



MASSACHUSETTS
CLEAN ENERGY
CENTER®

2022

MASSACHUSETTS
CLEAN ENERGY

Industry Report

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Since 2010, MassCEC has:



Awarded over **\$441.9M** through clean energy programs and investments and attracted over **\$2.5B** in private and federal capital



Supported over **5,200** college and vocational internships with more than **670** clean energy employers and attracted **64%** women or minority interns



Enabled **3,600+** clean energy-related certificate trainings



Awarded **\$159M** for technology innovation and company growth



Awarded **47,000** clean energy projects, supporting **164 MW** of solar and **251 MW** of clean heating and cooling



Tested **52** wind turbine blades at the Wind Technology Testing Center

ABOUT MASSCEC

The Massachusetts Clean Energy Center (MassCEC) is a state economic development agency dedicated to accelerating the growth of the clean energy sector across the Commonwealth while helping to meet clean energy, climate, and economic development goals. MassCEC works to spur job creation, deliver statewide environmental benefits, and secure long-term economic growth for the people of Massachusetts.

MassCEC is governed by a Board of Directors, which is chaired by Massachusetts Energy and Environmental Affairs Secretary Bethany A. Card.

Areas of Focus

MassCEC has a strong history of identifying and supporting promising clean energy start-ups and solutions. Our technology development grants and early-stage investments target novel and compelling climate-critical solutions that will significantly reduce greenhouse gas emissions and build a robust and equitable workforce to support those technologies. MassCEC’s unique investment program offers early-stage funding in technology that is critical for decarbonization focused on filling funding gaps not met by traditional venture capital. Our technology development and investment initiatives fund technology research and development grants, furnish seed and early-stage investment, provide expert advice and mentoring, and catalyze later-stage investments.

Market development is a central component of MassCEC’s work, which includes accelerating the adoption of new clean

energy technologies, proving and scaling innovative business models, and developing and supporting critical clean energy infrastructure.

MassCEC fosters collaboration among the industry, state government, research universities, and financial sector to advance the state’s clean energy economy. We partner with a diverse range of stakeholders, with a particular focus on those involved in clean transportation, high-performance buildings, net-zero grid, and offshore wind.

MassCEC is committed to creating a diverse, equitable, and inclusive organization and clean energy industry; where everyone is welcomed, supported, respected, and valued. Our workforce development programs incorporate principles of diversity, equity, inclusion, and environmental justice; and support the training of our clean energy workforce to achieve our climate goals. We are passionate about promoting the equitable distribution of the health and economic benefits of clean energy across the Commonwealth.

MassCEC owns and operates infrastructure critical to supporting Massachusetts’ leadership in the clean energy industry—the Wind Technology Testing Center in Charlestown, the only one of its kind in North America that tests commercial-scale wind blades, and the New Bedford Marine Commerce Terminal, the only existing port in the United States purpose-built for the deployment of offshore wind.



NOTE FROM THE CEO

JENNIFER
DALOISIO

I am pleased to share the Massachusetts Clean Energy Center's 2022 Clean Energy Industry Report with you. This report provides an overview of the clean energy industry in Massachusetts and demonstrates the results of focused leadership in both the public and private sectors to grow the clean energy sector.

Since our inaugural report in 2010, the Massachusetts clean energy industry has made tremendous gains in clean energy job creation, technology development, and economic impact. Our industry, like many others, saw a decline in progress due to the COVID-19 pandemic, but the latest data shows promising beginnings of a rebound.

Some highlights from the report show that the Massachusetts clean energy industry has over 104,000 direct jobs and an additional 95,046 indirect jobs. The most significant job growth was seen in the electric vehicle, offshore wind, net-zero grid, and solar power employment—all contributing to a more than 3% increase in jobs added over last year's report. The clean energy industry provides employment opportunities across all geographical areas of the Commonwealth and is responsible for \$28.4 billion in gross state product.

It is an exciting time for the Commonwealth's clean energy industry. Massachusetts has become a successful example of leading-edge clean energy and climate policy, implementation of innovative clean energy solutions, and new industry growth. In August of this year, Governor Baker signed into law An Act Driving Clean Energy and Offshore Wind. This landmark piece of legislation secures Massachusetts' leadership position by driving further growth in offshore wind, clean transportation, and exploring novel sources of clean energy. With these bold efforts come reliable and affordable energy for millions of residents and thousands of well-paying jobs in the Commonwealth.

We are proud to continue our leadership in the offshore wind sector. Vineyard Wind has begun offshore construction of the first commercial-scale offshore wind project in the U.S. and will use MassCEC's New Bedford Marine Commerce Terminal as the base for its installation operations. The Marine Terminal is the country's first and only purpose-built offshore wind port and is a launching point for a strong beginning to the Commonwealth's—and the nation's—commercial offshore wind future. On the heels of Vineyard Wind's project, Mayflower Wind will begin a lease of the Marine Terminal for its 1,200-megawatt project.

This report illustrates that the Massachusetts clean energy industry is:

Home to over
104,000
clean energy workers,
having grown **73%** since 2010

Powered by small
business, with
59% having ten
or fewer
employees

Growing fast, outpacing
overall growth in the state:
Clean energy Gross State
Product has grown over **55%**
since 2012, outpacing statewide
growth of **43%**

Spurred on by MassCEC technology development grants, Massachusetts is exploring more novel energy sources and research tools. From clean hydrogen to training through virtual reality, key partnerships with research universities and partners are yielding fascinating results.

We've succeeded in developing ways to decarbonize the iconic triple-decker buildings, making electric bikes and transportation accessible to more communities, and ensuring clean energy can be stored and delivered more reliably and resiliently.

MassCEC will continue to design intentional and targeted programming in our key clean energy focus areas: high-performance buildings, clean transportation, grid modernization, and offshore wind. Underpinning this

work is a commitment to workforce development, equity and inclusion, innovation and technology development, and market transformation. This thoughtful approach to programming is crucial to building and sustaining industry growth that helps us meet our climate goals.

The years ahead are full of promise for the clean energy industry and Massachusetts residents. We are rebounding from the economic downturn of the pandemic. Collaboration across state and municipal governments and private industry will enhance our already vibrant clean energy industry. And, with thoughtful purpose, clean energy will be created and delivered by an equitable workforce to benefit all residents across the Commonwealth.

2022 MASSACHUSETTS CLEAN ENERGY¹ INDUSTRY HIGHLIGHTS²



Solar-powered microgrid adds resilience to Ayer, MA, service station. Photo courtesy of Enel North America.

Sub-sectors that experienced the greatest rate of job growth between 2021 and 2022 reports

 Electric Vehicles **26%**

 Wind **7%**

 Smart Grid **6%**

 Solar **5%**

¹ A definition of clean energy can be found in the Glossary section of the report.

² Unless otherwise noted, the data in the 2022 Massachusetts Clean Energy Industry Highlights are as of December 2021.

Since 2010, the Massachusetts clean energy industry has experienced:

73%
job growth


ADDING


44,016
new workers

 **104,290** clean energy workers in MA


 Clean energy jobs represent **3%** of all jobs in MA

 **59%** of firms are small businesses (≤ ten workers)

 MA has **4%** of all clean energy jobs in the U.S., while being home to only **2%** of the country's population.

 **71%** of workers are employed in the Energy Efficiency, Demand Management, and Clean Heating and Cooling sector

 Companies represent more than **\$14 billion** in Gross State Product (GSP)

 While Boston is a hub for clean energy, **70%** of clean energy workers are based outside of Route 128

 Industry GSP increased by **\$5.1 billion** since 2012, a **55%** increase that outpaced growth in MA's overall GSP, which grew by **43%** over the same time

 **199,336** total direct, indirect, and induced jobs and **\$28.4 billion** in total GSP supported by the clean energy industry



While COVID-19 led to a loss of 19,800 clean energy jobs at the height of the pandemic in June 2020, an estimated **12,700** jobs (roughly **65%**) have been recovered as of September 2022. The industry has demonstrated it is in the process of a rebound and is expected to continue growing.

ECONOMIC CONTRIBUTION ANALYSIS

DECEMBER 2021

For purposes of this report, only workers directly supporting clean energy activities, such as conducting research, manufacturing products, performing installations, or repairing and maintaining clean energy systems, are included as clean energy workers. However, the impact of the industry is significantly greater than these “direct” jobs alone.³

³The economic contribution analysis in this report was calculated using IMPLAN modeling software.



The **104,290** DIRECT CLEAN ENERGY JOBS in Massachusetts supported an additional:



33,508 INDIRECT JOBS
(those outside of the clean energy sector that provide critical supply chain goods and services)



61,538 INDUCED JOBS
(those that result from increased spending in the economy)

Based on this analysis, the **MASSACHUSETTS CLEAN ENERGY INDUSTRY** is responsible for a total economic contribution of:



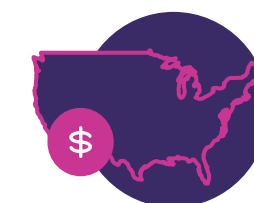
199,336 jobs



\$28.4 BILLION in MA GSP



\$1.8 BILLION in state and local taxes



\$3.5 BILLION in federal taxes



Members of Pile Drivers and Divers Local 56 participate in an offshore wind safety training.

The Massachusetts clean energy industry has a similar number of direct jobs as the College & University or Restaurant industries, yet exceeds both industries' economic contribution in indirect and induced jobs and state GSP.



MASSACHUSETTS IS A LEADER

#2 for energy efficiency in the U.S. by ACEEE (2022)

In 2021 and 2022, Massachusetts enacted comprehensive climate legislation to target reaching net-zero greenhouse gas emissions by 2050 while supporting underserved populations.

