeship and apprenticeship programs, and more advanced technical training and education.

[34] Sourced from survey responses, national averages.
[35] *Vermont Labor Force & Unemployment, 2019 – Seasonally Adjusted*. May 2, 2019. http://www.vtlmi.info/Labforce.cfm?qperiodyear=2019&qareatype=01&qadjusted=Y.
[36] Bureau of Labor Statistics, *LNS14000000 Seasonally Adjusted, (Seas) Unemployment Rate*, Feb 2019. https://data.bls.gov/timeseries/lns14000000.
[37] U.S. Census Bureau, *2013-2017 American Community Survey 5-Year Estimates,* and *2005-2007 American Community Survey 3-Year Estimates, S0101,* Vermont, Percent of population aged 55 and over, 2007-2017.
[38] *Vermont Labor Force & Unemployment, 2018 – Seasonally Adjusted*. Mar. 11, 2019. http://www.vtlmi.info/Labforce.cfm?qperiodyear=2018&qareatype=01&qadjusted=Y.

Figure 13. Vermont Unemployment Rates by Educational Attainment[39]



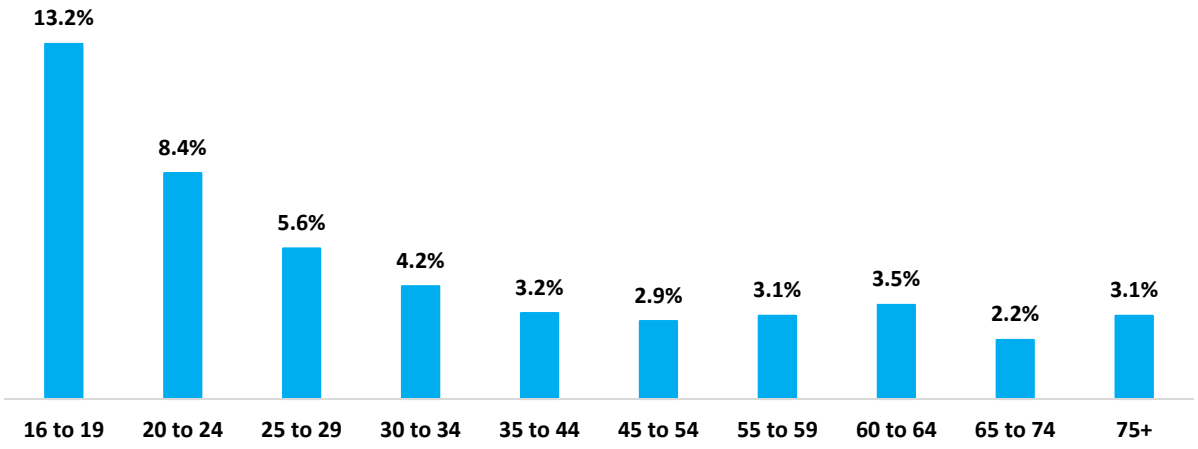
Younger workers have significantly higher unemployment rates than the overall averages. At the same time, young people nationwide report low levels of interest in construction jobs, which are the largest segment of jobs in the clean energy economy in Vermont. In a recent, nationwide survey completed by nearly 3,000 people between ages 15-30, BW Research found that young millennials and Gen Z'ers cited construction lowest among industries in which they would like to work,[40] findings that replicated other studies conducted on the topic.[41] Providing meaningful access to education and developing internship programs similar to those found in other states are options for exposing students to careers in clean energy.

[39] U.S. Census Bureau, *2013-2017 American Community Survey 5-Year Estimates*, S2301 "Employment Status," Vermont, Unemployment Rate. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_S2301&prodType=table.

[40] "Gen Z Careers in Hotels and Lodging," American Hotel & Lodging Association. Nov. 2018. https://www.ahla.com/sites/default/files/AHLA%20Short%20Report%20Revised%20%281%29.pdf.

[41] "Young People Don't Want Construction Jobs," *Wall Street Journal.* https://www.wsj.com/articles/young-people-dont-want-construction-jobs-thats-a-problem-for-the-housing-market-1533029401; https://www.tdindustries.com/news/blaming-millennials-for-the-skilled-craftworker-shortage-heres-why-you-shouldnt

Figure 14. Vermont Unemployment Rates by Age[42]



Training centers are located throughout the state to provide opportunities for unemployed populations to gain the skills necessary to achieve gainful employment. With regards to the clean energy industry, the training centers that will provide the most valuable education and skills needed to meet the current gaps in the market are those focused on technical or trades certifications or design-related education. Technical schools that provide skills necessary for success in the clean energy field are dispersed throughout the state; locations in St. Johnsbury, Essex Junction, Randolph Center, and Springfield are just a few examples. Registered apprenticeship sponsors throughout the state that are directly involved with the clean energy industry can be found in Colchester, Springfield, and Waterbury.[43] With the infrastructure in place, Vermont already has the necessary elements to continue growing the labor supply, particularly for the benefit of younger residents without a high school diploma.

[42] U.S. Census Bureau, *2013-2017 American Community Survey 5-Year Estimates*, S2301 "Employment Status," Vermont, Unemployment Rate. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_S2301&prodType=table.
While the nominal unemployment rates are dated, the relative disparity between age groups is current. Since unemployment data by age is not yet available at the state-level for 2018, only at the national-level, 2017 data is used in this figure, so unemployment rates appear high. However, through analysis of national-level unemployment trends through 2018, we are able to confidently assume that Vermont unemployment rates have dropped proportionately by age.

