

2020

Vermont Clean Energy Industry Report



PRODUCED FOR THE VERMONT CLEAN ENERGY DEVELOPMENT FUND & VERMONT DEPARTMENT OF PUBLIC SERVICE

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Table of Contents

Table of Contents	i
Acknowledgements	1
Opening Letter	2
Executive Summary	3
Introduction.....	5
Vermont Clean Energy Industry Overview	6
Overall Clean Energy Jobs	6
Full-Time Equivalent Clean Energy Workers	9
Clean Energy Jobs by Sector.....	11
Detailed Clean Energy Sector Employment.....	12
Energy Efficiency	12
Renewable Energy Generation.....	13
Clean Energy Value Chain Employment	15
Vermont’s Wood Fuel Sector	17
Employment and Revenues.....	17
Business Prospects and Support	19
Appendix A: Research Methodology	23
Appendix B: Clean Energy Technology List.....	27
Appendix C: Clean Energy Wages	30

Acknowledgements

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Opening Letter

The release of the 2020 Vermont Clean Energy Industry Report comes at a time of great uncertainty in all business sectors in Vermont and across the nation. Clean energy businesses have not been spared the widespread economic decline stemming from the novel coronavirus. Until the coronavirus curtailed much of the economy in March 2020, employment in the clean energy industry had been growing modestly. Unfortunately, Vermont lost an estimated 2,600 clean energy jobs as of April 2020—a 15 percent decline—due to the COVID-19 crisis. This year’s report details the pre-COVID progress and serves as baseline for the state of clean energy employment as we recover.

This is the 7th clean energy industry report by BW Research Partnership commissioned by the Clean Energy Development Fund at the Department of Public Service. While the report’s census of clean energy businesses was completed prior to the COVID-19 economic disruptions, the insights and trends gleaned from the report can assist the State as it works toward the Comprehensive Energy Plan’s goals, strives to bring back lost jobs, and helps to revitalize the clean energy industry.

With a pre-COVID total employment of over 18,900 workers, the clean energy sector is a significant part of the Vermont economy, representing about 6% of all workers—a higher than average amount compared with other states. However, this total has leveled off since 2017. In the first three years of the report clean energy employment expanded rapidly, growing by 29% from 2013 to 2017. In contrast, the number of workers dropped 1% from 2017 to 2019 and clean energy jobs only grew by 0.1 percent between the 2019 and 2020 reporting periods.

The data in this report reveal that Vermont’s concentrated effort to save energy and reduce the overall cost of energy had resulted in a growing number of energy efficiency workers—over 10,700 and growing. Energy efficiency is the largest sub-sector, by number of workers, of the clean energy market in Vermont.

In the past the Vermont Clean Energy Industry Report identified the number of 100 percent clean energy workers—meaning those that spent 100 percent of their work hours on clean energy jobs. However, recognizing that many other state and national clean energy reports are using a full-time equivalent (FTE) metric, this 2020 report also includes Vermont’s estimated FTE number of clean energy jobs in order to foster comparability to other state reports.

As the state’s clean energy and overall business sector struggle with the COVID-19 disruptions, we look forward to the return of strong job growth. An expanded clean energy industry works to make Vermont more affordable, increases economic opportunity, and can help us to protect Vermont’s most vulnerable people.

Sincerely,

June E. Tierney, Commissioner

Andrew Perchlik, CEDF Director

Executive Summary

Over the last three years, Vermont's clean energy economy has remained mostly steady. As of the last quarter of 2019, this year's Industry Report finds that the state was home to 18,910 clean energy workers. Clean energy jobs grew by 0.1 percent between the 2019 and 2020 reporting periods—just under the overall statewide employment growth of 0.2 percent over the same time frame. Clean energy job growth has been steady over the last three years, mirroring Vermont's overall statewide labor market with annual growth rates of under a percent.

In general, this year's report shows little movement in clean energy jobs across both clean energy technology and value chain sectors between 2019 and 2020, but the clean energy sector continues to be a strong source of jobs for residents across Vermont. Clean energy jobs in Vermont accounted for six percent of all jobs in the state—higher than the national concentration of clean energy workers, which was just over two percent. In fact, clean energy jobs were more concentrated in Vermont than in neighboring states like Massachusetts, New York, and Rhode Island, indicating that the clean energy economy is a dependable source of jobs in Vermont.

This year's report included the biennial wood fuels employer survey, which examines a critical sub-sector of Vermont's clean energy economy. The survey this year found that Vermont's wood fuel employers were most concerned with government regulations that limit the harvesting of wood fuels; this was the highest tested concern, with about eight in ten employers indicating some level of concern with the issue. At the time of the survey, employers were optimistic about the future. About a third of wood fuel employers reported making investments in their wood fuel business because they expected it to grow over the next 12 months and another third were encouraged by the market direction, expecting their wood fuel revenues to increase.

The 2020 Vermont Clean Energy Industry Report is based on data collected in the last quarter of 2019, before the advent of COVID-19. As a result, the employment figures included throughout this report serve as a baseline of clean energy employment pre-crisis. While the full extent of the pandemic's economic impacts are yet unknown, BW Research estimates that Vermont has already lost 2,600 clean energy jobs as of April 2020—a 15 percent decline—due to the COVID-19 economic fallout.¹ To note, the clean energy industry's 15 percent employment decline trails the overall state employment decline, which fell 20 percent over the same period.

The shuttering of doors for many businesses across the country has had other effects on the economy, including declining fossil fuel prices and reduced overall consumer spending and demand. While these overarching trends may continue through 2020, the clean energy industry is likely well-poised to see a rapid come back compared to other sectors. Firstly, many jobs in the clean energy sector can be conducted while maintaining physical distancing and using personal protective equipment (PPE). Secondly, the clean energy industry in Vermont is supported by policies and programs that ensure the continued deployment of clean energy technologies, maintaining steady demand that should quickly return after the shelter-in-place orders have subsided. Indeed, the majority of wood fuel employers in

¹ Further analysis related to the COVID-19 pandemic's economic impacts can be found at <http://bwresearch.com/covid>.

Vermont indicated that business support, grants, and consumer incentives have been helpful for the health of their business.

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.

Introduction

The 2020 Vermont Clean Energy Industry Report was commissioned by the Clean Energy Development Fund at the Vermont Department of Public Service (PSD). The following report is the seventh in a series of clean energy industry reports that track the progression of Vermont’s clean energy economy and labor market. The report details clean energy employment dating back to 2014, with an additional assessment of full-time equivalent clean energy workers. This year’s report also includes a biennial wood fuels employer survey that examines employment, revenue, and future business prospects of the wood fuels industry in Vermont.²

Employment in this report is broken out into four major technology sectors and their component clean energy sub-technologies. The major clean energy sectors are as follows:

1. Energy Efficiency
2. Renewable Energy
3. Clean Transportation
4. Other

For a detailed list and explanation of clean energy sub-technologies specific to the state of Vermont, please refer to Appendix B of this report.

In addition to jobs data, the report also details clean energy employment by value chain segment, clean energy wages, and employer hiring difficulties. All data presented in this report is based on the 2020 United States Energy and Employment Report (USEER), a joint project of the National Association of State Energy Officials (NASEO) and the Energy Futures Initiative (EFI).³ For more information on the USEER methodology, please refer to Appendix A of this report.

² Each year, PSD staff works with BWR to identify specific topics for deeper examination. For example, in 2019 the VCEIR examined both geographic distribution of clean energy jobs and workforce development challenges and opportunities. This year, the PSD requested further analysis regarding wood fuels.

³ www.USEnergyJobs.org

Vermont Clean Energy Industry Overview

Overall Clean Energy Jobs

As of the fall of 2019, Vermont was home to a total of 18,910 clean energy workers. Since 2013, clean energy jobs grew by 27.9 percent, or 4,122 workers.

Over the last three years, clean energy employment has remained relatively steady, mirroring the overall statewide labor market. Between the 2019 and 2020 reporting periods, Vermont's clean energy labor market grew by 24 jobs, a growth rate of 0.1 percent—slightly below the overall statewide employment growth of 0.2 percent. Clean energy job growth accounted for 3.5 percent of the 699 new jobs created in the state between 2019 and 2020.

Nationally, clean energy jobs grew by two percent over the same time period.

Clean energy jobs are more highly concentrated in Vermont compared to neighboring states and the national average. For every 10,000 workers, there are 608 clean energy jobs in Vermont.

Clean energy employment accounted for 6.1 percent of all jobs in Vermont at the end of 2019. In fact, clean energy jobs were uniquely concentrated in Vermont compared to other states and the national average. This year's Vermont Clean Energy Industry Report includes a clean energy location quotient (LQ), which provides a way of quantifying how concentrated an industry is in a region compared to the national average. Location quotients are calculated using the ratio of state- and nationwide clean energy jobs compared to total jobs.⁴ If Vermont's clean energy industry accounted for the exact same proportion of statewide jobs as the national proportion of clean energy jobs, then Vermont would receive a clean energy LQ of 1.0. Hypothetically, if Vermont had 10 clean energy jobs and 100 workers in total, while the United States had 100 clean energy jobs and 1,000 workers overall, then 10 percent of jobs in Vermont are clean energy jobs and 10 percent of jobs in the United States overall are clean energy jobs. In this example, the clean energy LQ for Vermont is 1.0 because 10 percent of the workforce in both the state and nation are clean energy job.

However, because clean energy jobs were more concentrated in Vermont compared to the overall nationwide concentration, the clean energy LQ for Vermont was 2.55. This means that within Vermont, clean energy jobs accounted for a higher-than-average share of total jobs. For every 10,000 workers in Vermont, there were 608 clean energy workers, while for every 10,000 workers in the United States, there were 238 clean energy jobs. Comparatively, the Massachusetts clean energy industry had an LQ of 1.46, New York's clean energy industry had an LQ of 0.74, and Rhode Island's clean energy industry had an LQ of 1.32.

⁴ National and overall statewide employment totals are taken from the Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2018 Annual Average and Q3 2019.

