



Massachusetts Clean Energy Industry Report

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Prepared for the Massachusetts Clean Energy Center
by BW Research Partnership

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Letter from MassCEC Chairman of the Board Richard K. Sullivan

Welcome to the 2012 Massachusetts Clean Energy Industry Report. This report follows our 2011 groundbreaking study to gauge the size and growth of clean energy sector employment and businesses. We are pleased to inform you that the industry grew significantly over the past 12 months and expects even stronger growth in the year to come.

Massachusetts is winning awards for our strong policies supporting energy efficiency and renewable energy. Fertile ground for these policies was laid when the Massachusetts legislature passed and Governor Patrick signed the Green Jobs Act creating the Massachusetts Clean Energy Center (MassCEC) in 2008.

MassCEC is dedicated to increasing the pace of clean energy growth, as the first state entity in the nation created with clean energy economic development as our primary goal. We are proud that Massachusetts is a recognized clean energy leader that can accelerate the development and commercialization of new technologies with world-class researchers, dedicated entrepreneurs, experienced investors and strong policies. To build on this success, we are assisting clean energy companies to

harness these assets, increase the pace of project development, and access a pool of highly-qualified, well-trained workers.

Despite a tough economic environment across the globe, the Commonwealth's clean energy industry is growing rapidly. Our survey shows that there are now 71,523 employees working in clean energy throughout the Commonwealth, up 11.2% from 2011. This growth outpaced the overall economy by almost a factor of ten. Clean energy continues to maintain its place as one of our Commonwealth's marquee industries with 1.7% of the total Massachusetts workforce.

The clean energy sector is emerging as a powerful economic industry in Massachusetts that will continue to generate thousands of jobs in the coming decades, and secure Massachusetts as a national and global leader in clean energy. This report captures the full extent of the clean energy community that have joined the Commonwealth's *Innovation Revolution*.



Richard K. Sullivan
Chairman of the Board,
Massachusetts Clean Energy Center

Acknowledgements

The 2012 Massachusetts Clean Energy Industry Report is the result of an extensive research process involving over 1,000 respondents. Again, this year, MassCEC sincerely thanks all of the respondents for engaging with us to gather this important data. This information depends on their willingness to generously share their time and insights.

Research Team

The publication of this report would not have been possible without the hard work and dedication of the research team including:

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In addition, MassCEC thanks Kevin Doyle for his Massachusetts workforce outreach efforts and would also like to acknowledge the industry associations that made a concerted effort to encourage their members to respond to the survey: Environmental Business Council of New England; Marine Renewable Energy Center (MREC); Massachusetts Association for Community Action (MassCAP); Mass Hydrogen Coalition; Massachusetts Manufacturing Extension Partnership (MassMEP); National Association of Energy Services Companies; New England Carpenters Regional Council; New England Clean Energy Council; New England Geothermal Professional Association (NEGPA); New Fuels Alliance; Northeast Energy Efficiency Council; Northeast Sustainable Energy Association (NESEA); and Solar Energy Business Association of New England (SEBANE).



Introduction

Massachusetts is a hotbed of innovation and invention. From computers to life sciences to defense, the Commonwealth has been at the forefront of new, exciting technologies for decades. With a robust ecosystem including world-class universities, abundant venture capital, a large professional services industry, and a deep and talented labor pool, Massachusetts has emerged as a leader in clean energy development and integration.

The Commonwealth ranks second in the nation for private clean energy investment (and first on a per-capita basis), and Massachusetts-based companies have received 17%—or \$62.8 million—of the federal dollars awarded through the U.S. Department of Energy’s ARPA-E program, which is devoted to advanced energy research projects that are transformational, sustainable, and bridge the gap between basic energy research and developmental and industrial innovation. At the same time, **the Bay State has significantly increased its production of renewable energy, with a**

thirty-fold increase in installed solar megawatts and a 108% growth in electric energy savings from energy efficiency between 2007 and 2011.

The clean energy industry creates jobs throughout the state and keeps the Massachusetts innovation engine running.

Market demand for clean energy products continues to increase. In 2011, the Massachusetts Clean Energy Center (MassCEC) released a groundbreaking report as part of its requirement to conduct an annual accounting of the clean energy industry in Massachusetts. The report demonstrated that due to a mix of leading academic institutions; an active network of technologists, entrepreneurs, and investors; a highly skilled workforce; market-building public policy; and engaged government leaders, Massachusetts was well positioned to take advantage of growing demand. The report also found that the Commonwealth is home to a large and diverse clean energy economy. Specifically, the 2011 report found 4,908 clean energy firms in Massa-

Massachusetts employing 64,310 clean energy workers, or 1.5% of all employees in the Commonwealth. These jobs are found in every county in Massachusetts, across activities ranging from engineering and research to manufacturing, and across industry sectors ranging from renewable energy to energy efficiency. And employers reported strong growth; at 6.7% growth from 2010, the report showed that clean energy firms were adding employees at a rate more than six times higher than in the economy overall.

