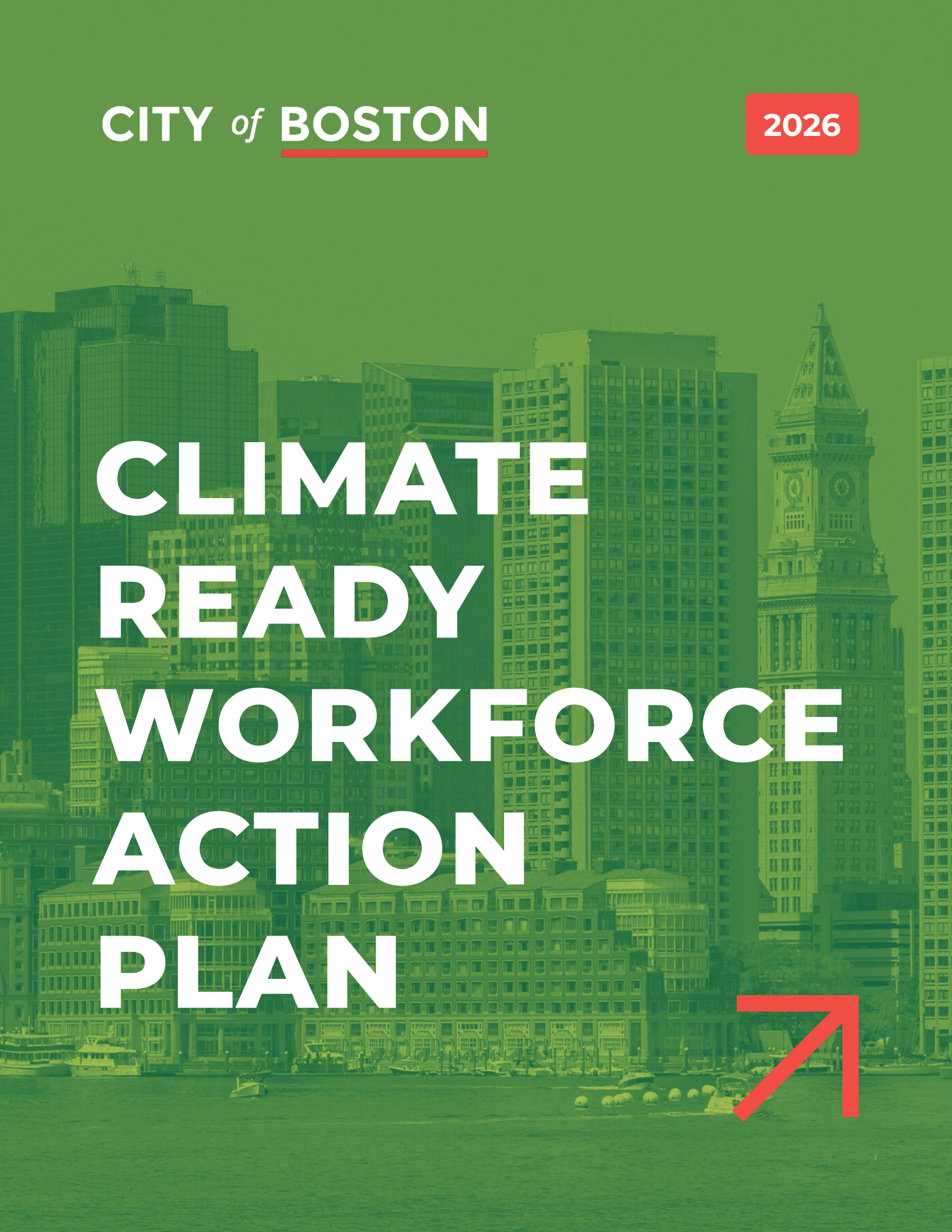
CITY of BOSTON

2026



CLIMATE READY WORKFORCE ACTION PLAN

ACKNOWLEDGMENTS

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We extend our sincere thanks to the more than 50 advisors who shared their guidance and expertise, including, though not limited to, City and State officials, training and education partners, labor partners, employer partners, and community leaders. A full list of the advisors can be found on page 164. We acknowledge that others may have contributed along the way, and we apologize for any inadvertent omissions and offer our appreciation to all whose support may not be individually named here.

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All photography sourced via the City of Boston Mayor's Office Flickr.

DESIGN

Isidor Studio

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Remarks from Mayor Wu

Dear Friends,

Four years after Boston was founded, residents came together and voted to turn private farmland into the first public park in America. Nearly four hundred years later, we are making a similar choice to care for what we share: not just the Boston Common, but every block, building, and backyard across all of our neighborhoods.

We know that climate change is already here, from flooding in East Boston to record-breaking heat in Roxbury. It's affecting all of us. So this August, we released the first draft of our 2030 Climate Action Plan: a clear, detailed strategy to make our city climate-ready by cutting emissions, strengthening resilience, and involving all of our neighborhoods in protecting our families and our future.

To build a climate-ready city, we need a climate-ready workforce. That means technicians and tradespeople, engineers and planners—all using their skills and their care to strengthen our city. This *Climate Ready Workforce Action Plan* is a blueprint for creating good-paying jobs that protect our planet and grow our economy.

Our mission is to make Boston a home for everyone. That starts by investing in our people. In the pages ahead, you'll find a clear strategy to grow a skilled green workforce and prepare our residents for the high-quality jobs that will shape our future.

Through the leadership and partnership of our City team and residents in every neighborhood, this plan will make sure *all* communities help us create a better future for Boston.

Sincerely,

Michelle Wu
Mayor of Boston

Remarks from Trinh Nguyen and Oliver Sellers-Garcia

Dear Partners,

We are incredibly grateful to have had the opportunity to collaborate with our partners at Northeastern University and Community Labor United to bring you this *Climate Ready Workforce Action Plan*.

The *Climate Ready Workforce Action Plan* provides data, for the first time, on the number of jobs that will be supported by Boston's strategies to decarbonize our buildings, provide clean energy to our residents, electrify transportation, and make Boston more resilient to the impacts of climate change. Over the next 25 years, these efforts will keep about 67,000 people employed in 45 green occupations each year, 10% of which would not exist without our climate policies and strategies. For example, Boston's Building Emissions Reduction and Disclosure Ordinance (BERDO) alone will drive $4.41 billion to $8.15 billion in new spending between 2025 and 2030 that will support upwards of 29,000 jobs per year during that timeframe.

The research is clear. The work we are doing to tackle the climate crisis has the potential to address longstanding economic inequities, a fact that is at the heart of Boston's vision for a Green New Deal. Now we must take advantage of this opportunity to work together with employers and our partners in labor and education to prepare Boston residents—especially the 45.5% of those 25 years and older without a bachelor's degree—for these family-sustaining green careers.

The City of Boston is well-prepared to do this work. For decades, we have created new, innovative, evidence-based career pipelines to train and connect diverse talent to growing markets such as healthcare, childcare, and the life sciences. We have built training models for pre-apprenticeships and registered apprenticeships, learn-and-earn opportunities, and pathways to industry-recognized credentials, all to meet the needs of both workers and employers. Now we are using our expertise, along with the information and recommendations in this report, to build a climate-ready workforce.

We are grateful to Mayor Michelle Wu for her leadership and support as we work together to advance the lives of all Boston workers in alignment with the administration's commitment to creating a safe, healthy, and climate-resilient city for all.

Sincerely,

Trinh Nguyen, Chief of Worker Empowerment

Oliver Sellers-Garcia, Green New Deal Director and Environment Commissioner

EXECUTIVE SUMMARY

The combination of its coastal location, history of using landfill to increase the city's footprint, and rapid real estate expansion of the Seaport district makes Boston particularly vulnerable to the impacts of climate change, especially rising sea levels but also extreme heat.

In response, the City of Boston was one of the first to release a climate action plan in 2016 and established the first dedicated Office of Climate Resilience (OCR) in the U.S. last year. While the current federal administration has rolled back several key clean energy initiatives led by the previous administration, and economic forecasts have dampened, the City of Boston is committed to preserving our climate goals, boosting our economy, and supporting workers. Boston's updated 2030 Climate Action Plan (CAP) outlines strategies for climate mitigation, building decarbonization, and resilience planning to reduce emissions, complete coastal resilience projects, address rising temperatures, and expand the urban forest canopy.

Given the urgency to protect Boston residents from the effects of climate change, the City will need to have a workforce in place that is ready to implement CAP strategies in both the near-term as well as the long-term. Investments in building retrofitting, transportation electrification, electrical grid upgrading and nature-based solutions will create new jobs and increase the demand for certain skills. The transition from a carbon-based to a green economy will require many more workers in the trades, project implementation, and design and inspection industries. Other key sectors such as energy operations, nature and conservation, and community engagement will require some additional workers but more importantly, workers with the right skills to implement and sustain green systems and solutions. As Boston's growing green economy changes labor demand, the City has the chance to enhance and expand high-road employment opportunities for Boston residents. Boston can do this by advancing policies that support high-quality jobs with living wages, benefits, and advancement opportunities, without fear of wage theft or health and safety abuses, and by supporting programs that provide access to training and career pathways for all Bostonians, especially those from historically marginalized backgrounds.

Key Questions

This *Climate Ready Boston Workforce Action Plan* provides a comprehensive roadmap for aligning the city's workforce development system with its ambitious climate goals. The assessment is framed around five sets of questions:

- **WORKFORCE DEMAND:** What occupations and skills will be needed to support the implementation and maintenance of the green infrastructure and technologies that are part of Boston's climate action plan?

- **WORKFORCE SUPPLY:** How many workers currently fill those positions that are in demand and how many will retire in the next decade? What skills will be needed to support both current jobs that will require green-related tasks as well as emerging green occupations? Which groups of workers can access green jobs?

- **TRAINING ASSETS:** What education and training programs currently serve Boston's green workforce system? What does current training capacity look like, and where are the biggest shortfalls?

- **JOB QUALITY:** What are the characteristics of jobs driven by CAP investments? What policies can help ensure that existing and new green-related jobs are good jobs, with family-supporting wages and benefits and upwardly mobile pathways?

- **JOB ACCESS:** What barriers prevent Boston residents from pursuing job training and career opportunities in green-related occupations? What economic and business value is created when those barriers are removed?

What will a Climate Resilient Boston Require?

To guide Boston leaders in this effort, we conducted a comprehensive analysis of the workforce needed to support some of the most capital-intensive of the CAP's goals and strategies. In the current federal context, city policies are more important than ever to create good jobs and reach our climate goals. We analyze how the strategies outlined in the CAP will shape the local labor market and project demand in four key areas of work:

1. **TRANSPORTATION ELECTRIFICATION:** moving city transportation (including city vehicle fleets, school buses, and private transportation) to electric power;

2. **ELECTRICAL GRID UPGRADING:** transitioning more of the city's power to renewable sources;

3. **COASTAL RESILIENCY AND NATURE-BASED SOLUTIONS:** strengthening coastal resiliency and improving city infrastructure and land use to ameliorate the effects of expected increases in storms, sea-level rise, and heat; and

4. **BUILDING DECARBONIZATION:** shifting Boston's buildings to higher levels of energy efficiency and toward carbon neutrality.

Does Boston have the workforce it needs to build a green economy?

In the context of the greater Boston labor market, we find that Boston can draw on a strong workforce base to support the City's ambitious climate plans over the next 25 years, but that it will be important to anticipate several potential gaps in the number of workers and skills required for key sectors. Drawing on the latest data and modeling, we project that implementing the City's Climate Action Plan will support approximately 67,000 jobs annually through 2050, with about 6,700 of those being new positions. These jobs are primarily concentrated in building trades and trade-adjacent occupations, but also include project implementation specialists; design and inspection professionals; community engagement workers; green operations managers; and workers designing and building nature-based solutions and other resilience infrastructure.

More than half of all projected jobs will stem from building decarbonization. Much of this employment will stem from the Building Emissions Reduction and Disclosure Ordinance (BERDO), which requires large buildings to reach net-zero emissions by 2050. Meeting this requirement will require billions in spending on insulation, new heating and cooling systems and other energy-saving systems. These activities will support between 28,000 and 106,000 jobs annually, depending on the pace of implementation. Most of these jobs will be in the construction and electrical trades, but many opportunities will also arise for energy auditors, mechanical engineers, and building systems managers who can design and oversee decarbonization projects and maintain them once in place.

Transportation electrification will be another key driver of employment. The City's commitment to electrifying its school buses, municipal vehicles, and adding public charging infrastructure will be supported by about $885 million in investment between 2025 and 2030, supporting more than 3,200 jobs annually for electricians, mechanics, and various technicians to install and maintain charging infrastructure and energy storage systems.

Upgrading the electrical grid will enable renewable integration and distributed generation and support between 3,600 and 7,300 jobs annually. A wide range of occupations will be needed—from electricians and GIS technicians to data analysts, line workers, and engineers.

Coastal resilience and heat abatement will create long-term employment in both the public and private sectors. Protecting Boston's coastline with seawalls, restored wetlands, and elevated green infrastructure will cost between $12 billion and $21 billion, based on planned and potential investments. This work could support 9,000 to 15,000 jobs annually through 2050, ranging from arborists, landscapers, and heavy machinery operators to urban planners, community outreach specialists, and stormwater managers.

We did not find evidence of significant job loss for workers in fossil-fuel-related occupations. Some workers are already learning the skills needed to work on both fossil-fuel and green technologies (e.g., the auto mechanic who works on both gas and electric vehicles), while others have the opportunity to learn new skills on the job, whether from hands-on experience or from training offered by manufacturers of the new green technologies (e.g., heat pumps, electric vehicles).

Will Boston's education and training programs be sufficient to prepare the workforce needing to implement its CAP?

We find that Boston has a strong ecosystem of apprenticeship, education, and training programs to support Bostonians' entry into many of the existing and new jobs that will be required to implement the Climate Action Plan in the foreseeable future. These education and training programs are delivered through joint employer-union apprenticeships, high school and community college programs, and short-term community-based workforce training programs.

Joint union-employer apprenticeships in the trades graduate more than 1,000 workers a year who are and will continue to be essential to the green economy. These apprenticeships are training a diverse group of tradespeople: 68% of Bostonians enrolled are people of color, and 17.5% are women. Union apprenticeships provide a living wage, benefits, and a career path in the trades. The capacity of these programs is limited by market demand, as apprentices work on active construction projects–meaning that if demand slows due to a recession or building slump, then there will be fewer apprenticeship training opportunities.

Beyond preparing workers for new climate-related roles that the City's climate action policies will create, Boston must also sustain a strong talent pipeline, as approximately 2,700 workers in occupations essential to the green economy retire each year. These ongoing replacement needs mean that training programs must support a steady pipeline of workers, not only prepare people for newly emerging positions.

Other major providers of training programs, including nonprofit organizations and community colleges, enroll many Black and Latino students and often serve Bostonians with barriers to employment. However, in most cases, these training programs lack some of the key elements needed to support these trainees.

Will the jobs supported by the CAP be good jobs that are accessible to all Boston residents?

The good news is that Climate Action Plan implementation will employ tens of thousands of workers in the Boston region who have already embarked upon career paths in the trades and trade-adjacent jobs or in project design, implementation, and management positions. These will be good jobs, offering family-supporting wages and benefits and plentiful opportunities for advancement. Unfortunately, for some other positions where more workers are needed, job quality is currently low, limiting opportunities for Boston residents. When training exists, it too often leads to low-wage, dead-end positions, with few opportunities to move up.

Recommendations

Boston currently has most of the trained labor force that will be needed to achieve CAP goals but may fall short of its workforce needs as some new jobs are created and workers in key sectors retire in greater numbers over the next decade. In addition, the City has the opportunity to leverage this transition to a clean economy to increase employment, wages, and advancement among previously marginalized groups of workers. To achieve the Boston CAP goals, the City of Boston can advance policies and programs in three key areas.

FIRST, the City can work to remove barriers preventing many Bostonians from accessing training opportunities that could lead to good green jobs. While some barriers are difficult to address at the City level, Boston can reduce them by:

- Continuing and expanding ESOL instruction
- Communicating good green jobs opportunities
- Easing access to childcare

SECOND, the City can develop and support quality training in Boston, with measures including:

- Funding wraparound services at high-performing training programs
- Engaging employers more directly in training programs
- Developing Boston Public Schools programs that provide pathways to good green jobs

THIRD, the City can enhance policies and programs to ensure City investments support the creation of family-sustaining quality jobs, improve job quality and support high-road employment, especially in sectors with a history of wage theft, health and safety abuses and other forms of employer exploitation:

- Using procurement policy to lead the way on good jobs. The City should expand the use of Project Labor Agreements to create pathways to good jobs and support union apprenticeship programs
- Enhancing and updating enforcement of the Boston Residents Jobs Policy
- Driving good green jobs through engagements with employers. We provide specific recommendations covering BERDO compliance, payment in lieu of taxes (PILOTs) and institutional master plan discussions with large non-profit institutions, and residential construction and landscaping jobs
- Continuing to invest in clean energy projects that provide high-quality jobs

These recommendations are anchored in Boston's climate justice principles as laid out in Boston's 2030 Climate Action Plan draft released in summer 2025. However, as Boston pursues these and other climate action policy changes during this time of uncertainty, the City should continue to ensure that residents are consulted at each stage, as outlined in a "reflective proposal review questionnaire" developed by a group of the City's environmental justice and community organizations.[1]

Ultimately, we cannot have a climate ready city without a climate ready workforce. It's imperative that the City use the available data and tools for Boston to build a greener and more inclusive local economy by supporting high-quality education and job training, policy reform, enforcement of standards, and economic incentives. With these tools, the City of Boston can ensure that *all* residents have access to sustainable, family-supporting careers in the growing green economy.

1.

INTRODUCTION: WHY A GREEN WORKFORCE NEEDS ASSESSMENT MATTERS

Thousands of new workers

Needed across green workforce industries

$1.4B annual losses

Estimated future damages from coastal and river flooding

Up to 40 days above 90°F

Projected by 2030 as extreme heat accelerates

70% of emissions

Come from buildings—retrofitting and electrification are essential

18 inches of sea level rise

Projected by 2050, putting neighborhoods and infrastructure at risk

The Moment is Now

Boston is uniquely vulnerable to the impact of climate change.

The combination of its coastal location, history of using landfill to increase the city's footprint, and recently rapid real estate expansion of the Seaport district make the city particularly susceptible to rising sea levels, fiercer storms, and higher precipitation. For example, heavy rain in September 2023 caused flash flooding that shut down parts of the MBTA and swamped areas such as Morrissey Boulevard in Dorchester.[2] According to the National Oceanic and Atmospheric Administration (NOAA), Boston experienced 19 days of flooding in 2024 and is expected to be similarly affected this year.[3] Unless things change globally, Boston sea levels are projected to be about 8 inches higher than 2000 levels by 2030, 18 inches higher by 2050, and 40 inches (about 3 feet) higher by 2070 with annualized losses from coastal and river flooding amounting to upwards of $1.4 billion. A "once in a hundred years" flood in Boston would inundate more than 2,000 buildings and cause more than $2.3 billion in damage, according to the city's estimates. Beyond flooding, Boston residents are also affected by other extreme weather events linked to climate change. The last decade was the hottest on record, capped off by a record-breaking all-time June high of 102 degrees on June 24, 2025. By 2030, Boston could see up to 40 days above 90 degrees, affecting the health and well-being of its residents.[4]

Although Boston may be more vulnerable than most cities, it is also a leader in climate preparedness.

In 2016, the city released a comprehensive report, *Climate Ready Boston*, assessing its vulnerabilities to coastal and storm flooding and extreme heat.[5] In 2024, Mayor Wu set up the first dedicated Office of Climate Resilience (OCR) in the country and recently released the draft 2030 Climate Action Plan (CAP) that provides an implementation framework for achieving Boston's climate goals. By making investments in climate mitigation, decarbonization, and resilience planning, the City is working with partners to reduce emissions, complete coastal resilience projects for all 47 miles of Boston's coastline, address rising temperatures, and implement nature-based solutions such as expanding the urban forest canopy. Over the past several years, the City has made significant public investment to transform municipal infrastructure, including $2 billion to overhaul Boston Public School facilities, $50 million for decarbonization of public housing units, and investing $30 million to electrify the City's vehicle fleet and add charging stations. **There is an urgent need to complete these projects soon to protect Boston residents—and that's where the workforce needs assessment is critical.** Investments in building retrofitting, transportation electrification, electrical grid upgrading and nature-based solutions will create new jobs and increase the demand for certain skills. The transition from a carbon-based to a green economy will require many more workers in the trades, project implementation, and design and inspection industries. Other key sectors such as energy operations, nature and conservation, and community engagement will require some additional workers but more importantly, workers with the right skills to implement and sustain green systems and solutions.

Boston's 2030 Climate Action Plan

Boston's 2030 Climate Action Plan (CAP) is an implementation roadmap to achieve its climate mitigation and resilience goals through a climate justice lens and an all-of-city approach.

The *Climate Ready Workforce Action Plan* provides a comprehensive analysis of the workforce needed to support some of the most capital-intensive of the CAP's goals and strategies. It analyzes how the strategies outlined in the CAP will shape the local labor market and projects demand in key areas of work. Together, the CAP and the *Climate Ready Workforce Action Plan* aim to ensure that tackling the climate crisis is not only technically achievable but also creates good jobs for local workers and strengthens the city's long-term economic resilience.

Over the last two years, Boston and the Commonwealth have taken historic action to address the climate crisis by increasing investments in the clean energy economy.

This focus will continue despite the current administration's defunding renewable energy research and projects. Boston's Climate Action Plan outlines key strategies that will support the creation of new jobs across four priority areas: building decarbonization, transportation, clean energy, and resilience and nature. We briefly describe these areas and the jobs they will support below with additional details on all modeling assumptions provided in section A.1 of Technical Appendix A.

Figure 1.1 – Timeline of Boston's Climate Action Plan

TRANSPORTATION ELECTRIFICATION

CAP CONTEXT: The City of Boston and the Commonwealth of Massachusetts are investing in new electric transit, school bus, and government vehicle fleets. To encourage more residents to make this shift from fossil fuel-powered vehicles to electric vehicles (EVs), the City needs more charging infrastructure. The Climate Action Plan includes strategies to ensure that every resident is within a five-minute walk of a public charging station. To achieve this, the City will expand curbside charging, add chargers in municipally owned lots, and foster public-private partnerships to increase publicly available EV charging in privately-owned lots. To reach this goal, the City is partnering with Eversource's Make Ready program to accelerate the installation of public chargers at municipal lots. Since 2020, the City has also required that large new developments with parking equip 25% of spaces with EV chargers and make the remaining 75% "EV-ready" for future installation.[6]

TYPES OF WORKERS NEEDED: Electricians, electrical engineers, automotive technicians, and positions supporting alternative transportation, like bicycle mechanics trained to work on electric bikes. Many fossil-fuel related jobs will become greener as auto mechanics learn to work on both gas and electric vehicles, bus drivers learn how to operate electric vehicles, and HVAC workers learn to install heat pumps. Finally, to capitalize on both public and private investments flowing to cities such as Boston, purchasing agents and business operations analysts will need training on applying for relevant state and federal tax credits and subsidies and complying with federal grants.

ELECTRICAL GRID UPGRADING

CAP CONTEXT: A just transition from fossil fuels to renewable energy is essential for a reliable, clean, and sustainable energy future. The CAP outlines several strategies to achieve this goal, including increasing the amount of renewable energy supplied to Boston's electric grid. To do that, more renewable sources of power and heat need to be built, including solar arrays, offshore wind, and geothermal systems. The utility-owned electricity distribution grid must be modernized to support the demands of electrification and to manage increasingly distributed energy resources, such as rooftop solar. Updating the grid will be central to electrifying transportation, and to ensure that the city's electrical network can deliver energy for an electric bus fleet and can charge more private electric cars, including in historically disinvested communities. At the same time, the expansion of renewable heating systems will require decommissioning gas networks and building geothermal networks.

TYPES OF WORKERS NEEDED: Electricians, wind welders, and geothermal drillers will be in great demand. To update the grid, the City and utilities will need GIS technicians and analysts, power market analysts, urban planners, civil and electrical engineers, and data analysts.

COASTAL RESILIENCY AND NATURE-BASED SOLUTIONS

CAP CONTEXT: As climate change delivers more extreme temperatures and rising sea levels, the City will need to prevent or respond to flooding, extreme storms, heat waves and intense weather events—mitigating these inevitable impacts to ensure residents' safety, livability, and comfort. Boston has the unfortunate distinction of being the eighth most vulnerable city in the world to climate-change-related flooding. Boston Harbor's relative sea level rise is speeding up at a faster pace than the global average.[7] What's more, storms are growing more frequent and more intense, which will increasingly cause severe flooding, overwhelming the city's sewer and water systems. As a densely built city, Boston's urban heat intensity ranks sixth out of 158 U.S. cities.[8] To protect residents from these climate changes in the short and long-term, the CAP includes strategies to protect and expand open space and the urban tree canopy, protect coastlines with nature-based solutions and gray infrastructure, and expand green infrastructure such as permeable pavement, rain gardens, swales, and related measures, and expand policies that incentivize stormwater management on private properties. In addition, the City's Coastal Flood Resilience Overlay District put Coastal Flood Resilience Design Guidelines in place for new buildings in 2021, which sets mandatory design flood elevations, revised height and setback rules, and limits certain uses in areas likely to flood.

TYPES OF WORKERS NEEDED: Arborists, landscapers, urban foresters, and heavy machinery operators to install and maintain resilient infrastructure; stormwater technicians and managers, green roof designers, community outreach specialists, urban planners, and GIS technicians and analysts to anticipate, coordinate, and prioritize investments based on rapidly changing conditions.

BUILDING DECARBONIZATION

CAP CONTEXT: Buildings make up almost 70% of Boston's emissions—reducing these emissions across the city's building stock is key to meeting our climate goals. The CAP outlines strategies to reduce emissions across all building types—large and small, existing and new—and leading by example through emissions reductions in municipal buildings. Boston has been making improvements in energy efficiency in municipal buildings through the 2017 Renew Boston Trust, which finances retrofits. The most significant policy that the city has adopted is the Building Emissions Reduction and Disclosure Ordinance (BERDO) 2.0, passed in 2021, which requires owners of large buildings to report annual energy and water consumption and adhere to progressively stringent emissions standards, aiming for net-zero emissions by 2050.[9] To reduce energy consumption in residential buildings, Mayor Wu recently announced the Boston Energy Saver program, which will help Bostonians access MassSave efficiency and electrification incentives, with the goal of installing at least 5,000 heat pumps and weatherizing 10,000 buildings from 2025 to 2027.[10]

TYPES OF WORKERS NEEDED: construction workers, energy auditors, weatherization technicians, HVAC technicians, electricians, and building systems operators, among others—all of whom will need training to install and maintain these new technologies.

For Boston's investments in each of these four areas to be realized in the near-term requires an understanding of the workforce that is needed for implementation. This includes estimating the number of workers and types of skills that will be in demand, building and supporting training programs, preparing individuals to enter the training pipeline, and working with employers to ensure job placements and a commitment to job quality. Without a workforce lens, Boston's CAP goals won't be achievable or equitable. The transition to a green economy will require "greening" some existing jobs while also creating new opportunities and ensuring a just and equitable transition for workers in fossil-fuel related occupations. This transition will result in a modest net increase in employment over the next two decades.

The Need for a Climate-Ready Workforce

Boston—and the nation—are at a critical moment in deciding our climate and jobs future.

Before 2025, demand for the clean energy workforce was growing faster than the overall economy. From 2021 to 2022, the U.S. Department of Energy estimated that job growth in clean energy roles grew by 3.9%, outpacing the national employment growth rate of 3.1% during the same period. The Bureau of Labor Statistics (BLS) projected strong growth in clean energy jobs in geothermal, wind, and solar electric power generation, with an employment decline in jobs related to fossil fuel electric power generation. While the current administration has rolled back several key clean energy initiatives and dampened economic forecasts, City policies can preserve our climate goals, boost our economy and support workers threatened by federal policies.

The bottom line is that we cannot have a climate-ready city without a climate-ready workforce.

To guide Boston leaders in this effort, we conducted an analysis of the workforce needed to achieve the City's climate goals in four priority areas: (1) Building Decarbonization, (2) Transportation Electrification, (3) Clean Energy, and (4) Resilience and Nature-Based Solutions.

Our analysis focused on addressing the following key research questions:

- **WORKFORCE DEMAND:** How many workers will be needed to achieve Boston's climate goals in each priority area? How many workers will be displaced from traditional carbon-based jobs?
- **WORKFORCE SUPPLY:** What is the current supply of workers in Greater Boston who can fill these jobs? How many are expected to retire in the next decade? How many workers will need to be trained or re-trained to fill these positions? What skills will these workers need to succeed?
- **JOB QUALITY:** Are green jobs *good* jobs? Do they lead to family sustaining wages and stable careers?
- **ACCESS/EQUITY:** Which groups of workers can access green jobs? What barriers prevent Boston residents from pursuing green job training and career opportunities?
- **TRAINING ASSETS:** What education and training programs serve Boston's green workforce system? What types of organizations train green workers? Which training programs are over/under subscribed?
- **CAPACITY AND GAPS:** What does current training capacity look like, and where are the biggest shortfalls? What barriers exist for Boston residents to access green training?

We conclude by offering recommendations on how the City can support and/or expand existing training programs, establish best practices for ensuring job quality, identify and coordinate career pathways, and advance economic opportunities created by Boston's climate investments that are open to all residents. These recommendations are anchored in Boston's climate justice principles as laid out in Boston's 2030 Climate Action Plan draft released in summer 2025.

2.

WORKFORCE DEMAND FROM BOSTON'S CLIMATE INVESTMENTS

45 occupations

Identified across Boston's green economy using detailed green skills analysis

$53B–$148B in total investment

Projected public and private spending associated with Boston's Climate Action Plan through 2050

44,000–132,000 jobs supported per year

Estimation of direct jobs supported from 2025–2050

6,700 net new jobs

Accounting for roughly 10% of total supported jobs

Definition: What is a "Green" Job?

Categorizing and defining green jobs is a complex exercise. The definition of a green job depends on contextual factors such as industry, occupation, production methods, and outputs (e.g., product and services). At an industry or occupation level, jobs that generate goods or services that benefit the environment are considered green jobs. At the production level, green occupations encompass jobs that utilize sustainable production processes. At the output level, green jobs can either directly mitigate climate change or improve environmental quality or indirectly serve those goals, by providing products and services upstream that lead to environmental benefits.

While there are only a few jobs that are completely "green" (e.g. solar panel installation, wind turbine technician, stormwater manager), there are many more jobs that already or will soon require green knowledge and skills (e.g., construction project manager, HVAC technician, civil engineer). For the purposes of this report, we employ a broad definition of green jobs defined by the Bureau of Labor Statistics[11] as either:

1. "Jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources."
2. "Jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources."

Methods: How Can We Measure Demand for Green Jobs?

Forecasting the exact number of jobs created by a policy is difficult, particularly when investments are being made at city, state and federal levels simultaneously. How can we measure the scale of green workforce demand created by the strategies outlined in Boston's CAP (by sector, occupation, and over time)? In doing so, we seek to answer the following research questions:

1. What is the current employment level and recent job posting growth for occupations identified as green and/or greening?
2. How many more jobs will be required during the green transition in the near-term (e.g., next 5 years) versus the long-term (e.g., 25 years)?
3. Which carbon-based occupations will be affected by the transition to green technologies? How many workers might be entirely displaced from traditional carbon-based jobs?
4. Given these projections, what are the aggregate employment effects of meeting Boston's green investment targets? How many net new jobs will be created?

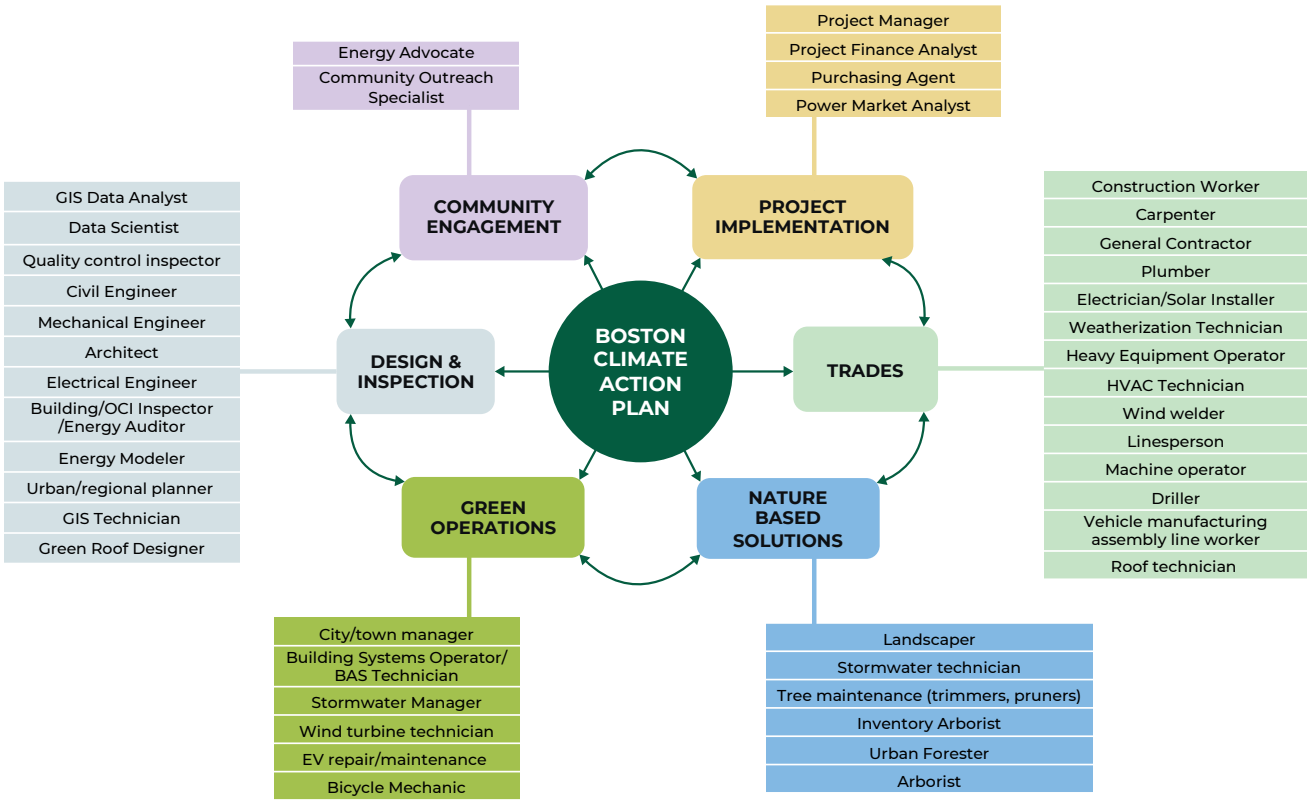
To answer these questions, we use three key sources of data that correspond to the primary phases of our demand-side analysis to (1) identify green occupations, (2) understand the current and projected employment trends of those green occupations, and (3) project the additional number of jobs supported by Boston's CAP.

1. IDENTIFYING GREEN-RELATED OCCUPATIONS USING ONLINE JOB POSTINGS

To identify green occupations, we make use of a proprietary dataset of several hundred million online job postings collected by Lightcast, a labor market information firm that produces real time labor market data on job postings.[12] For this study, we analyzed postings from 2012 through 2023 to assess trends over time. First, we develop a taxonomy of the skills that are traditionally required in green jobs using a range of sources including O*NET database maintained by the U.S. Bureau of Labor Statistics, encompassing over 900 occupation profiles and covering more than 55,000 jobs across the U.S. economy. Using machine learning techniques, we then analyzed the text of Lightcast job postings to assess the skill content of jobs and identify those that demand green skills– even when they are not roles that are traditionally thought of as "green" jobs. This includes green-enabled jobs—jobs driven by the green economy but not typically classified as performing a green role themselves. For example, this might include key green "enabled" jobs such as project managers, for which demand will increase as more technical green projects are created that require the specific skill sets beyond that of a generalist.

Using this technique, we identified 6 broad sectors of the green economy that are in high demand for Greater Boston and 45 key green and green-related occupations within each sector. Figure 2.1 shows that most of the green and/or green-related occupations that we identified are in the Trades as well as the Design and Inspection broad occupations groups. These sectors will be most impacted by the green transition due to the City's investments in climate mitigation and resilience, including new climate-ready infrastructure, over the coming decade. There will also be a set of occupations that will see greater demand to maintain this new infrastructure in the Green Operations and Nature-Based Solutions Occupations. Finally, there will be a need for greater planning and community engagement as these projects get underway.

Figure 2.1 – Identifying Green-Related Occupations



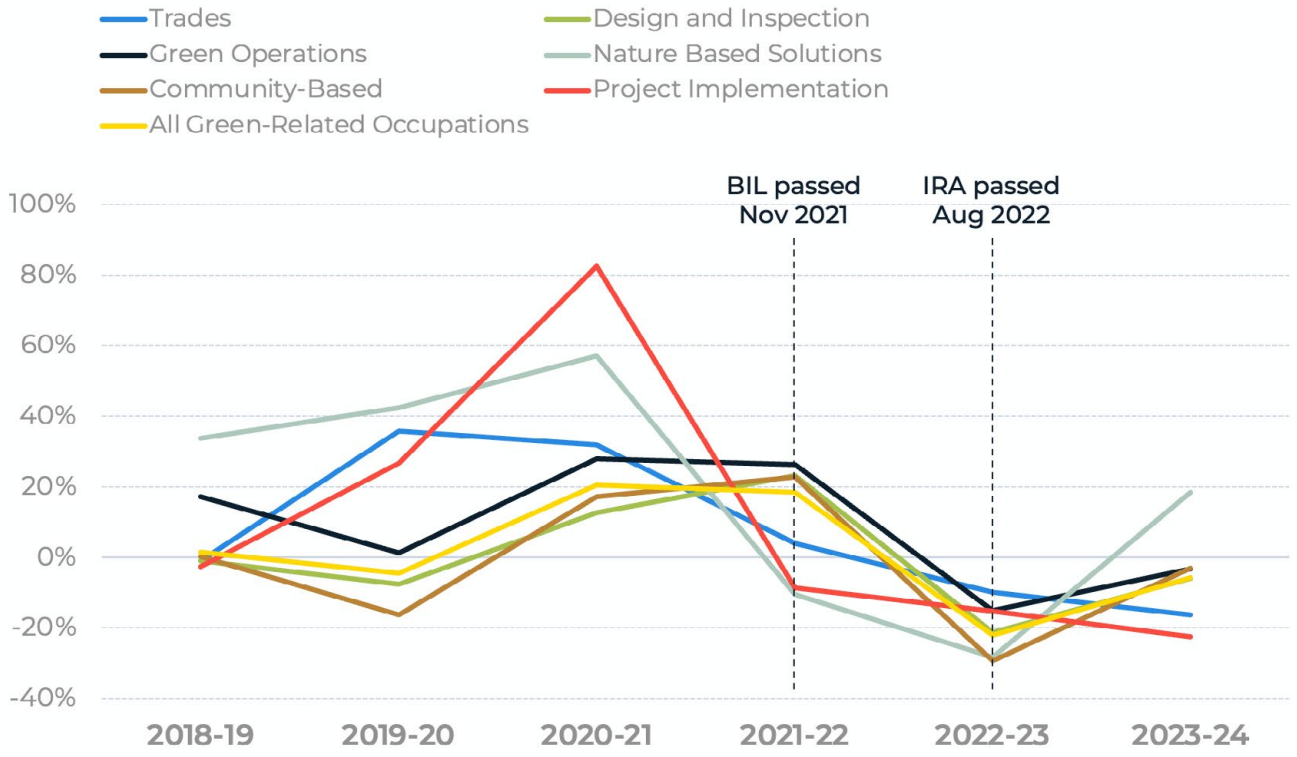
Source: Authors' calculations based on machine-learning text analysis of Lightcast online job posting data.