FIGURE 1. CLEAN ENERGY EMPLOYMENT IN VERMONT, 2013-2020⁵

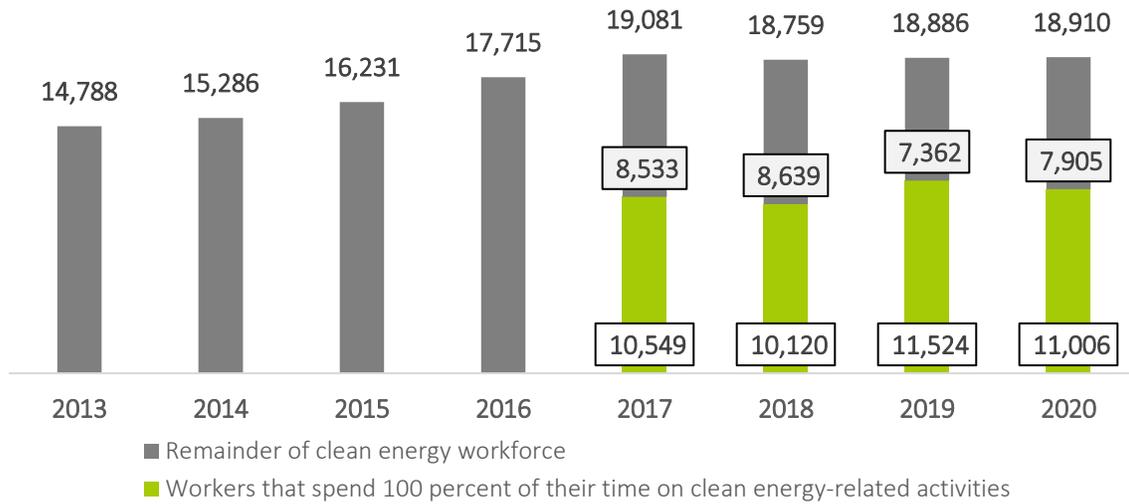
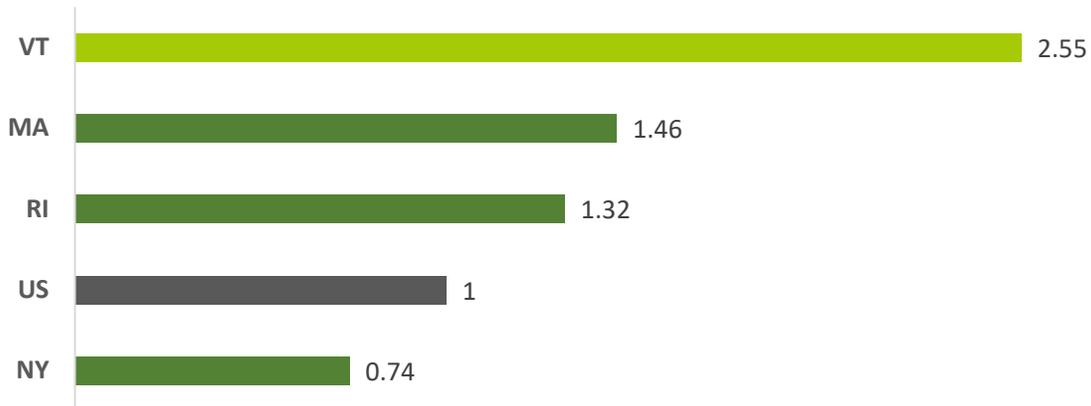


FIGURE 2. LOCATION QUOTIENTS BY STATE, 2020



There was a slight dip in the number of workers that spent 100 percent of their time on clean energy-related activities, from 11,524 to 11,006 between 2019 and 2020 (see Figure 1). This overall decline was led by a decline in 100 percent workers within the renewable energy generation sector.

⁵ In an attempt to reconcile the Vermont-specific methodology that has historically been used for these reports with the methodological updates to other clean energy reports, the research team has determined it best to revise both the 100 percent and FTE employment figures in this year’s report and moving forward. As such, the 100 percent employment estimates presented in this report for 2017, 2018, and 2019 will not match previous Vermont Clean Energy Industry Reports (VCEIRs). However, this methodological update provides a more accurate representation of clean energy activity in Vermont and allows for comparison across other state-level clean energy reports. Please refer to the Methodology section for further detail on the methodological revisions.

In 2019, 66 percent of renewable energy generation workers spent 100 percent of their time on clean energy activities; this declined to 61 percent in 2020. The proportion of renewable energy generation workers that spend at least 50 percent, or the majority but not all of their time on clean energy activities also declined from 71 percent in 2019 to 69 percent in 2020.

TABLE 1. CLEAN ENERGY EMPLOYMENT THRESHOLDS BY TECHNOLOGY SECTOR, 2016-2020

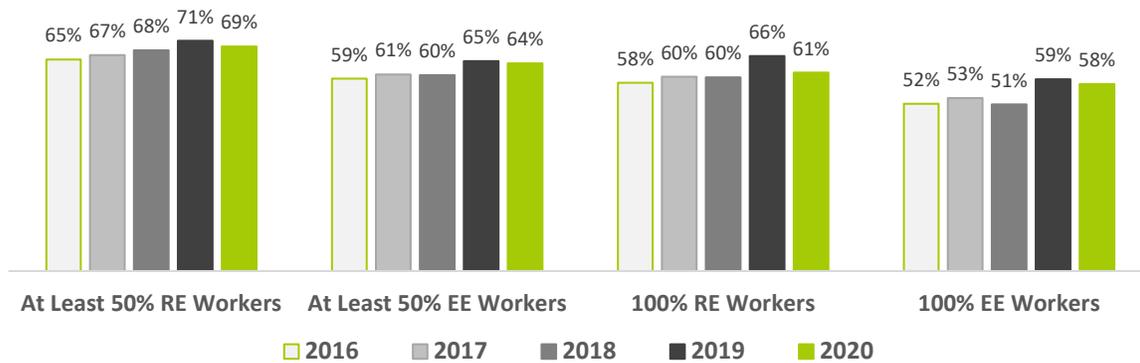
Workers that spend at least 50 percent of their time

	2014	2015	2016	2017	2018	2019	2020	
Renewable Energy	60%	61%	65%	67%	68%	71%	66%	69%
Energy Efficiency			59%	61%	60%	65%		64%

Workers that spend 100 percent of their time

	2014	2015	2016	2017	2018	2019	2020	
Renewable Energy	55%	55%	58%	60%	60%	66%	59%	61%
Energy Efficiency			52%	53%	51%	59%		58%

FIGURE 3. CLEAN ENERGY EMPLOYMENT THRESHOLDS BY TECHNOLOGY SECTOR, 2016-2020



Full-Time Equivalent Clean Energy Workers

The Vermont Clean Energy Industry Reports have historically reported 100 percent clean energy workers—as portrayed in the green bars of Figure 1.

However, recognizing that not all workers spend 100 percent of their time on clean energy activities, full-time equivalent clean energy workers (FTEs) are used as a proxy for the actual amount of clean energy labor performed in the state. Many other state and national clean energy reports are using this FTE clean energy jobs metric. Because of this, the 2020 VCEIR includes Vermont’s FTE clean energy jobs estimate in order to provide comparability to other state reports.

FTEs are weighted using the following three categories—those spending 0 to 49 percent, 50 to 99 percent, or 100 percent of their time working on clean energy activities. For example, a worker that spends 0 to 49 percent of their time on clean energy activities is weighted 0.25 in the total FTE jobs number, while a 100 percent clean energy worker is weighted as one FTE clean energy job. It should be noted that this metric is unrelated to the number of hours worked in a week, but solely to the proportion of total labor hours dedicated to clean energy activities. In other words, a part-time worker, working only 20 hours a week but spending 100 percent of their time on clean energy activities would be counted as one FTE clean energy job, because the entirety of this individual’s work week is dedicated to clean energy business activities.

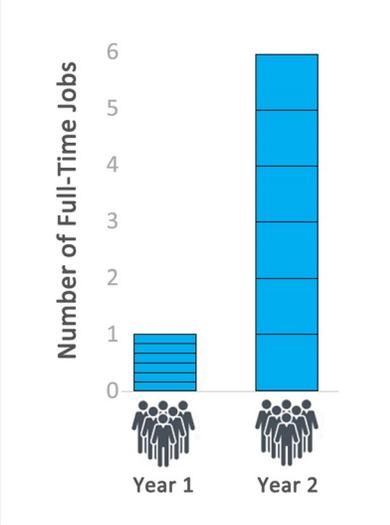
In 2019, full-time equivalent workers equated to more than three-quarters of Vermont’s clean energy workforce, meaning that 13,636 clean energy workers spend their full work week on clean energy-related activities.

The 100 percent clean energy employment—profiled in Figure 1—is not the same as FTE employment, but rather, is a subset of the FTE number. Where 100 percent clean energy workers are only the sum of workers that spend 100 percent of their time on clean energy related activities, FTE jobs weigh all clean energy workers based upon the proportion of time they spend on clean energy activities. Two workers spending 50 percent of their time on clean energy activities, for example, would account for one FTE worker (see call-out box on next page). For a full description of this methodology, please refer to Appendix A of this report.

There were 13,636 FTE clean energy jobs across the state, representing a proportion of just under three-quarters (72.1 percent) of Vermont’s clean energy labor force of 18,910 workers. Nationally, FTEs represented an average of 69.7 percent of clean energy employment. Since 2014, FTE clean energy jobs grew by 30.7 percent while total clean energy jobs grew by 23.7 percent, indicating that clean energy activities are playing an increasingly larger role in labor hours.

FIGURE 4. FTE CLEAN ENERGY JOBS EXPLAINED

An example can illustrate the importance of tracking FTE clean energy employment. If a Heating Ventilation, and Air Conditioning (HVAC) firm had 6 installers in 2018 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, FTE jobs would show a corresponding increase.

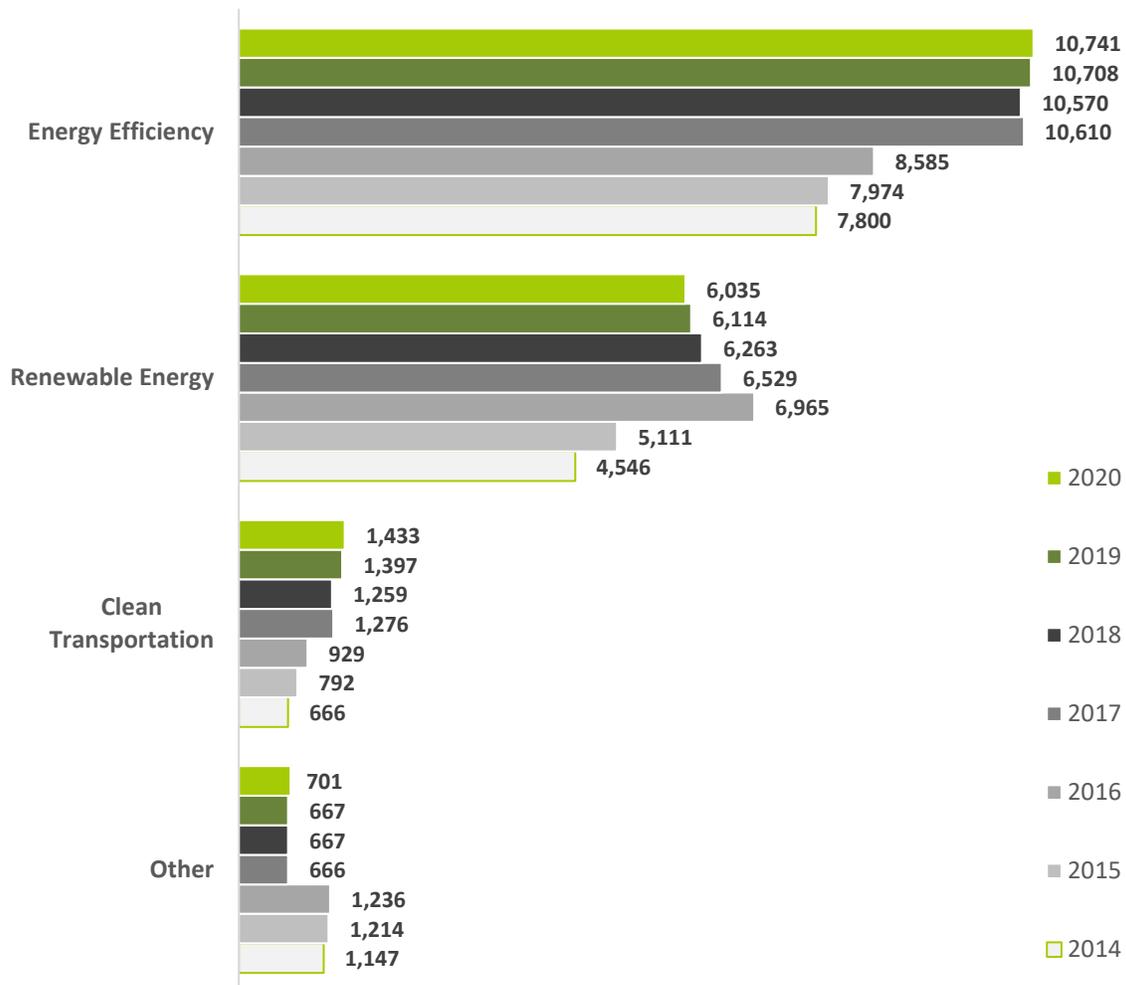


Clean Energy Jobs by Sector

Nearly all sectors, except for renewable energy generation, experienced slight growth between 2019 and 2020. Energy efficiency jobs grew by 0.3 percent, adding another 33 workers to the clean energy labor force. At the same time, clean transportation firms added 36 new jobs to their workforce, for a growth rate of 2.6 percent. Renewable energy generation firms shed jobs at a rate of 1.3 percent, or roughly 79 workers.