#1 On the clean energy Community Power Scorecard for the 6th straight year by the Institute for Local Self-Reliance (2022)

#3 Most LEED-certified square feet per capita by U.S. Green Building Council (2021)

#3 Total Solar Jobs by Interstate Renewable Energy Council (2022)

#3 Total storage and microgrid jobs per capita by Department of Energy U.S. Energy and Employment Report (2022)

#5 Boston's clean energy ranking among U.S. cities by American Council for an Energy-Efficient Economy (2021)

#5 Total battery storage capacity by Utility Dive (2022)

 First U.S. port for offshore wind deployment (New Bedford Marine Commerce Terminal)

 First commercial-scale offshore wind farm under construction



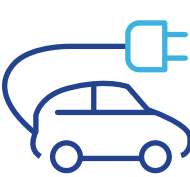
 Largest wind blade testing facility in North America (MassCEC Wind Technology Testing Center)



Photo courtesy of American Battery Technologies

 **125,000+** solar projects in MA

 **46,000+** electric vehicles sold in MA (through 2021)

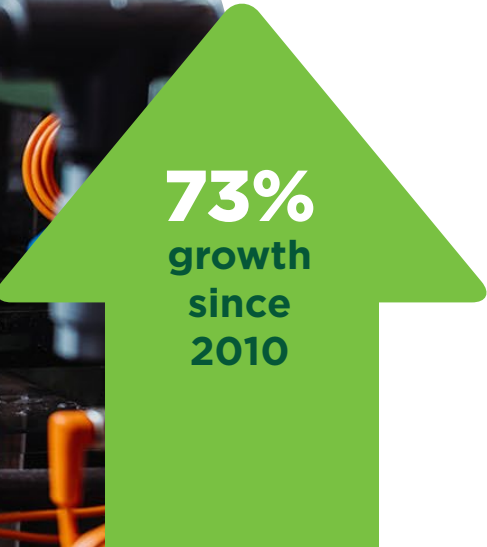
TOTAL CLEAN ENERGY JOBS

Between 2010 and 2021, the clean energy industry in Massachusetts added a net **44,016** jobs, which accounts for **14%** of all net jobs created in the state during that same time. Though the COVID-19 pandemic continues to have a lasting impact on the Massachusetts' clean energy industry and the broader labor market, between the 2021 and 2022 reports, clean energy businesses added back **3,082** jobs, representing a **3%** increase. This is comparable to the MA healthcare industry, which grew by **2%** over the same timeframe. Furthermore, between January and September 2022, it is estimated that the clean energy industry has grown by over **2.5%**, adding an estimated **2,709** additional jobs.

This report defines a clean energy worker as a person who spends some portion of their time working in renewable energy, energy efficiency, alternative transportation, or other carbon management technologies. In Massachusetts, **71%** of clean energy workers spend the "majority" or "all of their time" working in clean energy, compared to an average of **63%** nationally.



Nth Cycle team members operating electro-extraction refining system. Photo courtesy of Nth Cycle.



TOTAL CLEAN ENERGY EMPLOYMENT REPORT YEARS 2010-2022⁴

2023 (Estimated)	106,999
2022	104,290
2021	101,208
2020	113,968
2019	111,836
2018	110,767
2017	109,226
2016	105,212
2015	98,895
2014	88,372
2013	79,994
2012	71,523
2011	64,310
2010	60,274

104,290 workers spent some portion of their time working in clean energy. This is equivalent to **81,144** workers spending **100%** of their time on clean energy work.

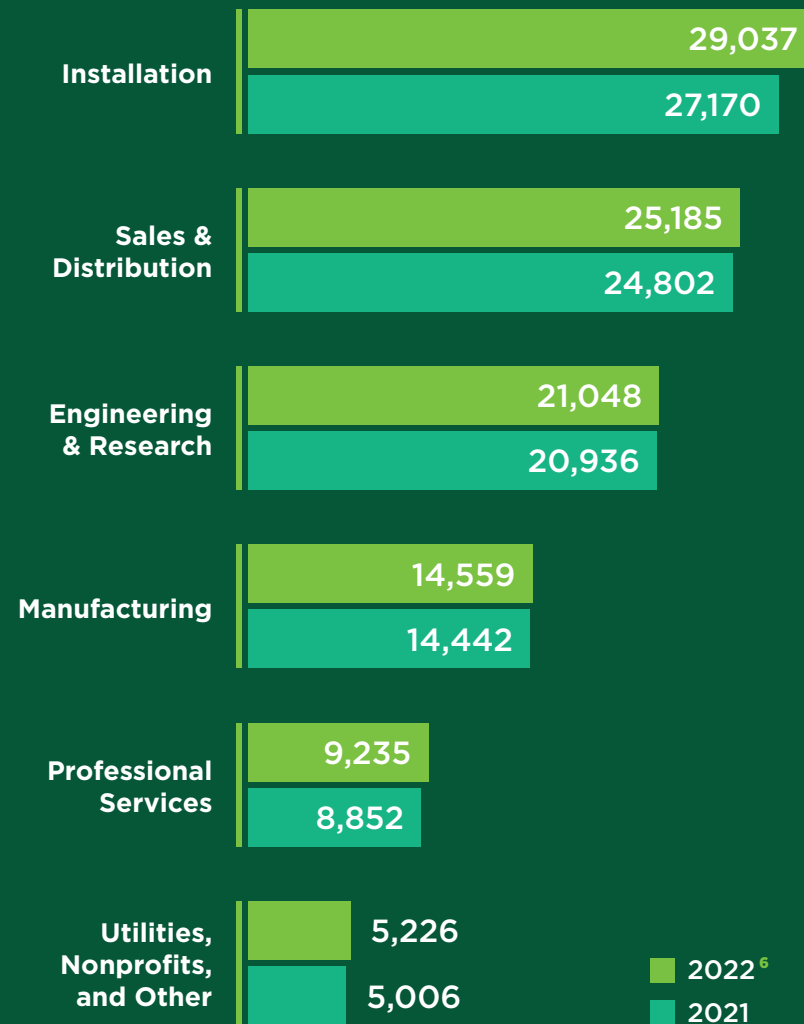
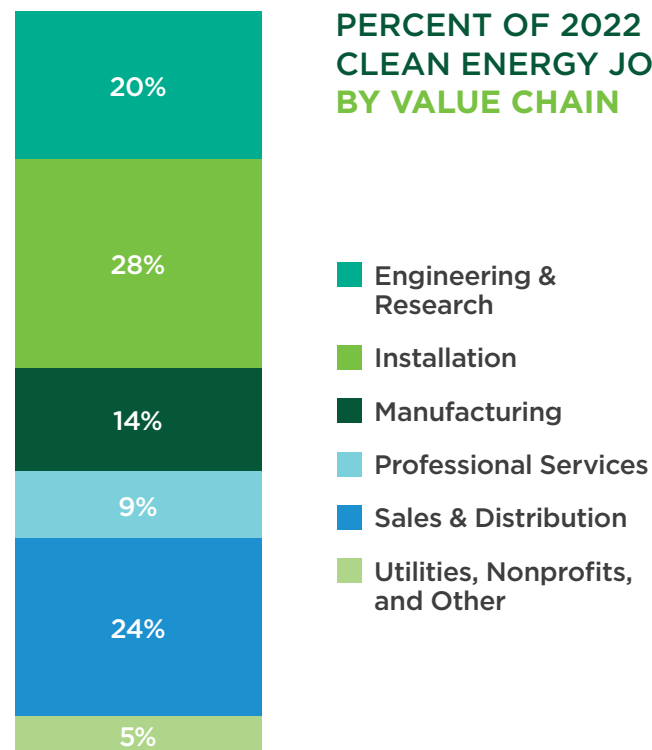


⁴2022 job numbers in this report were collected through December of 2021 and represent the net change in employment compared to December of 2020. The 2023 (estimated) job numbers are calculated by combining the 2022 Report year job numbers with estimated job recovery data from January through September 2022.

CLEAN ENERGY JOBS BY VALUE CHAIN⁵

All value chain segments rebounded, adding jobs between the 2021 and 2022 reports. Businesses with a primary focus on Installation experienced the highest growth rate increase at **7%**, adding **1,866** workers.

Professional Services grew by **4%** (**383** workers), while the Utilities, Nonprofits, and Other segment grew by **4%** (**200** workers). Additionally, businesses with a primary focus on Sales & Distribution saw a growth rate of **1.5%**, adding **383** new workers.



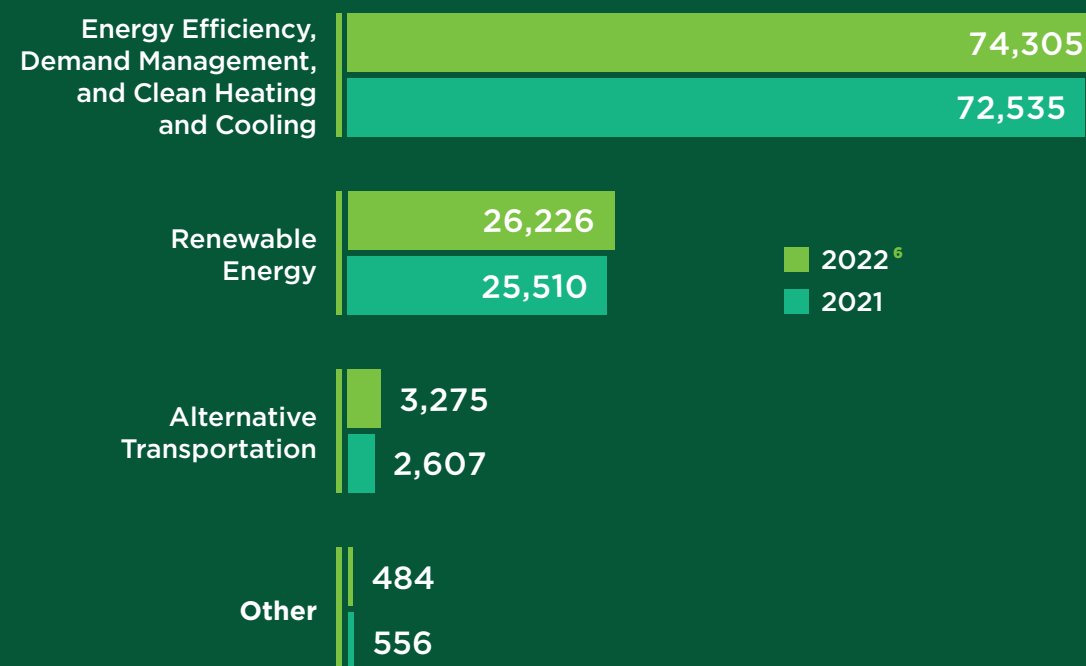
⁵ Definitions for all clean energy value chains, sectors, and sub-sectors can be found in the Glossary of this report.