[43] Listing the locations of centers is meant to illustrate widespread distribution of training centers across the state. See Appendix A: Clean Energy Trainings for full list of centers

Geography

SUBSTATE AREAS, COUNTIES, AND OPPORTUNITY ZONES

The Vermont Department of Labor breaks the state into 3 major geographic areas for some demographic analyses: the Burlington New England City and Town Area (NECTA), the North Balance, and the South Balance.[44] These areas are defined by town boundary lines.[45] The Burlington NECTA accounts for over 41% of total employment in Vermont, followed by the South Balance making up nearly 36% of state employment, and finally, the North Balance with about 23% of state employment. However, when looking into clean energy technologies, we can see a nuanced composition of Vermont clean energy employment. Renewable energy generation efforts are most concentrated in northern Vermont, with the North Balance employing the largest share (45%) and the Burlington NECTA employing the next largest share (35%). These areas combined employ nearly 4,900 people in RE generation. However, energy efficiency occupations employ a much higher share of Vermont clean energy workers (see Figure 4). The Burlington NECTA employs more than 5,000 people in energy efficiency roles,[46] which accounts for more than 60% of the area's clean energy employment. As shown in Figure 16, the Burlington NECTA has had more overall difficulty hiring new clean energy workers over 2018 (89% had some degree of difficulty), however the North and South Balances have had a more intensely difficult time hiring (both reported 50% of businesses found it very difficult to hire).

[44] http://www.vtlmi.info/oesmap2015.pdf.
[45] Ibid.
[46] Burlington is home to Efficiency Vermont (and VEIC, the entity that implements Efficiency Vermont), Vermont Gas Systems, and Burlington Electric Department, all of which are state energy efficiency utilities.

Table 8. Clean Energy Employment by Three Major Substate Areas

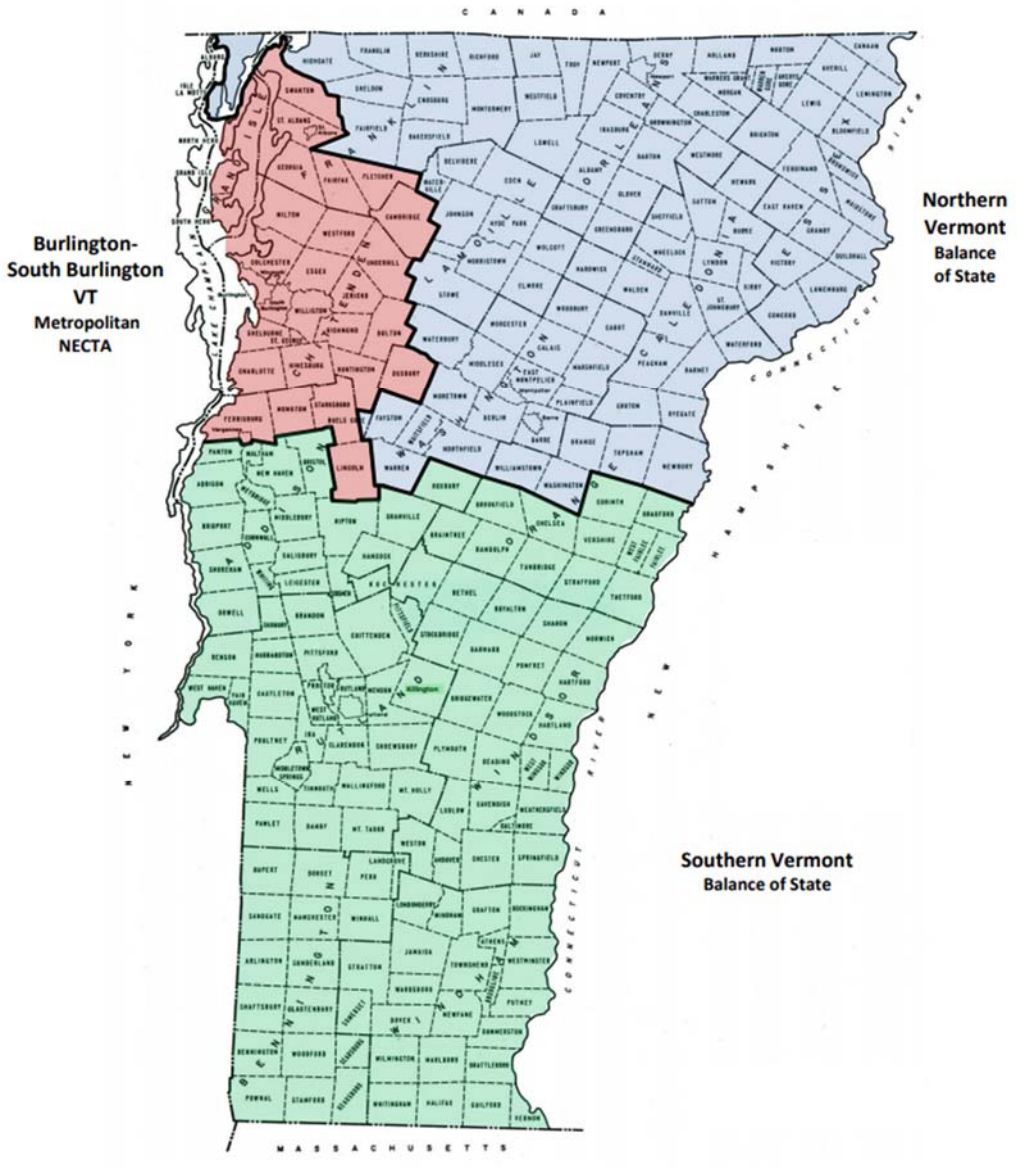
Area Name	Clean Energy Employment	Share of Vermont Clean Energy Employment	Clean Energy Employment Per Capita[47]
Burlington NECTA	8,300	43.9%	6.7%
North Balance	4,335	23.0%	6.2%
South Balance	5,999	31.8%	5.6%
N/A	252	1.3%	N/A