The remaining clean energy workers that cannot be attributed to a single sector, the “other” sector, including non-profit or research work, grew by 5.1 percent, or an additional 34 jobs.

FIGURE 5. CLEAN ENERGY EMPLOYMENT GROWTH BY TECHNOLOGY SECTOR, 2014-2020

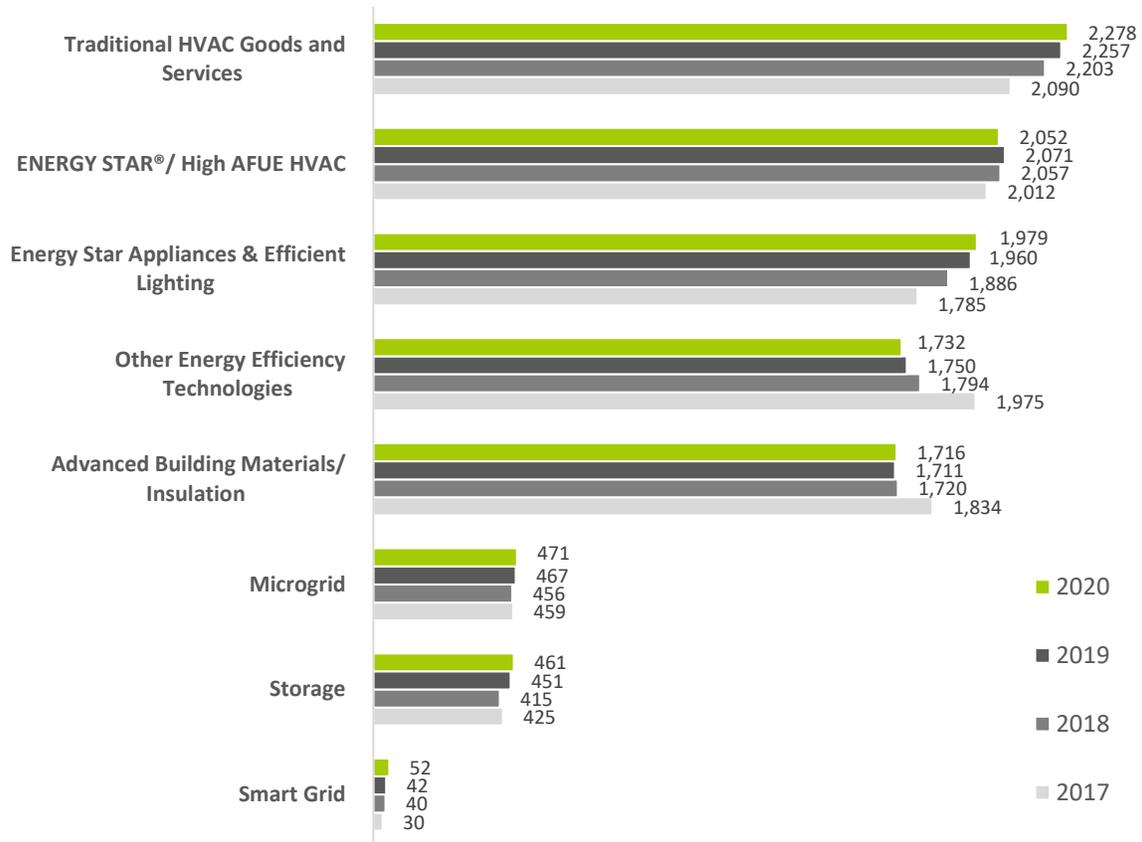


Detailed Clean Energy Sector Employment

Energy Efficiency

Within the energy efficiency sector, the traditional HVAC⁶ firms saw the greatest absolute job growth, adding 21 new energy efficiency workers to the clean energy labor force. Smart grid, storage, and microgrid firms all grew between 2019 and 2020, adding a collective 24 new clean energy jobs to Vermont’s economy. Other energy efficiency technologies and ENERGY STAR® or high AFUE HVAC firms shed a respective 18 and 19 jobs over the same time period.

FIGURE 6. ENERGY EFFICIENCY EMPLOYMENT BY SUB-TECHNOLOGY, 2017-2020⁷



⁶ “Traditional HVAC” workers are those that spend a portion of their time on energy efficient products and services, while “ENERGY STAR®/High AFUE HVAC” workers spend the majority of their labor hours working with energy efficient HVAC technologies.

⁷ “Other energy efficiency technologies” include variable speed pumps, 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.

Renewable Energy Generation

The sub-technologies that contribute to the overall decline in renewable energy generation employment include solar, renewable heating and cooling, woody biomass, non-woody biomass⁸, and other renewable energy generation technologies. These losses were slightly offset by modest job growth across wind, traditional and low-impact hydropower, and bioenergy generation.⁹

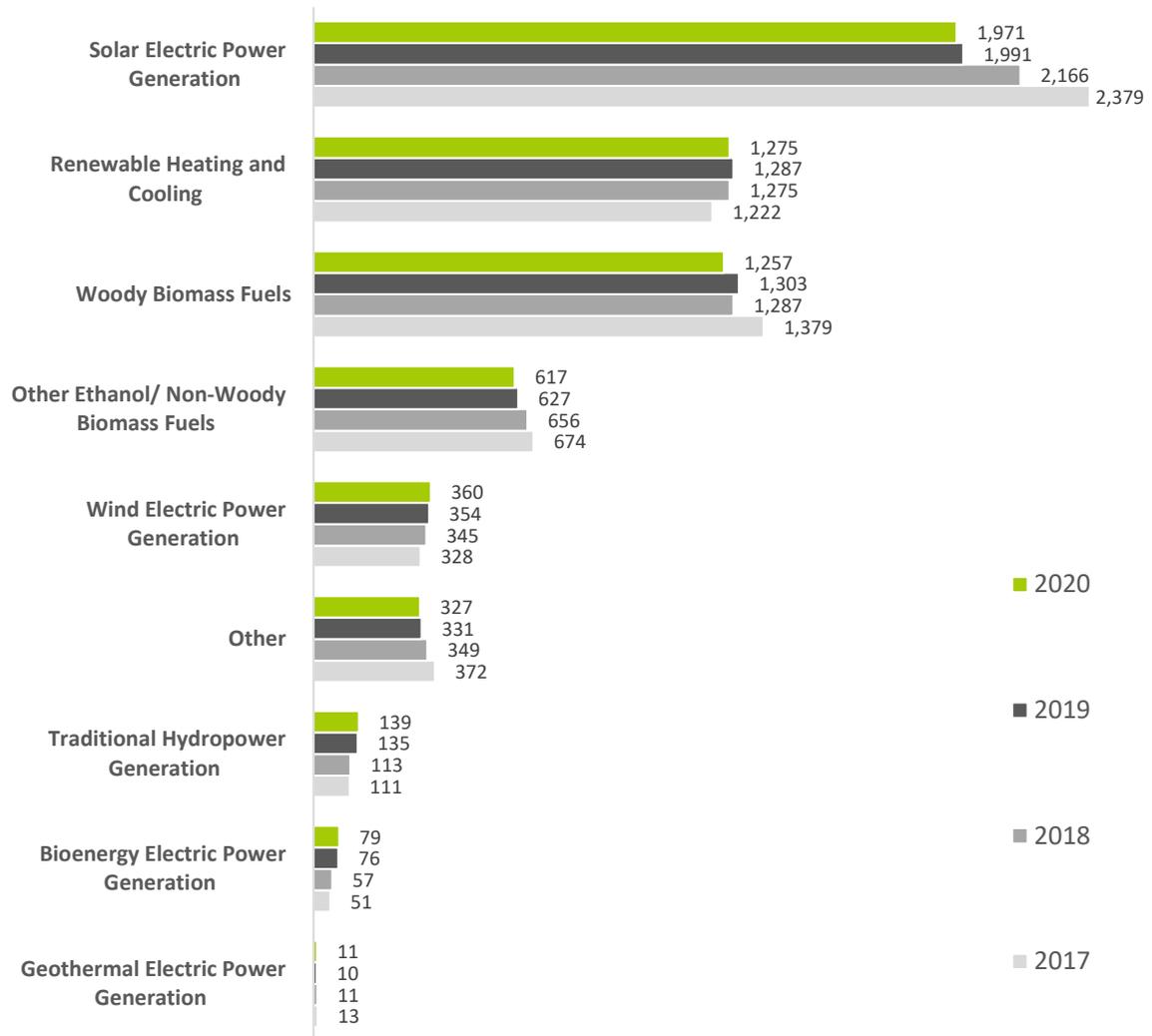
Unlike the rest of the nation, Vermont’s solar industry did not experience a rebound between 2019 and 2020. Nationwide, solar jobs grew by 3.1 percent after a two-year decline. In Vermont, solar employment continued its decrease from 2018, shedding 20 more jobs between 2019 and 2020—a decline of one percent. Despite this, solar jobs remain more concentrated in Vermont as a proportion of total jobs compared to the national average. The solar LQ in Vermont is 2.75; this means that solar jobs in Vermont are 2.75 more concentrated than in the United States overall.

Woody biomass firms actually saw the greatest net decline in employment over this time; these employers lost jobs at a rate of 3.5 percent, equating to 46 fewer jobs in the industry. Non-woody biomass firms shed 10 jobs, while renewable heating and cooling firms lost 12 jobs.

⁸ Non-woody biomass fuels, including biodiesel, includes any other fuels made from other materials such as straw, manure, vegetable oil, animal fats, etc.

⁹ For a full explanation of the difference between “bioenergy generation” and “woody biomass fuels” workers please refer to the Clean Energy Technology List in Appendix B.