⁶ 2022 job data in this report were collected through December of 2021 and represent the net change in employment compared to December of 2020.

CLEAN ENERGY JOBS BY SECTOR⁵

Energy Efficiency, Demand Management, and Clean Heating and Cooling remains the clean energy sector with the highest number of jobs; the sector grew by **2%** between Q4 2020 and Q4 2021.⁶

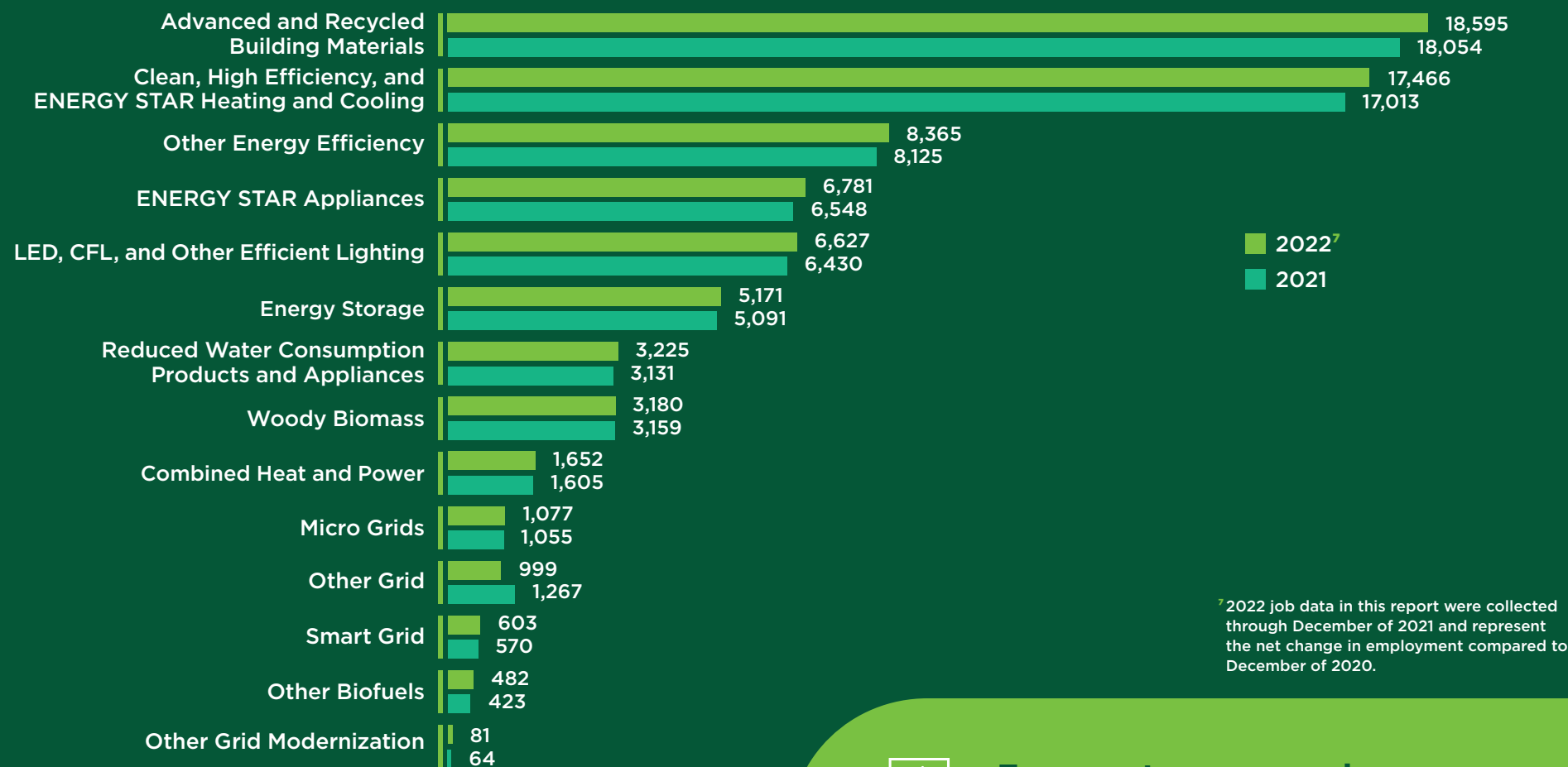
Renewable Energy employment grew by **3%** and Alternative Transportation employment increased by **26%**.



Ventilation system commissioning at low-income multi-family retrofit. Photo courtesy of Building Evolution Corporation.

ENERGY EFFICIENCY, DEMAND MANAGEMENT, AND CLEAN HEATING AND COOLING JOBS

Energy Efficiency, Demand Management, and Clean Heating and Cooling jobs continue to make up the largest portion of clean energy jobs within Massachusetts. Of the jobs that fall under Energy Efficiency, Demand Management, and Clean Heating and Cooling, Advanced Materials and Recycled Building Materials saw the largest increase, with **542** jobs added between December 2020 and December 2021, followed by Clean, High Efficiency, and ENERGY STAR Heating and Cooling with **453** jobs added.



⁷2022 job data in this report were collected through December of 2021 and represent the net change in employment compared to December of 2020.

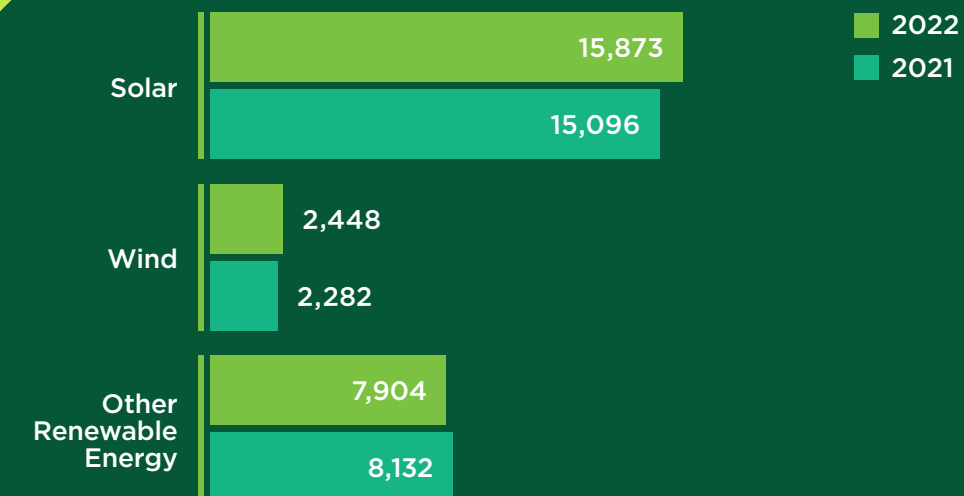


Energy storage now has a higher number of jobs compared to pre-pandemic levels.

RENEWABLE ENERGY JOBS

Wind energy grew by **7%** between the 2021 and 2022 reports, adding **166** new jobs. This sub-sector is likely to see continued growth since the 800 MW Vineyard Wind 1 project commenced onshore construction in 2021, and additional projects are contracted and advancing through permitting.

Massachusetts' solar industry grew by **5%** (**777** jobs). This is the first year of solar job growth since the 2017 Report.



Solar panel being tested for deficiencies in the field. Photo courtesy of BrightSpot Automation.