Note most of these are existing occupations that will require workers to perform similar functions as they do now, but in green contexts, or apply green knowledge, or employ green processes. Only a small subset of occupations will emerge as completely green, requiring the most technical green skills and training to carry out daily job functions—such as weatherization technician, wind welder, energy auditor, green roof designer, EV repair and maintenance, stormwater technician, energy advocate, and power market analyst.

2. MEASURING BASELINE JOB GROWTH AND EMPLOYMENT PROJECTIONS

Using the most recent employment projections from the U.S. Bureau of Labor Statistics,[13] we measure the pre-existing baseline for recent and projected job growth through 2033 for each of the 45 green-related occupations that we identified using the Lightcast data. Figure 2.2 shows that post-COVID, recent labor demand in each of these six broad occupation groups was strong as the economy re-opened between 2020 and 2021. However, job growth soon slowed in the subsequent two years 2021-22 and 2022-23 as the labor market settled into

Figure 2.2 – Annual Growth of Greater-Boston Job Postings, 2018-2023



Source: Authors' calculations using data from online job postings aggregated by Lightcast.

Note: Boston-area is defined as the Boston, Metro North, and Metro South/West Workforce Development Areas. Dashed lines represent when policy-driven climate-related investments become effective for the IRA = Inflation Reduction Act, BIL =Bipartisan Infrastructure Law, and ARPA = American Rescue Plan Act. The number of jobs for Trades is on the right-hand axis.

its “new normal.” More recently, the passage of the federal BIL and IRA spending helped spur rapid job growth in nature-based solutions, green operations, and community engagement occupations. However, job growth in the trades and project implementation continued to be negative through 2023-24.

In 2024, the Bureau of Labor Statistics projected above-average annual job growth of more than 4% per year over the course of the following decade (2023-2033) in key, green-related occupations within each broad group, particularly in the trades.[14] For example, Table 2.1 shows projected double-digit employment growth over the 10-year period from 2023-2033 for general contractors, electricians (including solar installers), construction workers, carpenters, plumbers, and HVAC technicians. Among Design and Inspection occupations, job growth among data scientists, green roof designers, urban/regional planners, and GIS data analysts was projected to grow faster than what BLS has projected for the overall labor market (4%). Other key green-related occupations in Green Operations (e.g., city/town manager, EV repair/maintenance), Nature Based Solutions (e.g., landscaper, tree maintenance), Community Engagement (e.g., energy advocate, community outreach specialist), and Project Implementation (project manager, purchasing agent) were similarly expected to experience above-average employment growth over the course of a decade.

The rollback of IRA and BIL tax credits under the current administration have removed a key federal stimulus for the development of clean energy. State and city policies are more important than ever to continue local momentum and reach our climate goals.

A NOTE ABOUT SOLAR INSTALLERS IN MASSACHUSETTS:

Massachusetts law requires that all electrical work for a solar panel installation, including the connection to the electrical system, be performed by a licensed electrician. While some non-electrical components might be installed by others, the Massachusetts Board of State Examiners of Electricians has ruled that all aspects of the solar photovoltaic (PV) installation itself are considered electrical work and must be done by a licensed professional. This is to ensure public safety and compliance with electrical codes. Non-electricians, such as homeowners or general contractors, cannot legally perform the electrical parts of the job. However, non-licensed individuals can perform other non-electrical tasks like physical mounting of the panels, some preparatory design work, or other parts of the installation that do not involve electrical components.

Table 2.1 – Recent Greater Boston Employment Snapshot and for 45 Green Occupations by Broad Group, 2023-2033

OCCUPATION BY SECTOR	EMPLOYMENT		
	2023 Actual	2033 Projection	Growth 2023-2033
Trades and Trade-Related	**49,230**	**56,253**	**14.3%**
General Contractor	8,816	9,945	12.8%
Electrician/Solar Installer	8,241	10,088	22.4%
Construction Worker	8,114	9,219	13.6%
Carpenter	7,924	8,798	11.0%
Plumber	6,019	7,073	17.5%
Heavy Equipment Operator	3,023	3,322	9.9%
HVAC	2,853	3,365	17.9%
Roof technician*	1,359	1,438	5.8%
Wind welder	1,127	1,222	8.4%
Machine operator*	610	610	0.0%
Weatherization Technician*	608	624	2.7%
Linesman	203	216	6.4%
Driller*	188	188	0.0%
Vehicle manufacturing*	145	145	0.0%
Design and Inspection	**38,586**	**40,494**	**4.9%**
GIS Data Analyst	9,357	9,882	5.6%
Data scientist	5,594	7,106	27.0%
Civil Engineer	5,086	5,154	1.3%
Mechanical Engineer	4,487	4,570	1.8%
Architect	4,000	3,963	-0.9%
Quality control inspector	3,410	3,139	-7.9%
Electrical Engineer	2,279	2,214	-2.9%
Energy Modeler	1,835	1,835	0.0%
Building/OCI Inspec/ Energy Auditor	1,447	1,447	0.0%
Urban/regional planner	511	549	7.4%
GIS Technician	314	304	-3.2%
Green roof designer	266	331	24.4%

OCCUPATION BY SECTOR	EMPLOYMENT		
	2023 Actual	2033 Projection	Growth 2023-2033
Green Operations	**13,121**	**13,528**	**3.1%**
City/town manager*	6,999	7,384	5.5%
Stormwater manager	4,937	4,986	1.0%
BSO/BAS Technician	480	443	-7.7%
Bicycle Mechanic*	367	367	0.0%
EV repair/maintenance*	192	202	5.2%
Wind turbine technician*	146	146	0.0%
Nature Based Solutions	**10,975**	**11,794**	**7.5%**
Landscaper	8,369	9,088	8.6%
Tree maintenance*	1,916	2,008	4.8%
Stormwater technician*	268	274	2.3%
Urban forester*	211	217	3.0%
Inventory arborist	109	108	-0.9%
Arborist*	102	98	-3.8%
Community Engagement	**8,917**	**9,994**	**12.1%**
Energy Advocate	7,822	8,758	12.0%
Community Outreach Specialist	1,095	1,236	12.9%
Project Implementation	**25,866**	**27,399**	**5.9%**
Project Finance Analyst	13,108	13,486	2.9%
Purchasing agent	6,410	6,731	5.0%
Project Manager	6,231	7,061	13.3%
Power market analyst	117	121	3.4%

Sources: Employment levels for Boston, Metro North, and Metro South/West Workforce Development Areas from Massachusetts Executive Office of Labor and Workforce Development, Department of Economic Research, obtained from https://lmi.dua.eol.mass.gov/lmi/LongTermOccupationProjections?_ga=2.83433622.1639114892.1755803789-1040143 10.1741730950; *2023 Level is from Lightcast, constrained to QCEW inputs; 2033 Projection is derived using national projections for growth from the Bureau of Labor Statistics.

However, there are several caveats to keep in mind. First, some of these above-average growth occupations are those with a very small employment base. For example, among green roof designers there were only 266 jobs in 2023 with a projected growth rate of 24.4% yielding a total of only 331 jobs by 2033.

Second, we note that not all the workers in these occupations are currently participating in or will be expected to carry out green functions. In fact, they may be employed in a variety of unrelated industries yet still have the basic skills that would allow them to take on important roles in the green economy with either on-the-job or short-term training to acquire green content knowledge.

For example, project managers work in many industries, such as education, healthcare, or engineering that are often context-specific which suggests these workers could potentially transition to applying their skills in the green context if they are equipped with that knowledge.

Third, we have been building the foundation to measure the demand for green jobs from the ground up, starting with the 45 detailed occupations identified through our green skills analysis. We should also note that these occupations cut across multiple industries, many of which will need to be engaged in preparing workers to learn the skills needed for the green transition—either through informal on the job training or workforce development programs. Technical Appendix A, Figures A1 through A6 provide heat maps identifying the share of jobs in each of the six sectors that lie within each industry based on reverse staffing patterns. For example, most employment in the Trades lies within the construction industry, followed by manufacturing, although there are also some occupations that are concentrated in the retail sector such as automotive service technicians. Design and Inspection jobs are largely concentrated in the professional, scientific and technical services industries, followed by government and manufacturing. Employment in Green Operations is more dispersed across construction, government, retail trade and other services. Coastal resilience and nature-based solutions jobs are also more dispersed across administrative support & waste management, government, utilities, and to a much lesser extent, construction. In contrast, employment in Project Implementation is highly concentrated in professional, scientific and technical services as well as the finance industry.

3. PROJECTING TOTAL JOBS SUPPORTED BY BOSTON'S CLIMATE ACTION PLAN

Traditional economists' input-output models cannot be readily applied to create adequate projections of how climate mitigation and resilience investments will stimulate specific green economic opportunities or how those will ripple throughout the economy. This is because the supply chains and materials involved in building climate-resilient infrastructure differ from those that drive traditional infrastructure investments (e.g., building roads or bridges) built with locally produced materials (e.g., concrete or rebar). Instead, green projects often rely on different building materials, many of which are imported from outside the region. As a result, green projects are less likely to create local employment unless Boston entrepreneurs create new businesses to replace "imported" portions of the supply chain.

To overcome these challenges, we projected the number of jobs supported by Boston's Climate Action Plan for each of the four key priority areas using the following four step process (please see section A.1 of Technical Appendix A for additional details):

a. Estimate the total dollar investment for each Boston CAP strategy

b. Project the total number of jobs supported by the CAP using the UMass Political Economy Research Institute (PERI) model[15]

c. Determine the number of jobs supported per year based on the timing of projects

d. Disaggregate total jobs supported by broad industry sector

Public regulations like BERDO and the CFROD will drive significant long-term private investment in decarbonizing Boston's buildings.

Estimate the total dollar investment for each CAP strategy

First, we develop estimates of the total dollar investments that will be required for each major strategy described in Boston's CAP. Specifically, we focused on four key climate objectives as described in the CAP: Transportation Electrification, Electrical Grid Upgrading, Building Decarbonization and Coastal Resiliency and Nature-Based Solutions to combat excessive heat, stormwater and inland flooding caused by extreme precipitation, and coastal flooding.

Many of the priority areas are defined, but implementation strategies and the spending to meet them have yet to be fully developed. To identify current spending on each of the four priority areas, we assessed and identified planned spending from local capital planning documents that would affect economic opportunity in the region. For example, baseline and near-term spending (2025-2030) for transportation electrification was assessed using documents from both the City utilities and the Massachusetts Bay Transit Authority. We also engaged with staff across city agencies to better identify near-term (e.g., through 2030) budgeted amounts and how they determined what the long-term (e.g., through 2050) attainment goal was in each CAP strategy. Finally, we also worked with key stakeholders outside of city government to model, to the best of our abilities, what CAP goal attainment through 2050 would entail. We then developed cost estimates to the extent possible.

We also modeled how public regulations like the Building Emissions Reduction and Disclosure Ordinance (BERDO) and the Coastal Flood Resilience Overlay District (CFROD)[16] could drive private investment in the long-term. For example, the Rocky Mountain Institute (RMI),

an independent, nonpartisan nonprofit founded in 1982 that transforms global energy systems through market-driven solutions, has developed cost estimates for shifting buildings away from carbon emissions and toward electrical or renewable power sources ("decarbonizing"). We applied those estimates to the building footprint across the City of Boston and estimated how much it will cost to decarbonize Boston's buildings. We assume that owners of the large buildings covered by the law, which requires that they decrease their emissions to net-zero by 2050, will comply. However, we also acknowledge that these investments could be costly and create hardships for some building owners or significantly "crowd-out" other projects within the construction market for the city. See A.1 of Technical Appendix A for more details.

Project the total number of jobs supported by the CAP

To determine the number of jobs supported by the CAP, we utilized a set of estimates derived from input-output structure models that have been developed by the Political Economy Research Institute (PERI) at University of Massachusetts Amherst. The PERI estimates make use of the IMPLAN models which are the most complex and comprehensive estimates of the mix of tasks that produce employment and economic relationships in carbon-reducing investments and represent the best estimates that currently exist of how to identify employment effects of spending on climate priorities.

PERI analysis examines employment at the national level via three channels: direct, indirect, and induced job creation channels. For example, the impacts of investments in the respective areas of home retrofitting or installing solar panels would be expected to produce:

- **Direct job creation**—the jobs created, for example, by retrofitting buildings to make them more energy efficient or installing solar panels;
- **Indirect job creation**—the jobs associated with industries that supply intermediate goods for the building retrofits or solar panels, such as glass, steel, and transportation. In other words, indirect effects measure job creation along the clean energy investment supply chain;
- **Induced job creation** —the expansion of employment that results when people who are paid in the construction or steel industries spend the money they have earned on other products in the economy. These are the multiplier effects within a standard macroeconomic model.

Note that our analysis only focused on the direct effects of Boston's spending on CAP strategies because we do not have reliable estimates of indirect or induced employment effects at the local level for two reasons. First, the indirect (supply chain) effects are harder to predict because many green inputs are not manufactured locally in Boston and/or those that are manufactured locally are very idiosyncratic compared to the national supply chain. Second, the induced job creation is also harder to predict at the local levels since resources are more constrained, increasing the likelihood that investments because of the CAP will "crowd out" private investment for other capital projects that would otherwise

have employed these workers. Specifically, CAP projects may displace or delay other projects that would have employed those same workers, rather than creating entirely new jobs.

Thus, our analysis estimates the total number of workers employed (jobs supported) through spending related to the strategies outlined in Boston's CAP. By "supported," we mean positions where someone will be working on green projects stimulated by the CAP, even if those workers were already employed in that occupation but on non-green projects instead. Importantly, most of this impact reflects the upgrading of skills and the movement of existing workers into green roles, rather than net new job creation. We then apply a conservative estimate from the literature, roughly 10%, to project the number of net new jobs that are created by spending related to the strategies outlined in Boston's CAP.[17]

"Jobs supported" includes all workers employed on CAP-stimulated green projects—primarily existing workers shifting from non-green roles, with an estimated 10% representing net new jobs.

Given that these indirect macro effects are likely to be small at the local level, we feel confident that our analysis provides a fair, and conservative estimate of the number of jobs likely to be supported versus created if spending on CAP-related work proceeds as planned in Boston.

To determine the total number of ***direct jobs*** supported by Boston's CAP, we divide the total dollar amount estimated in step 1 by the cost of each potential job supported. PERI estimates the cost for each job created to be roughly $33,460 (Inflation Reduction Act estimates) to upwards of $54,750 (BIL estimates).[18] These estimates are annualized costs per job per year which assumes year-round full-time employment. This may differ from the number of workers supported by these investments if one job-year is used to support multiple part-time or part-year workers.

In our modeling, we also use the estimates generated by the BIL. The BIL estimates use a higher cost per job, which are most similar to the types of activities currently funded through Boston's climate policies. Using the higher cost estimate also gives us a more conservative projection of how many jobs will be supported. This approach reflects two factors: the uncertainty about when CAP projects will be implemented, and the City's commitment to creating quality jobs, which typically cost more to create because they pay higher wages and provide more comprehensive benefits.

Finally, we acknowledge the ***uncertainty*** surrounding these planned investments, particularly those that are scheduled to occur over a longer time horizon and especially given federal priority shifts. Even already committed spending and regulation may not occur exactly as planned. For example, if a project is delayed or if costs are projected to be significantly above the original budget, these investments may not occur on-time or at all. Similarly, regulation requires compliance, and if stakeholders do not comply with policies like BERDO, the economic impacts of its regulations will be muted. Thus, our estimates are our best projections of the potential economic and employment impacts given the currently available information.

As a result, when we are estimating the employment effects of a ***potential investment*** rather than discussing one that is already in specific plans or spending documents, we generate both optimistic and conservative scenarios for three out of the four climate areas that involve long-term investments: Electrical Grid Upgrading, Coastal Resiliency and Nature-Based Solutions, and Building Decarbonation. Although we have tried to account for risks that can be anticipated at this time, our projections may vary significantly relative to the actual number of jobs created due to unanticipated factors such as new technology, changing macroeconomic conditions, and global supply chains that can cause economic growth and employment to accelerate or stagnate over time.

Determine the number of jobs supported per year

While we understand the overall potential costs, we do not know exactly when City, federal, and private investments will be made, and therefore, when those investments will spur economic and employment opportunities. Yet any type of spending activity creates employment over a given amount of time. For example, a project that creates 100 jobs that last for one year only needs to be distinguished from another project that creates 100 jobs that continue for 10 years each. It is important to keep this time dimension in mind in any assessment of the impact on job creation of any investment activity.

As a result, there are two ways to measure the employment impacts of new economic investments. One is through measuring "job years." This measures cumulative job creation over the total number of years that jobs have been created. Thus, an activity that generates 100 jobs for one year would create 100 job years. By contrast, the activity that produces 100 jobs for 10 years would generate 1,000 job years. Alternatively, we could report the same spending impacts in terms of jobs-per-year. For example, with the 10-year project we are using in our example, we could express its effects as creating 100 jobs per year for 10 years.

A "job year" equals one full-time job for one year, offering a consistent way to compare impacts across strategies with different CAP timelines.

Since we do not have information on the exact timing of many of Boston's CAP strategies, we express the impacts in terms of jobs per year. To do this, we simply divide the total number of job-years by the number of years between now and the CAP goal, resulting in the number of jobs supported each year during that time horizon. As a result, while our estimates of demand can be used to inform workforce development programming and to assess whether or not existing training programs are of an adequate scale, we cannot guarantee that these will be the exact numbers or the exact times those workers will be required.

Disaggregate total jobs supported by broad industry sector

In addition to presenting employment creation for the Boston economy through the City's CAP, we also disaggregate the total jobs supported across six key economic sectors that are most likely to be affected: Trades, Design and Inspection, Green Operations, Nature Based Solutions, Community Engagement, and Project Implementation. We identified these sectors based on the percentage of direct jobs estimated by PERI to be in each major occupation group (by two-digit Standard Occupational Classification code) as described in Section A.1 of Technical Appendix A.

Note that the level of employment generated within these six sectors through the Boston CAP accounts for most, but not all, of the total employment creation through these initiatives. The remaining employment creation is sprinkled across many other smaller occupations throughout the economy. However, to guide the City's strategy with respect to workforce development, we focused on only those six sectors of the economy that we identified as being in high demand due to the priorities listed in Boston's CAP.

We should note that these occupational sectors cut across multiple industries, many of which will need to be engaged in preparing workers to learn the skills needed for the green transition—either through informal on the job training or workforce development programs.

Results: The Scale of Workforce Demand Created by Boston's CAP

By applying the BIL/IRA estimates from the PERI input-output model to the dollar value of Boston's planned public investments and private sector investments arising from the enforcement of the BERDO and CFROD regulations, we estimate the total number of jobs that will be supported by the work outlined in Boston's CAP. Note that this method intentionally accounts for crowd-out where green-related spending may shift employment away from other capital projects that would otherwise have employed these workers. Thus, our estimates of the number of supported jobs is some combination of net new jobs as well as existing jobs that previously had supported non-green projects. This helps ensure that we do not overstate how many new jobs will be created by Boston CAP strategies. Finally, we consider the projected decline in traditional carbon-based jobs, to arrive at the final number of net new jobs over time.

By applying PERI's BIL/IRA input-output estimates, we assess how CAP investments support jobs over time, reflecting both newly created roles and workers moving into green work.

1. TOTAL JOBS SUPPORTED BY BOSTON'S CAP OVER TIME

Transportation Electrification, 2025-2030

We first developed estimates of the labor needed to support the CAP based on Boston's plans to electrify public bus transportation in the near-term. This includes converting the entire Boston Public Schools bus fleet to electric buses, adopting battery electric busses for the MBTA, adapting bus yards and depots to service and charge electric buses for both BPS and the MBTA, building public vehicle charging stations across the city, and building charging networks to make it possible to shift the City of Boston's fleet of vehicles to electric power.

Given the short-term nature of these planned investments and the progress thus far, we felt that the downside risks to these investments were low and did not warrant producing a conservative scenario. Overall, we anticipate that these plans will yield $885 million in new spending between 2025 and 2030 that will support upwards of 3,233 jobs per year over the 5-year period.

Projecting Labor Demand: Transportation Electrification

POLICIES AND PROGRAMS DRIVING INVESTMENTS:

- **Charging stations:** Build public vehicle charging stations across the city; build charging networks to make it possible to shift the City of Boston's fleet of vehicles to electric power.
- **Electric buses:** Convert the entire Boston Public Schools bus fleet to electric buses; adopt battery electric busses for the MBTA; adapt the bus yards and depots to service and charge electric buses for both BPS and the MBTA;

METHODOLOGICAL NOTES:

- Since there are no bus manufacturers based in the city, this does not include the manufacturing of electric buses.
- Many of the goals in this priority are slated to be completed by 2030, although current pace suggests delays.

KEY INPUTS AND ASSUMPTIONS

- Adoption and purchase of 700 electric busses in the BPS fleet; 800 light electric vehicles for the city fleet by 2030
- MBTA adoption of green busses across the fleet of approximately 1,100-1,200 busses (planned by 2040)
- BPS moving from wet refueling to electric recharging; City upgrade to level three chargers to enhance efficiency
- MBTA upgrading of facilities for charging. City upgrading of maintenance sheds to accommodate larger busses

POTENTIAL DOWNSIDE RISKS

- **Medium Confidence**—Clear plans for bus purchasing for BPS, city, and MBTA fleets with electric charging installation, but unallocated funding for remaining fleet upgrades.
- **Low Confidence**—Estimates/allocations are low relative to current spending for garage/depot and maintenance yard upgrading for electric buses, plus battery and charging technology could change needs.

OVERALL ASSESSMENT

- Transportation electrification is in transition mode currently and nearing initial attainment
- New technologies (batteries especially) likely keep the target moving, but initial attainment is close
- No need to model alternative scenarios since all investments are in the short-term.

Table 2.2 – Electrifying Transportation Investment Modeling Projections, 2025-2030

ACTION	POTENTIAL SPENDING	JOB-YEARS SUPPORTED OVER 2025—2030	JOBS SUPPORTED ANNUALLY OVER THE NEXT 5 YEARS
BPS Yard Improvements	$50 million	914	183
MBTA Yard Improvements	$800 million	14,600	2,922
CoB Fleet EV Charging Installation	$10 million	183	36
Public EV Charging Installation	$25 million	457	92
TOTAL	**$885 million**	**16,164**	**3,233**

Source: Authors' calculations applying PERI estimates to Boston CAP projected spending.

Electrical Grid Upgrading, 2025-2040

We next turned to modeling the labor needed to upgrade the regional power grid that supports the City of Boston to meet the expected increases in demand as the city moves from fossil fuels to electricity and integrates power from intermittent renewable sources. Given the longer time horizon for investment through 2040, we interviewed City and utility company staff to assess their progress towards the long-term goals in each of their planning documents. This included identifying planned grid improvements to expand or build new substations, improving transmission lines, and building or integrating new heating and cooling sources such as geothermal power.

Unlike electrifying transportation, upgrading the electrical grid involves greater uncertainty due to both the longer time horizon as well as specific concerns regarding the nature and timing of the investments. For that reason, we separate our projections into shorter 5-year time horizons within this longer 15-year period where possible in Table 2.3. For example, funding is available for grid upgrading but depends on utilities negotiating rate payer fees. It is also difficult to separate green versus routine line upgrading, and, despite holding great promise, current costs suggest that rolling out geothermal at scale is not yet feasible. Given these uncertainties, we generated both optimistic (100% completion) and conservative (only 50% completion) employment projections. Overall, we anticipate that these plans will yield $1 billion to $2 billion in new spending between 2025 and 2040 that will support upwards of 3,653 to 7,306 jobs per year over the 15-year period.

Projecting Labor Demand: Electrical Grid Upgrading

POLICIES AND PROGRAMS DRIVING INVESTMENTS:

- **Increased demand:** As the city moves from fossil fuels to electricity, need to build the infrastructure to increase electricity supply, such as expanding or building new substations and improving transmission lines;
- **Integration:** As more intermittent renewable sources of power are brought online, need to integrate them into the electrical grid, such as building or integrating new heating and cooling sources, including geothermal power

METHODOLOGICAL NOTES

- For this subsection, project plans were only available through 2040.

KEY INPUTS AND ASSUMPTIONS

- Installation of at least 5 critical substations or substation improvements and transmission upgrades across the city
- Costs are hard to identify but are likely between $500 million and $1 billion across the region
  - City of Boston—New East Eagle Substation.
  - City of Cambridge—New Cambridge Substation—Clean Energy Hub.
  - City of Boston—Greater Dorchester Area Initiative.
  - City of Somerville—Somerville Substation Expansion.
  - City of Cambridge—Alewife Substation Transformer Addition.
  - Transmission line upgrades to deal with both to-home and behind the meter renewable adoption cost between $500,000 and $9.5 million per mile
  - Geothermal pilot could lead to expansion; Cost of ~$15 million to heat and cool 36 buildings—overall costs could be lower when invested in and deployed at scale

POTENTIAL DOWNSIDE RISKS

- **Low Confidence**—Funding is available for grid upgrading and substation buildout via negotiation with utilities and set by rate payer fees, but less clarity on how much and exactly when it is deployed.
- **Low Confidence**—Creating line and system upgrades for "backwards metering" that facilitates renewable energy but timing is uncertain and difficult to distinguish from "regular" line upgrading.
- **Low Confidence**—Initial pilots for geothermal rollout and installation show very high costs making the feasibility of rollout at scale very uncertain.

OVERALL ASSESSMENT

- A number of important renewable projects are identified in the city and utility 5- and 10-year plans but transmission upgrades, regular maintenance, and line repairs after storms make this goal difficult to attain.
- Model separate scenarios for:
  - Optimistic—assuming 100% completion
  - Conservative— assuming only 50% completion

Source: Authors' calculations applying PERI estimates to Boston CAP projected spending. Note: *Indicates that no information is available regarding when these investments might occur so we are unable to make projections that there will be any annual job creation. The figures under the Jobs Supported Annually over 15 Years column represent average annual estimates, expressed in 5-year intervals where possible. These are annual averages and should not be divided by 15.

Table 2.3 – Electrical Grid Upgrading Investment Modeling Projections, 2025-2040

ACTION	POTENTIAL SPENDING	TOTAL JOB-YEARS SUPPORTED THROUGH 2040	JOBS SUPPORTED ANNUALLY OVER 15 YEARS**
Optimistic Scenario—Assuming 100% Completion			
Substation and Transmission Improvements 2025-2030	$1 billion	18,265	3,653
Substation and Transmission Improvements 2030-2035	$1 billion	18,265	3,653
Per mile transmission improvements*	$9.5 million	174	NA
Geothermal Installation**	$75,000 per unit	1.5	NA
TOTAL	**$2 billion**	**36,705**	**7,306**
Conservative Scenario—Assuming 50% Completion			
Substation and Transmission Improvements 2025-2030	$0.5 billion	9,132	1,826
Substation and Transmission Improvements 2030-2035	$0.5 billion	9,132	1,826
Per mile transmission improvements*	$500,000	9	NA
Geothermal Installation**	$50,000 per unit	1	NA
TOTAL	**$1 billion**	**18,275**	**3,653**

Source: Authors' calculations applying PERI estimates to Boston CAP projected spending.

Note: *Indicates that no information is available regarding when these investments might occur so we are unable to make projections that there will be any annual job creation. The figures under the *Jobs Supported Annually over 15 Years* column represent average annual estimates, expressed in 5-year intervals where possible, and should not be divided by 15.

Coastal Resiliency and Nature-Based Solutions, 2025-2050

To model labor demand supporting coastal resiliency and nature-based solutions, we identified several planned major investments. First, forthcoming major infrastructure projects in coastal resilience are expected to be approved by the Army Corps of Engineers in 2028. Second, the City has planned ongoing investments in green infrastructure, including enhanced public space and stormwater management strategies. Third, regulations like Boston's Coastal Flooding Resilience Overlay District (CFROD) will require large buildings in coastal flooding zones to build structures to mitigate or adapt to flooding and stormwater.

Projecting Labor Demand: Coastal Resiliency and Nature-Based Solutions

POLICIES AND PROGRAMS DRIVING INVESTMENTS AND JOBS:

- **Infrastructure improvements:** Protect city assets and build infrastructure to mitigate increased urban heat and flooding such as elevating parks above flood plains; installing infrastructure to help manage stormwater; and managing the city's tree canopy.
- **Boston Water and Sewer Commission (BWSC):** Additional permitting and oversight of stormwater responsibilities for property owners.
- **Coastal Flooding Resiliency Overlay District (CFROD):** Requires building owners to meet certain green infrastructure standards when building, renovating, or retrofitting on the property that go beyond FEMA's flood maps, to include areas likely to flood in a 100-year storm.

KEY INPUTS AND ASSUMPTIONS

- City estimates suggest that coastal resilience projects (both from public and private sector reach attainment at between $1 billion and $4 billion)
- This suggests that the investments will support between 18.2K and 72.8K workers over some period. Assuming a 2050 timeframe, these are levels that are likely easily absorbed through current workforce

POTENTIAL DOWNSIDE RISKS

- **High Confidence—**Installation of green infrastructure and implementation of green infrastructure strategies such as urban forestry will likely occur but be limited in scale.
- **Medium Confidence—**Coastal resilience investments and CFROD compliance presents opportunities for large investments but how and when rollout will happen remains uncertain.

OVERALL ASSESSMENT

- Indeterminate timeframe of CFROD is a downside risk to potential projections
- Model separate scenarios for:
  - Optimistic—assuming 100% completion
  - Conservative—assuming only 50% completion

These coastal and nature-based investments involve even greater uncertainty due to both the longer time horizon (e.g., through 2050) as well as the reliance on approval from federal entities (e.g., Army Corps of Engineers) and compliance from private stakeholders. For example, building owners do not need to comply with the CFROD until they undertake a major renovation or construction effort. That makes the timing of these investments and labor demands more difficult to model. Again, we separate our projections into shorter 5-year time horizons within this longer 15 year period where possible in Table 2.4. Given these uncertainties, we generated both optimistic (100% completion) and conservative (only 50% completion) employment projections. Overall, we anticipate that these plans will yield $12.25 billion to $21.5 billion in new spending between 2025 and 2050 that will support upwards of 8,858 to 15,525 jobs per year over the 25-year period.

$12.25–$21.5 billion in planned investments (2025–2050) supporting upwards of 8,858–15,525 jobs per year over the 25-year period.

Building Decarbonization, 2025-2050

While building decarbonization offers the largest opportunity for supporting employment, it also holds the greatest uncertainty because it relies on private market stimulation driven by Building Emissions Reductions and Disclosure Ordinance (BERDO) regulations and compliance. We modeled the labor demand that will be needed to meet Boston's BERDO requirements for large commercial, industrial, and multifamily buildings to achieve carbon-neutrality by 2050, as well as complying with initial emissions limits set for 2025 through 2030.

Early compliance only requires a few initial steps such as estimating each building's baseline carbon impact, and taking steps towards energy efficiency and emissions reduction, such as weatherizing and HVAC system upgrading. We use the low level of cost per square foot and further discount those costs by 50% to estimate what must be spent to comply with 2030 BERDO requirements. To generate an optimistic estimate of the number of jobs supported in the near term, between now and 2030, we used City estimates showing that 50% of all square footage in commercial, industrial and multifamily space will need to invest in retrofitting to reach BERDO emission reduction goals.[19] We also generate a conservative scenario that assumes only 40% of the available square footage will be retrofitted by 2050 as well as a "worst-case" scenario assuming only 20% of the available square footage will be retrofitted by 2050 (note: in this scenario, buildings that exceed their allowable emissions limits can comply with BERDO requirements through renewable energy procurement or Alternative Compliance Payments [ACPs], both of these compliance pathways are excluded from

Table 2.4 – Coastal Resilience and Nature-Based Investment Modeling Projections. 2025-2050

ACTION	POTENTIAL SPENDING	TOTAL JOB-YEARS SUPPORTED THROUGH 2050	JOBS SUPPORTED ANNUALLY OVER 25 YEARS
Optimistic Scenario—Assuming 100% Completion			
Green Infrastructure Implementation (2030)	$0.50 billion	913	183
District Level Coastal Infrastructure (2050 or longer-term)	$15 billion	273,973	10,959
Coastal Resilience and Adaptation Investments (2050)	$6 billion	109,589	4,384
TOTAL	**$21.5 billion**	**384,475**	**15,525**
Conservative Scenario—Assuming only 50% Completion			
Green Infrastructure Implementation (2030)	$0.25 billion	457	91
District Level Coastal Infrastructure (2050 or longer-term)	$8 billion	146,119	5,845
Coastal Resilience and Adaptation Investments (2050)	$4 billion	73,059	2,922
TOTAL	**$12.25 billion**	**219,635**	**8,858**

Source: Authors' calculations applying PERI estimates to Boston CAP projected spending.

this analysis but ACPs will be reinvested into building decarbonization capital projects in environmental justice communities via the Equitable Emissions Investment Fund). Overall, we anticipate that these plans will yield $4.41 billion to $8.15 billion in new spending between 2025 and 2030 that will support upwards of 16,106 to 29,763 jobs per year over the 5-year period.

Large buildings covered under BERDO are expected to reach net-zero emissions by 2050. In addition, the CAP includes strategies to support smaller multifamily, single family, and small commercial buildings not covered by BERDO in achieving emissions reductions. In modeling this, we assumed that most larger buildings will undertake the required interventions, but that small building retrofitting may be done at a much lower rate. We assumed that only 5% of smaller buildings will reach that standard by 2030, since retrofits can be expensive, even after subsidies and rebates, and these buildings face fewer regulatory requirements.

Projecting Labor Demand: Building Decarbonization

POLICIES AND PROGRAMS DRIVING INVESTMENTS: THE BUILDING EMISSIONS REDUCTION ORDINANCE (BERDO)

- BERDO is a local law that aims to reduce air pollution and greenhouse gas emissions generated by large buildings in Boston.
- Building owners covered by BERDO are required to report their buildings' annual energy and water consumption.
- Starting in either 2025 or 2030, they will also need to comply with building emissions standards (i.e., emissions limits).
- These emissions standards decrease over time, with all buildings expected to reach net-zero emissions by 2050.

METHODOLOGY

- City of Boston staff estimated square footage of retrofits for compliance in each category.
- Used RMI (formerly Rocky Mountain Institute) to estimate spending over next 5 years.
- Used spending to estimate jobs for the whole period as well as annually over 5 years.
- Annual Job Years=total number of jobs supported/ number of years in the time horizon.

KEY INPUTS AND ASSUMPTIONS, 2025-2030

- About 50% of BERDO multifamily square footage will be retrofit by 2030 (73+ million square feet)
- An estimated 50% of BERDO commercial/ industrial square footage will be retrofit by 2030 (114 million square feet)
- Reductions are relatively small at first with HVAC and weatherization
- Low end estimate of price per square foot utilized, in addition to a 50% discount
- Potential 20% of buildings go through weatherization and HVAC replacement by 2030
- Potential that 10% of buildings fulfill decarbonization

KEY INPUTS AND ASSUMPTIONS, 2025-2050

- 146 million square feet of multifamily residential will reach BERDO compliance
- 228 million square feet of commercial and industrial space will reach BERDO compliance
- New builds will explore innovative HVAC solutions including geothermal solutions

POTENTIAL DOWNSIDE RISKS

- **High Confidence—**BERDO multifamily and commercial real estate upgrades likely to happen in the short-term but potential adverse impact of changing economy could depress real estate markets; New development may be muted if Commercial Real Estate investors are required to spend significantly on compliance. Costs of small building development may be bid up due to regulatory driven retrofits of large buildings.
- **Low/Medium Confidence—**Difficult to estimate demand for small building retrofits, weatherization, and decarbonization as there are no policy or regulatory levers for compliance. Current subsidies mute, but do not eliminate, cost differentials, providing weak incentives for adoption.

OVERALL ASSESSMENT

- Reliance on private investments is uncertain and could take time to materialize.
- Model separate scenarios for:
  - Optimistic—assuming original 50% retrofit completion
  - Conservative—assuming revised 40% retrofit completion
  - Worst Case—assuming revised 20% retrofit completion

To develop potential cost estimates for these projects, we used RMI (formerly the Rocky Mountain Institute) cost estimates for building retrofitting. One drawback is that these estimates are static, not dynamic, and do not estimate what potential substitutions or price effects may take place if costs run high. However, if costs do run to the high end, it is likely that some of the investments in decarbonization will not happen. To model that we produce an optimistic versus a conservative scenario based on low ($77 per square foot) versus high ($274 per square foot) costs estimates from RMI. Overall, we anticipate that these plans will yield $39.1 billion to $146.4 billion in new spending between 2025 and 2050 that will support upwards of 28,500 to 106,600 jobs per year over the 25-year period.

Table 2.5a – Building Decarbonization Investment Modeling Projections, 2025-2030

ACTION	POTENTIAL SPENDING	JOB-YEARS SUPPORTED OVER 2025—2030 PERIOD	JOBS SUPPORTED ANNUALLY OVER 5 YEARS
Optimistic Scenario—50% compliance			
BERDO Residential buildings that have 15 or more units (assumes 50% retrofit completion)	$2.74 billion	49,996	9,999
BERDO Non-residential buildings that are 20,000 square feet or larger (assumes 50% retrofit completion)	$4.26 billion	77,813	15,563
Small Building Retrofits (assumes 5% of buildings not covered by BERDO achieve net-zero emissions by 2050.)	$1.15 billion	21,005	4,201
TOTAL	**$8.15 billion**	**148,814**	**29,763**
Conservative Scenario—40% compliance			
BERDO Residential buildings that have 15 or more units (assumes 40% retrofit completion)	$2.19 billion	39,997	7,999
BERDO Non-residential buildings that are 20,000 square feet or larger (assumes 40% retrofit completion)	$3.41 billion	62,250	12,450
Small Building Retrofits (assumes 7% of buildings not covered by BERDO achieve net-zero emissions by 2050.)	$1.61 billion	29,406	5,881
TOTAL	**$7.21 billion**	**131,654**	**26,331**
Worst Case Scenario— 20% compliance			
BERDO Residential buildings that have 15 or more units (assumes 20% retrofit completion)	$1.09 billion	19,999	4,000
BERDO Non-residential buildings that are 20,000 square feet or larger (assumes 20% retrofit completion)	$1.71 billion	31,125	6,225
Small Building Retrofits (assumes 7% of buildings not covered by BERDO achieve net-zero emissions by 2050.)	$1.61 billion	29,406	5,881
TOTAL	**$4.41 billion**	**80,530**	**16,106**

Source: Authors' calculations applying PERI estimates to Boston CAP projected spending.