FIGURE 7. RENEWABLE ENERGY GENERATION EMPLOYMENT BY SUB-TECHNOLOGY, 2017-2020¹⁰

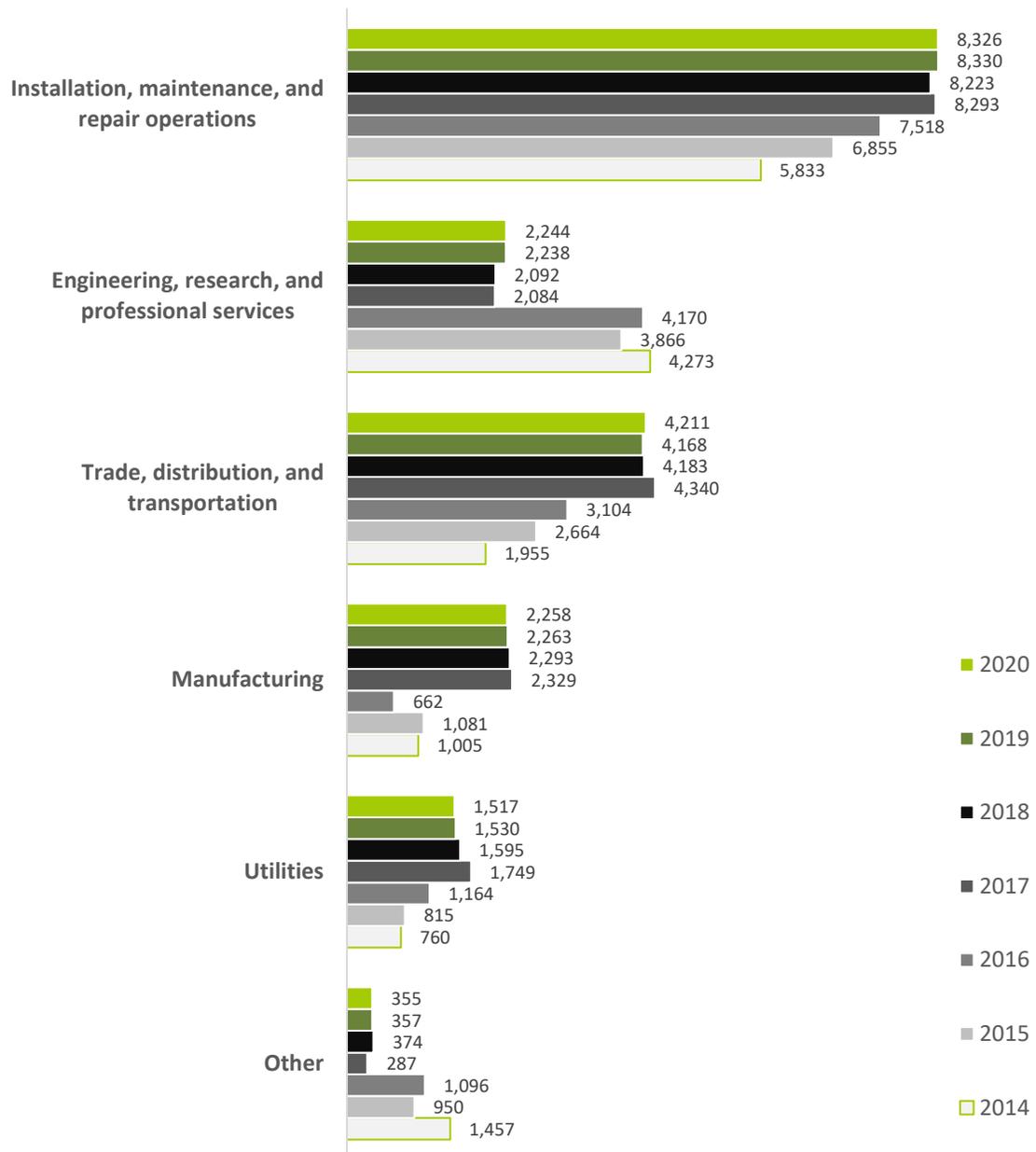


¹⁰ While “low-impact hydropower” is included in Vermont’s clean energy technology definition, it is not pictured on this graph because there were no captured jobs in in Vermont.

Clean Energy Value Chain Employment

Of all clean energy value chain activities, trade, distribution, and transport of clean energy goods saw the most growth between 2019 and 2020. This sector added 43 new jobs, for a growth rate of one percent in 12 months.

FIGURE 8. CLEAN ENERGY EMPLOYMENT BY VALUE CHAIN SEGMENT, 2014-2020



CLEAN ENERGY HIRING

Hiring difficulty decreased slightly since 2019. The proportion of employers that reported hiring had been at least somewhat difficult declined by three percentage points, from 85.7 percent to 82.6 percent. Moreover, employers that indicated hiring had been very difficult between 2019 and 2020 decreased from 38.1 percent to 33.9 percent. Of those that reported hiring difficulty, lack of experience and competition or a small applicant pool were the top reported reasons for difficulty.

It is important to note that hiring difficulty was assessed in the fourth quarter of 2019, prior to the COVID-19 pandemic. The hiring landscape and labor market has likely changed in the months since employers were surveyed.

FIGURE 9. EMPLOYER-REPORTED HIRING DIFFICULTY, 2016-2020

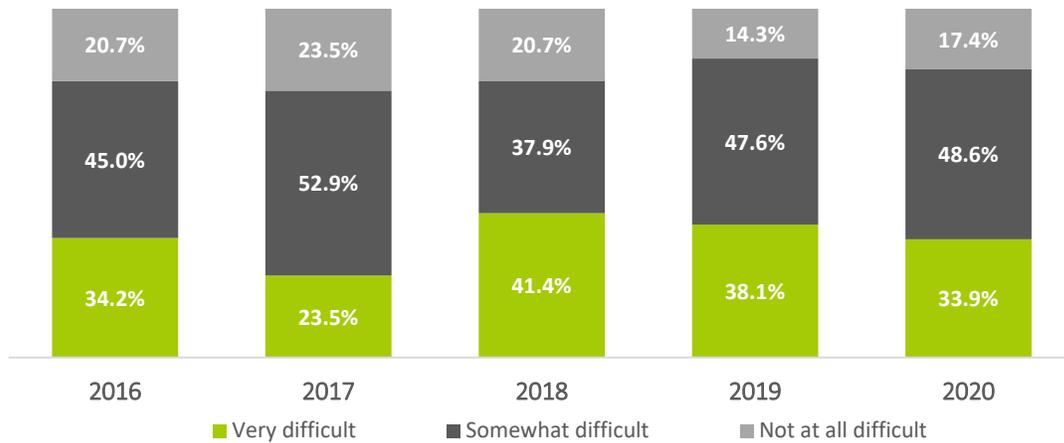


FIGURE 10. REASONS FOR HIRING DIFFICULTY IN VERMONT, 2020



Vermont's Wood Fuel Sector

The wood fuels sector is a critical component of Vermont's clean energy economy. For this reason, the state's CEDF has prioritized investments into the stimulation of the advanced wood heat market. Through its Small-Scale Energy Incentive Program, the CEDF provides incentives for homes or small businesses to purchase efficient wood pellet boilers, as well as EPA-certified cord wood or pellet stoves. The CEDF also offered specific incentives for low- and moderate- income residents of Windham and Rutland counties to change out their wood pellet stoves.¹¹ Other Vermont organizations—including the Department of Economic Development, Department of Environmental Conservation, and Department of Forests, Parks and Recreation—have also taken steps to support the wood fuels sector in Vermont.

The Vermont Clean Energy Industry Reports include a biennial survey of wood fuel employers across the state to gain a better understanding of the opportunities, challenges, and strengths of the state's wood fuels economy.

Employment and Revenues

Wood fuels employment is a breakdown of both “woody biomass fuels” and “renewable heating and cooling” jobs within the renewable energy generation sector.¹² This includes workers involved in the production, refinement, and sales and distribution of wood fuels used to either heat homes or generate electricity but do not include, for example, bioenergy generation jobs, which are expressly involved in the electricity-producing component of energy generation, such as the utility workers at wood chip electric power generation plants. Also included in this wood fuels cross-cut employment estimate are workers involved in the heating of buildings using wood fuels technologies.

Wood fuels jobs are broken down into the following industries specific to wood fuels harvesting and logging; production, sales, and distribution of wood fuels; and wood fuels combustion systems:

1. Logging and harvesting of wood fuels
2. Production and processing, wholesale distribution, and professional service support of wood fuels such as chips, pellets, or firewood¹³
3. Manufacturing, research and development, sales, installation, or professional service support for wood fuel combustion systems, such as stoves, furnaces, boilers, or inserts

In total, there were 1,794 wood fuel workers across the state of Vermont in 2020. Overall, the wood fuels sector contributes just over \$64.3 million to Vermont's Gross Regional Product (GRP), accounting for about 0.2 percent of statewide GRP.¹⁴

¹¹ https://publicservice.vermont.gov/renewable_energy/cedf

¹² See the Detailed Clean Energy Sector Employment Section on page 11 of this report.

¹³ This includes companies that produce, sell, or transport wood chips for the heating of homes and businesses or for wood-fired electric power plants.

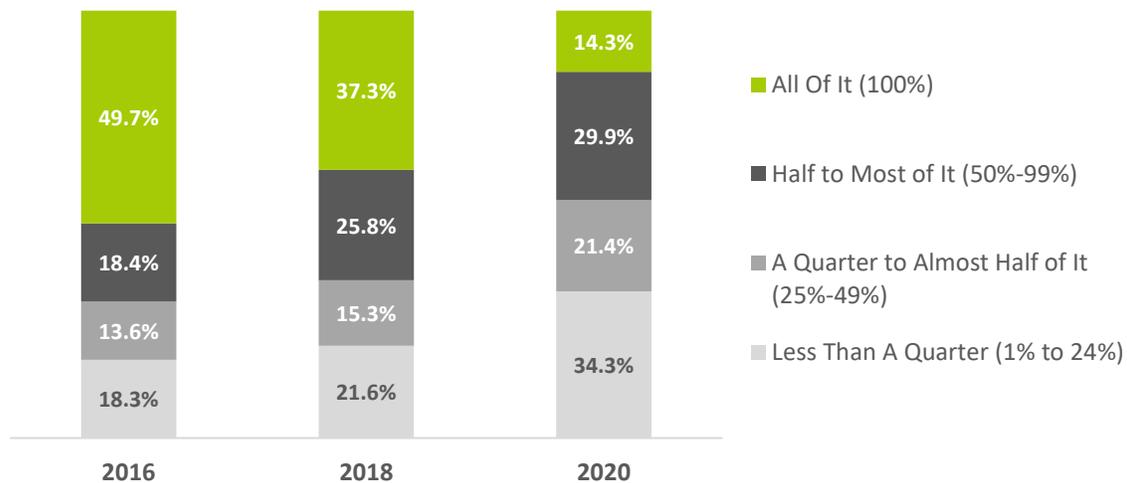
¹⁴ GRP calculations are based on survey data and secondary data from Emsi (Economic Modeling Specialists Intl.) and the US Bureau of Economic Analysis.

TABLE 2. WOOD FUEL EMPLOYMENT BY INDUSTRY, 2020

	2016 Employment	2018 Employment	2020 Employment
Logging	517	461	452
Wood fuel processing and preparation, including chips, pellets, or firewood	982	790	768
Combustion systems, such as stoves, furnaces, boilers, inserts, etc. ¹⁵	629	554	536
Other	42	36	37
Total ¹⁶	2,171	1,841	1,794

About four in ten (44.3 percent) surveyed wood fuel employers indicated that the majority of their firms' revenues are related to wood fuels. Those firms engaged in the manufacture, sales, or installation of combustion systems were more likely to indicate the majority of their revenues are related to wood fuels. Since 2016, however, the proportion of wood fuel employers that reported all of their revenues are derived from wood fuel-specific activities declined from 49.7 percent to 37.3 percent.