Table 9. Clean Energy Employment by Technology by Three Major Substate Areas

Area Name	Renewable Energy Generation Employment	State Share	Energy Efficiency Employment	State Share
Burlington NECTA	2,138	35.0%	5,009	46.8%
North Balance	2,720	44.5%	2,047	19.1%
South Balance	1,242	20.3%	3,484	32.5%
N/A	15	0.2%	169	1.6%

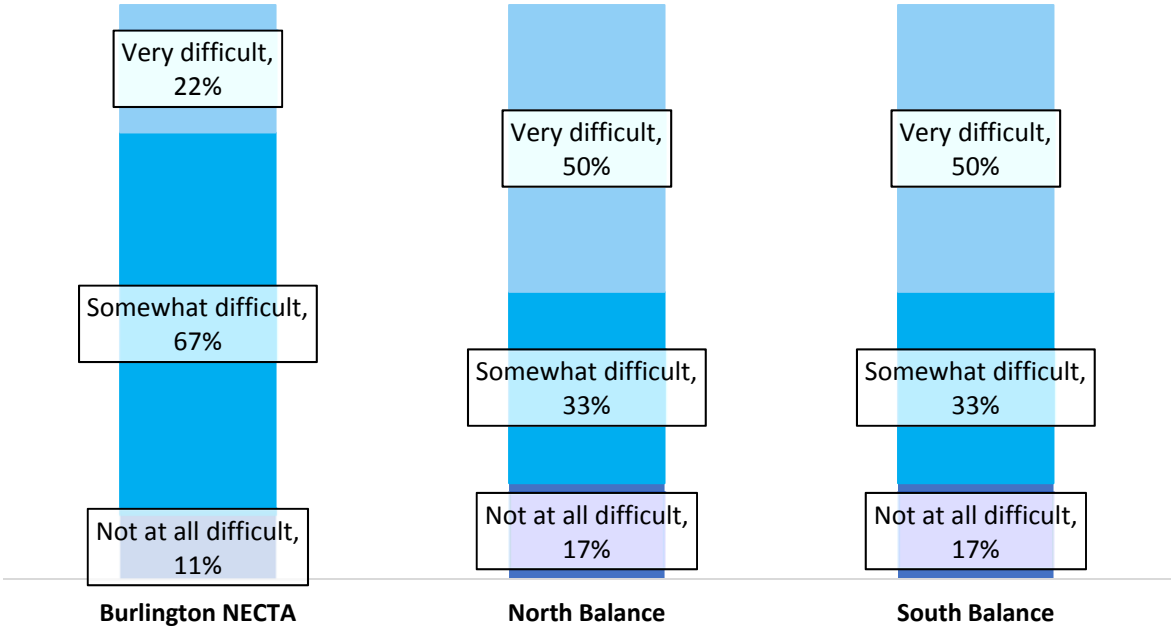
[47] VTLMI, ELMI Regions, Burlington-South Burlington MetroNECTA and Balance of State Areas Occupational Employment and Wages, 2018, Excel file download. http://www.vtlmi.info/occupation.cfm#oes.

Figure 15. Map of Three Major Substate Areas[48]



[48] http://www.vtlmi.info/oesmap2015.pdf.

Figure 16. Hiring Difficulty by Three Major Substate Areas



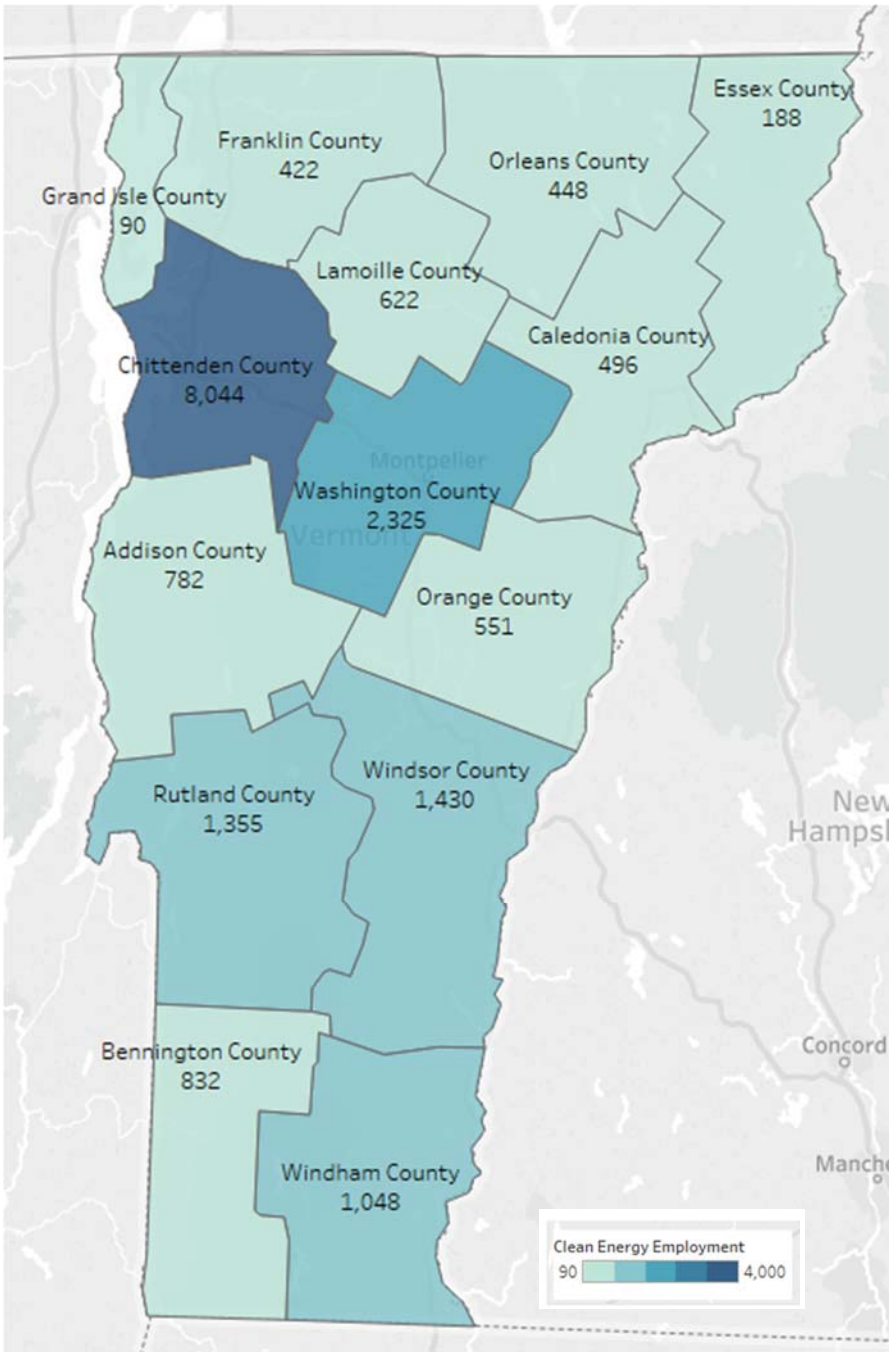
Vermont clean energy industry employment is focused in Chittenden County, the core of the Burlington NECTA, with more than 8,000 people employed in the industry, or nearly 43% of clean energy employment in the state. This is unsurprising as Burlington is an economic hub, so firms likely locate there for easier access to clients, supplies, and labor as well as the demand created by the different types of clean energy work.

