MAINE GOVERNOR'S
Energy Office

2024 Maine Clean Energy Industry Report

Produced for the State of Maine Governor's Energy Office

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[bw] RESEARCH PARTNERSHIP

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Executive Summary

The clean energy sector is a high growth sector of Maine's economy, growing faster than the state's overall economy and faster than any other New England state's clean energy economy. There were close to 15,600 clean energy workers in the state of Maine in 2023, representing 2.4 percent of the entire state's workforce. Between 2022 and 2023, the clean energy economy added more than 500 jobs, and by the end of 2023, it represented 3.2 percent of Maine's total economic output, up from 2.7 percent in 2022. Not only is the clean energy economy growing, but it is outpacing Maine's overall economy; while employment in the overall economy grew by 1.7 percent from 2022 to 2023, the clean energy workforce grew by 3.6 percent. Within New England, Maine's clean energy workforce has grown the fastest since 2019.[1]

The clean energy sector is a high growth sector of Maine's economy, growing faster than the state's overall economy and faster than any other New England state's clean energy economy.

The employment analysis presented in this report is based upon the data collected in the annual United States Energy and Employment Report (USEER) in the third and fourth quarters of 2023, along with historical data starting from the 2019 USEER. The report also includes analyses of clean energy contributions to Gross State Product (GSP) using USEER data and the state's clean energy patent data.[2] Since the employment data presented in this report is for 2023 and earlier, the economic effects of the state's clean energy policies and incentives implemented or announced in late 2023 and 2024 are not showcased in this report.

Maine has announced several significant clean energy policies and investments over the past year that will continue to support a leading clean energy economy. Announced in early 2023, Governor Janet Mills has accelerated Maine's commitment to clean energy, establishing a new goal of 100 percent clean electricity by 2040.[3] This bold new goal complements those already established in recent years with the support of the Maine Legislature. This includes 275,000 heat pumps installed by 2027; 80 percent of

[1] All comparisons are with respect to Maine's clean energy definition, which includes employment in Electric Power Distribution (NAICS 221122) and excludes natural gas vehicle jobs. Details on Maine's clean energy definition can be found in Appendix A: Maine Clean Energy Technology List.

[2] Data on patents and investment deals were gathered from the U.S. Patent & Trademark Office.

[3] "Maine Energy Plan: Pathway to 2040," *State of Maine Governor's Energy Office,* https://www.maine.gov/energy/studies-reports-working-groups/current-studies-working-groups/energyplan2040.

electricity delivered in the state from renewable sources by 2030 (Maine's Renewable Portfolio Standard, or RPS); 750 megawatts of distributed generation; 400 megawatts of energy storage capacity by 2030; 30,000 clean energy jobs by 2030; 3,000 megawatts of offshore wind installed by 2040; and 30 percent reduction in oil consumption from 2007 levels by 2030 and at least 50 percent reduction by 2050.[4] These policy goals and commitments can help reduce energy price volatility, stabilize costs in the long-run, and ensure that today's energy investments are made with an eye toward the future.

The clean energy economy grew nationwide in 2023 due to continued investment in the industry through the federal government's Inflation Reduction Act (IRA) and Bipartisan Infrastructure Law (BIL), along with new and expanded state initiatives. The state received nearly $800 million in energy infrastructure investment through the IRA and BIL, including over $220 million for a cutting-edge multi-day energy storage system and new technologies for enhanced grid stability and transmission capacity. The state received an additional over $150 million solar and energy storage access, residential and commercial energy efficiency measures, and other energy infrastructure planning and workforce development. While some impact from uncertainty over federal energy policy and priorities may be observed in the coming years, the state's numerous financial awards, commitments to clean energy, and strong policy and incentive environment are expected to continue to fuel job growth.

Key findings on Maine's clean energy economy include:

1 **The clean energy economy contributed nearly $3 billion[5] to Maine's total GSP in 2023, representing 3.2 percent of the state's total GSP.**

Clean energy GSP grew by 20 percent in Maine from last year, a rate nearly triple that of the overall state GSP growth (7.2 percent). A rise in GSP is a leading indicator of business and employment growth. The public or private utilities value chain was the largest contributor to the state's clean energy GSP, at $1.3 billion, followed by professional and business services, at $635 million.

2 **Maine had the highest rate of clean energy employment growth over the past five years of any New England state.**

Since 2019, Maine has added more than 900 clean energy jobs, a growth rate of more than 6 percent, more than double that of the state's overall workforce. Over one-third of clean energy jobs created in Maine during this period are in the renewable electric power generation sector, which grew nearly four times faster in Maine than it did nationally during this time.

3 **Energy efficiency is the largest sector within Maine's clean energy economy, employing nearly 60 percent of clean energy workers.**

The sector has grown by 3.7 percent since 2022. While this is not a faster rate than all other technology segments, energy efficiency added the greatest number of workers (nearly 360)

[4] https://www.maine.gov/energy/sites/maine.gov.energy/files/2025-01/Maine%20Energy%20Plan%20January%202025.pdf
[5] $2,878,649,532

compared to the other technologies. Over 3,700, or 40 percent, of these workers are involved with high efficiency HVAC and renewable heating and cooling in 2023, including heat pumps.

4 **The alternative transportation technology sector has grown by the fastest rate since 2019 when compared to other sectors, while the renewable electric power generation sector added the most jobs.**

The alternative transportation sector has grown by 30 percent in the last five years, adding 206 jobs. The renewable electric power generation has grown by 12 percent during this period, adding 338 jobs.

5 **Approximately half of the clean energy workforce is in the construction value chain segment, which accounted for more than 7,600 jobs in 2023.**

This segment saw the largest number of jobs added, gaining over 300 jobs from 2022 to 2023 and growing by more than four percent.

6 **Approximately 2,600 business establishments in Maine are involved in clean energy activities, representing 4.3 percent of all establishments in the state.**

Over three-in-five (62 percent) of these establishments are in energy efficiency, with over 1,600 total establishments. The clean energy economy added 84 establishments since 2022, representing a 3.4 percent increase.

7 **Somerset County has the highest concentration of clean energy jobs in its workforce among Maine counties while Cumberland County has the largest number of clean energy jobs overall.**

Clean energy jobs in Somerset County represent five percent of total jobs in its overall workforce, the largest concentration among all counties in the state. The largest number of clean energy jobs in Maine is found in Cumberland County at 4,800, which also has the most jobs in the overall workforce.

Introduction

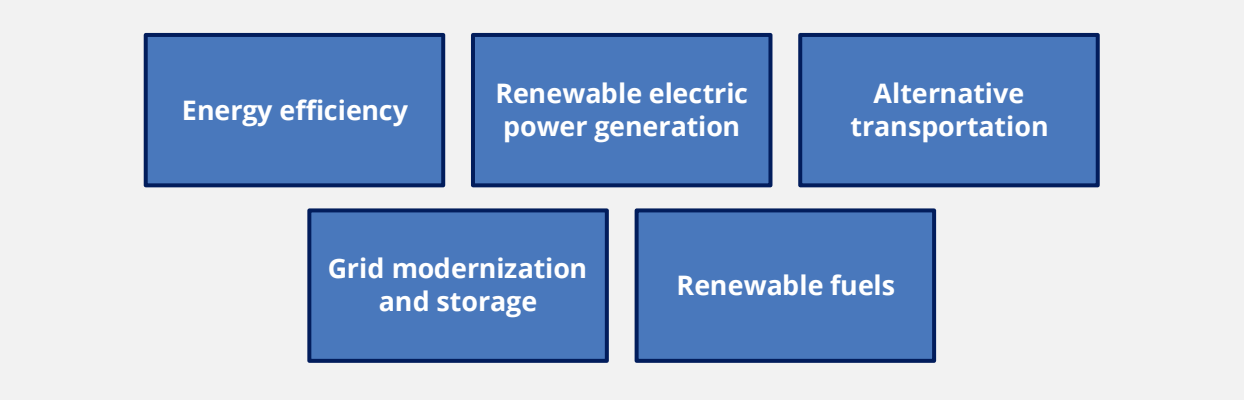
The 2024 Maine Clean Energy Industry Report, commissioned by the Maine Governor's Energy Office (GEO), updates and builds upon last year's analysis of the clean energy economy in the state. This publication aims to provide policymakers with insights into challenges and opportunities within Maine's clean energy industry, allowing them to make informed decisions in clean energy that impact the state's residents, workforce, and economy. One-year trends are particularly important for highlighting temporary factors like economic shocks or sudden policy changes, while long-term analysis shows the effects of structural changes in an economy and stability in specific industries, which helps to distinguish between cyclical and structural changes in the economy and shows the effects of long-term policy. As an example, the contributions of private and public investment into the state's GSP do not yield immediate effects on the workforce but suggest continued employment growth in the years following investment.

Clean energy jobs are defined as workers who spend part or all of their time engaged with specific clean energy technologies. This includes research, development, production, manufacture, distribution, sales, implementation, installation, or repair of clean energy components, goods, or services. Clean energy technologies are grouped across five technology sectors: Clean Energy Generation; Clean Grid and Storage; Energy Efficiency; Clean Fuels; and Alternative Transportation. This report identifies the strongest clean energy technologies and sectors in the state, along with areas in which the state can be more competitive.

Clean Energy Jobs

This report begins with a discussion of the clean energy industry's five major technology sectors: energy efficiency, renewable electric power generation, alternative transportation, grid modernization and storage, and renewable fuels (Figure 1). The major technologies and their sub-technologies are also discussed throughout the report. Additionally, clean energy jobs are discussed in relation to the value chain segments of installation, manufacturing, professional service, sales, and utility industries.

Figure 1. Maine Clean Energy Sectors



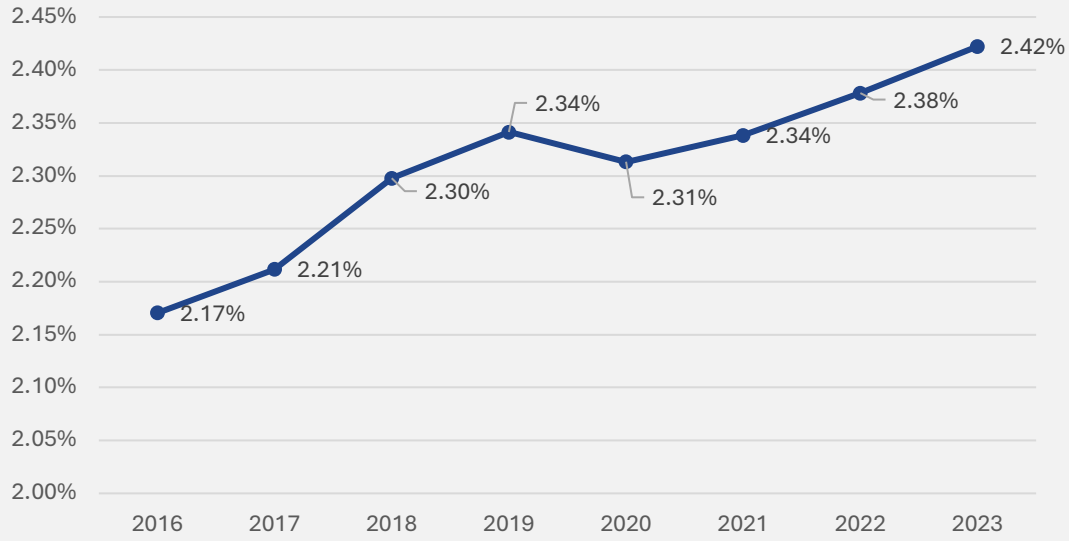
The clean energy jobs data in this report is sourced from the U.S. Department of Energy's annual U.S. Energy & Employment Jobs Report (USEER), a national energy jobs study, which considers only direct employment in the energy sector. This study classifies a job as an 'energy job' based on whether a worker is involved in qualifying energy activities while employed, either part of or all the time.[6] Energy jobs that are included in the clean energy industry are defined based on whether the workers spend part or all their time engaged with specific clean energy technologies. In Maine, the energy technologies defined as clean, and for which clean energy employment is discussed in this report, are laid out in Appendix A: Maine Clean Energy Technology List. This definition of clean energy is unique to Maine.[7]

The share of clean energy workers in Maine's labor force continues increasing year after year, barring a drop from 2019 to 2020 when overall employment in Maine dropped. In 2016 and 2017, clean energy employment made up 2.2 percent of the state's entire workforce, and this share rose to 2.4 percent in 2022 and 2023 (Figure 2). While slow, this sustained growth showcases the increasing importance of clean energy in the state's workforce and economy.