This 2012 report provides updated information regarding many of the findings in the 2011 report. As with the 2011 report, this 2012 report is based on survey data gathered directly from clean energy employers that have been identified across a wide variety of industries in the Commonwealth. This differentiates the report from other studies, which typically rely solely on databases of known employers—those organizations that are members of industry associations, have signed up for various clean energy incentives or programs, or have been otherwise identified as conducting clean energy work. Though these known-employer lists are important in researching the clean energy economy, analyses based solely on such lists can undercount clean energy workers because they miss the large number of companies engaged in clean energy work that have not yet been identified as part of the cluster. Furthermore, most clean energy employment studies tend to rely

on assumptions and economic models, or are based on incomplete or unverified employment counts from secondary sources. These sources cannot capture in-depth employer information because employers are not active participants in the research.

In order to obtain a more complete picture of clean energy employers, the team conducted a survey of randomly selected Commonwealth employers from industries identified as being potentially related to clean energy. To capture the breadth of the cluster, surveys were administered online and by telephone to a list of known clean energy employers as well as to a representative, clustered sample of companies across the entire Commonwealth. This sample included companies from all across the value chain, from manufacturing to service and from research and development to construction. This same method of employer identification was used for the 2011 report, allowing us to effectively compare data from both years.

The findings in this report are highly reliable because they come straight from the source: the clean energy employers of Massachusetts. Further, the research refines and validates the findings of 2011. Over the past two years, the research team attempted approximately 45,000 telephone calls and sent over 10,000 emails to employers. This massive survey effort, with

KEY FINDINGS OF THE 2012 MA CLEAN ENERGY INDUSTRY STUDY

■ **4,995**

clean energy firms

■ **71,523**

clean energy workers

■ **1.7%**

of total workers in the Commonwealth

■ **11.2%**

employment growth rate from 2011 to 2012

a combined margin of error of approximately +/-3.1% at a 95% confidence interval, yielded 930 survey responses.

As a result of this intensive research effort, the *2012 Massachusetts Clean Energy Industry Report* provides comprehensive and reliable data on the number of clean energy firms and employees while validating the findings from 2011. **This report finds that Massachusetts has a large clean energy cluster with 4,955 clean energy firms that employ 71,523 clean energy workers.** For the purpose of this report, a clean energy firm is defined as an employer engaged in whole or in part in providing goods and services related to renewable energy, energy efficiency, alternative transportation, and carbon management. Clean energy workers are defined as spending at least a portion of their time supporting the clean energy aspects of their businesses.

In addition to the overall numbers, there are several important findings from this research. First, **the 71,523 clean energy workers in Massachusetts represent 1.7% of total employment in the Commonwealth,** an increase from last year and a number large enough to warrant

considering the clean energy cluster a key sector in Massachusetts. Though there are many reasons for the cluster's strength, one factor is that the cluster has breadth and depth across multiple industries and technology areas. Despite uneven performance within value chain activities, the breadth allows for the cluster's continued growth and strength in the Commonwealth.

The research also finds that Massachusetts clean energy employers are growing significantly faster than their peers in other sectors. **Since 2011, clean energy employment has grown by 11.2%, nearly 10 times faster than the overall 1.2% growth rate¹ among all industries in the Commonwealth over the same period.** The 11.2% employment growth rate shows that the pace is in fact quickening, outpacing the same period from 2010-2011 by more than 3,000 jobs. Employers are also optimistic about their future prospects, anticipating 12.4% growth over the coming 12 months.

The following pages include detailed findings of the research, including a review of the size, growth, distribution, and workforce needs of clean energy employers in Massachusetts.

¹ EMSI Complete Employment, 2012.1.



Research Findings

Clean Energy is a Large Industry Cluster in Massachusetts

As reported in 2011, the passage of key legislative and policy initiatives, including the Green Communities Act, the Green Jobs Act, and the Global Warming Solutions Act,² have paid off by producing a large and growing cluster of companies. These initiatives, together with expanded incentive and training programs, have “cemented the state’s position as a national leader in smart, proactive policies promoting clean-energy development.”³

Investments in clean energy have clearly produced dividends. Massachusetts is currently home to 4,995 clean energy employers and 71,523 clean energy workers.

Clean energy workers make up 1.7% of all workers in the Commonwealth and are found in numerous industries across the state.

