



# Vermont 2017

## Clean Energy Industry Report

# Letter



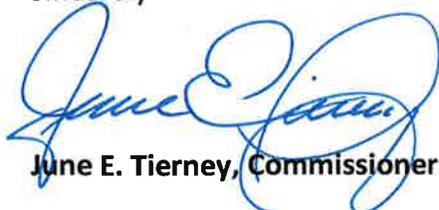
This report is the fourth Vermont Clean Energy Industry Reports (VCEIR) commissioned by the Vermont Clean Energy Development Fund (CEDF) at the Public Service Department (PSD). In 2013, when this project was conceived, support for clean energy was escalating as the State, advocates, and businesses moved to implement recommendations from the 2011 Comprehensive Energy Plan.

In 2013 Vermont, like most other states, did not have a data on the number of employees engaged in the clean energy industry in the state. To get a clear picture of Vermont's clean energy jobs Vermont commissioned the 2013 report based on a report done in Massachusetts the year before. In 2016 the US Department of Energy (DOE) commissioned a national jobs survey for all energy sources. DOE contracted with the same firm that conducted Vermont's survey and the national survey was developed using the methodology employed in Vermont and other earlier state industry survey projects. This fourth report was derived from the Vermont portion of the national energy employment dataset created for DOE.

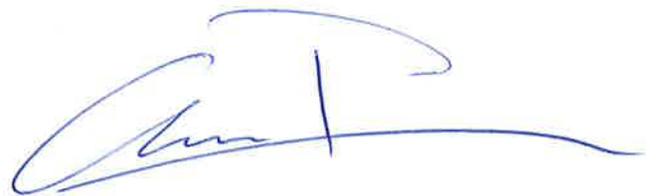
This 2017 report reveals the good news that the total number of Vermonters engaged in the clean energy industry has grown by 29% since the baseline was collected in 2013. Over 12,000 Vermont workers have full time jobs in the clean energy sector and, in total, over 19,000 clean energy workers, up more than 1,300 employees over 2016 work at least part time in the sector. This is a significant number, indicating that one in every 16 workers in Vermont (over 6% of all workers) is, at least part time, employed in the clean energy industry sector. Given the uncertainties in the national clean energy policy environment, constraints to new net metering systems in 2016, and the fact that fossil fuel prices have been trending down, we are pleased to see continued growth among the state's clean energy businesses.

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

Sincerely



**June E. Tierney, Commissioner**



**Andrew Perchlik, CEDF Manager**

## Acknowledgements

This industry report is the fourth in a series conducted and written by BW Research Partnership, Inc. under contract to the Clean Energy Development Fund (CEDF) of the Public Service Department (PSD). The PSD and CEDF would especially like to thank all the employers in the state who responded to the survey and provided thoughtful input.

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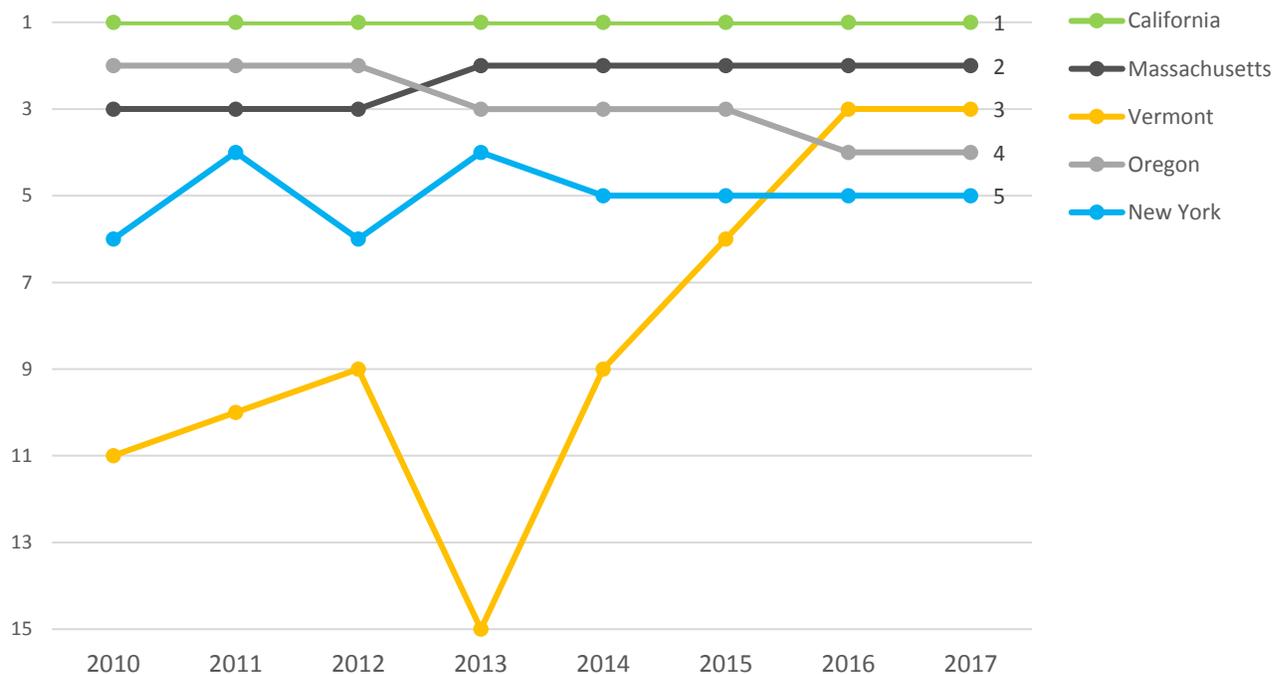


# Executive Summary



Since the release of Vermont’s first Clean Energy Report in 2014, Vermont has continually bolstered a clear commitment to the clean energy transition. This is evident from the state’s rapid ascent in the *U.S. Clean Tech Leadership Index*, where it placed 15th in 2013, 9th in 2014, 6th in 2015, and 3rd in 2016 and 2017.<sup>1</sup> Furthermore, in 2016, the American Council for an Energy Efficient Economy (ACEEE) placed Vermont as the 3rd highest achiever amongst all 50 states in regards to energy efficiency policy and program efforts.<sup>2</sup> Most recently, Vermont ranked second among all 50 states in the *Clean Energy Momentum Ranking State Progress* report released in the spring of 2017 by the Union of Concerned Scientists.<sup>3</sup> With this steady trajectory of progress, Vermont citizens are poised to see further cost savings and employment opportunities as the state continues to pursue its commitment to the clean energy transition in 2017.

**Figure 1. U.S. Clean Tech Leadership Index, Top Five States, 2010-2017<sup>4</sup>**



<sup>1</sup> U.S. Clean Tech Leadership Index (CleanEdge, Inc., May 2017)

<sup>2</sup> 2017 State Energy Efficiency Scorecard (<http://database.aceee.org/state/vermont> )

<sup>3</sup> Clean Energy Momentum *Ranking State Progress*, Union of Concerned Scientists ([www.ucsusa.org/EnergyProgress](http://www.ucsusa.org/EnergyProgress), April 2017)

<sup>4</sup> U.S. Clean Tech Leadership Index (CleanEdge, Inc., June 4, 2016)

Since 2013, clean energy employment has grown by 29 percent in Vermont, which amounts to a total of just over 19,000 jobs that are at least in part clean energy-related; over just the last 12 months, clean energy-related employment grew by almost eight percent. This means that about one in every 16 working Vermonters is employed in the clean energy industry.<sup>5</sup> Of these workers, about 64 percent spend all of their time on clean energy-related business activities, translating to roughly 12,200 “full-time” clean energy jobs. The state is now home to 3,751 establishments conducting clean energy work, an 18 percent increase since 2016. Clean energy workers now account for six percent of total statewide employment, compared to just two percent for the nation. This year’s data indicates that the state’s clean energy economy is becoming increasingly specialized. Over the last year, the percentage of renewable energy and energy efficiency workers that spend all of their time on clean energy-related work increased by 12 and 18 points respectively. Today, seven in ten renewable energy workers and six in ten energy efficiency workers spend all of their time on clean energy-related work; this translates to 4,509 renewable energy workers and 5,922 energy efficiency workers that spend all of their time supporting the clean energy portion of business.

With 56 percent of total clean energy employment, energy efficiency remains the largest employment sector in Vermont’s clean energy economy; the sector grew by 24 percent over 2016 and supports about 10,600 workers. Employment activity is more evenly spread across each of the sub-technologies compared to last year; these shifts are likely the result of fluctuating market demand and firm activity in the construction industry.

Employment in renewable energy generation declined by about six percent over the last 12 months, largely in the renewable fuels component of energy generation. Woody and non-woody biomass fuels respectively declined by about 270 and 160 jobs due to a number of factors, including declining fossil fuel prices. Solar technologies remain the largest sub-technology in the generation sector, supporting about 3,000 jobs and a 12 percent growth rate over 2016. The remainder of the state’s clean energy economy is supported by clean transportation technologies, which experienced the highest growth rate at 37 percent over the last 12 months.