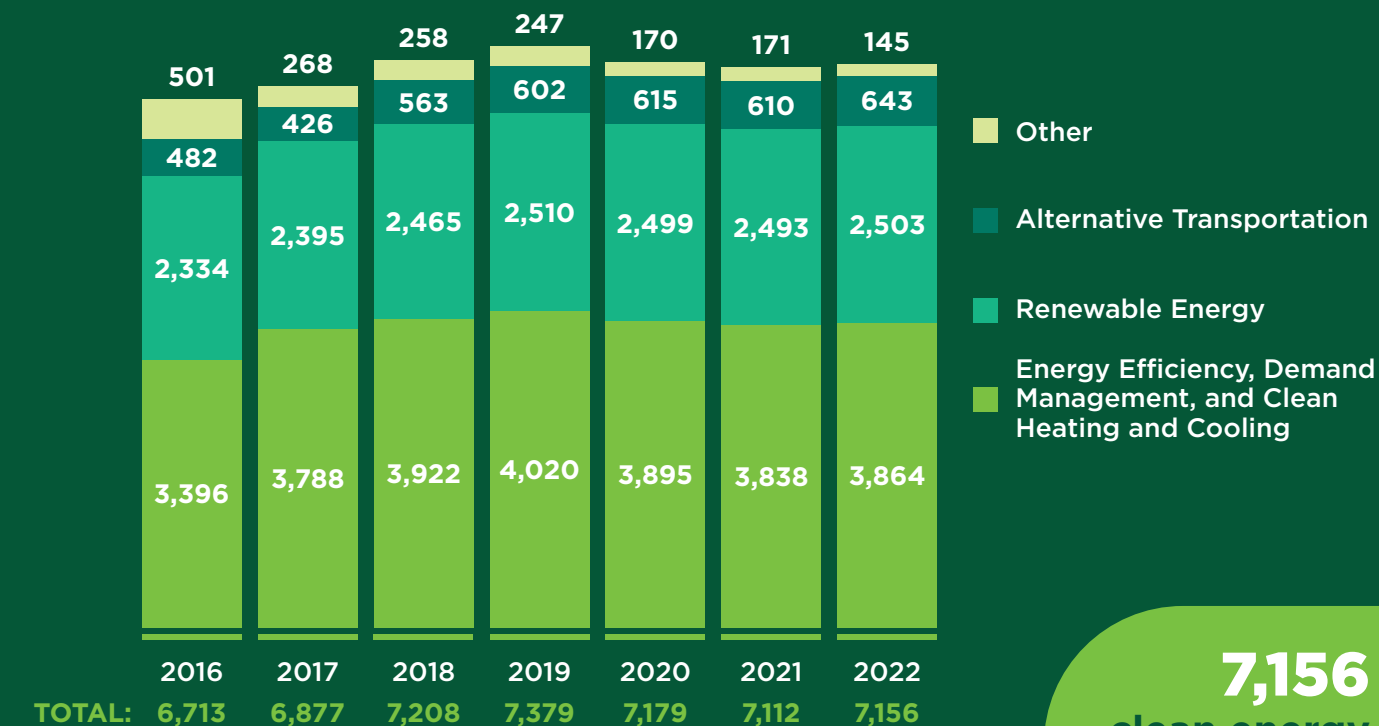
ALTERNATIVE TRANSPORTATION JOBS

The Massachusetts Electric Vehicles workforce continues to grow. Between December 2020 and December 2021, the sector added **642** jobs for a growth rate of **26%**, which is in line with the national trend of growth in Electric Vehicle jobs. MA is ranked **8th** for the total number of Electric Vehicle jobs created in the United States.



⁸ 2022 job data in this report were collected through December of 2021 and represent the net change in employment compared to December of 2020.

CLEAN ENERGY BUSINESSES



7,156
clean energy
businesses
in 2022

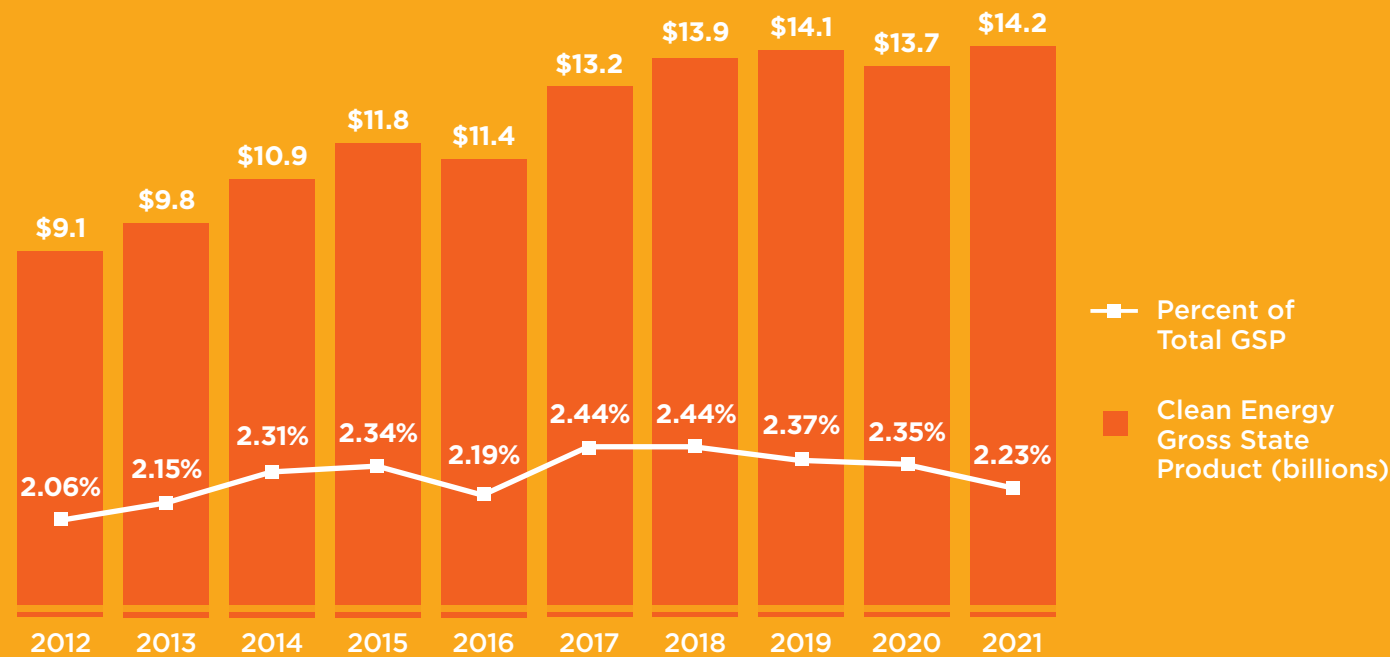
CLEAN ENERGY BUSINESSES

The overall number of clean energy businesses⁸ in Massachusetts increased slightly by **44**, relative to the year before, with the largest addition of Alternative Transportation businesses at **33**. The trend has remained the same, with the majority (**54%**) of businesses focused on Energy Efficiency, Demand Management, and Clean Heating and Cooling.

Small businesses (1 to 10 employees) account for **59%** of all clean energy firms, which is about **2%** lower than the 2021 report. Mid-size businesses (11 to 49 employees) represent **26%** of clean energy businesses.

⁸ For purposes of this report, a business is an establishment location. A clean energy business or firm with multiple locations would be counted multiple times in this analysis, based on the number of unique locations.

Solar carport and bus charging station at Vineyard Transit Authority. Photo courtesy of Enel North America.



CLEAN ENERGY GROSS STATE PRODUCT

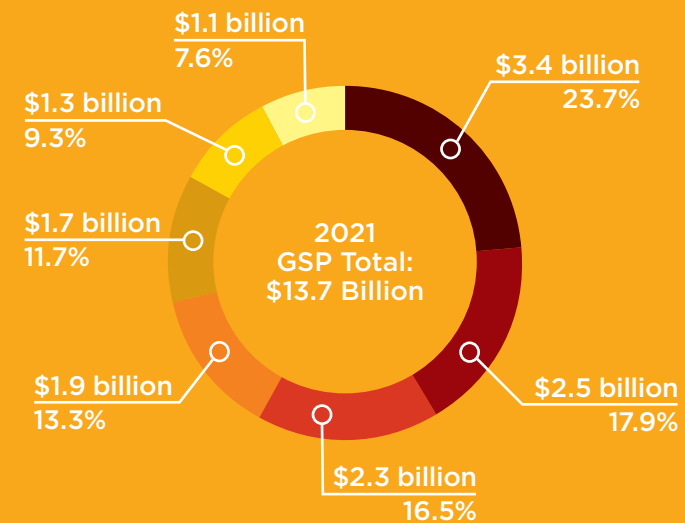
The clean energy industry contributed **\$14.2 billion**, or roughly **2.2%**, to the Commonwealth's Gross State Product (GSP) in 2021.⁹ The industry's GSP increased by **55%** from 2012-2021. This outpaces overall growth in Massachusetts GSP, which grew by **43%** over the same time period. Clean energy GSP increased by **3.7%** (over **\$500 million**) between 2020 and 2021.

⁹ 2021 data is the most recent available. The clean energy GSP was derived from survey incidence rates, proportional revenue reporting, and existing data from the Bureau of Economic Analysis, calculated by NAICS code. Utility data and state government spending were included as direct inputs.

CLEAN ENERGY GROSS STATE PRODUCT BY VALUE CHAIN

Professional Services contribution to Massachusetts clean energy GSP grew by **39%**, Engineering & Research grew by **23%**, and Installation grew by **7%** between 2020 and 2021.

The Manufacturing sector accounts for the largest contribution to clean energy GSP, at **24%** of total clean energy GSP.



- Manufacturing
- Installation & Maintenance
- Sole Proprietors
- Other Services
- Sales & Distribution
- Engineering & Research
- Professional Services



LineVision non-contact sensor installed on a transmission tower that will provide monitoring and analytics to improve the capacity, resilience, and safety of the grid. Photo courtesy of LineVision, Inc.

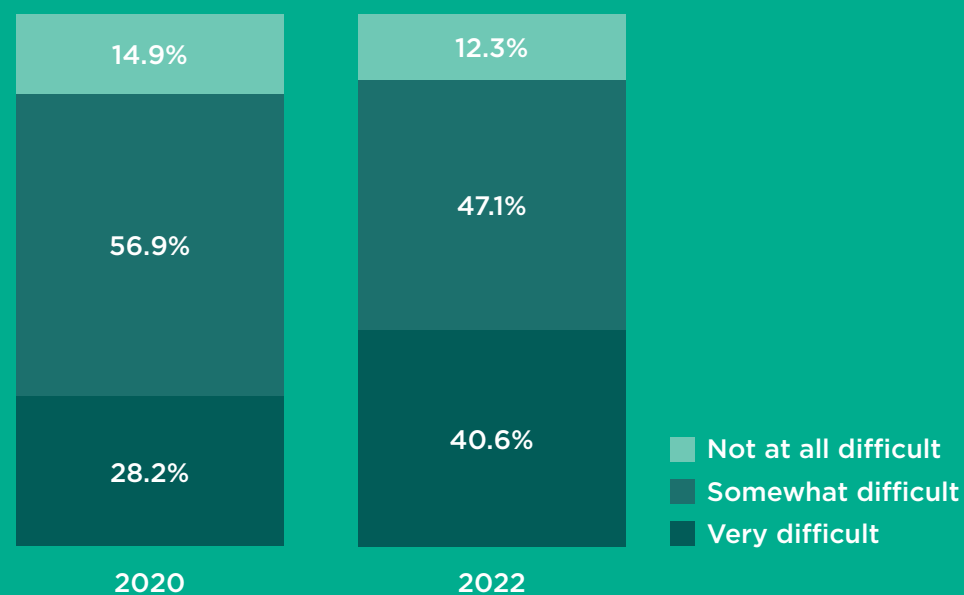


HIRING DIFFICULTY

As the clean energy industry continues to recover from the ongoing impacts of the COVID-19 pandemic, a tight labor market, supply chain constraints, and inflation create additional headwinds to industry growth.