[6] More information about USEER methodology and how jobs are counted as energy jobs in the report can be found in Appendix B of the 2024 USEER published by the United States Department of Energy. https://www.energy.gov/policy/us-energy-employment-jobs-report-useer#:~:text=The%202022%20USEER%20analysis%20shows,in%20the%20same%20time%20period

[7] For example, electric transmission and distribution workers (this includes workers in NAICS 22112 Electric Power Transmission, Control, and Distribution) are included in Maine's clean energy definition and are classified under the grid modernization and energy storage technology sector due to their crucial role in bringing renewable electric power generation online and their heavy involvement grid modernization activities. In comparison, Massachusetts classifies these workers separately from other grid modernization activities within their clean energy definition and reports. Unless otherwise noted, all state and national comparison figures within this report apply the Maine definition of clean energy to ensure accurate comparison.

Figure 2. Share of Clean Energy Employment Among Total State Employment, 2016-2023



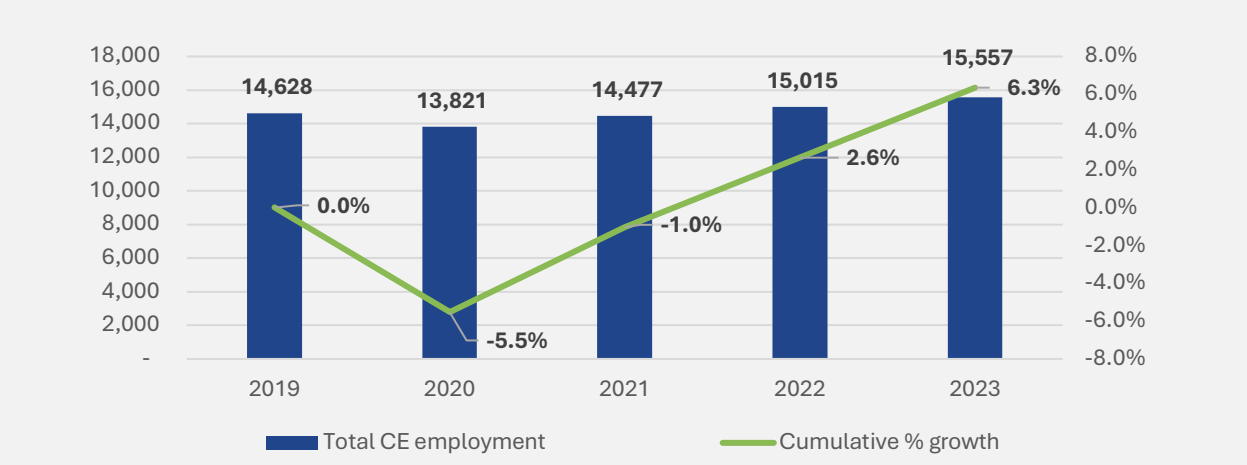
Clean Energy Industry Overview

Total Clean Energy Employment

Over the last five years, clean energy employment in Maine has increased by 6.3 percent, or more than 900 jobs. The clean energy jobs have also continuously increased each year since dipping in 2020. After surpassing its 2019 height in 2022, Maine's clean energy industry reached nearly 15,600 workers by the end of 2023. From 2022 to 2023, the job growth in this sector represented a 3.6 percent increase (Figure 3), outpacing Maine's total economy which rose by 1.7 percent.[8] Over the same period, the national clean energy industry experienced a 5.3 percent employment growth.

Over the last five years, Maine has experienced the highest growth rate of clean energy employment (6.3 percent) among all New England states, outpacing Connecticut with the second highest rate, by 1.6 percentage points. When looking at the Northeast region of the U.S., Maine's clean energy sector is comparable in growth to New Jersey, which grew by 7.0 percent between 2019 and 2023, but lags slightly behind Pennsylvania (7.9 percent growth) and New York (8.0 percent growth).[9]

Figure 3.Clean Energy Employment in Maine, 2019-2023



[8] *Quarterly and Annual Industry Employment and Wages*. Center for Workforce Research and Information. Maine Department of Labor. https://www.maine.gov/labor/cwri/qcew1.html

[9] National and state comparisons in this section are with respect to Maine's clean energy definition, which includes employment in Electric Power Distribution (NAICS 221122) and excludes natural gas vehicle jobs. Details on Maine's clean energy definition will be included in the 2024 CEIR.

The largest clean energy technology sector in Maine's clean energy economy is energy efficiency, employing almost three-in-five (58 percent) of clean energy workers, similar to the share in last year's report. The next greatest is renewable electric power generation, representing 20 percent of the state's clean energy sector, followed by grid modernization and energy storage at 11 percent. Renewable fuels and alternative transportation make up 5.7 percent of employment each (Figure 4).

The largest clean energy technology sector in Maine's clean energy economy is energy efficiency, employing almost 58% of clean energy workers.

Since 2019, alternative transportation employment has grown by 30 percent, the largest growth rate of Maine's clean energy technology sectors, gaining 206 workers. In terms of job quantity, renewable electric power generation added the largest number of workers (338) to the clean energy economy, growing by 12 percent. The renewable fuels sector experienced the smallest growth during this time frame, growing by less than a full percentage point (Figure 4).

From 2022 to 2023, grid modernization and energy storage grew by the largest rate of 5.9 percent, adding almost 100 jobs. Energy efficiency grew by 3.7 percent, employing close to 8,700 workers in 2022 to over 9,000 workers by the end of 2023. Renewable fuels was the only major technology sector to have a decline in employment, losing around 20 jobs over this period (Figure 4).

Approximately 2,600 establishments in Maine were involved in clean energy-related activities by the end of 2023, representing 4.3 percent of all establishments in the state.[10] Following a similar trend to employment, energy efficiency makes up the greatest share (62 percent) of clean energy establishments in Maine. The second largest technology sector of Maine's clean energy establishments is renewable electric power generation, comprising 21 percent, followed by renewable fuels (6.0 percent) (Figure 5).

Alternative transportation and grid modernization & energy storage establishments account for 5.4 and 5.2 percent of clean energy firms, respectively (Figure 5).

Since last year's report, 84 additional establishments have been added to the clean energy economy (Figure 5).[11] The energy efficiency sector added the most to the economy, gaining 54 establishments. This was followed by renewable electric power generation with an additional 22 establishments, and the remaining technology sectors seeing smaller gains.

[10] Total establishments in Maine, Q42023, are sourced from: *Quarterly and Annual Industry Employment and Wages.* Center for Workforce Research and Information. Maine Department of Labor. https://www.maine.gov/labor/cwri/qcew1.html.
[11] Business establishments represent unique business locations. New or added establishments result from existing businesses opening new locations and/or new businesses opening with one or more locations.

Figure 4. Clean Energy Employment in Maine by Technology Sector, 2019-2023

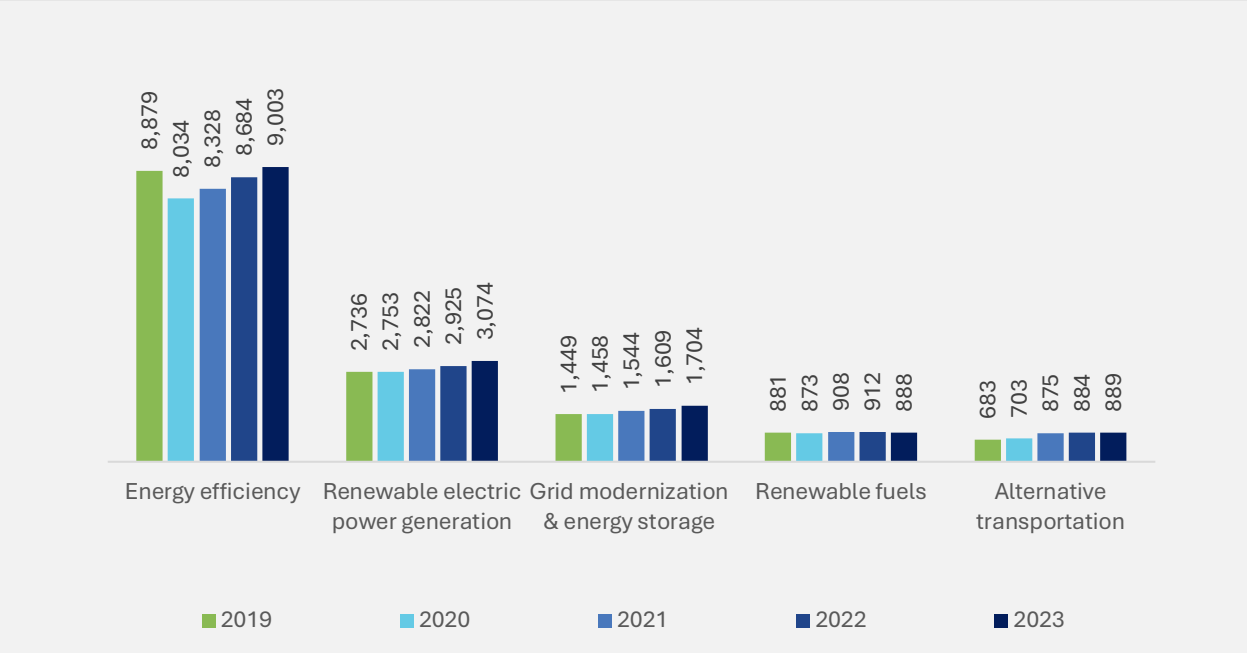
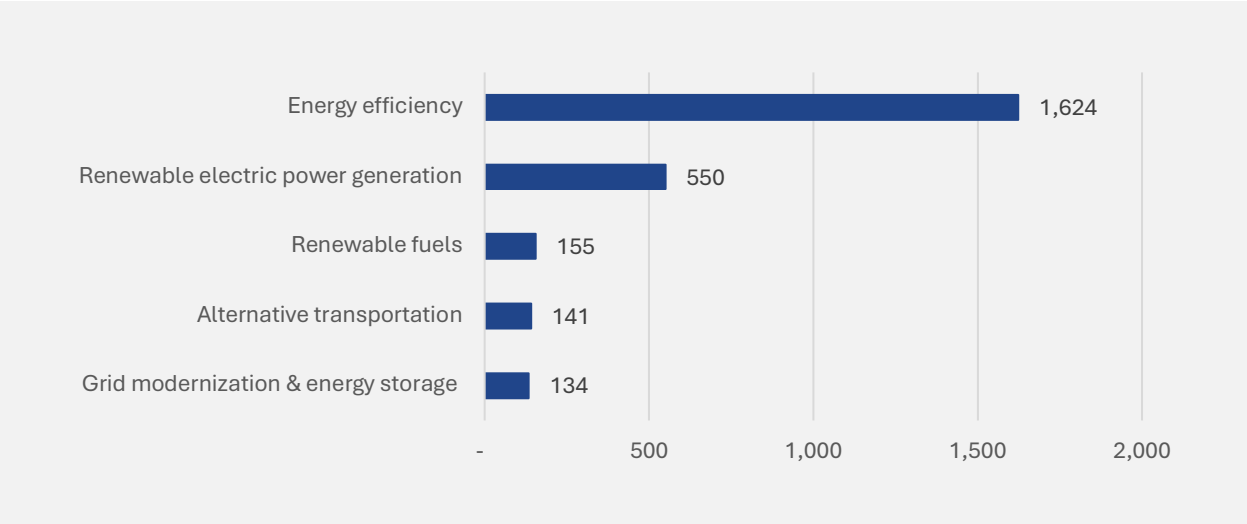