This most recent installment of Vermont’s Clean Energy Industry Report reveals important market trend developments. First, Vermont’s clean energy economy is trending towards larger firms. In 2015, about 66 percent of firms reported one to five clean energy workers, compared to 59 percent in 2017. At the same time, firms with 25 to 99 workers increased by two percentage points over the last 12 months. Second, clean energy hiring has become less difficult for firms since 2016. The percentage of employers that report hiring was “very difficult” declined from 34 percent in 2016 to 23 percent in 2017. Finally, Vermont’s clean energy economy is also expanding its borders, as the proportion of employers that reported primarily in-state customers declined to about three-quarters from 83 percent in 2016, while those that serve out-of-state or international clients increased by six percentage points.

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<sup>5</sup> Vermont Department of Labor (<http://www.vtlmi.info/ces.cfm>)

This year's data indicates further growth and improvements ahead as the state's clean energy industry continues to move forward into 2017. However, despite the breadth of efforts that the state of Vermont is putting forth towards a clean energy future, it must be noted that many factors affect the price of renewable energy in economic markets. Depressed fossil fuel prices might slow the clean energy transition in the short term, but as clean energy options become cheaper and more commonplace, this market force will be overcome. In addition, the transition of energy regimes has historically been slow, as consumers are apprehensive to switch away from their current energy sources. However, the progress that Vermont's government and communities have made over the last four years is undeniable and bodes well for future long-term growth. The Green Mountain State is well on its way to creating a viable and vibrant clean energy industry.

# Industry Overview



## Employment Growth

A note about clean energy workers and survey methodology:

Employment data for this report captures 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 quantification of the state's clean energy economy. To better understand 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. This year, survey data indicates that Vermont's clean energy economy has become slightly more specialized; 77 percent of renewable energy generation workers and 65 percent of energy efficiency workers spend at least half of their time supporting energy efficiency business activities, while 69 and 56 percent of renewable energy and energy efficiency workers respectively spend all of their time on clean energy-related work.

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. Similarly, woody and non-woody biomass employment is not comparable to the 2017 DOE United States Energy and Employment Report (USEER), as this report uses proprietary data from 2016 and the Bureau of Labor Statistics to extrapolate the 2017 reported totals.

It is also important to note that employment data excludes any retail employment—i.e., workers at gasoline stations, fuel dealers, motor vehicle dealerships, appliance and hardware stores, and other retail establishments are not included in the survey.

Vermont's clean energy economy now supports just over 19,000 workers, up 7.7 percent over 2016 and 29 percent from the baseline of 14,788 in 2013.<sup>6</sup> Of these workers, about 64 percent spend all of their time on clean energy-related business activities, translating to roughly 12,200 "full-time" clean energy jobs. Clean energy workers now account for six percent of total statewide employment, compared to a two percent nationwide average.<sup>7</sup> As with previous

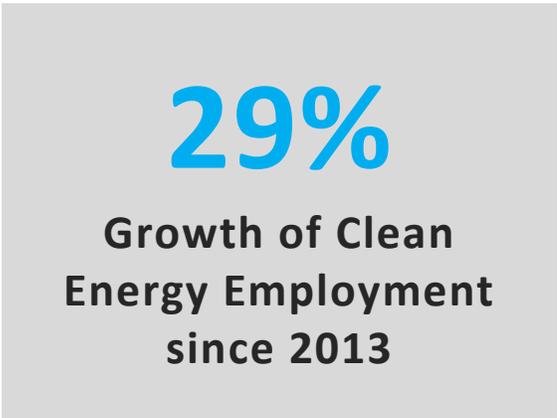
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<sup>6</sup> It is important to note that the 19,081 employment figure represents all workers that spend any portion of their time on clean energy-related business activities, as noted in the call-out box above.

<sup>7</sup> See the Department of Energy's United States Energy and Employment Report 2017 (USEER 2017). Clean energy employment is taken as a percentage of total covered employment for Vermont and the United States based on the Bureau of Labor Statistics Quarterly Census of Employment and Wages (BLS QCEW) data for March 2016 in

years, the majority of work is concentrated in the energy efficiency sector, followed by renewable energy generation and fuels. Clean transportation technologies also represent a growing segment within the state’s clean economy. Though much of the work is in repair and maintenance, clean transportation technologies support seven percent of the state’s clean energy workforce.

The state’s clean energy economy has become slightly more specialized, with both more renewable energy and energy efficiency workers that spend all of their time supporting clean energy business activities. Over the last year, the percentage of renewable energy and energy efficiency workers that spend all of their time on clean energy-related work increased by 12 and 18 points respectively. At the same time, the number of energy efficiency workers that spend only half their time supporting efficiency-related work activities declined by seven percentage points. To date, about seven in ten and six in ten renewable energy and energy efficiency workers respectively spend all of their time on clean energy work; this translates to about 4,500 “full-time” renewable energy workers and 5,900 “full-time” energy efficiency employees.



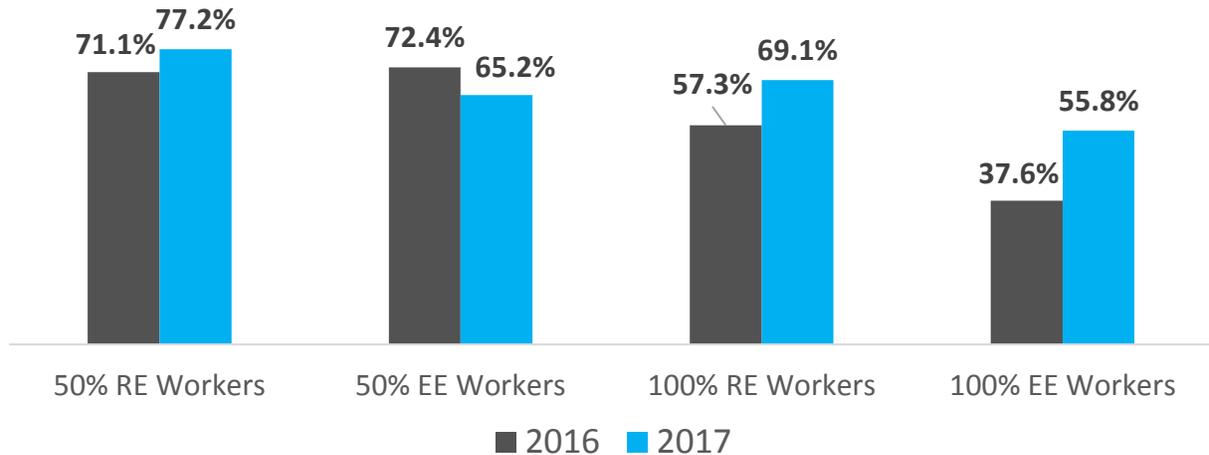
**Table 1. Clean Energy Employment Thresholds, 2014-2017<sup>8</sup>**

	Workers that spend <u>at least 50 percent</u> of their time				Workers that spend <u>100 percent</u> of their time			
	2014	2015	2016	2017	2014	2015	2016	2017
<b>Renewable Energy</b>	75%	70%	71%	77%	55%	55%	57%	69%
<b>Energy Efficiency</b>			72%	65%			38%	56%

order to be in line with the USEER employment extrapolations which were based on the 2016 Q1 data from the QCEW.

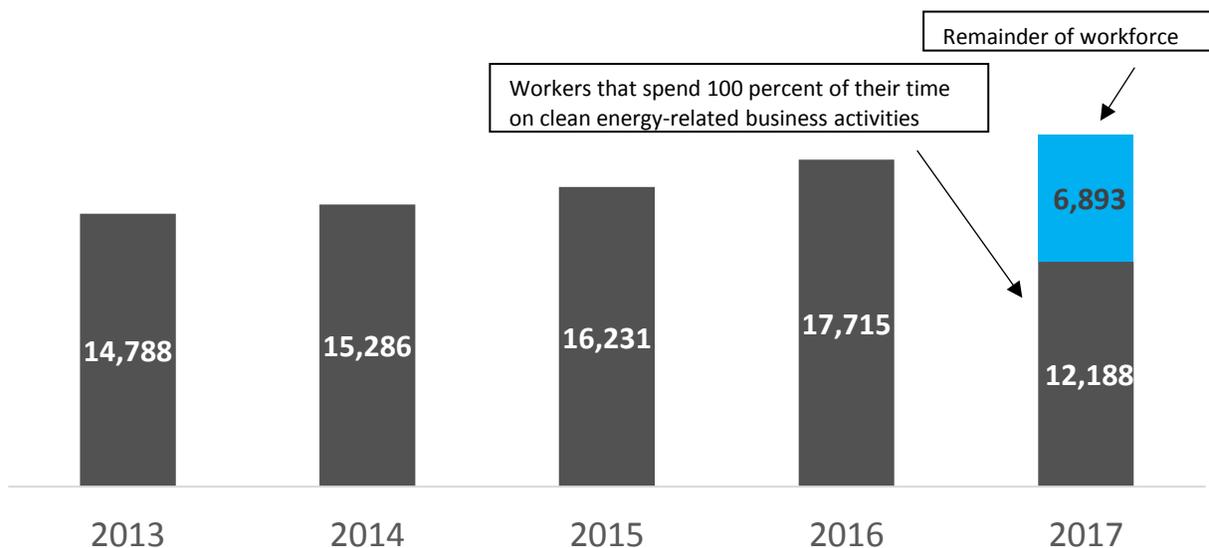
<sup>8</sup> Labor intensity for 2014 and 2015 is only available for the overall clean energy workforce; additional granularity by sector was not introduced until the 2016 survey.

