2020 MassCEC Building Operators Workforce Development Report

PRODUCED FOR THE MASSACHUSETTS CLEAN ENERGY CENTER

[bw] RESEARCH PARTNERSHIP

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About This Report

The Massachusetts Clean Energy Center (MassCEC) commissioned this 2020 Building Operators Workforce Development report to identify workforce development needs related to specific occupations within the building operations, building energy management, and facilities maintenance field. The research examines six building operator occupations from both the employer and current worker perspectives. Data included in this report address employer hiring practices and challenges; training, experience, and certification requirements; and demographics and diversity initiatives.

The report also details what level of training and experience and which certifications have been valuable to current workers in finding employment in the building operator field, as well as building operator employment benefits, median wages for entry-, mid-, and senior-level positions, career satisfaction, and career advancement opportunities.

The employer survey includes only Massachusetts-based firms, while the current worker survey encompasses the Northeast. The research team also surveyed building operator workers outside of the Northeast states from across the country to identify if there are any significant differences in the building operator talent pipeline across the nation; where statistically significant differences are found, these are footnoted in the respective sections. In general, because talent pipelines can extend beyond state borders and workers in the Northeast often cross state lines for work, findings from the Northeast workforce may be generalized to Massachusetts-specific needs.

In addition to these two surveys, the research team also collected qualitative data by conducting executive interviews with building operator employers and training program administrators. For more information on the specific organizations interviewed, please refer to the Methodology in Appendix A of this report.

BUILDING OPERATORS DEFINED

While building operators can be considered a subset of the energy efficiency industry, this field of work is becoming increasingly more complex and difficult to define. Building operators are in charge of managing building energy consumption for large commercial, retail, government, recreational, healthcare, or educational facilities as well as single tenant or multi-tenant residential properties. In some cases, building operations are outsourced to third-party firms that specialize in this field of work, while other businesses employ on-site building operators.

For the purposes of this report, a building operator is defined as any worker that operates, maintains, repairs, or installs any technologies related to building energy consumption and energy savings, including lighting, heating, cooling, building envelope and diagnostics, or computerized maintenance and energy management systems, as well as any other measures designed to improve the energy efficiency and energy cost savings of the building.

BW Research estimates that there are approximately 45,000 building operator-related jobs in the Commonwealth. It is important to note that this approximation is the full universe of building operators in

Massachusetts and does not imply that all these individuals are conducting energy efficiency work.[1] Additionally, these jobs are not captured as part of the annual MassCEC Clean Energy Industry Report.

The occupational titles for a building operator may vary, and there is no definitive set of job tasks or skills. Due to this variable nature of building operations work, there are relatively few training programs or courses specific to building operator and energy management fields, though such comprehensive programs are becoming increasingly popular as the demand for these occupations increases. By way of example, Roxbury Community College's new Center for Smart Building Technology opened its doors in January 2020 and is focused entirely on the future of building operations.

Building operators are pivotal to managing the energy efficiency of all buildings or commercial and industrial parks, but increasingly, these jobs require the understanding and expertise from multiple areas such as heating, ventilation, and air conditioning (HVAC), engineering, data analysis, and computer science. With new smart building technologies on the rise, this field of work is increasingly important in combatting climate change and reducing overall energy consumption. Because this is a relatively nascent area of work that requires an understanding of new and evolving technologies, the research team, in conjunction with MassCEC, selected the following six occupations described below to examine the current workforce landscape related to building operations. These data are used to produce policy recommendations and guidance for how to best support building operators and workers in the future.

BUILDING OPERATOR OCCUPATIONS

The six building operator occupations identified for the study are defined below. For each, a Standard Occupational Classification (SOC) code is included in a footnote. All occupations examined in this report have an equivalent or closely related SOC code. As such, job descriptions for each occupation are pulled from the Occupational Information Network (O*NET).

1. **Building maintenance mechanics or general maintenance workers**[2] perform work involving the skills of two or more maintenance or craft occupations to keep machines, mechanical equipment, or the structure of an establishment in repair. Duties may involve pipe fitting; boiler making; insulating; welding; machining; carpentry; repairing electrical or mechanical equipment; installing, aligning, and balancing new equipment; and repairing buildings, floors, or stairs.

2. **HVAC installers, mechanics, or service technicians**[3] install, service, or repair heating and air conditioning systems in residential buildings or commercial establishments.

3. **Facilities managers, maintenance supervisors, or superintendents**[4] directly supervise and coordinate the activities of mechanics, installers, and repairers.