As of December 2021, **88%** of employers reported that it was "very difficult" and "somewhat difficult" to find qualified talent, an increase from **86%** just prior to the pandemic. Additionally, the percentage of employers reporting that it was "very difficult" to find qualified talent increased to **41%**, the highest it has been in over ten years.

EMPLOYER HIRING DIFFICULTY 2020 AND 2022 REPORTS¹⁰



¹⁰Data on employer hiring difficulty from 2020 and 2022 Industry Reports are collected through December 2019 and 2021, respectively. Data collected through December 2020 is not included here because many clean energy employers were not actively hiring during that timeframe.

CLEAN ENERGY WORKER DEMOGRAPHICS¹¹

The representation of workers by demographic group as a percentage of the clean energy workforce remained roughly unchanged from the 2021 to 2022 reports.

There is still much work that needs to be done to improve equity and access to opportunity within the industry. The state is committed to supporting individuals and businesses within environmental justice communities, women- and minority-owned clean energy business enterprises, and disadvantaged populations to get education, training, and job opportunities in clean energy.

¹¹Data for age, race, ethnicity, and gender is from: <https://www.bls.gov/lau/table14full21.htm>. Due to lack of BLS data, population percentages for Asian and Two or more races categories were sourced from jobseq.com. Veteran employment is from: <https://www.bls.gov/news.release/pdf/vet.pdf> and BLS QCEW 2021 Annual Employment for Massachusetts.

	2022 Clean Energy Employment	Percent of 2022 Clean Energy Workforce	Percent of 2022 Overall MA Workforce
Male	72,492	69.5%	49.1%
Female	31,798	30.5%	50.9%
Hispanic or Latinx	16,665	16.0%	10.8%
Not Hispanic or Latinx	87,625	84.0%	89.2%
White	76,945	73.8%	80.9%
Black or African American	8,291	8.0%	9.3%
Asian	8,763	8.4%	7.2%
American Indian or Alaska Native	1,178	1.1%	0.5%
Native Hawaiian or other Pacific Islander	827	0.8%	0.2%
Two or more races	8,285	7.9%	1.9%
Veterans	9,891	9.5%	3.8%
Workers over the age of 55	14,750	14.1%	25.6%

CLEAN ENERGY INVESTMENTS

A robust innovation network is a key driver of the Massachusetts clean energy industry. Innovation support can take numerous forms, including ecosystem support, grants, and direct company investments.

Investments in Massachusetts clean energy companies can fall into three key segments:

Stage I: Research & Prototyping – Companies at the ideation, theoretical research, and prototype development stage.

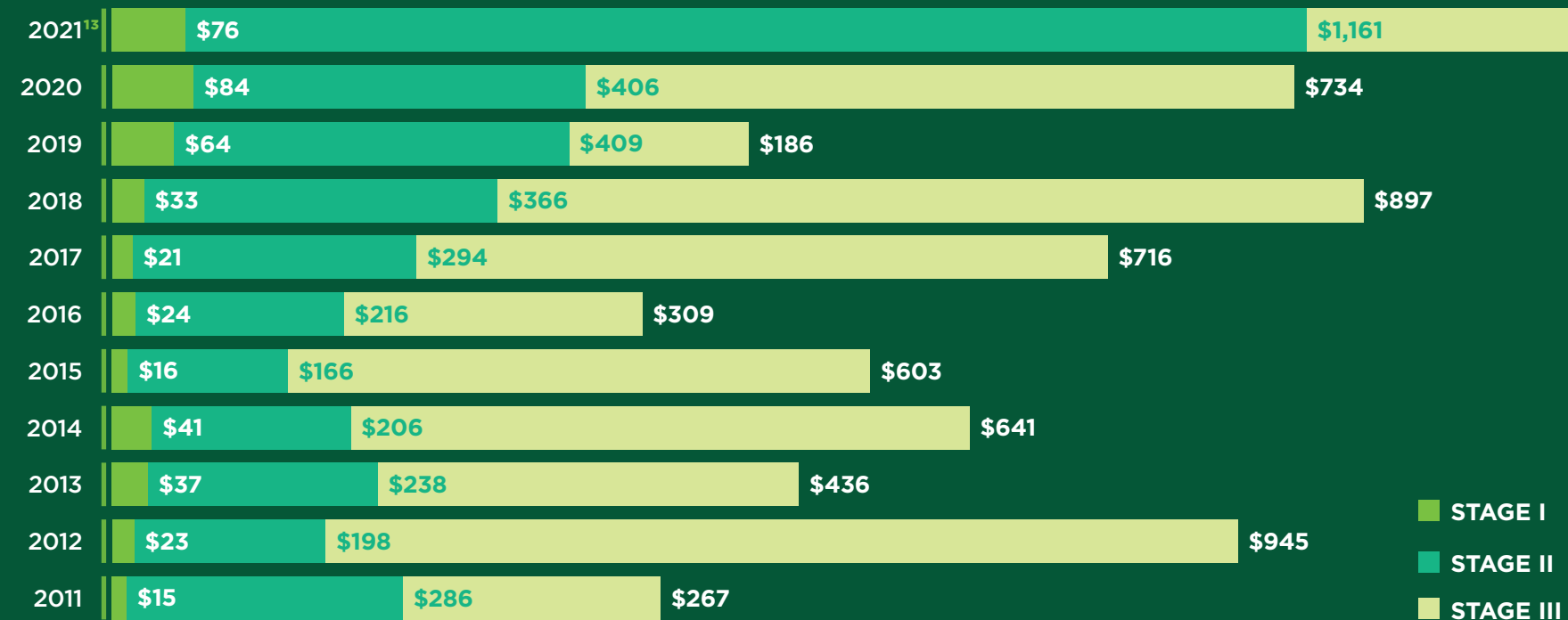
Stage II: Demonstration & Acceleration – Companies at the product testing, system evaluation, and market research stage.

Stage III: Commercialization & Growth – Companies that are expanding manufacturing capacity and identifying early-stage customers.

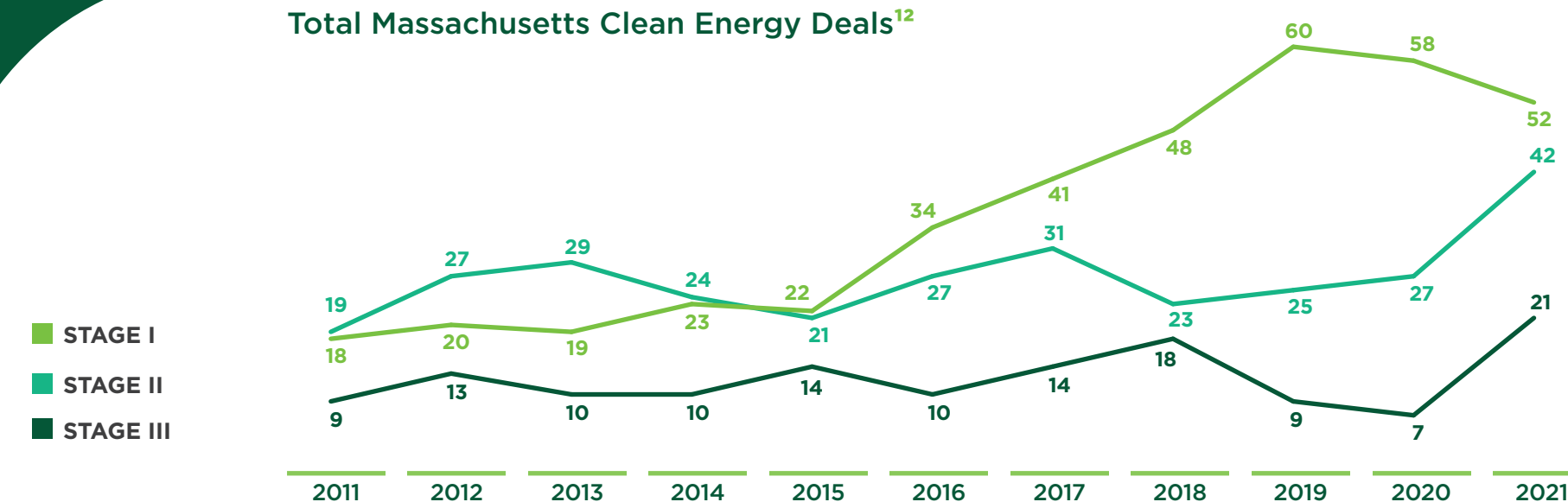


2021 ushered in decade-high investor activity for climate technology in Massachusetts. However, a closer look shows that Stage I Investments decreased by both number of deals and total investment, indicating the increase in investor activity primarily flowed to later-stage, more mature technologies.