Of these 71,523 workers, 18,280 work primarily with installation and maintenance firms; 20,671 work in sales and distribution; 13,182 work for engineering and research firms; 11,162 work for manufacturers, and 8,229 work for other types of clean energy companies, such as legal, finance, and policy firms.

Clean energy firms work in many technology areas, led by energy efficiency and renewable energy. Specifically, 2,646 firms and 40,207 clean energy workers produce goods or services related to energy efficiency, while 2,205 firms and 29,777 clean energy workers work with renewable energy.⁴

² “A Future of Clean Energy and Growth: Advancing Massachusetts’ Clean Energy Leadership,” CleanEdge, April 2010.

³ *Id.*

⁴ Note that this includes overlap. Many of the firms reported work with both renewable energy and energy efficiency technologies.

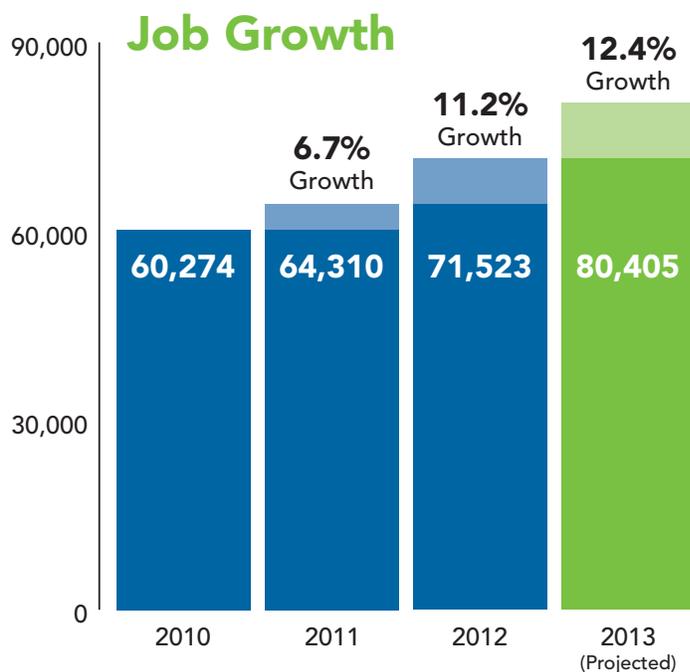
The size of the cluster is impressive, demonstrating Massachusetts' position as a national leader in clean energy. Given the Commonwealth's strong employer base, leading policies, and clear commitment to growing the cluster, the potential for employment growth in the clean energy sector is significant.

Clean Energy Employers in Massachusetts are Growing Rapidly

Overall, clean energy firms in Massachusetts have experienced impressive growth from July 2011 to June 2012, adding 7,213 new jobs—an 11.2% growth rate. Despite job growth of

1.2% for all Massachusetts jobs over the period,⁵ nearly one-third of all clean energy companies grew, while only 13% cut their workforce. This finding highlights clean energy as a bright spot in jobs recovery in the Bay State.

The research also found that respondents are optimistic about future growth. Overall, clean energy employers expect to have 8,881 more clean energy jobs over the coming 12 months, a 12.4% growth rate in clean energy employment. Thirty-eight percent of employers expect to have more clean energy workers in the coming year, while only 2.7% expect fewer. In comparison, overall Massachusetts employment is projected to grow by 1.4% over the coming 12 months.⁶



Clean Energy is Generating Jobs and Creating New Businesses

The 11.2% growth from 2012 is a combination of new positions at existing clean energy firms, repurposing of employees to support clean energy at existing firms, and new businesses. Of the new clean energy workers added over the last year, nearly three-quarters were reported as having been hired to new positions, while 26% were in existing positions to which clean energy responsibilities were added.

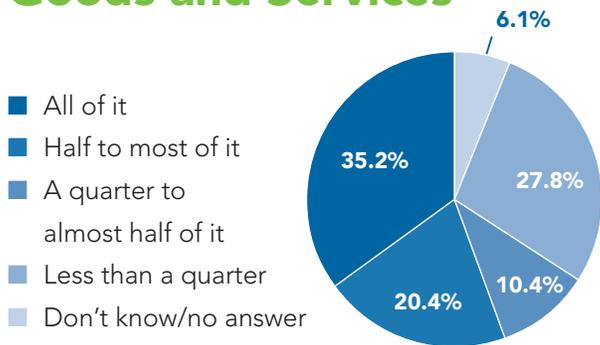
⁵ EMSI Complete Employment, 2012.1.