[1] The building operator employment estimate is based on the six Standard Occupational Classification (SOC) codes in this research within industries most likely to employ on-site building operators or house third-party building operations management companies such as rental and leasing, manufacturing, healthcare, education, accommodations, and public administration.
[2] SOC 49-9071 (Maintenance and Repair Workers, General)
[3] SOC 49-9021 (Heating, Air Conditioning, and Refrigeration Mechanics and installers)
[4] SOC 49-1011 (First-Line Supervisors of Mechanics, Installers, and Repairers)

4. **Control valve mechanics or electric meter technicians**[5] install, repair, and maintain mechanical regulating and controlling devices, such as electric meters, gas regulators, thermostats, safety and flow valves, and other mechanical governors.

5. **Energy engineers or energy managers**[6] design, develop, or evaluate energy-related projects or programs to reduce energy costs or improve energy efficiency during the designing, building, or remodeling stages of construction. May specialize in electrical systems; HVAC systems; green buildings; lighting; air quality; or energy procurement.

6. **Boiler or utilities operators, building engineers, or stationary engineers**[7] operate or maintain stationary engines, boilers, or other mechanical equipment to provide utilities for buildings or industrial processes. Operate equipment, such as steam engines, generators, motors, turbines, and steam boilers.

It is important to note that this report was commissioned before the global Coronavirus (COVID-19) pandemic. While labor market and employment realities have changed across the United States during the first two quarters of 2020, it is likely that hiring requirements such as on-the-job training, experience, and certifications will remain the same as the economy recovers post-COVID-19. However, employer-reported hiring difficulties and needs may have shifted as a result of shutdowns and job losses.

Nevertheless, qualified building operators will likely continue to remain in demand given the aging current workforce, continual upgrade of buildings, and further adoption of new smart building technologies across Massachusetts' public and private sectors. During this period, as the shelter-in-place orders begin to lift, there is opportunity to mobilize resources, create partnerships, and set in motion the necessary steps to ensure the labor market demand for building operators can be met in the future.

[5] SOC 49-9012 (Control and Valve Installers and Repairers, Except Mechanical Door)
[6] Most closely related to SOC 17-2199.03 (Energy Engineers) and SOC 17-2199 (Engineers, All Other)
[7] SOC 51-8021 (Stationary Engineers and Boilers Operators)

Executive Summary

Key Findings

Building operator fields tend to exhibit variability across the six specific occupations examined. Occupational differences are most notably found across training and education requirements, while benefits, career satisfaction, and work experience remain consistent. Such variability is largely the result of facility type and size, as energy management needs vary across buildings. Large offices, industrial parks, retail stores, hotels, casinos, research centers, and government buildings are more likely to have a dedicated team of building operator specialists, either on-site or contracted out to third-party energy management and building maintenance services. Due to the specialized nature of this work, such building operator positions likely require higher levels of education in addition to specific licensures. On the other hand, for single-tenant or small multi-tenant residential properties, building energy needs are typically managed by a single on-site facilities manager or maintenance worker with more general knowledge, skills, and abilities related to multiple fields—heating and air conditioning or mechanical and electrical work. Such individuals are less likely to have specific educational or certification requirements.

It is important to note that in addition to facility type and size, occupational differences for training and educational attainment are a result of the variety of occupations tested for this study; engineering and managerial positions are more likely to require higher levels of education compared to technicians and mechanics.

The following are overall key findings from the research:

Experience and on-the-job training are key for all building operator trades. Lack of experience and industry-specific knowledge is the number one reported reason for hiring difficulties over 2019, and over half of employers indicated that there are sufficient applicants, but they do not have the experience required for the job. Few employers indicated that they require no formal work experience—about one to 10 percent across all surveyed occupations. The majority of employers indicated that they require at least one year of experience in a comparable position for each occupation. Furthermore, all surveyed current workers reported that internships and apprenticeship programs improved their ability to land a job in the building operator trades, and 66 percent of current workers highlighted on-the-job training as the most important element in successful career navigation.

Technology is changing the nature of work across building operator and building energy management trades. Seven in ten employers (70.9 percent) reported that their building energy managers and technicians need additional training in order to stay up-to-date with technological changes in the industry. Additionally, during executive interviews, several building operator employers mentioned how new technologies, such as the Internet of Things (IoT)[8], are fundamentally changing the nature of skills required from building operators. The influx of data from smart building technologies and IoT is creating a new spectrum of possibilities, allowing building operators to gather numerous datapoints on building efficiency and optimize functions based on these variables; these are new modes of energy management that previously did not exist and require new skillsets like data analysis and knowledge of computer and proprietary software systems.

[8] IoT is a network of sensors, meters, appliances, and other devices that are capable of sending and receiving data. In the case of building operations, IoT allows for data to be collected across all appliances and technologies facility in order to identify how energy is being used.