Total Massachusetts Clean Energy Investments (millions)¹²



Total Massachusetts Clean Energy Deals¹²

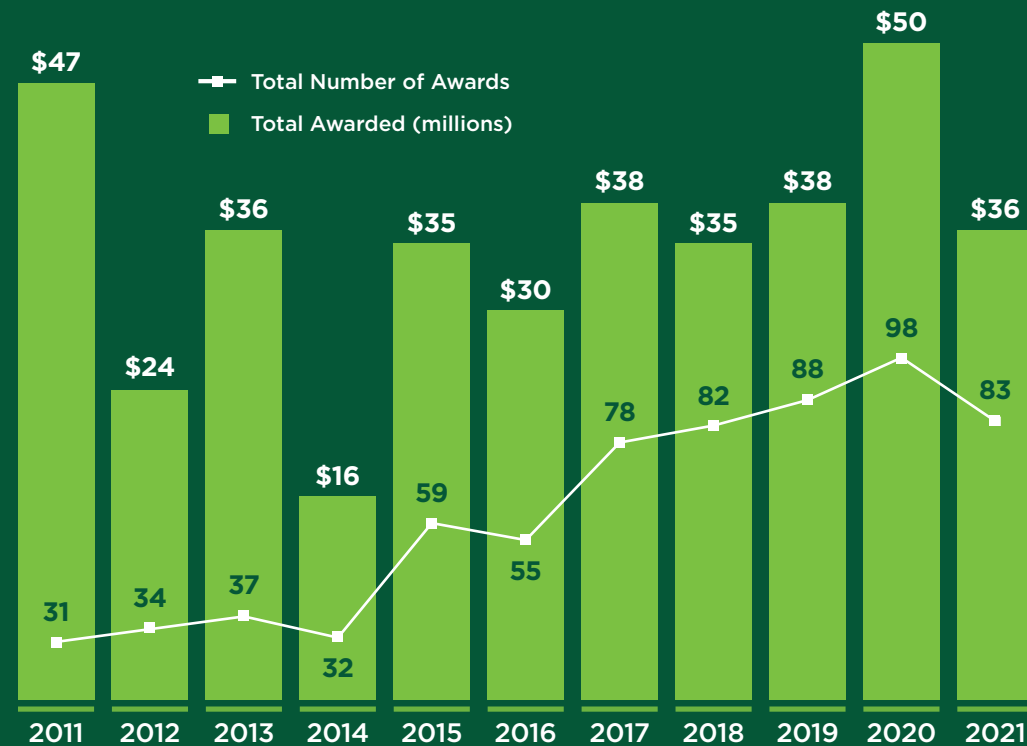


¹⁴The investments data are a compilation of data from PitchBook. Past reports have relied on a broader range of sources for investment data. This year, a change was made to source primarily from PitchBook to improve accuracy. As a result, the 2022 report may include figures about investment activity that differ from prior reports.

¹²PitchBook Data, Inc.; Data has not been reviewed by PitchBook analysts.

¹³A \$1.8 billion Series B investment in Commonwealth Fusion Systems was excluded to show more typical investments at this stage.

TOTAL MASSACHUSETTS CLEAN ENERGY INNOVATION GRANTS AND AWARDS



CLEAN ENERGY INNOVATION

Grant and award funding are critical forms of support for clean energy companies, project demonstrations, and pilots.¹⁵

¹⁵Sources include MassCEC innovation funding, ARPA-E, Office of Science, SunShot, SBIR, and STTR.



Photo courtesy of SeaTrac.

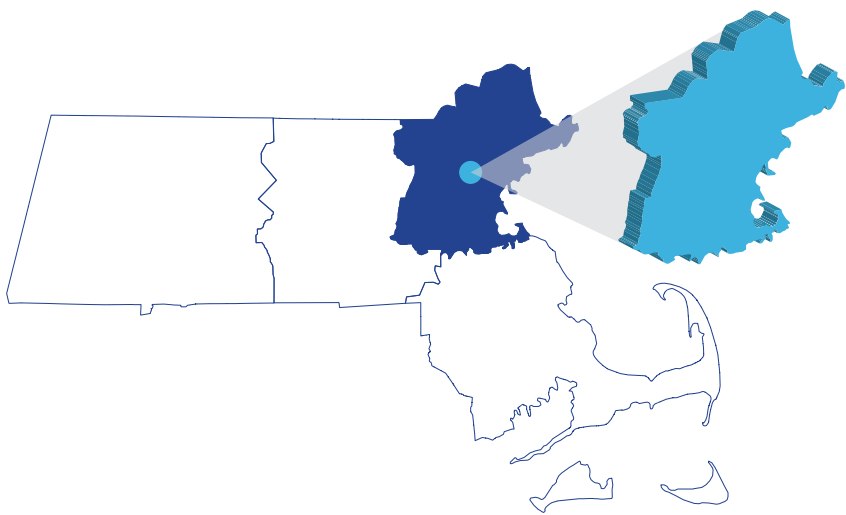
CLEAN ENERGY PATENTS

Patents across time are a helpful proxy for innovation. Clean energy patents have increased nearly **146%** since 2010, though there was an **8%** reduction in the number of patents filed between 2020 and 2021.¹⁶

TOTAL MASSACHUSETTS CLEAN ENERGY PATENTS

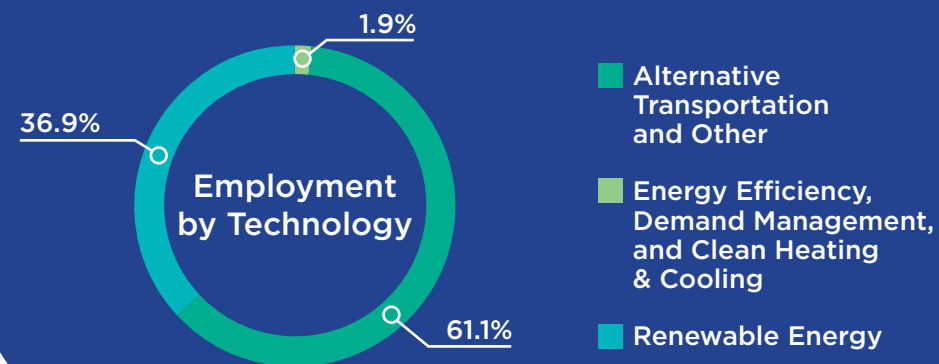
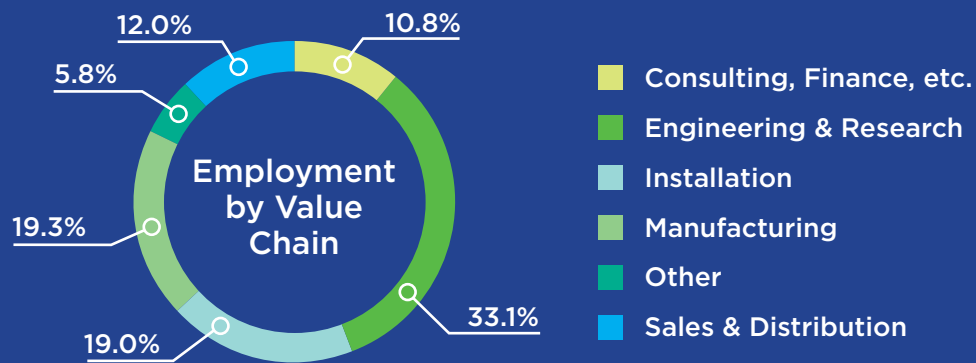


¹⁶The patents data for this report is based on data from the USPTO PatentsView Database.



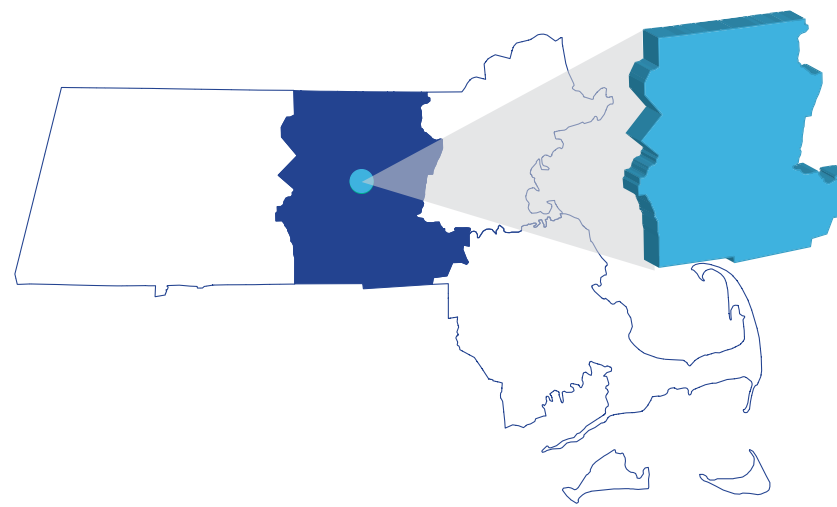
NORTHEAST REGION

The Northeast region employs **49%** of clean energy workers and is home to **46%** of clean energy businesses. About **33%** of the clean energy jobs are in Engineering & Research, and the region employs the largest relative percentage (**37%**) of Renewable Energy workers.