**Figure 2. Clean Energy Employment Thresholds, 2016-2017**



The state is home to 3,751 clean energy establishments, almost doubling the amount of locations that conduct clean energy-related work since 2015. The majority of these establishments are involved with energy efficiency work—about 61 percent or 2,296 establishments. Renewable energy generation establishments comprise 35 percent of the total, with 1,296 locations, followed by transportation establishments at four percent or 159 establishments.<sup>9</sup>

**Figure 3. Clean Energy Employment Growth, 2013-2017**



<sup>9</sup> It is important to note that this technology breakdown is a rough estimate as some locations conduct work across multiple technologies and sub-technologies. In order to prevent double-counting, the distribution of establishments is assigned based on employer’s self-selected primary major technology of focus.

## Vermont's Solar Industry: A Snapshot

**SunCommon** President James Moore and his small scale-solar installation company, SunCommon, is a helpful depiction of Vermont's rapidly expanding solar industry. The company was founded on the belief that everyone innately deserves a healthy environment and that clean energy is the key towards this future. Mr. Moore believes that Vermont's solar future is extremely bright on the basis that the vast majority of Vermonters have recognized that fossil fuels are not a sustainable path for long-term economic growth for the state. Most of SunCommon's suppliers are in-state and spur economic activity in a number of trades including wiring, conduit, construction labor, electrical labor, specialized engineering support, and legal support. Moreover, the majority of SunCommon's staff are hired from within Vermont after returning to the state post-college. The company also enacted a community solar program where 800 Vermont members receive solar credits produced by a group array to reduce their utility bills. President Moore asserted that despite a flat growth period due to the suspension of SunCommon's community solar program between 2015 and 2016, he expects 2017 to be a year of high growth for the company. Most importantly, Mr. Moore believes the biggest challenges for solar installers across the state moving forward will be to work together with a diverse portfolio of clean energy options while drastically increasing the amount of local solar energy generation.

Vermont's highly ranking energy efficiency status is the product of a long history of energy efficiency initiatives. In 1999, it became the first state to create a statewide energy efficiency utility (EEU), enacting legislation that created the utility and authorized an energy efficiency volumetric charge to support efficiency programs. Efficiency Vermont now serves the majority of the state and is operated by Vermont Energy Investment Corporation.<sup>10</sup> In 2016, the American Council for an Energy Efficient Economy (ACEEE) placed Vermont as the 3rd highest achiever amongst all 50 states in regards to energy efficiency policy and program efforts.<sup>11</sup>

**Efficiency and  
transportation lead  
employment growth  
in 2017.**

<sup>10</sup> U.S. Department of Energy (<https://energy.gov/savings/efficiency-vermont>)

<sup>11</sup> 2016 State Energy Efficiency Scorecard (<http://database.aceee.org/state/vermont>)

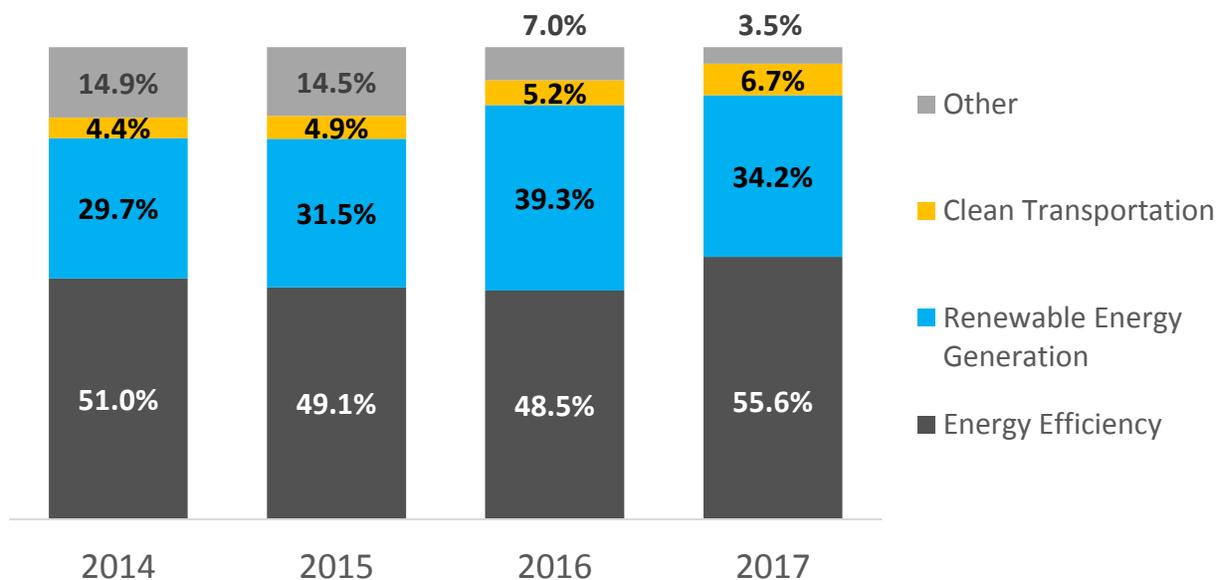
## Vermont's Solar Industry: A Snapshot

### Catamount Solar

Principle Kevin McAlister of Catamount Solar entered the solar industry after seeing extremely promising growth, profitability, and sustainability of renewable energy. Despite Vermont's increasingly competitive solar industry, given increases in large out-of-state companies migrating to the state, Catamount Solar still reported 60 to 70 percent revenue growth between 2014 and 2016. These large suppliers are projected to lower the cost of solar systems so much so that it will challenge Catamount and other smaller-scale solar companies' abilities to maintain healthy profit margins in 2017. Catamount is committed to the local workforce development of the state and thus, while its suppliers are mainly out-of-state, the majority of the company's employees are from Vermont. Over the last three years Catamount has added 12 new positions, due to an expanding solar market and recent acknowledgment that the company needed to increase project turnover rate. Catamount has also separated themselves from the solar pack with their "worker's cooperative" nature of the company structuring. This employee ownership structure has helped Catamount ease recruitment difficulties. On the consumer side, the company is a proponent of the benefits of solar net metering, where excess energy is sold back to the power grid. Catamount wholeheartedly believes that solar will be a large contributor to

Energy efficiency work remains the bulk of activity across the state's clean energy industry. The sector saw employment increase by 24 percent, or about 2,000 jobs. Improved sampling across several industries in this year's research effort captured more clean energy workers, particularly for the manufacturing industry and the energy efficiency sector. As such, a small portion of this growth may be attributed to improved sampling and data collection. This is especially true of nationally-reported energy efficiency manufacturing (see USEER 2017), where manufacturing comprises 13 percent of total employment. For Vermont, however, manufacturing represents only five percent of the energy efficiency sector—or about 560 jobs. As a result, the effect is likely diminished and growth may be attributable to other industry segments, such as construction, trade, and professional services.