Table 2.5b – Building Decarbonization Investment Modeling Projections, 2025-2050

ACTION	POTENTIAL SPENDING	JOB-YEARS SUPPORTED 2025-2050	JOBS SUPPORTED ANNUALLY OVER 25 YEARS
Optimistic Scenario—100% compliance @ $274 per square foot			
BERDO Residential buildings that have 15 or more units (assumes 100% retrofit completion)	$40.4 billion	738,000	29,500
BERDO Non-residential buildings that are 20,000 square feet or larger (assumes 100% retrofit completion)	$63.1 billion	1,150,000	46,100
Buildings not covered by BERDO achieve net-zero emissions by 2050	$42.9 billion	783,000	31,000
TOTAL	**$146.4 billion**	**2,671,000**	**106,600**
Conservative Scenario—100% compliance @ $77 per square foot			
BERDO Residential buildings that have 15 or more units (assumes 100% retrofit completion)	$10.8 billion	197,000	7,800
BERDO Non-residential buildings that are 20,000 square feet or larger (assumes 100% retrofit completion)	$16.8 billion	308,000	12,300
Buildings not covered by BERDO achieve net-zero emissions by 2050	$11.5 billion	209,000	8,400
TOTAL	**$39.1 billion**	**714,000**	**28,500**

Source: Authors' calculations applying PERI estimates to Boston CAP projected spending.

2. GREEN LABOR DEMAND BY SECTOR AND OCCUPATION

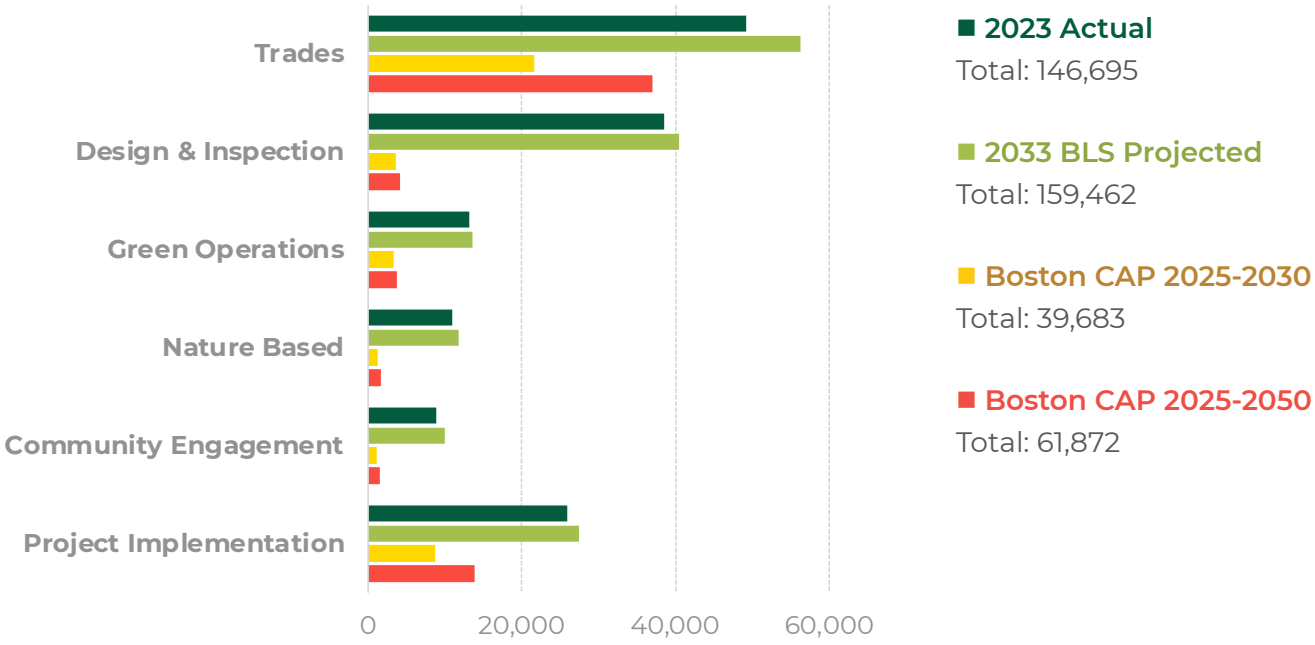
We aggregate the scenarios from each of the four investment areas into one unified set of estimates to come up with an overall best-, conservative-, and worst-case scenario for the Boston CAP. This allows for greater transparency of our aggregate estimates which come from mixing and matching the various optimistic and conservative scenarios based on the degree of confidence we had from our research into the magnitude and timing of each CAP strategy. Altogether, we anticipate that the Boston CAP will result in anywhere from $53B to $148B in spending which will support 44,244 to 132,665 jobs each year from 2025 through 2050. In the text we opt to present the conservative case as we consider this to be the most likely to occur. See Section A.1 of Technical Appendix A for details.

Based on the conservative scenario, we project that the Boston CAP will support roughly 67,000 full-time-equivalent jobs per year. Table 2.6 disaggregates the overall number of jobs into our six occupational sectors. Just over 50% of those jobs are projected to be in the Trades—largely in construction occupations. Another 20% of supported jobs are projected to be in Project Implementation, primarily in management, and to a lesser extent, office and administrative occupations. Although the absolute number of jobs in Design and Inspection and Green Operations are considerably smaller, they provide an important complement to the occupations that will experience the largest absolute increases in labor demand. This is because these complementary occupations may experience significant percentage increases in labor demand that could create bottlenecks in retrofitting buildings due to the need for design and inspection, and/or operate climate mitigation efforts such as stormwater management and heat mitigation.

How does this compare to the prior BLS projections for job growth in these sectors? Figure 2.3 shows that the BLS projections indicate that between 2023 and 2033, demand for workers in "green" related occupations is projected to grow by 8.7 percent, while overall employment growth is expected to be only 5.7%. **We project that Boston's CAP will sustain roughly 25% of jobs in these occupations by 2030 and potentially one out of every three jobs by 2050, primarily in the Trades.**

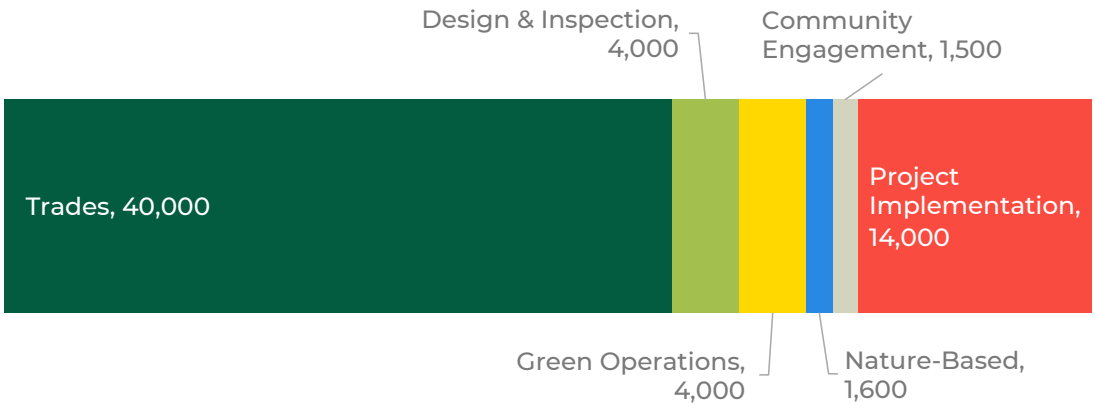
How many of these 67,000 supported jobs will be net new jobs? Prior research suggests that no more than 10% of jobs supported by climate investments such as the BIL or IRA will be net new jobs, which translates into roughly 6,700 net new jobs overall based on the Boston CAP. There are two reasons for this. First, many existing workers will move from non-green to green roles within their occupations as some portion of existing jobs are "greened" (e.g., auto mechanics). Second, some carbon-based jobs will be entirely displaced (e.g., gas plant operators) or converted to green jobs (e.g., drillers). However, much of the activity through 2030 is focused on expanding electric generation capacity. It is not until after 2030 that this additional electric generation begins to drastically erode the need for fossil fuels throughout the economy. Between 2025 and 2030, we expect to see some modest declines as electricity generation via natural gas and other fossil fuels experience lower demand as shown in Figure 2.4.

Figure 2.3 – Current and Projected Employment by Boston's CAP Priority Areas, 2023 v 2033



Sources: Left-hand figure—Authors' calculations using actual (2023) and projected (2033) employment as reported from BLS. Right-hand figure—Authors' calculations applying PERI estimates to Boston CAP projected spending under the conservative scenario.

Figure 2.4 – An Estimated ~67,000 Total Annual Green Jobs Will Be Supported by 2050



Sources: Left-hand figure—Authors' calculations applying PERI estimates to Boston CAP projected spending under the conservative scenario. Right-hand figure—Authors' calculations using actual (2023) and projected (2033) employment as reported from BLS.

Table 2.6 – Estimated Demand by Broad Occupation Group for Conservative Scenario

BROAD OCCUPATION GROUP	ELECTRIFYING TRANSPORTATION		ELECTRICAL GRID UPGRADING		COASTAL RESILIENCY & NATURE BASED SOLUTIONS	
	PERI Estimate of Direct Jobs	Annual Jobs Supported	PERI Estimate of Direct Jobs	Annual Jobs Supported	PERI Estimate of Direct Jobs	Annual Jobs Supported
Trades	**47.6%**	**1,539**	**47.6%**	**1,739**	**26.6%**	**2,384**
Construction	33.9%	1,096	33.9%	1,238	18.1%	1,620
Production	13.7%	443	13.7%	500	11.5%	1,029
Design and Inspection	**5.9%**	**191**	**5.9%**	**216**	**13.2%**	**1,181**
Architecture & Engineering	5.9%	191	5.9%	216	13.2%	1,181
Green Operations	**5.6%**	**181**	**5.6%**	**205**	**8.7%**	**780**
Installation, Maintenance & Repair	5.6%	181	5.6%	205	1.8%	162
Transportation & Material Moving	NA	NA	NA	NA	6.9%	618
Coastal Resiliency & Nature Based	**5.0%**	**162**	**5.0%**	**183**	**6.5%**	**581**
Buildings & Grounds	5.0%	162	5.0%	183	5.0%	447
Stormwater Tech	NA	NA	NA	NA	1.5%	133
Project Implementation	**23.1%**	**747**	**23.1%**	**844**	**18.2%**	**1,630**
Management	17.5%	566	17.5%	639	5.5%	492
Office & Admin.	5.6%	181	5.6%	205	14.9%	1,334
Business Operations	NA	NA	NA	NA	7.8%	698
Community Engagement	**5.0%**	**162**	**5.0%**	**183**	**5.0%**	**447**
Comm. & Social Svc	5.0%	162	5.0%	183	5.0%	447
Total		**3,233**		**3,653**		**8,950**

Source: Authors' calculations applying PERI estimates to Boston CAP projected spending.

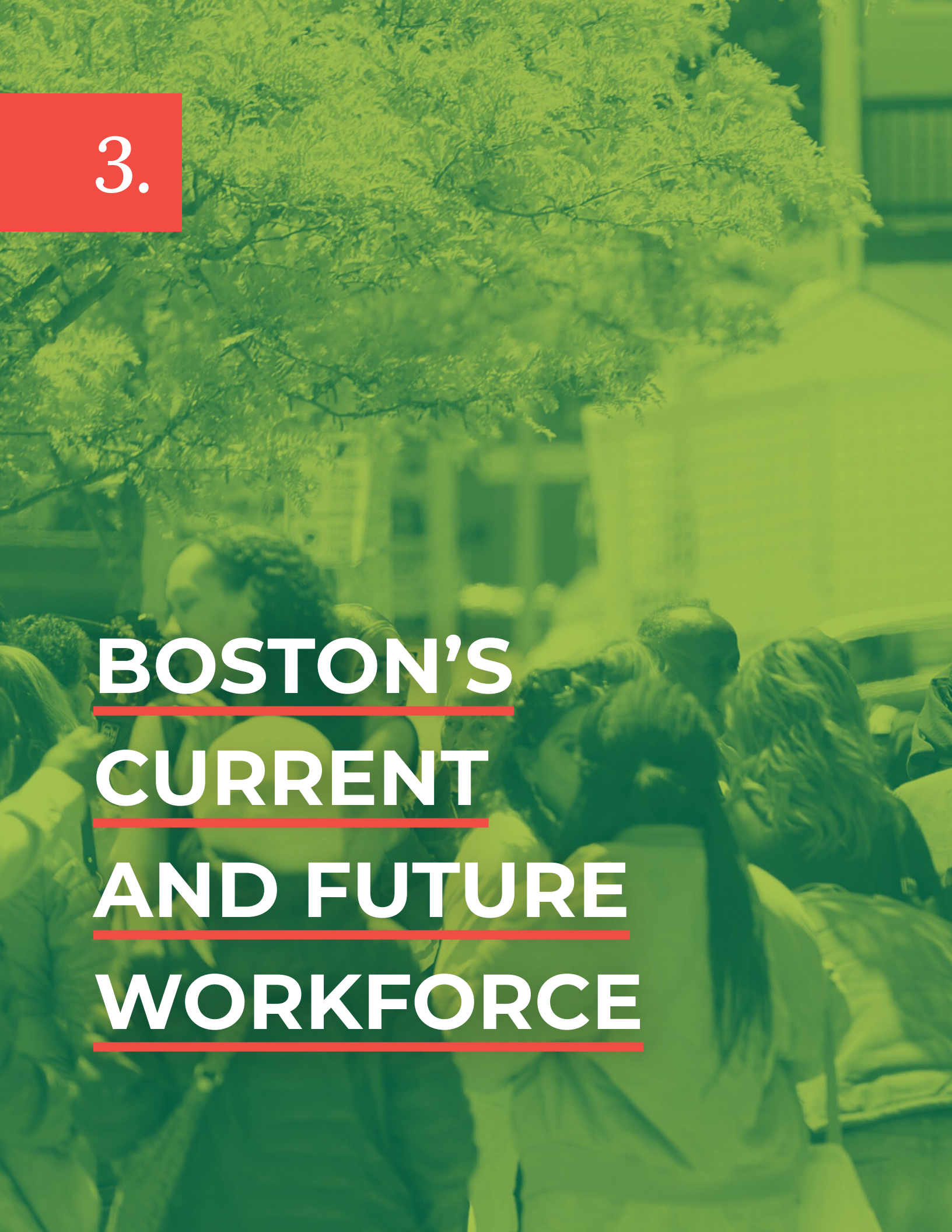
BROAD OCCUPATION GROUP	BUILDING DECARBONIZATION		TOTAL	
	PERI Estimate of Direct Jobs	Annual Jobs Supported	Annual Jobs Supported	Percent of Total
Trades	**60.8%**	**31,316**	**36,978**	**55.2%**
Construction	60.8%	31,316	**35,270**	**52.7%**
Production	NA	NA	**1,972**	**2.9%**
Design and Inspection	**5.0%**	**2,575**	**4,163**	**6.2%**
Architecture & Engineering	5.0%	2,575	**4,163**	**6.2%**
Green Operations	**5.0%**	**2,575**	**3,741**	**5.5%**
Installation, Maintenance & Repair	5.0%	2,575	**618**	
Transportation & Material Moving	NA	NA	**618**	**0.9%**
Coastal Resiliency & Nature Based	**1.4%**	**695**	**1,621**	**2.4%**
Buildings & Grounds	1.4%	695	**1,488**	**2.2%**
Stormwater Tech	NA	NA	**133**	**0.20%**
Project Implementation	**20.7%**	**10,662**	**13,883**	**20.7%**
Management	13.4%	6,902	**8,599**	**12.8%**
Office & Admin.	7.3%	3,760	**5,480**	**8.2%**
Business Operations	NA	NA	698	1.0%
Community Engagement	**1.4%**	**695**	**1,487**	**2.2%**
Comm. & Social Svc	1.4%	695	**1.487**	**2.2%**
Total		**51,100**	**66,936**	**100%**

3. THE BOTTOM LINE

As many as 67,000 workers in 45 different occupations—half in the Trades—will be needed over the next 25 years to design, build, and operate Boston's Green economy. Roughly 10% or 6,700 of these jobs will be net new job additions. These findings are in line with both regional and national studies that show although decarbonization brings consistent job growth across most states (other than fossil fuel producers), the net gains tend to be small. Regardless, green skills training will increasingly be required to enter and retain these jobs as the economy continues to decarbonize and older workers retire. We discuss this need for labor supply replacement in the next chapter.

Table 2.7 – Summary of Labor Demand Projections for Conservative Scenario

OCCUPATIONAL SECTOR	ANNUAL JOBS SUPPORTED, 2025-2050
Trades: This includes building trades workers, such as electricians, carpenters and plumbers, as well as skilled trades workers in other sectors, such as linespeople or electric vehicle technicians.	36,978
Project implementation workers: This includes project managers, purchasing agents, finance employees, compliance managers, and others who will oversee what is needed to get these projects done.	4,163
Design and inspection: This includes workers such as architects, engineers, drafters, and building inspectors.	3,741
Nature-based workers: These include everyone managing the city's environment or green infrastructure: arborists, landscapers, storm water technicians, etc.	1,621
Green operations workers: These are a mix of workers and technicians who will manage the new infrastructure once it is built, such as city planners and town managers or stormwater managers and building operations specialists.	13,883
Community engagement: This includes people organizing communities and public relations professionals who speak to those communities on behalf of the utilities, developers, and government agencies involved in the greening process.	1,487
TOTAL:	**66,936**



3.

BOSTON'S CURRENT AND FUTURE WORKFORCE

Boston's workforce is experienced but needs green-context training to meet demand.

~108,440

Workers in 45 green-related occupations

27,000 (25%)

Are age 55+, which will require about **2,700 replacement workers needed** each year through 2033

1,400

Trained/year currently, **just 15% of need**

**as of 2023*

Introduction

Many workers who will fill the roles supported by Boston's CAP may already have the required skills but will need to learn how to apply them in a green context. Some workers, such as those in project implementation and community engagement, will learn on the job by working on green projects. Others, such as workers involved in designing, installing, and managing coastal resilience infrastructure, both grey and green infrastructure, will need more formal training. Moreover, as these jobs turn over, particularly as older workers retire in greater numbers over the next decade, green skill training will be required for younger workers to enter these jobs and stay employed as the economy continues to decarbonize.

Two risks loom if the current Boston regional workforce is unable to develop the skills and expertise that will be in heavy demand, whether through training programs or on-the-job learning. First, firms might hire workers from outside the region—for instance, hiring Danish or Dutch specialists to plan and build coastal resilience projects—thereby depriving Bostonians of these opportunities and funneling Boston's funds away from the region. Second, Boston might be unable to achieve its priorities—like upgrading the grid—in a timely way, leaving residents vulnerable to the direct impacts of climate change.

Definition: Who is a Green Worker? What Green Skills are Needed?

Recall from the prior chapter that categorizing and defining green jobs is a complex exercise– the same is true of defining green workers and skills. This is because defining a green worker depends on various contextual factors like industry/occupation, specific tasks, and job roles. At an industry or occupation level, workers that generate goods or services that benefit the environment are considered green workers. At the task level, green workers are involved in activities that utilize sustainable production processes. At the role level, green workers may seek to directly mitigate climate change or improve environmental quality or indirectly serve those goals, by providing products and services upstream that lead to environmental benefits.

As a result, very few workers are completely "green" (e.g. wind turbine technician, stormwater manager), instead there are many current workers that already or will soon require green knowledge and skills (e.g., construction project manager, HVAC technician, civil engineer). For the purposes of this report, we employ a broad definition of green workers that corresponds to the Bureau of Labor Statistics green jobs definition as either:

1. Workers in businesses that produce goods or provide services that benefit the environment or conserve natural resources.
2. Workers whose duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources.

Methods: Projecting the Number of Workers and Types of Skills Needed

Projecting the number of available workers with types of skills that will be required to support Boston's CAP is challenging, particularly with the continued need to replace large numbers of workers as the Baby Boom generation retires. How can we measure whether Boston's current and future workforce will be sufficient to meet the projected demand supported by the City's climate investments over the next 25 years? In doing so, we seek to answer the following research questions:

1. How many available workers are projected without any additional investments in education and training?
2. What labor supply will be needed in the future to cover the net new vacancies and to replace workers who leave their jobs?
3. What is the current annual flow of newly trained people available to enter green jobs?
4. Do the existing workers have the right skills, or do programs need to green existing skills?

Figure 3.1 illustrates the three primary forces at work in this dynamic system to estimate the flow of green workers into and out of the labor market as Boston shifts from a carbon-based to a green economy.

Labor Force Entry

New graduates and others returning to the workforce can be encouraged to train for green jobs and bolster the workforce.

Labor Force Exit

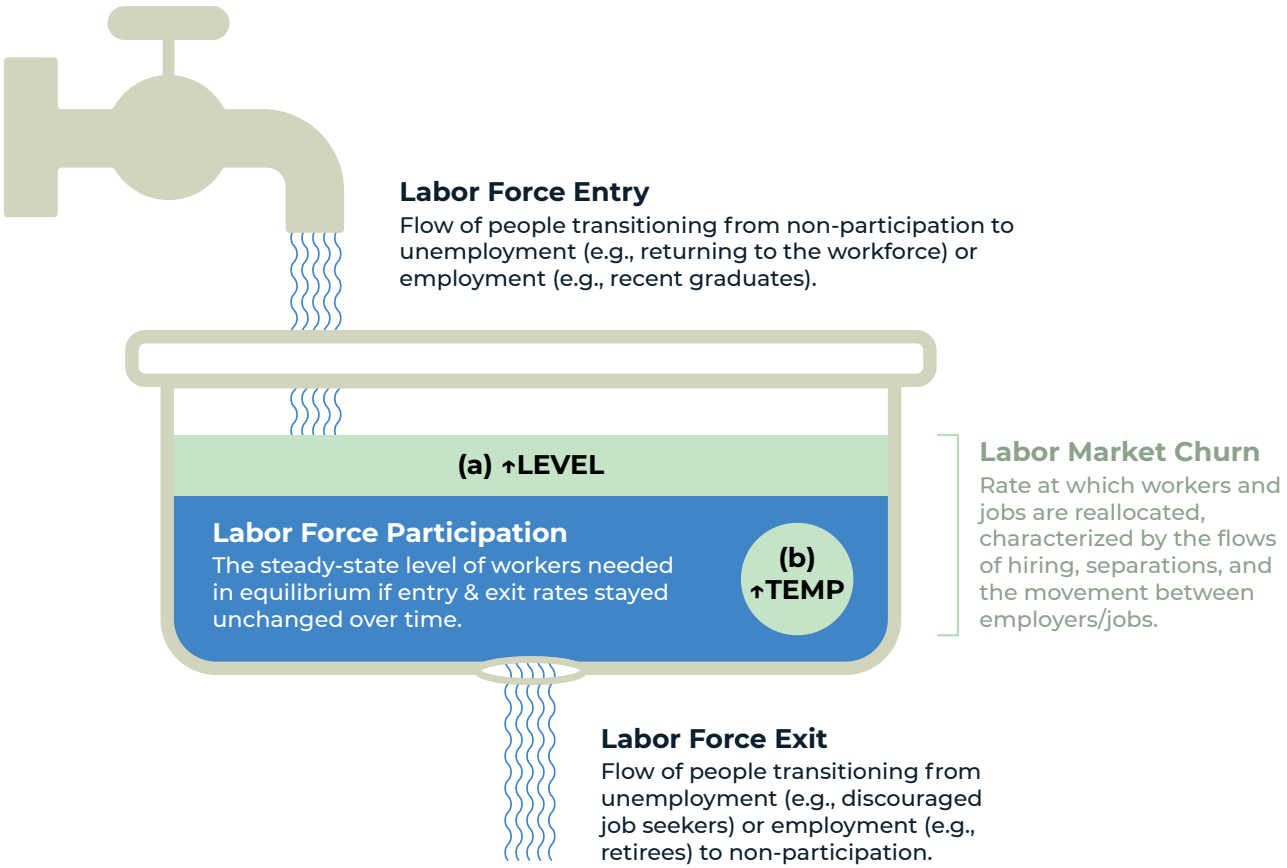
Some carbon-based workers will be entirely displaced while the last of the Baby Boom generation will retire, creating an additional gap in the workforce.

Churn

Shifting from carbon-based to climate mitigation and resilience infrastructure creates a need for:

- **Increasing Level of Employment:** Some net new workers to design, plan, build, and manage green infrastructure, increasing labor demand beyond the "steady state" level during the transition (e.g., through 2050).
- **Raising the Skill Level of Workers:** Some re-training of existing carbon-based workers to learn green skills or apply current skills to work in green contexts.

Figure 3.1 – Labor Market Dynamics Transitioning from a Carbon-Based to a Green Economy



Sources: Authors' illustration of labor market dynamics during the green transition.

To estimate these labor market stocks and flows, we use three key sources of data that correspond to the primary phases of our supply-side analysis to: (1) understand the current and projected number of available workers to fill green occupations, (2) compare these trends to the current flow of newly trained workers, and (3) identify current and emerging skills that will be required to support Boston's CAP. These insights can be used to improve existing training programs. Below, we briefly describe the administrative data sources and methodology that we used for each of these three phases. Additional detail on the data and methodology can be found in Section B of the Technical Appendix.

1. CURRENT AND PROJECTED NUMBER OF GREEN WORKERS

To measure the current and projected number of available green workers, we use the BLS 2023 employment data for our 45 green-related occupations as a baseline. We then use a cohort component model where we "age" the current workforce by one decade to estimate the number of workers who will retire, necessitating new hiring. Specifically, we calculate the share of workers aged 55+ years for each of our six economic sectors using national data disaggregated by age and occupation. We then apply those occupation-specific shares to the 2023 employment levels for each of our six occupational sectors for Greater Boston to estimate the number of retiring workers and associated hiring needs that will need to be replaced by 2033. Note that this is a somewhat conservative estimate since the average age of the workforce in Massachusetts is slightly higher than that of the U.S. However, this gives us some sense of the current levels and expected replacement needs over the next decade.

2. CURRENT AND PROJECTED FLOW OF NEWLY TRAINED GREEN WORKERS

The existing landscape of green training assets in Boston includes a mix of school-based education programs at high school and community colleges, union apprenticeship programs, and short-term workforce development programs offered through nonprofit organizations, utility companies, and the City of Boston. However, the fragmented nature of the workforce training sector in general makes it difficult to assess the total number of workers attending and completing these programs, so we supplement our data collection efforts with qualitative data collected from interviews with career and technical education leaders, community college program administrators, union apprenticeship directors, nonprofit organizations, private sector employers, and City staff. In this section, we focus on the number of newly trained workers flowing from these programs each year, with a more detailed description of the type and quality of these training assets in greater detail in Section VI of this report.

School-based educational programs

We were unable to estimate the number of workers trained for green occupations in school-based educational programs. This would require analyzing completion data by the Classification of Instructional Programs (CIP) codes that correspond with green fields of study. However, because the Integrated Postsecondary Education Data System (IPEDS) does not explicitly track "green" programs, this approach requires careful methodology and has notable limitations. First, not all green occupations align perfectly with a single CIP code. Many green jobs, such as energy auditors, are performed by people with various educational backgrounds. Second, deciding which CIP codes to include is subjective. For example, a student with a degree in civil engineering may or may not go into a green-related job.

Union apprenticeship programs

To estimate the number of workers enrolled in joint apprenticeship programs each year, we used data obtained from the Massachusetts Division of Apprentice Standards (DAS). Many registered union apprenticeship programs that combine on-the-job and classroom training are found in the building trades. These are rigorous,

paid, multi-year training sponsored jointly with a group of employers and directed by a Joint Apprenticeship and Training Committee (JATC), typically resulting in some type of formal certification and licensure.

We supplemented this administrative data by conducting interviews with leaders from the Boston Building Trades Unions, an umbrella organization with comprehensive knowledge of building trades training in the area. The interviews helped identify pre-apprenticeship programs as well as a small number of training programs that are not registered apprenticeships but do prepare trainees to work green union jobs.

3. CURRENT AND EMERGING GREEN SKILLS

To analyze the skills required by jobs that will be required to meet the goals outlined in Boston's CAP, we used machine learning to analyze the text of millions of online job postings provided by Lightcast. This big data approach allows us to measure the frequency of skills required for our 45 green-related occupations, as well as discover emerging green skills over time. To do this we employed the following methodology:

1. Developed a taxonomy of green skills that are frequently required in fully green jobs using natural language processing, a machine learning technique to transform written language into a usable database of skills and job requirements.
2. Analyzed the skill content of other jobs to identify green-related or green-enabled jobs that demand green skills. For example, we parsed the skill demands for every electrician job posting across the labor market to identify what skills are requested by employers when they appear to be engaged in green work relative to non-green work.
3. Built skill profiles of "green" occupations using job ads that showed demand for green skills at 10 times the rate of other roles in the same occupations.

This process allowed us to measure "skill centrality" to assess how important specific skills are to a job and, separately, how closely those skills are associated with a *green* job. This is more accurate than simply counting how often a skill is mentioned in job postings, which can overstate the value of common skills (e.g., "communication") while understating the value of more specialized skills (e.g., "stormwater management"). See Section A.2 of Technical Appendix A for a more detailed description of our methodology.

We also supplemented our text analysis with qualitative data gleaned from interviews with 24 employers, training providers, CBOs and state and local government. Using a list provided by the City, MassCEC, and the Barr Foundation, we identified 44 Boston-serving training programs in "green" occupations, excluding 4-year institutions. In our interviews with training providers, we asked about completion and placement rates, funding, employer partnerships, employability skills offered, and whether the Lightcast machine-learning text analysis aligned with their on-the-ground experiences.

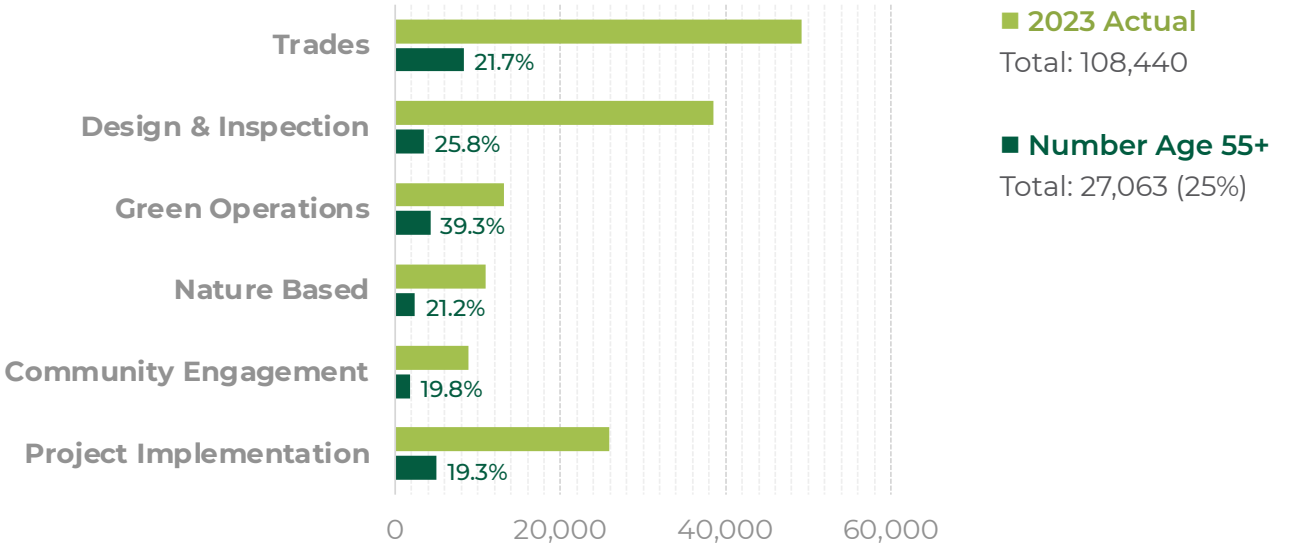
Results: The Current Number and Future Flow of Green Workers in Boston

To better understand the need for green workforce training, we compare the current number and future flow of green workers to the projected demand. The current number tells us where we are at today as the green transition is just getting underway. The future flow helps us to anticipate where any gaps between supply and demand might emerge that would require additional training resources.

1. NUMBER OF WORKERS PROJECTED ACROSS OCCUPATIONAL SECTORS

As of 2023, there were approximately 108,440 Boston area workers in the 45 green-related occupations. Of these, roughly 25% (27,000 workers) were aged 55 years or older, who will likely retire within the next 10 years. Assuming an equal distribution across the decade, this would indicate that 2,700 workers will need to be replaced each year through 2033. Figure 3.2 plots this information by our six occupational sectors, revealing that the largest number of replacements will be needed in the trades, although the largest percentage will be in green operations.

Figure 3.2 – Number of Current Workers in Green-Related Occupational Sectors and Projected Number of Replacements due to Retirements



Sources: Employment levels for Boston, Metro North, and Metro South/West Workforce Development Areas from Massachusetts Executive Office of Labor and Workforce Development, Department of Economic Research. Share aged 55 years and older is derived using national projections for growth from the Bureau of Labor Statistics.

2. FLOW OF NEWLY TRAINED WORKERS IN THE TRADES

The fragmented nature of the workforce training sector makes it difficult to assess the total number of workers flowing from these programs. However, our data collection enabled us to piece together the current (incomplete) snapshot to get a sense of what these flows might look like. Please note that these figures only capture graduates from the training programs in the trades, the occupations with the highest green labor demands, and do not reflect the potential pipelines corresponding to the other occupations that align with the list of 45 occupations.

In terms of school-based educational programs, data are available on enrollments by program, but not completions. However, even the enrollment data gives us some indication that there is strong demand for green-related programs. Madison Park Vocational Technical High School data show that students in green-related trades programs account for 27% of enrollments (280 students) with programs such as Building/Property Maintenance, Electricity, Automotive Technology, and Carpentry ranking highly in enrollment among the 21 vocational programs that are offered. Roughly 92 students were on track to graduate in spring of 2025.

Table 3.1 – Enrollment and Program Length Across Select Green-Related Training Providers

	TOTAL ENROLLMENT IN GREEN-RELATED TRAINING AT TIME OF DATA COLLECTION	LENGTH OF COURSE (YEARS)
Joint Union-Employer Registered Apprenticeships	5,157	3-5 years depending on program
Madison Park High School	280	4
Bunker Hill Community College	87	2
Roxbury Community College	10	2

Table 3.2 – 2024-25 Program Enrollments for Madison Park Vocational Technical High School

CHAPTER 74 PROGRAMS	GRADE 9	GRADE 10	GRADE 11	GRADE 12	SP	TOTAL
Exploratory	282	9	0	0	0	291
Building/Property Maintenance	0	20	22	21	0	63
Electricity	0	21	20	19	0	60
Automotive Technology	0	25	18	16	0	59
Health Assisting	0	21	13	19	0	53
Carpentry	0	21	14	16	0	51
Hospitality Management	0	15	13	17	2	47
Medical Assisting	0	20	20	7	0	47
Culinary Arts	0	15	16	14	0	45
Programming & Web Development	0	16	14	13	1	44
Automotive Collision Repair & Refinishing	0	14	18	11	0	43
Cosmetology	0	14	16	11	0	41
Dental Assisting	0	12	8	16	0	36
Plumbing	0	5	14	16	0	35
Information Support Services & Networking	0	12	1	10	0	23
Metal Fabrication & Joining Technologies	0	9	6	8	0	23
Design & Visual Communications	0	5	5	11	1	22
Graphic Communications	0	6	8	2	0	16
Marketing	0	6	3	6	0	15
Radio & Television Broadcasting	0	6	5	4	0	15
HVAC	0	8	0	4	0	12
Chapter 74 Programs Total	282	280	234	241	4	1,041
Green-Related Chapter 74 Programs	0	100	88	92	0	280
Share of Chapter 74 Programs that are Green-Related	0%	36%	38%	38%	0%	27%

Note: SP = Students receiving special education beyond 12th grade.

Source: Author's calculations using data from the School and District Profiles maintained by the Department of Elementary and Secondary Education, accessed from: https://profiles.doe.mass.edu/profiles/student.aspx?orgcode=00350537&orgtypecode=6&leftNavId=16969&

Table 3.3 – Awards Conferred by Meta Major for Two Community Colleges in Greater Boston

A. BUNKER HILL COMMUNITY COLLEGE

	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24
Arts & Humanities	301	283	306	258	173	162
Business and Communication	319	321	277	242	202	165
Education	68	45	42	67	46	34
Health	308	216	302	254	237	235
Social and Behavioral Sciences and Human Services	152	120	122	129	108	110
STEM	304	294	281	283	257	200
Trades	130	110	140	96	84	87
TOTAL	**1582**	**1389**	**1470**	**1329**	**1107**	**993**
Trades share	**8.2%**	**7.9%**	**9.5%**	**7.2%**	**7.6%**	**8.8%**

B. ROXBURY COMMUNITY COLLEGE

	FY 22	FY 20	FY 21	FY 22	FY 23	FY 24
Arts & Humanities	28	11	9	12	11	10
Business and Communication	35	30	23	18	21	24
Education	17	13	6	12	13	1
Health	128	118	77	49	63	52
Social and Behavioral Sciences and Human Services	20	12	9	6	8	8
STEM	38	33	19	21	29	17
Trades	20	15	9	16	11	10
TOTAL	**286**	**232**	**152**	**134**	**156**	**122**
Trades share	**7.0%**	**6.5%**	**5.9%**	**11.9%**	**7.1%**	**8.2%**

Source: Authors' calculations using data from the Department of Higher Education data web site: https://www.mass.edu/datacenter/factbook/awardsconferred.asp

In terms of completion data, we were able to find the degrees conferred for two of the four community colleges in Boston. Table 3.3 shows that among the 8 "meta majors" listed, Trades accounted for roughly 8-9% of the degrees conferred in FY24, slightly exceeding the pre-pandemic rate observed in FY19. In terms of magnitude, the two colleges combined supply roughly 97 new graduates in the trades each year.