FIGURE 11. FIRM REVENUE DERIVED FROM WOOD FUELS ACTIVITIES, 2016, 2018, & 2020¹⁷



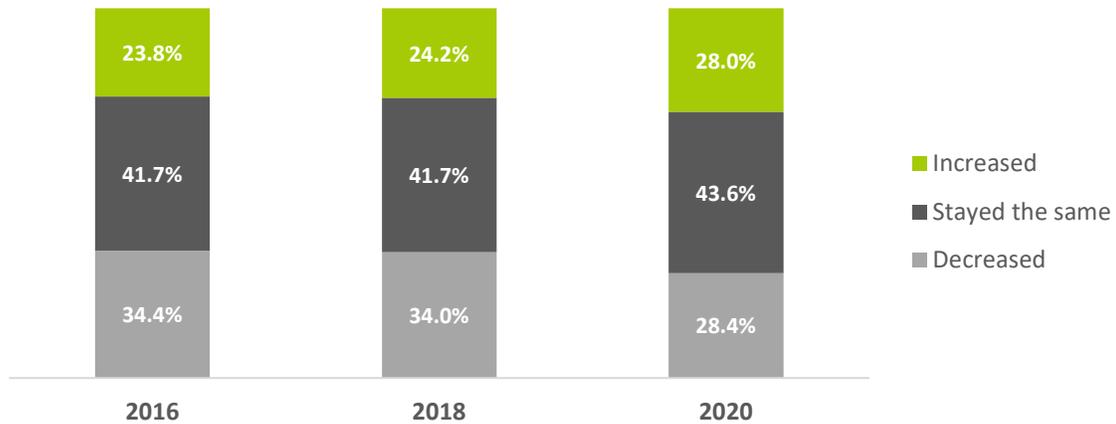
¹⁵ This includes workers involved in the manufacture, research and development, sales, installation, and other support, such as legal, consulting, or financial services, for wood fuel combustion systems.

¹⁶ This employment total is a combined subset from the “woody biomass” and “renewable heating and cooling” industry sectors within renewable energy generation.

¹⁷ Responses were adjusted to reflect 2020 industry employment shares. The share of employers that said “all” revenue was from wood fuels in 2020 was significantly lower than in 2016 (0.001) and 2018 (0.05). And the share of employers that said “less than a quarter” of revenue was from wood fuels in 2020 was significantly higher than in 2016 (0.05).

Between 2018 and 2019, 43.6 percent of employers reported that their revenues stayed the same, while about 28 percent each indicated that their revenues either increased or decreased. These responses were fairly similar across each wood fuel sector, though wood fuel processing and preparation firms were slightly more likely to report an increase (31 percent) compared to logging (27 percent) and combustion system firms (28 percent).

FIGURE 12. WOOD FUEL FIRM REVENUE CHANGE AS COMPARED TO PREVIOUS YEAR¹⁸



Business Prospects and Support

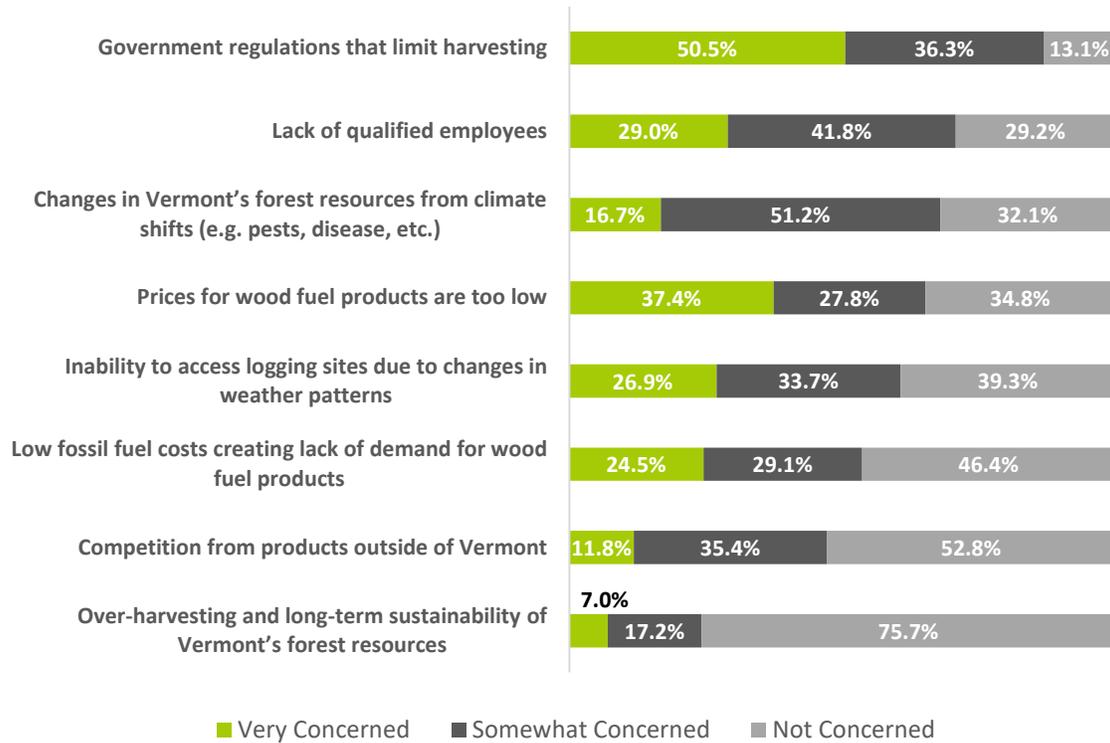
Among the surveyed potential concerns, Vermont’s wood fuel employers were least concerned about over-harvesting and long-term sustainability of Vermont’s forest resources; about 75.7 percent of employers indicated they are not concerned about the issue and 60.8 percent disagreed that it is a concern. On the contrary, the majority of employers (86.9 percent) were concerned with government regulations that limit harvesting, the highest level of concern among those tested. In fact, 50.5 percent of employers indicated that they are very concerned with government regulations that limit harvesting and another 36.3 percent indicated they are somewhat concerned with the issue. Moreover, 43.9 percent of employers agreed that under-harvesting is a concern in Vermont. A lack of qualified employees, changes in Vermont’s forest resources due to climate shifts, and low wood fuel product pricing marked the next three largest concerns, with about 65 to 71 percent of employers reporting being either very or somewhat concerned with each.

Logging firms were more likely to indicate that the same top four issues (government regulations, climate impact on forest resources, low fuel product prices, and changing weather patterns) are of concern for

¹⁸ Employers were asked whether their firm’s wood fuel-related revenues increased, decreased, or stayed the same over the past year; 2016 employers were asked about their 2014-2015 revenue change, 2018 employers were asked about their 2016-2017 revenue change, and 2020 employers were asked about their 2018-2019 revenue change. Responses were adjusted to reflect 2020 industry employment shares. There are no statistically significant differences across years.

their future business prospects compared to wood fuel processing or combustion system manufacturing, sales, or installation firms. For wood fuel loggers, government regulations that limit harvesting was their biggest concern (90.9 percent), followed by low wood fuel prices (75.8 percent).

FIGURE 13. CONCERN LEVEL FOR FIRM'S FUTURE BUSINESS PROSPECTS, 2020¹⁹

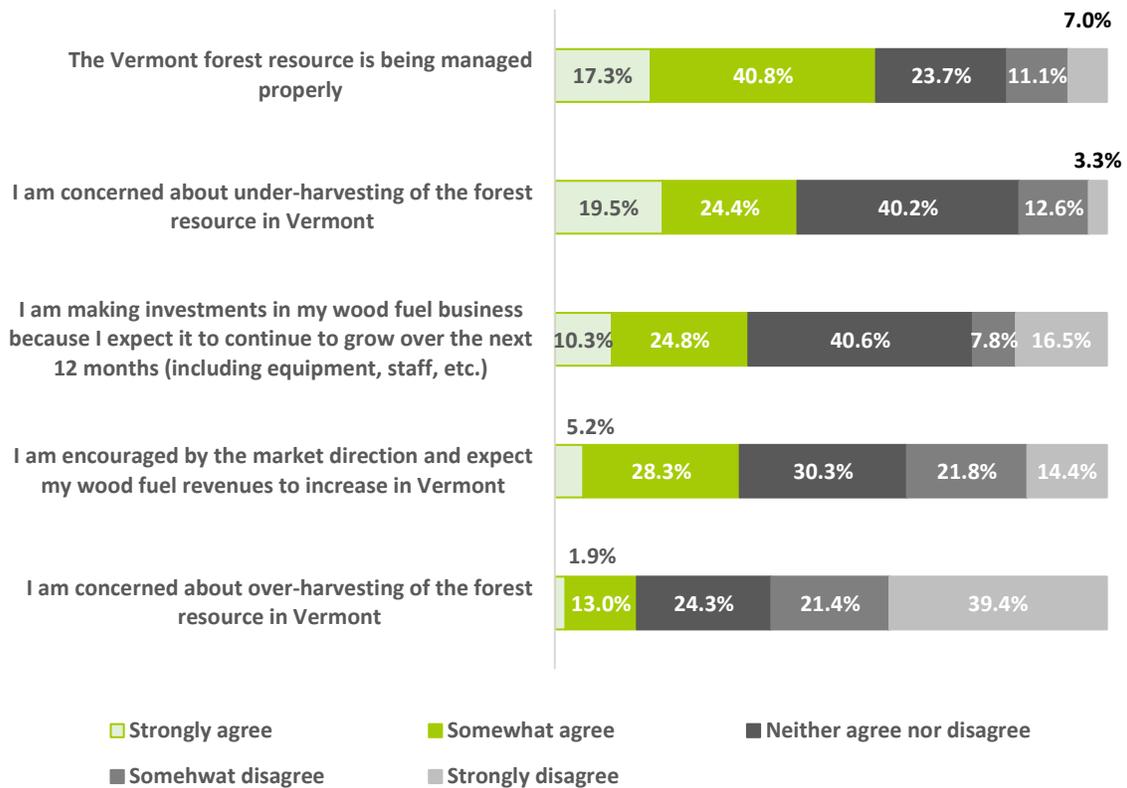


Despite concerns with harvesting regulations and under-harvesting in general, the majority of wood fuel employers do agree that Vermont's forest resources are being managed properly (58.2 percent).

About one third of employers (35.1 percent) were making investments in their wood fuel business because they expect to grow over the next 12 months, and another 33.5 percent were encouraged by the market direction and expect their wood fuel revenues to increase.

¹⁹ This question was new to this year's wood fuel employer survey. As such, there are no historical comparisons available for this metric.