⁶ *Id.*

Clean Energy is Generating an Increasing Share of Revenue

Businesses report that their clean energy revenues are increasing as a share of overall revenue. Thirty-five percent of surveyed firms reported that 100% of their revenues are attributed to clean energy goods and services, while 56% receive at least half of their revenue from clean energy work. This work is defined as producing goods or services related to renewable energy, energy efficiency, carbon management, or alternative transportation.

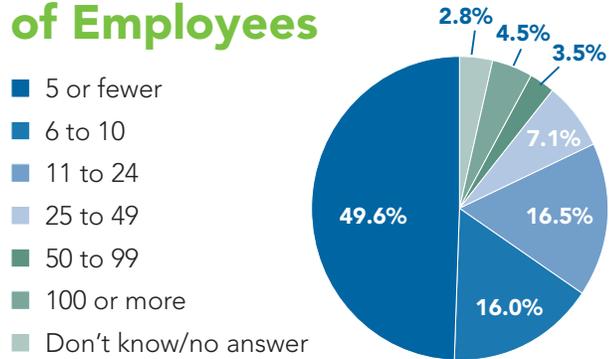
Percent of Revenue From Clean Energy Goods and Services



Small Businesses Continue to Play a Key Role in the Clean Energy Cluster

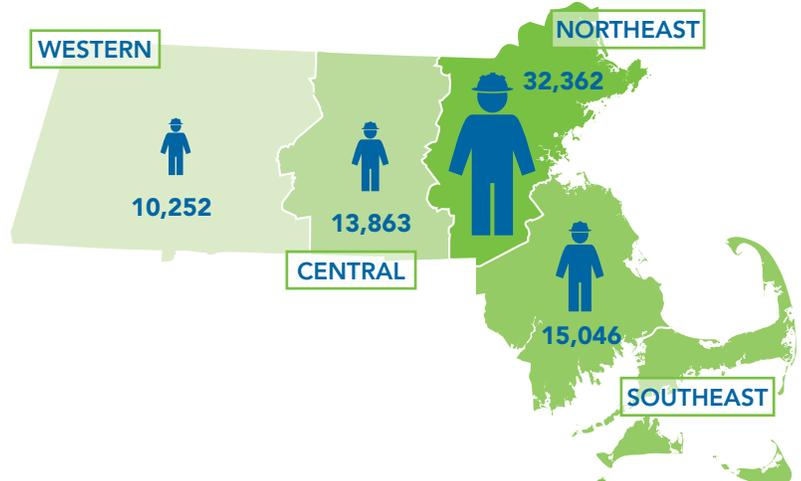
The majority of the Commonwealth's clean energy employers are small, with nearly two-thirds having ten or fewer permanent clean energy employees.

Company Size by Number of Employees



Clean Energy Firms are Distributed Throughout the Commonwealth, but Growth is Uneven

Clean energy employment can be found throughout the Bay State. The map below illustrates the clean energy employment concentrations of the four Green Community Regions in Massachusetts. The Northeast has the greatest concentration of workers, followed by the



Southeast, Central, and West. All areas, however, show significant employment, ranging from 10,252 clean energy workers in the West to 32,362 clean energy workers in the Northeast.

Despite solid gains last year, clean energy employment in the Southeast region actually declined by 252 workers, or 1.6%. These losses were offset by growth in the Northeast and Central regions at 17.5% and 17.4% employment growth, respectively. The West also grew by 6.2%, adding nearly 600 clean energy workers. Clean energy employers expect to grow

their clean energy employment by 19.4% in the Southeast, 13% in the Northeast, 6.2% in the Central, and 8.6% in the West.

Clean Energy is Generating Growth in Numerous Industries in Massachusetts

In addition to the impressive size of the cluster, the research shows that its diverse activities are bolstering growth. Though specific industry segments such as R&D, professional services, and sales are clearly important to the cluster, the entire value chain of activities is well represented in Massachusetts, as illustrated by Table 1 below.

Table 1: Current Clean Energy Employment, Overall⁷

Primary Value Chain Activity	2012 Establishment Count	2012 Employment Count	2011-2012 Employment Growth Rate	Percentage of total, by Establishment	Percentage of total, by Employment
Manufacturing and Assembly	489	11,162	37%	10%	16%
Engineering and Research	889	13,182	20%	18%	18%
Sales and Distribution	917	20,671	11%	18%	29%
Installation and Maintenance	1,996	18,280	-12%	40%	26%
Other Activity (Finance, legal, policy, and other support)	705	8,229	44%	14%	12%
Total	4,995	71,523	11%		