Figure 5. Clean Energy Establishments in Maine by Technology Sector, 2023



Clean Energy Value Chain Employment

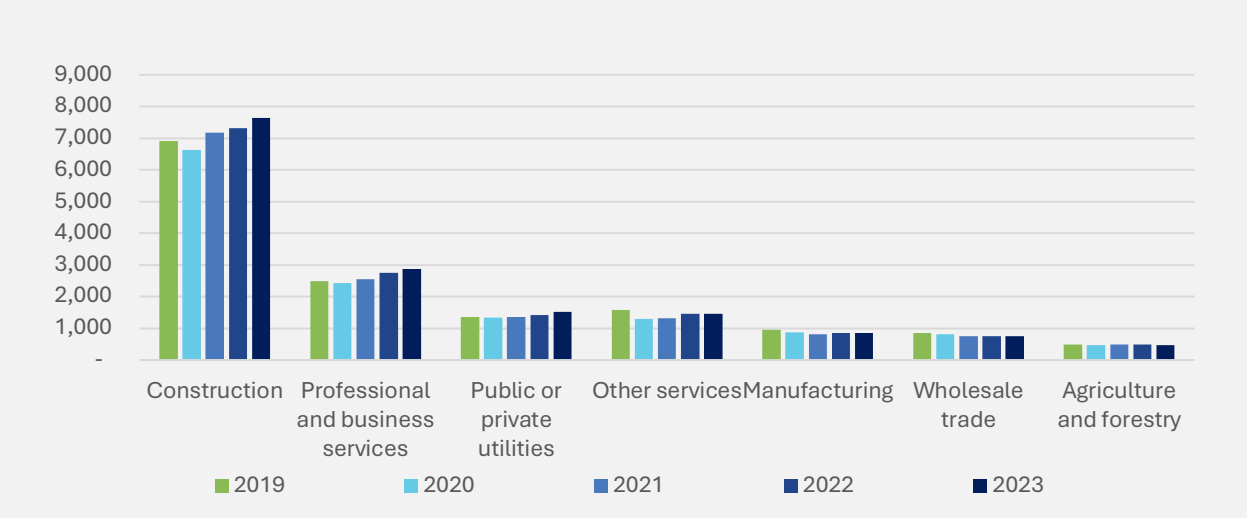
Understanding the value chain segments in which clean energy workers are involved can guide policymakers and investors to make the most educated investment and policy decisions and identify segments of growth and opportunity. The major value chain segments of clean energy workers in Maine

include construction,[12] manufacturing,[13] wholesale trade,[14] professional and business services,[15] other services,[16] agriculture and forestry, and utilities.

Just over half (51 percent) of the clean energy workforce is in the construction value chain segment, with over 7,600 jobs in 2023. Given the prominence of the energy efficiency major technology in the state's clean energy economy, the concentration of workforce in the construction segment is unsurprising; installation of heat pumps, along with building retrofits are just two of the types of work employees within the construction segment perform. This segment also saw the largest number of jobs added, gaining over 300 jobs from 2022 to 2023. Meanwhile, the public or private utilities segment grew at the fastest rate of 6.9 percent compared to the other value chain segments, representing a growth of nearly 100 jobs (Figure 6), primarily due to new electric transmission and distribution projects and increased capacities over the last year.

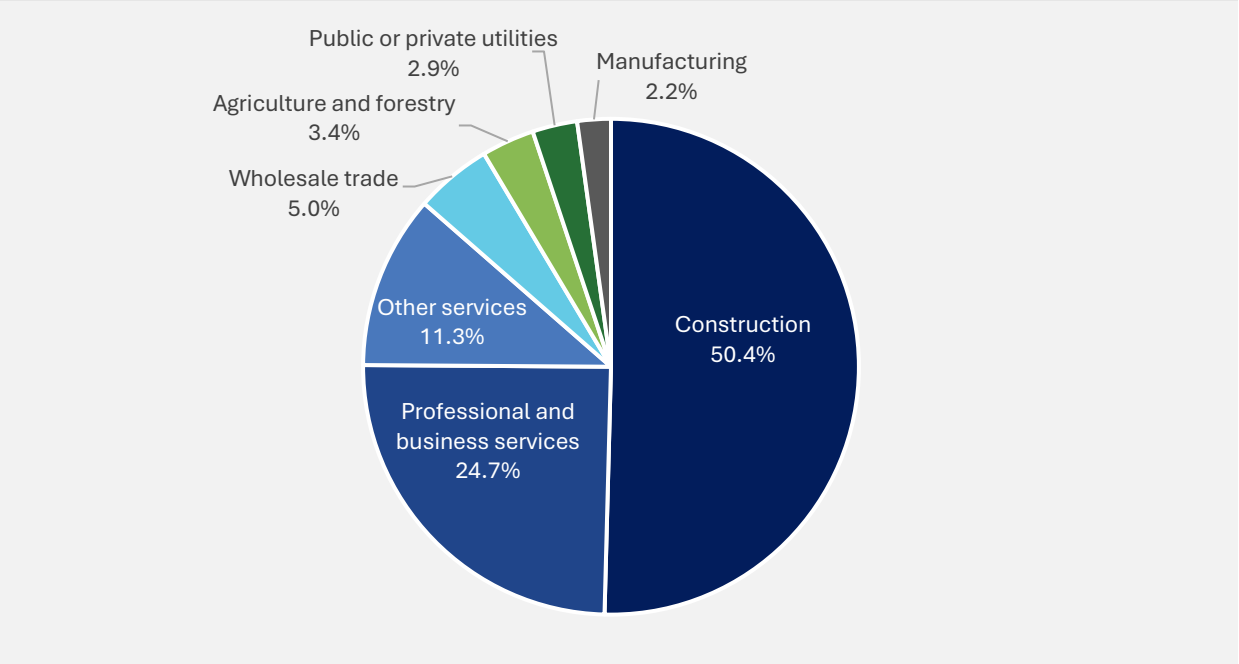
Similar to the employment composition across value chain segments in Maine's clean energy industry, half of the state's clean energy establishments are found in the construction value chain, making up over 1,300 establishments. Professional and business services firms represent 25 percent of clean energy establishments in the state, with almost 650 establishments, while manufacturing is the smallest segment, making up only 2.2 percent of the clean energy establishments (Figure 7).

Figure 6. Clean Energy Employment in Maine by Value Chain Segment, 2019-2023



[12] Construction is comprised of all workers engaged in residential, commercial, and industrial building construction, contracting and electrical work, insulation and weatherization, or plumbing and heating, air conditioning, and ventilation work.
[13] Manufacturing encompasses petrochemical, industrial gas, ethyl alcohol, or other basic organic chemical manufacturing as well as 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.
[14] Wholesale trade includes fuel dealers, motor vehicle and parts wholesalers, electrical equipment and household appliance wholesalers, and other wholesale related to clean energy products and technologies.
[15] Professional business services include all finance, legal, consulting, engineering, research, or architectural support.
[16] Other services largely comprises automotive repair and maintenance, but also includes organizational and non-profit work such as environment and conservation organizations, business associations, or advocacy organizations.

Figure 7. Clean Energy Establishments in Maine by Value Chain Segment, 2023



Detailed Clean Energy Sector Employment

This section discusses clean energy employment within each major technology from 2019 through 2023. Overall, the ENERGY STAR® & efficient lighting sub-technology, within energy efficiency, added the largest number of jobs from 2022 through 2023. Other ethanol & non-woody biomass jobs within the renewable fuels sector grew at the highest rate of almost 14 percent.

Energy Efficiency

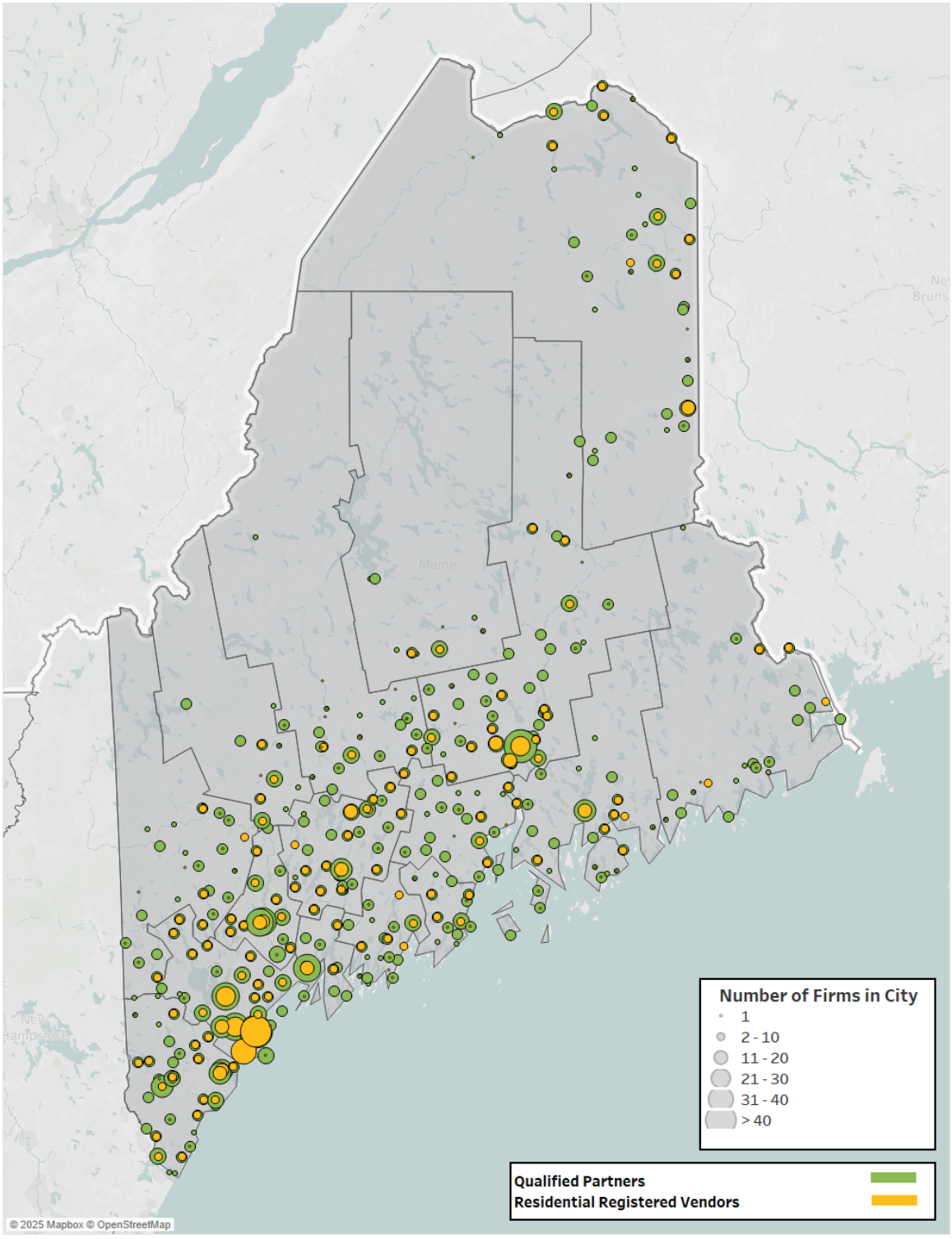
The energy efficiency sector encompasses all workers involved in the research, manufacture, sales, installation, repair, or professional service support of technologies and services designed to improve the efficiency of commercial, residential, and industrial buildings. The following are sub-technologies included in this sector: ENERGY STAR® appliances, lighting, and HVAC systems; advanced building materials and insulation technologies; solar thermal water heating and cooling; and other energy efficient technologies and processes like recycled building materials, heat pumps, or reduced water consumption products and appliances.