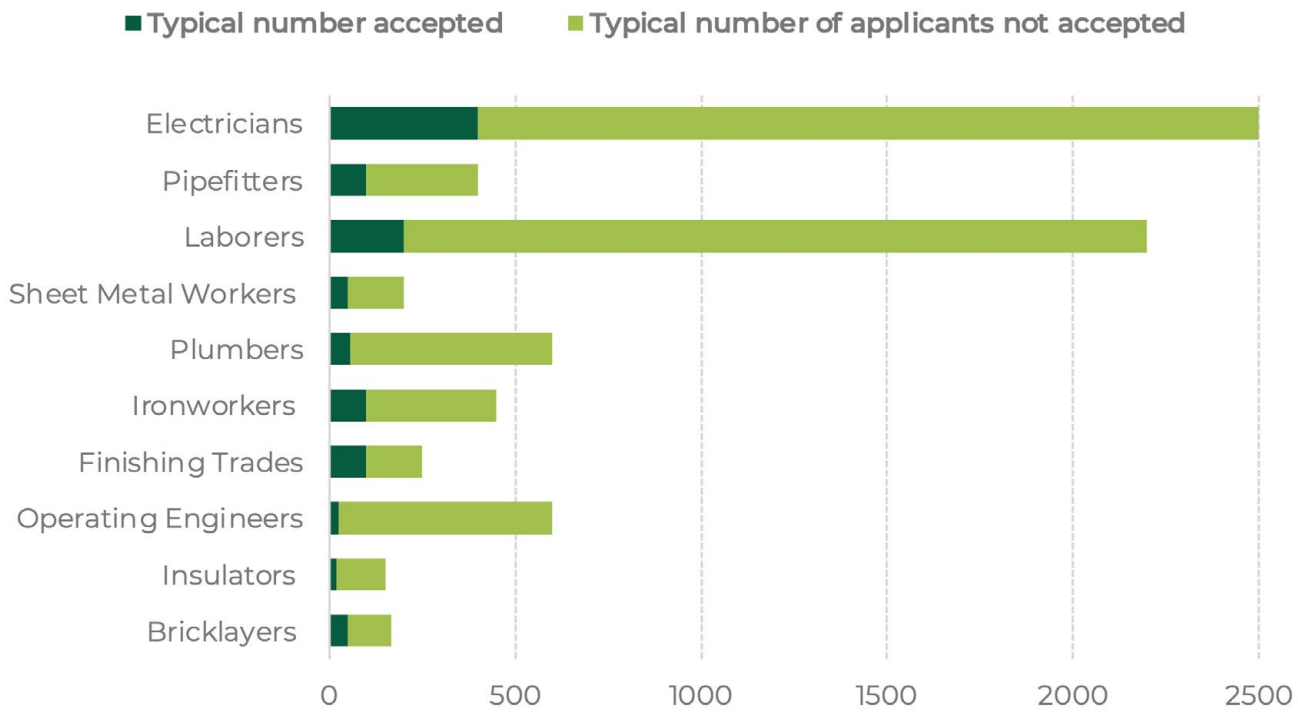
Other data from interviews with apprenticeship programs provided some indication of the size of the population served as well as the annual number of apprentices accepted, which is driven by market demand. For example, although Table 3.4 estimates a total of 5,157 active apprentices in Greater Boston as of 2024, the number of applicants for most apprenticeship programs greatly exceeds the number of seats available each year.

Table 3.4 – Number of Active Apprentices in Union Programs, Greater Boston, 2024

PROGRAM	TRADE/ SHORT NAME	REGISTER APPRENTICESHIP PROGRAM?	ACTIVE APPRENTICES
Greater Boston Joint Apprentice Training Center for the Electrical Contracting Industry	Electricians	Y	1,414
North Atlantic States Carpenters Training Fund	Carpenters	Y	835
Pipefitters, Refrigeration, Air Conditioning and Oil Burners Local 537 JATC	Pipefitters	Y	586
New England Laborers Apprenticeship Program	Laborers	Y	449
Sheet Metal Workers Local 17 JATC	Sheet Metal Workers	Y	392
Ironworkers Local 7 Apprenticeship Program	Ironworkers	Y	356
Finishing Trades Institute New England	Painters	Y	257
Plumbers Local 12 Training Center	Plumbers	Y	256
Bricklayers and Allied Craftworkers Local 3	Bricklayers	Y	144
Roofers Local 33 Joint Apprentice and Training Program	Roofers	Y	137
Heat and Frost Insulators Local 6 JATC	Insulators	Y	122
Operating Engineers Local 4 Training Center	Operating Engineers	Y	121
Electric Power Utility Technology (EPUT) (UWUA/Eversource/Bunker Hill CC)	Utility Workers	N	40
International Brotherhood of Boilermakers Northeast Area Apprenticeship Program	Boilermakers	Y	22
Plasterers and Cement Masons Local 534 JATC	Plasterers	Y	18
Carmen's Union/MBTA Rail Vehicle Maintenance Technician Training Program	Rail Vehicle Maintenance	N	8
Total			**5,157**

Source: Authors' calculations based on data from the Massachusetts Division of Apprentice Standards (DAS) and interviews with leaders from the Boston Building Trades Unions.

Figure 3.3 – Applications and Acceptances for Union Apprenticeship Programs (2024)



Source: Authors' Interviews with training directors. Note: Program names abbreviated for clarity.

It is important to note that our analysis includes joint apprenticeship programs with Bostonians enrolled (the majority of which are based in Boston) and other training programs and community colleges located in Boston proper. We do not account fully for regional training capacity.

Similarly, Figure 3.3 confirms that interest in union apprenticeship programs is far larger than their capacity. Interviewees reported more than 7,500 applicants seek entry into these programs in any given year with only about 1,100 gaining admittance, describing long waitlists and limited seats. The number of seats is driven by market demands combined with the need to train new members as older workers retire. In a boom year, or a year with higher-than-average retirement, the demand for apprentices increases, and the union can accept more applicants who work alongside more advanced workers on construction projects. In slower years, or years with fewer retirements, the number of apprentices accepted declines. Therefore, training capacity in trade apprenticeships is determined by demand for union labor, not other factors that typically determine the capacity in other programs (number of teaching staff, funding and so on).

3. TYPES OF SKILLS NEEDED BY OCCUPATIONAL SECTOR

The skills analysis Boston's regional workforce already has most of the skills needed to build, implement, and maintain the CAP priorities. Many of the major initiatives that would bring Boston closer to its net-zero emissions goals could be implemented by existing workforces.

Second, we find that the skills in demand cross numerous occupations. For instance, our analysis shows that workers across a range of building trades increasingly need to understand and work with renewable energy systems, components and software.

More broadly, we found that an increasing number of occupations need workers with digital skills, meaning that they can work with existing software and related technology. These digital skill demands might be simple, such as being able to work with software applications for building automation, HVAC systems, or solar arrays. We also found that, increasingly, workers will need to be able to learn new analytical tasks—for instance, learning about carbon-neutral and net-zero practices. Helping workers better appreciate these skills and topics will help them be ready for the new demands of green jobs. Similarly, we found that employers are seeking workers who can manage green projects and the people who work on them. Even workers who are not employed in jobs associated with Boston's Climate Action Plan will increasingly need these skills—and will need to be ready to work with "green" specialists, particularly electricians.

Third, we find that the transition is increasing demand for electricians who can install car chargers and solar panels, or utility line workers who can install the electricity lines that serve those items. Notably, the skills of an electrician do not differ in green and non-green projects.

The vast majority of workers in the six occupational groups will draw on their occupation's existing core skills. Green construction needs a range of building trades workers. What may make a certain worker "green" is often the project or employer, rather than the skills being used. For most of these workers, their existing apprenticeship or education program has already prepared them to handle the work required by the Climate Action Plan.

Some workers will need to supplement their skills with relatively small amounts of "green" knowledge or skills. For example, design workers are trained in the foundational design software and design interface skills. Atop that basic knowledge, workers will also need training in and understanding of green requirements like LEED or passive house standards. City staff confirmed this finding in our discussions. As noted earlier, many workers have the technical skills to, say, manage watershed or stormwater projects. They may lack the craft quality enhancements needed to enable projects to meet green infrastructure standards, but they can learn these on the job, although in some cases the City may wish to invest in upskilling workers for particularly critical tasks, like coastal resilience infrastructure.

Many jobs are already becoming greener, making it difficult to identify exactly what a green job is. Many jobs in the trades or in infrastructure have already adopted green skills and are moving towards building greener structures and systems. Boston's workers will be ready to implement Boston's Climate Action Plan without major outside interventions.

Here, we list the skills associated with each of our occupational sectors to describe the tasks workers are performing already in their existing job roles.

1. TRADE-RELATED

Trades jobs are founded on very traditional skill sets. These foundational skills can handle many of Boston's green priorities, sometimes by learning or incorporating new green skills and sometimes by applying traditional skills to green projects. For example, installing a home car charger primarily involves installing a higher voltage outlet that then connects to a car charger. This installation is very similar to installing service for a dryer or an electric range.

Some trades apply their existing skills in ways that support green projects:

- Electricians installing solar panels, building systems
- Plumbers building grey water systems/water recapture

In other trades, traditional skills are essential contributions to green projects:

- Sheet metal workers building ductwork for efficient/renewable fuel HVAC systems
- Ironworkers building wind turbines or transit infrastructure
- Insulators wrapping ducts and pipes
- Painters or other finishing trades applying interior or exterior coatings after a retrofit or new build
- Carpenters framing out the building envelope for an efficient new building
- Operating engineers running heavy equipment to build a geothermal heat pump
- Welders performing maintenance on new infrastructure like wind turbines
- Welders and pipefitters removing aging infrastructure to be replaced by low carbon energy sources

Across the trades, deeper understandings of green renewable energy systems—like solar installation and solar panel software or trade-specific weatherization skills—are in demand, even in non-electrician trades. Many of these workers will need to be able to work with solar systems, electrical systems, and other green aspects of major infrastructure projects, such as green infrastructure, wetlands, and hazardous waste mitigation.

2. DESIGN AND INSPECTION

Design Workers have or can easily develop skills to:

- Help develop new plans for infrastructure and buildings (e.g., engineering and architecture)
- Assist with spatial analysis software and design software, such as drafting and analysis of geographic information systems.
- Provide solar or infrastructure design requiring new sun exposure modeling software expertise
- Navigate local building codes to get necessary approvals.

These design positions often require a four-year college degree at a minimum—although colleges and training programs already have good pipelines of students and trainees preparing for these positions, there will be a need to develop long-term workforce planning to replace retirees.

Inspection Workers

- Help inspect and assure the quality of city buildings.
- Understand how new applications meet local code by reading and interpreting design documents.
- Apply knowledge of changes in building codes, project controls, and energy auditing and responses to audits.
- Understand and evaluate both traditional building systems and also new advanced green systems.

3. GREEN OPERATIONS

Note that little differentiates green and non-green repair and maintenance workers. We do not find a set of specialized "green" skills for jobs on net-zero projects; the positions require the same foundational skills as their counterparts in other jobs. Programming to prepare workers can be relatively broad for these roles; in some cases, workers may need to build skills that specifically support net zero goals:

- Manage and maintain green infrastructure or to manage the implementation of new green processes or applications within a building.
- Build systems and electrical systems
- Troubleshoot and maintain building systems
- Weld to repair buildings or infrastructure
- Wrap, clean, or repair duct work

- Understand and work with reporting and monitoring systems
- Develop life-cycle assessments of infrastructure or building components to identify opportunities for extending life of assets

Some operations jobs may be accessible to many through short-term training and on-the-job development (e.g., bicycle mechanics). A small portion require a bachelor's degree or higher education. For the most part, training programs already have good pipelines of students and trainees preparing for these positions. Further, for the most part, they will be relying on their occupation's core skills as they work on green projects.

4. COASTAL RESILIENCE AND NATURE-BASED SOLUTIONS

Most of the skills this occupational group will need are related to urban forestry, tree maintenance, and stormwater management. For the most part, workers already have the skills needed to support the CAP green infrastructure investments. In the future, the City may want to explore the skill needs of workers in coastal resilience. More specialization in green projects may be needed in managerial positions, including analytical skills and expertise in environmental compliance.

- Manage the tree canopy, vegetation, and stormwater of the city.
- Diagnosis, analysis, and strategy for canopy maintenance.

Most workers who maintain trees and vegetation are pruners and trimmers or landscapers, which require no formal education but come with low annual salaries, few or no benefits, and limited opportunities for advancement. Pathways to more advanced roles, like arborist, require additional education and certifications. Education that prepares a worker for licensure and certifications is often the step towards advancement in this field. Advanced roles like urban forester, inventory arborist, and arborist require more education.

5. PROJECT IMPLEMENTATION

Project implementation jobs are critical to ensure that Climate Action Plan projects are implemented, maintained, and remain functioning. The jobs in this group of occupations largely use analytical and business operations and project management skills. Environmental specialization is in high demand, as managing environmentally focused projects involves specialized knowledge and skills around sustainable design and building. These occupations are needed across industries, so those who specialize in sustainability or carbon reduction stand out. Workers who have learned the core skills needed for this occupation can then augment their skill sets through short format "introduction to climate/sustainability" courses. These courses could help them learn, for instance, how to process federal tax credits or handle other programs that help to advance the CAP goals. People in these jobs have high resilience, too, as they may easily transition to different occupations.

- Help to manage business operations central to the CAP.
- Develop specialized understandings of a range of green functions like renewable energy markets, emissions reporting, or tax compliance.
- Manage incentives for green buildings that are financed through the tax code.

These jobs often pay well and offer high mobility and possibility of moving across industries. Typically, these jobs have higher educational requirements, but that may not be critical. For example, project managers can be trained through a suite of non-degree credentials. For the most part, training programs already have good pipelines of students and trainees preparing for these positions. To help members of historically underserved communities step into these good jobs, workforce training programs should develop effective curricula that teach both the critical project management skills and the green skills needed for these occupations.

6. COMMUNITY-BASED

Community engagement specialists and energy advocates, particularly those focused on community organizing, require a core set of capabilities much like those held by engagement specialists in other fields. These workers often hold a bachelor's degree, but employers and city staff may want to examine whether that B.A. is necessary, especially in communities where advanced education is not the norm.

- Help people engage in planning and preparing for new development or energy applications that drive net-zero goals.
- Encourage consumers to invest in heat pumps, weatherization, or other energy efficiency upgrades.
- Act as corporate community affairs representatives, such as representing a clean energy developer or a power company.
- Act as community-based net-zero advocates for community organizations and advocacy nonprofits. It may be valuable to train community engagement specialists and energy advocates so that they have specific knowledge in carbon footprint reduction and strategies for legal engagement.

In conclusion, we note again that most workers in the six occupational groups needed to transform Boston will be drawing on their existing skills. Green construction needs a range of building trades workers. Electrification needs electricians and line workers. What may make a certain worker "green" is often the project or employer, rather than the skills being used.

Table 3.5 – Comparison of Top General and Green-Specific Skills by Occupational Sector

TRADE RELATED OCCUPATIONS

Top Non-Green Skills	Top Green Skills
Baseline Specific Skills are Critical › HVAC › Electrical Wiring and installation › Carpentry › Underground Utility Installation and Maintenance › Welding › Construction and Building Code › Construction Management › Advanced electrical systems installation and repair	Electrical Related Skills Are Critical Green Skills in the Trades › Installation of electric vehicle charging infrastructure › Electrical systems efficiency/high voltage systems › Solar installation/software (PVsyst) › Environmental code compliance › Weatherization and air sealing › Hazardous waste management › Stream/wetland restoration

DESIGN & INSPECTION OCCUPATIONS

Top Non-Green Skills	Top Green Skills
Digital Design and Building Code Skills › Programming language proficiency › Wide range of specialized software applications › Spatial analysis and design software › Quality Management and Inspection › Energy auditing and responses › Building Codes › Project Controls	Assessment and Strategy Setting › Energy efficiency assessments › Renewable energy systems › Net zero strategies systems › Electrical systems layouts › Residential energy efficiency › Environmental resource mgmt. › Building energy codes › Environmental regulations

GREEN OPERATIONS OCCUPATIONS

Top Non-Green Skills	Top Green Skills
Maintenance of major systems lead skill demands › Electrical repair and troubleshooting › Battery systems maintenance › Welding › HVAC and ducting maintenance › Monitoring and reporting › Data collection and reporting › General DIY Skills › Building operations and repair	Green planning/management › Reporting/planning/monitoring › Lifecycle assessment › Environmental justice assessment › Standard setting and assessment › Green implementation › Electrical system maintenance › Testing software/tools (especially electrical testing) › Battery system/EV repair

NATURE-BASED SOLUTIONS OCCUPATIONS

Top Non-Green Skills	Top Green Skills
Critical skills are largely related to managing and maintaining assets › Forestry training › Pruning, groundskeeping, mowing › Irrigation, horticulture, plant pathology › Wastewater management, project management › Small heavy machinery operations (skid steer, forklift, crane truck, etc)	Green skills involve those that help set strategies around practice—and are most needed in managerial roles › Watershed management, natural resource management › Environmental regulations (CAA/CWA) and compliance › Environmental geographic information systems › Data Analysis
Project management, procurement, and financial analysis are core › Central to roles in their field are construction management and project management › Tax compliance, research, preparation and returns are important skills for implementation › Managing procurement, price negotiation, change orders, and supplier performance	Building skill to drive net-zero or sustainable construction is critical › Understanding of emissions calculations, climate change programs, and greenhouse gases › Carbon accounting, energy auditing, energy modeling, and sustainability reporting › Renewable energy markets › Understanding environmental engineering, building performance, and cost analysis

COMMUNITY ENGAGEMENT OCCUPATIONS

Top Non-Green Skills	Top Green Skills
Baseline Professional Skills Lead Demand › Community Outreach, Social Work, Human Services, Case Management drive core responsibilities › Understandings of public health interventions › Bilingual communication (Spanish and English) seen as critical across roles	Focus in on environmental interventions › Focus on community development and community engagement › Carbon footprint reduction focus › Interacting with the legal system

Source: Authors' calculations using data on millions of job postings provided by Lightcast.

Most green work builds on existing skills that workers already have, including green construction relying on building trades and electrification depending on electricians and line workers.

Carbon-intensive occupations

The Climate Ready Workforce Action Plan is designed to create and sustain good green jobs. This includes supporting workers in sectors with a decline in employment, including carbon-intense occupations.

BLS projections foresee few disruptions in job demand or decline in employment in carbon-intense occupations before 2033 (See Table 3.6). Many of these jobs are projected to grow faster than the labor force over that period. For example, although we expect that Service Unit Operators, Gas and Oil workers will be less in demand over the long term, as the region moves away from carbon fuels, BLS projections show growth prior to 2033. Some of the carbon-intense occupations shown in Table 3.6 are likely to become greener over time. For example, commercial drivers (both taxi and light truck) and bus and truck mechanics, will become greener jobs with the adoption of electric vehicle technology.

A more qualitative assessment of the long-term prospects of labor market demand suggests that carbon-intensive industries could see some displacement in the next ten years. Boston's CAP includes the development of a plan that supports careers of existing gas workers as Boston transitions away from gas infrastructure. The City plans to coordinate with utilities, regulators, labor organizations and other interested stakeholders to ensure a just and equitable energy transition.

In some sectors, city action may not be required, as many employers and corporate suppliers have already started making relevant investments. For instance, EV manufacturers are training auto service technicians in the skills that will allow them to service electric powered vehicles. Finally, as noted earlier in this section, and as we will explore later in this report, drillers may be able to shift into positions in geothermal energy, which will use many of the same skills.

The potential for new green jobs in geothermal networks

When new green technologies come into use, they may spur demand for jobs associated with those technologies. An example is thermal energy networks utilizing ground-sourced heat pumps. A geothermal network is a system of interconnected ground-source heat pumps connected by buried pipes. For heating, water is circulated through a ground loop that absorbs the warmth from underground and brings it indoors through a geothermal heat pump. For cooling, the heat pump absorbs and concentrates excess indoor heat and sends it out of the building through the ground loop; either the heat disperses back into the ground or is shared with another building connected to the loop. They are expanding throughout the country and are being piloted by National Grid and Eversource in Massachusetts. Once the utilities establish the feasibility of these systems, their demand for drillers will increase.

Two major geothermal network projects are underway in Massachusetts. In June 2024, Eversource piloted the nation's first utility-owned networked geothermal system in Framingham. This pilot heats and cools 36 buildings, free of fossil fuels. Eversource will monitor the system's efficiency, cost-effectiveness, and customer satisfaction for two years before deciding whether to install more such projects. The US Department of Energy is funding an expansion of the Framingham project, which is projected to double the number of buildings served at half the cost of the original installation. This will be the first

Table 3.6 – Occupations with Long-term Displacement Risk due to Carbon Intense Skill Demand

OCCUPATION	PROJECTED GROWTH RATE (%) 2023-2033	TYPICAL EDUCATIONAL ATTAINMENT
Heavy and Tractor-Trailer Truck Drivers	4.3	Postsecondary nondegree award
Power Plant Operators	-15.5	High school diploma or equivalent
Chemical Plant and System Operators	-1.1	High school diploma or equivalent
Mining and Geological Engineers, Including Mining Safety Engineers	1.9	Bachelor's degree
Continuous Mining Machine Operators	1.6	No formal educational credential
Chemical Equipment Operators and Tenders	-5	High school diploma or equivalent
Power Distributors and Dispatchers	-6.6	High school diploma or equivalent
Service Unit Operators, Oil and Gas	17.5	No formal educational credential
Pump Operators, Except Wellhead Pumpers	11.4	High school diploma or equivalent
Excavating and Loading Machine and Dragline Operators, Surface Mining	-0.1	High school diploma or equivalent
Rotary Drill Operators, Oil and Gas	17.6	No formal educational credential
Geological Technicians, Except Hydrologic Technicians	5.2	Associate's degree
Extraction Workers, All Other	10.3	High school diploma or equivalent
Bus and Truck Mechanics and Diesel Engine Specialists	4.3	High school diploma or equivalent
Mobile Heavy Equipment Mechanics, Except Engines	7.6	High school diploma or equivalent
Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic*	-18.6	High school diploma or equivalent
Stationary Engineers and Boiler Operators	4	High school diploma or equivalent
Gas Plant Operators	-9	High school diploma or equivalent
Petroleum Pump System Operators, Refinery Operators, and Gaugers	3	High school diploma or equivalent
Taxi Drivers	28.5	No formal educational credential
Light Truck Drivers	10	High school diploma or equivalent

Source: BLS Occupational Outlook Handbook Projections, 2023-2033. Note that workers in this position may find opportunities in geothermal energy, as described below and later in this report.

test of the feasibility of expanding geothermal networks. In 2025, National Grid will begin construction on another geothermal network to heat and cool seven buildings, serving 346 families in the Boston Housing Authority's Franklin Field apartments. The MassCEC funded, HEET-run Kickstart Massachusetts project has 12 more community-led geothermal network projects in the pipeline; pre-feasibility work has been completed. Massachusetts is poised to be a leader on geothermal network expansion, based on the expansion of the Framingham project and continued interest in this technology by utilities.

Because geothermal network loops are like existing gas pipes, the existing unionized natural gas and building trades workforce has skills that are directly transferable to this new technology. Specialized training may benefit transitioning workers as well as those newly entering the workforce. Working with HEET and the International Ground Source Heat Pump Association, the Geothermal Market Capacity Coalition is proposing a national network of Geothermal Drilling Centers of Excellence to facilitate rapid expansion of networked geothermal. Worker training, including the development of a pre-apprenticeship program and partnering with union apprenticeships, will be a central part of their mandate, which could benefit Boston workers.

Trade apprenticeship programs remain a critical pathway to green jobs but have far more interested applicants than available seats.

The Bottom Line

In this chapter, we looked at the kinds of jobs, occupations, careers, and skills the City will need to achieve CAP goals; how many people will be required in the various positions, now and into the future; what kinds of knowledge, skills, and abilities the relevant employers are seeking in job applicants; and what green skills, in particular, will be required in these evolving efforts to design, build, and operate our new, innovative green economy.

Boston currently has enough workers to fill almost all of its green-related positions, although there may be some mismatch in the skills that workers possess and those that are in-demand. More importantly, it's likely that the City will experience a sizable labor shortage in the future in the actual ***number*** of workers, stemming from two sources. First, Climate Action Plan investments are projected to expand the number of jobs in the region, supporting tens of thousands of positions each year, including an estimated 6,700 ***net new*** jobs that would not exist without the projects that have been planned as part of Boston's CAP over the next 25 years.

In addition, the BLS projects that roughly 2,700 workers in green-related occupations will retire each year, creating ongoing replacement needs over the coming decades. Although the picture is far from complete, it appears that there will be a sizable gap between the number of workers needed to be replaced due to retirements versus the number of workers trained to fill those jobs each year. From our limited data collection, it appears that Boston education and training programs are currently producing approximately 1,400 newly trained green workers per year. This figure should be understood as a lower-bound estimate of training capacity, as it reflects only the

providers we were able to identify and does not fully capture the full range of employer-based or on-the-job training. However, much of this visible pipeline currently comes from apprenticeship programs in the Trades, which account for a large share of the projected employment needs, giving us some insight into the potential annual gap between supply and demand arising solely from replacing retirees (e.g., 2,700 versus 1,400).

Moreover, only about 200 of these 1,400 newly trained workers currently come from high school programs (e.g., Madison Park) and community colleges (e.g., BHCC and RCC), with an even smaller number being trained through community-based programs. Thus, it appears that there is an opportunity to expand public education and community-based programs to address the projected wave of retirements while also supporting the projected 6,700 net new jobs attributed to the CAP investments.

Finally, a subset of these workers will need training or education to use their existing skills in green positions, including in some areas of project implementation, green operations, and community engagement. However, that reskilling will not be extensive, as we have noted and will see in subsequent sections. The bottom line is that most of the required skills are occupation-specific but need to be applied in green contexts.

There are also training gaps. Some occupations ***do not have any*** training opportunities. For example, project implementation roles for planning and finance in the green sector have no training programs associated with them. As a result, many employers look for proxies, such as having a college degree, to be able to fill these roles when one might not be needed. As a result, this can exacerbate barriers to entry, especially for people of color who have less access to college training. To address this gap in access to training that can lead to good jobs, we must develop curricula that meet the employers needs and can be used to establish industry recognized credentials other than a bachelor's degree.

Some occupations ***do not have enough*** capacity in existing training programs to meet the demand for worker participation. For example, trade union apprenticeship programs are an important pathway to good green jobs for Bostonians, but these programs have far more interested applicants than available seats. As discussed above, the number of seats is driven by market demand—in a boom year, the demand for workers of all skill levels increases, and the union can support more apprentices, who work alongside more advanced workers on construction projects. In slower years, the number of apprentices accepted declines in line with market demands. Therefore, training capacity in the trades apprenticeships can be increased by programs and policies that bolster new construction and the demand for union labor.

Some occupations have training programs that ***do not lead to good jobs*** that pay a living wage and/or have realistic advancement opportunities. In some occupations, job training is plentiful but does not lead to high quality jobs. For example, trainees who complete a residential construction-related program struggle to find job opportunities with living wages, benefits and career advancement pathways. To address this gap in job quality, we must either ensure that every entry level job pays a living wage equal to the City's Living Wage Ordinance or is part of an established career pathway that leads to a living wage within the first year.

4.

JOB QUALITY: ARE GREEN JOBS GOOD JOBS?

Introduction

As we build a green economy, the City of Boston can use policy, programs and investments to ensure more Bostonians have access to good, green jobs. While Boston has a strong economy with a relatively high median wage of $30.32 per hour, not all Bostonians are prospering equally. According to US Census Bureau data, 16.9% of people living in Boston have incomes below the US poverty line.[20] The *Boston Jobs, Living Wage and Prevailing Wage Ordinance* mandates an hourly wage of $18.78 (updated annually) for anyone working on a city contract, a wage currently $3.78 above the state minimum wage[21]

In this chapter, we examined access to jobs and whether they are good jobs that pay a living wage with benefits and opportunity for advancement. We define living wage as the City of Boston's living wage as of July 1, 2025, which is $18.78/hour, or $39,062/year. Other important job quality components, such as health and retirement benefits or career advancement potential, are harder to measure across employers within a given occupation or industry.

Definition: How do we define a "good" green job?

We define "good" jobs as jobs that pay living wages and benefits—and in which workers are respected, have a voice, and are free from discrimination and differential treatment based on race, gender, and other identities. Specifically, we frame our analysis to reflect the following:

Job Quality—The Job Quality framework we use aligns with the Department of Labor's Good Jobs Principles developed under the previous administration, which emphasizes fair wages, benefits, job security, career advancement opportunities, and worker voice (see Figure 4.1).

High-Road Employment—While job quality focuses on individual roles or attributes of a job, high-road employment considers employer and industry practices that prioritize worker well-being. These employers offer living wages, structured career ladders, training opportunities, and equitable workplace policies.

Equity—A central priority of Boston's workforce investments is ensuring equitable access and advancement for marginalized groups to green jobs. This includes expanding non-bachelor's degree pathways, addressing systemic barriers, and creating opportunities that improve economic mobility for underrepresented communities. It also involves tackling occupational segregation and ensuring that workforce strategies lead to high-quality, accessible jobs for all workers.

Figure 4.1 – Department of Labor "Good Jobs" Principles[22]

Recruitment and Hiring—Qualified applicants are actively recruited—especially those from underserved communities. Applicants are free from discrimination, including unequal treatment or application of selection criteria that are unrelated to job performance. Applicants are evaluated with relevant skills-based requirements. Unnecessary educational, credentials and experience requirements are minimized.

Benefits—Full-time and part-time workers are provided family-sustaining benefits that promote economic security and mobility. These include health insurance, a retirement plan, workers' compensation benefits, work-family benefits such as paid leave and caregiving supports, and others that may arise from engagement with workers. Workers are empowered and encouraged to use these benefits.

Diversity, Equity, Inclusion, and Accessibility (DEIA)—All workers have equal opportunity. Workers are respected, empowered, and treated fairly. DEIA is a core practiced norm in the workplace. Individuals from underserved communities do not face systemic barriers in the workplace. Underserved communities are persons adversely affected by persistent poverty, discrimination, or inequality, including Black, Indigenous, people of color; LGBTQ+ individuals; women; immigrants; veterans; military spouses; individuals with disabilities; individuals in rural communities; individuals without a college degree; individuals with or recovering from substance use disorder; and justice-involved individuals.

Empowerment and Representation—Workers can form and join unions. Workers can engage in protected, concerted activity without fear of retaliation. Workers contribute to decisions about their work, how it is performed, and organizational direction.

Job Security and Working Conditions—Workers have a safe, healthy, and accessible workplace, built on input from workers and their representatives. Workers have job security without arbitrary or discriminatory discipline or dismissal. They have adequate hours and predictable schedules. The use of electronic monitoring, data, and algorithms is transparent, equitable, and carefully deployed with input from workers. Workers are free from harassment, discrimination, and retaliation at work. Workers are properly classified under applicable laws. Temporary or contractor labor solutions are minimized.

Organizational Culture—All workers belong, are valued, contribute meaningfully to the organization, and are engaged and respected especially by leadership.

Pay—All workers are paid a stable and predictable living wage without overtime, tips, and commissions. Workers' pay is fair, transparent, and equitable. Workers' wages increase with increased skills and experience.

Skills and Career Advancement—Workers have equitable opportunities and tools to progress to future good jobs within their organizations or outside them. Workers have transparent advancement opportunities. Workers have access to quality employer- or labor-management-provided training and education.

Results: Current Job Quality Patterns and Gaps

Most of the occupations that are critical to implementing the Boston CAP either pay, at minimum, a living wage for a worker with no dependents, or they offer employment in occupations that pay at the median wage. The median wage for most of the 45 green-related occupations is above the Boston living wage (Table 4.1).[23]

When employers expect a job to be filled by someone with a college degree, they generally pay more than for a position that does not require advanced education. Whether or not an occupation includes a college degree as a requirement generally tells us whether an entry-level position will pay a living wage or more. Usually, to move up from low entry-level pay to a living wage, a worker must add more skills and expertise while on the job.

However, advancement opportunities vary from one employer to another, as employers can choose whether to create and offer opportunities to advance. Burning Glass Institute research on employee mobility shows that workers in the same position at different employers may find significantly different opportunities for initial pay, promotion, and wage increases. Larger and high-performing firms may offer workers faster promotions, higher pay, and greater access to jobs that do not require a degree. But not all employers offer wage mobility; small firms especially may not be able to offer raises or advancement.[24]

INDUSTRY LABOR MARKET CONDITIONS IN THE BUILDING TRADES

As trades workers make up the bulk of workers required to achieve Climate Action Plan goals, we take a deeper dive into looking at market conditions in the construction industry to help guide investments in training and good jobs. Job quality in the construction sector is bifurcated, with the coexistence of good jobs with benefits, safety and health protections, and living wages on one hand, and precarious employment characterized by low wages, instability, wage theft and misclassification on the other.[25] The split largely mirrors the divide between non-residential (industrial, commercial, heavy and highway, institutional) on one hand, and residential construction on the other.

The split into low and high road sectors began in the late 1960s, with legal and economic challenges to existing practices in the face of high construction costs. Efforts by businesses to lower labor costs by diminishing union presence and power were most effective in reducing union density in the residential construction sector, which went from about 50% in 1950s to below 20% in the 1970s dipping to an estimated 1-5% today.[26] Unions were more successful at retaining presence in large-scale construction jobs, especially in the Northeast, Midwest and West Coast.

Table 4.1 – Median and 10th Percentile Wages and Typical Education Requirements for the 45 Green-Related Occupations, Greater Boston

OCCUPATION	MEDIAN WAGES	10TH PERCENTILE WAGES (ALL WORKERS, METRO BOSTON)	TYPICAL EDUCATION / TRAINING (BLS OOH)
Community Engagement			
Community Outreach Specialist	$55,000	$31,300	High school diploma
Energy Advocate	$50,000	$33,037	High school diploma
Design and Inspection Occupations			
Architect	$108,000	$44,774	Bachelor's degree
Building/OCI Inspector	$76,534	$40,000	High school diploma
Civil Engineer	$106,190	$51,000	Bachelor's degree
Data analyst	$100,000	$51,324	Bachelor's degree
Electrical Engineer	$125,000	$67,530	Bachelor's degree
Energy Auditor	$93,713	$37,485	Bachelor's degree
Energy Modeler	$112,550	$60,000	Bachelor's degree
GIS Technician	$64,558	$49,280	Postsecondary credential
Green Roof Designer	$68,656	$25,877	Bachelor's degree
Mechanical Engineer	$98,919	$55,000	Bachelor's degree
Quality control inspector	$56,275	$32,641	High school diploma
Urban/regional planner	$80,176	$58,648	Bachelor's degree
Green Operations Occupations			
BAS Tech	$72,444	$32,500	High school diploma
Bicycle Mechanic	$30,163	$11,400	No formal education
Building Systems Operator	$72,888	$35,680	High school diploma
City/town manager	$200,000	$80,000	Bachelor's degree
EV repair/maintenance	$92,595	$40,700	Postsecondary credential
Stormwater manager	$96,793	$47,000	Bachelor's degree
Wind turbine technician	$54,145	$27,073	Postsecondary credential

OCCUPATION	MEDIAN WAGES	10TH PERCENTILE WAGES (ALL WORKERS, METRO BOSTON)	TYPICAL EDUCATION / TRAINING (BLS OOH)
Coastal Resiliency and Nature-Based Solutions			
Arborist	$29,497	$28,800	Postsecondary credential
Inventory arborist	$90,000	$53,208	Postsecondary credential
Landscaper	$37,254	$8,731	No formal education
Stormwater technician	$65,000	$37,273	Associate's degree
Tree maintenance	$56,275	$32,900	No formal education
Urban forester	$89,500	$79,996	Postsecondary credential
Project Implementation Occupations			
Power Market Analyst	$71,973	$29,155	Bachelor's degree
Project Finance Analyst	$100,000	$60,000	Bachelor's degree
Project Manager	$100,000	$42,108	Bachelor's degree
Trades			
Carpenter	$55,000	$21,863	Postsecondary credential
Construction Worker	$45,919	$17,698	Postsecondary credential
Driller	$156,188	***	High school diploma
Electrician/Solar Installer	$64,000	$30,000	Postsecondary credential
General Contractor	$90,000	$46,856	Postsecondary credential
Heavy Equipment Operator	$66,765	$37,690	Postsecondary credential
HVAC Tech	$72,444	$32,500	Postsecondary credential
Linesperson	$117,988	$57,644	High school diploma
Machine operator	$50,000	$42,000	High school diploma
Plumber	$72,032	$29,497	Postsecondary credential
Roof technician	$42,000	$26,031	No formal education
Vehicle manufacturing assembly line worker	$54,000	$30,095	High school diploma
Weatherization Technician	$72,444	$32,500	Postsecondary credential
Wind welder	$42,653	$25,500	Postsecondary credential

Source: Authors' calculations of American Community Survey 2023 (age, wage), Occupational Outlook Handbook (educational requirements). Note: *** Indicates that the data are insufficient to provide 10th percentile earnings.

Residential construction

Residential construction, broadly speaking, is characterized by smaller, less-capital intensive firms facing intense competitive pressures. Pressure to maintain a labor supply and keep total costs down leads to deskilling of work, through breaking down jobs into simple component parts or using prefabricated materials. Employers do not have resources to train workers, and there are few advancement opportunities and high turnover. Wages are lower than in large scale projects and few employers provide health insurance or retirement benefits. This sector is characterized by high levels of labor brokers, cash-only payment, misclassification and wage theft. These conditions have caused some observers to remark that "the residential construction industry features some of the worst employment conditions in the United States." A 2021 report estimated that misclassification, wage theft and tax fraud by Massachusetts residential construction employers allowed them to reduce labor costs by at least $140.4 million in 2019—funds that would otherwise have gone to workers and the Commonwealth.[27] These practices harm workers, law-abiding employers, and the Commonwealth.

A subset of residential construction that is key to meeting the Boston CAP goals is home weatherization and retrofit. Most of the companies that retrofit homes for energy efficiency are small, employing 1-10 people. Medium-sized companies (10-50 employees) are more likely to work in the commercial sector. Wage data by company size is not available, but the average entry wage is $20.00 per hour. Advancing to crew leader takes the hourly wage to $24.00. Wages for weatherization technicians in Massachusetts are about 26% lower than in other states.[28] Relatively low wages and difficult working conditions result in a low retention rate.