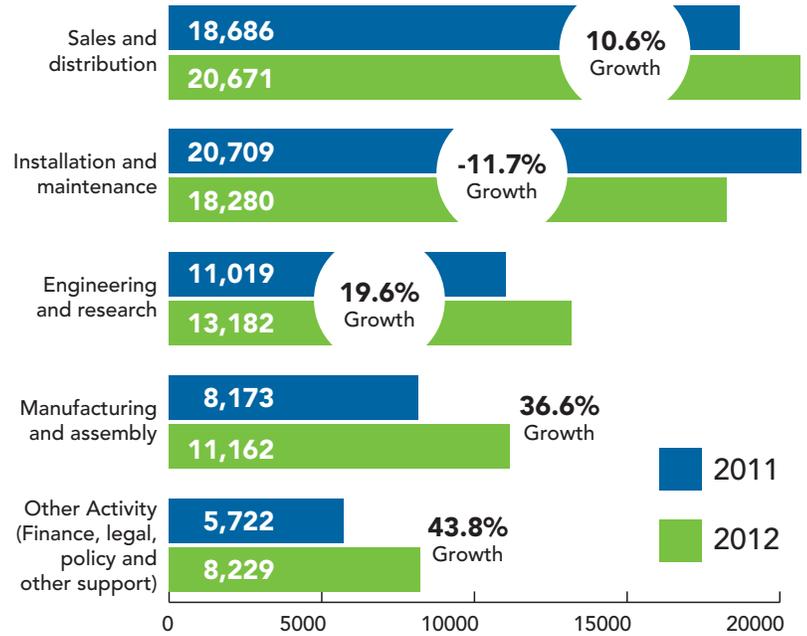
⁷ Note that the total in each category is rounded to the nearest worker, which explains the difference with the totals reported herein.

There are many firms engaged in more than one activity, **installation and maintenance is the largest value chain activity by number of firms, while sales and distribution firms employ the most clean energy workers.**

More than one in three clean energy firms in Massachusetts is primarily engaged in installation and maintenance, while nearly one in five is an engineering or R&D firm. Sales and distribution and manufacturing are also clearly important segments of the cluster, making up 14% and 10% respectively.

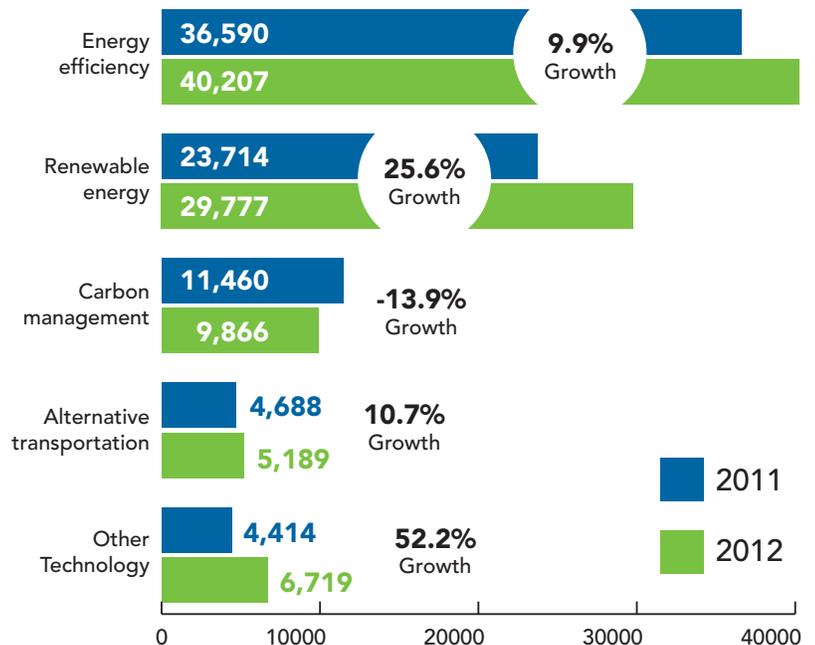
Challenges in the Construction Sector are Impacting Installation and Maintenance Firms

The only segment of the clean energy economy that is experiencing a decline in employment is installation and maintenance, and the decline is significant at 12%. This decline reflects continued weakness in the construction sector in the Commonwealth, as there are fewer construction firms and fewer workers at those that remain. Additionally, increased efficiency and consolidation of firms has impacted overall employment in this area. Despite these negatives, the mere fact that the industry grew by 11.2% despite a steep decline in its largest segment shows just how diverse and strong the cluster is in the Bay State.