Many building operator occupations require less than a four-year college degree. This is especially true for building maintenance mechanics, HVAC installers, control valve mechanics, and boiler or utilities operators. The majority of employers indicated that energy engineer positions require at least a Bachelor's degree, with 32 percent noting they require their energy engineers to possess a Master's degree. Required educational attainment for facilities managers was at both ends of the spectrum; 40 percent of employers indicated they require no more than vocational technical training and another 34 percent indicated they require a Bachelor's degree. These variable requirements are the result of inherent differences in the industry, where some facilities managers are in charge of smaller residential properties and others work with a team of dedicated building operators for larger commercial or industrial facilities; large facilities with more complex energy management protocols and software are more likely to require higher levels of education from their workers.

Few employers *require* building operator-related certifications, but most do *prefer* certified workers, indicating certifications are helpful to getting a job. Only 13 percent of employers reported insufficient certifications as a reason for hiring difficulty, and less than a third of employers reported requiring one of the seven tested[9] building operator certifications. However, between 46 and 53 percent *prefer* one of the seven certifications, and roughly two-thirds of surveyed workers indicated that they have at least one of the seven certifications. The top two most required certifications by at least 30 percent of employers are the Certified Energy Manager (CEM) and the Certified Facility Manager Certification (CFM). The Building Operator Certification (BOC) is also required by at least 30 percent of employers for building maintenance mechanics, HVAC installers, and energy engineers. For a full list of certification requirements by occupation, please refer to Table 2 in this report. Interestingly, the top required certifications by employers—the CEM and CFM—are least represented among current workers. Current workers largely reported possessing a Building Systems Maintenance Certificate (SMC) (21 percent) or a Facilities Management Certificate (FMC) (15 percent). These differences may be the result of the higher education levels required to take the CEM and CFM. It is also possible that the rapidly changing nature of this field of work and the onset of new technologies is slowly creating a new industry standard, as employers and employees work to meet new technological demands.

Career satisfaction and opportunities for advancement are high. Ninety-three percent of current workers reported overall satisfaction (both "very satisfied" and "somewhat satisfied") with their career in building energy management, and 58 percent indicated they are "very satisfied". This is a fairly high level of career satisfaction. Another Massachusetts study that examined other energy efficiency occupations found an overall average satisfaction of 89 percent.[10] Seventy-eight percent of surveyed workers reported that they believe there are opportunities for career advancement with their current employer, such as a promotion to a higher position with more responsibilities and increased wages.

Building operator-related occupations offer many employment benefits. Eighty-one percent of current workers receive some type of health insurance coverage from their company and 78 percent also receive retirement benefits. Eighty-two percent of current workers also report getting paid vacation from work. Additional employment benefits include flexible work schedules, company vehicles, tuition support, and transportation stipends.

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[9] The seven tested certifications are as follows: Building Systems Maintenance Certificate (SMC); Facilities Management Certificate (FMC); Facility Management Professional Certification (FMP); Certified Professional Maintenance Manager Certification (CPMM); Certified Facility Manager Certification (CFM); Certified Energy Manager (CEM); Building Operator Certification (BOC).

[10] http://ma-eeac.org/wordpress/wp-content/uploads/Massachusetts-Energy-Efficiency-Workforce-Development-FINAL-REPORT-CAREER-PROFILES.pdf

Hiring pipelines are concentrated on general online job sites and word-of-mouth. This is true for both employers and current workers. Seventy-one percent of employers reported using general online job sites as a hiring source, and 67 percent of current workers report that they would use the same when searching for a new job. Employers also rely heavily on word of mouth, including asking current employees to recruit new workers; 44 percent of employers use word of mouth to find potential new employees.

An aging workforce and low public awareness of building operator careers may be contributing to talent shortages. Several individuals noted during executive interviews that the current building operator workforce is aging and retiring. There were additional concerns with the lack of new young entrants into this field of work as the prevailing narrative for high school students is to attend a four-year university. In Massachusetts, specifically, 73 percent of high school graduates go directly to college; this is ten percentage points higher than the national average.[11] Interviewees noted that there is simply a general lack of awareness that the building operator fields provide stable and rewarding employment opportunities.

[11] The National Center for Higher Education Management Systems (NCHEMS), 2016. http://www.higheredinfo.org/dbrowser/?year=2016&level=nation&mode=data&state=0&submeasure=63.