All sub-technologies in energy efficiency grew over the last year, with the largest growth, in terms of both percentage change and absolute jobs, seen in ENERGY STAR® & efficiency lighting jobs. This sub-technology grew by over 12 percent, adding 119 jobs to the economy. The traditional HVAC segment also saw triple-digit gains, adding 115 jobs to the economy at a growth rate of 8.2 percent (Figure 10).

The Efficiency Maine Trust (EMT) plans and implements energy efficiency programs in Maine. Figure 8 shows where EMT Qualified Partners and Residential Registered Vendors, which are contractors who perform energy efficiency upgrades, are located throughout the state. Maine's State Housing Authority, MaineHousing, authorizes programs such as the Home Energy Assistance Program (HEAP), Weatherization Assistance Program (WAP), Heat Pump Program, and Central Heating Improvement Program (CHIP) for low-moderate income households in the state. More specifically, HEAP assists with heating costs for fuel, emergency fuel delivery, and energy-related repairs. MaineHousing's CHIP assists in heating system repair and replacement services through local community-based organizations while WAP provides funding for both homeowners and renters to increase their homes' energy efficiency systems.[17] The location of MaineHousing's WAP vendors are displayed in Figure 9.

[17] "Get to Know MaineHousing," *Maine State Housing Authority (MaineHousing),* 2021, https://legislature.maine.gov/doc/5485.

Figure 8. Locations of Efficiency Maine Trust (EMT) Qualified Partners and Residential Registered Vendors, Maine, December 2023[18]



[18] Find a Qualified Partner. Efficiency Maine Trust. https://www.efficiencymaine.com/at-work/qualified-partners/?svc%5B%5D=25%2C13%2C14%2C15&svc%5B%5D=16&zpc=03901&dst=10&srt=3

Figure 9. Locations of MaineHousing Weatherization Assistance Program Vendors, Maine, January 2025

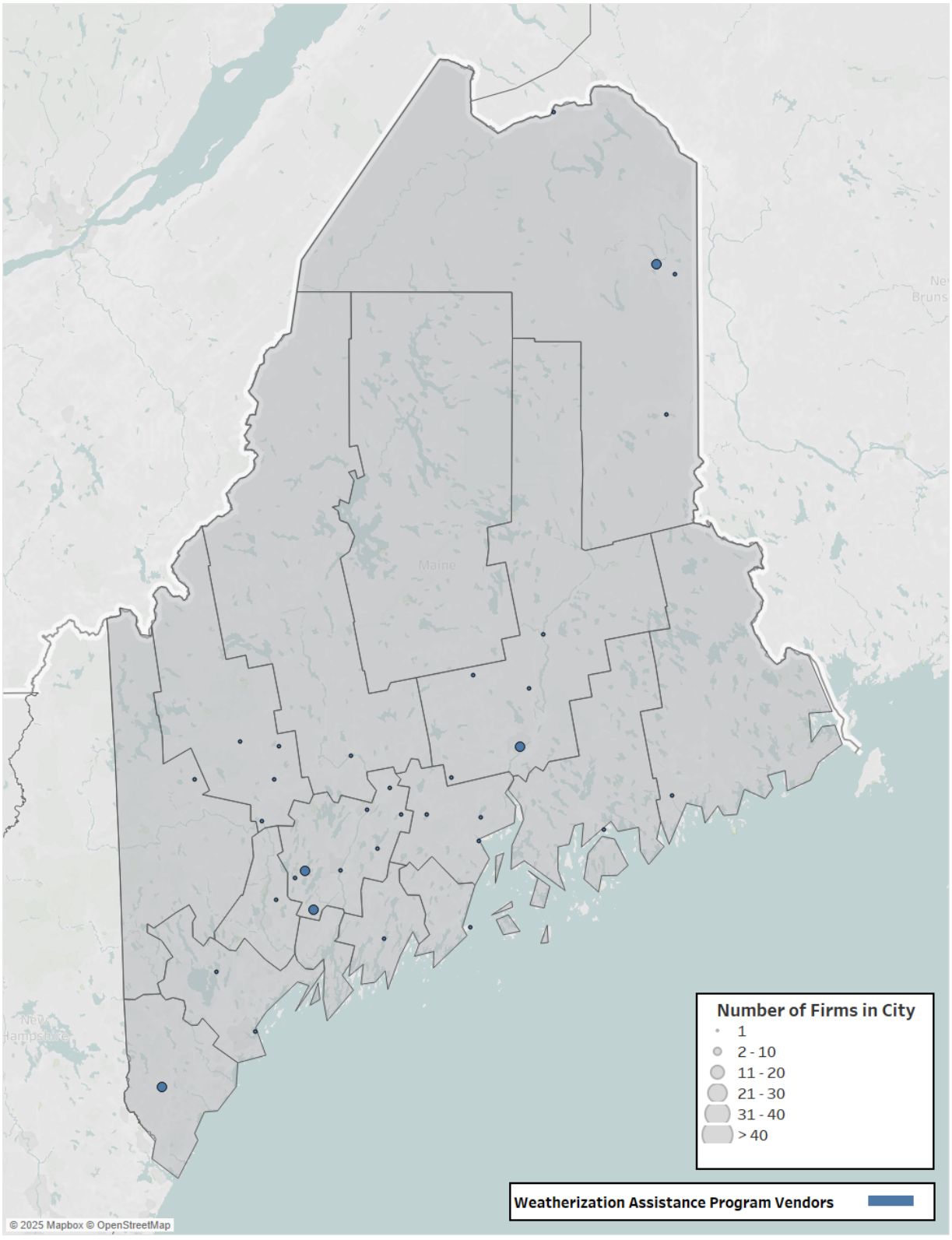
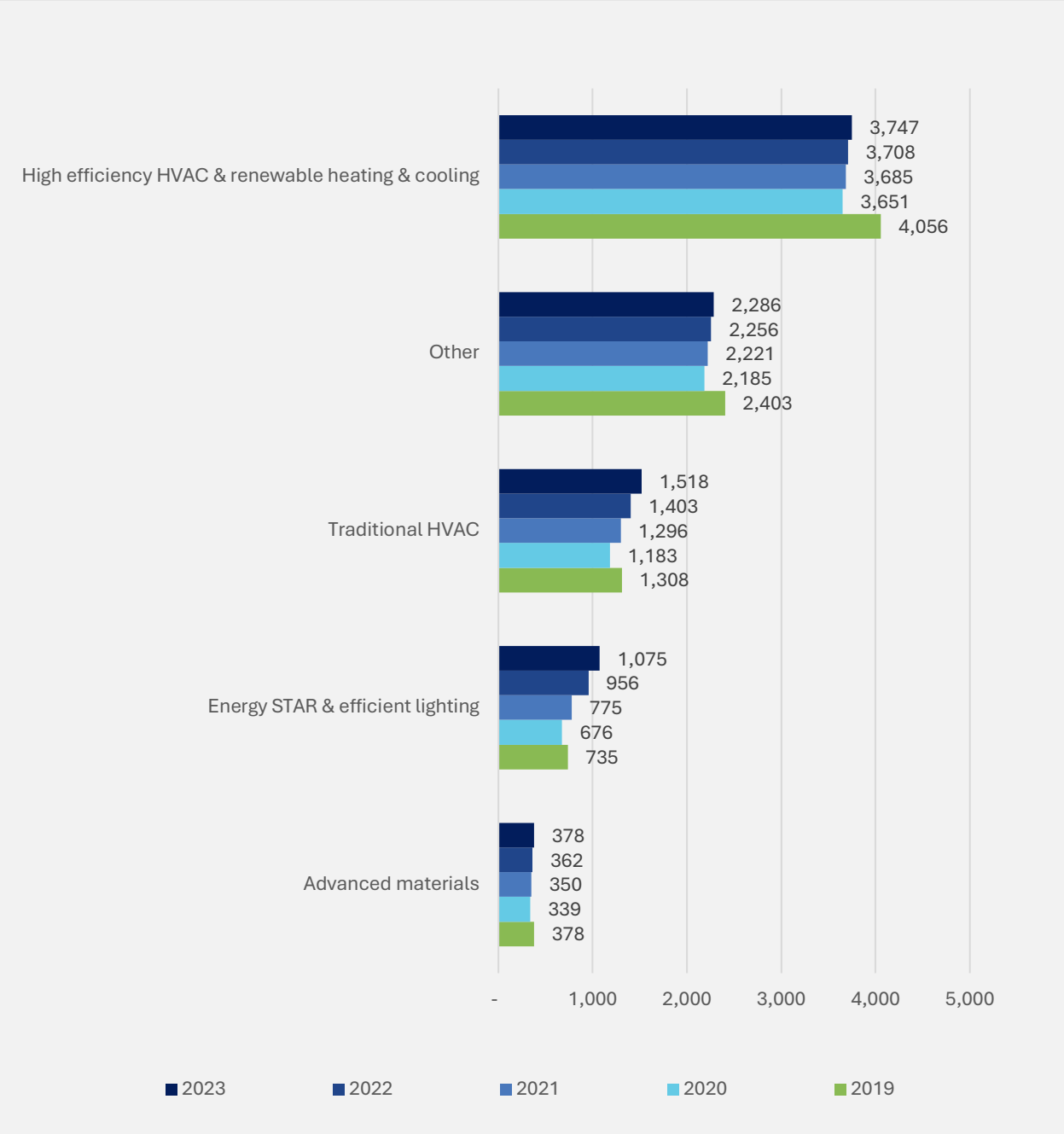


Figure 10. Energy Efficiency Employment by Sub-Technology, 2019-2023[19]