Figure 4. Clean Energy Employment by Technology, 2016-2017<sup>12</sup>



The transportation sector is another area of focus in the state’s clean energy efforts. Vermont adopted California’s Low-Emission Vehicle Program in 2005, committing to a 30 percent reduction in average new vehicle greenhouse gas emissions from 2002 levels by 2016. The state has also adopted California’s Zero-Emission Vehicle (ZEV) program, which requires increasing the production of plug-in hybrid, battery electric, and fuel-cell vehicles from 2018 to 2025.<sup>13</sup> The state now has numerous alternative fueling stations and incentives or laws that promote the purchase of alternatively-fueled vehicles.<sup>14</sup>

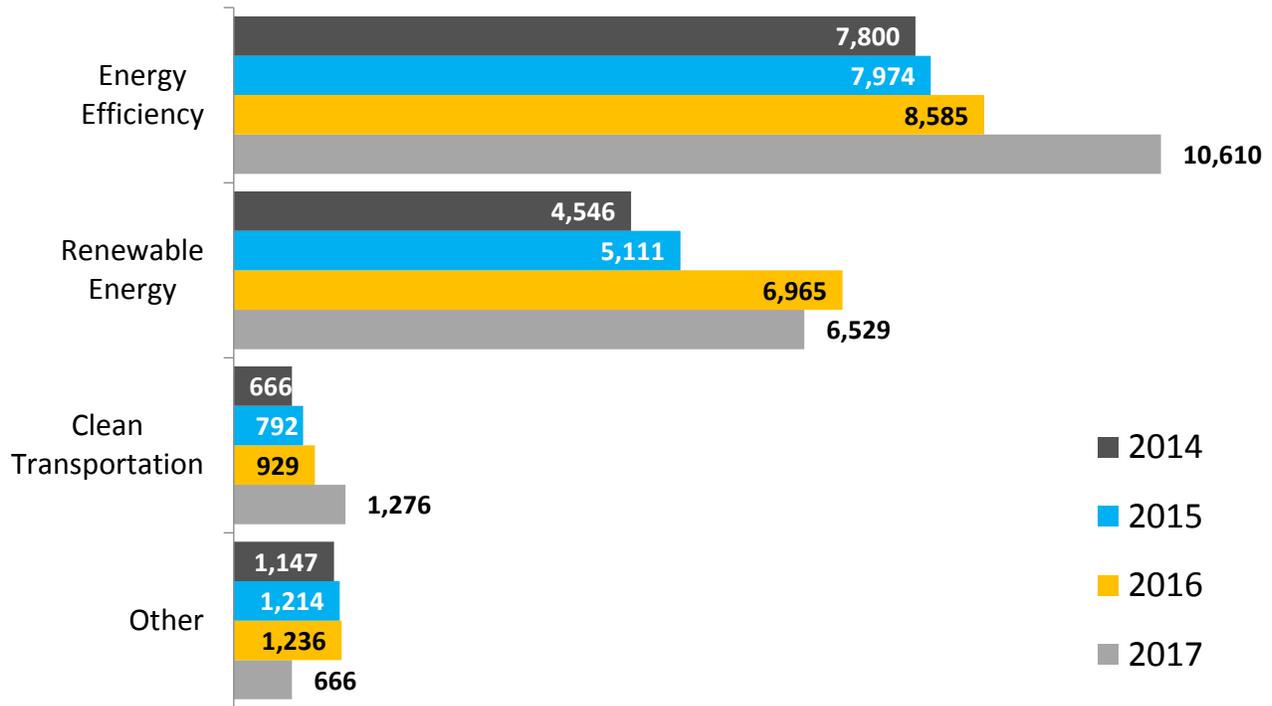
Though still fairly small, Vermont’s clean transportation industry saw employment grow by 37 percent over 2016—this translates to an additional 347 workers. The state’s clean transportation workforce is largely focused on hybrid, plug-in hybrid, and electric vehicles; there is no activity across hydrogen and fuel cell technologies. Because the majority of this employment is found in the automotive repair and maintenance industry, it is not possible to apportion workers out by sub-technology.

<sup>12</sup> Declining share of “other” is likely the result of improved allocation methodology over the years.

<sup>13</sup> 2016 State Energy Efficiency Scorecard (<http://database.aceee.org/state/vermont> )

<sup>14</sup> U.S. Department of Energy (<http://www.afdc.energy.gov/states/vt>)

**Figure 5. Clean Energy Employment Growth by Technology, 2014-2017**



Much of the progress made in Vermont’s clean energy landscape can be credited to the suite of policies and supporting programs identified in the 2017 Clean Tech Leadership Index, in which Vermont placed third in the country for the second year in a row.<sup>15</sup> Moreover, further accessibility in renewable energy procurement has been allowed through the various financial incentives put in place by the state and federal government. These include but are not limited to rebates, corporate tax deductions/credits, personal tax credits, and grant/loan programs.<sup>16</sup>

In 2016, the state government put forth a new installment of the Comprehensive Energy Plan (CEP) to reaffirm the 2011 statewide goal of 90 percent renewably-sourced energy production by 2050. The CEP policy was formed on the foundations of creating an equitable economy, sustainable environment, and unrivaled public health level. Since the last Comprehensive Energy Plan in 2011, the state has added over 250 MW of electric capacity with 100 MW of additional new wind generation, repowered hydropower, and solar which accounted for 90 MW alone with net metering at homes, farms, businesses, and communities in the state.<sup>17</sup> Additionally, Vermont enacted a statewide mandatory renewable portfolio standard, called the Renewable Energy Standard (RES) via Act 56 of 2015. The RES requires that the total renewable energy shall be 55 percent of each retail electricity provider’s annual electric sales beginning on

<sup>15</sup> U.S. Clean Tech Leadership Index (CleanEdge, Inc., May 2017)

<sup>16</sup> DSIRE Programs (<http://programs.dsireusa.org/system/program?fromSir=0&state=VT>)

<sup>17</sup> 2016 Vermont Comprehensive Energy Plan, Vermont Public Service Department

January 1, 2017 and increasing by four percent each third year until reaching 75 percent in 2032.<sup>18</sup>

The state has also shown that solar-generated power is part of Vermont's present and future energy profile. In 2016, Vermont installed 55.1 MW of solar energy putting the state at eighth in the nation for number of watts installed per capita.<sup>19</sup> The most promising indication of progress is that solar products and services have fallen by 64 percent in price since 2011. The future of solar in the state is bright with projections predicting an additional 274 MW of solar power to be added over the next 5 years.<sup>20</sup>

In total, renewable energy firms employ 6,529 workers. Solar technologies remain the largest employer within this sector, with almost 2,400 workers—a 12 percent growth over 2016. In fact, Vermont's solar workers account for 0.6 percent of the nationwide solar workforce.<sup>21</sup> This is followed by woody biomass, renewable heating and cooling technologies, and non-woody biomass; these three sub-technologies account for half of all jobs in the renewable generation and fuels sector in the state.

The wood energy sector is an important component of Vermont's energy profile. About one out of every six Vermont households uses wood products as their primary heating source.<sup>22</sup> Vermont Forest Sector Systems Analysis was released in January 2016 by the Working Lands Enterprise Initiative. The organization reported wood energy as one of three key value chain opportunities. The Working Lands Enterprise Initiative funding for wood product companies complements the advanced wood heating activities supported by the CEDF.<sup>23</sup>

Despite employment gains in the sector's largest sub-technology (solar), employment in renewable energy generation and fuels shrank by about six percent, largely the result of declines in the renewable fuels component of clean energy generation and a slight decline in hydroelectric generation. Both woody and non-woody biomass fuels respectively declined by about 270 and 160 jobs. Job loss in these sub-sectors is likely attributable to several factors:

1. Continued declines in the price of fossil fuels. Nationwide, the price for heating oil and diesel respectively declined by 21 and 15 percent between 2015 and 2016.<sup>24</sup> In Vermont specifically, the per unit price for fuel oil and kerosene declined by 11 and eight percent respectively.<sup>25</sup>
2. Unusually late and warmer winters in addition to an early spring in 2016.

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<sup>18</sup> 30. V.S.A. §8005

<sup>19</sup> Solar Energy Industries Association, 2016

<sup>20</sup> State Solar Policy: Vermont (<http://www.seia.org/state-solar-policy/Vermont>)

<sup>21</sup> See USEER 2017

<sup>22</sup> U.S. Energy Administration (<https://www.eia.gov/state/?sid=VT>)

<sup>23</sup> Working Lands Enterprise Board

([http://workinglands.vermont.gov/sites/ag\\_wlei/files/VT%20Forest%20Sector%20Analysis\\_2016.pdf](http://workinglands.vermont.gov/sites/ag_wlei/files/VT%20Forest%20Sector%20Analysis_2016.pdf))

<sup>24</sup> Energy Information Administration (<https://www.eia.gov/outlooks/steo/report/prices.cfm>)

<sup>25</sup> State of Vermont, Public Service Department, Vermont Fuel Price Report September 2015 – September 2016

3. Limited forest activity due to reduced demand in the forest product sector, particularly for pulpwood.

Though the data appears to indicate a seemingly sharp decline in hydroelectric generation employment, despite essentially flat job growth in federally-reported statistics, shifts in the data are likely attributable to more robust technology and sub-technology allocations. According to federally-reported data, employment in Vermont’s hydroelectric generation industry only declined by 2.5 percent.<sup>26</sup>