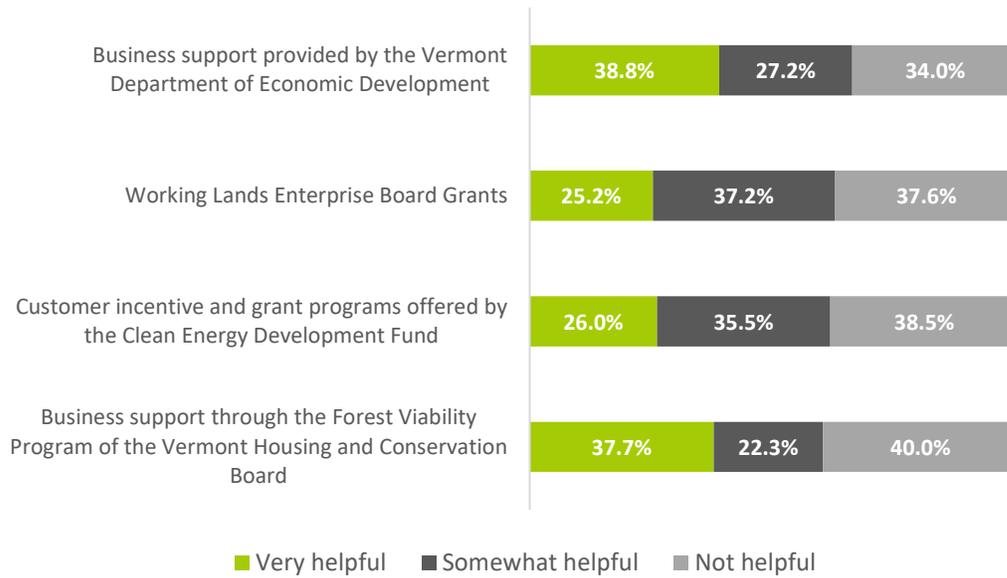
FIGURE 14. WOOD FUEL BUSINESS AND FOREST HEALTH, 2020²⁰



With regards to programs and organizations, business support provided by the Department of Economic Development was considered the most helpful program; 66 percent of employers who had some level of experience with the program indicated it has been helpful to the health of their business. About six in ten employers also indicated that Working Lands Enterprise Board Grants; customer incentives and grant programs offered by the Clean Energy Development Fund (CEDF); and, business support through the Forest Viability Program of the Vermont Housing and Conservation Board have been helpful to the health of their wood fuel business.

²⁰ Comparisons to the 2016 and 2018 wood fuel employer survey are not included in here because many topics that were tested in the survey question were changed in this year’s survey. Among those topics that have not changed, there were no significant changes of interest.

FIGURE 15. PROGRAM AND ORGANIZATIONAL SUPPORT, 2020²¹



²¹ This question was new to this year's wood fuel employer survey. As such, there are no historical comparisons available for this metric. Individuals who reported they had no experience with the organization or program tested in the survey question were factored out from the analysis in order to provide results only from those who have had experience with these organizations and programs.

Appendix A: Research Methodology

EMPLOYMENT DATA

In congruence with previous reports, this year's Clean Energy Industry Report is based on the 2020 United States Energy and Employment Report (USEER). The 2020 USEER utilized data from the Bureau of Labor Statistics Quarterly Census of Employment and Wages (BLS QCEW 2019 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 4,800 outbound calls and 499 emails sent to participants across Vermont. This year, survey invites were sent via mail to more than 150 business locations in 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 2019, 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 2019 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, 524 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 +/- 3.98 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 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.

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 2020. 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.

100 PERCENT & FULL-TIME EQUIVALENT JOBS

In an attempt to reconcile the Vermont-specific methodology that has historically been used for these reports with the methodological updates to other clean energy reports, the research team has determined it best to revise both the 100 percent and FTE employment figures in this year's report and moving forward. As such, the 100 percent employment estimates presented in this report for 2017, 2018, and 2019 will not match previous Vermont Clean Energy Industry Reports (VCEIRs). However, this methodological update provides a more accurate representation of clean energy activity in Vermont and allows for comparison across other state-level clean energy reports. The revised methodology is explained below.

Full-time equivalent (FTE) jobs are extrapolated using state employment thresholds by technology weighted on census division and previous year's data. These thresholds are adjusted for response bias between our known and unknown universes, then the proportion of firm revenues from energy projects are incorporated. Employment thresholds are survey data from questions asking what percent of a firm's employment spends at least 50 percent of their time working on energy-related activities and what percent spend all their time on clean energy activities. Using the adjusted thresholds, employment by state is then split into three groups, those that spend all (100 percent) of their time on energy-related activities, those that spend a majority (50 to 99 percent) of their time, and those that spend less than a majority (0 to 49 percent) of their time. These employment groups are weighted 0.25 on the less than a majority group, 0.75 on the majority group, and 1 on the 100 percent group. FTE jobs are the sum of these products.

Because the 100 percent employment estimates are a subset of the overall FTE metric, these employment figures have also been updated accordingly using the above methodology.

WOOD FUELS EMPLOYER SURVEY

In early 2020, BW Research conducted a supplemental survey of wood fuel (woody biomass) employers in the state of Vermont. The sample for the survey consisted of wood fuel firms that completed the 2020 United States Energy and Employment Report (USEER) survey, additional samples pulled together through secondary research, and a sample of loggers provided by the State of Vermont. The survey was fielded between January 7th and January 29th, 2020 and averaged seven minutes in length. A total of 85 firms and sole proprietors provided information about their level of involvement in the wood fuel industry in Vermont.

WAGE DATA

Reported technology wages at the 5-digit occupational level (as determined by the Standard Occupational Classifications, or SOCs) are a product of 5-digit SOC wages provided by the Bureau of Labor Statistics, a technology-specific multiplier created at the 2-digit occupational level, and a geographic-specific multiplier created at the 2-digit occupational level.

The technology-specific multiplier is a sum of the products of occupational group multipliers and the share of that occupational group's employment within total technology employment (as reported in the 2020 US Energy and Employment Report). Occupational group multipliers are the quotients of occupational group averages of technology-specific 5-digit SOC wages over the averages of their

corresponding BLS-provided 5-digit SOC wages. As stated above, technology-specific 5-digit SOC wages are a product of BLS-provided 5-digit SOC wages and a technology-specific 2-digit SOC multiplier. These technology-specific 2-digit SOC multipliers are the quotients of adjusted 2-digit SOC wages over BLS-provided 2-digit SOC wages. The adjusted 2-digit SOC wages are four-fifths BLS-provided 2-digit SOC wages and one-fifth survey-produced 2-digit SOC wages from Vermont firms. The survey-produced 2-digit SOC wages are averages of survey-produced 5-digit SOC salaries divided by 2080 (a year's working hours assuming full-time employment).

The geographic-specific multiplier is the quotient of the BLS 2-digit SOC wages in Vermont over the national BLS provided 2-digit SOC wages. This allows the research team to capture the premium or discount Vermont has over the rest of the nation.

Appendix B: Clean Energy Technology List

A clean energy job is defined as any worker that is directly involved with the research, development, production, manufacture, distribution, sales, implementation, installation, or repair of components, goods, or services related to the following sectors: Renewable Energy Generation; Clean Grid and Storage; Energy Efficiency; Clean Fuels; and Clean Transportation. These jobs also include supporting services such as consulting, finance, tax, and legal services related to energy.

The State of Vermont categorizes sub-technologies differently from the USEER data collection effort and reports. The below lists identify which sub-technologies are specific to Vermont’s clean energy definition. They are placed in their respective USEER category, with additional in-text and footnote explanation as to where they would fall for the Vermont Clean Energy Industry Report.

RENEWABLE ENERGY GENERATION

Renewable energy generation jobs cover all utility and non-utility employment for renewable electricity-generating technologies. Included in these employment estimates are any firms engaged in renewable energy facility construction, generation equipment manufacturing, wholesale parts distribution, and professional and business services such as consulting, finance, administrative, and legal support for the following renewable energy generation sub-technologies:

- Solar Photovoltaic Electric Generation
- Concentrated Solar Electric Generation
- Wind Generation
- Geothermal Generation
- Bioenergy/Biomass Generation
- Low-Impact Hydroelectric Generation, including wave/kinetic generation
- Traditional Hydroelectric Generation
- Combined Heat and Power
- Other Renewable Electric Power Generation
- Renewable Heating and Cooling²²
 - Solar Thermal Water Heating and Cooling
 - Other Renewable Heating and Cooling (geothermal, biomass, heat pumps, etc.)

RENEWABLE FUELS²³

These jobs encompass all work related to the production of clean fuels. Fuels employment spans industries such as agriculture and forestry, manufacturing, professional and business services, wholesale trade, transportation, and construction.

²² For Vermont, “renewable heating and cooling” is included under the “renewable energy generation” sector, while for USEER data collection, this sub-technology is categorized under “energy efficiency”.

²³ For Vermont, “non-woody biomass” and “woody biomass” are included under the “renewable energy generation” sector, while for USEER data collection, these sub-technologies are categorized as “fuels”.

It is important to note the difference between bioenergy electricity generation jobs and woody biomass fuels jobs. The former includes workers that are involved in the generation of electricity from materials derived from biological sources or any organic material, while the latter encompasses those workers who are engaged in fuel development from materials such as manure, vegetable oil, trees and woody plants, and other living matter. In other words, bioenergy generation workers are expressly involved in the electricity-producing component (including the construction of generators and manufacture of turbines) while woody biomass workers are involved in the production, refinement, and distribution of those fuels used to produce the electricity.

Vermont includes the following renewable fuel sub-technologies under the overall renewable energy generation sector:

- Woody Biomass, including cellulosic biofuel
- Non-Woody Biomass, including biodiesel

ENERGY EFFICIENCY

- Traditional HVAC goods, control systems, and services
- ENERGY STAR Certified Heating Ventilation and Air Conditioning (HVAC), including boilers and furnaces with an AFUE rating of 90 or greater and air and central air conditioning units of 15 SEER or greater
- ENERGY STAR® Appliances & Efficient Lighting
 - ENERGY STAR Certified Appliances, excluding HVAC
 - ENERGY STAR Certified Electronics (TVs, Telephones, Audio/Video, etc.)
 - ENERGY STAR Certified Windows and Doors
 - ENERGY STAR Certified Roofing
 - ENERGY STAR Certified Seal and Insulation
 - ENERGY STAR Certified Commercial Food Service Equipment
 - ENERGY STAR Certified Data Center Equipment
 - ENERGY STAR Certified LED Lighting
 - Other LED, CFL, and Efficient Lighting
- Advanced Building Materials/Insulation
- Other Energy Efficiency
 - Reduced Water Consumption Products and Appliances
 - Recycled Building Materials

CLEAN GRID & STORAGE²⁴

Electric Power Transmission and Distribution

- Smart Grid
- Microgrids
- Other Grid Modernization

Storage

- Pumped Hydropower Storage
- Battery Storage, including battery storage for solar generation

²⁴ For Vermont, these are included under the “energy efficiency” sector, while for USEER data collection, these sub-technologies are categorized under “transmission, distribution, and storage” (or clean grid and storage for clean energy-specific industry reports).