Table 10. Clean Energy Employment by County

County Name	Clean Energy Employment	Share of Vermont Clean Energy Employment	Clean Energy Employment per 100 Jobs[49]
Addison County	782	4.1%	3.9%
Bennington County	832	4.4%	4.7%
Caledonia County	496	2.6%	3.5%
Chittenden County	8,044	42.6%	8.5%
Essex County	188	1.0%	7.2%
Franklin County	422	2.2%	1.6%
Grand Isle County	90	0.5%	2.3%
Lamoille County	622	3.3%	4.6%
Orange County	551	2.9%	3.5%
Orleans County	448	2.4%	3.4%
Rutland County	1,355	7.2%	4.5%
Washington County	2,325	12.3%	6.9%
Windham County	1,048	5.6%	4.8%
Windsor County	1,430	7.6%	5.0%
N/A	252	1.3%	N/A

[49] Vermont Dept. of Labor, *Labor Force & Unemployment, Counties, 2018 Annual Average*. http://www.vtlmi.info/Labforce.cfm?qyearqperiod=201800&qareatype=04&qadjusted=N.

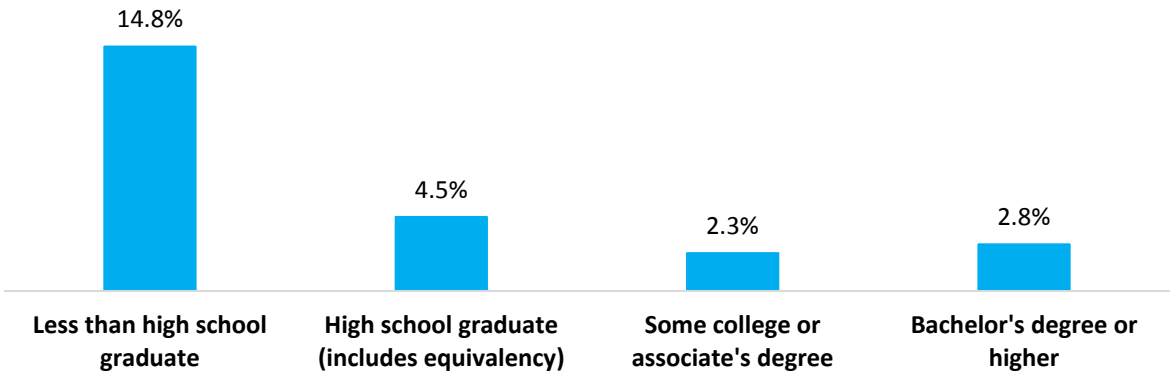
Figure 17. Map of Clean Energy Workers by County



Overall analysis of employment and geography presents information that largely tracks with economic and population concentrations. However, the high concentration of renewable energy generation in the North Balance is an interesting finding. Upon closer inspection, Essex County has one of the highest clean energy rates of employment per capita in the state, hosts no clean energy related training

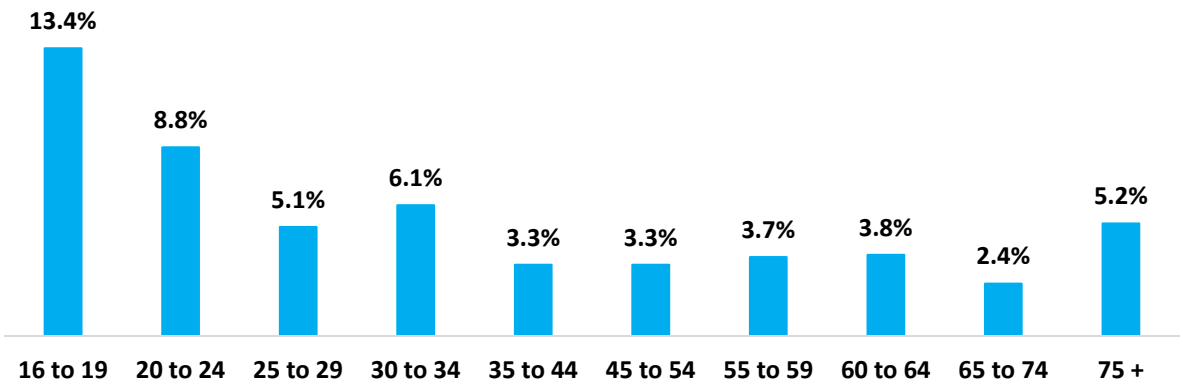
facilities, and has one of the highest unemployment rates in the state. The data suggest that there may be a pocket of untapped, untrained labor in this northeast corner.