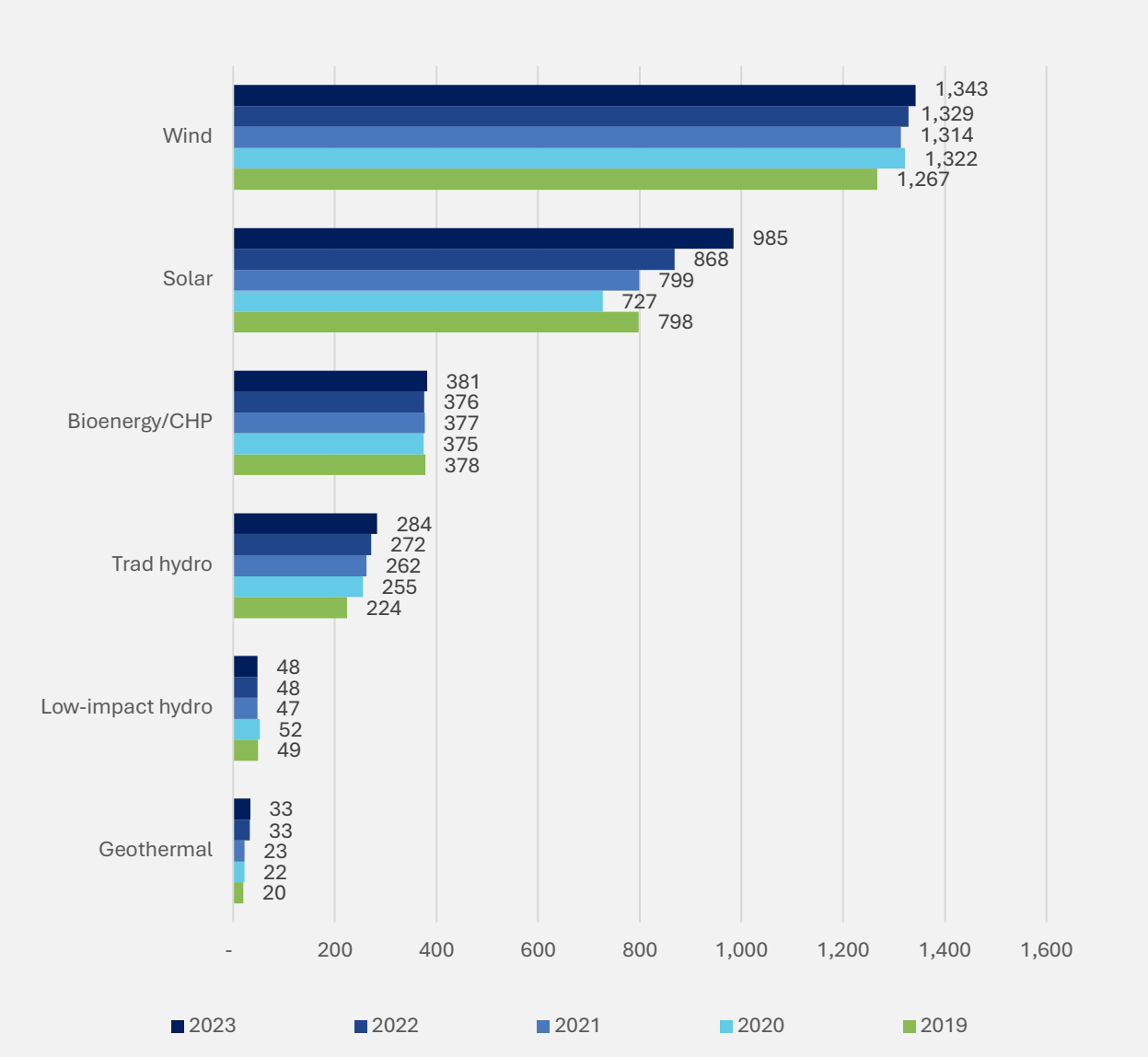
[19] Other energy efficiency technologies include variable speed motors, other design services not specific to a sub-technology, software not specific to a sub-technology, energy auditing, rating, monitoring, metering, and leak detection, energy efficiency policy not specific to a sub-technology, LEED certification, consulting not specific to a sub-technology, and phase-change materials.

Renewable Electric Power Generation

Clean power generation jobs encompass all workers engaged in the research, development, production, manufacture, sales, installation, maintenance, repair, or professional service support of renewable electricity generating technologies, including solar, wind, geothermal, bioenergy, and hydropower.

Employment in wind technologies makes up the largest share (44 percent) of the renewable electric power generation workforce in Maine and grew by 1.0 percent from 2022 to 2023. Solar energy employment experienced the largest gains over the last year, adding 117 jobs to the economy at a growth rate of 13.5 percent. Traditional hydropower and bioenergy/combined heat and power also saw growth during this period (Figure 11).

Figure 11. Renewable Electric Power Generation Employment by Sub-Technology, 2019-2023[20]



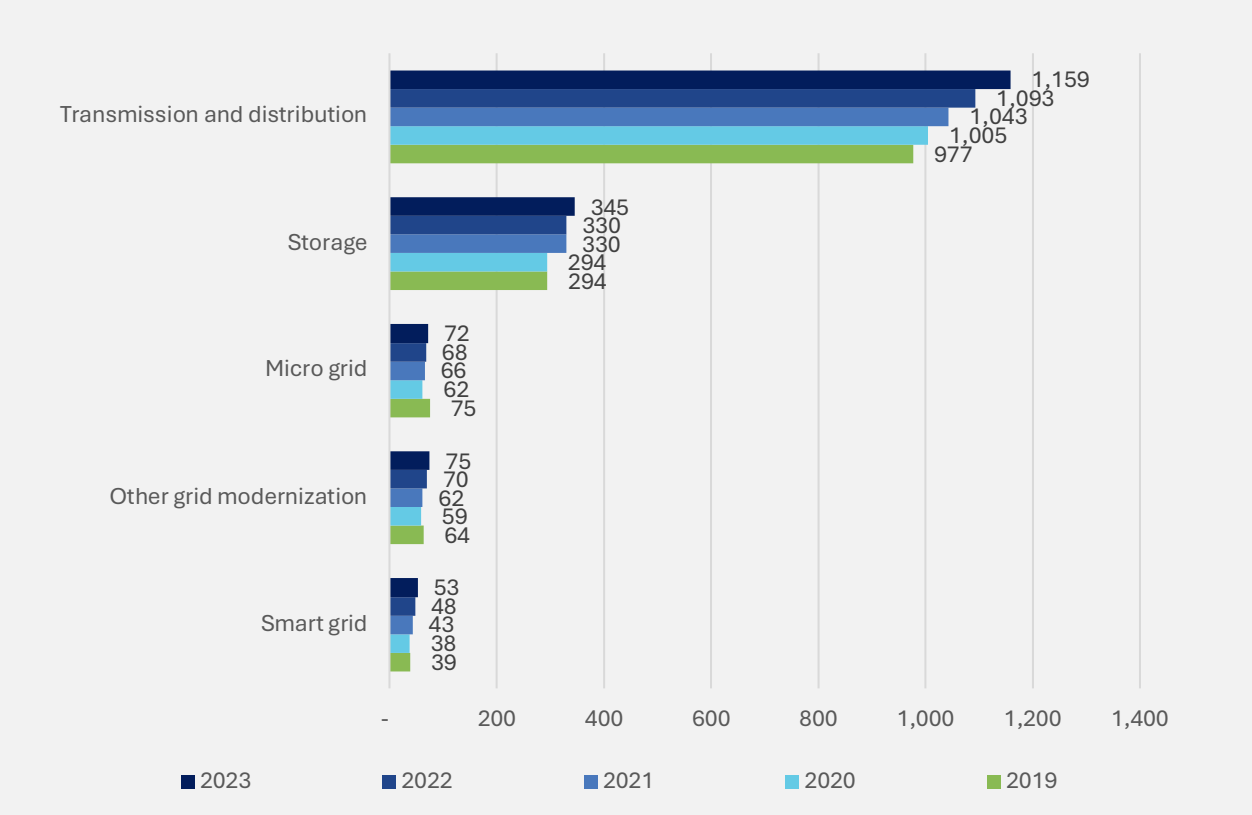
[20] The wind energy employment estimate represents both land-based and offshore wind energy. CHP is Combined Heat and Power.

Grid Modernization and Energy Storage

For the purposes of this report, grid modernization and energy storage workers include any individuals that support the deployment (construction), manufacture, wholesale trade, or legal, financial, and engineering services of smart grid and energy storage technologies. This also includes electrical transmission and distribution (T&D)[21] workers since the maintenance and expansion of electrical T&D infrastructure is critical for handling the energy flow and demand of renewable energy sources and facilitating a new, low-carbon energy system.

About two-thirds of Maine workers involved in grid modernization and energy storage technology work in the T&D sub-technology (68 percent), which grew by six percent from 2022 to 2023, adding almost 70 jobs to the economy. While the clean storage sub-technology did not grow from 2021 to 2022, it added 15 new jobs over the last year, representing a 4.7 percent growth. This sub-technology includes pumped hydropower storage,[22] battery storage,[23] mechanical storage,[24] thermal storage,[25] and biofuel storage (including ethanol and biodiesel). The remaining sub-technologies in grid modernization and energy storage, which are smart grid, other grid modernization, and microgrid, all experienced minimal growth (Figure 12).

Figure 12. Grid Modernization and Energy Storage Employment by Sub-Technology, 2019-2023



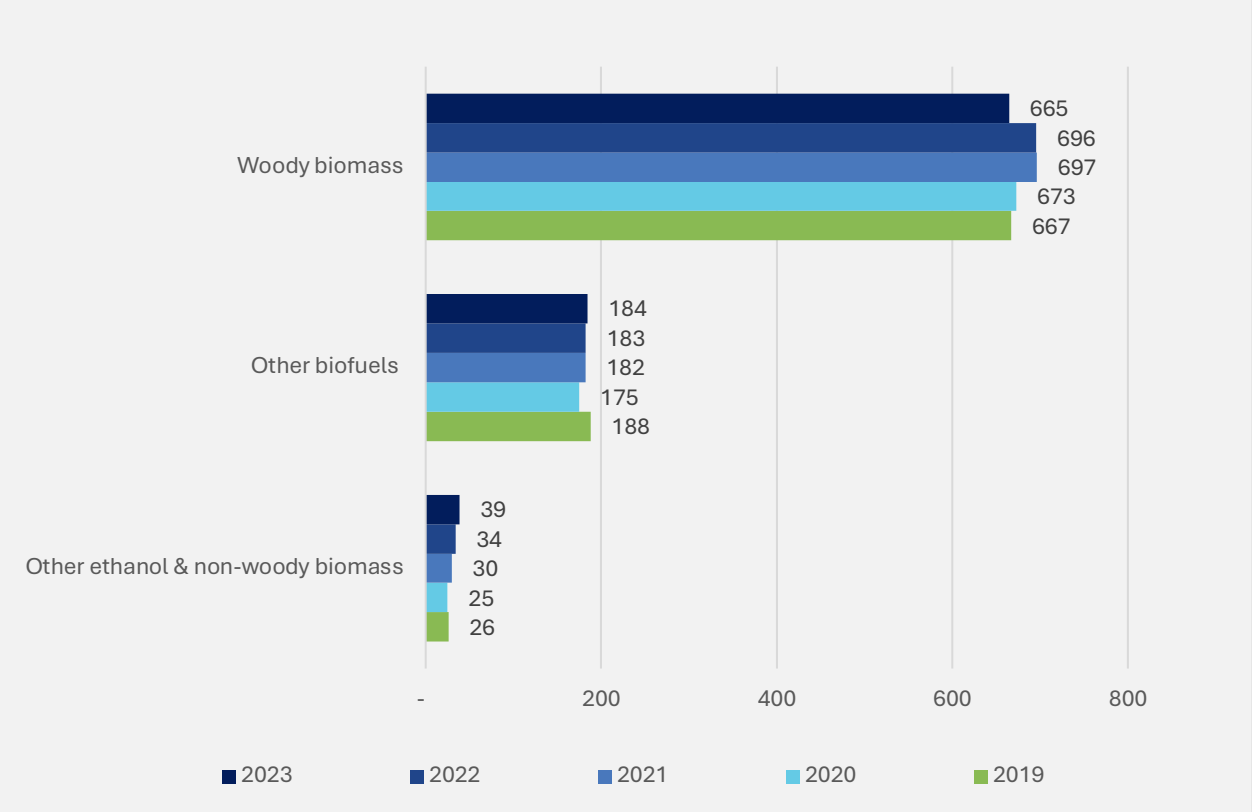
[21] This consists of Electric Power Transmission, Control, and Distribution (NAICS 22112) workers.
[22] Hydroelectric energy storage used by electric power systems for load balancing. This method stores the gravitational potential energy of water pumped from a lower elevation reservoir to a higher elevation.
[23] This includes battery storage for solar generation and lithium batteries, lead-based batteries, other solid-electrode batteries, vanadium redox flow batteries, and other flow batteries.
[24] This includes flywheels and compressed air energy storage.
[25] Temporary storage of energy for later use when heating or cooling is needed.