Conclusions & Recommendations

THE URGENCY AND IMPORTANCE OF BUILDING OPERATORS

Building operations and energy management will continue to remain a vital field of work, as a growing number of studies suggest that building air quality and temperature directly impact individual health and student learning outcomes.[12] It is likely that building operations and energy management will become increasingly more important given the new realities of the COVID-19 pandemic, where building air quality and circulation is ever more important to prevent the spread of the disease; this is especially true for hospitals, schools, and childcare facilities, as well as commercial and industrial spaces. The added benefits of managing buildings at optimum function and efficiency also expand beyond health and safety standards; increased building efficiencies translate into energy cost savings, greenhouse gas emissions reduction, and climate change mitigation.

These occupations are not necessarily "new;" building operations and management fields are longstanding jobs that will continue to be essential to the proper function of modern society's infrastructure. However, as with many other industries, the development and deployment of new technologies is changing the nature of the tasks, skills, and areas of expertise required of the modern-day building operator. Comprehensive understanding of how to work these systems is required, and without a skilled workforce to do so, even the most sophisticated new buildings will not operate at maximum efficiency. This changing nature of work combined with the fact that much of the current workforce is close to retirement is sure to create a gap in workforce supply and demand, emphasizing the urgency of ensuring there is a next generation of highly-skilled and trained building operators ready to meet industry demand.

A CASE FOR GREATER EQUITY

Not only are building operator occupations vital to society and the economy, they are also opportunities for high-paying jobs with numerous employment benefits, high career satisfaction, and growth opportunity. Many building operator positions support high entry-level wages, with low educational requirements[13], offering potential pathways out of poverty and opportunities to revitalize whole communities.

A comparative analysis of unemployment rates in Massachusetts highlights the current racial and ethnic socioeconomic disparity in the state. Pre-pandemic data from the Census Bureau indicates that the unemployment rate for White residents was at 4.8 percent, which was significantly lower than the unemployment rates for Black or African American residents and Hispanic or Latinx residents, at 9.2

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[12] *See generally:* https://hechingerreport.org/the-learning-effect-of-air-quality-in-classrooms/; https://www.epa.gov/iaq-schools/indoor-air-quality-high-performance-schools; https://www.epa.gov/report-environment/indoor-air-quality; https://www.neefusa.org/health/asthma/national-public-health-week-health-impacts-indoor-air-quality

[13] This refers largely to building maintenance mechanics, HVAC technicians, and control valve mechanics. Engineering and management positions typically have higher educational and experience requirements. However, all building operator occupations studied provide above-average entry-level wages, regardless of educational attainment requirements.

percent and 8.5 percent, respectively; this was roughly four to four and a half points higher than White individuals.[14] At the same time, new studies highlighting the disproportionate impacts of COVID-19 on racial and ethnic minorities, both health-wise and socioeconomically, indicate that Black and Hispanic Americans are more likely to have experienced the economic ramifications of the nationwide shutdown with higher rates of job and wage losses.[15]

Building operator trades can help to move the needle on equity; these are jobs that have the potential to break the cycle of poverty by offering sustainable-wage career pathways to historically disadvantaged communities.

ACTION ITEMS FOR WORKFORCE DEVELOPMENT SUPPORT

There are a number of short-term action items that MassCEC can facilitate in order to support building operator employers and future workers. In large part, the quickest, most effective, and likely most impactful way that MassCEC can support building operator workforce development is by **adopting the role of connector or facilitator and enabling partnerships amongst industry, training providers, and the potential workforce.** In a changing workforce landscape, these partnerships would maintain open lines of communication, keeping training providers up to date on new technologies and skill requirements and connecting potential workers to training and employment opportunities. The focus of the actions should center on increasing exposure to building operator careers, identifying and connecting currently undervalued talent for building operations, and supporting and providing access to comprehensive talent development programming with multiple on- and off-ramps for workers to navigate building operator careers while building a strong stable of talent.

The following is a list of concrete action items that BW Research recommends be done in the near-term. For each, the key issue is first identified based on the research findings above, with recommendations for action following. In general, all action items follow a main theme—where MassCEC facilitates connections and partnerships. BW Research believes this will be the quickest way to jumpstart comprehensive and streamlined building operator workforce development. Because there are likely many nodes of activity across the state, and because MassCEC is a well-known institution across the clean energy and energy efficiency spaces, partnership development would allow MassCEC to connect these nodes of activity in meaningful and effective ways.