- Lithium Batteries
- Lead-Based Batteries
- Other Solid-Electrode Batteries
- Vanadium Redox Flow Batteries
- Other Flow Batteries
- Mechanical Storage, including flywheels, compressed air energy storage, etc.
- Thermal Storage
- Biofuel, including ethanol and biodiesel storage

CLEAN TRANSPORTATION

- Hybrid Electric Vehicles
- Plug-In Hybrid Vehicles
- Electric Vehicles

Appendix C: Clean Energy Wages

The following tables provide wages for clean energy occupations in Vermont by each major clean energy sector as well as three levels of experience—entry-, mid-, and senior-level positions. Overall, 81 percent of clean energy jobs in Vermont pay a premium compared to their corresponding occupational average across all levels of experience. Ninety-two percent of entry-level positions pay a premium, 86 percent of mid-level positions pay a premium, and 65 percent of senior-level positions pay a premium.²⁵

RENEWABLE ENERGY GENERATION				
SOC	Description	Entry-level	Mid-level	Senior-level
11-1011	Chief Executives	\$ 38.03	\$ 74.19	\$ 128.10
11-1021	General and Operations Managers	\$ 24.88	\$ 39.49	\$ 79.29
11-9021	Construction Managers	\$ 27.17	\$ 39.97	\$ 54.52
13-1199	Business Operations Specialists, All Other	\$ 21.05	\$ 32.64	\$ 51.17
13-2011	Accountants and Auditors	\$ 27.19	\$ 32.24	\$ 44.00
15-1122	Information Security Analysts	\$ 28.87	\$ 41.01	\$ 62.30
15-1199	Computer Occupations, All Other	\$ 24.10	\$ 37.64	\$ 57.62
17-2199	Engineers, All Other	\$ 29.70	\$ 52.02	\$ 90.10
17-3019	Drafters, All Other	\$ 19.87	\$ 26.38	\$ 48.92
17-3029	Engineering Technicians, Except Drafters, All Other	\$ 21.74	\$ 32.14	\$ 60.39
17-3031	Surveying and Mapping Technicians	\$ 16.46	\$ 22.58	\$ 45.33
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$ 30.21	\$ 39.63	\$ 61.28
43-3031	Bookkeeping, Accounting, and Auditing Clerks	\$ 16.47	\$ 24.72	\$ 32.24
43-5041	Meter Readers, Utilities	\$ 17.01	\$ 25.68	\$ 36.91
43-5061	Production, Planning, and Expediting Clerks	\$ 20.46	\$ 30.29	\$ 39.03
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	\$ 14.21	\$ 18.62	\$ 23.93
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	\$ 24.59	\$ 32.82	\$ 51.13
47-2011	Boilermakers	\$ 22.73	\$ 30.23	\$ 32.09
47-2061	Construction Laborers	\$ 14.18	\$ 17.41	\$ 23.40
47-2073	Operating Engineers and Other Construction Equipment Operators	\$ 18.93	\$ 23.25	\$ 30.03
47-2111	Electricians	\$ 19.91	\$ 26.84	\$ 33.76

²⁵ The statewide comparison is pulled from the Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Q4 2019. Entry-level wages are at the 20th percentile, mid-level are median hourly wages, and senior-level wages are at the 90th percentile.

47-2132	Insulation Workers, Mechanical	\$ 18.36	\$ 23.22	\$ 31.68
47-2151	Pipelayers	\$ 16.24	\$ 18.76	\$ 24.60
47-2152	Plumbers, Pipefitters, and Steamfitters	\$ 19.40	\$ 26.23	\$ 33.44
47-2181	Roofers	\$ 15.44	\$ 19.45	\$ 23.73
47-2211	Sheet Metal Workers	\$ 16.79	\$ 23.57	\$ 30.80
47-2221	Structural Iron and Steel Workers	\$ 19.48	\$ 26.26	\$ 33.46
47-2231	Solar Photovoltaic Installers	\$ 12.72	\$ 18.27	\$ 27.54
47-3013	Helpers--Electricians	\$ 13.46	\$ 16.46	\$ 20.54
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	\$ 13.37	\$ 16.24	\$ 20.16
47-4098	Miscellaneous Construction and Related Workers	\$ 13.86	\$ 14.49	\$ 16.81
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	\$ 23.84	\$ 32.29	\$ 47.92
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	\$ 23.94	\$ 32.68	\$ 47.54
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door	\$ 22.53	\$ 33.48	\$ 44.73
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	\$ 21.53	\$ 28.43	\$ 37.48
49-9041	Industrial Machinery Mechanics	\$ 24.62	\$ 31.25	\$ 38.44
49-9051	Electrical Power-Line Installers and Repairers	\$ 27.93	\$ 42.34	\$ 49.94
49-9071	Maintenance and Repair Workers, General	\$ 17.21	\$ 22.88	\$ 30.68
49-9081	Wind Turbine Service Technicians	\$ 16.40	\$ 20.94	\$ 31.03
49-9098	Helpers--Installation, Maintenance, and Repair Workers	\$ 14.58	\$ 17.59	\$ 22.93
49-9099	Installation, Maintenance, and Repair Workers, All Other	\$ 18.00	\$ 23.47	\$ 32.02
51-1011	First-Line Supervisors of Production and Operating Workers	\$ 20.36	\$ 30.28	\$ 44.56
51-2098	Assemblers and Fabricators, All Other, Including Team Assemblers	\$ 13.36	\$ 18.39	\$ 28.17
51-4121	Welders, Cutters, Solderers, and Brazers	\$ 16.85	\$ 21.99	\$ 30.23
51-4199	Metal Workers and Plastic Workers, All Other	\$ 13.60	\$ 19.10	\$ 27.49
51-8012	Power Distributors and Dispatchers	\$ 38.93	\$ 43.54	\$ 62.01
51-8013	Power Plant Operators	\$ 32.48	\$ 40.11	\$ 56.11
51-8099	Plant and System Operators, All Other	\$ 24.64	\$ 28.77	\$ 43.01
51-9199	Production Workers, All Other	\$ 12.63	\$ 16.70	\$ 27.61
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	\$ 15.92	\$ 20.90	\$ 28.54
53-7199	Material Moving Workers, All Other	\$ 17.22	\$ 21.74	\$ 36.31

CLEAN GRID AND STORAGE				
SOC	Description	Entry-level	Mid-level	Senior-level
11-1011	Chief Executives	\$ 36.65	\$ 72.44	\$ 130.04
11-1021	General and Operations Managers	\$ 23.98	\$ 38.56	\$ 80.49
11-9021	Construction Managers	\$ 24.69	\$ 38.84	\$ 55.60
13-2011	Accountants and Auditors	\$ 26.43	\$ 31.24	\$ 43.23
15-1122	Information Security Analysts	\$ 28.40	\$ 40.12	\$ 61.27
15-1199	Computer Occupations, All Other	\$ 23.71	\$ 36.82	\$ 56.67
17-2199	Engineers, All Other	\$ 23.29	\$ 40.34	\$ 72.79
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$ 28.57	\$ 37.89	\$ 59.11
43-3031	Bookkeeping, Accounting, and Auditing Clerks	\$ 16.47	\$ 24.14	\$ 32.78
43-5041	Meter Readers, Utilities	\$ 17.55	\$ 26.74	\$ 39.30
43-5061	Production, Planning, and Expediting Clerks	\$ 21.11	\$ 31.53	\$ 41.55
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	\$ 14.21	\$ 18.37	\$ 23.81
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	\$ 20.79	\$ 28.09	\$ 43.49
47-2011	Boilermakers	\$ 23.36	\$ 30.11	\$ 33.59
47-2061	Construction Laborers	\$ 14.58	\$ 17.34	\$ 24.49
47-2073	Operating Engineers and Other Construction Equipment Operators	\$ 19.46	\$ 23.15	\$ 31.43
47-2111	Electricians	\$ 20.47	\$ 26.73	\$ 35.33
47-2132	Insulation Workers, Mechanical	\$ 18.88	\$ 23.12	\$ 33.15
47-2151	Pipelayers	\$ 16.70	\$ 18.68	\$ 25.74
47-2152	Plumbers, Pipefitters, and Steamfitters	\$ 19.94	\$ 26.12	\$ 34.99
47-2181	Roofers	\$ 15.87	\$ 19.37	\$ 24.83
47-2211	Sheet Metal Workers	\$ 17.26	\$ 23.48	\$ 32.23
47-2221	Structural Iron and Steel Workers	\$ 20.03	\$ 26.15	\$ 35.02
47-3013	Helpers--Electricians	\$ 14.04	\$ 17.59	\$ 22.82
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	\$ 13.95	\$ 17.35	\$ 22.39
47-4031	Fence Erectors	\$ 13.59	\$ 13.27	\$ 15.23
47-4098	Miscellaneous Construction and Related Workers	\$ 15.14	\$ 14.82	\$ 17.63
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	\$ 23.84	\$ 31.57	\$ 47.81

49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	\$ 24.75	\$ 33.63	\$ 48.16
49-3042	Mobile Heavy Equipment Mechanics, Except Engines	\$ 25.51	\$ 27.17	\$ 31.40
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door	\$ 23.13	\$ 35.03	\$ 45.87
49-9041	Industrial Machinery Mechanics	\$ 25.26	\$ 32.69	\$ 39.42
49-9051	Electrical Power-Line Installers and Repairers	\$ 28.67	\$ 44.29	\$ 51.20
49-9071	Maintenance and Repair Workers, General	\$ 17.66	\$ 23.93	\$ 31.46
49-9098	Helpers--Installation, Maintenance, and Repair Workers	\$ 14.97	\$ 18.40	\$ 23.51
49-9099	Installation, Maintenance, and Repair Workers, All Other	\$ 18.48	\$ 24.55	\$ 32.83
51-1011	First-Line Supervisors of Production and Operating Workers	\$ 18.90	\$ 29.72	\$ 43.91
51-2098	Assemblers and Fabricators, All Other, Including Team Assemblers	\$ 13.47	\$ 17.80	\$ 27.33
51-4121	Welders, Cutters, Solderers, and Brazers	\$ 17.91	\$ 23.54	\$ 33.95
51-4199	Metal Workers and Plastic Workers, All Other	\$ 14.45	\$ 20.44	\$ 30.87
51-8012	Power Distributors and Dispatchers	\$ 38.11	\$ 43.98	\$ 60.87
51-8013	Power Plant Operators	\$ 31.79	\$ 40.52	\$ 55.08
51-8099	Plant and System Operators, All Other	\$ 24.12	\$ 29.06	\$ 42.22
51-9199	Production Workers, All Other	\$ 12.93	\$ 15.41	\$ 28.36
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	\$ 15.17	\$ 20.67	\$ 26.55
53-7199	Material Moving Workers, All Other	\$ 16.40	\$ 21.51	\$ 33.78

ENERGY EFFICIENCY				
SOC	Description	Entry-level	Mid-level	Senior-level
11-1011	Chief Executives	\$ 36.10	\$ 71.73	\$ 125.92
11-1021	General and Operations Managers	\$ 23.62	\$ 38.18	\$ 77.95
11-9021	Construction Managers	\$ 25.10	\$ 37.94	\$ 53.00
13-1199	Business Operations Specialists, All Other	\$ 20.05	\$ 32.64	\$ 50.01
13-2011	Accountants and Auditors	\$ 26.43	\$ 31.48	\$ 43.65
15-1122	Information Security Analysts	\$ 26.59	\$ 37.61	\$ 58.24
15-1199	Computer Occupations, All Other	\$ 22.19	\$ 34.53	\$ 53.86
17-2199	Engineers, All Other	\$ 25.39	\$ 42.43	\$ 68.19