Renewable Fuels

The renewable fuels sector includes all workers involved in the production, distribution, and sales or professional and business service support for clean fuels and clean fuel technologies that use woody (including trees and woody plant parts) and non-woody (including fuel made from straw, manure, vegetable oil, and animal fats) biomass.

Renewable fuels is the only sub-technology to see a small net employment loss over 2023, with the woody biomass sub-technology losing around 30 workers. The other biofuels technology remained stagnant, while other ethanol & non-woody biomass employment grew by a small number of jobs (Figure 13).

Figure 13. Renewable Fuels Employment by Sub-Technology, 2019-2023



Alternative Transportation

The alternative transportation technology sector is comprised of workers that support the manufacture, sales, repair and maintenance, or professional business support—such as legal, financial, engineering, or consulting services—of alternative vehicle technologies. Alternative transportation includes technologies like plug-in hybrid, hybrid electric, electric, hydrogen, and fuel cell vehicles.

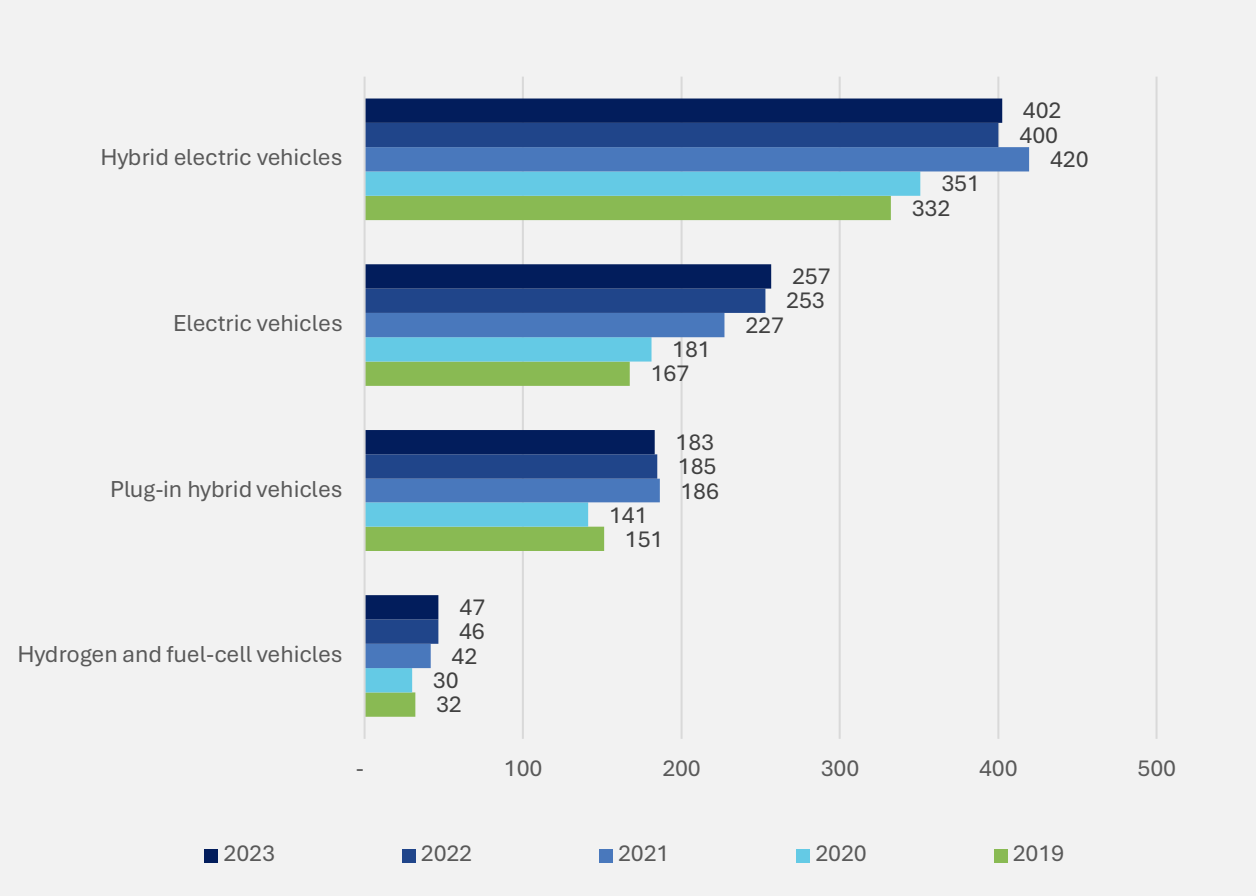
The alternative transportation technology sector has grown by the fastest rate since 2019 when compared to other sectors. Over the last year, however, employment growth was minimal in alternative transportation technologies, seeing a net gain of five jobs from the previous report. While hybrid electric vehicle jobs experienced flat growth over the last year, they still account for the largest share (45 percent) of employment in this sector. Most of the growth in the alternative transportation sector was in the

electric vehicles sub-technology, which grew by 1.5 percent, while the other sub-technology sectors remained stagnant between 2022 and 2023 (Figure 14).

Growth in Maine's alternative transportation sector is slower than in other Northeastern states, with the lowest percentage of growth for both hybrid electric vehicles (HEVs) and electric vehicles (EVs). While employment in HEVs grew by only 0.5 percent in Maine from 2022 to 2023, the second lowest growth rate was in Vermont at 3.7 percent, over three percentage points higher. The largest HEV job growth rate in the Northeast was in Massachusetts, increasing by 22 percent. EV employment growth in Maine was also minimal, at 1.5 percent, while Vermont, having the next lowest growth rate in the Northeast, reached 6.6 percent. Massachusetts boasted a 23 percent increase in EV employment. Nationally, employment in HEVs and EVs increased by 11 percent and 13 percent, respectively.

While employment in alternative transportation did not see substantial growth in the state over the last year, the deployment of HEVs and EVs did. Light-duty vehicle registrations for EVs rose from 5,000 to 7,400 from 2022 to 2023, increasing by 48 percent. Registrations rose for HEVs as well, from 28,900 registrations to 33,600, a 16 percent increase.[26]

Figure 14. Alternative Transportation Employment by Sub-Technology, 2019-2023



[26] *Vehicle Registration Counts by State*. Alternative Fuels Data Center. U.S. Department of Energy's Vehicle Technologies Office. 2022 & 2023. https://afdc.energy.gov/vehicle-registration?year=2022.

Regional Clean Energy Employment

Cumberland County has the largest number of jobs in both clean energy and energy efficiency in Maine, representing 31 percent of the state's clean energy workforce. Meanwhile, Somerset County has the highest concentration of clean energy jobs compared to its total workforce, with clean energy representing 5.4 percent of the county's total employment, and Lincoln County has the highest concentration of energy efficiency jobs (3.1 percent) (Table 1 and Figure 15).

Since 2020, Piscataquis County has experienced the highest percentage growth of clean energy employment, increasing by 49 percent. Clean energy employment in Franklin County and Somerset County rose by 45 percent and 44 percent, respectively, from 2020 to 2023. The greatest number of jobs added since 2020 belongs to Penobscot, with 335 clean energy jobs added into the workforce. Meanwhile, only three counties have seen energy efficiency employment increases since 2020: Lincoln County (44 percent growth), Androscoggin County (17 percent growth), and Cumberland County (one percent growth).[27]

Cumberland County has the largest number of jobs in both clean energy and energy efficiency in Maine, representing 31% of the state's clean energy workforce.

[27] Q42020 clean energy employment by county is sourced from the 2021 Maine Clean Energy Industry Report.

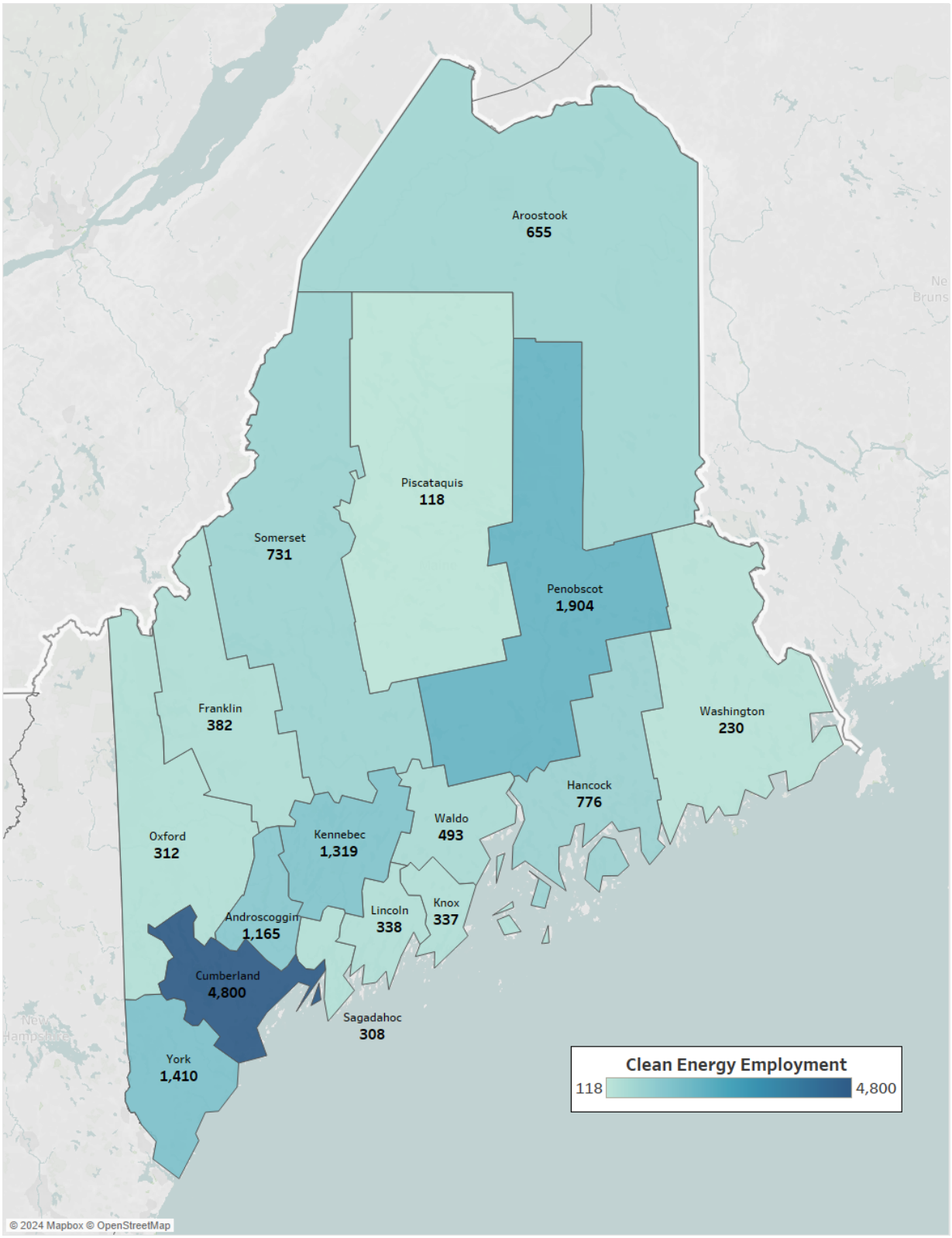
Table 1. Clean Energy, Energy Efficiency, and Total Employment by County, Maine, 2023