Key Issue: An aging workforce and strong growth has created a talent shortage in building operations. While this may be temporarily slowed by COVID-19, the gap is expected to widen as fewer young people express interest in building operator positions and other technical and vocational careers.
Action Item: BW Research recommends that MassCEC leverage its network of schools, employers, and other organizations across the state to raise awareness of building operator careers across both high school and university students. Efforts to raise awareness include arranging web presentations for high schools and colleges with current workers or key employers in the building operations space, such as EMCOR, and creating digital career profile brochures that can be distributed electronically to students and

[14] U.S. Census Bureau. American Community Survey, Employment Status in Massachusetts. 2018 5-Year Estimates.
[15] *See generally:* https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/racial-ethnic-minorities.html; https://www.pewresearch.org/fact-tank/2020/05/05/financial-and-health-impacts-of-covid-19-vary-widely-by-race-and-ethnicity/

advisors. Career presentations and other media should highlight the high levels of career satisfaction, sustainable wages, career advancement opportunities, and numerous employment benefits available to building operator and building energy management workers. It would be additionally beneficial to showcase how these careers connect to environmental and climate change initiatives to highlight how working in environmental-related fields does not necessarily require a university degree and provide real-time "day in the life of" vignettes that illustrate the work and impact of the careers.

Key Issue: The talent pipeline, which is heavily predicated on general online job sites like Indeed or Monster and word-of-mouth hiring, naturally excludes certain demographic subgroups—including women and ethnic and racial minorities.
Action Item: BW Research recommends that MassCEC connect to program administrators and academic advisors at community colleges and vocational schools in low-income, under-served, or minority communities to promote and streamline access to the MassCEC online job board. Four in ten surveyed employers mentioned using the MassCEC online job board when searching for qualified job candidates. MassCEC should capitalize on the fact that many employers already use their job boards and create a "go-to" building operator-specific page that allows recent graduates and other jobseekers to connect with current job openings. Intentional outreach to disadvantaged or high unemployment communities, providing them with career exposure and ease of access to the building operator talent pipeline through the MassCEC online job board would increase overall workforce diversity in the building operator trades.

Key Issue: Work experience and on-the-job training are vital to finding employment in the building operator trades. However, employers note that experienced workers are difficult to find.
Action Item: With the increasing application of smart building technologies and IoT, many skillsets cannot be learned simply through theoretical classroom training. The importance of field work and real-world simulations to complement theoretical knowledge will be pivotal to cultivating a comprehensive understanding of a building's energy systems. BW Research recommends that MassCEC utilize their current Vocational Internship Program and connect to employers that reported interest in participation, while investing in outreach and tools to identify and assess talent that is currently disconnected from the economic mainstream. Of employers who indicated they are not currently aware of the MassCEC Vocational Internship Program, six in ten indicated that they would be interested in participating. MassCEC can use this contact database of interested building operator employers to connect recent graduates and jobseekers to building operator-specific internships.

Key Issue: Building operator occupations are inherently diverse, ranging from engineering and management roles to technician and mechanic positions. Naturally, there is not a single, one-size-fits-all, general educational and career pathway trajectory for building operator occupations.
Action Item: BW Research recommends focusing on connecting certification opportunities to jobseekers for more technology-specific jobs such as boiler or utilities operators and control valve mechanics. Between seven and eight in ten employers reported hiring difficulties for these occupations as well as longer-term work experience requirements. These occupations are more likely to have a specific technology-focus compared to building energy engineers or managers, who are more likely to require wholistic knowledge of multiple systems and processes. MassCEC should reach out and create working partnerships with manufacturers of energy efficiency building technologies, including computer systems and smart grid connective technologies. These partnerships would serve to keep MassCEC up to date on the changing technology landscape of the building operator fields, in order to provide interested jobseekers with the proper information. For individuals who come out of the MassCEC Vocational

Internship Program, MassCEC should fully or partially fund the required certifications for these individuals to transition from the internship program into full-time employment with those firms.