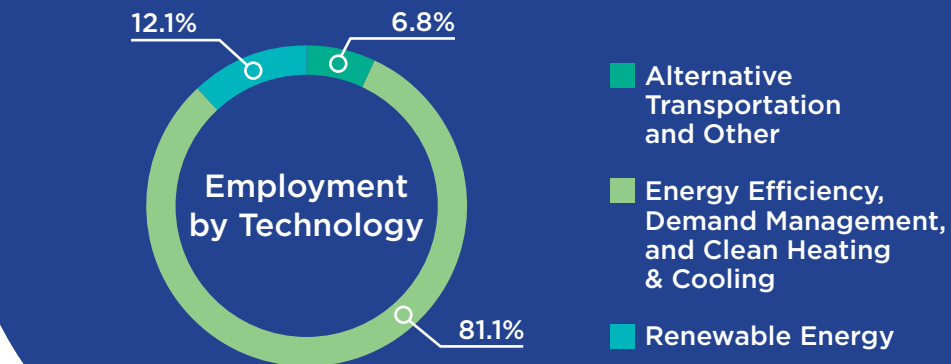
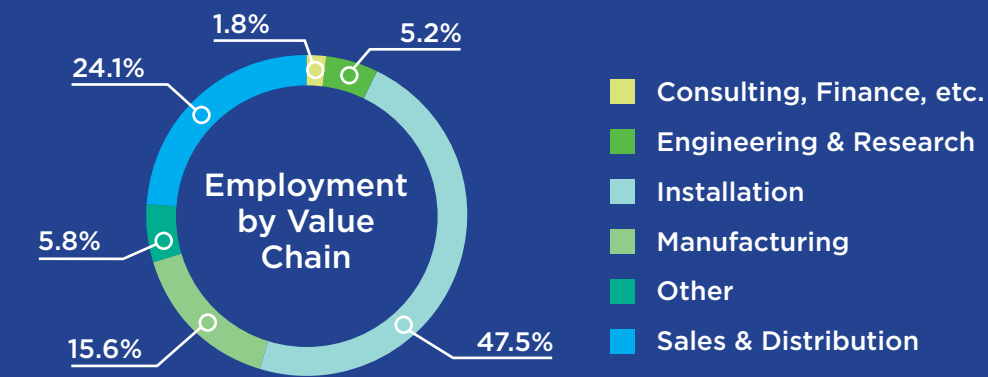
CHANGES IN NORTHEAST REGION, 2021 REPORT TO 2022 REPORT

	2021 Report	2022 Report	2021-2022 Report Change	2022 Percent of Clean Energy Total in MA	2022 Percent of Total Jobs/Businesses in Region
Employment	49,398	50,657	2.5%	48.6%	2.7%
Businesses	3,301	3,322	0.6%	46.4%	2.8%



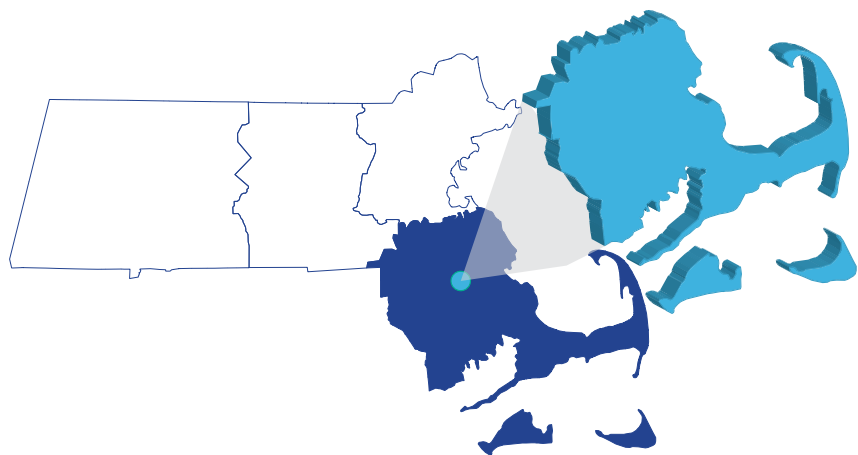
CENTRAL REGION

The Central region experienced the greatest rate of clean energy job growth, with a **5%** increase between the 2021 and 2022 reports. The region employs the largest percentage of clean energy employees and businesses relative to the total number of jobs and businesses, at **5%** and **4%**, respectively. Among all regions, the Central region has the highest percentage of its clean energy workers focused on Alternative Transportation, at **7%**, and Installation jobs, at **48%**.



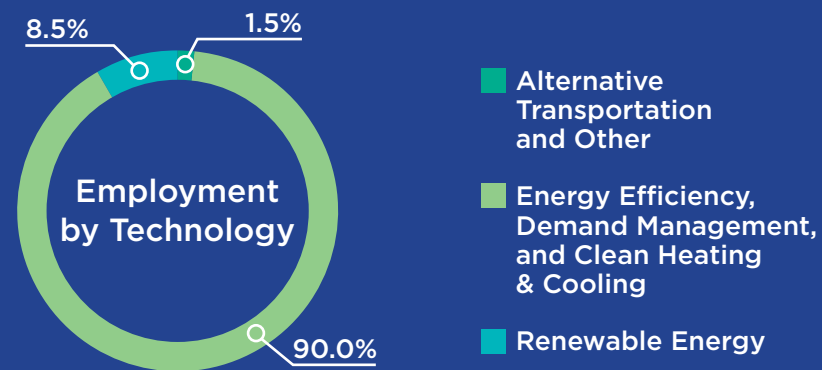
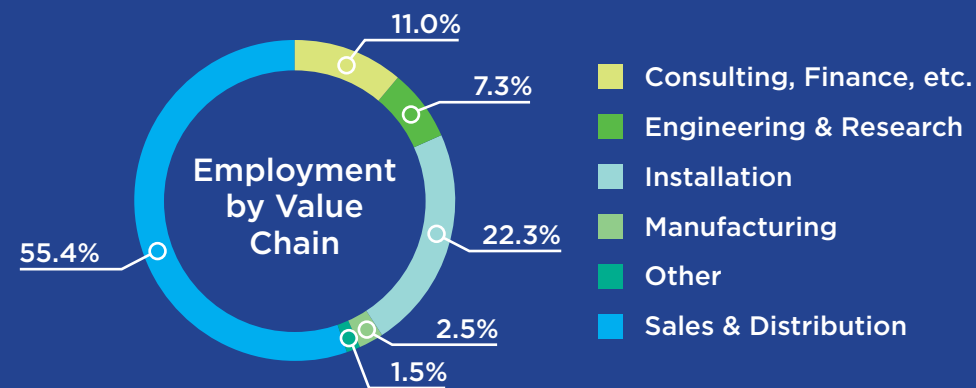
CHANGES IN CENTRAL REGION, 2021 REPORT TO 2022 REPORT

	2021 Report	2022 Report	2021-2022 Report Change	2022 Percent of Clean Energy Total in MA	2022 Percent of Total Jobs/Businesses in Region
Employment	16,370	17,257	5.4%	16.5%	5.1%
Businesses	1,099	1,105	0.5%	15.4%	4.2%



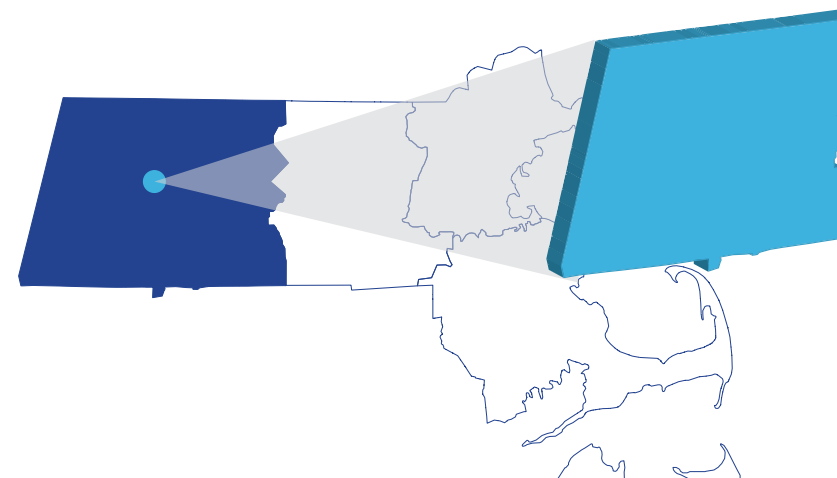
SOUTHEAST REGION

The Southeast region has **55%** of its clean energy jobs in Sales & Distribution and **90%** focused on Energy Efficiency, Demand Management, and Clean Heating and Cooling. The Southeast region saw the largest increase in clean energy businesses (**0.8%**) between the 2021 and 2022 reports.



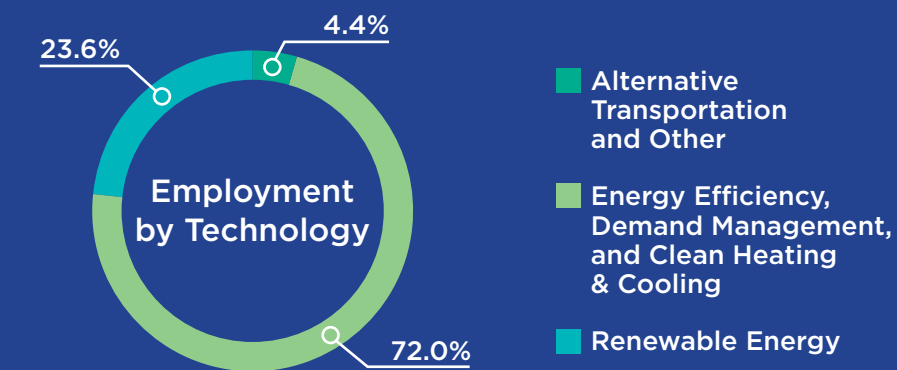
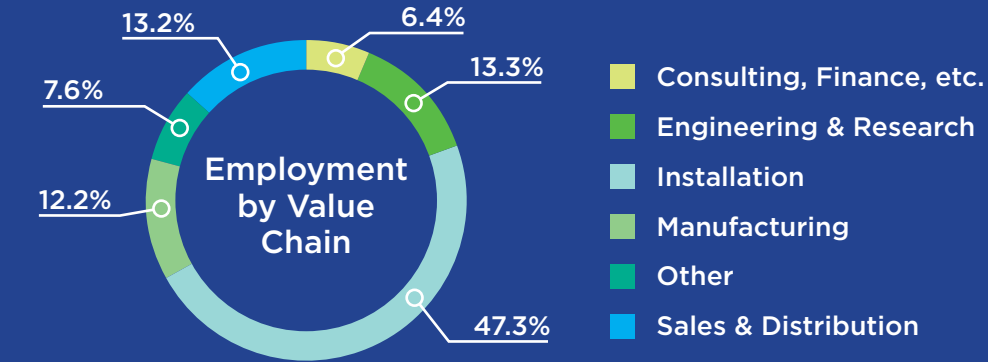
CHANGES IN SOUTHEAST REGION, 2021 REPORT TO 2022 REPORT

	2021 Report	2022 Report	2021-2022 Report Change	2022 Percent of Clean Energy Total in MA	2022 Percent of Total Jobs/Businesses in Region
Employment	23,318	24,031	3.1%	23%	2.9%
Businesses	1,675	1,689	0.8%	23.6%	2.3%



WESTERN REGION

The Western region has **47%** of its clean energy jobs in Installation and **72%** focused on Energy Efficiency, Demand Management, and Clean Heating and Cooling. The region employs the second largest percentage of clean energy employees and businesses relative to the total number of jobs and businesses, at **4%** and **3%**, respectively.