41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$ 26.99	\$ 37.14	\$ 57.96
43-3031	Bookkeeping, Accounting, and Auditing Clerks	\$ 16.20	\$ 23.55	\$ 31.86
43-5061	Production, Planning, and Expediting Clerks	\$ 21.04	\$ 33.05	\$ 41.34
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	\$ 14.21	\$ 18.18	\$ 23.31
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	\$ 22.54	\$ 30.91	\$ 46.20
47-2011	Boilermakers	\$ 22.96	\$ 29.87	\$ 32.60
47-2021	Brickmasons and Blockmasons	\$ 19.18	\$ 24.48	\$ 30.55
47-2031	Carpenters	\$ 17.62	\$ 22.39	\$ 29.99
47-2061	Construction Laborers	\$ 14.33	\$ 17.20	\$ 23.77
47-2073	Operating Engineers and Other Construction Equipment Operators	\$ 19.13	\$ 22.97	\$ 30.50
47-2081	Drywall and Ceiling Tile Installers	\$ 16.79	\$ 21.02	\$ 30.09
47-2111	Electricians	\$ 20.12	\$ 26.52	\$ 34.30
47-2131	Insulation Workers, Floor, Ceiling, and Wall	\$ 15.29	\$ 18.49	\$ 22.85
47-2132	Insulation Workers, Mechanical	\$ 18.56	\$ 22.94	\$ 32.18
47-2151	Pipelayers	\$ 16.41	\$ 18.53	\$ 24.99
47-2152	Plumbers, Pipefitters, and Steamfitters	\$ 19.60	\$ 25.91	\$ 33.96
47-2181	Roofers	\$ 15.60	\$ 19.21	\$ 24.10
47-2211	Sheet Metal Workers	\$ 16.97	\$ 23.29	\$ 31.28
47-2221	Structural Iron and Steel Workers	\$ 19.69	\$ 25.94	\$ 33.99
47-3012	Helpers--Carpenters	\$ 12.85	\$ 16.27	\$ 19.62
47-3013	Helpers--Electricians	\$ 13.46	\$ 16.54	\$ 20.87
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	\$ 13.37	\$ 16.31	\$ 20.48
47-4031	Fence Erectors	\$ 12.27	\$ 13.07	\$ 14.32
47-4098	Miscellaneous Construction and Related Workers	\$ 13.67	\$ 14.59	\$ 16.58
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	\$ 22.25	\$ 32.23	\$ 46.62
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door	\$ 22.23	\$ 32.75	\$ 45.01
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	\$ 21.24	\$ 27.80	\$ 37.71
49-9041	Industrial Machinery Mechanics	\$ 24.28	\$ 30.56	\$ 38.68
49-9051	Electrical Power-Line Installers and Repairers	\$ 27.55	\$ 41.41	\$ 50.25
49-9071	Maintenance and Repair Workers, General	\$ 16.98	\$ 22.37	\$ 30.87
49-9098	Helpers--Installation, Maintenance, and Repair Workers	\$ 14.38	\$ 17.20	\$ 23.07
49-9099	Installation, Maintenance, and Repair Workers, All Other	\$ 17.76	\$ 22.96	\$ 32.22

51-1011	First-Line Supervisors of Production and Operating Workers	\$ 20.36	\$ 31.95	\$ 46.28
51-2098	Assemblers and Fabricators, All Other, Including Team Assemblers	\$ 13.94	\$ 18.39	\$ 28.17
51-4121	Welders, Cutters, Solderers, and Brazers	\$ 18.12	\$ 23.54	\$ 32.92
51-4199	Metal Workers and Plastic Workers, All Other	\$ 14.62	\$ 20.44	\$ 29.93
51-9199	Production Workers, All Other	\$ 11.78	\$ 16.01	\$ 27.05
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	\$ 14.46	\$ 17.69	\$ 22.52
53-7199	Material Moving Workers, All Other	\$ 15.63	\$ 18.40	\$ 28.66

CLEAN FUELS				
SOC	Description	Entry-level	Mid-level	Senior-level
11-1011	Chief Executives	\$ 36.14	\$ 72.15	\$ 128.51
11-1021	General and Operations Managers	\$ 23.64	\$ 38.41	\$ 79.54
11-9021	Construction Managers	\$ 26.34	\$ 40.11	\$ 53.80
13-1199	Business Operations Specialists, All Other	\$ 20.05	\$ 32.64	\$ 50.48
13-2011	Accountants and Auditors	\$ 26.43	\$ 31.84	\$ 42.97
15-1122	Information Security Analysts	\$ 27.41	\$ 38.32	\$ 58.35
15-1199	Computer Occupations, All Other	\$ 22.88	\$ 35.17	\$ 53.96
17-2199	Engineers, All Other	\$ 29.34	\$ 52.88	\$ 91.06
17-3019	Drafters, All Other	\$ 19.92	\$ 26.05	\$ 48.92
17-3029	Engineering Technicians, Except Drafters, All Other	\$ 21.79	\$ 31.75	\$ 60.39
17-3031	Surveying and Mapping Technicians	\$ 16.51	\$ 22.30	\$ 45.33
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$ 29.80	\$ 39.32	\$ 61.78
43-3031	Bookkeeping, Accounting, and Auditing Clerks	\$ 16.25	\$ 23.55	\$ 31.70
43-5061	Production, Planning, and Expediting Clerks	\$ 20.54	\$ 32.22	\$ 39.95
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	\$ 14.21	\$ 18.37	\$ 23.16
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	\$ 23.31	\$ 31.15	\$ 46.58
47-2061	Construction Laborers	\$ 14.38	\$ 16.75	\$ 23.73
47-2073	Operating Engineers and Other Construction Equipment Operators	\$ 19.20	\$ 22.36	\$ 30.45
47-2111	Electricians	\$ 20.20	\$ 25.82	\$ 34.23
47-2151	Pipelayers	\$ 16.47	\$ 18.04	\$ 24.94
47-2152	Plumbers, Pipefitters, and Steamfitters	\$ 19.67	\$ 25.23	\$ 33.90

47-2181	Roofers	\$ 15.66	\$ 18.71	\$ 24.06
47-2211	Sheet Metal Workers	\$ 17.03	\$ 22.68	\$ 31.22
47-2221	Structural Iron and Steel Workers	\$ 19.76	\$ 25.25	\$ 33.92
47-3013	Helpers--Electricians	\$ 12.97	\$ 16.81	\$ 21.06
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	\$ 12.88	\$ 16.58	\$ 20.67
47-5031	Explosives Workers, Ordnance Handling Experts, and Blasters	\$ 17.77	\$ 25.43	\$ 36.82
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	\$ 25.01	\$ 32.47	\$ 46.99
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door	\$ 23.16	\$ 34.12	\$ 45.26
49-9041	Industrial Machinery Mechanics	\$ 25.30	\$ 31.84	\$ 38.89
49-9071	Maintenance and Repair Workers, General	\$ 17.69	\$ 23.31	\$ 31.04
49-9098	Helpers--Installation, Maintenance, and Repair Workers	\$ 14.98	\$ 17.92	\$ 23.20
49-9099	Installation, Maintenance, and Repair Workers, All Other	\$ 18.50	\$ 23.92	\$ 32.39
51-1011	First-Line Supervisors of Production and Operating Workers	\$ 20.11	\$ 30.76	\$ 46.09
51-2098	Assemblers and Fabricators, All Other, Including Team Assemblers	\$ 13.90	\$ 18.65	\$ 28.70
51-4121	Welders, Cutters, Solderers, and Brazers	\$ 18.03	\$ 23.09	\$ 32.00
51-4199	Metal Workers and Plastic Workers, All Other	\$ 14.55	\$ 20.05	\$ 29.10
51-9199	Production Workers, All Other	\$ 12.93	\$ 16.61	\$ 29.74
53-3031	Driver/Sales Workers	\$ 14.91	\$ 14.97	\$ 24.22
53-3032	Heavy and Tractor-Trailer Truck Drivers	\$ 23.58	\$ 26.47	\$ 32.34
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	\$ 16.39	\$ 21.23	\$ 27.04
53-7199	Material Moving Workers, All Other	\$ 17.72	\$ 22.09	\$ 34.40

ALTERNATIVE TRANSPORTATION				
SOC	Description	Entry-level	Mid-level	Senior-level
11-1011	Chief Executives	\$ 39.06	\$ 74.54	\$ 128.97
11-1021	General and Operations Managers	\$ 25.56	\$ 39.68	\$ 79.83
13-1199	Business Operations Specialists, All Other	\$ 20.40	\$ 31.96	\$ 51.64
13-2011	Accountants and Auditors	\$ 26.43	\$ 31.00	\$ 43.40
15-1122	Information Security Analysts	\$ 27.96	\$ 39.31	\$ 59.51

15-1199	Computer Occupations, All Other	\$ 23.34	\$ 36.08	\$ 55.04
17-2199	Engineers, All Other	\$ 29.46	\$ 53.94	\$ 89.79
17-3019	Drafters, All Other	\$ 20.02	\$ 27.16	\$ 51.54
17-3029	Engineering Technicians, Except Drafters, All Other	\$ 21.90	\$ 33.10	\$ 63.62
17-3031	Surveying and Mapping Technicians	\$ 16.59	\$ 23.25	\$ 47.76
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$ 28.57	\$ 38.04	\$ 58.16
43-3031	Bookkeeping, Accounting, and Auditing Clerks	\$ 16.47	\$ 24.14	\$ 32.24
43-5061	Production, Planning, and Expediting Clerks	\$ 20.58	\$ 34.62	\$ 40.90
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	\$ 14.21	\$ 18.56	\$ 23.93
47-2061	Construction Laborers	\$ 16.67	\$ 20.44	\$ 27.70
47-2073	Operating Engineers and Other Construction Equipment Operators	\$ 22.25	\$ 27.30	\$ 35.54
47-2111	Electricians	\$ 23.41	\$ 31.52	\$ 39.96
47-2132	Insulation Workers, Mechanical	\$ 21.59	\$ 27.26	\$ 37.49
47-2152	Plumbers, Pipefitters, and Steamfitters	\$ 22.80	\$ 30.79	\$ 39.57
47-2211	Sheet Metal Workers	\$ 19.74	\$ 27.68	\$ 36.45
47-2221	Structural Iron and Steel Workers	\$ 22.90	\$ 30.83	\$ 39.60
47-3013	Helpers--Electricians	\$ 15.01	\$ 16.75	\$ 21.95
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	\$ 14.91	\$ 16.51	\$ 21.54
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	\$ 22.88	\$ 30.92	\$ 45.59
49-3021	Automotive Body and Related Repairers	\$ 15.27	\$ 19.82	\$ 29.86
49-3023	Automotive Service Technicians and Mechanics	\$ 13.59	\$ 19.18	\$ 27.13
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	\$ 16.09	\$ 21.87	\$ 29.91
49-3042	Mobile Heavy Equipment Mechanics, Except Engines	\$ 22.89	\$ 25.43	\$ 30.03
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door	\$ 20.10	\$ 28.39	\$ 38.85
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	\$ 19.21	\$ 24.11	\$ 32.55
49-9041	Industrial Machinery Mechanics	\$ 21.96	\$ 26.50	\$ 33.39
49-9071	Maintenance and Repair Workers, General	\$ 15.35	\$ 19.40	\$ 26.65
49-9098	Helpers--Installation, Maintenance, and Repair Workers	\$ 13.01	\$ 14.91	\$ 19.91
49-9099	Installation, Maintenance, and Repair Workers, All Other	\$ 16.06	\$ 19.90	\$ 27.81

51-1011	First-Line Supervisors of Production and Operating Workers	\$ 18.90	\$ 29.47	\$ 43.91
51-2098	Assemblers and Fabricators, All Other, Including Team Assemblers	\$ 12.96	\$ 17.87	\$ 28.17
51-4121	Welders, Cutters, Solderers, and Brazers	\$ 17.66	\$ 22.81	\$ 32.11
51-4199	Metal Workers and Plastic Workers, All Other	\$ 14.25	\$ 19.81	\$ 29.20
51-9199	Production Workers, All Other	\$ 12.43	\$ 16.24	\$ 28.62
53-3031	Driver/Sales Workers	\$ 14.61	\$ 14.72	\$ 25.19
53-3032	Heavy and Tractor-Trailer Truck Drivers	\$ 23.11	\$ 26.01	\$ 33.64
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	\$ 12.43	\$ 15.94	\$ 22.12
53-7199	Material Moving Workers, All Other	\$ 13.44	\$ 16.58	\$ 28.14