Non-residential construction

The non-residential construction sector encompasses industrial, large commercial and infrastructure projects. Most contractors in this sector are large, heavily capitalized, and equipped to work on large, complex projects. Labor unions operate almost exclusively in this sector. The Institute for Construction Research estimates that 35.1% of building trades workers in the non-residential sector in New England belong to unions.[29] Wages are higher, and training takes place in more formal settings, including registered apprenticeship programs whose cost is shared across employers. Workers with union representation benefit from negotiated wages and benefits, prevailing wage protections, and a range of other benefits.[30]

While the non-residential construction industry historically excluded women workers and workers of color, challenges beginning in the civil rights era have led to a more diverse industry. Employers and unions use a variety of programs and policies to increase racial and gender diversity. Training programs play an important role in building pathways to union membership, and data on enrollees in apprenticeship programs demonstrates union-sponsored programs are leading non-union counterparts in advancing racial and gender diversity in construction employment in the non-residential sector (Table 5.1).

The City's main ability to influence working conditions is in the non-residential sector through its own contracting, which is subject to the Boston prevailing wage ordinance. The Boston Resident Jobs Policy promotes equitable access to building trades jobs by Bostonians, women, and people of color.

5.

ACCESS/EQUITY: WHO GETS IN? WHO'S LEFT OUT?

Structural inequities persist.

18% of Boston residents live in poverty, women earn **$0.79** per dollar, and racial and immigrant disparities continue to shape opportunity.

Access to good green jobs is uneven.

Women, people of color, and immigrant workers are overrepresented in lower-wage green roles.

Boston's CAP aims for a just transition.

Climate investments aim to expand equitable pathways so all Bostonians can participate and thrive.

Introduction

Boston's Climate Action Plan aims to open employment pathways for groups that have been previously excluded from economic opportunity. Like most cities in the United States, Boston has high levels of poverty and persistent inequality by race, gender, class, and national origin. About 112,000 Boston residents—roughly 18% of the population—live in poverty. Economic struggles disproportionately fall on Asian, Black and Latino Bostonians, whether measured by income, by wealth, or by levels of debt. Furthermore, women make, on average, 79 cents for every dollar men earn. People of color and women are overrepresented in low-wage jobs and industries in Boston. Immigrant families and Bostonians who do not speak English also endure higher rates of poverty. People of color in Boston experience disproportionate exposure to environmental pollution and have worse health outcomes. And while Boston Public Schools have dramatically improved outcomes for students of color, the history of de facto segregation and inequality in our schools continues to influence communities of color, especially Black Bostonians.

These disparities, hardships, and exclusions have left many Bostonians at a disadvantage in the job market—making it difficult to offer them reliable pathways to good green jobs.

Mayor Michelle Wu has articulated a bold vision for the future of our City that will tackle the climate crisis with policies that address economic, social, and racial inequities and advance health, livability, and justice for *all* Boston residents."[31] That vision includes an economy in which all Bostonians can thrive; green and affordable housing; clean energy; an easy and efficient transportation system; and stronger climate resilience to address the impact of climate change's increased heat, flooding, storms, and other climate-induced disruptions, ensuring that city residents are safe and the places we live and work are protected. That vision is integrated into the updated CAP.

In this section, we will look in more depth at this Boston CAP goal: How can historically marginalized groups of Bostonians have equitable access to good green jobs? Currently, immigrants, people of color, women, formerly incarcerated people, and other marginalized groups have less access to employment meeting the good jobs criteria addressed above and are disproportionately employed by low-road employers. For example, since the late 1980s, the residential construction sector has increasingly relied on immigrant workers, nearly 1.6 million.[32] The National Association of Homebuilders estimates that 26% of construction workers in Massachusetts are immigrants, close to the national figure of 30%.[33] Despite their important economic contribution in the construction industry, immigrant workers—especially those who are undocumented—are vulnerable to workplace abuses because of a fear of deportation, language barriers, and other factors. So, while the residential construction sector is an important source of employment for immigrants, it is also a source of exploitation and abuse.

As our analysis in the next section shows, green jobs differ with respect to racial and gender diversity and inclusion, as well as wages. In the following sections, we draw on this analysis to further consider how we can ensure job quality and access to green careers for all Bostonians.

DEFINITION: WHAT DO WE MEAN BY ACCESS?

Equity, access and opportunity to earn a living wage are central to Boston's climate investments. As the growing green economy changes labor demands and careers available to Bostonians, the City is committed to advancing policies and programs that ensure that jobs in the green economy are good jobs, and that all Bostonians—especially those historically marginalized in the City's economy—can enter and thrive in good green jobs.

Methods: Measuring Access to Jobs

To understand whether those high-road opportunities currently exist, we examined: racial and gender diversity in our set of 45 occupations; measures of whether these are good jobs (i.e., well-paying and with opportunities for advancement); whether opportunities in the green sector will change over time, and if so, how; and whether, given the age of the existing workforce, impending retirements may open up more opportunities job openings for these residents' employment.

Results: Which Workers Have Access to Green Jobs?

As we consider the demographics of the occupations in Boston CAP priority occupations, we find important inequities. First, men are overrepresented in many of the priority occupations. Women-dominated occupations in this list are primarily in professional roles that typically require a bachelor's degree. Additionally, roles that have a significant majority of women in them, such as Community Outreach Specialist and Energy Advocate, have lower median salaries. This is partly driven by long-standing industry trends. Much of the work is in construction, which has disproportionately employed men. Bridging this gap will require ongoing efforts to build pathways for women to enter the trades in greater numbers; apprenticeship demographics are a leading indicator of growing numbers of women in unionized trades (see below). For more information see analysis by the Policy Group on Tradeswomen's Issues on challenges faced by women in the trades, as well as recommended solutions to increase women's engagement.

Second, we find racial and ethnic disparities in access to high-paying jobs that do not require post-secondary degrees. White workers often are in the highest-paying occupations that have lower educational requirements. While workers must earn credentials for building trades, these jobs often do not require additional academic degrees beyond high school. The construction trades are bifurcated, with the non-residential construction sector providing more pathways to good jobs than the residential sector, which has high rates of wage theft and misclassification.[34] Inclusion of people of color and women is lower in some occupations than in others. For example, as indicated in Table 5.1, electricians and general contractors, which are high-paying jobs, are roughly 80% white. Conversely, roofing technician, a low-paying job, is highly diverse; only approximately 14% of the workforce is white. Similar disparities exist by ethnicity: Lower-paying, physically demanding jobs have some of the highest concentrations of Hispanic workers. Apprenticeship demographics are a leading indicator of growing racial and ethnic diversity in the unionized building trades (see next page).

Table 5.1 – Gender, Race / Ethnicity, and Age Demographics of Boston Climate Action Plan Occupations in Boston MSA in 2023

OCCUPATION	PERCENT WOMEN	PERCENT ASIAN	PERCENT BLACK	PERCENT HISPANIC	PERCENT WHITE	PERCENT OTHER	MEDIAN AGE
Community Engagement							
Community Outreach Specialist	72.18%	6.00%	5.44%	19.92%	66.53%	2.12%	43.2
Energy Advocate	76.64%	4.33%	32.98%	17.35%	37.23%	8.11%	45.1
Design and Inspection							
Architect	26.80%	14.67%	1.39%	7.56%	74.42%	1.96%	44.2
Building/OCI Inspector	7.79%	12.95%	12.80%	14.49%	57.36%	2.39%	50.3
Civil Engineer	19.16%	8.77%	1.41%	4.71%	80.59%	4.51%	40.6
Data analyst	42.36%	26.84%	3.80%	5.07%	59.70%	4.59%	42.6
Electrical Engineer	6.84%	17.20%	5.09%	2.80%	72.21%	2.71%	45.8
Energy Auditor	57.04%	10.53%	5.43%	9.76%	69.93%	4.35%	43.4
Energy Modeler	16.76%	20.98%	2.45%	6.20%	66.63%	3.74%	***
GIS Technician	27.48%	***	***	***	***	***	35.3
Green Roof Designer	***	***	***	***	***	***	***
Mechanical Engineer	13.56%	10.69%	2.72%	8.26%	72.53%	5.80%	40.2
Quality control inspector	41.47%	16.00%	6.66%	11.31%	60.90%	5.13%	45
Urban/regional planner	53.86%	2.66%	0.69%	3.00%	88.94%	4.72%	***
Green Operations							
BAS Tech	3.58%	1.58%	3.86%	12.60%	75.24%	6.71%	***
Bicycle Mechanic	5.97%	***	***	***	***	***	***
Building Systems Operator	6.71%	2.63%	3.44%	8.00%	78.95%	6.98%	***
City/town manager	30.55%	6.53%	2.29%	3.35%	85.06%	2.78%	***
EV repair/maintenance	***	***	***	***	***	***	39.9
Stormwater manager	37.35%	3.92%	6.83%	8.82%	76.16%	4.27%	***
Wind turbine technician	2.03%	1.93%	2.42%	5.32%	78.92%	11.41%	***

OCCUPATION	PERCENT WOMEN	PERCENT ASIAN	PERCENT BLACK	PERCENT HISPANIC	PERCENT WHITE	PERCENT OTHER	MEDIAN AGE
Coastal Resilience and Nature-Based Solutions							
Arborist	38.39%	***	***	***	***	***	35.9
Inventory arborist	***	***	***	***	***	***	35.9
Landscaper	4.73%	1.11%	3.63%	26.56%	62.00%	6.70%	35.9
Stormwater technician	25.47%	15.65%	6.77%	8.85%	66.50%	2.24%	40.8
Tree maintenance (trimmers, pruners)	***	***	***	***	***	***	35.9
Urban forester	46.15%	***	***	***	***	***	35.9
Project Implementation							
Power Market Analyst	59.81%	12.36%	9.72%	17.26%	59.43%	1.23%	44.8
Project Finance Analyst	42.28%	13.06%	7.16%	3.53%	73.08%	3.17%	39.6
Project Manager	13.57%	1.46%	1.77%	6.93%	85.83%	4.01%	42.8
Trades Occupations							
Carpenter	2.46%	2.06%	3.91%	14.75%	69.67%	9.60%	40.9
Construction Worker	2.85%	1.73%	1.68%	31.26%	51.06%	14.27%	39.1
Driller	***	***	***	***	***	***	***
Electricianr	2.53%	3.13%	5.02%	7.70%	77.72%	6.43%	39.9
General Contractor	5.51%	2.30%	5.31%	6.45%	80.95%	5.00%	44.6
Heavy Equipment Operator	0.28%	0.00%	1.67%	3.64%	86.84%	7.86%	41.3
HVAC Tech	3.58%	1.58%	3.86%	12.60%	75.24%	6.71%	39.4
Linesman	***	***	***	***	***	***	35.7
Machine operator	21.47%	0.00%	0.00%	46.89%	53.11%	0.00%	42.1*
Plumber	2.94%	2.08%	5.30%	7.31%	80.56%	4.75%	40.8
Roof technician	30.56%	16.67%	23.61%	45.49%	14.24%	0.00%	37
Vehicle manufacturing assembly line worker	39.56%	0.00%	0.00%	26.37%	73.63%	0.00%	40.8
Weatherization Technician	3.58%	1.58%	3.86%	12.60%	75.24%	6.71%	39.4
Wind welder	12.91%	11.14%	2.56%	20.03%	60.48%	5.79%	43.8

Source: Authors' calculations of American Community Survey 2023 (demographics and age) data collected for Boston MSA. Age estimates are from calculations on occupation from CPS at national occupational level.

Note: *Indicates age estimate for All Production Related Machine Operators. *** Indicates data insufficient to provide estimate

6.

TRAINING ASSETS

Boston's green training ecosystem is growing.

60 programs prepare residents for green jobs across unions, nonprofits, and schools.

Union pathways are essential.

787 Boston residents are in union apprenticeships (16% of all apprentices).

Union programs drive diversity.

68% of Boston apprentices are people of color; **17%** are women. Unions train **80%+** of all women and POC apprentices statewide.

Demand exceeds capacity.

Programs receive **~7,500** applicants yearly; only **~1,100** accepted (19% rate).

Introduction

In the previous section of this report, we examined what kinds of workers will be needed to implement Boston's Climate Action Plan. However, Boston's Climate Action Plan has another key goal: to ensure that all Boston residents have access to opportunities in the green economy. To achieve this goal, Boston needs training programs that prepare residents with the skills and tools to enter and thrive in the green economy.

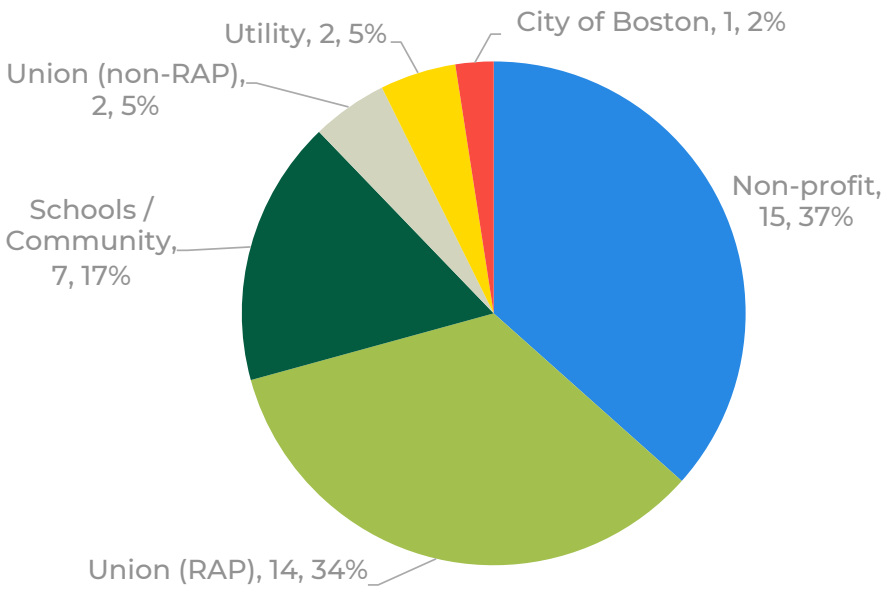
To understand the training landscape, this section offers an inventory and analysis of training programs preparing Bostonians to work in the needed occupations. We include training offered by joint union-employer apprenticeship programs; nonprofit organizations and schools including secondary and higher education. In all, the research team found 60 programs, which form the basis of our analysis. We did not include training programs funded by MassCEC that are conducted solely by employers or utilities. We start by examining the rapidly changing landscape for Boston's workforce development programs. Then we move on to analysis of how the programs connect to the 45 occupations that will be in demand to support the green transition.

What organizations offer green job training in Boston?

Green jobs training programs in Boston include those offered by joint union-employer registered apprenticeship programs (15), union non-registered apprenticeship programs (2), nonprofit organizations (15), high schools and community colleges (7), utility companies (2), and the City of Boston (1). Many of these programs serve residents with numerous barriers to employment. Programs vary in length, ranging from a few weeks to five years in the case of registered apprenticeships. Some programs, including Bunker Hill and Roxbury community colleges and Franklin Cummings Institute of Technology, offer numerous programs and certificates in green occupations, while other trainers are focused on one area. Union apprenticeship programs are often not conceptualized as green programs but are preparing workers for building trades occupations in high demand in the green economy. A handful of pre-apprenticeship programs prepare trainees to enter building trades apprenticeships. School programs may focus exclusively on green careers (Boston Green Academy at Horace Mann High School), as well as prepare students to enter building trades with or without a green specialization. Madison Park Technical Vocational Technical High School, Boston's only vocational high school, works closely with several building trades unions and employers, and it is also greening its curriculum. A project labor agreement signed by the mayor in May 2025 with the Greater Boston Building Trades Unions and the North Atlantic States Regional Council of Carpenters. It will allow Madison Park graduates to enter the Building Pathways pre-apprenticeship program, a nonprofit organization founded by the Greater Boston Building Trades Unions with the goal of recruiting and retaining under-represented groups in the union building trades.

Figure 6.1 – Boston training providers by type (N=41)

Note: Does not include training funded by MassCEC that are conducted by employers. Some training providers administer more than one training program.



Nonprofit and community-based organizations' job training programs are funded by federal, state (including MassCEC) and the Mayor's Office of Workforce Development, and grants from private foundations. Union apprenticeship programs are largely funded by payroll-based contributions. Total hourly compensation and contributions to these programs are negotiated in collective bargaining agreements, with funding added as a small cost per hour worked for each union member. Recent Healey administration funding for green workforce programs include:

- $577,500 grant awarded to Building Pathways in September 2024 to establish a comprehensive program to empower minority/women-owned business enterprises to successfully bid on and complete on clean energy projects that include solar installations, energy storage systems, microgrids, and deep building decarbonization retrofits.
- $659,835 in two grants awarded to Insulators Union Local 6 to expand its existing curriculum to include the installation and maintenance of removable insulation blankets, an effective way to achieve optimal energy efficiency in retrofitting existing structures without complicating ease of access to equipment.
- $2.5 million grant awarded to Franklin Cummings Tech in October 2023 to support the launch of the state-of-the-art Center for Energy Efficiency and the Trades, which focuses on increasing the number of students of color entering the Massachusetts green job workforce.

The Mayor's Office of Workforce Development (OWD) targets its training programs to low-income residents, communities of color, women, immigrants, and youth. Boston's Neighborhood Jobs Trust, which receives its funding through linkage fees paid by developers of large commercial projects, is the source for much of the city's funding. For instance, in 2023, the Neighborhood Jobs Trust provided $3.9 million to the Office of Workforce Development. OWD receives funding from other sources as well, some of it from competitive government grants.

In the last 2.5 years, Boston received funding for two green workforce development programs that dramatically increased the city's capacity to provide training. First, Boston's Office of Workforce Development received a highly competitive three-year $23 million federal Good Jobs Challenge grant in August 2022. The initiative will train and place 4,600 residents in jobs in three targeted industries: childcare, healthcare, and clean energy, with a focus on good jobs that pay more than the prevailing wage in the sector. The Good Jobs Challenge funds four education and training programs at Franklin Cummings Tech (Renewable Energy Technology; HVAC&R; Practical Electricity; and Electric Vehicle Technology) and three additional programs: Building Energy Efficient Maintenance Skills (BEEMS); weatherization training; and a Marine Technician Program at Bunker Hill Community College. All are profiled in Appendix B.

In June 2024, Boston's Office of Workforce Development received a $9.8 million award from the federal National Oceanic and Atmospheric Administration's Climate-Ready Workforce initiative. Delivered by the Greater Boston Climate Resilience Jobs Alliance, this initiative aims to train at least 1,200 low-income residents for careers that enhance the city's climate resilience. These include nature-based solutions; water utility management; construction of critical coastal infrastructure; emergency preparedness and response; and community engagement.

GREEN TRAINING PROGRAMS OFFERED BY NONPROFIT AND COMMUNITY-BASED ORGANIZATIONS

To assess the number, types, and outcomes of the training programs, we used a list of nonprofit and school-based training programs we received from the City of Boston, MassCEC, and the Barr Foundation. After examining information on program websites, we conducted semi-structured interviews to learn three main things about the programs. First, we analyzed whether these training programs use the approaches that research has found to be most effective for helping students learn, which are listed below. (We will examine the answers in the next section.) Second, we estimated the number of people trained and placed in green jobs. And third, we obtained available demographic data on participants to determine the extent to which opportunities are being created for all Boston residents. (See Technical Appendix A for complete methodology).

When we interviewed these providers, we asked about other such programs in their occupational areas. In all, we found 44 programs that prepare Boston residents, particularly those from low-income communities, for "green" occupations. The 44 nonprofit and school-based programs offer training in 14 of the 45 unique green occupations identified in the labor market analysis. Table 6.1 highlights seven of these occupations to illustrate programs in each of Boston's priority climate measures. Some occupations are served by several nonprofit and school-based training programs: HVAC technician (4), Weatherization Technician (4), Building Systems Operator/BAS Technician (5). Other occupations are served by fewer: Landscaper (2), Stormwater technician (1), Tree maintenance (1), and Wind turbine technician (1) (See full list in Appendix N).

Table 6.1 – Examples of nonprofit and school-based programs and occupations (based on a sample of 44 programs)

OCCUPATIONS	PROGRAM ADMINISTRATOR	PROGRAM NAME	PRIORITY CLIMATE MEASURE
Building Systems Operator/BAS Technician	Roxbury Community College	Building Automation Systems (BAS)	Building Decarbonization
	Cape Light Compact, Eversource MA, National Grid, Energize CT and RI Energy	Building Operator Certification (BOC) Training Level 1	Building Decarbonization
		Building Operator Certification (BOC) Training Fundamentals	Building Decarbonization
		Building Operator Certification (BOC) Training Level 2	Building Decarbonization
	PowerCorpsBOS	PCB Building Operating Systems	Building Decarbonization
HVAC Technician	Franklin Cummings Tech (BFIT)	HVAC&R Technology (Building Energy Management Concentration)	Building Decarbonization
	MassHire Boston	HVAC	Building Decarbonization
	Action for Equity	Green Equity Partnership**	Building Decarbonization
	Mass Save	Clean Energy Pathways	Building Decarbonization
Weatherization Technician	Green Jobs Academy	Home Weatherization Installer Boot Camp	Building Decarbonization
	Asian American Civic Association	Weatherization	Building Decarbonization
	LISC Boston	Bridge to Green Jobs	Building Decarbonization
	Mass Save	Clean Energy Pathways	Building Decarbonization
Wind Turbine Technician	Franklin Cummings Tech (BFIT)	Engineering Technology (Renewable Energy Technology Concentration)	Clean Energy
Tree maintenance (trimmers, pruners)	PowerCorpsBOS	PCB Urban Forestry	Resilience & Nature
Stormwater technician, Landscaper	Codman Square Neighborhood Development Corporation (CSNDC)	Green Infrastructure Certification (Envirocert)	Resilience & Nature
Landscaper	PowerCorpsBOS	PCB Urban Greening	Resilience & Nature

Not all the nonprofit and school-based programs maintain demographic data over time on participants. We were able to obtain this data from self-reporting by half of the providers (22). Data we were able to obtain reveal that they mostly serve men (Figure 6.2) and about 90% of program participants are people of color (Figure 6.3).

We include one of the 44 programs profiled below to illustrate how we depicted program data, funding, and partners (see the complete analysis of the training ecosystem in Appendix B).

Figure 6.2 – Gender of participants in nonprofit, utility, business coalition, and school-based programs, based on a sample of 22 programs.

Note: Schools and community college data was taken from NCES and the Department of Education.

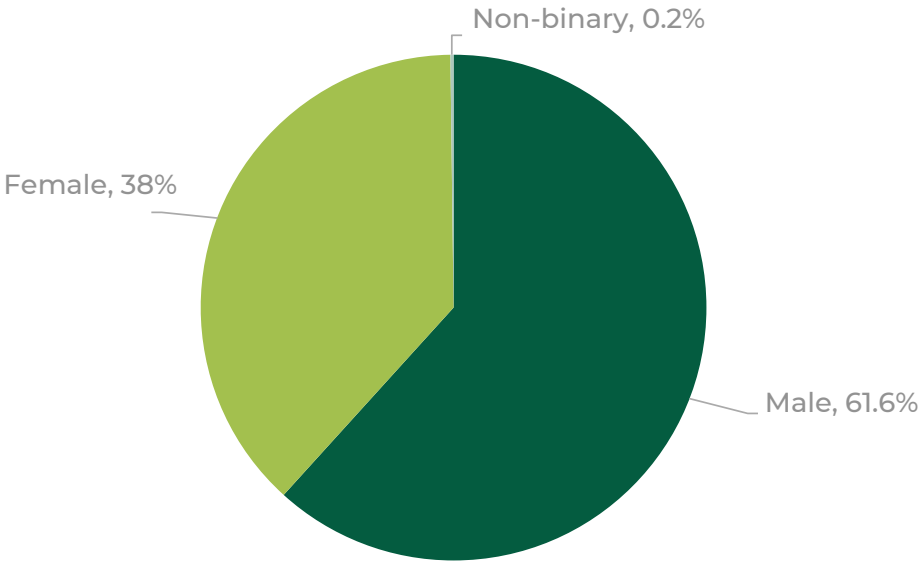


Figure 6.3 – Race/ Ethnicity and gender of participants in nonprofit, utility, business coalition, or school-based programs, based on a sample of 44 programs

Note: Schools and community college data was taken from NCES and the Department of Education.

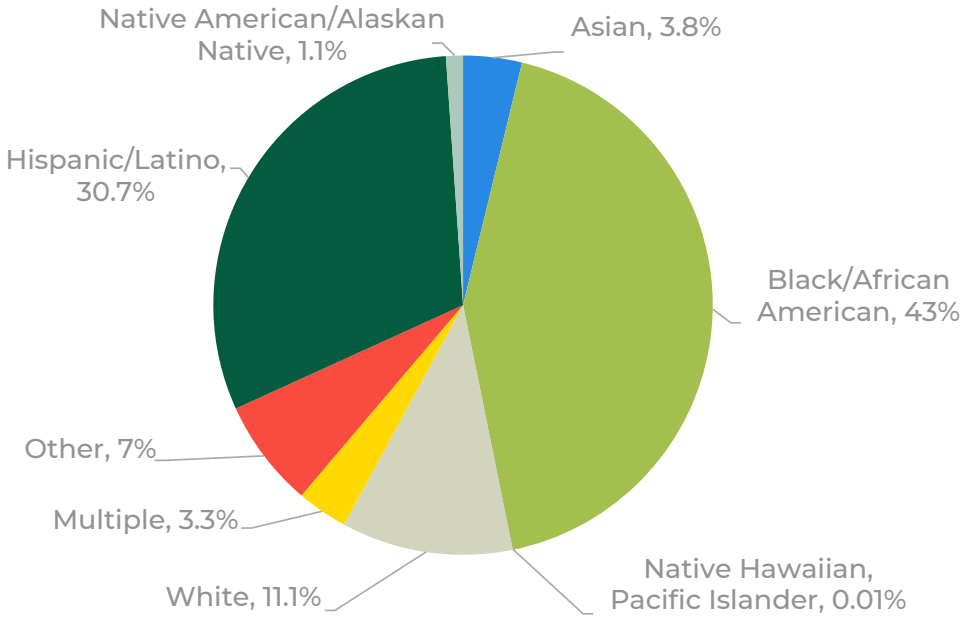


Figure 6.4 – Sample Training Program Snapshot

PowerCorpsBOS

Priority climate areas: Resilience & Nature; Building Decarbonization

✓ **EXPERIENTIAL LEARNING**	Hands-on technical training in a specialized track
✓ **PAID TRAINING**	Weekly stipend
✓ **STACKABLE CREDENTIALS**	OSHA-10, CPR, Various (based on track), Link with community colleges
✓ **EMPLOYER PARTNERSHIPS**	Project/training site, Internship host, Potential job placement
✓ **EMPLOYABILITY SKILLS**	Interview & resume preparation, Job search assistance
✓ **COMPREHENSIVE SERVICES**	Transit pass, Driver's license assistance, Financial literacy

30-40	70%	57%
Cohort Size	Graduation Rate	Job placement rate*

**Direct employment only, 43% of students continued in additional training*

Target groups: Returning citizens, court-involved residents, youth who have experienced homelessness or housing instability, young people who have been in foster care, and other marginalized groups.

Program highlight: Although city employment opportunities are open to the public, PCB is developing career pipelines into city departments by tailoring the training to the job descriptions of expected openings.

Program partners: Partnerships are key to the program's success. Employer partners give students hands-on experience and knowledge of the field. Potential employers give presentations and host site visits. These include Mass Horticulture, Mt. Auburn Cemetery, Newton Cemetery, and the Harvard Arboretum.

UNION APPRENTICESHIP PROGRAMS PREPARING TRADES WORKERS FOR GREEN OCCUPATIONS

A joint apprenticeship program is a rigorous, paid, multi-year training program sponsored jointly by a union and a group of employers. Programs are directed by a Joint Apprenticeship and Training Committee (JATC) composed of an equal number of management and union representatives. While apprenticeship is used in many industries, with or without union involvement, the JATC model is fundamental to training in the unionized building trades.

Joint apprenticeship programs are registered apprenticeship programs (RAPs) that combine on-the-job and classroom training and prepare enrolled apprentices for lifelong careers in the trades, including securing any needed certificates and licensure. At the federal level, RAPs are registered and overseen by the US Department of Labor (DOL). The Massachusetts Division of Apprentice Standards is recognized by the DOL as the State Apprenticeship Agency responsible for supporting, promoting, developing, and servicing Registered Apprenticeship Programs in the Commonwealth.

To assess the green training programs offered by unions through joint apprenticeship programs, we used data obtained from the Massachusetts Division of Apprentice Standards (DAS) and interviews with leaders from the Boston Building Trades Unions, an umbrella organization with comprehensive knowledge of building trades training in the area. The interviews helped identify pre-apprenticeship programs and a small number of training programs that are not registered apprenticeships but do prepare trainees to work green union jobs.

For each program included, we carried out an approximately hour-long, semi-structured interview with a representative of the program, usually the program director, asking questions related to:

- Program characteristics
- Application and recruitment
- Participant retention
- Green jobs
- Equity programs
- Perceived policy gaps

UNION APPRENTICESHIP PROGRAMS PREPARING BOSTON RESIDENTS FOR GREEN JOBS

Table 6.3 shows the JATC or union-affiliated training programs preparing Bostonians to perform green jobs that we identified. The table shows the full program name, a short name (usually the name of the primary trade trained), and whether the program is a registered apprenticeship program. The union registered apprenticeship programs offer training in 14 of the 45 unique green occupations identified in the labor market analysis. The “green applications/skills” column shows the types of green work the program trains for, according to training director interviews.

Table 6.2 – Union training programs (August 2024)

PROGRAM	TRADE/ SHORT NAME	REGISTERED APPREN-TICESHIP (RAP)	GREEN APPLICATIONS/ SKILLS	UNIQUE OCCUPATION	ACTIVE APPRENTICES
Applications/Skills	Unique Occupation	Active Apprentices	Solar, batteries, EV charger, wind, building systems (HVAC, blinds, etc.)	Electrician/ Solar Installer; Wind Turbine Tech; Building Systems Operator	1414
North Atlantic States Carpenters Training Fund	Carpenters	Y	Off shore wind-pile drivers, millwrights and carpenters, building envelope	Carpenters	835
Pipefitters, Refrigeration, Air Conditioning and Oil Burners Local 537 JATC	Pipefitters	Y	Heat pumps	Plumber; HVAC	586
New England Laborers Apprenticeship Program	Laborers	Y	Storm water, solar	Construction Worker	449
Sheet Metal Workers Local 17 JATC	Sheet Metal Workers	Y	HVAC	Building Systems Operator; HVAC	392
Plumbers Local 12 Training Center	Plumbers	Y	Heat Pumps, rainwater reuse, solar water heating	Plumber; HVAC	256
Ironworkers Local 7 Apprenticeship Program	Ironworkers	Y	Structural components wind and solar, MBTA maintenance	Wind welder	356
Finishing Trades Institute New England	Finishing Trades	Y	Glass, photovoltaic glass, turbine coatings, retrofit		257

PROGRAM	TRADE/ SHORT NAME	REGISTERED APPREN-TICESHIP (RAP)	GREEN APPLICATIONS/ SKILLS	UNIQUE OCCUPATION	ACTIVE APPRENTICES
Operating Engineers Local 4 Training Center	Operating Engineers	Y	Equipment operation wind, solar, substations, retrofits, geothermal	Heavy Equipment Operator, Driller	121
Roofers Local 33 Joint Apprentice and Training Program	Roofers	Y	Roofing and waterproofing	Roof Technicians	137
Heat and Frost Insulators Local 6 JATC	Insulators	Y	Insulation	Insulation	122
Bricklayers and Allied Craftworkers Local 3	Bricklayers	Y	Insulation, waterproofing	Insulation	144
Electric Power Utility Technology (EPUT) (UWUA/ Eversource/Bunker Hill CC)	Utility Workers	N	Electric lines, station operations, power systems tech	Linesperson	40
Plasterers and Cement Masons Local 534 JATC	Plasterers	Y	Roof and drainage applications	Roof technician	18
Carmen's Union/ MBTA Rail Vehicle Maintenance Technician Training Program	Rail Vehicle Mainte-nance	N	Maintain electric subway vehicles	EV Repair/ Maintenance	8
Boilermakers Northeast Area Apprenticeship Program at Local 29	Boilermaker	Y	Carbon capture, floating windmills, Hydrogen production		22

Source: Number of active apprentices and registration status from the Massachusetts Division of Apprentice Standards (DAS) data, August 2024.

Our analysis below focuses on the 14 Joint Registered Apprenticeship Programs preparing Bostonians for good green jobs. We refer to these programs collectively as "green jobs union apprenticeships." We provide more detail on the Electric Power Utility Technology program in the profiles of community and education-based programs.

Program Structure

All union apprenticeship programs include classroom and on-the-job training. Programs alternate jobsite and classroom training according to a few models (Table 6.3).

1. Block training: Weeklong classroom sessions several times per year
2. Day/night training: Classes 1-2 times per week during the day or after work
3. Weekend classes: Classroom instruction on the weekend.
4. Pre-job training: Multiple-week training program before placement on job site.

Table 6.3 – Program structure for union apprenticeship programs

PROGRAM NAME	TRAINING FORMAT	LENGTH OF PROGRAM
Sheet Metal Workers	Block training	5 years
Electricians	Day class 1x per week	5 years
Finishing Trades	Block training	3 years
Plasterers	Weekend classes	3 years
Pipefitters	Block training	5 years
Carpenters	Block training	4 years
Operating Engineers	Night class 2x per week	4 years
Laborers	Pre-job training and return courses	2-3 years
Ironworkers	Night classes 2x per week + block training	3 years
Bricklayers	Pre-job training + night classes 1x per week	5 years
Boilermakers	Block training	4 years
Insulators	Day training 1x every other week	4 years
Plumbers	Block training	5 years
Roofers	Weekend classes	3 years

Source: Interviews with apprenticeship personnel.

BOSTON RESIDENTS ENROLLED

Joint union-employer apprenticeship programs provide pathways to good careers for Boston residents. Union programs serving the Greater Boston area that train for green jobs enroll 787 Boston residents. These programs have an average of 16% Boston residents, according to data from the Massachusetts Division of Apprentice Standards (DAS) and interviews. In most cases, Boston-area programs' jurisdiction encompass Eastern Massachusetts, with some programs covering all of New England.

Boston residents are more likely to access construction apprenticeships through union programs. Statewide, DAS data shows that 92% of Boston residents in construction apprenticeship programs are in union programs. In all union programs across Massachusetts, 12.5% of apprentices are Boston residents. In all non-union apprenticeship programs, 3.1% of apprentices are Boston residents.

Table 6.4 – Boston resident enrollment in union apprenticeship programs (2024)

PROGRAM	BOSTON RESIDENTS ENROLLED	PERCENT BOSTON RESIDENTS
Greater Boston Joint Apprentice Training Center for the Electrical Contracting Industry	281	20%
Sheet Metal Workers Local 17 JATC	57	15%
Ironworkers Local 7 Apprenticeship Program	56	16%
New England Laborers Apprenticeship Program	50	11%
Pipefitters, Refrigeration, Air Conditioning and Oil Burners Local 537 JATC	45	8%
Finishing Trades Institute New England	44	17%
Plumbers Local 12 Training Center	36	14%
Roofers Local 33 Joint Apprentice and Training Program	28	20%
Bricklayers and Allied Craftworkers Local 3	22	15%
North Atlantic States Carpenters Training Fund	132	16%
Heat and Frost Insulators Local 6 JATC	10	8%
Operating Engineers Local 4 Training Center	17	14%
Plasterers and Cement Masons Local 534 JATC	4	22%
Boilermakers Northeast Area Apprenticeship Program at Local 29	5	23%
TOTAL	**787**	**16%**

Source: Authors' calculations using Division of Apprentice Standards data. Data includes city of residence.

RACIAL, ETHNIC, AND GENDER DIVERSITY

The City of Boston recognizes that increasing the number of people of color, women, and Hispanic/Latine people in the trades is key to efforts to expand equitable access to good jobs. Inclusion of women and people and color in the building trades represents significant but unfinished progress in a sector where unions historically excluded people of color as well as women. The construction industry was the first sector where the federal government intervened to require affirmative action by increasing the number of people of color on federally funded projects. Locally, leaders and groups including Chuck Turner, Mel King, the Boston Jobs Coalition, and the United Community Construction Workers fought against exclusion in the Boston area, fighting for and winning inclusive City policy that is now known as the Boston Resident Jobs Policy (BRJP), which sets hiring standards for Bostonians, people of color, and women on public and private construction projects in the City.[35] (See more below.)

Regulation and community organization have moved the needle on racial inclusion in Boston building trades. Today, union apprenticeships have increased their diversity and are training larger numbers and higher proportions of people of color and women than their non-union counterparts. The number of apprentices who are women and people of color is a leading indicator of the diversity of union memberships for years to come.

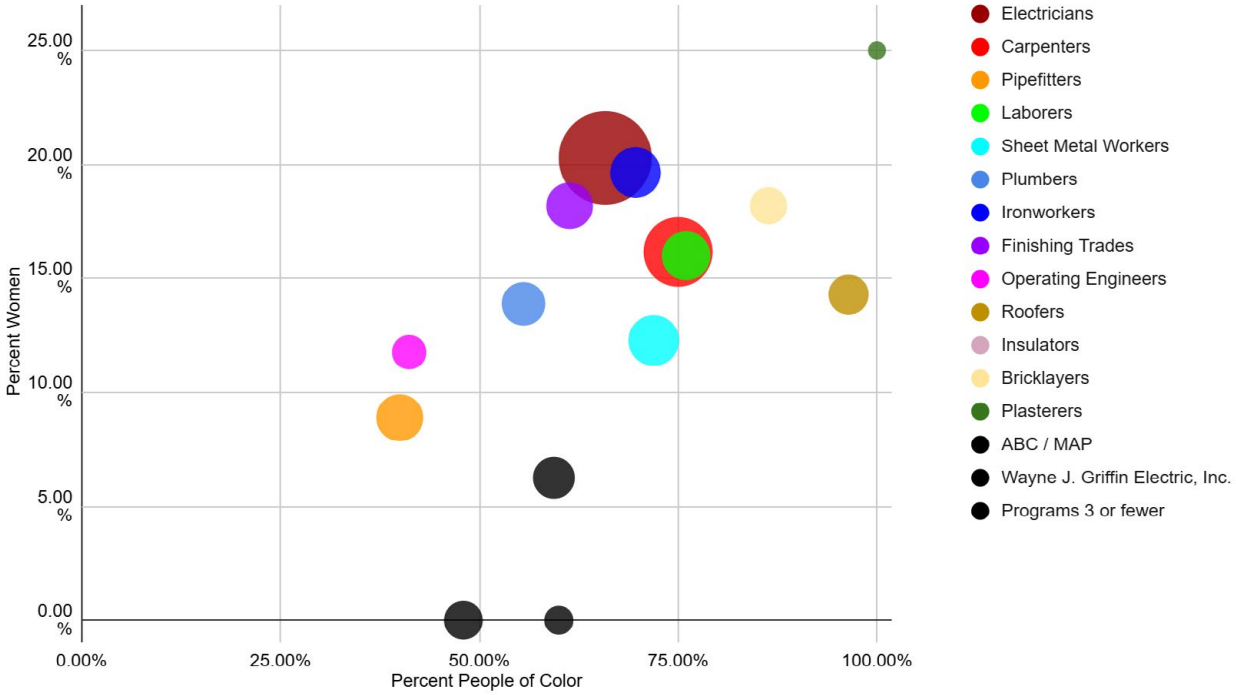
The union apprenticeship programs we studied generally perform well on racial diversity, especially when considering Boston residents only. Programs with the highest number of Boston apprentices who are people of color are Electricians (185) and Carpenters (99). Programs with the highest percentages of Boston apprentices who are people of color include Plasterers (100%), Roofers (96%), Brick Layers (86%), Insulators (80%), Laborers (76%), Carpenters (75%), and Sheet Metal Workers (72%) See figure 7.