## **Bourne’s Energy**

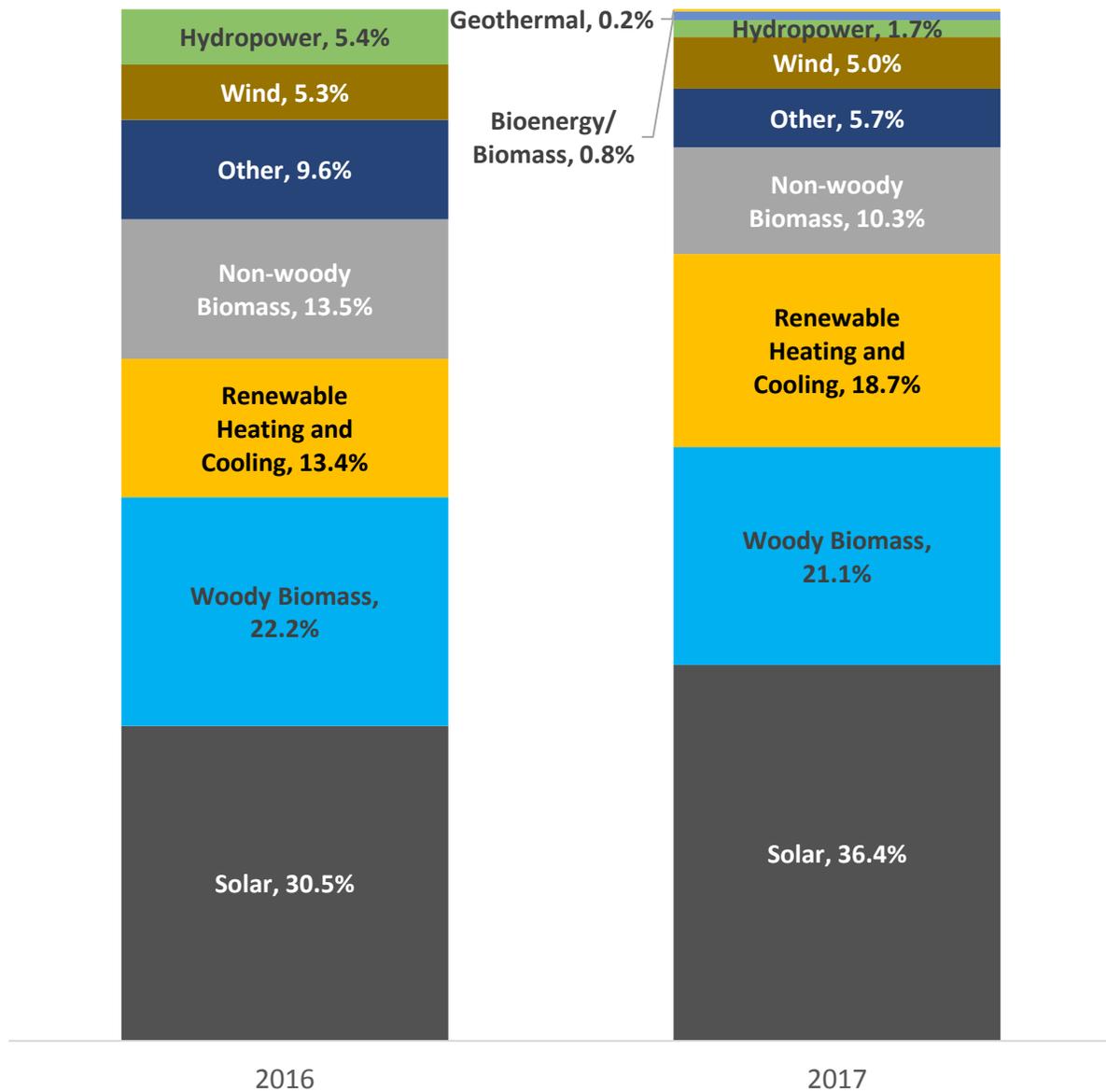
**Interviewee:**  
**Peter Bourne**  
**President Bourne’s Energy**

President Peter Bourne of Bourne’s Energy provided his view on Vermont’s clean energy industry and his company’s transition from solely delivering fossil fuels to both fossil fuel and biofuels. Mr. Bourne stated that the company started supplying renewable fuels because he believes his customers should know that Bourne’s Energy is working to help them reduce energy consumption while simultaneously lowering heating costs. Mr. Bourne stated that his company has mainly been adding staff for wood pellet operations and providing training programs that keep technicians up to date on the latest clean energy technologies. The company mainly serves the residential and commercial fuel delivery markets in Vermont. Over the last three years Bourne’s has hired ten renewable energy-oriented employees with the majority coming from within the state. Mr. Bourne identified the biggest challenge for his company in the near future as state policy that he sees as focused on large electric utilities to the detriment of family-owned businesses. Mr. Bourne stands by the value of a competitive market where clean energy competition spurs economic growth and where the barriers to entry are not too great for a small clean energy business in Vermont like Bourne’s to thrive.

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<sup>26</sup> See Methodology section at the end of the report for more details on changes between 2016 and 2017 and an explanation of the changing hydroelectric generation technology definition.

**Figure 6. Renewable Energy Generation Employment by Sub-Technology, 2017**

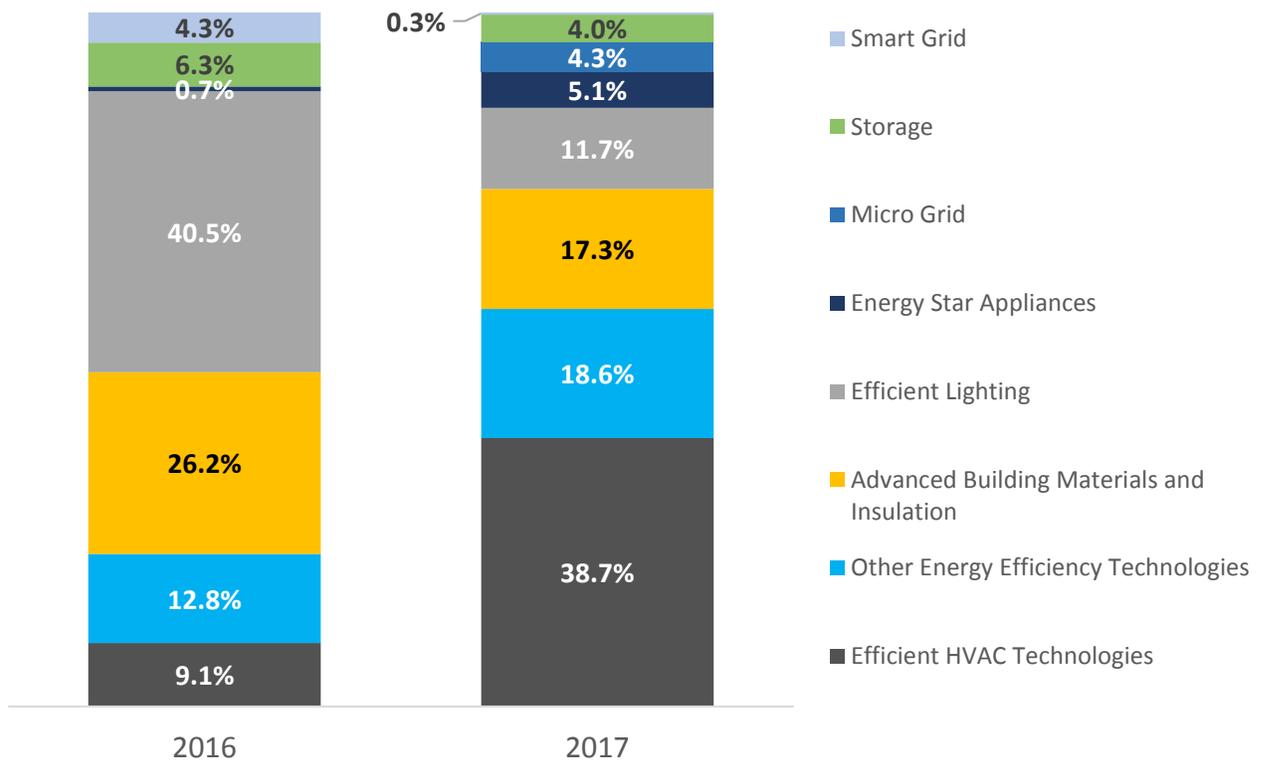


With almost 11,000 employees, energy efficiency firms are the largest employer of clean energy workers across the state. The 2017 data indicates that activity is fairly evenly spread across each of the sub-technologies, with efficient HVAC technologies accounting for about four in ten workers.<sup>27</sup> Clean transmission technologies, such as storage, smart grid, and micro-grid, account for 914 workers, or roughly nine percent of total energy efficiency employment.

<sup>27</sup> It should be noted that some portion of efficient HVAC workers also spend their labor hours working with non-efficient HVAC technologies. Approximately 20 percent of employees in this sub-technology spend the majority of their labor hours installing or working with non-efficient HVAC systems, but still spend some portion of time supporting clean and efficient HVAC technologies.

Though it appears that activity within the energy efficiency sector experienced significant shifts over 2016, this is not surprising for firms engaged in energy efficiency-related trades. Most construction firms that support energy efficiency installations and upgrades conduct work across each of the individual sub-technologies. As such, the allocation of employees to the primary sub-technology where they spend the majority of their time is likely to fluctuate given changes in market demand and firm activity.