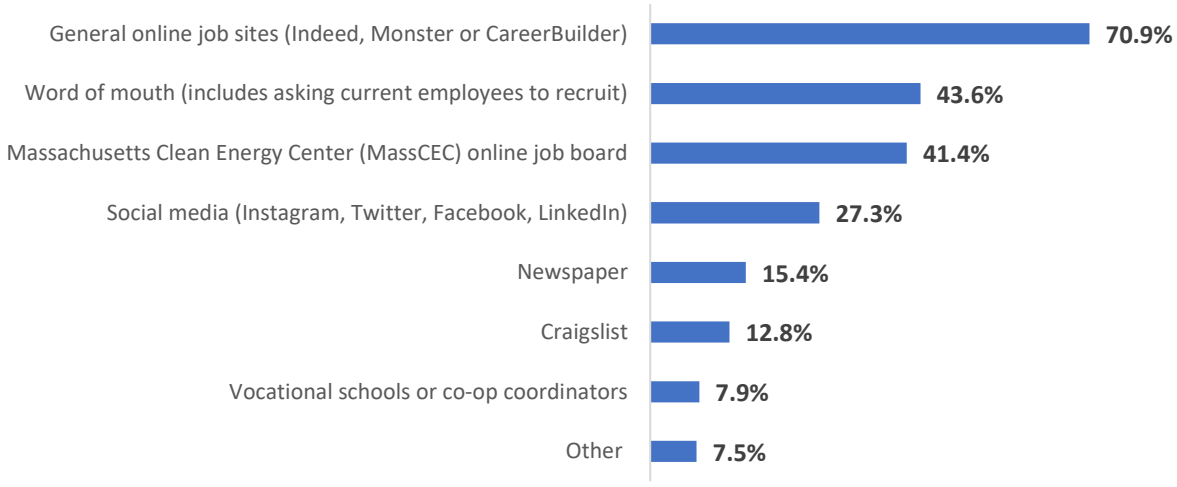
Employer Survey Results

Hiring Practices & Challenges

Employers typically hire from online job sites, but also use word of mouth and the MassCEC job board to find potential candidates. Seven in ten (70.9 percent) employers reported using general online job sites such as Indeed, Monster, or CareerBuilder when looking for qualified applicants. Word of mouth is used by 43.6 percent of respondents, followed by the MassCEC online job board (41.4 percent). Additionally, social media sites are also used for recruitment by 27.3 percent of employers.

In the executive interviews, one individual mentioned that they required a better talent pipeline to assist with recruitment. Web postings and the local newspaper were insufficient, and there is no "one-stop" shop for employers to post job openings.

FIGURE 1. HIRING SOURCES – EMPLOYER SURVEY

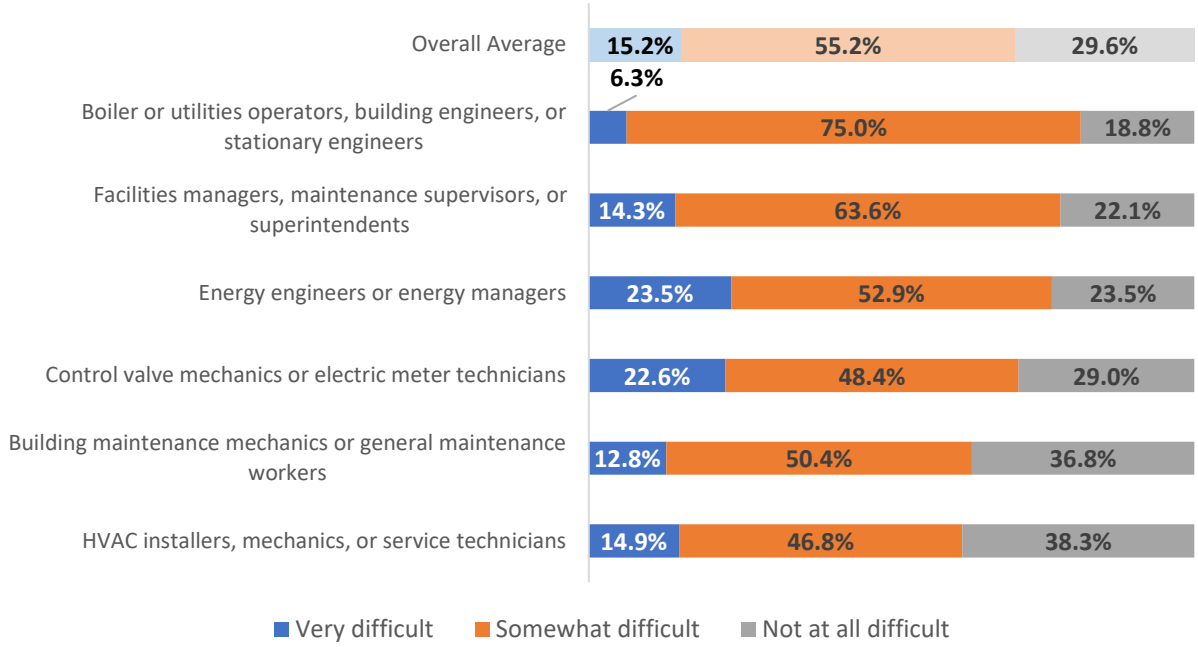


Seven in ten building operator employers reported hiring difficulty. In total, 70.4 percent of surveyed employers reported hiring difficulty, with 15 percent indicating hiring had been "very difficult". Occupations with above-average overall hiring difficulty include the following:

1. Boiler or utilities operators, building engineers, or stationary engineers (81.3 percent)[16]
2. Facilities managers, maintenance supervisors, or superintendents (77.9 percent)
3. Energy engineers or energy managers (76.5 percent)
4. Control valve mechanics or electric meter technicians (71.0 percent)

[16] This is the combined percentage of employers that reported hiring had either been "very" or "somewhat" difficult.