The union apprenticeship programs we studied enroll 31.5% people of color, according to DAS data. Non-union apprenticeship programs statewide enroll 21.3% people of color. Considering only Boston resident apprentices, union apprenticeships include 68.0% people of color, while for non-union apprenticeships the number is 55.2.

The Massachusetts Division of Apprentice Standards reports Hispanic/Latino/a/x data separately from race data for each individual. The city of Boston considers Hispanic/Latino individuals as “people of color” for the Boston Residents Jobs Policy. As shown in Figure 6.6, union programs interviewed enroll 12.5% Hispanic/Latino apprentices, according to DAS data. Nonunion apprenticeship programs statewide enroll 12.4% Hispanic/Latino/a/x apprentices.

Figure 6.5 – Proportion of People of Color and women by training program—Boston apprentices only

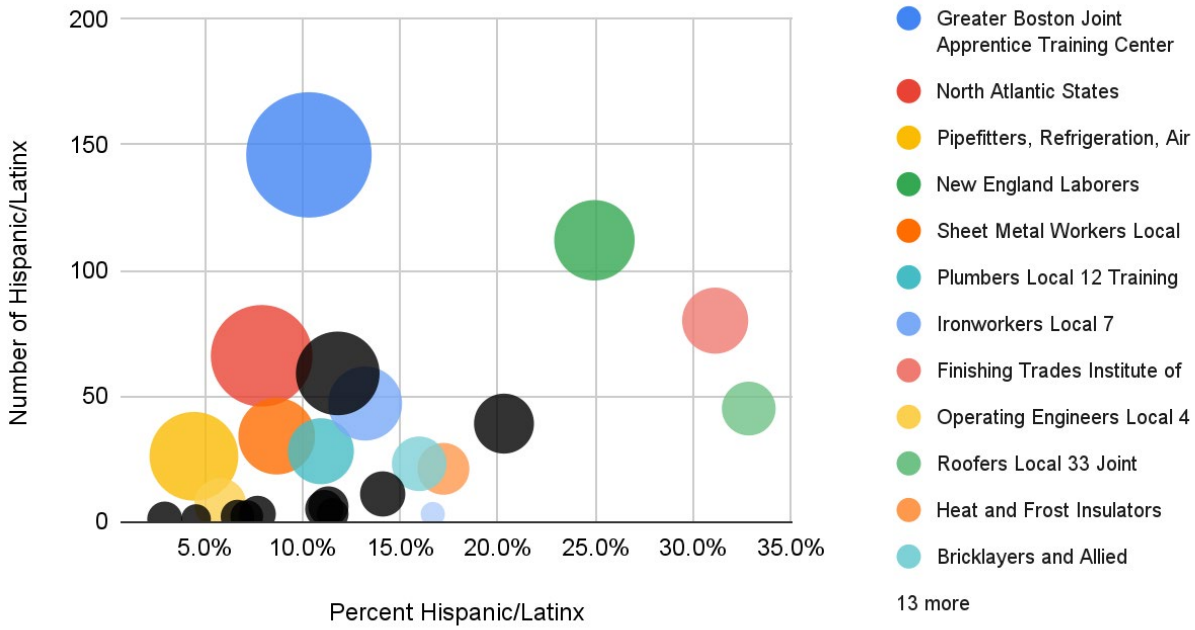
Size of circle indicates relative number of active enrollees in each program



Source: Division of Apprentice Standards (August 2024)

Figure 6.6 – Proportion Hispanic/Latinx people by training program

Size of circle indicates relative number of active enrollees in each program



Source: Division of Apprentice Standards (August 2024)

Union apprenticeships enrolled a higher percentage of people of color compared to non-union programs, indicating that union pathways are be a stronger driver of workforce diversity in the trades. Considering all programs statewide, DAS data shows union programs train 81% of all construction apprentices of color and outperform non-union programs enrolling people of color in Boston and statewide.

Building trades have historically been nearly all-male trades, but union apprenticeship programs are opening pathways to careers in the trades and increasing the percentage of women in trades. Programs with the highest number of Boston apprentices who are women are Electricians (57) and Carpenters (22). Programs with the highest percentages of women apprentices include Insulators (40%) Plasterers (25%), Electricians (20%), Iron workers (20%), Finishing Trades (18%) and Bricklayers (18%). (Figure 6.5)

Union apprenticeship programs covering green occupations in the Greater Boston area enroll 11.6% women, according to DAS data. Considering only Boston resident apprentices, that number increases to 17.5%. Non-union apprenticeship programs statewide currently enroll 4.4% women, according to DAS. Considering only Boston residents, that number decreases to 3.0%. According to DAS data, union apprenticeship programs statewide train 88% of all women apprentices.

Although the number and proportion of women in the construction trades remains low, union programs have been working to increase outreach and enrollment. The Massachusetts Girls in the Trades partnership and Northeast Center for Tradeswomen's Equity (NCTE) promote pathways to union apprenticeships and support women in the trades. Many unions have established women's employee groups and engage in the Care That Works pilot program to increase childcare supply during early work hours.

DRIVERS OF GROWING DIVERSITY IN THE TRADES

The growth of diversity in climate-critical building trades over the previous decades has several drivers. Nationwide, building trades unions are pursuing several initiatives to increase racial and gender diversity in the building trades, including pre-apprenticeship programs, partnerships with community groups and other organizations, and the provision of supportive services.

At the local level, various policies and programs work together to increase the demand for women and people of color workers in the building trades. Since 1983, the Boston Residents Jobs Policy has set standards for the employment of Boston residents, women, and people of color on covered construction projects. This policy applies to private development projects over 50,000 square feet, as well as all public development projects.

The standards are:

- At least 51% of total work hours of journey people and 51% of total work hours of apprentices in each trade must go to Boston residents
- At least 40% of the total work hours of journey people and 40% of the total work hours of apprentices in each trade must go to people of color, and
- At least 12% of the total work hours of journey people and 12% of the total work hours of apprentices in each trade must go to women.

Compliance data is tracked on the City's dashboard; covered projects have met or exceeded goals for people of color since 2021.[36]

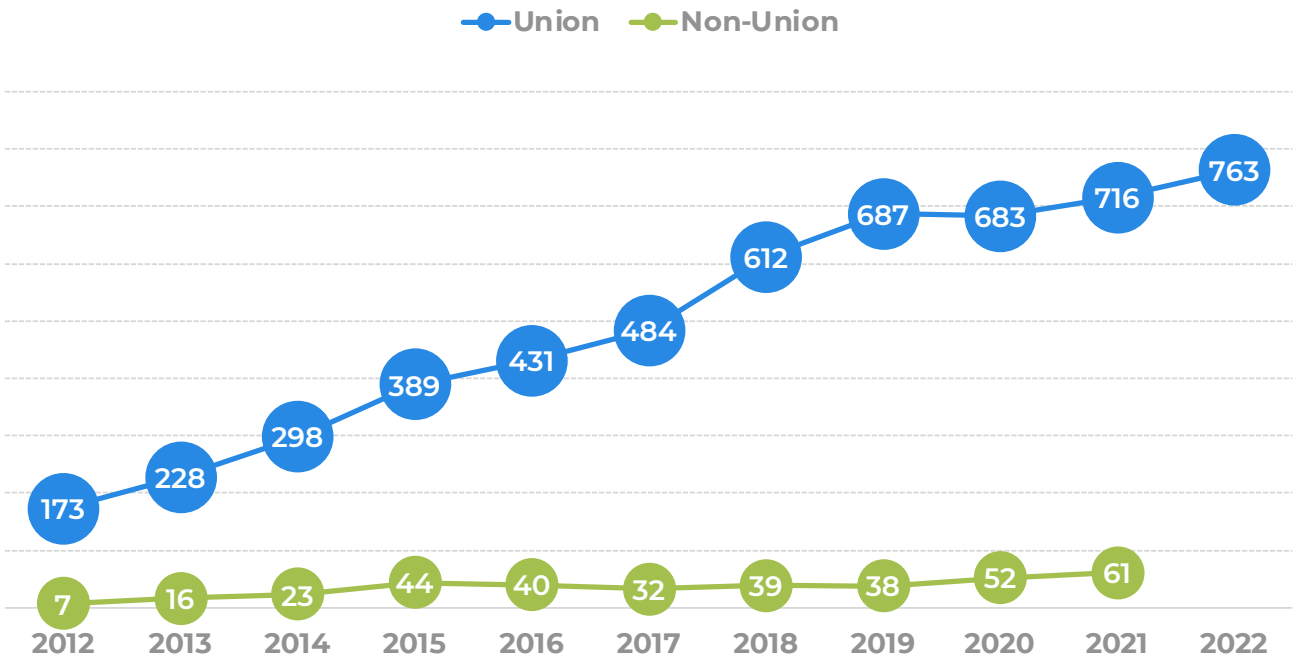
Trades leaders established the Policy Group on Tradeswomen's Issues in 2008 to work with contractors, unions, and a range of other actors to increase demand for a diverse workforce. The group provides guidance and technical support on best practices in diverse hiring, including building partnerships, and setting and reaching workforce participation goals (such as those laid out in the Boston Residents Job Policy.

In 2011, the Boston Building Trades Unions founded Building Pathways to ensure the building trades were more accessible to people of color and women. Building Pathways works in close coordination with joint apprenticeship programs, union contractors, and trades unions, to support the "recruitment, retention, and advancement of under-represented groups in the union building trades, particularly women, people of color, and young adults." They conduct outreach to diverse communities, deliver respectful workplace training, and advocate for policies and practices that increase diversity in the building trades. Building Pathways' free, 200-hour apprenticeship readiness program is recognized by apprenticeship directors and labor leaders as a key driver of diversity in the green jobs union apprenticeships. Building Pathways prepares about 68 graduates a year for union apprenticeship programs. Stipends are provided to enrollees when grant funding allows; for example, members of a recent class each received stipends of $599. Participants receive personal protective equipment, case management services, and fuel or transit cards. In 2024, enrollment was 83% people of color, 32% Hispanic/Latine, 37% women, and 51% Boston residents.

In addition, IBEW Local 103 recently established its own pre-apprenticeship program focused on developing a diverse and skilled workforce to install, maintain and upgrade clean energy systems. This free, unpaid 119-hour program takes place on evenings and weekends over 10 weeks. The current cycle is the first, and includes 39 people, 67% of whom are people of color, 5% women, and 50% Boston residents.

The Policy Group on Tradeswomen Initiatives (PGTI) has tracked women apprentices statewide since 2012 and finds a growth in the number and percentage of women in union and non-union apprenticeship programs statewide from 2012 to 2021 (Figure 6.7). Over that period, the proportion of women in union apprenticeships in Massachusetts more than doubled.

Figure 6.7 – Women Apprentices in Massachusetts, by program sponsor, 2012-2021



7323	763	10.4%	2169	30%
Active Apprentices	Women	Women's Participation	People of Color	People of Color Participation

Source: Policy Group on Tradeswomen's Issues, based on data obtained from the Division of Apprentice Standards, https://i0.wp.com/policygroupontradeswomen.org/wp-content/uploads/2021/09/Q42021Snip.png?ssl=1

DAS could not provide historical data on apprentice demographics in response to our request, so we are unable to provide detailed analysis on trends over time. However, the Policy Group on Tradeswomen Initiatives (PGTI) has tracked women apprentices statewide since 2012 and finds a growth in the number and percentage of women in union and non-union apprenticeship programs statewide from 2012 to 2021 (Figure 6.7). Over that period, the proportion of women in union apprenticeships in Massachusetts more than doubled.

Recruitment

Union apprenticeship programs recruit applicants through pre-apprenticeship programs, local schools, and community outreach. In the Boston area, most programs work with Building Pathways. Building Pathways is a nonprofit organization founded by the Greater Boston Building Trades Unions dedicated to the recruitment, retention, and advancement of under-represented groups in the union building trades, particularly women, people of color, and young adults. Many programs also work directly with YouthBuild, a pre-apprenticeship program that provides building trades exploration for people aged 17-24 who do not have a high school diploma, and Helmets to Hardhats, which connects veterans to apprenticeship programs. Some apprenticeship programs have direct entry slots or give preference to Building Pathways, YouthBuild, and Helmets to Hardhats applicants.

Union apprenticeship programs in Greater Boston recruit at local high schools including vocational and traditional high schools, as well as those with Career Technical Education (CTE) programs. Apprenticeship programs advertise at schools, attend high school career fairs, and connect with career counselors. The Massachusetts Girls in Trades program connects female students in middle school and high school with apprenticeship opportunities. Apprenticeship programs also advertise widely in the community at community centers, churches, events, and over social media through print and digital advertising. Nevertheless, interviews with programs revealed that word of mouth is one of the most common ways applicants learn about these opportunities.

In May 2025, Mayor Michelle Wu signed a Project Labor Agreement (PLA) with the Greater Boston Building Trades Unions and the North Atlantic States Regional Council of Carpenters for the Boston Public Schools Long-Term Facilities Plan. The PLA ensures that all major BPS capital projects moving forward will have a consistent supply of skilled, union labor. It also creates a new and expanded direct pathway for graduates of Madison Park Technical Vocational High School to good-paying, stable union jobs in the construction trades. The PLA specifies that graduates of Madison Park will have direct entry into the Building Pathways pre-apprenticeship program. Madison Park offers six Ch. 74-certified vocational programs aligned with the building trades: Carpentry; Electricity; Heating, Ventilation, and Air Conditioning (HVAC); Metal Fabrication; Plumbing; and Building and Property Maintenance. According to the terms of the PLA, the top-performing half of each graduating class from each of these six programs at Madison Park—up to 50 students per year—will have guaranteed admission into Building Pathways, followed by admission to a registered apprenticeship program. Madison Park will be the only technical vocational school in Massachusetts to offer its graduates direct entry into apprenticeship programs at this scale.

APPLICATIONS VS ACCEPTANCES

Apprenticeship class size is decided on a year-by-year basis, based on projections of demand for union services. When economic activity and development trends are down, programs accept fewer enrollees. For most programs and most years, interest in enrollment far exceeds program capacity. Programs in the Greater Boston area that shared this data typically receive between 150 and 2500 applications. Admissions processes vary between programs, but generally include an application, an interview and may include a written test. Some unions expedite entry for Building Pathways graduates, veterans, or other groups. Acceptance rates range between 4% and 40 percent, with an average of 19% across all programs displayed below.

Summary

Boston is served by 44 education and training programs that provide skills to Boston residents in the green economy. While some provide pathways to family-sustaining, high-quality jobs, some of the jobs in the green economy do not meet these criteria. These programs offer training in 19 of the 45 unique green occupations identified in the labor market analysis. There are multiple training options in many of the trades, both union and non-union. Of the 22 nonprofit and school-based programs for which we could obtain enrollment data, women represented only 38% of trainees. Many of the programs are in the trades; despite advances, women's entry into trades falls far behind gender parity. The relatively high rates of participation among Black and Latino Bostonians (43% and 30%, respectively) is likely due to concerted efforts to recruit participants from these groups.

As of August 2024, union apprenticeship programs enrolled 787 Boston residents, representing 16% of total enrollment. Of these residents, 68% are people of color and 17.4% are women. Interest in union apprenticeships far exceeds capacity. In the next section, we examine the characteristics of effective training programs and summarize how many of these programs meet efficacy criteria.

7.

EFFECTIVE PRACTICES AND BARRIERS TO ACHIEVING THEM

Boston's workforce is experienced but needs green-context training to meet demand.

Six core criteria of effective training:

1) Experiential learning
2) Paid training
3) Stackable credentials
4) Employer partnerships
5) Employability skills
6) Comprehensive services

Nonprofit and school-based programs align with several key criteria:

93% offer stackable credentials
82% use experiential learning
75% teach employability skills
70% have employer partnerships
Only 45% offer paid training
Only 47% provide comprehensive services

Why this matters:

Paid training and support services expand opportunity for historically marginalized residents, making participation possible for people with limited resources.

Introduction

In the previous section, we introduced all the Boston-area programs currently training people for green jobs. In this section, we discuss how programs detailed above offer what research has shown are effective practices that increase completion and placement.

All union apprenticeships meet five of the six criteria. Among nonprofit and school-based programs, almost all use the most critical element—experiential or hands-on learning, and most also meet another criterion, employer partnerships, although how thoroughly employers are engaged varies widely. Few of the nonprofit and school-based programs provide paid training and comprehensive services, two elements that are particularly important in assisting people with barriers to employment. (Table)

We discuss these effective training elements below. In addition, we outline another program element we identified through our research as essential to trainees' success, both during the program and when applying for jobs: using the application process to ensure a good fit between the trainees and the occupation.

Features of effective training programs:

1. EXPERIENTIAL LEARNING. This approach emphasizes hands-on activities so that learners can apply theoretical knowledge to real-world situations. The process typically involves a cycle of experiencing, reflecting, thinking, and acting, which helps deepen understanding and retention of the material. Through hands-on experience, students develop critical thinking, problem-solving, and decision-making skills.

2. PAID TRAINING. One of the key reasons students from disadvantaged backgrounds drop out of community college and training programs is that they cannot afford to forgo income. As Boston's climate action seeks to create an inclusive green workforce, the earn-and-learn model becomes an important way to ensure that low-income, unemployed, or underemployed Bostonians can join these training programs. Paid training comes in the form of stipends or hourly wages.

3. STACKABLE CREDENTIALS. When individuals have successfully completed a specific training or program of study, many training programs award them a certificate, giving them a formal credential that attests to their knowledge, experience, and skills. Certificates are typically issued by educational institutions or professional organizations. A stackable credential is one that can be applied to the requirements of a higher-level credential. In some cases, an individual can start employment with the first credential and then earn additional stackable credentials to advance.

4. EMPLOYER PARTNERSHIPS. These take many forms in nonprofit and school-based programs, including giving presentations, hosting trainees on site visits, helping to develop curriculum, offering internships, and making commitments to hire program graduates. Research shows that when sector-based workforce programs are built with employer partnerships, more graduates get jobs, and at higher starting wages. These partnerships benefit both students and employers. They ensure that students learn the skills that employers need. And they can help employers access well-trained workers by broadening the pool of talent and removing employer bias towards certain groups or misconceptions about whether high school or college degrees are essential for certain jobs.

5. EMPLOYABILITY SKILLS. Typically described as "soft skills," these encompass a range of competencies, behaviors, attitudes, and personal qualities that enable individuals to perform well in the workplace. Employability skills are just as important as "hard skills" in helping people get hired and stay in jobs, research finds. These include communication skills, time management, reliability, teamwork, emotional intelligence, conflict management, digital literacy, creativity, and adaptability.

6. COMPREHENSIVE SERVICES (or "wraparound services"). These help participants from disadvantaged communities overcome obstacles such as a lack of housing, transportation, food, clothing, emergency funds, and mental health. These services also build necessary skills, like financial literacy, that help individuals complete programs and succeed in the workplace over the long term. Some comprehensive services intersect with the employability skills mentioned above (i.e., being paired with counselors or case managers). Many programs offer some of these services themselves and contract with social service organizations for the others.

Table 7.1 – Effective training practices in Boston serving training programs

	CRITERIA					
Present in Programs	**Experiential Learning**	**Paid Training**	**Stackable Credentials**	**Employer Partnerships**	**Employability Skills**	**Comprehensive Services**
Union* (N=14)	14 (100%)	14 (100%)	14 (100%)	14 (100%)	14 (100%)	Varies**
Nonprofit and school-based (N=44)	36 (82%)	20 (45%)	41 (93%)	31 (70%)	33 (75%)	24** (54%)

* Includes Registered Apprenticeship Programs and MBTA
**Varies. Most nonprofit and school-based programs provide a combination of referrals to third-party organizations and in-house services. The extent of coverage can vary within a program, depending on funding.

1. EXPERIENTIAL LEARNING

All the programs cataloged in this report offer some degree of experiential learning. Union apprenticeships combine classroom and on-the-job training. Apprenticeships last two to five years, alternating jobsite work with classroom training one to two times per week, on weekends, or in one-two week "blocks" before or interspersed with jobsite training.

Of the community and nonprofit programs, we found that some are completely hands-on, as is the case with the Asian American Civic Association's two-week Weatherization Technician Training. Others combine classroom instruction with hands-on or lab experience, as does Apex Clean Energy Institute's solar energy training, XCC's water and wastewater operator training, and all the programs at community colleges and vocational schools. According to training providers, this combination is most effective, enabling participants to apply what they learn and stay engaged. Many certifications require a specific number of work hours that can be earned through hands-on training. Upskilling programs, such as Green Job Academy's Crew Lead training and the online BE+ training, typically have little experiential content.

In union programs, apprentices are placed on construction projects where they work closely with journey-level workers (the next step up from apprentice) to learn skills on the job. Classroom instruction usually includes a mix of lectures and hands-on instruction in training facilities. Training facilities vary by trade but include replications (sometimes at a smaller scale) of work environments. To cite a few examples, the Greater Boston Joint Apprentice Training Center for the Electrical Contracting Industry has solar panels mounted on a outdoor low-level "roof"; the Plumbers Local 12 Training Center has a model rooftop water capture system; and the Sheet Metal Workers Local 17 JATC's workshop includes spaces for welding, building out and testing and balancing HVAC systems.

Project-based learning is related to experiential learning. What differentiates it from experiential learning is that students work on one project over an extended period, ranging from a week to a semester. These projects are designed to address complex questions or solve actual workplace problems, requiring students to apply critical thinking, collaboration, creativity, and communication skills. By creating a product or presentation, students demonstrate their understanding and mastery of the subject matter. This method not only enhances academic learning but also fosters deeper content knowledge and essential life skills. An example is the Building Automation System training program at Roxbury Community College, which added a "Living Lab" component to its course in 2020. The Living Lab offers hands-on training in operating all building systems for maximum energy efficiency. Students are thus able to better understand the challenges associated with managing a complex commercial building in a real-world setting.

2. PAID TRAINING

An earn-and-learn model is essential to support access and equity in job training. Paid training is especially important for people seeking to leave low wage jobs, as they are unlikely to have savings or other resources to complete unpaid training. Paid training can also provide essential support to people who are unemployed or underemployed and prevent the necessity of entering a low-wage job.

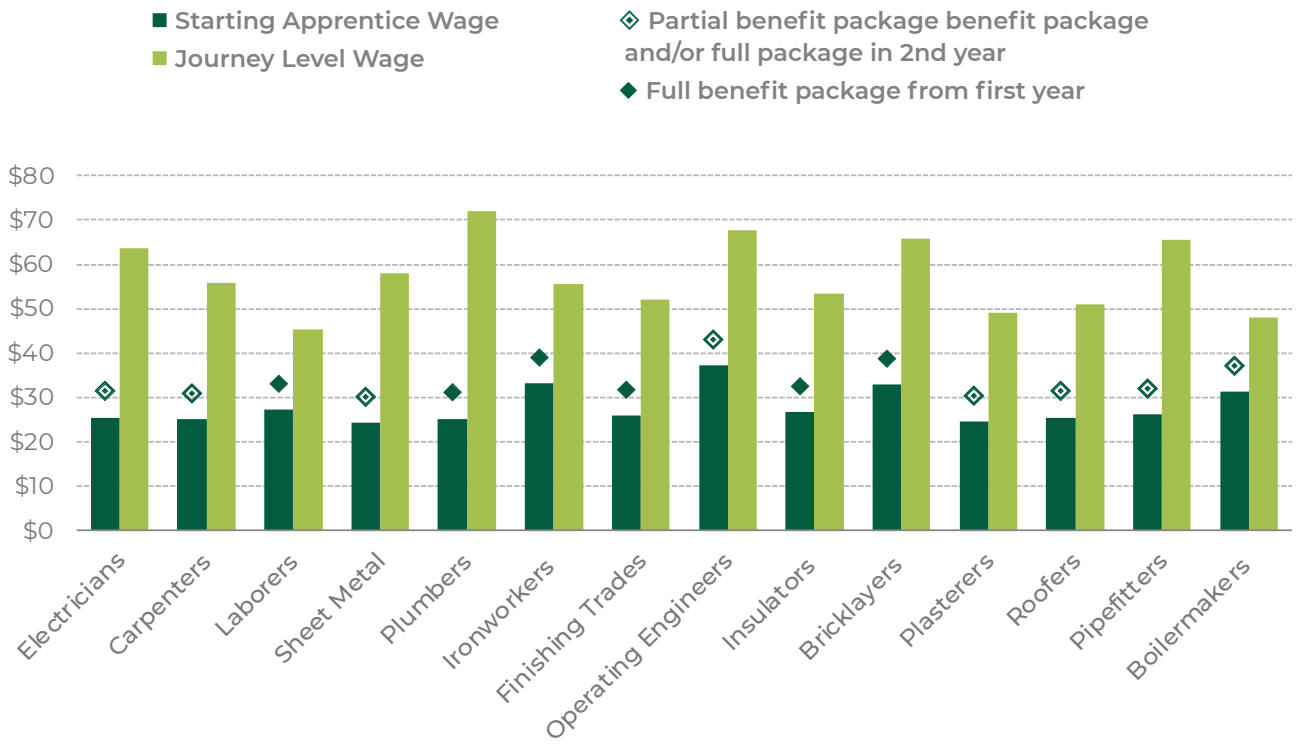
Only 20 of the 44 nonprofit and school-based programs we studied pay trainees stipends or hourly wages (at least minimum wage). The wage and stipend availability and amounts can vary from year to year depending on the programs' funding. While most of the nonprofit and school-based programs provide no-cost training for participants, the lack of paid training forms a barrier for equitable participation.

All joint apprenticeship programs are earn-while-you learn, with strong wages. Apprentices are covered by collective bargaining agreements negotiated between unions and employers. As such, they enter the training program with a negotiated suite of wages, health and retirement benefits, and protections on the job. Apprentices get incremental increases in pay, usually biannually, until graduating to a journey-level rate. Currently, starting apprentice wages for Boston-area programs range from $24.33 to $37.19 per hour, which is higher than the current state minimum wage of $15/hour or Boston's living wage of 18.78 (See Figure 7.1) The average yearly earnings for first year apprentices in our study was $58,127.

At the completion of the apprenticeship, participants begin making journey-level wages. Currently, journey wages in the trades we studied range between $45.38 and $72.14 per hour. Ranging between $94,390 and $150,051 annually, journey wages are 6 to 68% higher than Boston's median household income of $89,212.

Union members' wage and benefits package enhances that salary, with the cost of benefits typically paid by employers on top of the wage earned. For example, a journey level Sheet Metal Worker in Boston at Local 17 makes $57.94 per hour in wages. On top of the wage, the employer pays contributions to a healthcare plan, a pension and annuity fund for retirement, as well as contributions to local training funds that support the apprenticeship. This brings the total wage package to $108.69. Some programs offer the full package to first-year apprentices, while others offer partial packages that increase with program completion.

Figure 7.1 – Starting apprentice wage, journey level wage, and benefits for union apprenticeship programs



Source: Interviews with apprenticeship personnel.

3. STACKABLE CREDENTIALS

In certain sectors, short-term training courses that certify individuals in particular skills or tasks are widely used to show that workers have the knowledge, experience, and skills needed to meet a company's standards and to succeed in a job. Certifications can help workers advance their careers in the four priority climate sectors by demonstrating their expertise and commitment to sustainability, as well as secure pay raises. Some green occupations require a state-issued license, including water and wastewater operators, sheet metal workers, gasfitters, and electricians among others. We identify some of these in Table 7.2.

Employers explained to us that they appreciated certificates, but cared even more that job applicants had relevant work experience or certificates that demonstrate work experience, as this showed a candidate's work-readiness and higher likelihood of retention.

Trainees must pass a test and/or field examination to earn the certificate or license. All training programs typically pay for both fees associated with the curriculum and taking the test for the first time, which range from $59 to over $200 (Table 7.3). By removing these costs, programs remove obstacles for many low-income participants from accessing better economic opportunities in the green economy. Some licenses and certifications need to be renewed every few years. This cost is usually covered by employers.

Table 7.2 – Certifications and licenses as stackable credentials for career advancement

CERTIFICATIONS AND LICENSES	
Fundamentals of Energy Efficient Building Operations (FEEBO) FEEBO is an introductory course in energy efficiency in commercial buildings for a career in building operations and maintenance. It can be paired with one year of work experience to meet the eligibility requirements for BOC Level I training, which is an internationally recognized training standard (ISO 17024).	› Certification administered by: Building Operator Certification (BOC) › Boston-serving training program: BOC (Appendix B)
Massachusetts Grade III Municipal Wastewater Operator's License (MA Grade III) The MA Grade III certification is one of the entry-level certifications for a career in the wastewater sector. Combined with work experience from a 10-week paid internship allows individuals to secure jobs in wastewater management with a starting pay of $24-27 per hour with benefits. They can advance to Grade IV wastewater operators after one year of holding the license and work experience.	› New England Interstate Water Pollution Control Commission (NEIWPCC) › Boston-serving training program: X-Cel Conservation Corps (Appendix B)
National Green Infrastructure Certification Program (NGICP) NGICP gives entry-level workers the basic skill sets for constructing, inspecting, and maintaining green infrastructure (GI). Individuals with less than 2 years of experience go through 35 hours (minimum) of training through in-person, virtual, or hybrid that gives a field or video module on GI construction, inspection, and maintenance techniques and practices. NGICP offers eight other more advanced certificates.	› Certification administered by: › EnviroCert International › Boston-serving training program: › Codman Square Neighborhood Development Corporation (Appendix B)
Photovoltaic (PV) Associate The PV Associate exhibits fundamental knowledge of "the application, design, installation, and operation" of PV, Solar Heating, and Small Wind energy systems. It is particularly useful for new installers to become qualified to design, sell, install, or maintain systems under supervision. With additional PV installation training and an OSHA-10 certification, individuals can advance to higher NABCEP Board Certifications, such as the PV Installation Professional for PV design, installation, operations, commissioning and maintenance. Note: In Massachusetts, only licensed electricians are allowed to do solar installations.	› Certification administered by: › North American Board of Certified Energy Practitioners (NABCEP) › Boston-serving training program: › Apex Clean Energy Institute (page x), Solar Helping Ignite Neighborhood Economies (Appendix B)

Table 7.3 – Sample costs of common certifications and licenses

CERTIFICATION/LICENSE	COST
OSHA-10	OSHA 10-Hour online training, Study Guide and Certificate—$59 In person and multilingual OSHA 10 training can be more expensive.
BPI Building Science Principles Certificate	Web-Based Digital Reference Guide—$109 or Printed Reference Guide—$129 BSP Online Exam—$109
Envirocert NGICP	$190
MA Grade 3 Municipal Wastewater Operator's License	$104
NABCEP PV Installation Professional (PVIP)	Application—$125.00 Exam—$375.00

Integrating the exam schedule into the training program ensures that graduates have at least the baseline certifications, which are transferable across many green occupations, such as OSHA-10. Thirteen of the 44 nonprofit and school-based programs and all union apprenticeships offer OSHA-10 courses, a basic 10-hour program covering the common safety and health hazards on work sites, which culminates in a certification exam. This is a fundamental certification for any trade-adjacent work, as it demonstrates an individual's safety knowledge and is required under many federal, state, and local contracts. Further, it saves employers from having to pay for this certification for their entry-level workers. Two nonprofit programs and all union programs also offer the more comprehensive OSHA-30 (SHINE and Apex Clean Energy Institute). See Appendix B for the complete list of locally offered certifications. Appendix C contains examples of other widely used industry-recognized certifications.

Certificate training programs are typically offered directly by the organization that administers the certification (e.g., BE+, Building Operator Certification trainings), although some use a train-the-trainer model (e.g., Envirocert) so individuals can be trained by certified trainers. For example, Envirocert is offered by Codman Square Neighborhood Development Corporation (CSNDC). To further support trainees in receiving these certifications, training programs can also become accredited training providers or have their curricula accredited by third parties, demonstrating that their training meets industry standards.

4. EMPLOYER PARTNERSHIPS

Employer partnerships are essential to workforce training programs. But some partnerships are more valuable than others.

Union Programs

Union apprenticeships are sponsored jointly by a union and a group of employers (Table 7.4). Programs are directed by a Joint Apprenticeship and Training Committee (JATC) composed of an equal number of management and union representatives. For their on-the-job training, apprentices work on those employers' contractor projects alongside journey-level trades people (Table 7.4)

Perhaps more important, employer partners make a big difference in ensuring graduates get jobs in their field. Apprentices may work on projects for one or more employers during training; some are hired onto core crews or for subsequent projects for the same employer. In the unionized building trades, assignment to projects is governed by the union contract. The contract specifies whether apprentices and journey people will be able to solicit their own work, or whether union business agents will assign them to projects according to negotiated policies and procedures.

Nonprofit and school-based programs

We found a range from minimally to highly involved employer partners among the nonprofit and school-based programs. Employer input in curriculum development helps training providers understand what the industry wants in its employees, enabling programs to adjust training to meet current labor demands and industry standards. In other programs, employers play an active role in designing training curriculum. For instance, A Better City, PowerCorp Boston (PCB), and Roxbury Community College collaborated with employers to develop a Commercial Building Operator program. PCB participants spent two days at the RCC Center for Smart Building Technology and another two days at employer facilities for on-the-job exposure to topics covered in the classroom.

Most of the nonprofit and school-based programs we surveyed partner with several employers, but few of those employers commit to hiring graduates, highlighting that partnership alone can be largely symbolic. Some organizations, including Browning the Green Space (BGS) and the Alliance for Climate Transition (formerly Northeast Clean Energy Council), are closely involved with a wide range of employers. That enables those programs to point their graduates to several different jobs, freeing them from relying only on one employer that may or may not be hiring. Apex Clean Energy Institute had difficulties placing its graduates when its employer-partner Nexamp, a community solar company, opened a second headquarters in Chicago and reduced hiring in Boston. In response, Apex began collaborating with smaller solar and clean energy businesses in Boston, finding new job prospects for their graduates.

Table 7.4 – Union program and employer partners

UNION PROGRAM	EMPLOYER PARTNERS
Greater Boston Joint Apprentice Training Center for the Electrical Contracting Industry	IBEW 103 has over 250 signatory contractors. More than 80 contractors are members of NECA (National Electrical Contractors Association) Greater Boston Chapter.
North Atlantic States Carpenters Training Fund	North Atlantic States Regional Council of Carpenters has over 800 signatory contractors.
Pipefitters, Refrigeration, Air Conditioning and Oil Burners Local 537 JATC	Local 537 has over 90 signatory contractors.
New England Laborers Apprenticeship Program	Massachusetts and Northern New England Laborers' District Council has over 1000 signatory contractors.
Sheet Metal Workers Local 17 JATC	Local 17 has 44 signatory contractors in the Boston area. Some contractors are part of Sheet Metal and Air Conditioning Contractors' Association (SMACNA) of Boston.
Plumbers Local 12 Training Center	Local 12 has 65 signatory contractors. Roughly 60 are part of the Greater Boston Plumbing Contractors Association.
Ironworkers Local 7 Apprenticeship Program	Local 7 has 132 signatory contractors.
Finishing Trades Institute New England	DC35 has 148 signatory contractors covering bridge and tank contractors, glaziers and glassworkers, and painting and drywall. Some are part of the PFEANE and GEANE (Painting and Finishing Employers' Association of New England/Glass Employers' Association of New England).
Operating Engineers Local 4 Training Center	No data collected
Roofers Local 33 Joint Apprentice and Training Program	Local 33 has over 20 signatory contractors.
Heat and Frost Insulators Local 6 JATC	Local 6 has 24 signatory contractors. Some are part of the ICANE (Insulation Contractors Association of New England).
Bricklayers and Allied Craftworkers Local 3	No data collected
Electric Power Utility Technology (EPUT) (UWUA/Eversource/Bunker Hill CC)	Eversource
Plasterers and Cement Masons Local 534 JATC	Local 534 has 46 signatory contractors.
Carmen's Union/MBTA Rail Vehicle Maintenance Technician Training Program	MBTA
Boilermakers Northeast Area Apprenticeship Program at Local 29	No data collected

Source: Interviews with apprenticeship personnel.

5. EMPLOYABILITY SKILLS

Many of the programs offer some employability skills (often called "soft" skills). However, few offer a comprehensive mix that some trainees need. That is primarily because these trainings and services are expensive, often too much for the program's limited budget. Further, most providers cannot offer a complete set of support programs themselves and can have difficulty coordinating with any outside services with whom they have contracted. Unfortunately, that lack seriously hurts trainees' job prospects. Employers are reluctant to hire these programs' trainees because, lacking employability skills, they do not last on the job. Employers we interviewed said that these skills are as, if not more, important as having basic technical skills or sustainability knowledge. They want candidates who arrive on time, are reliable, and can work in a team. One employer told us that from a pool of hundreds of resumes, half answer phone interviews, half of those show up for group interviews and pass background checks, less than ten show up for the first day of work, and only half of those remain as long-term employees. Too often, they told us, candidates from many training programs don't have the ability to stay in a job.

6. COMPREHENSIVE SERVICES

For trainees with multiple barriers to employment, comprehensive or "wraparound" services are fundamental to their success in training programs. These services may include support for transportation, childcare, and food; connection to mental health or substance abuse services; case management; and peer support.

Twenty four of 44 nonprofit and school-based programs provide support or wraparound services, either by offering some themselves, especially if the program administrators already offer social services, or by referring trainees to third-party organizations.

As part of the Climate-Critical Workforce Training, Equipment, and Infrastructure Grants, MassCEC offers funding to expand training programs and build employer partnerships and develop wraparound services to help trainees tackle barriers to entry and advancement. Some union apprenticeship directors reported that apprentices can access substance use and addiction support programs, along with other services covered by health insurance. Directors reported working with apprentices ad-hoc to resolve problems with transportation, housing, childcare and other challenges. Union apprenticeship programs also refer parents to the Care That Works pilot in Boston, which connects apprentices and Building Pathways trainees (as well as other Boston workers) with unionized childcare that matches the building trades' non-standard hours. Affinity groups within unions, such as women's committees, may also help with support and problem-solving.