Figure 18. Northeast Counties (Orleans, Essex, Caledonia) Unemployment Rates by Educational Attainment[50]



The northeast counties of Vermont, Orleans, Essex, and Caledonia have high rates of clean energy employment per capita, but also have the highest unemployment rates in the state, especially among young people and those that have not finished a high school education.

Figure 19. Northeast Counties (Orleans, Essex, Caledonia) Unemployment Rates by Age[51]



[50] U.S. Census Bureau, *2013-2017 American Community Survey 5-Year Estimates*, S2301 "Employment Status," All Vermont Counties, Unemployment Rate. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_S2301&prodType=table.

[51] U.S. Census Bureau, *2013-2017 American Community Survey 5-Year Estimates*, S2301 "Employment Status," All Vermont Counties, Unemployment Rate. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_S2301&prodType=table.

Figure 20. Map of Unemployment Rates by County

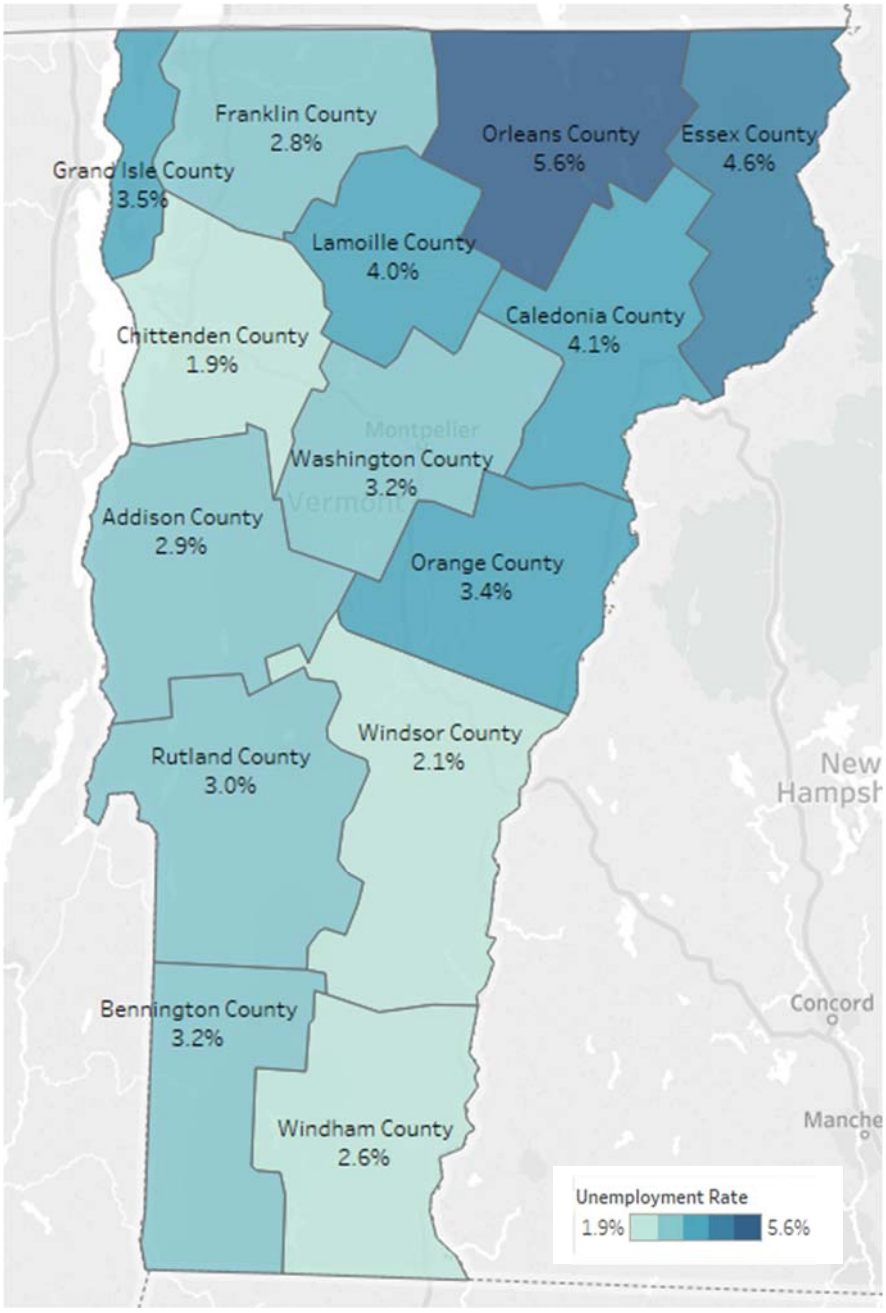
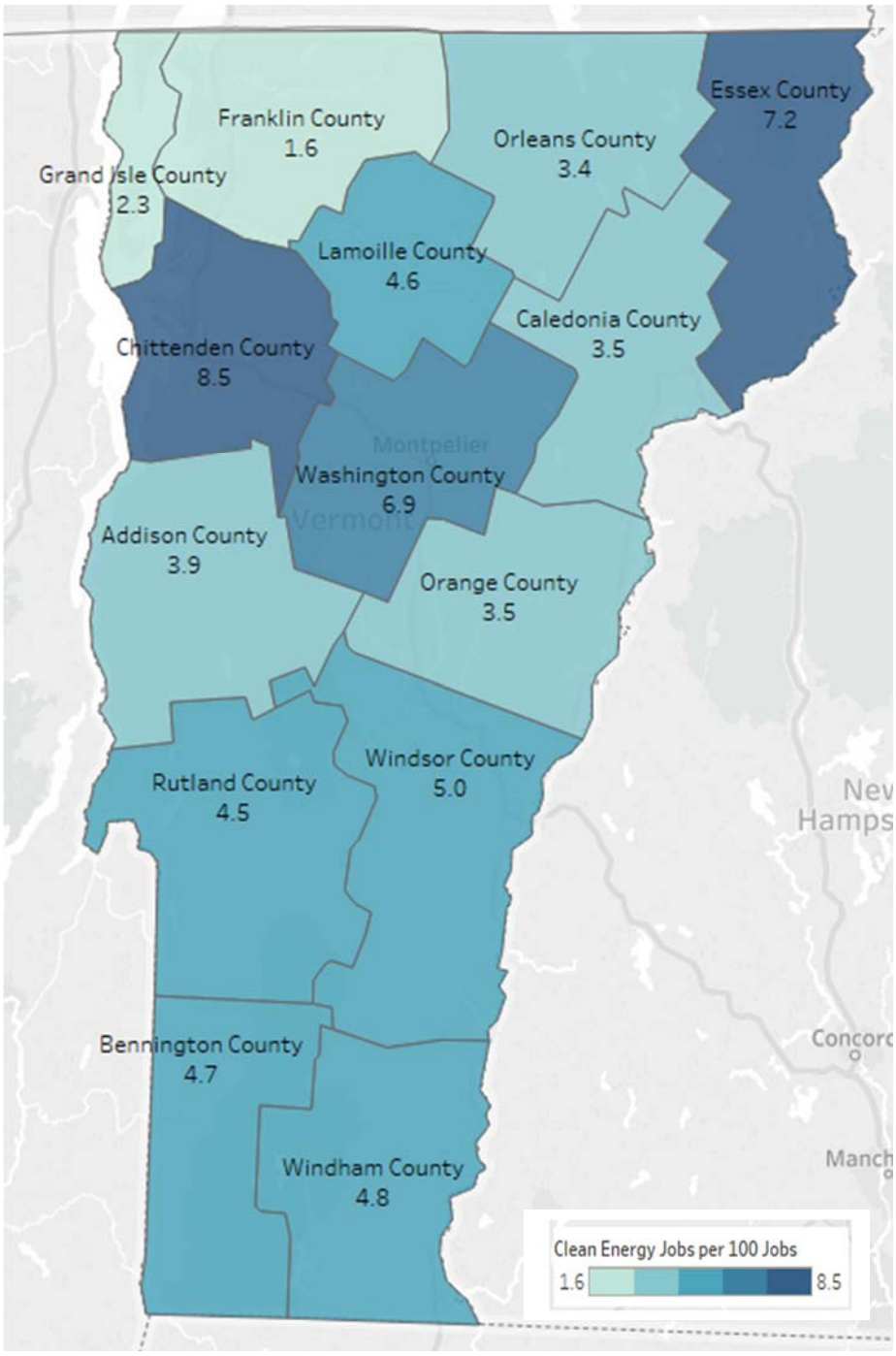