Multiple Technology Areas are Growing

The research shows that clean energy firms in Massachusetts are working across a spectrum of technology areas, and in many cases in more than one. Survey participants were first asked to list the major technology areas with



Business Type	2012 Establishment Count	2012 Employment Count	2011-2012 Employment Growth Rate
Renewable Energy	2,205	29,777	26%
Energy Efficiency	2,646	40,207	10%
Alternative Transportation	403	5,189	11%
Carbon Management	437	9,866	-14%
Other Technology	723	6,719	52%

which their employers are most closely associated. Because researchers anticipated that many employers would be active in a number of technology areas, multiple responses were permitted.

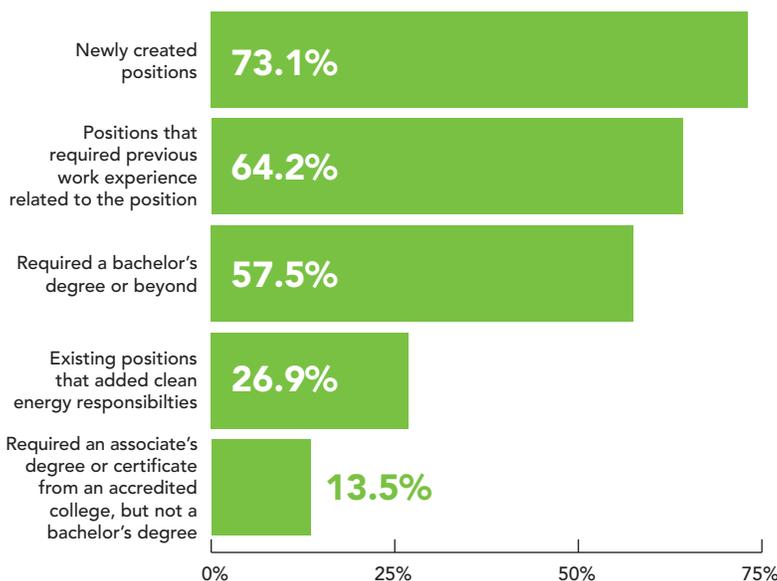
Renewable energy is adding the most jobs, with an impressive 26% growth rate since 2011. Energy efficiency is also adding many jobs, as are “other firms” where most of the professional services firms are located. Carbon management is smaller than reported in 2011, primarily because many firms that classified themselves as engaged in carbon management in 2011 were actually energy efficiency or “other” firms.

Massachusetts Clean Energy Firms Seek Educated, Experienced Workers

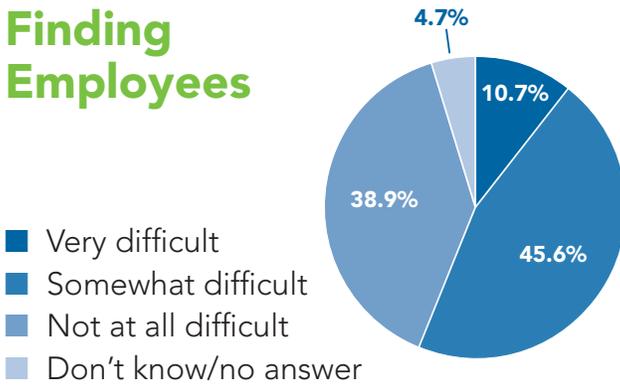
Massachusetts clean energy employers were asked targeted questions about their new clean energy workers in an attempt to understand the types of applicants that are achieving successful employment outcomes. The 2011 study demonstrated that Massachusetts employers value educational credentials, expecting higher levels of education than their counterparts in other regions of the country. The 2012 research underscores this finding, with employers reporting that 58% of new clean energy hires were required to have a bachelor’s degree or beyond, and another 14% were required to have an associate’s degree or certificate.

At the same time, employers are seeking experienced workers, reporting that 64% of the new clean energy positions required previous work experience related to the job.

Of the newly created positions, the largest segment deals with technical work, such as technicians and production workers. Management and professional positions are the second largest segment, followed by administrative positions and sales positions.