**Figure 7. Energy Efficiency Employment by Sub-Technology, 2017**



# Clean Energy Value Chain



Out of the total 3,751 establishments, installation remains the largest segment of activity in Vermont's clean energy economy, with just over a third of total establishments. Professional services account for a quarter of clean energy establishments, followed by trade and distribution establishments which represent two in ten clean energy locations.<sup>28</sup>

**Vermont has a diverse set of clean energy establishments.**

Nearly all value chain segments saw employment grow over the last 12 months, with the exception of engineering services and "other". These declines are likely the result of methodological changes in the 2017 data collection effort.<sup>29</sup> In order to better align with

the 2017 USEER, which provides the foundation for Vermont-specific clean energy data, value chain employment is now extrapolated almost entirely using the North American Industry Classification System (NAICS). Where last year and previous Vermont clean industry reports relied more heavily on employer self-reported primary value chain activity, NAICS codes better align with federally-reported statistics.

For the installation, manufacturing, and trade sectors, using NAICS codes does not result in significant shifts in the data. However, changes in engineering, research, and professional services, as well as the utilities sector may be attributable to this new methodology. With this new methodology, installation, trade, and manufacturing activities saw employment grow by 10, 40, and 252 percent respectively. The decline in the engineering sector may be the result of the reallocation of project developers. In previous years, project developers likely self-assigned themselves to the engineering sector. However, there is significant overlap as developers for large renewable generation projects are most often utility companies. As such, they would be placed in the utility NAICS for this year's extrapolations. This overlap likely accounts for the seeming decline in engineering and sharp increase in the utilities sector.

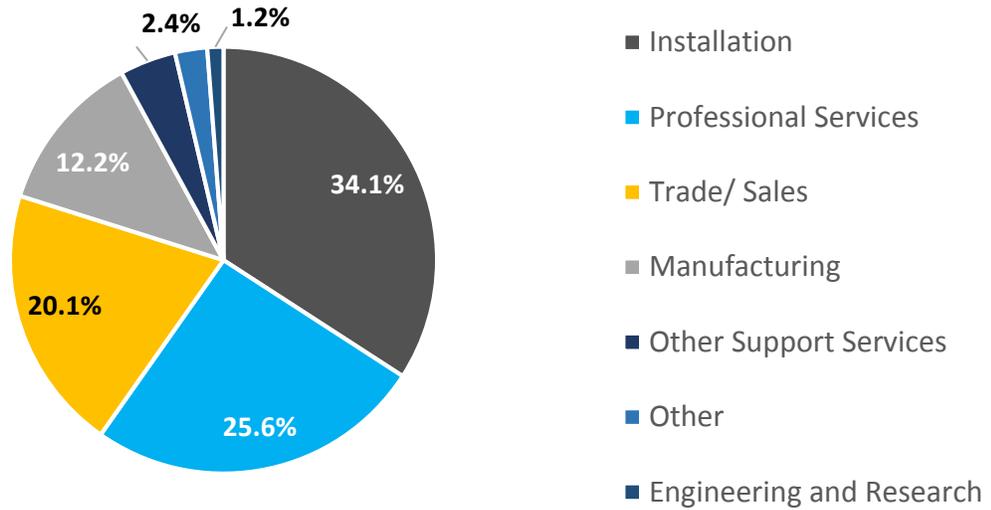
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<sup>28</sup> The distribution of establishment activity reported here is based on employer self-reported primary value chain activity. The establishment total presented throughout this report counts each business location that conducts clean energy-related work; a firm may have multiple establishments, or locations.

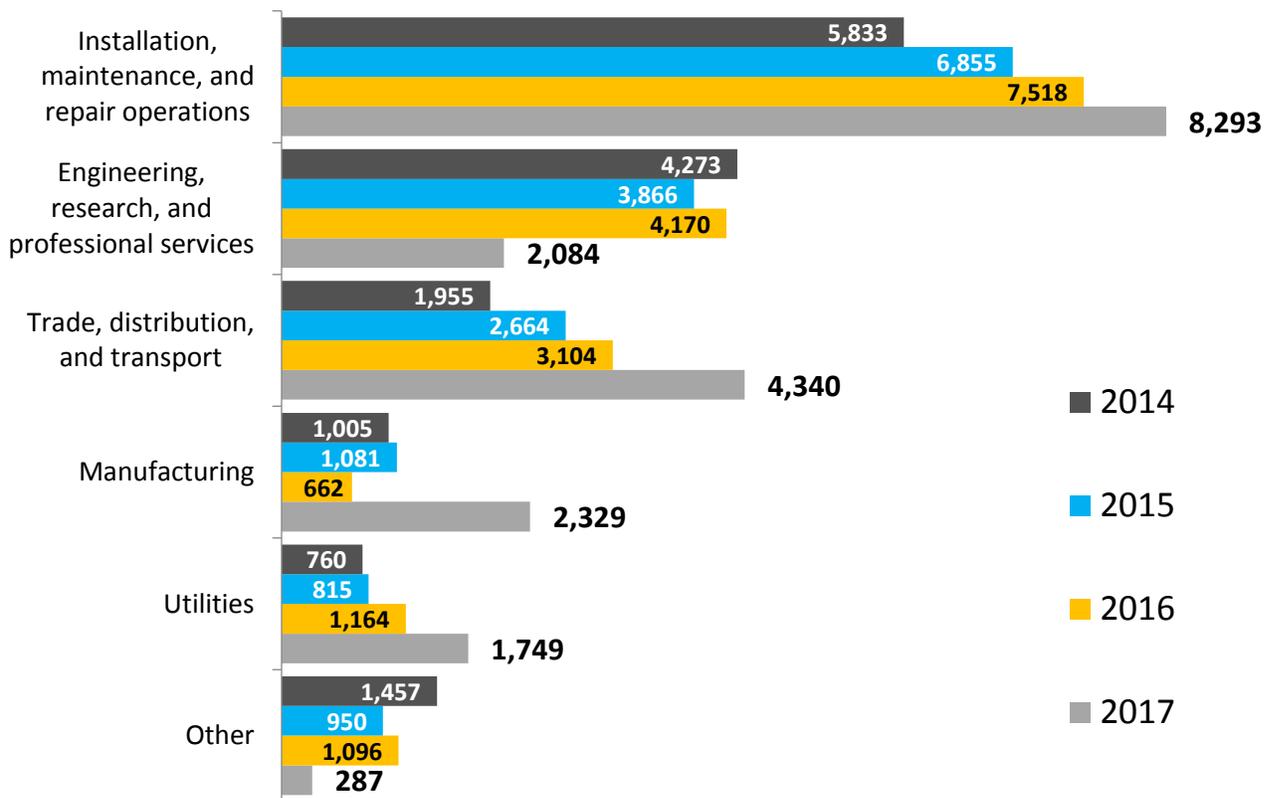
<sup>29</sup> See Methodology section at the end of the report for more details on changes between 2016 and 2017.

Declines in the “other” value chain sector is also the result of extrapolating value chain employment based on federally-assigned NAICS codes. In the 2017 dataset, employers who selected “other” as their primary value chain activity in previous years now have their workers auto-assigned to the appropriate industry based on their federally-assigned NAICS tag.

**Figure 8. Clean Energy Establishments by Value Chain, 2017**



**Figure 9. Value Chain Employment Growth, 2014-2017<sup>30</sup>**



<sup>30</sup> The “utilities” category here includes all workers at establishments that are engaged in the provision of utility generation services. Such utility generation employees only include clean energy-related utility generation, such as solar, hydroelectric, biomass, or wind electric generation.