FIGURE 2. REPORTED HIRING DIFFICULTY



The top two reported reasons for hiring difficulty include the following:

1. Lack of experience or industry-specific knowledge (22.9 percent)
2. A small applicant pool (21.7 percent)

Reasons for hiring difficulty varied across occupations; the cells highlighted in Table 1 below indicate where 25 percent or more of employers reported hiring difficulty while seeking qualified applicants for each occupation. Building maintenance mechanic and boiler operator employers were more likely to indicate that a small applicant pool was an issue during the 2019 hiring process; about a quarter (24.7) to three in ten (30.8 percent) of these employers selected a small applicant pool as a reason for hiring difficulty.

Employers who were seeking to fill open positions for facilities managers, maintenance supervisors or superintendents reported hiring difficulty due to competition with other industries (related to the provision of wages and benefits)[17] (28.3 percent). The lack of appropriate certifications contributed to hiring difficulty for employers seeking to fill control valve mechanic and boiler operator positions, while lack of experience or industry-specific knowledge presented an issue for filling facilities management and control valve mechanic positions.

[17] Overall, building operators earn hourly wages that are above the statewide average (see page 32 of this report that details wages for all six occupations for entry-, mid-, and senior-level positions). It is possible that the reported hiring difficulty due to the inability to provide competitive wages and benefits is related to differences by sector, industry, or building type as building operators working on smaller residential units are likely to have lower educational attainment and thus lower wages. Additionally, one individual noted during the executive interviews that the public sector was often unable to provide the prevailing wage for building operators and as such faced significant hiring difficulties due to competition.