Finding Employees

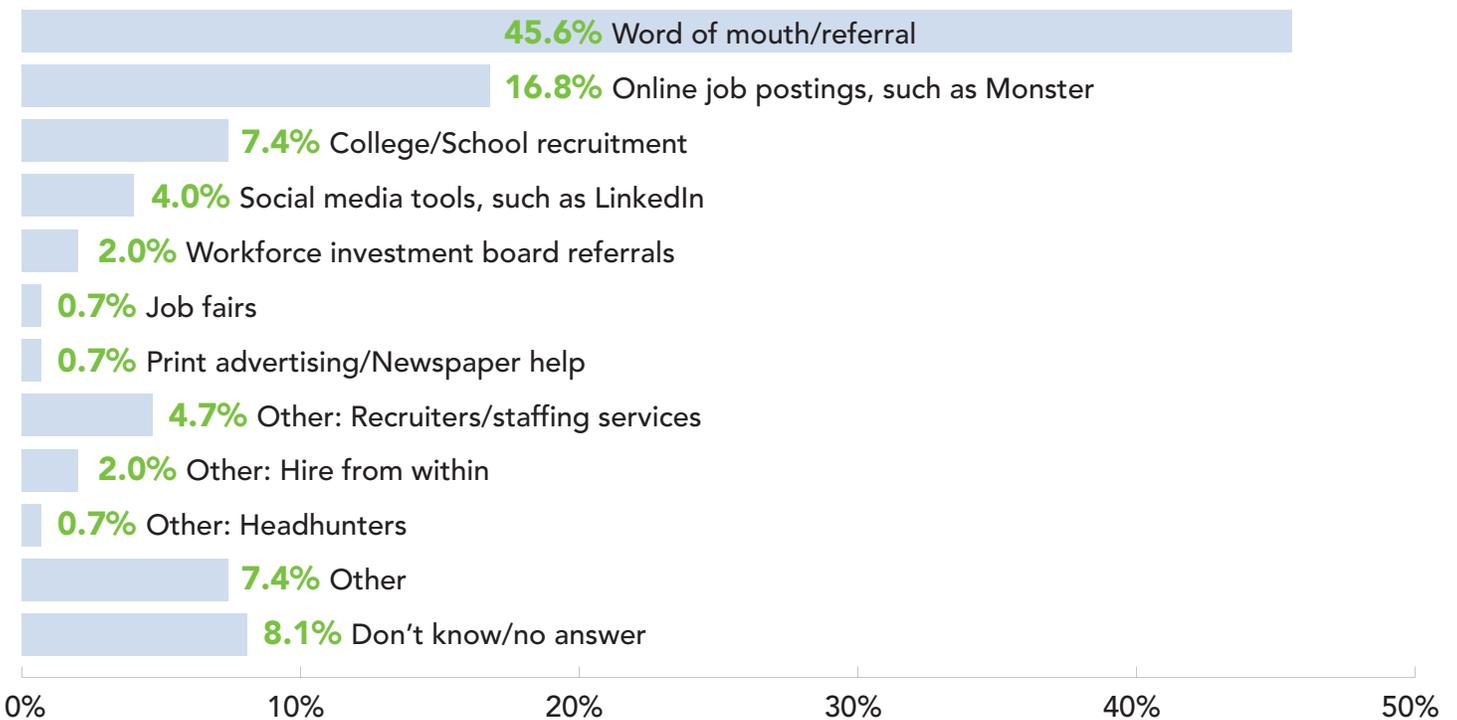


Despite solid growth in the industry, nearly 85% of clean energy employers in Massachusetts report some or no difficulty finding adequately prepared workers, with only 11% reporting great difficulty. Employers reported that the greatest deficiencies of applicants include lack of required technical skills, lack of required education, and poor communication, problem solving, and analytical skills.

More than two-thirds of all firms that added workers over the past year use word of mouth and

referrals, while about one-third reported posting the position online using a job board. About one-quarter of firms recruit directly out of colleges and schools, and a growing number (16%) are using social media to recruit new employees.

When asked which method has been most successful for finding qualified applicants, 46% reported that word of mouth referrals were most successful, while online job boards were cited only 17% of the time, and college recruiting was cited by 7.4% of employers.⁸



⁸ Note that these questions were not asked of all employers, only those that added employees over the past 12 months.



Conclusions

Clean energy continues to be a shining example of Massachusetts's innovation economy, and this report underscores its importance to the Bay State. The Massachusetts clean energy cluster is growing at a rapid clip of 11.2%, outpacing the overall economy nearly tenfold. The 4,995 clean energy firms and 71,523 clean energy jobs in the Commonwealth are responsible for 1.7% of all employment in the state. The cluster shows no signs of slowing, either, with employers anticipating 12.4% growth over the next 12 months. Such impressive growth certainly cements the cluster's place as a marquee industry in the Commonwealth.

With only a few exceptions, this growth is spread evenly throughout the Bay State, creating jobs in manufacturing, engineering, sales, and professional services. The Commonwealth's successes in the areas of renewable energy and energy efficiency technologies highlight a strong and vibrant ecosystem of firms.

There are a few areas of concern. Despite dramatic growth among most of the value chain activities, Massachusetts installation and maintenance firms report declining employment. Though the research suggests that this is mostly due to

overall weakness in the construction industry, the Commonwealth should do more to spur residential and commercial installations of clean energy goods and services. Given the research findings, targeted help for small businesses will also pay dividends in this important cluster.