For people reentering society after incarceration, a designated case manager may offer mental health counseling and conflict resolution services. Providing both of these services during and after training has improved graduation and job retention rates. While some programs provide some of these services in-house, most refer trainees to third-party organizations or give participants needs-based grants. Some programs, like the Asian American Civic Association's Building Energy Efficiency Maintenance Skills (BEEMS) and Weatherization Technician programs, continue to provide these services and to follow up with their graduates monthly for a year post-graduation.

Providing mental health counseling and conflict resolution services during and after training has improved graduation and job retention rates.

Matching Applicant Interest to Occupational Demands

Programs are most successful when applicants have a clear idea of program demands and benefits. Programs that ensure that applicants fully understand an occupation are likely to retain and graduate more of their trainees. For occupations that may be less attractive because of working conditions, such as weatherization technician, trainees are more likely to stay interested if the program has outlined a clear career path up front. For example, X-Cel Conservation Corps (XCC) uses a thorough initial application form with videos and job-specific questions to provide potential trainees with information about the responsibilities of a wastewater operator and clarify the certifications they will receive as part of the training. This also serves as a vetting process for potential trainees by gauging their interest, leading to high graduation rates. XCC graduates can go directly into wastewater operator positions after graduation, as well as proven advancement opportunities through additional training or work experience within 6-12 months.

Sometimes people interested in a particular line of work can learn about it from pre-apprenticeship programs. For example, Building Pathways familiarizes students with union trades apprenticeships and helps them build skills that make it easier to enter and succeed in apprenticeship programs. Likewise, feeder programs in land care, ecological restoration, or urban forestry prepare individuals for those careers. Examples include PowerCorps 10-month green jobs training program, and the three-year Openlands Arborist Registered Apprenticeship Program in Chicago.

Programs have numerous opportunities to gather information about an applicant's actual level of interest and commitment before accepting someone into the program. Between application and acceptance, an applicant usually has a lot of communication with that program, including phone or in-person interviews, resume and application reviews, and reference checks. This vetting process gives the program opportunities to assess whether the applicant will be a good fit, to ensure that participants understand the level of commitment required for success, and to determine whether the applicant is genuinely interested in training and employment.

Summary

There are six criteria of effective practice in workforce training that have been identified by researchers: experiential learning, paid training, stackable credentials, employer partnerships, employability skills, and comprehensive services. All union apprenticeships meet most of the first five criteria and provide some—but not a full range—of comprehensive services. Nearly all nonprofit and school-based programs provide stackable credentials (93%). The majority use experiential learning (82%) and employer partnerships (70%), and teach employability skills (75%). Less than half provide paid training (45%) or comprehensive services (47%). Paid training and comprehensive services are among the most important criteria in expanding economic opportunities for historically marginalized communities, as they enable people with few economic resources and other barriers to participation to take part in training. Boston's Office of Workforce Development could use its training dollars to provide pay and comprehensive services to effective programs.

8.

WHAT IS BLOCKING TRAINEES' SUCCESS?

What's Working

- Paid pathways like union apprenticeships boost completion and placement.
- Some programs offer stipends, T-passes, mobile training, or driver's ed.
- Integrated models let participants earn a GED/HS diploma while training.

What's Not Working

- Over half of programs offer no financial support.
- Transportation gaps, early hours, and unaffordable childcare limit access.
- Most training is English-only; HS diploma requirements exclude many.
- Low awareness of green careers across communities.

Promising Models

- Paid, employer-connected pathways.
- Wraparound support and alumni networks.
- Train-the-trainer models.
- Reentry-focused green training programs.

Introduction

We now turn to the question of whether people from historically marginalized communities are able to access training opportunities leading to economic security and upward mobility? The short answer is–not as well as they might. To do so, more efforts to eliminate barriers to success must be in place. To identify barriers, we interviewed representatives of Boston community colleges, community-based training providers, union-based apprenticeships, employers, and community organizations, as well as other workforce development experts.

We have found two main areas of challenge. First, many people are unable to access training programs due to structural, institutional and practical barriers. People who already face economic or other forms of marginalization will face the steepest barriers to entering programs, including the ability to forgo wages during unpaid training, criminal record checks; lack of reliable transportation; certification and exam costs; language barriers; and lack of access to information about available opportunities. Historical exclusion of women and people of color from some occupations, including the building trades, creates ongoing barriers to entry for potential workers, especially women who may anticipate gender-based harassment on the job. Barriers to finding and affording childcare, particularly at early hours needed for trades occupations, are most likely to affect women workers, who are often responsible for children even in two-parent families. These barriers must be addressed to ensure equitable access to programs.

Another set of barriers are those that make it difficult for trainees to complete a program and/or obtain employment. These include a lack of ongoing financial support and a denser web of support services. Some training programs, particularly community-based programs, struggle to meet the needs of trainees, partly because they have difficulties hiring knowledgeable faculty, and partly because employers are not willing to pay interns, give trainees opportunities to learn on the job, or commit to hiring program graduates—even when those employers are supporting the training programs. We take a closer look in this section.

METHODS

To understand barriers to accessing and succeeding in training programs, we interviewed 26 training providers that administered 43 of the Boston-serving nonprofit and school-based programs, and 14 training directors at union apprenticeship programs. To gather additional information on interest in and barriers to participation in apprenticeship programs, we used interviews with leaders of membership-based community organizations in Boston, most of which represent residents in majority disadvantaged neighborhoods.

Barriers to accessing training

Many Bostonians cannot afford to enter unpaid training. As noted in the previous section, paid training is essential to increasing program completion and job placement for historically underrepresented groups. When job seekers are struggling to survive—lacking funds, housing, mental health support, child care, or transportation—it can be hard for them to afford training in new job skills for no pay, to develop the employability skills and habits needed to obtain and keep a job.

There is room for improvement on this front. 55% of nonprofit and school-based offerings do not provide any financial support. The rest of the nonprofit programs provide stipends that are equivalent to the minimum wage. School-based programs (both high school and community college) are typically unpaid as training is part of a degree program. The unionized building trades offer paid training and well-paid careers, which likely explains the high demand to join these apprenticeship programs. Trade unions negotiate wages for apprentices during the collective bargaining process. Starting apprentice wages for Boston-area programs range from $24.33 to $37.19 per hour, which make these positions very attractive when compared to the current state minimum wage of $15/hour.

However, outside the unionized building trades, 50% of Boston's training providers operate as 501(c)(3) organizations. Whether or not they can pay trainees often depends on the terms of grants from private foundations or government grants and funds. One training provider mentioned that they would rather train fewer people than provide unpaid training. It should be noted that MassCEC programs (Technical Trades Work and Learning and Clean Energy Internship Program) provide funding that can be used for wages or stipends.

At a Glance: Barriers to Trainee Success

Access barriers: Limited financial support, transportation and childcare challenges, language and credential screens, and uneven access to information about opportunities.

Completion and placement barriers: Insufficient wraparound supports, inconsistent employer engagement, instructor shortages, CORI/licensing hurdles, and incomplete data tracking.

QUICK FACTS

Unpaid training:

55% of nonprofit and school programs offer no financial support.

What pays draws interest:

Union apprenticeships start at **$24.33–$37.19/hr**; appx **7,500 applicants** compete for **1,100 slots** (appx. 19 % acceptance).

Childcare cost cliff:

Infant care appx **$24K per year** (appx. 42 % of a first-year apprentice's $57.6K income).

Getting there:

10 of 44 programs report that jobs require driving; license or fine issues can block entry.

Language access:

36% of residents speak a language other than English at home; **15%** have language access needs; **43 of 44** programs run English-only

HS diploma screen:

Roughly **20 of 44** programs require a HS diploma or GED; BPS graduation rate is **80.5%** (less for low-income, Black, and Latine students).

CORI reality check:

Many employers screen out returning citizens; union apprenticeships do not require CORI checks although many are unaware of this.

Employer engagement:

Frequent curriculum input and classroom engagement, but few paid internships or direct hires.

Instructor shortages:

Nonprofit and school based programs struggle to recruit qualified instructors; union programs generally don't.

WHY IT MATTERS

Without paid pathways, wraparound supports, and committed employer partners, Boston's green training system will struggle to deliver equitable entry, completion, and advancement into good high quality jobs.

Many Bostonians lack transportation to access training and job sites

Union, nonprofit and school-based program directors noted that lack of transportation can be a barrier to job training and placement for some trainees. Low-income applicants without drivers' licenses or personal vehicles can't travel to training sites unless both the applicants and the sites are near public transportation. For some building trades programs, training may include work on multiple job sites over the course of an apprenticeship, some of which may be located far from Boston. That can be equally true for job placement after completing a program; jobs that are not near public transportation may be out of reach. Further, individuals seeking training may have unpaid parking tickets or other tickets that must be paid before they can renew a drivers' license; this cost may stop them from being able to join a training program.

Some programs, like PowerCorpsBOS, provide a monthly T pass. If training sites cannot be reached by public transit, trainees must have access to a vehicle. To overcome this challenge, some training programs have worked with transportation companies to arrange transportation or have created mobile training centers.

While many job training are within city limits, the internship or job site components of the training may be inaccessible by public transit. For instance, most water and wastewater treatment plants are located outside the city. To address this problem, programs like X-Cel Conservation Corps (XCC) scheduled its driver's training to start after participants are recruited but before their 10-week program begins so that participants are close to getting a license by the time their cohort begins the program. Even if trainees have a driver's license, many don't have a car. Ten of 44 nonprofit and school-based programs said that the jobs available for their graduates require driving to places that are not public transit accessible. Some nonprofit and school-based programs we interviewed help participants search for used vehicles or use additional grant funding to help trainees secure a vehicle (Appendix B in supplemental materials).

Many would-be trainees need affordable and convenient childcare

Many parents cannot join training programs unless they have affordable and reliable childcare. That's especially true for women. All the training programs in this study include significantly fewer women than men. Addressing the childcare barrier is essential to creating equitable access to good green jobs.

Massachusetts is one of the most expensive states in the nation for childcare. In 2023, the average annual cost of full-time center-based child care was $24,005 for an infant and $22,463 for a toddler. The average cost of full-time childcare in a family childcare setting was $15,129 for an infant and $14,074 for a toddler.

The high cost of childcare means it is unaffordable for many trainees who need it. Addressing the childcare barrier is essential to creating equitable access to good green jobs.

The high cost of childcare means it is unaffordable for many trainees who need it. Childcare is often considered "affordable" if it does not exceed 7% of a household's income, according to a 2023 benchmark from the Department of Health and Human Services. Since average first-year apprenticeship wages are $57,593.60 annually, costs of childcare for one infant would cost 42% of annual income in a center setting and 26% in family childcare setting, far above the affordability threshold.

Further, in some cases, these parents have been receiving childcare vouchers from the state. However, if their wages increase on entering or advancing in a training program, they may lose voucher eligibility. This can extend financial difficulties even as a parent is moving ahead in their training and career.

Finally, not all good green jobs begin and end within the window when licensed childcare providers are normally open. Typically, a Massachusetts licensed childcare provider opens on weekdays around 6:00-7:00 am and closes around 5:00-6:30 pm. That's a problem for workers in the building trades, who typically must be at work by 5:30-6:30 am. Childcare providers, meanwhile, may have little incentive to provide care for families with nontraditional hours and schedules, especially if they can easily fill standard hour slots. To address this barrier, Boston supported the Care That Works pilot program, which paired trainees and workers needing early morning childcare with family childcare provider members of SEIU Local 509. Initial recommendations based on pilot outcomes are included in the recommendations of this report.

It can be hard to find childcare close to home. Many neighborhoods in Boston do not have sufficient licensed childcare seats to meet local demand. As a 2025 analysis by the City of Boston's Office of Early Childhood explains, "If all Boston resident children ages 0 to 2 needed to be enrolled in a formal setting, 76% would not have a seat." Gaps exist across all city neighborhoods, although some neighborhoods had a surplus of seats for certain age groups.

Some trainees face language barriers

All but one training program, Green Jobs Academy, is offered only in English, creating a significant barrier for Bostonians who do not speak English. According to City of Boston demographic data, more than 36% of Boston residents speak a language other than English at home. More than 15% have language access needs in speaking, reading, writing or understanding English.

Residential construction employers rely on a workforce that includes a substantial number of immigrants. While we were unable to find data on languages spoken by residential construction workers, language instruction for this group may be instrumental in preparing for entry into union membership and a pathway to a good career.

Limited Access for Bostonians without a High School Degree or GED

Many building trades apprenticeship programs require a high school diploma or the equivalent—which keeps out some applicants. This requirement disproportionately impacts people who are low income and Black and Latine. As of 2023, the overall four-year cohort graduation rate for Boston Public Schools was 80.5 percent, with 10.9% of non-graduates still in school and another 8.3% having dropped out. High school graduation rates are lower among students from families that are low income (77.8%), Black (78.2%), Hispanic/Latino (77.5%) and Native American/Alaska Native (40%), as well as among students in foster care (42.7%) and homeless students (67.2%). Lower high school graduation rates among these demographic groups combined with a requirement for a high school degree to be trained or hired results in racial and class inequalities in access to good green jobs.

High school diploma requirements in building trades apprenticeship programs disproportionately impact low-income, Black, and Latine applicants, resulting in racial and class inequalities in access to good green jobs.

Slightly less than half (20 of the 44) nonprofit and school-based workforce training programs we surveyed require high school diplomas or equivalency. However, we did find two training providers—YouthBuild Boston (YBB) and X-Cel Education—that support their participants in obtaining their high school diploma or GED alongside job skills training. The need for a high school diploma for many of these training highlights the importance of efforts to increase graduation rates.

Many potential trainees lack knowledge of the building trades or believe they would not be welcomed

Many people lack knowledge of the various opportunities in the building trades, as do many community organizations that advise these potential applicants. Even those familiar with one or two programs sometimes lacked information about the rest. Even when they know about trade union training programs, some Bostonians may believe that they are not open to women and people of color. Often, these potential applicants do not know about trade unions' recent efforts to become more inclusive.

Many potential applicants are not aware of green careers

The National Clean Energy Workforce Alliance cites lack of awareness of green energy careers as a barrier to industry growth. The Barr Foundation's 2023 report on increasing access to clean energy jobs calls for introducing high school students, returning citizens, and historically underserved groups to these options more consistently. They suggest that high schools, community colleges, and nonprofit organizations that offer programs in green occupations collaborate so that career pathways are consistently defined and to coordinate strategies for building awareness of them.

To build awareness of clean energy careers, Governor Healey's administration created a Clean Energy Innovation Career Pathway program in which high school students receive curriculum on career opportunities, work-based learning opportunities, and certifications in the renewable energy sector (see Appendix B). Funded through MassCEC, the Department of Elementary and Secondary Education developed pilot programs in five schools—Carver Middle High School, Hadley-Hopkins Academy, Norwood High School, Reading Memorial High School, and Revere-CityLab Innovation School—during the 2024-2025 school year. The goal was to develop modular curricula with hands-on learning components that was expanded to about 125 students during the 2025-2026 school year. Other school efforts are underway. For example, several stakeholders, including City of Boston staff, created an informal Clean Energy Task Force at Madison Park Technical Vocational High School to identify how a clean energy focus can be incorporated into existing school programs.

Career awareness programs currently serving Boston residents include Mass Save's Green Step program, University of Massachusetts Boston's Summer Program in Urban Planning, and Boston Green Academy Horace Mann Charter School, where 25% of students are in the Chapter 74 Environmental Science Career and Technical Education (CTE) program.

Barriers to completing training and accessing employment

Many trainees require comprehensive support to succeed in training programs

We have discussed at length the need for comprehensive services for trainees to successfully complete programs and find jobs. While MassCEC includes comprehensive services in the green training programs it supports, few other funders provide sufficient resources for a comprehensive set of services, although some private foundations offer training providers the funds to add or contract out these services.

Obtaining a Commercial Driver's License can expand employment options, but costs, fees, and other difficulties may get in the way

Commercial driver's licenses (CDL) are required to drive commercial motor vehicles that weigh more than. 10,000 pounds; vehicles that transport 16 or more persons; or any vehicles transporting hazardous materials. Trainees who seek any jobs involving these tasks must complete training with a registered provider, obtain a commercial learner's permit, and complete their CDL skills test or the Hazmat endorsement knowledge test for transporting hazardous materials. These trainings can cost

more than $2,000, and taking the test costs $30. There is also an additional $75 fee added to the Hazmat endorsement to a CDL, and there are more costs associated with a Transportation Security Administration background check.

A CDL is needed for driving bucket trucks and chip trucks used by landscape and tree-service companies and tree crews. Roots to Re-entry (R2R) incorporates a free, 3-week CDL training for older returning citizens (about 40 years) who have limited physical capacity.

Trainees need support in the transition to full-time work

In nonprofit and school-based programs, training providers described how some graduates struggle with the transition from training to employment. They report that many graduates are taking full-time jobs for the first time and struggle to adjust to expectations like showing up on time and not missing work. Some have problems with responding to supervisors, getting along with colleagues, or anger management. Graduates need ongoing support as they adjust to holding a job.

Providers we interviewed typically follow graduates from a minimum of six months to the rest of their professional career. Services ranged from regular follow-up to discuss job concerns to annual alumni and networking events. XCC, for instance, provides lifetime support for its graduates. It hosts biannual alumni events to maintain a strong graduate network and help them find better-paying positions. In union programs, training is full-time, or may exceed 40 hours when training takes place in the evening. By the time apprentices become journey-level workers they are fully adjusted to holding a full-time job.

Trainees with court or prison records have more difficulty finding work

Nationally, about 60% of formerly incarcerated people remain unemployed for years after their release. Research shows that having a job dramatically reduces the likelihood of recidivism. So why are employment rates so low? Partly because many states ban formerly incarcerated people from participating in numerous occupations that require licenses or certifications. Even when that's not so, some employers simply won't hire anyone with court involvement or incarceration in their history, and in Massachusetts, are permitted by law to require a criminal offender record information (CORI) check.

Of the 41 nonprofit and school-based Boston-serving education and training programs we reviewed, 13 mentioned that many employers screen out any former offenders, making it harder for this group to find jobs. Two programs run a CORI check and will not accept applicants with histories of incarceration or court involvement because the employers with whom they work will not hire anyone who checks the box. Most Boston-based programs require criminal background checks for applicants when employers in the relevant occupation conduct them and screen out reentering citizens as job candidates. This

Nationally, about 60% of formerly incarcerated people remain unemployed for years after their release.

presents a barrier to training, employment, and stability for the 1,707 returning citizens in Massachusetts each year.

We note, however, that Massachusetts has implemented laws to support reintegration such as the "ban the box" law that mostly prohibits employers from asking for information on criminal history on initial job applications. The law allows only a five-year look back for a criminal record, with some exceptions.

Trade union apprenticeships do not require CORI checks. Although a history of incarceration may slow or complicate state licensing for some trades, apprenticeship programs report supporting their members to overcome these barriers. However, we found that community partners did not realize incarceration histories do not necessarily prevent the individuals they support from entering trades programs. As a result, those they serve end up avoiding trades apprenticeship programs due to the mistaken belief that a criminal record disqualifies them.

While employers usually decide whether to hire reentering citizens, sometimes trade unions forge agreements on hiring procedures that prevent employers from requiring CORI checks. However, CORI requirements on specific job sites (notably public schools) may prevent unions from placing particular apprentices there.

Other training providers can help returning citizens by working with employers to find options. For example, X-Cel Conservation Corps (see Appendix B) offers training for the MA Grade 3 Municipal Wastewater Operator's License for entering employment in municipal wastewater plants. People with CORI records or court involvement are not eligible to work at these plants, but they *are* eligible to work at industrial waste plants. Therefore, XCC offers an optional Grade 5 certification course that requires an additional 3-4 weeks of classes meeting weekly. Several green training programs in Boston focus on returning citizens, including PowerCorps Boston, Boston Civilian Climate Corps, Mass Save Clean Energy Pathways, All In Energy Auditor Training, CSNDC, BEEMS, Building Trades Exploration, Apex Clean Energy Institute, and X-Cel Conservation Corps. Many union apprenticeship programs had in the past accepted apprentices from the Operation Exit program run by the City of Boston's Department of Returning Citizens, but it appears the program is no longer active.

In addition, our training profiles include two programs that start in prison:

- **Roots to Reentry in Philadelphia focuses on landscaping.** Philadelphia established R2R in 2010. By starting training in prison, followed by six weeks of on-the-job training with employers, 90% of program graduates are employed within a year of graduation. The recidivism rate is 30%, less than half the average rate of 65% for the entire population of Philadelphia ex-offenders.
- **Apex Clean Energy Institute focuses on solar energy.** In Fall 2024, the Apex Clean Energy Institute partnered with the Massachusetts Department of Correction (MADOC) and the Suffolk County House of Correction (SCHOC) to pilot the classroom learning section of the program while its five participants are still in correctional facilities, before continuing the hands-on training with Community Work Services.

Other notable programs that start in prison or focus on reentering citizens include The Fortune Society's EPA-funded training in environmental jobs, including green infrastructure and the National Institute of Corrections' Green Corrections Initiative.

Massachusetts has general support programs to help reentering citizens obtain training and jobs. The Educational Justice Institute (TEJI), a nonprofit, manages the Massachusetts Prison Education Consortium, which establishes and maintains an education pipeline starting while people are in prison, and offers academic and career advising. Members of the consortium include: Massachusetts Departments of Correction; Probation Service; the Parole Board; Office of Community Corrections; and others. Further, the School of Reentry provides people incarcerated in minimum security facilities a 12–18-month residential program offering education, personal counseling, and career and technical education and training. It was established in 2016 by the Executive Office of Public Safety and Security.

All Mass Save funded jobs require a CORI check, which will remain a barrier to returning citizens or any individual with a criminal record. This includes much of the weatherization, renewable energy, and other energy efficiency work across the city. None of the Boston-serving training providers we interviewed mentioned working with organizations that seal or clear these records.

Employability skills deficits can limit job market success

Training graduates must have relational and employability skills in addition to the technical skills learned in training. Some Boston-area community organizations already offer these skills. For instance, Browning the Green Space (BGS) is a nonprofit that connects communities of color with green jobs. Among the programs it works with is the Boston Civilian Climate Corps, a 16-week paid training program in building electrification for formerly court involved and previously incarcerated individuals. It connects these trainees with workforce development partners who can provide job placement assistance, such as the Codman Square Neighborhood Development Corporation (CSNDC).

One of the most successful training programs we examined is the Renewing Sovereignty Project in Chicago which trains people with various obstacles to employment to work in the solar sector. Renewing Sovereignty only accepts trainees recommended by community organizations with which applicants have completed a year of preparatory programming that covers conflict resolution, violence prevention, communication, financial planning, and related topics. Renewing Sovereignty's graduates have a high success rate in finding and keeping good jobs. Boston residents with barriers to employment may need this level of pre-program preparation as well.

Training programs in our profile mentioned that supporting organizations like Browning the Green Space (BGS) and A Better City have helped the programs work more closely with employers and other partners to ensure a good fit between program graduates and possible jobs. All in Energy's Energy Auditor training, for instance, tried to place graduates with employers that either have a commitment to diversity in hiring and equity in treatment of employees. In some cases, they seek employers or a high level of multilingual staff—*or* that becomes a coalition member of Browning the Green Space. Once an employer is a member, staff support them with bias training, transparent and fair hiring and compensation practices, retention and career advancement of diverse employees, and an annual evaluation to track progress towards its achieving these goals.

Some employers are not as engaged in these programs as would be useful

As noted earlier, some employers reported that they did not hire from these training programs because the graduates often do not have "good work habits" and relational skills. While many employers review curriculum, give talks, or help with mock interviews, few provide internships or commit to hiring graduates. Only the Asian American Civic Association programs have a job placement guarantee from their employer partners; an employment specialist works with all participants. Although Power Corps Boston does not have employment commitments from employer partners, many employers offer positions to graduates from its Building Operations track. That's because its six-month internship component lets employers become familiar with the trainees and their work habits.

In our employer survey and interviews, several employers mentioned that they do not consider graduates from a number of green training programs to be "work ready." One potential solution to address this is to ensure employers understand and are committed to the goals of the program and have the opportunity to give feedback on curriculum and other elements. For example, DC's Water and Sewer Authority (DC Water) hosts information sessions and surveys contractors to ensure that their training programs remain relevant. As a result, most contractors and employers use DC WaterWorks and DC Green Infrastructure training as their first recruitment source.

Some training programs need more instructors

Some nonprofit and school-based training programs cannot find enough instructors, particularly for advanced classes focusing on the latest technologies. For example, Madison Park Vocational Technical High School is restarting its HVAC program which had been put on hold because it had been unable to recruit faculty. Several programs told us that people earn higher salaries working in the field as employees than they can working as instructors. In contrast, union apprenticeship programs did not report any shortage of faculty, likely due to the fact that they offer higher wages and benefit packages and have a pool of members from which to draw potential instructors.

Two programs, CSNDC and GJA, have implemented train-the-trainer programs to address faculty shortages for industry-specific training and multilingual training where necessary. Other programs have found innovative strategies to overcome the trainer

shortage as well. For example, XCC hires program graduates who performed well in class and are interested in teaching. Currently, more than 80% of their training staff graduated from the program. This approach results in a higher share of instructors and staff who are people of color and share participants' life experiences. Further, it offers program graduates with open court cases or other employment obstacles a pathway to employment using their newly acquired skills. Finally, this approach also creates a strong alumni network. XCC has successfully drawn on that network, bringing in graduates who are fully employed in the water/wastewater industry to teach additional courses as needed.

Inadequate record keeping

Many community-based training providers do not maintain complete data on trainee demographics, cohort sizes, completion rates, employment, and job retention. The reasons are twofold. First, it is not always required by funders. Second, they do not have enough staff to collect data.

Conclusion

Many green training programs are working with people who need intensive support to complete even short-term training. As we'll discuss in our recommendations, there are a variety of ways to offer these comprehensive services that are essential to improving program completion and placement rates. The added cost is worth it if the investment puts individuals on a path to employment and career advancement in good jobs. Still, programs face other barriers to delivering quality programs that must be addressed separately.

9.

RECOMMENDATIONS

Overview

Boston already has most of the trained labor force that will be needed to achieve CAP goals. An overarching goal is to achieve a *just* transition to a clean economy that, brings previously excluded groups into full employment and engagement. To achieve the Boston CAP goals, the City of Boston can advance policies and programs in three key areas.

First, the City can work to remove barriers preventing many Bostonians from accessing training opportunities that could lead to good green jobs. While some barriers are difficult to address at the City level, Boston can reduce them by:

- Continuing and expanding ESOL instruction
- Communicating good green jobs opportunities
- Easing access to childcare

Second, the City can develop and support quality training in Boston, with measures including:

- Funding wraparound services at high-performing training programs
- Engaging employers more directly in training programs
- Developing Boston Public Schools programs that provide pathways to good green jobs

Third, the City can enhance policies and programs to increase their good jobs impact by:

- Using procurement policy to lead the way on good jobs. The City should expand the use of Project Labor Agreements to create pathways to good jobs and support union apprenticeship programs
- Enhancing and update enforcement of the Boston Residents Jobs Policy
- Driving good green jobs through engagements with employers. We provide specific recommendations covering
    - BERDO
    - Payment in lieu of taxes (PILOTs) and institutional master plan discussions with large nonprofit institutions
    - Residential construction and landscaping jobs
- Continuing to invest in clean energy projects that provide high quality jobs

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As Boston pursues these and other climate action policy changes, the City should maximize equity impacts by ensuring changes are made in consultation with residents as outlined in a “reflective proposal review questionnaire” developed by a group of the City’s environmental justice and community organizations.[37]

1 *Address barriers to accessing training programs*

The City should continue and seek to expand its English for Speakers of Other Languages program

Boston needs to support or create more training programs for non-English speakers. Offerings from Jewish Vocational Services (JVS) illustrate the elements of a comprehensive ESOL program approach:

- Hiring multilingual teachers and staff who speak the native languages of program participants to assist in communication and instruction.
- Offering ESOL programs to help participants improve their language skills for the specific job setting and for daily life.
- Providing program materials in several languages to ensure understanding.
- Employing professional interpreters for classes and individual meetings.
- Using translation apps to address communication gaps in classes and individual meetings.

All the services listed above are expensive, but the City could build them into its funding.

The City should communicate good green job training opportunities to Bostonians

Lack of knowledge of the training programs discussed in this report is a barrier to entry for many Bostonians. The City already communicates with residents via job and apprenticeship fairs, its website, and other means. The City should expand these efforts.

- Ensure all activities and information related to union apprenticeships and green job pathways emphasize racial and gender diversity

By emphasizing inclusion, schools can help encourage women and people of color to consider green trades jobs (See Appendix C for a case study of the Chicago Public Schools Multi-Project Labor Agreement to provide high school students with multiple pathways into skilled trades professions).

The City should take steps to expand childcare offerings

Because women are often responsible for the care of children in a family, childcare is an important barrier to address to advance gender equity in good green jobs. Without accessible, affordable, and high-quality childcare, workers with young children are all but barred from entering a union apprenticeship or other training program. Women, who comprise more than half of the city's population, are underrepresented in *all* the training programs we included in this report. The City has already improved access to childcare with important initiatives and investments that include zoning changes, the Great Starts enrollment platform, advancing public pre-K, supporting Family Child Care (FCC) providers and providers in training, engaging with families, and supporting the Care That Works nonstandard hour pilot. Boston can build on these efforts to deepen support for registered apprentices and other trainees who need childcare.

Address affordability crisis

- Provide cash support to apprentice parents. We recommend the City of Boston establish a grant program to support enrollees in registered apprenticeship programs to offset high childcare costs. The City should expand Inclusion of Daycare Facilities zoning to all Boston neighborhoods to capture additional revenue and should allow payments in lieu of onsite childcare creation to be used for cash support to registered apprentices.

Facilitate access to non-standard hour care

- Enable Non-Standard Hour Matching in Great Starts. We recommend the modification of the Great Starts platform to allow parents to filter by start time or end time.

Expand and stimulate supply

- Expand Pre-K hours, locations, and early morning care. The Wu Administration is already prioritizing the expansion of universal pre-K for 3- and 4-year-olds in settings including Boston Public Schools, community-based organizations, and family-based childcare programs. To further support apprentices with children eligible for these programs, we recommend the City:
  - Continue to expand the locations where pre-K is provided,
  - Expand the number of hours offered per day beyond 6.5, and incorporate early opening into pre-K settings.

- Deepen zoning changes. The Wu administration has already made important interventions to the zoning code to increase the number of day care facilities.

  In 2022, Mayor Wu issued an Executive Order that streamlined and improved existing policy on Inclusion of Daycare Facilities, which requires certain projects in 15 zoning districts (development areas) clustered in the downtown area to a) set aside a portion of floorspace for a childcare facility or b) build such facilities off-site. Mayor Wu's executive order set a standard formula for payment in lieu of direct creation of childcare facilities, with funds administered by the City and used for the creation and improvement of childcare facilities.[38]

  In 2023, the Boston Zoning Commission adopted changes to address barriers identified by the Mayor's Office of Early Childhood and Zoning reform staff, which made it easier to create childcare facilities throughout the city. The changes have enabled the creation of more home-based childcare facilities through allowing "accessory family child care homes" in all residential areas.

  We recommend the City continue use zoning reform to deepen support for good jobs training by:

  - Extending the IDF beyond the 15 downtown districts to all of Boston
  - Expand allowable uses of IDF-generated revenue for cash support for registered apprentices, stipends for non-standard hour provision, or support for RAP-sponsored care.
  - Ensure facilities that receive IDF linkage funds offer non-standard hour care

Grants to Registered Apprenticeship programs to establish childcare facilities.

- At least three of our interview subjects reported their RAP or affiliated union had considered establishing a childcare center to meet the needs of union members. Unions can fund childcare through set contributions negotiated as part of an hourly compensation package. For example, wage packages could include $0.10 per hour to fund a childcare account. The advantage of this model is that accumulated and ongoing contributions, together with investment returns, eventually create a self-sustaining fund. The disadvantage is that it takes several years to accumulate enough funds to initiate a program. To assist unions interested in funding childcare through hourly contributions, the City could provide seed money using IDF funds. Any such grant program should explicitly provide for good jobs standards for childcare workers.

Incentivize providers to expand hours and overall availability

- Stipend support to FCC providers providing non-standard hour care. We recommend the City of Boston establish a stipend program to support FCC providers and who open early to serve registered apprentices. The City should expand Inclusion of Daycare Facilities zoning to all Boston neighborhoods to capture additional revenue, and should allow payments in lieu of onsite childcare creation to be used for stipend support for FCC non-standard hour care.

  Stipend support to Informal sector providers. There are 26,000 families on the waiting list for State Childcare Financial Assistance in Massachusetts. Families who are waiting for a voucher and cannot afford FCC or center-based care rely on informal caregivers for the coverage they need. Informal care, also known as Family, friend, and neighbor (FFN) child care, is an unseen and un- or under-paid form of care that keeps our economy running by allowing many parents to enter the workforce even if they cannot access a voucher or afford formal care.

  For many families, FFN child care is the preferred arrangement. Parents often rely on FFN child care because it can promote positive racial, ethnic, and self-identities for their children.[39] Nationally, FFN is often the preferred form of child care among immigrant families, dual language learner families, and families of color.[40] Many FFN providers speak languages other than English, with 64% of FFN caregivers speaking Spanish in a recent survey.[41] FFN is an important complement to licensed child care options for parents in the building trades and other careers with non-standard hour schedules who need care before FCC and center options are generally available.[42]

  Low wages paid to informal care providers extend cycles of poverty and restrict the choice of parents who rely on FFN care. While FFN providers can currently be reimbursed with a Massachusetts voucher for families that have them, reimbursement rates are at maximum $23.06 per child per day for full-time care. There is currently an effort at the state level to increase voucher reimbursement rates for FFN.[43]

  The City of Boston can increase the availability of FFN care and ensure better pay for FFN providers by establishing a stipend program to support FFN providers who open early to serve registered apprentices.

- Adopt policies to ensure childcare jobs are good jobs. Low pay and lack of advancement in childcare jobs drive turnover and constrain supply in the industry.[44] The City can build supply by adopting policies and program to incentivize childcare jobs that:
    - Pay wages and benefits that ensure employees do not have to rely on public assistance or safety net
    - Provide access to Continuing education and career pathways
    - Partner with community based organizations for job fairs and recruitment efforts
    - Ensure employees have the ability to and are comfortable expressing concerns in the workplace
    - Follow health and safety regulations
    - Have strong whistleblower protection policies
    - Enter into labor peace agreements

2 *Improve and expand training programs*

Support trainees by offering wraparound services and by teaching the employability skills needed to succeed

Building on the City's Good Jobs Challenge grant, we recommend that the city: Ensure that city-supported training programs use an intake process to assess applicants' knowledge of and interest in an occupation and needed support services.

This intake screening would help assess:

- Awareness of the occupation and what it entails
- Work readiness (communication, teamwork, professional soft skills)
- Technical skills (basic math, reading, writing, trade-related skills)
- Need for wrap-around services (stipends, transportation, childcare, language needs)

Ideally, this intake assessment would be part of a longer process that prepares individuals to enter the workforce, much as how the Boston Private Industry Council (PIC) works with youth throughout the school year to prepare them for summer job placement. This more comprehensive assessment would include an initial interview, assessment of strengths and weaknesses, career goal setting, and coaching to ensure that the participant understands the skill requirements, working conditions, and career possibilities of the occupation for which they want to train.

- The City should pilot pre-training programs that build employability and life skills and can be scaled up throughout the workforce development ecosystem.

  One model that the City could pilot is the pre-training approach used by Chicago's Renewing Sovereignty Project (RSP). RSP manages Clean Energy Training, a 13-week intensive training program for solar sector jobs, directed at people who have been in prison, in the foster care system, or face other barriers to employment. As noted above, trainees are only accepted after they have been through a six-month to one-year program with a community-based organization that agrees to support the trainee through employment. The curriculum of the programs varies depending on which of five organizations in the Chicago Coalition for Intercommunalism (CCIC) offers it. What all these programs offer in common: a focus on critical thinking and problem-solving; life skills (e.g. conflict resolution, violence prevention, and financial planning); and social support services.

  Once individuals have completed one of these programs, the sponsoring community organization can recommend them for the Clean Energy Training program. That program, offered by the 548 Foundation, prepares trainees to earn the NABCEP PV Associate and OSHA-30 certificates, which prepares trainees for solar technician jobs. Trainees are paid $18.00 an hour for time spent in the classroom and in the field from 9:00am to 3:00pm. Among the first three cohorts of students, completion, placement, and non-recidivism rates have been over 80%. On average, their starting wages have been $25.00 per hour (See Appendix C).

- The City should expand and facilitate support for pre-apprenticeship programs that prepare underrepresented groups to enter union apprenticeship programs.

  Pre-apprenticeships give people an opportunity to explore career opportunities as well as develop needed skills and knowledge to secure entry into competitive apprenticeship programs and succeed on the job. The City supports job training programs, including preapprenticeships, through the Neighborhood Jobs Trust, which is funded by linkage fees charged to large-scale real estate developments. Current policies should be updated and streamlined to ensure that the NJT can provide longer-term, stable funding. Developers of large multi-building projects can designate a recipient of their NJT linkage fees to a particular training program that plays a valuable role in creating a pipeline of workers. However, developers can only designate linkage fees one project at a time, which needlessly increases

their paperwork if they intend to designate all linkage fees to one recipient. We recommend that Boston enable developers to designate linkage fee recipients for multiple parts of any large project. This would increase the stability of designated training programs while reducing the developer's administrative burden.

- The City should work with union, nonprofit and educational partners to develop new pre-apprenticeship and apprenticeship programs outside the trades and in green occupations. The City should fund comprehensive support services for trainees and help training providers identify effective providers.

  The cost of providing these supports varies, depending on need. One study estimates that if a full array is included, the job-training component of a program accounts for between 50-70% and support services for 30-50% of delivery cost.[45]

- The City should provide funding for training providers to support graduates with coaching and mentoring to increase job retention and advancement.

  It's one thing to land a job; it's another to keep it; and it's yet another challenge to have that job develop into a career. For individuals who have faced employment barriers in the past, it's not enough to just have the technical skills required to do the job. Trainees must learn an invisible curriculum on the job to navigate workplace culture, supervisor expectations, and co-worker interactions. A gold-star example of a Boston workforce intermediary that offers support and coaching long after the training is done is Jewish Vocational Services (JVS). The City should work with JVS to figure out the cost of adding post-employment support to city-funded training programs.

Boston's Office of Workforce Development should convene employers, training and apprenticeship providers, and intermediaries annually

Many green occupations and job roles are rapidly evolving in both technical knowledge and practical skills. This means that training programs cannot simply rely on a static curriculum or a standardized skill set to adequately prepare participants for what employers need. Further, attracting and retaining talent is costly, and employers want to ensure that training program graduates have the skills and job readiness that will set them up for a successful career.

That is why the most effective training programs work closely with employer partners that help develop and revise curriculum, offer internships, and commit to hiring graduates. These employers also work with intermediaries, such as Browning the Green Space, to foster an inclusive environment and sustain long-term job placement commitments.