County Name	Clean Energy Jobs	Jobs in Energy Efficiency	Total Jobs in Overall Workforce[28]	Percent of Total Clean Energy Workforce
Androscoggin	1,165	758	42,964	7.5%
Aroostook	655	200	20,006	4.2%
Cumberland	4,800	3,209	170,840	30.9%
Franklin	382	99	8,396	2.5%
Hancock	776	536	19,243	5.0%
Kennebec	1,319	703	45,468	8.5%
Knox	337	243	14,176	2.2%
Lincoln	338	287	9,374	2.2%
Oxford	312	167	13,957	2.0%
Penobscot	1,904	900	58,833	12.2%
Piscataquis	118	42	4,280	0.8%
Sagadahoc	308	251	14,677	2.0%
Somerset	731	344	13,454	4.7%
Waldo	493	156	9,871	3.2%
Washington	230	77	7,838	1.5%
York	1,410	872	60,510	9.1%
N/A[29]	281	158	30,499	1.8%

[28] Quarterly and Annual Industry Employment and Wages. Center for Workforce Research and Information. Maine Department of Labor. https://www.maine.gov/labor/cwri/qcew1.html.

[29] This category includes all clean energy jobs that could not be attributed to a single county. Total jobs in Maine's overall workforce in this category is sourced from the U.S. Bureau of Labor Statistics Quarterly Census of Employment and Wages database.

Figure 15. Clean Energy Employment by County, Maine, 2023



Clean Energy Demographics

The clean energy workforce in Maine is representative of some populations and less representative among others. Women are relatively underrepresented in clean energy, accounting for roughly a quarter of Maine's clean energy workforce compared to half of the state's overall workforce. However, Maine's clean energy workforce is more representative of race and ethnicity and has a strong representation of veterans relative to the overall workforce. Table 2 presents Maine's clean energy industry demographics and includes comparison to Maine's construction and manufacturing industries.

The overall workforce in the state has 51 percent female representation, compared to only 27 percent in the clean energy economy. Despite the low representation, it is slowly increasing; the percentage of females in the clean energy workforce grew by 1.0 percentage point from last year's report. The underrepresentation of women in clean energy is not unique to Maine; nationally, women make up only 27 percent of the clean energy workforce. Yet, Maine's clean energy industry has a higher share of female workers than the construction industry does (15 percent), and a slight edge over the manufacturing industry as well (26 percent).

> Maine's clean energy workforce is more representative of race and ethnicity and has a strong representation of veterans relative to the overall workforce.

Non-white workers make up 8.9 percent of the clean energy workforce in the state, compared to 6.5 percent in the overall workforce. This industry is also more racially diverse than both the construction and manufacturing industries in the state, which comprise 3.5 percent and 6.5 percent, respectively, workers identifying as a race other than White. In addition, 3.8 percent of the clean energy workforce identifies as Hispanic or Latino, while these workers represent 2.3 percent of the greater state economy and even less in the construction and manufacturing industries (Table 2). Maine's clean energy workforce demographics have remained largely unchanged in recent years, showing no significant increase in diversity.

Approximately 21 percent of clean energy workers are aged 55 and over, which is less than the share in the state's overall workforce (28 percent), construction industry (27 percent), the manufacturing industry (29 percent). Although Maine's clean energy workforce tends to be younger than its overall workforce and may not experience a significant wave of retirements in the coming years, the share of workers aged 55

years and over increased by a small amount, 0.7 percentage points, between 2022 and 2023, indicating a lack of new workers entering the field who are below age 55 (Table 2).

Table 2. Clean Energy Workforce Demographics, 2023[30]

	Maine Clean Energy Industry[31]	Maine Overall Economy	Maine Construction Industry	Maine Manufacturing Industry
Female	26.6%	51.4%	15.1%	26.0%
Male	73.4%	48.6%	84.9%	74.0%
White	91.1%	93.5%	96.5%	93.5%
Hispanic or Latino	3.8%	2.3%	2.2%	2.1%
Black or African American	3.2%	2.7%	1.2%	2.4%
Asian	2.4%	1.6%	0.5%	2.1%
American Indian or Alaska Native	0.7%	0.6%	0.6%	0.5%
Native Hawaiian or Other Pacific Islander	0.2%	0.1%	0.1%	0.1%
Two or more races	2.3%	1.5%	1.2%	1.4%
Veterans	7.5%	7.1%[32]	Insufficient data	
55 and over	21.1%	27.6%	26.7%	28.6%

[30] Demographic data for Maine's overall economy, construction industry (NAICS 23), and manufacturing industry (NAICS 31) are compiled from JobsEQ using the average of four quarters ending in Q2 2023.
[31] The demographic estimation for clean energy technology sectors cannot be provided due to low sample sizes.
[32] *Table 6A. Employment status of veterans 18 years and over by state, 2023 annual averages*. U.S. Bureau of Labor Statistics. https://www.bls.gov/news.release/vet.t06A.htm
& *Quarterly and Annual Industry Employment and Wages*. Center for Workforce Research and Information. Maine Department of Labor. https://www.maine.gov/labor/cwri/qcew1.html

Clean Energy Patents

Patent trends can provide valuable insight into a region's innovation environment and economic advancement. This section analyzes Maine's clean energy-related patent trends over the last several years, from 2019 through 2023, to look at how the clean energy economy is advancing in the state. The clean energy patents granted to projects or people (or groups of people) included in this analysis have been classified based on the state's definition of clean energy, laid out in Appendix A: Maine Clean Energy Technology List.

Patents[33]

Between 2019 and 2023, 20 patents in clean energy technologies were granted to entities in Maine, based on U.S. Patent & Trademark Office PatentsView data. In 2023, only one clean energy patent, focused on energy storage through batteries, was reported. The number of clean energy patents has declined in the state year after year since 2019 (Figure 16), after increasing by four patents from 2018 to 2019.

When looking at all 20 patents granted in the state since 2019, nearly two-thirds (65 percent) of the clean energy patents are related to renewable electric power generation. Of these patents, three-in-five (62 percent) are focused on wind energy innovation. This innovation in wind energy is primarily taking place in the state's public universities, with seven out of eight wind energy patents assigned to the University of Maine System Board of Trustees. There are limited patents for grid modernization & energy storage technologies, for which there are three patents, and even less for energy efficiency, renewable fuels, and alternative transportation (Figure 17).

[33] BW Research is using a new methodology for identifying patent information in this year's report due to the different reporting style of the PatentsView data, therefore figures may vary slightly from previous years reports.

Figure 16. Clean Energy Patents in Maine, 2019-2023

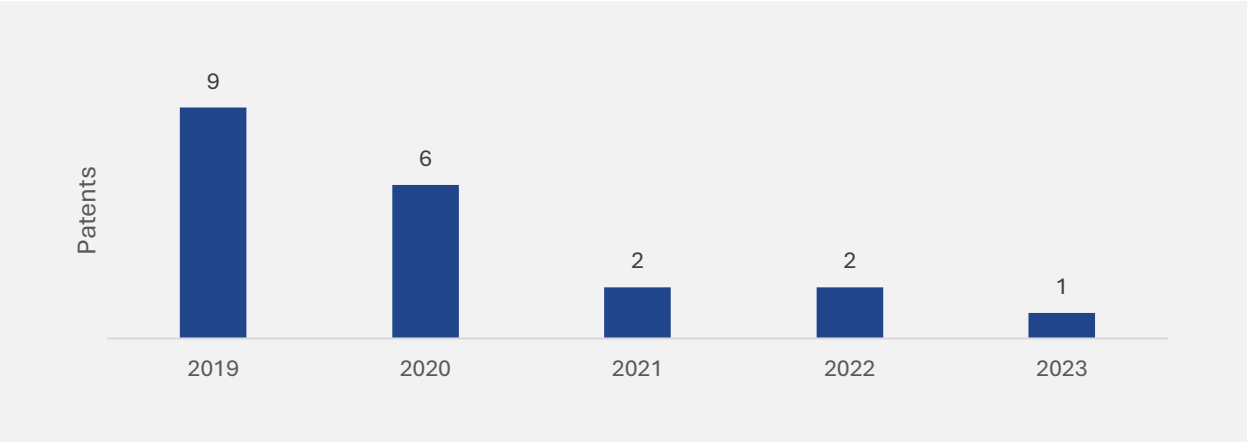
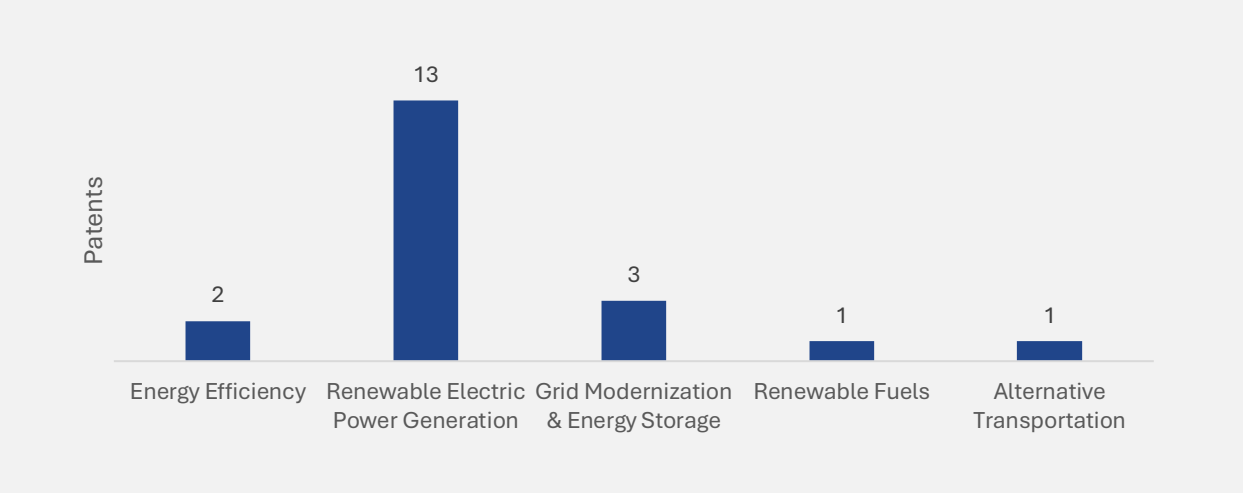


Figure 17.Clean Energy Patents in Maine by Technology Sector, 2019-2023



Gross State Product Analysis

The clean energy economy contributed $2,878,649,532 to Maine's total GSP in 2023, representing 3.2 percent of the state's total GSP. The GSP, or the Gross State Product, is the full economic output of a state representing the total value of the state's final goods and services produced. Almost half (46 percent) of the clean energy industry's economic contributions to GSP were in public or private utilities, which contributed $1.3 billion in 2023, representing 1.5 percent of the state's entire GSP of $91.08 billion (Figure 18).