Continued commitment to education is clearly critical to maintaining a thriving clean energy cluster in the Commonwealth. Employers in Massachusetts require more education than their counterparts in other states, and the importance of a college degree is in evidence. Though Massachusetts ranks first in the nation for college degree attainment, more should be done to teach students about STEM fields and clean energy careers at the K-12 level, increase access to college, expand clean energy baccalaureate programs at public universities, and develop targeted policies to maintain the Commonwealth's high standard of living in order to ensure that the state is able to continue developing skilled workers and retaining them after graduation.

Massachusetts has long been a hub of technological innovation. By continuing to support this growing cluster, the Commonwealth can build upon this success well into the 21st century.

Appendix A: Research Methodology

In June and July of 2011 and May and June of 2012, BW Research worked closely with the Massachusetts Clean Energy Center to conduct a survey of clean energy companies in the Commonwealth. For the purposes of the survey, a clean energy firm is defined as a company involved with an activity related to the clean energy industry. The Clean Energy Industry is defined as being directly involved with researching, developing, producing, manufacturing, distributing or implementing components, goods or services related to renewable energy, energy efficiency or conservation, smart grid, energy storage, carbon management, and/or electric or hybrid vehicles. Clean energy employees are defined as full-time and part-time permanent employees who support the clean energy portion of the business, including administrative staff.

In order to accurately capture data from the cluster, surveys were administered online and by telephone to a list of known employers as well as to a representative, clustered sample of companies from the NAICS industries identified by the Bureau of Labor Statistics as being potentially related to the renewable energy, energy efficiency, and alternative transportation sectors.

Over the two years of surveying, the research team attempted approximately 45,000 telephone calls and sent over 10,000 emails to employers. The survey effort, with a combined margin of error of approximately +/-3.1% at a 95% confidence interval, yielded 1,401 survey responses from the samples in 2011 and 930 responses in 2012. The 2011 survey fielded from June 30 to July 29, 2011 and averaged 15 minutes in length and the 2012 survey fielded from May 8 to June 1 and averaged 10 minutes in length.

Known Universe

The original list, developed from previous work efforts and databases from the Massachusetts Clean Energy Center and partner organizations, contains the companies that are more likely to be active in the clean energy economy. After duplicate cleaning and applying estimates from the survey data to account for companies that are no longer in business, do not have at least one Massachusetts location, or do not identify as in the clean energy industry, as well as improvements and additions since the first survey effort, the 2012 known universe of firms is estimated at 1,599 companies.

All firms in the database with email information were sent multiple online invitations.

Firms in the database that did not complete an online survey and those without email information were called up to six times and asked to complete the telephone version.

Of the estimated 1,599 firms in the known universe, 445 completed a survey (28%). These employers have a mean of 21.36 clean energy workers per clean energy firm in the known database. Therefore, the higher mean and increased universe in 2012 yield 34,170 workers in the known universe, an increase of 35.7%. Due to the high participation rate, the margin of error is low at a confidence level of 95% (approximately +/- 3.9%).

Unknown Universe

This database for the unknown universe was drawn from BLS NAICS industries and InfoUSA company listings. The list contains 16,783 firms, which were clustered by industry (agriculture, manufacturing, sales/trade, services/R&D, construction, and repair) and by size (small, medium, large). Firms were randomly called within the clusters and the known firms were removed from the sample. In total, calls were made to 4,255 of the 16,783 firms in the 2012 database and up to four attempts were made per firm, in order to determine whether there were significant differences in the incidence and churn rates between 2011 and 2012.

There were no statistically significance differences in the incidence rates (i.e., the percentage of firms that identified as clean energy) for any of the 18 clusters. As such and because the 2011 sampling was more comprehensive (calls were made to 16,237 of the 17,245 firms in the database as part of the 2011 project), the rates for 2011 were carried over to 2012. Statistically higher churn rates (i.e., the percentage of firms no longer in business, disconnected or wrong number, etc.) were found in four of the 18 clusters and were applied to 2012.

In addition, 171 firms from the unknown universe identified as clean energy and completed full surveys. Due to the more robust and representative survey effort undertaken in 2011, the data utilized for extrapolations for the unknown universe (with the exception of the future growth statistic) were carried over from 2011 (e.g., average clean energy employment, percent breakdown by technology area, value chain activity, and geography).

Compared to the known universe, the level of clean energy employment at “unknown” firms is lower by a significant margin, with a mean of 11 (compared to 21.36 in the known sample), and the overall number of clean energy firms in the unknown universe is declining, resulting in a decline of 4.6% in employment to 37,353.



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