Table 11. Clean Energy Employment, Unemployment Rate, and Training Center and Program Prevalence by County

County Name	Clean Energy Employment per 100 Jobs[52]	Unemployment[53]	Share of State Training Centers, Actual and Percent[54]	Share of State Training Programs, Actual and Percent
Addison County	3.9%	2.9%	2 (4.7%)	3 (3.5%)
Bennington County	4.7%	3.2%	3 (7.0%)	5 (5.9%)
Caledonia County	3.5%	4.1%	3 (7.0%)	5 (5.9%)
Chittenden County	8.5%	1.9%	11 (25.6%)	31 (36.5%)
Essex County	7.2%	4.6%	0 (0.0%)	0 (0.0%)
Franklin County	1.6%	2.8%	2 (4.7%)	4 (4.7%)
Grand Isle County	2.3%	3.5%	0 (0.0%)	0 (0.0%)
Lamoille County	4.6%	4.0%	2 (4.7%)	3 (3.5%)
Orange County	3.5%	3.4%	2 (4.7%)	3 (3.5%)
Orleans County	3.4%	5.6%	2 (4.7%)	3 (3.5%)
Rutland County	4.5%	3.0%	3 (7.0%)	6 (7.1%)
Washington County	6.9%	3.2%	6 (14.0%)	8 (9.4%)
Windham County	4.8%	2.6%	2 (4.7%)	4 (4.7%)
Windsor County	5.0%	2.1%	5 (11.6%)	10 (11.8%)

[52] Vermont Dept. of Labor, *Labor Force & Unemployment, Counties, 2018 Annual Average*. http://www.vtlmi.info/Labforce.cfm?qyearqperiod=201800&qareatype=04&qadjusted=N.
[53] *Counties Labor Force & Unemployment, 2019 January – Seasonally Adjusted*. Mar. 11, 2019. http://www.vtlmi.info/Labforce.cfm?qperiodyear=2018&qareatype=01&qadjusted=Y.
[54] See Appendix A: Clean Energy Trainings

Figure 21. Map of Clean Energy Jobs per 100 Jobs by County



One area of potential interest for future job growth is the new Opportunity Zone designation[55], created by Congress in 2017. Qualified investments into Opportunity Zone funds may be directed towards enterprises that include clean energy businesses or installations. Vermont is home to 25 Opportunity Zones, spread evenly throughout the North, South and Burlington NECTA allowing investment from the Opportunity Zone Fund to reach these communities.[56] In order to understand the data in the context of community, adjacent or near-adjacent Opportunity Zones are aggregated, resulting in 12 Aggregated Opportunity Zones.[57] Opportunity Zones constitute about one third of Vermont's clean energy workers. Unsurprisingly, the Burlington/ S.Burlington/ Winooski Aggregated Opportunity Zone has the majority of the estimated clean energy workers, with about 58% of the total clean energy workers in Vermont's Opportunity Zones. Following, the Rutland Aggregated Opportunity Zone employs about 420 clean energy workers, and the Barre Aggregated Opportunity Zone employs about 390.