The gross product contribution of the state's clean energy sector increased by approximately one-half billion dollars between 2022 and 2023, representing a 20 percent increase. In comparison, the state's overall GSP grew by 7.2 percent over the last year.

Figure 18. Maine Clean Energy Gross Product, 2023, by Value Chain, in Millions

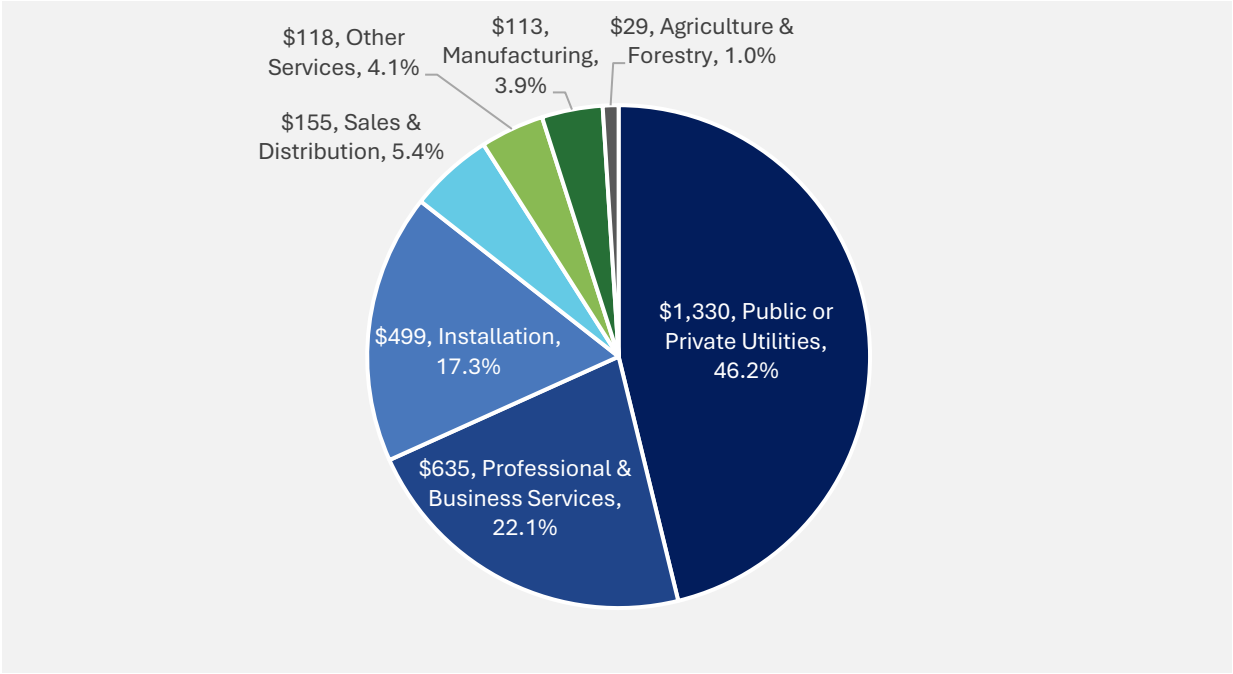
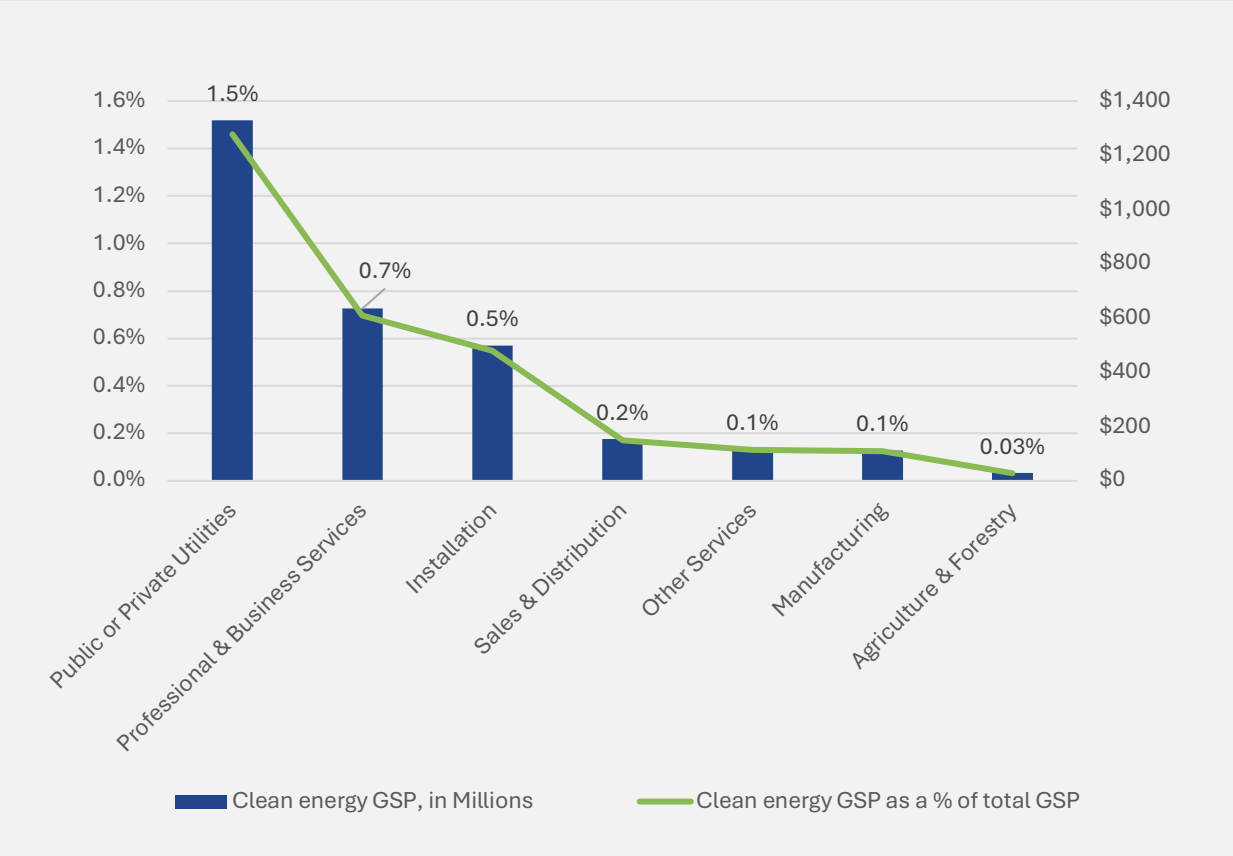


Figure 19. Maine's Clean Energy Contributions to Total Gross State Product, 2023, by Sector, in Millions



Appendix A: Maine Clean Energy Technology List

A clean energy job is defined as any worker directly involved with the research, development, production, manufacture, distribution, sales, implementation, installation, or repair of components, goods, or services related to the following technology sectors of clean energy generation; clean grid and storage; energy efficiency; clean fuels; or alternative transportation. These jobs also include supporting services such as consulting, finance, tax, and legal services related to energy.

Renewable Electric Power Generation

- Solar photovoltaic electric generation
- Concentrated solar electric generation
- Wind generation
- Geothermal generation
- Bioenergy/biomass generation, including combined heat and power
- Low-impact hydroelectric generation, including wave/kinetic generation
- Traditional hydropower generation

Grid Modernization & Energy Storage

Electric Power Transmission and Distribution

- Electric power transmission, control, distribution
- Smart grid
- Microgrid
- Other grid modernization

Storage

- Pumped hydropower storage
- Battery storage, including battery storage for solar generation
    - Lithium batteries
    - Lead-based batteries
    - Other solid-electrode batteries
    - Vanadium redox flow batteries
    - Other flow batteries
- Mechanical storage, including flywheels, compressed air energy storage, etc.
- Thermal storage

Energy Efficiency

- Traditional HVAC goods, control systems, and services (HVAC firms/employees who work with traditional HVAC goods, systems, and services most of the time but conduct some clean energy HVAC work such as installing high efficiency HVAC systems and components as well)
- High efficiency HVAC and renewable heating and cooling

    - ENERGY STAR® Certified Heating Ventilation and Air Conditioning (HVAC), including boilers and furnaces with an AFUE rating of 90 or greater and air and central air conditioning units of 15 SEER or greater
    - Solar thermal water heating and cooling
    - Other renewable heating and cooling (geothermal, biomass, heat pumps, etc.)
- ENERGY STAR® and efficient Lighting
    - ENERGY STAR certified appliances, excluding HVAC
    - ENERGY STAR certified electronics (TVs, telephones, audio/video, etc.)
    - ENERGY STAR certified windows and doors
    - ENERGY STAR certified roofing
    - ENERGY STAR certified seal and insulation
    - ENERGY STAR certified commercial food service equipment
    - ENERGY STAR certified data center equipment
    - ENERGY STAR certified LED lighting
    - Other LED, CFL, and efficient lighting
- Advanced building materials/insulation
- Other energy efficiency
    - Recycled building materials
    - Reduced water consumption products and appliances

Renewable Fuels

- Woody biomass
- Other ethanol and non-woody biomass, including biodiesel
- Other biofuels

Alternative Transportation

- Plug-in hybrid vehicles
- Electric vehicles
- Hybrid electric vehicles
- Hydrogen and fuel cell vehicles

Appendix B: Research Methodology

Employment Data

Data for the 2024 Maine Clean Energy Industry Report is taken from data collected for the 2024 US Energy and Employment Report (USEER). The survey was administered by phone and web. The phone survey was conducted by ReconMR, and the web instrument was programmed internally. Each respondent was required to use a unique ID in order to prevent duplication.

The 2024 USEER survey in Maine resulted in 4,665 calls and 621 emails to potential respondents. 284 business establishments participated in the survey. The responses were used to develop incidence rates among industries and to apportion employment across various industry categories in ways currently not provided by state and federal labor market information agencies. The margin of error for the 2024 USEER survey in Maine is +/-5.77% at a 95% confidence level.

For the full 2024 USEER methodology, see: https://www.energy.gov/sites/default/files/2024-10/USEER%202024%20Appendices_1002_0.pdf