CHANGES IN WESTERN REGION, 2021 REPORT TO 2022 REPORT

	2021 Report	2022 Report	2021-2022 Report Change	2022 Percent of Clean Energy Total in MA	2022 Percent of Total Jobs/Businesses in Region
Employment	12,122	12,346	1.8%	11.8%	3.6%
Businesses	1,036	1,040	0.4%	14.5%	3.3%

METHODOLOGY

The Massachusetts 2022 Clean Energy Industry Report uses publicly available data from the 2022 U.S. Energy and Employment Report (USEER)¹⁷ on Massachusetts energy employment produced by BW Research Partnership on behalf of the Department of Energy (DOE). These public data are refined and customized for Massachusetts based on additional analyses conducted on behalf of the Massachusetts Clean Energy Center by BW Research Partnership.

The 2022 USEER survey in Massachusetts was administered by telephone, with approximately 24,600 outbound calls within the state, and web, with nearly 13,000 emails sent to potential participants in Massachusetts. In total, 1,277 business establishments in Massachusetts participated in the survey effort, with 429 providing full responses to the survey. These responses were used to develop incidence rates among industries and apportion employment across various industry categories in ways currently not provided by state and federal labor market information agencies. The margin of error is +/- 4.72% at a 95% confidence level.

See the full Expanded Methodology for more details on the 2022 Massachusetts Clean Energy Industry Report.¹⁸



Staff verifies tolerances on a lamination system used to create lightweight composite panels for fuel-efficient transportation. Photo courtesy of Multiscale Systems, Inc.

¹⁷ The full 2022 USEER report can be found at: <https://www.energy.gov/policy/us-energy-employment-jobs-report-useer>.

¹⁸ The 2022 Clean Energy Industry Report Expanded Methodology can be found at: <https://bit.ly/2022Methodology>.

GLOSSARY

Activity

For the purposes of this report, an establishment's activity refers to the primary value chain industry to which it most associates its work. Activities include research, development, and engineering; manufacturing, sales, and distribution; installation and maintenance; legal, finance, and other professional services; and other.

Advanced and Recycled Building Materials

Includes doors, windows, air sealing, floor, wall, or piping insulation, and any additional building envelope materials that represent advances in efficiency over traditional materials.

Clean Energy

Clean Energy is defined as any technology that either reduces or eliminates greenhouse gas emissions from the generation, distribution, and consumption of electricity and fuels. The major sectors of the clean energy industry include Renewable Energy Generation; Energy Efficiency, Demand Management, and Clean Heating and Cooling; and Alternative Transportation.

Clean Energy Business or Establishment

For the purposes of this report, a clean energy business or establishment is a business location in Massachusetts with at least one employee involved with an activity related to the clean energy industry.

Clean Energy Industry

The aggregate of establishments that are 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, and/or Electric or Hybrid Vehicles.

Clean, High Efficiency, and ENERGY STAR Heating and Cooling

Includes the following:

ENERGY STAR/High AFUE HVAC

HVAC that meets the international ENERGY STAR standard for energy efficient consumer products originated in the United States or has high Average Fuel Utilization Efficiency (AFUE) rating of 90 or greater or 15 SEER or greater.

Renewable Heating and Cooling

Refers to establishments that are involved with heating, ventilation, and air conditioning (HVAC) and water heating from renewable energy sources or work that increases the energy efficiency of HVAC systems.

Clean Energy Worker

Full-time and part-time permanent employees who support the clean energy portion of the business, including administrative staff and excluding interns and other temporary workers.

Combined Heat and Power (CHP)

Generates electricity and useful thermal energy in a single, integrated system. Heat that is normally wasted in conventional power generation is recovered as useful energy.

Electric Vehicles

A vehicle that uses one or more electric motors for propulsion with no onboard generator or non-electric motor.

ENERGY STAR Appliances

Appliances that meet the international ENERGY STAR standard for energy efficient consumer products originated in the United States.

Energy Storage

Includes the following:

Pumped Hydro Storage

Hydroelectric energy storage used by electric power systems for load balancing. The method stores energy in the form of gravitational potential energy of water, pumped from a lower elevation reservoir to a higher elevation.

Battery Storage

A cell or connected group of cells used to convert chemical energy into electrical energy by reversible chemical reactions and may be recharged by passing a current through it in the direction opposite to that of its discharge.

Mechanical Storage

Includes technologies like flywheels and compressed air, which use kinetic or gravitational forces to store energy.

Thermal Storage

Temporary storage of energy for later use when heating or cooling is needed.

Firm

A business organization, such as a corporation, company, or partnership. A firm can have multiple establishment locations.

Gross State Product (GSP)

Gross State Product is a measurement of a state's output. It is the sum of value added from all industries in the state. In this report, clean energy is captured as a portion of the total Gross State Product.

LED, CFL, and Other Efficient Lighting

Energy-efficient lighting sources.

Micro Grids

A group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid.

Other Alternative Transportation

Includes jobs in transportation technologies, such as biodiesel for on-road vehicles.

Other Biofuels

Other fuel derived directly from living matter.

Other Energy Efficiency

Includes variable speed pumps; other design services not specific to a detailed technology; software not specific to a detailed technology, energy auditing, rating, monitoring, metering, and leak detection; policy and nonprofit work not specific to a detailed technology; consulting not specific to a detailed technology, LEED certification, or phase-change material; and all other activities not specific to a detailed technology.

Other Grid

This sub-technology includes all other clean grid activity, where employers were unable to assign work to a single sub-technology. This includes firms that conduct clean grid activity across multiple sub-technologies.

Other Grid Modernization

Other modernization of the nation's electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure that can meet future demand growth.

GLOSSARY

Other Renewable Energy

Includes geothermal, bioenergy or biomass, low-impact hydro, and other electric power generation detailed technologies that are not defined by the categories presented or cannot be assigned to a single category.

Other Sector

Consists of all jobs that could not be classified into one specific clean energy technology sector because the work overlaps with multiple categories. An example of this could be greenhouse gas management or accounting.

Other Services

Includes categories like business organizations, utilities, nonprofits, and select government organizations that are directly involved in clean energy.

Reduced Water Consumption Products and Appliances

Includes technologies such as high-efficiency washing machines, faucet aerators, and low-flow shower heads.

Smart Grid

An electricity supply network that uses digital communications technology to detect and react to local changes in usage.

Solar

Technologies that generate electric power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect.

Sub-Technology

For the purposes of this report, sub-technology refers to the specific technologies with which an establishment works within each technology area. The sub-technologies for Energy Efficiency and Renewable Energy are listed under the respective definitions.

Technology

For the purposes of this report, technology refers to the primary application or end use of an establishment's produced goods or services.

Value Chain Segments

Include the following:

Engineering & Research

Engineering & Research includes all engineering and scientific research firms engaged in clean energy project and technology development.

Installation

Installation is comprised of firms engaged in residential, commercial, and industrial building construction, contracting, electrical, insulation and weatherization, or plumbing and heating, air conditioning, and ventilation work.

Manufacturing

Refers to heating and air conditioning equipment manufacturing, engine and compressor manufacturing, semiconductor manufacturing, and energy efficient product, appliance, or lighting manufacturing, as well as motor vehicle and parts manufacturing and solar panel and wind assembly.

Professional Services

Any sort of financial, legal, architectural, mathematical, or scientific services that support clean energy technology development and deployment.

Sales & Distribution

Sales & Distribution includes mostly wholesale trade as well as some warehousing and distribution activity. For clean energy, this value chain category includes motor vehicle and parts wholesalers, electrical equipment and household appliance wholesalers, plumbing and heating equipment and supplies wholesalers, and other wholesale related to clean energy products, component parts, and technologies.

Utilities, Nonprofits, and Other

This segment is largely comprised of automotive repair and maintenance but also includes organizational and non-profit work, such as environmental and conservation organizations, business associations, and advocacy organizations, as well as electric power generation and distribution utilities..

Wind

Technologies that convert the wind's kinetic energy into electrical power.

Woody Biomass

Fuel developed from the by-product of management, restoration, and hazardous fuel reduction treatments, as well as the product of natural disasters, including trees and woody plants (limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or rangeland environment).

High performance building under construction.
Photo courtesy of Haycon.

Back cover image: Solar, storage, and electric vehicle charging stations installed at UMass Boston. Photo courtesy of Enel North America.





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