Table 12. Clean Energy Employment by Aggregated Opportunity Zones

Aggregated Opportunity Zone	Clean Energy Employment Estimates[58]	Share of Opportunity Zone Clean Energy Employment
Barre	390	6%
Bennington	230	4%
Brattleboro	370	6%
Burlington/S.Burlington/Winooski	3,640	58%
Johnson	90	1%
Newport	130	2%
Randolph/S.Royalton	280	4%
Rutland	420	7%
Springfield/Bellows Falls	200	3%
St. Albans	210	3%
St. Johnsbury/Lyndonville	270	4%
Vergennes	80	1%

[55] The Tax Cuts and Jobs Act of 2017 created Opportunity Zones – economically-distressed Census Tract areas that are selected to receive investments on Qualified Opportunity Funds. Investments made on Qualified Opportunity Funds receive tax benefits.

[56] https://vcgi.maps.arcgis.com/apps/Styler/index.html?appid=67893e0aa46941a79ed9e839a27a424e.

[57] See Appendix B: Aggregated Opportunity Zones

[58] Estimates are derived from BLS data and are rounded to the nearest ten.

Conclusions

Vermont continues to be the national leader in in per-capita clean energy jobs,[59] the result of years of effective policies and a robust, early-adopter market for clean energy goods and services. As demographic shifts in the Vermont labor market and national trends create headwinds for employment growth, clean energy activity as defined by the labor intensity metric is up nearly 8% over 2018, while overall employment growth is up only 0.5%. This seeming paradox is explained by increases in the proportion of workers in Vermont who spend a majority, or all of their time performing clean energy services or producing clean energy goods.

Energy efficiency continues to lead the way in Vermont. While it rarely gets the media attention that renewable technologies receive, energy efficiency has been the most consistent job creator in Vermont and nationally, and also the least likely to be subject to economic and trade shocks. Further, these positions are largely in the construction trades and in design services (architecture, engineering, etc.), have long and established career pathways, and typically offer higher wages and benefits.

While the increased intensity of clean energy jobs demonstrates a continuation of growth, the lack of new talent is creating difficulty for employers. Employers across the value chain of activity report difficulty hiring workers of all types, from entry-level laborers to experienced engineers. The difficulty is reported to be driven by lack of technical skills and certifications and prior experience, but also location. These talent shortages are likely constraining growth and require a complex set of solutions.

There are several options available to relieving employer difficulty and connecting more Vermonters to the industry, including expanding pre-apprenticeship programs with local unions, community colleges, and employers in the region; developing a robust internship program and other incentive packages to entice more university students to stay in Vermont upon graduation; and creating more opportunity in rural areas by developing clean energy certifications for existing trades workers in rural communities to expand their offerings and business opportunities for hiring.

Younger workers with a high school education or less have the highest unemployment rate in the state and are therefore a promising population to target for training. With such low overall unemployment rates, this population, if properly prepared, may be able to fill the expected clean energy employment growth and relieve employer difficulty while lowering unemployment further. The northeast counties also appear to offer opportunities for new or expanded trainings, as this area appears to have both untapped and underserved labor supply with high concentrations of clean energy work.

Vermont clean energy employers are very optimistic for 2019, expecting to add about 1,000 jobs, a growth rate of 5%. For employers to meet such projections, a new influx of talent will be required, but will likely be a challenge given hiring difficulties in previous years. With the creation of new partnerships and expanding workforce programs to currently disconnected populations, however, Vermont can continue to make progress toward its energy goals, add jobs to the state economy, and provide higher wages to its residents.

[59] Derived from BLS QCEW data and survey responses.

Methodology

In congruence with previous reports, this year's Clean Energy Industry Report is based on the 2019 United States Energy and Employment Report (USEER). The 2019 USEER utilized data from the Bureau of Labor Statistics Quarterly Census of Employment and Wages (BLS QCEW 2018 Q2), as well as survey data. The survey was designed and implemented by BW Research Partnership, with management from Energy Futures Initiative (EFI) and the National Association of State Energy Officials (NASEO). 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 more than 5,700 outbound calls and 265 emails sent to participants across Vermont. The phone survey was conducted by ReconMR. 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 2018, 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, subtechnology, 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 2018 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, 595 business establishments in Vermont participated in the survey effort. These responses were used to develop incidence rates among industries 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 is +/- 3.72 percent for Vermont 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 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.

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 Vermont Clean Energy Industry Reports, and supplemental primary research conducted in Q1 2019. 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.

Appendix A: Clean Energy Training[60]

City	Training Center Name	Program Name
Barre	Precision Driver Training School	CDL - Commercial Driver's License Program
	Cochran's Monuments	Intro to Basic Monumental Computerized Drafting
	ReSOURCE	YouthBuild
Bennington	Community College of Vermont	Administrative Management (A.S.)
		Environmental Science (A.S.)
	Hayden Plumbing and Heating*	Plumbing Apprenticeship
	Southwest Vermont Career Development Center	Commercial Drivers License Class B
		CDL Permit Prep
Berlin	Giroux General Transport, Inc.	Class A Commercial Driver's License (CDL A)
		Class A Commercial Driver's License (CDL B)
Brattleboro	Community College of Vermont	Administrative Management (A.S.)
		Environmental Science (A.S.)
Burlington	Advanced Welding Institute	Combination Structural and Pipe Welding
		Structural Welding
	ReSOURCE	Apprentice-Style Manufacturing Program
		YouthBuild
		Office Administration
	KnowledgeWave	MS Office Specialist Certification Preparation
		Business Operations Program
		Microsoft Certified Solutions Associate (MSCA)
		Microsoft Certified Solutions Expert (MSCE)
	University of Vermont	Computer Software Certificate

[60] Vermont's Eligible Training Providers, January 7, 2019.
* Indicates a Registered Apprenticeship Sponsor.