Building off the Learning Lab and the Climate and Coastal Resilience Workforce Alliance, the City could support annual convenings of employers/contractors, training providers, and intermediaries within sectors (e.g., electrification, energy efficiency), to ensure that training curriculum, relevant certifications, and applicant criteria are better aligned with labor demand.

Require training providers to report demographic and job placement data as a condition for funding.

Without consistent data on training program completion, job placement, and job retention, it's difficult to assess the adequacy of workforce preparation for the green economy. And without demographic data on participants, it's impossible to determine which groups are well-served or underserved. The City should require all city-funded programs to follow a standardized format for collecting data as a condition for continued funding. Data collected should include: demographics; program completion, support services provided, job placement and retention; and place of employment and position. The City could also connect to efforts that expand the use of longitudinal data systems in Massachusetts. Some states, such as New Jersey and California, require programs that receive state or federal funding to provide participation and completion data to a longitudinal data system. These systems include detailed information on additional program outcomes, like skills acquired, job placement, and job retention. The City should encourage the state to require training programs to maintain such data such as through efforts undertaken by the Friends of Longitudinal Data Systems (FoLDS), a new group dedicated to advancing cutting-edge social policy research in Massachusetts. A collection of education advocates, researchers, philanthropic funders, and policymakers, FoLDS elevates longitudinal data research for evidence-based policymaking and advocates for long-term improvements in the state's data infrastructure.[46]

The City could also consider building a centralized data system that tracks enrollment, completion and placement outcomes for every workforce development program it funds and publish these metrics in a public, interactive dashboard. A dashboard that disaggregated results by race, gender and neighborhood would help surface equity gaps, strengthen accountability and transparency, and help inform workforce development funding and program decisions.

Help training providers recruit more instructors.

Some of the nonprofit and school-based programs told us that they face frequent faculty shortages, a problem that research finds is common.[47] Several program directors mentioned that they could train more cohorts if they could recruit more knowledgeable faculty. We found that this is particularly true for programs in Building Automation Systems, HVAC, and battery storage. The main reasons are that instructors are paid less than they would make on the job and that people in the occupations work full time and have little time for teaching. The City could offer increased pay for instructors and use the convenings discussed above to ask employers to work in partnership with training programs by offering their employees as part-time instructors.

Increase support for formerly incarcerated residents

People recently returned from incarceration face discrimination and barriers to employment. To be successful, training programs must focus on their specific needs.

Fund wraparound services for green training programs serving returning residents.

Eleven of the nonprofit and school-based training programs we profiled serve formerly incarcerated residents. There are several ways the City can support reentering residents and currently incarcerated people. Programs such as Chicago's Returning Sovereignty Project offer work and life-related skills such as critical thinking, problem-solving, maintaining relationships, conflict resolution, violence prevention, and financial planning along with social support services.

Develop an in-prison program for at least one entry-level green occupation that leads to a career pathway.

Green training programs that begin in prison can boost inmates' chances of finding jobs and careers after prison, reducing recidivism, and easing their return to the community (see profile of Philadelphia's Roots to Reentry program for nonviolent offenders).The City could develop a new program or support an existing one such as the Apex Clean Energy Institute (see profile).

Reinvigorate and expand the Operation Exit (OE) program.

Operation Exit (OE) was established by the City of Boston Office of Public Safety in 2014 to prepare reentering residents to enter building trades apprenticeships. From 2014 to 2019, OE ran six cycles of a three-and-a-half week training program that included career readiness and job training, peer-to-peer mentorship, and a combination of classroom and hands-on learning. Of 105 participants, 74% were Black and 16% Latine. OE had impressive outcomes: 87% of graduates were placed into a union apprenticeship or livable-wage job. The average hourly wage of OE graduates after one year of work was $24.33; 100% had access to health and retirement benefits. Apprenticeship directors reported good experiences with apprentices from OE and expressed interest in continuing to work with the program. However, many of those we interviewed believed the program had ended or was inactive. The latest data on the City website are from 2019.[48] Reviving this program could serve several important City goals on employing residents with barriers to employment.

Support an entrepreneurship program for formerly incarcerated residents.

Numerous programs throughout the country support returning residents in starting their own businesses, under such names as Defy Ventures, Rising Tide Capital, Inmates to Entrepreneurs, and The RESET program. These programs could be reviewed and discussed with local stakeholders to consider replicating in Boston, focusing on the clean energy sector.

Ensure training programs are aware of resources for record-clearing.

The City can also connect training programs to organizations that can help clear records, such as Greater Boston Legal Services and ExpungeMA; in our interviews, training providers did not seem aware of these programs.

Develop green careers training and pathways within Boston Public Schools

Several Boston Public School programs prepare students for green occupations (Table 9.1). Other Boston schools have some formal programs and informal practices that connect students with green jobs union apprenticeships.

Table 9.1 – BPS Schools and Enrollment by Green Workforce Adjacent Program Area, SY2023

SCHOOL	PATHWAYS PROGRAM AREA	ENROLLEES
Boston Green Academy Horace Mann Charter School	Environmental Science & Technology (C74)	78
Burke High School	Environmental and Life Science (IP)	16
Dearborn 6-12 STEM Academy	Engineering Technology (NC74)	63
Madison Park Technical Vocational High School	Electricity (C74)	55
Madison Park Technical Vocational High School	Heating, Ventilation, Air Conditioning, Refrigeration (C74)	44
O'Bryant School of Math & Science	Engineering Technology (NC74)	159
Total		**415**

Source: MA Education-to-Career Research and Data Hub.

Support new programs at Madison Park

Madison Park Vocational Technical High School is Boston's only vocational high school and serves a high percentage of high-need students. The school has had a troubled history of leadership turnover and underperformance, but Mayor Wu has committed to transforming it into a state-of-the art vocational technical school. Through the diligence of Congresswoman Ayanna Pressley, the City secured $1.66 million in federal funding for the project in 2023. Building on a community-engaged planning process that started in 2022, construction on a newly designed space will start in 2025. This historic investment provides an opportunity for the City to create a state-of-the art vocational-technical high school.

Add new CTE programs that lead to good green jobs to Madison Park's curriculum offerings.

In 2022, Madison Park formed a Clean Energy Task Force that identified nine programs in which to integrate green skills: six in the building trades, two related to computers, and one in auto technology. In 2024, Northeastern University conducted a workforce analysis of the programs that the new facility could offer, focusing on occupations in high demand, pay a living wage, and are expected to demonstrate strong growth in the next 3 to 5 years.[49] These include Engineering Technology, Environmental Sciences, and Business Technology, and Advanced Manufacturing.

Madison Park's Clean Energy Taskforce is integrating green job training into existing vocational programs in several ways, such as adding electric vehicle repair and vehicle charging maintenance to the automotive technology program. The school is in the process of procuring a $500,000 grant from MassCEC to purchase specialized equipment for electric vehicle repair. In addition, Madison Park is partnering with Roxbury Community College so students can have access to the Building Operator Certification (BOC) certificate program, which prepares building operators and facilities staff to improve buildings' energy efficiency and operational effectiveness.

A model program at Madison Park is Achieve Green, a pre-apprenticeship partnership between IUPAT DC35, the Painters and Glaziers Employers Association of New England, and the City of Boston. This program allows students at Boston's Madison Park Technical Vocational High School to learn air sealing and glazing work, completing a first apprenticeship a year before they graduate.[50]

The Clean Energy Taskforce should consider successful models such as the Green Tech Academy that starts with a year of exploration in two pathways, energy and agriculture, with students choosing a specialization for the remaining high school years. The Manpower Demonstration Research Corporation points out that Green Tech's strong partnerships with local employers is a key aspect of its success in the Kansas City, Missouri region, which is a collaboration of 31 high schools.[51]

The Clean Energy Task Force also initiated a Career Exploration Initiative that brings students on field trips to clean energy employers. Other programming includes co-ops, career days, and guest speakers. As part of this project, a Madison Park co-op student helped lead several focus groups of students that revealed how little they knew about green careers. These groups identified key strategies for marketing green career pathways to students: dispelling myths that all green jobs are outside or focus on landscaping; highlighting the contributions to reducing climate impacts on communities; and emphasizing good wages and career progression for the future.

Link green CTE and Innovation Pathways to experiential learning opportunities such as co-op and summer jobs.

Eligible Madison Park high school seniors can participate in a Cooperative Education (Co-op) program that offers supervised workplace employment and learning experiences.[52] Cooperative partners include some union locals with joint registered apprenticeship programs, including the International Union of Painters and Allied Trades District Council 35 (DC35), International Brotherhood of Electrical Workers Local 103, Pile Drivers Local 56 (North Atlantic States Regional Council of Carpenters), Ironworkers Local 7, Sheet Metal Workers Local 17.[53] Students completing co-op placements in partnership with union locals may be more likely to apply and be accepted into full apprenticeship programs.

In addition, the Office of Youth Employment and Opportunity is working to link green-related BPS Innovation Pathways to summer jobs. Massachusetts has designated Innovation Pathway programs designed to give students coursework and experience in a specific high-demand industry, such as information technology, engineering, healthcare, life sciences and advanced manufacturing.[54] Now that the Mayor has guaranteed a summer job to every eligible BPS student who applies for one, students in green-related pathways can be matched with a green employer for a summer experience. Youth typically work 6 to 7 weeks for 20 to 25 hours per week at the minimum wage. Northeastern University research has shown that summer jobs increase high school graduation, boost employment and wages, and reduce criminal justice involvement for one to four years after participation.[55]

Multiply and enhance pre-apprenticeship and union co-op programs at Madison Park in coordination with Building Pathways and Boston Building Trades.

These programs can help young Bostonians learn about and prepare to enter green union apprenticeships. BPS should dedicate needed resources to expanding the number and capacity of these programs. A US Department of Education *Planning Guide for Aligning Career and Technical Education (CTE) and Apprenticeship Programs* is included as Appendix C to this report. Additional resources are at WorkplaceGPS.[56]

Boston Public Schools can build on existing programs and practices to become a recognized leader in ensuring young Bostonians can enter and thrive in green jobs, union apprenticeships, and the building trades.[57] We recommend that the City:

Educate and familiarize counselors about green job opportunities and union apprenticeships.

To match students with appropriate opportunities and encourage broad career exploration, counselors must understand the structure and benefits of union apprenticeships. The City should explore methods to encourage the development of such understanding, including in-district education materials and workshops, the identification of continuing professional education opportunities, and presentations and tabling at professional meetings.

Ensure regular and consistent communication between apprenticeships and other green training opportunities and school district staff.

We recommend BPS hire or assign staff whose roles include regularly reaching out to green job apprenticeship programs and other green career options. These intermediaries should invite representatives to career fairs and other events, secure information on application opportunities, and identify recruitment and educational opportunities.

3 *Use procurement and policy tools to drive good jobs and an expanded labor market*

The City should use prevailing wage requirements, state or federally approved apprenticeship requirements, and mandates for public disclosure of workforce numbers, pay, and subcontracting to ensure green jobs are good jobs. We look at specific recommendations below.

Use Project Labor Agreements to enforce Climate Action Plan goals in construction, renovation, and retrofit projects over $1 million.

Over the last 20 years, cities have increasingly been using Project Labor Agreements (PLAs) and Community Workforce Agreements (CWAs) to promote diverse and local hiring on public construction projects. These agreements can include targeted hiring goals to increase employment of local residents and of groups historically underrepresented in the building trades, including apprenticeship utilization goals that specify the minimum project hours that must be completed by apprentices.[58] The City of Boston can boost demand for high-quality training programs by ensuring all capital projects over a certain cost threshold are covered by Project Labor Agreements (PLAs). In May 2025, the City of Boston reached a landmark PLA with the Greater Boston Building Trades Unions and the North Atlantic States Regional Council of Carpenters. The Agreement will ensure a consistent supply of skilled, union labor for major BPS capital projects carried out under the District's Long-Term Facilities Plan, as well as creating a direct pathway for graduates of Madison Park Technical Vocational High School to good-paying, stable union jobs in the construction trades. PLAs such as these are the strongest tool available to the City of Boston to support union apprenticeship programs in training Boston residents, women, and people of color for good careers in the green economy.

Governor Maura Healey recently signed into law language affirming that municipalities and other government entities in Massachusetts may enter into PLAs in the public interest.[59] The City of Boston has experience completing projects with PLAs and is well positioned to expand their use.

Boston's $4.7 billion, five-year capital plan includes 427 projects, 324 of which are valued at $1 million or over.[60] These include work on the City's schools, multi-modal transportation infrastructure, libraries, community centers, and resilience infrastructure.

PLAs will ensure these projects support high-road training programs. In addition, PLAs provide key support to expanding the capacity and diversity of union apprenticeship programs:

- PLAs expand demand for union labor, giving program directors the ability to increase the number of seats in their programs.
- PLAs can and should contain language to support good career pathways, including
    - Targeted hire goals
    - Apprenticeship utilization goals
    - Support for pre-apprenticeship programs
    - Workplace climate and retention policies

More information on PLAs can be found in Appendix C.

Make procurement scoring and PLAs work together

Procurement practices can work with PLAs by linking RFP and bid scoring with contractor plans to meet PLA apprenticeship and diverse hiring criteria. When reviewing bids, the City should give higher scores to contractors with plans to meet hiring criteria or other requirements in a PLA.

One effective policy is in Oregon. Oregon Metro uses procurement to enhance workforce participation from underrepresented groups by incorporating the agency's PLA into bid scoring. As part of their responses to both RFPs and Invitations to Bid (ITB), contractors are required to submit plans that include a narrative outlining how they will meet the targeted hire goals governed by the PLA, including their planned recruitment strategies, retention strategies, and strategies to ensure a respectful workplace free of harassment, discrimination, and bullying.[61] For evaluative procurements, such as design-build projects, a contractor's response to the public benefit program requirements represents 20% of their overall score on a proposal.[62] For low-bid procurements, the public benefit requirement response is evaluated by procurement staff and, if found to be insufficient, may render their bid "nonresponsive" and disqualify it from the bidding opportunity. Upon award, the contractors' plan becomes a binding term of the prime contract for the duration of the project.[63,64]

Ensure Boston contracts go to high-performing bidders

Boston can support good green jobs career pathways by hiring contractors with a demonstrated commitment to equitable hiring practices. Boston should consider whether contractors have previously met Boston Residents Jobs Policy goals when awarding project contracts. Boston should consider formalizing how BRJP performance is scored when considering bids. Any formula should include consideration of performance over multiple projects, size of projects, and inclusion of registered apprentices.

Additionally, we recommend Boston use RFP requirements and scoring rubrics to ensure City projects support contractors who are building good career pathways for all Boston residents. We recommend RFP requirements include:

- A statement of intent concerning how or whether the applicant and its contractors and subcontractors intend to utilize apprentices on the project, including whether each of its contractors and subcontractors on the project participates in a state or federally certified apprenticeship program;
- Detailed plans for assuring labor harmony during all phases of the construction, reconstruction, renovation, development, and operation of the project, including documentation of the applicant's history with picketing, work stoppages, boycotts, or other economic actions against the applicant and a description or plan of how the applicant intends to prevent or address such actions;
- Documentation on whether the applicant and its contractors have been found in violation of state or federal safety regulations or wage and hour laws in the previous 10 years.

Use incentives and credits to reward high-performing contractors

Another tool available to increase demand for registered apprentices through awarding contractors bid credits for strong performance on City hiring goals. Incentives promote workforce diversity and social equity by awarding credits for firms that commit to and succeed in hiring underrepresented workers into apprenticeships and journey-level roles.

Boston could offer incentives on construction contracts above a certain value, scoring contractors more favorably for past performance and/or commitments related to apprenticeship utilization, diverse hiring, hiring residents returning from incarceration, and more. An example from Chicago can be found in Appendix C Case Study: Chicago Bid Incentives.

Use Memoranda of Agreement to Direct Jobs to Boston Residents.

In addition, some cities use a Memorandum of Agreement (MOA) or a Memorandum of Understanding (MOU) on hiring in green jobs. DC Water and Sewer Authority created an MOA with the District of Columbia municipal government for its Long Term Control Plan (LTCP).[65] Under the MOA, DC Water will fill 51% of new jobs and 35% of total apprenticeship hours with DC residents on all green infrastructure contracts and procurements over $250,000 for a five-year period. To meet these labor demands and expand economic opportunity for underemployed and unemployed DC residents, DC Water created the Green Infrastructure training program. DC Water connects contractors with trained and certified residents while also engaging MWBEs and local Certified Business Enterprises outlined in the agreement. Additionally, DC Water evaluates its strategic training partners annually on how well these programs place trainees in jobs. They are required to maintain data on job placement to continue their contract with DC Water.

DC Water also runs a training and hiring initiative called DC WaterWorks, (which targets individuals with several employment barriers for training. Each year, DCWW customizes its curriculum to match DC Water's construction forecast and contractors' project needs. This program has graduated and placed at least 700 individuals since 2015.

Drive Good Jobs through BERDO

The City should develop strategies to incentivize and encourage *all* building owners covered by BERDO to adopt strong labor standards, adjusting the approach with various types of building owners.

As noted earlier, BERDO, combined with small building retrofits, could employ workers for more than 40,000 annual job-years over five years, accounting for 25 to 47% of Boston's total construction related employment by 2030. Currently, most BERDO-covered building owners are not required to follow any special labor or good jobs standards in bringing their buildings into compliance. However, the BERDO Review Board evaluates which projects should receive Equitable Emission Investment Funds meant to benefit Environmental Justice Populations and populations disproportionately affected by air pollution. In considering which projects to fund, the Board must consider benefits including living wages, equitable employment and contracting standards, and the impact of local workforce development programs. The fund also can directly support equitable workforce development training programs for residents who have been disproportionately impacted by the effects of climate change.

Clarify whether BRJP applies to BERDO projects

Neither the BERDO or BRJP ordinances clarify whether BRJP applies to large BERDO projects. The BRJP applies to projects that "substantially rehabilitate" structures over 100,000 square feet.

BERDO covers:

- Residential buildings that have 15 or more units.
- Non-residential buildings that are 20,000 square feet or larger.
- Any tax parcel with multiple buildings that add up to at least 20,000 square feet or 15 units.

The ordinance states that "Building Owners *may choose* to report additional metrics, including … Boston Resident Jobs Policy compliance." However, the ordinance does not indicate whether or when BERDO projects would be defined as "substantially rehabilitating" a structure over 100,000 square feet.[66]

The City should provide clarification and guidance on when BRJP may apply to large BERDO projects.

Support good green jobs in residential decarbonization and clean energy

As this report has noted, jobs in reducing buildings' carbon emissions and installing clean energy systems are sharply bifurcated by industry segment. Large commercial and industrial projects tend to offer good family-supporting wages and benefits, while residential contractors offer workers low pay and few benefits. Owners of single-family homes, small multifamily buildings, or small commercial buildings may not have the insight or funds to find and hire a contractor that offers good jobs, while unionized contractors more often bid on larger projects.

Boston is currently providing technical support, financing, and construction management services for residential decarbonization through its Healthy and Green Retrofit Pilot Program. Currently, this project includes 30 homeowners of two- to four-unit buildings, and supports them to electrify and decarbonize their buildings.[67] We recommend that in future versions of this program, participating contractors be required to meet good job qualifications and standards, at the minimum prevailing wage set by the state's Department of Labor.

We recommend the City work with contractors, unions, and other stakeholders to increase good jobs practices in residential contracting. Working with partners like the Emerald Cities Collaborative, the City can simultaneously support local contractors, raise job standards, lower energy burdens for Bostonians, and advance decarbonization and clean energy in small residential and commercial buildings.

Public Solar NYC has taken an innovative approach to bundling solar energy in part to ensure that projects fund good green jobs. This plan would streamline the installation of small rooftop solar arrays across New York City by forming a new Local Development Corporation which would finance, own, and manage rooftop solar at scale. By combining projects, this approach creates economies of scale on installation and can insist on strong labor standards in its contracts.[68]

Continue to Support Geothermal Networks

The Boston Housing Authority's 400-plus unit Franklin Field Apartments in Dorchester is a pilot site in National Grid's Networked Geothermal Demonstration Program. Geothermal grids use interconnected ground-source heat pumps to supply heat and cooling and are six times more efficient than individual gas furnaces and are fossil-free.[69] The demonstration will connect seven buildings. To build on this decarbonization effort, the BHA is bundling funds from other programs to electrify the buildings in the geothermal network. This includes investing BHA resources to improve building efficiency, updating electrical equipment, and expanding ventilation. The BHA is also partnering with the City of Boston on a Environmental Protection Agency Environmental Justice

Geothermal grids, if implemented more widely, provide new opportunities for unionized utility workers as sources of energy shift. Boston should continue to participate in partnerships with National Grid to move this technology from pilot to full-scale implementation, with attention to ensuring good jobs.

Summary

Boston has much of the labor force needed to implement the 2030 Climate Action Plan, Climate Ready Boston, and its other climate-related plans, but the lack of centralized access and transparency around demographic and job placement data among non-union training providers prevents adequate assessment of program effectiveness. Key needs for creating an inclusive workforce are reaching younger people through high schools and developing more programs for returning residents. Including more young people in the green economy will require an overhaul of high school technical and vocational education to improve overall quality and incorporate green elements into existing curriculum. Including more returning residents and others with barriers to employment will require training programs to offer a more comprehensive set of support services for trainees to succeed.

Further, employers need to be more engaged in the workforce system and in creating more good jobs. Many career paths in green jobs are broken, with only low-wage positions with little advancement potential. The city will need to create stronger collaboration between employers, training providers, and intermediaries to align training programs with industry needs.

Beyond training, Boston will need to make policy changes to improve job quality, including utilizing project labor agreements, prioritizing high-performing contractors in city procurement, leading and negotiating with large nonprofit institutions, and strengthening job policy enforcement. As the retrofitting work to comply with the Building Emissions Reduction and Disclosure Ordinance (BERDO) and other city initiatives commences, we focus on the need for accountability to ensure strong labor standards in the construction and related sectors.

Ultimately, the report presents data and tools for Boston to build a greener and more inclusive local economy by supporting high-quality education and job training, policy reform, enforcement of standards, and economic incentives. With these tools, the Wu Administration can ensure that all Boston residents have access to sustainable, family-supporting careers in the growing green economy.

Endnotes

1. **Community Labor United, Green Justice Coalition.** 2021. *Developing policy with an equity lens: A reflective proposal review questionnaire*. https://greenjusticecoalition.org/wp-content/uploads/2021/05/GreenJusticeCoalition_Equality-tool1-1.pdf
2. **Douglas, P.** 2025, *If Massachusetts can't fix constant flooding on Morrissey Blvd., how will we prepare for rising seas?* https://apps.bostonglobe.com/2025/10/metro/flooding/morrissey-boulevard/
3. **National Oceanic and Atmospheric Administration.** *Annual High Tide Flooding Outlook*. https://tidesandcurrents.noaa.gov/high-tide-flooding/annual-outlook.html
4. **City of Boston.** 2016. *Climate Ready Boston.* https://www.boston.gov/sites/default/files/embed/2/20161207_climate_ready_boston_digital2.pdf
5. **City of Boston.** 2016. *Climate Ready Boston.* https://www.boston.gov/sites/default/files/embed/2/20161207_climate_ready_boston_digital2.pdf
6. **City of Boston.** 2020. *Electric Vehicle Readiness Policy for New Developments.* https://www.boston.gov/sites/default/files/file/2020/03/EV%20Readiness%20Policy%20For%20New%20Developments%20%287%29.pdf
7. **Douglas, E., and P. Kirshen. 2**022. *Climate Change Impacts and Projections for the Greater Boston Area.* University of Massachusetts Boston. https://greenribboncommission.org/wp-content/uploads/2022/06/GBRAG_report_05312022@1915.pdf
8. **Climate Central.** 2023. *Urban Heat Hot Spots.* https://www.climatecentral.org/climate-matters/urban-heat-islands-2023
9. **City of Boston.** 2023. *Ordinance Amending City of Boston Code, Ordinances, Chapter VII, Sections 7-2.1 and 7-2.2: Building Energy Reporting and Disclosure* (BERDO 2.0). https://www.boston.gov/sites/default/files/file/2023/12/BERDO%202.0%20Final%20Amended%20Docket%200775_1.pdf
10. **City of Boston.** 2024. *Mayor Wu to Announce Partnership With Local Utility Companies to Reduce Energy Costs for Residents.* https://www.boston.gov/news/mayor-wu-announce-partnership-local-utility-companies-reduce-energy-costs-residents
11. **U.S. Bureau of Labor Statistics.** 2013. *The BLS Green Jobs Definition.* https://www.bls.gov/green/green_definition.htm
12. Lightcast
13. **U.S. Bureau of Labor Statistics.** 2025. *Employment Projections.* https://www.bls.gov/green/green_definition.htm
14. **U.S. Bureau of Labor Statistics.** 2024. *Employment Projections*: 2023–2033. https://www.bls.gov/news.release/archives/ecopro_08292024.pdf
15. **Pollin, R., Wicks-Lim, J., Chakraborty, S.** 2024. *State-Level Employment Effects of Biden's Green*

Energy, Manufacturing, and Infrastructure Programs. Political Economy Research Institute (PERI). https://peri.umass.edu/publication/state-level-employment-effects-of-bidens-green-energy-manufacturing-and-infrastructure-programs/

16. **City of Boston.** *Boston Municipal Code, Article 25A, "Redevelopment Authority," Municode.* https://library.municode.com/ma/boston/codes/redevelopment_authority?nodeId=ART25ACOFLREOVDI

17. *The PERI models suggest that far fewer jobs will be newly created compared to the jobs that will continue to be supported. For instance, they estimate that the combined effects of the BIL, IRA, and CHIPS legislative initiatives will lead to an 8.1 percent demand increase for Construction Laborers. Other sources such as Xie et al. (2023) show greater variation across states in these estimates. For example, although decarbonization brings consistent job growth across most states, the net gains tend to be small with major fossil-fuel producing states actually seeing significant declines. See Appendix A, the Technical Appendix for more details. Generally, coastal states such as Massachusetts see more opportunities with high consistency across assumptions, yielding estimates that as high as 20 percent of projected employment through 2050 could be net new jobs.*

18. **Pollin, R., Wicks-Lim, J., Chakraborty, S., Semieniuk, G., Lala, C.** 2023. *Employment Impacts of New U.S. Clean Energy, Manufacturing, and Infrastructure Laws. Political Economy Research Institute (PERI).* https://peri.umass.edu/?view=article&id=1749:employment-impacts-of-new-u-s-clean-energy-manufacturing-and-infrastructure-laws&catid=12

19. *Here we assume that 50 percent of the square footage of covered buildings will be retrofit, meaning that they will reduce their greenhouse gas emissions by 60 percent by 2030.*

20. **U.S. Census Bureau.** 2023. *QuickFacts: Boston City, Massachusetts.* https://www.census.gov/quickfacts/fact/table/bostoncitymassachusetts/IPE120223

21. *Living Wage updates annually in July per the Ordinance,* https://codelibrary.amlegal.com/codes/boston/latest/boston_ma/0-0-0-15515.

22. **U.S. Department of Commerce and U.S. Department of Labor.** *Good Jobs Principles.* Accessed January 15. https://www.dol.gov/sites/dolgov/files/goodjobs/Good-Jobs-Summit-Principles-Factsheet.pdf (Archived version; the document has since been removed by the Trump administration.)

23. *Analyzing ACS wages data also shows that some fields have below $10,000 annually. This is because ACS data is collected annually—suggesting that many workers may work much less than full time in these roles.*

24. **Reimagine Main Street.** 2022. *Small Employers and Good Jobs: Opportunities and Constraints.*

25. **Juravich, T.; R. Ormiston; and D. Belman.** 2021. *The Social and Economic Costs of Illegal Misclassification, Wage Theft and Tax Fraud in Residential Construction in Massachusetts.* UMass Amherst Labor Center and ICERES. June 28, 2021. https://www.umass.edu/labor/research/working-paper-series/social-and-economic-costs-illegal-misclassification-wage-theft-and-tax-fraud-residential.

26. **Ormiston, R.** 2024. *Union Membership in the Skilled Construction Trades*, 2013–22. https://iceres.org/wp-content/uploads/2024/01/ICERES-Report-on-Construction-Union-Membership-FINAL.pdf

27. **Juravich, T.; R. Ormiston; and D. Belman.** 2021. *The Social and Economic Costs of Illegal Misclassification, Wage Theft and Tax Fraud in Residential Construction in Massachusetts.* UMass Amherst Labor Center and ICERES. June 28, 2021. https://www.umass.edu/labor/research/working-paper-series/social-and-economic-costs-illegal-misclassification-wage-theft-and-tax-fraud-residential

28. **Career Explorer.** 2016. *Weatherization Technician Salary — Massachusetts.* https://www.careerexplorer.com/careers/weatherization-technician/salary/massachusetts/

29. **Ormiston, R.** 2024. *Union Membership in the Skilled Construction Trades*, 2013–22. https://iceres.org/wp-content/uploads/2024/01/ICERES-Report-on-Construction-Union-Membership-FINAL.pdf

30. **McNicholas, C., Poydock, M., Shierholz, H., & Wething, H. 2020.** *Unions aren't just good for workers—they also benefit communities and democracy.* https://www.epi.org/publication/unions-arent-just-good-for-workers-they-also-benefit-communities-and-democracy/

31. **City of Boston.** 2020. *Boston's Green New Deal.* https://www.boston.gov/departments/mayors-office/bostons-green-new-deal

32. **Center for American Progress.** 2018–2019. *Analysis of 1-Year American Community Survey Microdata. (see* Svajlenka, N. 2020. *Protecting Undocumented Workers on the Pandemic's Front Lines.* Center for American Progress. https://www.americanprogress.org/article/protecting-undocumented-workers-pandemics-front-lines-2/;
National Immigration Forum. 2024. *Immigrant Construction Workers in the United States.* https://immigrationforum.org/article/immigrant-construction-workers-in-the-united-states/

33. **Siniavskaia., N. 2024.** *States and Construction Trades Most Reliant on Immigrant Workers.* 2023. https://eyeonhousing.org/2024/12/states-and-construction-trades-most-reliant-on-immigrant-workers-2023/

34. **Juravich, T.; R. Ormiston; and D. Belman.** 2021. *The Social and Economic Costs of Illegal Misclassification, Wage Theft and Tax Fraud in Residential Construction in Massachusetts.* UMass Amherst Labor Center. June 28, 2021. https://www.umass.edu/labor/research/working-paper-series/social-and-economic-costs-illegal-misclassification-wage-theft-and-tax-fraud-residential

35. **Turner, C.** 1988. *Sharing the Pie: The Boston Jobs Coalition. Labor Research Review* 1(12). https://core.ac.uk/download/pdf/5116926.pdf;
King, M. 1981. *Chain of Change: Struggles for Black Community Development.* South End Press.

36. **City of Boston,** Boston Residents Job Policy Dashboard.

37. **Green Justice Coalition; Community Labor United.** 2021. *Developing Policy with an Equity Lens:*

A *Reflective Proposal Review Questionnaire.* https://greenjusticecoalition.org/wp-content/uploads/2021/05/GreenJusticeCoalition_Equality-tool1-1.pdf

38. **City of Boston / Mayor Michelle Wu.** 2022. *Executive Order Establishing Additional Policy Guidance for Inclusion of Day Care Facilities (IDF) Zoning Provisions.* July 2022. https://media.wbur.org/wp/2022/07/Executive-Order-Day-Care.pdf

39. **Orland, J., Bromer, J., Grosso, P.D., Porter, T., Ragonese-Barnes, M., Atkins-Burnett, S.** 2022. *Understanding Features of Quality in Home-Based Child Care That Are Often Overlooked in Research and Policy.* Mathematica & U.S. HHS. https://acf.gov/sites/default/files/documents/opre/hbccsq-quality-features-brief-july2022.pdf

40. **Park, M., and J. Flores Peña.** 2021. *The Invisible Work of Family, Friend, and Neighbor Caregivers and Its Importance for Immigrant and Dual Language Learner Families.* https://www.migrationpolicy.org/Research/Family-Friend-Neighbor-Care

41. **Miller, K,, Schulman, K.** *Sustaining Family, Friend, and Neighbor Child Care During and After COVID-19: Survey Findings.* National Women's Law Center. 2022. https://nwlc.org/resource/sustaining-family-friend-and-neighbor-child-care-during-and-after-covid-19-survey-findings/

42. **Community Labor United.** 2023. *Family, Friend, and Neighbor Child Care in Massachusetts.* January 2023. https://carethatworks.org/wp-content/uploads/2023/10/clu_ctw_ffnreport_final.pdf

43. **Community Labor United.** 2023. *Family, Friend, and Neighbor Child Care in Massachusetts.* January 2023. https://carethatworks.org/wp-content/uploads/2023/10/clu_ctw_ffnreport_final.pdf

44. **Massachusetts Taxpayers Foundation.** 2025. *The Workforce Behind the Workforce: Examining the Early Childhood Education Labor Force in Massachusetts.* https://masstaxpayers.org/sites/default/files/publications/2025-09/The%20Workforce%20Behind%20the%20Workforce%20-%20Examining%20The%20Early%20Childhood%20Education%20Labor%20Force%20in%20Massachusetts.pdf

45. **Administration for Children and Families (ACF).** *Pathways for Advancing Careers and Education* (PACE). https://acf.gov/opre/project/pathways-advancing-careers-and-education-pace-2007-2018;
Administration for Children and Families (ACF). 2022. *Year Up Long-Term Impact Report.* https://acf.gov/sites/default/files/documents/opre/year%20up%20long-term%20impact%20report_apr2022.pdf;
Institute for Women's Policy Research (IWPR). 2020. *Supportive Services in Workforce Development Programs.* https://iwpr.org/wp-content/uploads/2020/11/C449-Supportive-Services-in-Workforce-Development-Programs.pdf

46. **See here food more information on the work that FoLDS is undertaking to make change at the state level:** https://massinc.org/2022/10/28/event-recap-first-annual-friends-of-longitudinal-data-systems-fall-symposium/

47. **Cormier, M.; T. Brock; J. Jacobs; R. Kazis; and H. Glatter.** 2022. *Preparing for Tomorrow's Middle-Skill Jobs.* Community College Research Center. https://academiccommons.columbia.edu/doi/10.7916/d6nb-xd89/download;
National Center for Construction Education and Research. 2024. *Contractors: Focus on the Skills Gap, Not the People Shortage, for Immediate Impact.* *https://www.constructiondive.com/spons/contractors-focus-on-the-skills-gap-not-the-people-shortage-for-immediat/718404/*

48. **Available at** Boston.gov

49. **Modestino, A. S., and T. Stern.** 2024. *Labor Market Analysis of Madison Park Chapter 74 Programs.* Memorandum, May 17.

50. **See Rising Stars.** 2025. https://www.risingstarsprogram.org/achieve-green

51. **Klein, N.** 2023. *Can High Schools Prepare Students for Green Jobs?* https://www.mdrc.org/work/publications/can-high-schools-prepare-students-green-jobs

52. **Madison Park Technical Vocational High School.** *Cooperative Education (Co-Op).* https://madisonpark.bostonpublicschools.org/career-programs/cooperative-education-co-op/

53. **Madison Park Technical Vocational High School.** *Building and Property Maintenance.* https://madisonpark.bostonpublicschools.org/career-programs/building-property-maintenance/
Madison Park Technical Vocational High School. *Electricity.* https://madisonpark.bostonpublicschools.org/career-programs/electricity/
Madison Park Technical Vocational High School. *Metal Fabrication & Joining Technologies.* https://madisonpark.bostonpublicschools.org/career-programs/metal-fabrication-joining-technologies/

54. **Massachusetts Executive Office of Education.** *Designated Innovation Pathways Programs.* https://www.mass.gov/info-details/designated-innovation-pathways-programs

55. **Modestino, A. S.; R. Cope; and P. Blakeley.** 2022. *Boston's Summer Youth Employment Program.* Northeastern University, Research Report 2023-01. https://impactengines.northeastern.edu/project/boston-syep-researchreport-22/

56. **Apprenticeship Expansion Element 5: Alignment with Career Pathways and Postsecondary Education.** WorkforceGPS. https://share.google/WYHQCbPIjN0ANiA2L

57. *See Appendix B: Madison Park.*

58. **Figueroa, M., Grabelsky., Lamare, R.** 2011. *Community Workforce Provisions in Project Labor Agreements.* Cornell ILR School. https://ecommons.cornell.edu/items/38cd650d-a14d-4f2d-8611-00df401c7ac9

59. **Massachusetts General Law.** 2024. *An Act Relative to Strengthening Massachusetts' Economic Leadership.* M.G.L. Ch. 238 §283. https://malegislature.gov/Laws/SessionLaws/Acts/2024/Chapter238

60. **Analyze Boston.** *Capital Budget* (FY25–29). https://data.boston.gov/dataset/capital-budget

61. **Oregon Metro.** n.d. *Construction Contracts: Public Benefits Program Requirements.* https://www.oregonmetro.gov/how-metro-works/contract-opportunities/doing-business-metro/large-construction-contracts

62. **Oregon Metro.** n.d. *Construction Contracts: Public Benefits Program Requirements.* https://www.oregonmetro.gov/how-metro-works/contract-opportunities/doing-business-metro/large-construction-contracts

63. **Oregon Metro.** 2022. *Construction Career Pathways Program: Information for Bids.* https://www.oregonmetro.gov/sites/default/files/2022/01/19/Construction-Careers-Pathways-Program-information-for-bids-20220118.pdf

64. **Oregon Metro.** *Construction Career Pathways Regional Workforce Equity Agreement: Plan for Bids.* https://www.oregonmetro.gov/sites/default/files/2022/10/11/Construction-Career-Pathways-regional-workforce-equity%20-agreement-plan-for-bids-20221011.pdf

65. *The LTCP responded to the 2005 Federal Consent Decree that mandated a 96% reduction of combined sewer overflows to the District's waterways.*

66. **City of Boston.** 2021. *Ordinance Amending City of Boston Code, Ordinances, Chapter VII, Sections 7-2.1 and 7-2.2, Building Energy Reporting and Disclosure* (BERDO. https://www.boston.gov/sites/default/files/file/2023/12/BERDO%202.0%20Final%20Amended%20Docket%200775_1.pdf

67. **City of Boston.** 2024. *Healthy and Green Retrofit Pilot Program Bid Opportunities.* https://www.boston.gov/housing/healthy-and-green-retrofit-pilot-program-bid-opportunities

68. **New York City Comptroller's Office.** 2022.*Public Solar* NYC. https://comptroller.nyc.gov/wp-content/uploads/2022/12/Public-Solar-NYC_PUBLIC.pdf

69. **HEET.** *What Is Gas-to-Geo?* n.d. https://www.heet.org/what-is-gas-to-geo#:~:text=Is%20it%20efficient%3F,furnace%20on%20the%20market%20today.

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