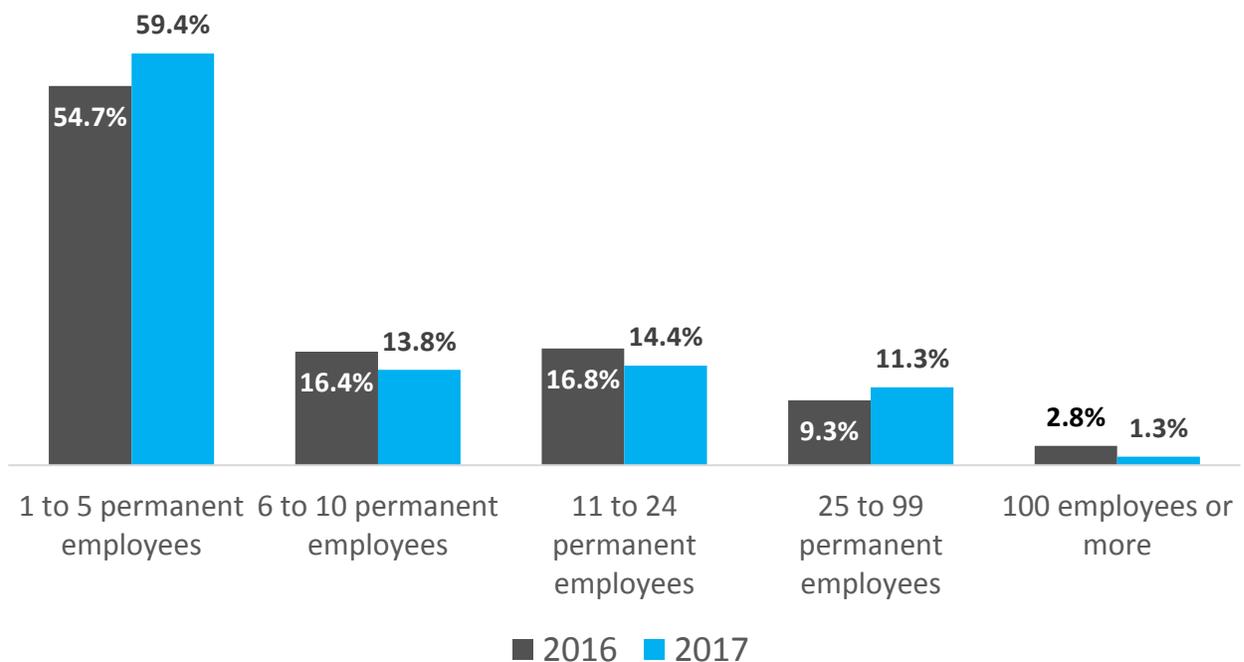
# Clean Energy Market and Labor Supply



Over the last couple years, the share of small businesses continues to evolve, with some business sizes adding workers and others losing workers. Of the 3,751 clean energy establishments in 2017, about six in ten report one to five clean energy workers. In 2015, about seven in ten firms (66 percent) reported one to five clean energy workers. This declined by ten points to 55 percent in 2016, before increasing slightly to 59 percent in 2017. At the same time, firms with 25 to 99 workers increased by two percentage points over the last 12 months.

**Vermont's clean economy business makeup is evolving.**

**Figure 10. Clean Energy Establishment Size, 2016-2017**

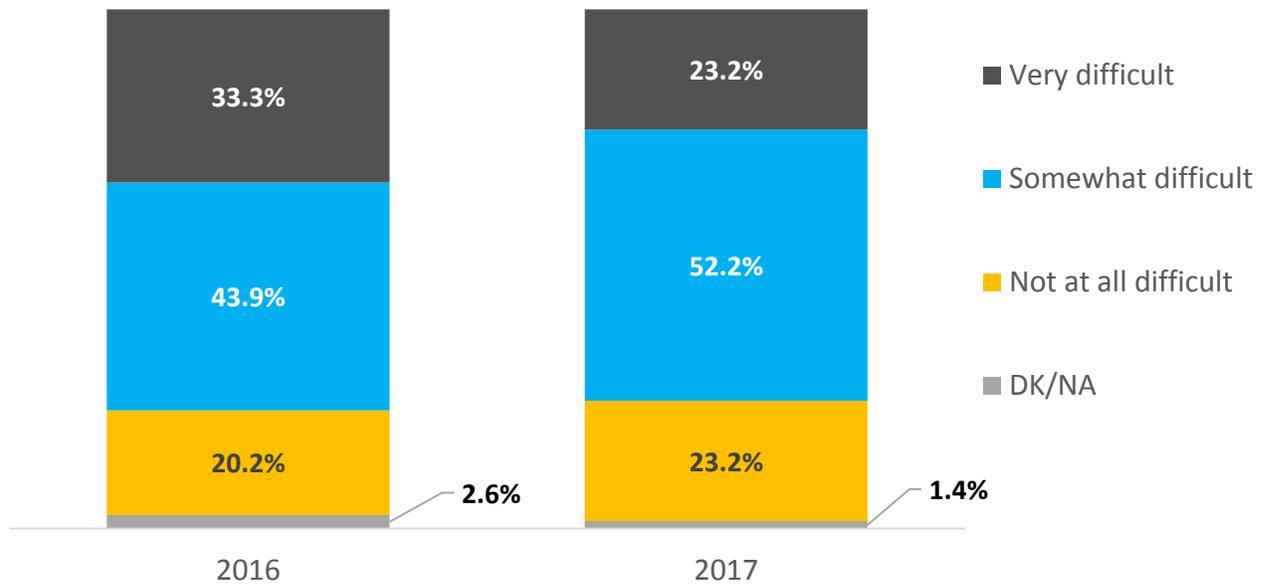


About three-quarters of firms report that hiring was either very or somewhat difficult in 2017, down two percentage points from 2016. The percentage of employers that report hiring was “very difficult” declined from 33 percent in 2016 to 23 percent in 2017.

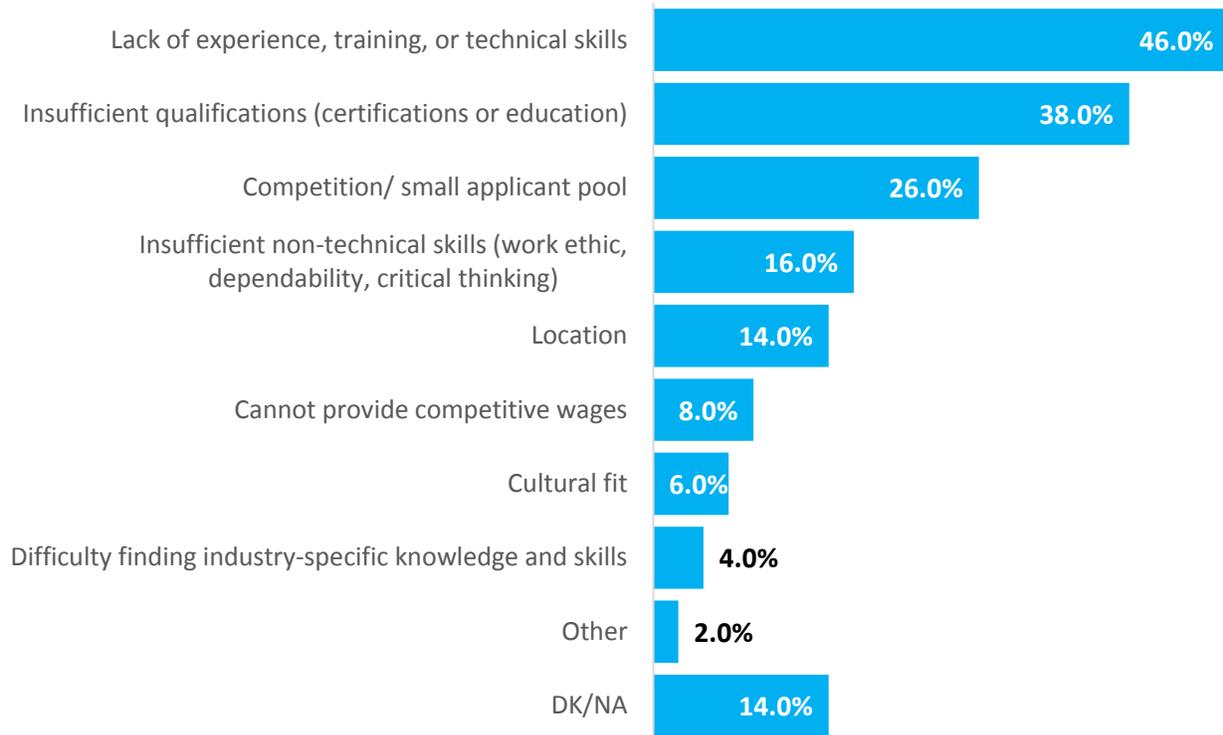
**Hiring difficulty has eased over the last 12 months.**

The most reported reasons for hiring difficulty include lack of experience training, or technical skills, followed by insufficient qualifications and a small applicant pool.

**Figure 11. Hiring Difficulty, 2017**



**Figure 12. Reasons for Hiring Difficulty, 2017<sup>31</sup>**



In 2016, 83 percent of employers report that their customers were primarily within the state.