Colchester	Green Mountain Power*	Electrical Lineworker Apprenticeship
		Substation Electrician Apprenticeship
Enosburg Falls	Pro Driver Training	VT CDL Class A Training
		VT CDL Class B Training
Essex Jct.	SkillTech at the Center for Technology, Essex	Basic Welding
		Intermediate Welding
		Basic Electricity and Motor Controls
		Fundamentals of Natural Gas
		Intermediate Electrical Motor Controls
		Semiconductors & Preventative/Predictive Maintenance
	Center for Technology, Essex	Automotive Technology
		Building Technology Commercial
		Building Technology Residential
		Engineering & Architectural Design HVACR Technician Training Natural Resources Programs (Forestry)
Hyde Park	Green Mountain Technology and Career Center	Commercial Driver's License Training
Lyndonville	Northern Vermont University	Project Management Fundamentals and Agile Project Management
		Excel Specialist Boot Camp for Business
Middlebury	Community College of Vermont	Administrative Management (A.S.)
		Environmental Science (A.S.)
	P.A. Hannaford Regional Technical School District	VT YouthWorks 2018
Milton	Champlain Valley Driver Training School	Class A Commercial Driver's License (CDL A)
		Class A Commercial Driver's License (CDL B)
		CDL Passenger Endorsement
Montpelier	Community College of Vermont	Administrative Management (A.S.)
		Environmental Science (A.S.)

Morristown	Community College of Vermont	Administrative Management (A.S.)
		Environmental Science (A.S.)
Newport	Community College of Vermont	Administrative Management (A.S.)
		Environmental Science (A.S.)
	Precision Driver Training School	CDL - Commercial Driver's License Program
Randolph	Randolph Technical Career Center	Basic Welding
		Commercial Driver’s License (CDL) Training
	Vermont Technical College	Building Performance Institute- Building Analyst, Envelope Professional, & Heating
		NCCER Project Supervision Continuing Education & Workforce Development/Green Trainings-Construction
Rockingham	Northeast Driver Training LLC	CDL A
		CDL B
Rutland	Community College of Vermont	Administrative Management (A.S.)
		Environmental Science (A.S.)
	Robert Stubbins Electrical & General Contractor*	Electrical Apprenticeship
	Stafford Tech Center ATE	Commercial Driver's License (CDL A)
		Commercial Driver's License (CDL B)
		Stafford Welding School
St. Albans	Community College of Vermont	Administrative Management (A.S.)
		Environmental Science (A.S.)
St. Johnsbury	Community College of Vermont	Administrative Management (A.S.)
		Environmental Science (A.S.)
	St. Johnsbury Academy	Concepts for Success Manufacturing
Springfield	Community College of Vermont	Administrative Management (A.S.)
		Environmental Science (A.S.)
	HB Energy Solutions*	Electrical Apprenticeship

		Plumbing Apprenticeship
	River Valley Technical Center	Advanced Manufacturing
		Carpentry
		Business and Financial Services
Waterbury	SunCommon*	Electrical Apprenticeship
White River Jct.	Community College of Vermont	Administrative Management (A.S.)
		Environmental Science (A.S.)
	Hartford Area Career and Technology Center	Intro to Welding
Williston	Vermont Technical College	National Ctr. for Construction Education & Research (NCCR) Project Supervision
	Technology for Tomorrow	Microsoft Office Specialist Excel
		Microsoft Office Specialist PowerPoint
		Microsoft Office Specialist Word
Winooski	Community College of Vermont	Administrative Management (A.S.)
		Environmental Science (A.S.)

Appendix B: Aggregated Opportunity Zones

Aggregated Opportunity Zone	Census Tract	Zip Code	Town
Barre	50023955200	05641	Barre
Bennington	50003970900	05201	Bennington
Bennington	50003971200	05201	Bennington
Brattleboro	50025968500	05301	Brattleboro
Burlington/S.Burlington/Winooski	50007001000	05401	Burlington
Burlington/S.Burlington/Winooski	50007000500	05401	Burlington
Burlington/S.Burlington/Winooski	50007002400	05404	Winooski
Burlington/S.Burlington/Winooski	50007002500	05404	Winooski
Burlington/S.Burlington/Winooski	50007003600	05403	South Burlington
Johnson	50015953200	05656	Johnson
Newport	50019951500	05855	Newport
Newport	50019951400	05855	Newport
Randolph/S.Royalton	50017959400	05060	Randolph
Randolph/S.Royalton	50027965100	05068	South Royalton
Rutland	50021963300	05701	Rutland
Rutland	50021963200	05702	Rutland
Rutland	50021963100	05701	Rutland
Springfield/Bellows Falls	50027966700	05156	Springfield
Springfield/Bellows Falls	50027966600	05156	Springfield
Springfield/Bellows Falls	50025967000	05101	Bellows Falls
St. Albans	50011010700	05478	St. Albans
St. Johnsbury/Lyndonville	50005957200	05851	Lyndonville
St. Johnsbury/Lyndonville	50005957400	05819	St. Johnsbury
St. Johnsbury/Lyndonville	50005957500	05819	St. Johnsbury
Vergennes	50001960300	05491	Vergennes