**Vermont's clean economy is expanding its borders.**

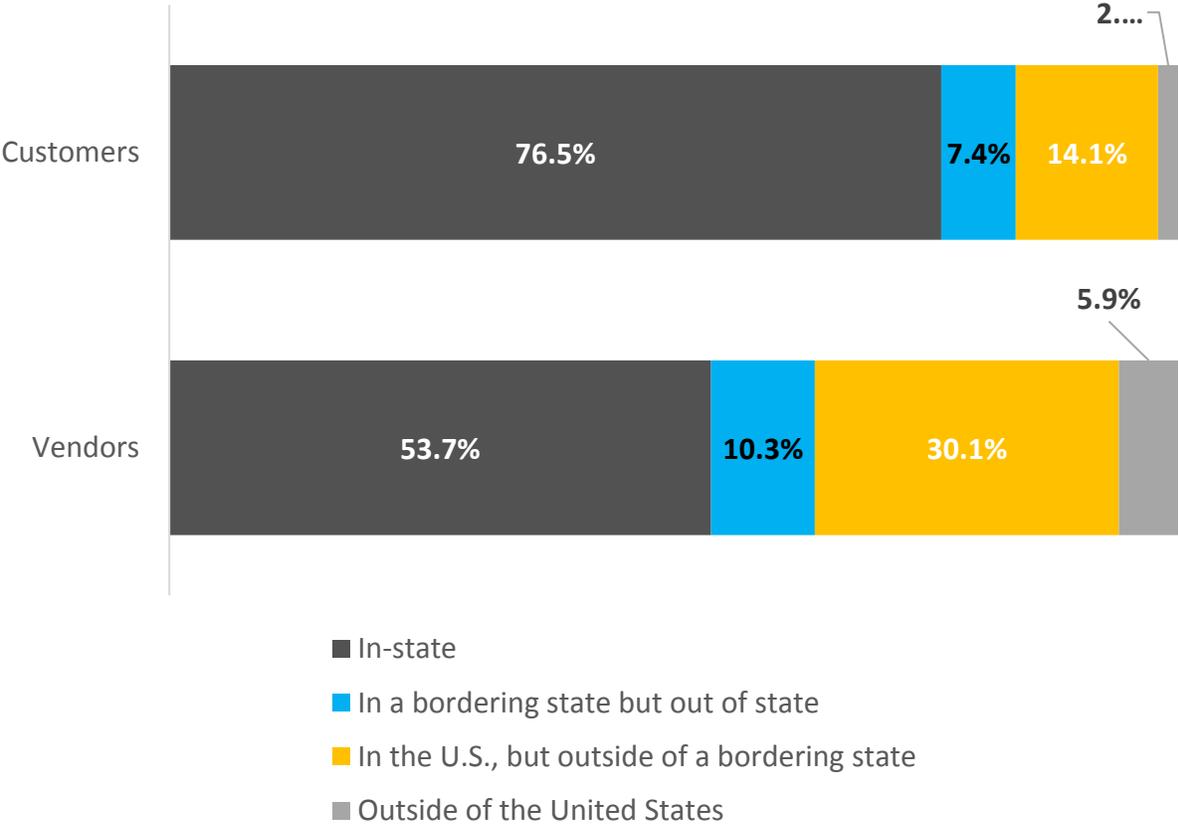
This has declined to about three-quarters in 2017, while the proportion of those that report primarily out of state or international customers increased by six percentage points.

The state has a healthy supply of in-state vendors, with just over half of employers noting that their suppliers and vendors are

primarily located in Vermont. Another 10 percent note that their vendors are primarily in a bordering state.

<sup>31</sup> This was a multiple choice question; percentages do not sum to 100 because respondents could select more than one response.

Figure 13. Customers and Vendors, 2017



# Conclusions



In the fourth annual installment of Vermont’s Clean Energy Industry Report, results indicate an expanding market poised for further growth. This year’s research supports the notion that the growing clean energy cluster is a major contributor to the economic growth of the state’s overall economy. Since 2013, clean energy employment has increased by 29 percent, amounting to 19,081 clean energy-related jobs today. Energy efficiency and clean transportation firms led employment growth in 2017, with respective growth rates of 24 and 37 percent.

In addition to employment growth, the market experienced some notable shifts this year, as the clean economy becomes increasingly specialized, and the sector shifts toward larger establishments and out-of-state clients. The percent of renewable energy and energy efficiency workers that spend all of their time on clean energy-related work increased dramatically since 2016. At the same time, clean energy establishments are growing in size with a marked shift over the last two years from small firms with one to five employees to larger firms with 25 employees or more. The state’s clean energy firms are also expanding their borders, with a six percent increase in employers that primarily serve out-of-state customers.

Vermont’s clean energy economy continues to remain a promising source of economic growth and employment opportunity, as evidenced by this year’s research. Future reports will continue to track what is next on the state’s energy horizon.

## Methodology

As with the 2016 report, data for this year’s report is derived from the United States Energy and Employment Report (USEER). For the first time, USEER 2017 uses data from a federal data collection administered by BW Research Partnership on behalf of the Department of Energy. The survey responses are the property of the U.S. Department of Energy and are held in strict confidence as CIPSEA-protected information. As a result, this study relies only on the publicly available data for Vermont found here:

[https://energy.gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report%20State%20Charts%20\\_0.pdf](https://energy.gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report%20State%20Charts%20_0.pdf) , together with proprietary data and supplemental research specific to Vermont.

The 2017 USEER methodology used the most recently available data from the Bureau of Labor Statistics Quarterly Census of Employment and Wages (BLS QCEW 2016 Q1), together with a detailed supplemental survey of business establishments across the United States. The survey was designed and conducted by BW Research Partnership on behalf of the Department of Energy. The DOE conducted a comprehensive review of the methodology underlying the 2017 USEER and consulted with the Bureau of Labor Statistics for consistency. This methodology has been used for local, state, and federal energy-related data collection and analysis for nearly a decade.

The survey uses a stratified sampling plan that is representative by industry code (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. Survey results are analyzed and applied to the existing public QCEW data series, constraining the potential universe of energy establishments and employment.

The 2017 USEER was administered by phone and web, with more than 500,000 outbound calls and 60,000 emails sent to employers across the United States. In total, approximately 30,000 business establishments participated in the survey effort, with about 10,000 providing full responses to the survey. These responses were used to develop incidence rates among industries by state and to apportion employment across energy technologies and value chain activities. The margin of error for incidence in the index is +/-0.76 percent at a 95 percent confidence interval. The survey was administered between October 8, 2016 and November 24, 2016 and averaged 16.5 minutes in length.

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 2017.

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.

### Methodological Changes 2016-2017

Given improvements to the 2016 USEER methodology, it is important to note these changes when comparing data to previous Vermont Clean Industry Reports and other national reports. While the research team conducted secondary analyses to ensure that 2017 data is as closely comparable to previous Vermont reports, some changes remain irreconcilable and are clarified here.

Namely, improved sampling and survey design allowed for better capture and assignment of clean energy workers into their technologies of focus. As such, there are several important considerations for this year's dataset:

**Improvements in the allocation of “other” employees indicate a seeming decline in employment in the “other” major technology segment.** This sector typically consists of educational institutions and non-profits and in previous years, employer respondents were artificially inflating the “other” total. This year, employers that selected “other” as their primary area of focus—without selecting any other major technology—were either prompted to go back and select another primary area of focus or automatically terminated. As such, the “other” category in this year's report is extrapolated separately using previous years' data. The institutions included in “other” are colleges and universities, municipalities, professional associations, and non-profit organizations that the research team had proprietary data from in the 2016 report.

**Improved sampling across several industries in this year's research effort captured more clean energy workers,** particularly for the manufacturing industry and the energy efficiency sector. As such, a small portion of this growth is attributed to improved sampling and data collection. This is especially true of nationally reported energy efficiency manufacturing (see USEER 2017), where manufacturing comprises 13 percent of total employment. For Vermont, however, manufacturing represents only five percent of the energy efficiency sector—or 560 jobs. As a result, the effect is likely diminished and growth may be attributable to other industry segments, such as construction, trade, and professional services.

**Technology and sub-technology allocations were more robust this year, and taxonomic improvement resulted in a seemingly sharp decline in hydroelectric generation employment.** The 2017 data collection effort implemented an improved method to provide better controls on state data where insufficient sample size or respondent error could inaccurately skew employment totals across technologies and sub-technologies. For hydroelectric generation specifically, much of the activity in previous years for planning and construction of electrical transmission of hydroelectric power was included in the renewable energy generation sector, although much of this power is being generated in Canada. This year, these workers were allocated into the transmission and distribution sector (see USEER 2017), but it is not possible to extrapolate what percentage of transmission and distribution construction workers are supporting hydroelectric generation technologies. Though the data appears to indicate a decline in hydroelectric generation employment (NAICS 221111), federal data reports that employment in the hydroelectric generation industry declined by only 2.5 percent in Vermont.

**Employment by value chain is almost entirely based on the North American Industry Classification System (NAICS) as opposed to relying on employer self-reported primary value chain activity as a proxy.** As the 2017 USEER methodology forms the foundation upon which this subset of Vermont-specific clean energy data is derived, the 2017 VCEIR report aims to align more closely with the revised value chain allocation methodology; this method also allows for comparison to federally-reported statistics. In last year's report, value chain employment relied more heavily on employer-reported primary activity. Though this is a good proxy with

which to extrapolate employment, the 2017 methodology was revised to better align with federally-reported statistics. For the installation, manufacturing, and trade sectors, using NAICS codes does not result in significant shifts in the data. However, changes in engineering, research, and professional services, as well as the utilities sector may be attributable to this new methodology. In previous years, project developers likely self-assigned themselves to the engineering sector. However, there is significant overlap as developers for large renewable generation projects are most often utility companies. As such, they would be placed in the utility NAICS for this year's extrapolations. This overlap likely accounts for the seeming decline in engineering and sharp increase in the utilities sector.

Declines in the "other" value chain sector are also the result of extrapolating activity based on federally-assigned NAICS codes. In the 2017 dataset, employers who selected "other" as their primary value chain activity in previous years now have their workers auto-assigned to the appropriate industry based on the federally-assigned NAICS tag.