FIGURE 3. REPORTED REASONS FOR HIRING DIFFICULTY, OVERALL AVERAGE

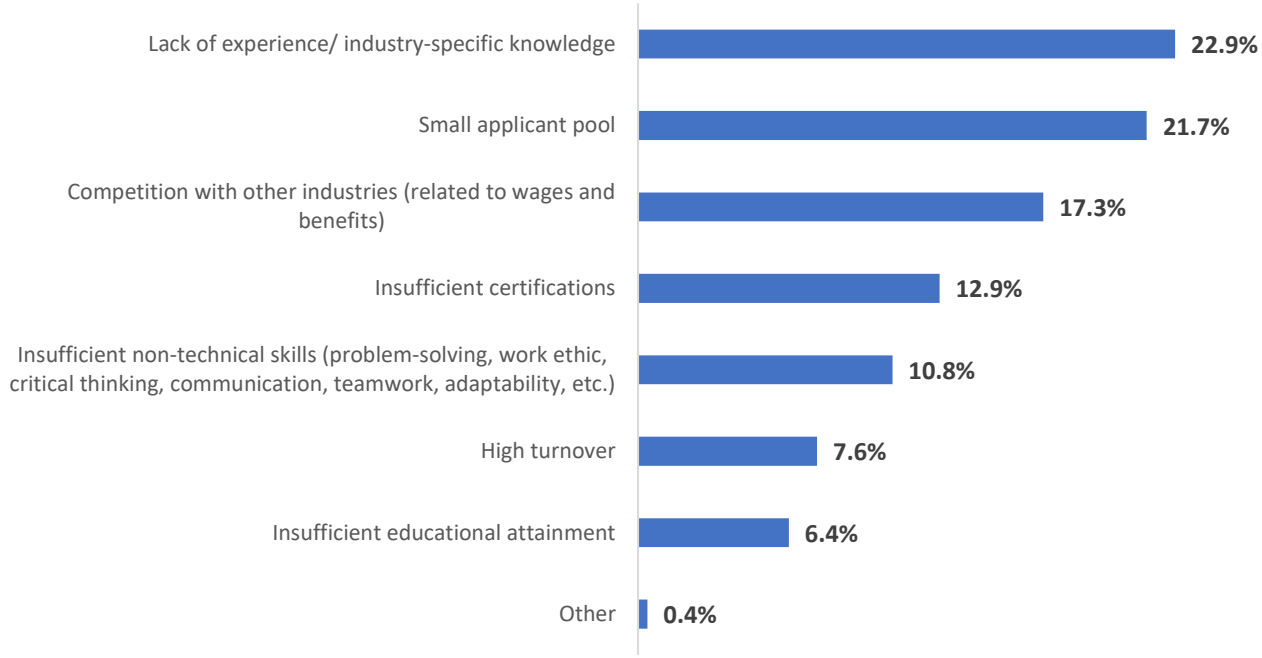


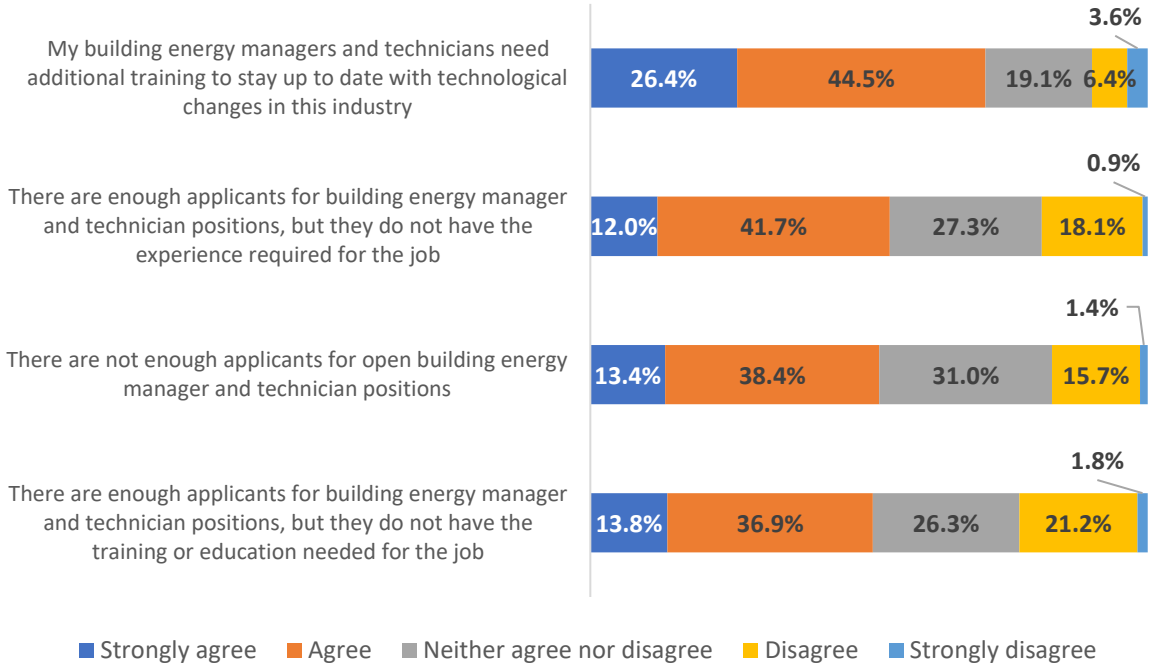
TABLE 1. REPORTED REASONS FOR HIRING DIFFICULTY BY OCCUPATION

	Small applicant pool	High turnover	Competition with other industries	Insufficient educational attainment	Insufficient certifications	Lack of experience/ industry-specific knowledge	Insufficient non-technical skills
Building maintenance mechanics or general maintenance workers	24.7%	12.3%	12.3%	2.7%	8.2%	23.3%	16.4%
HVAC installers, mechanics, or service technicians	13.8%	10.3%	20.7%	10.3%	13.8%	24.1%	3.4%
Facilities managers, maintenance supervisors, or superintendents	20.0%	6.7%	28.3%	1.7%	5.0%	26.7%	11.7%
Control valve mechanics or electric meter technicians	22.7%	0.0%	18.2%	4.5%	27.3%	27.3%	0.0%
Energy engineers or energy managers	17.9%	5.1%	12.8%	15.4%	15.4%	20.5%	12.8%
Boiler or utilities operators, building engineers, or stationary engineers	30.8%	3.8%	7.7%	11.5%	26.9%	11.5%	7.7%

The majority of employers felt that their building energy operators—across all six occupations tested—need additional training to stay up to date with technological changes in the industry; 70.9 percent indicated that they agree with this statement, and 26.4 percent reported they "strongly" agree. This statement received the highest level of agreement across all tested. The importance of technological know-how was also cited across several executive interviews, where individuals mentioned the rise of smart building and IoT technologies creating the need for more building operators with data analysis and computer skills in addition to basic understanding of building controls and HVAC systems.[18] In addition to technological advancements, interviewees also mentioned the multi-disciplinary nature of work, where knowledge across multiple skillsets are increasingly required of future building operators. Individuals mentioned that few programs offer such breadth or knowledge or skill development opportunities across data analysis, computer and software programs, IoT, smart building technologies, engineering, and HVAC and building systems.

Most employers also agreed that, across all six occupations, there are sufficient applicants for open positions, but that they lack the experience required for the job (53.7 percent). Another 51 percent indicated that there are enough applicants, but they do not have the training or education needed.

FIGURE 4. OVERALL HIRING NEEDS



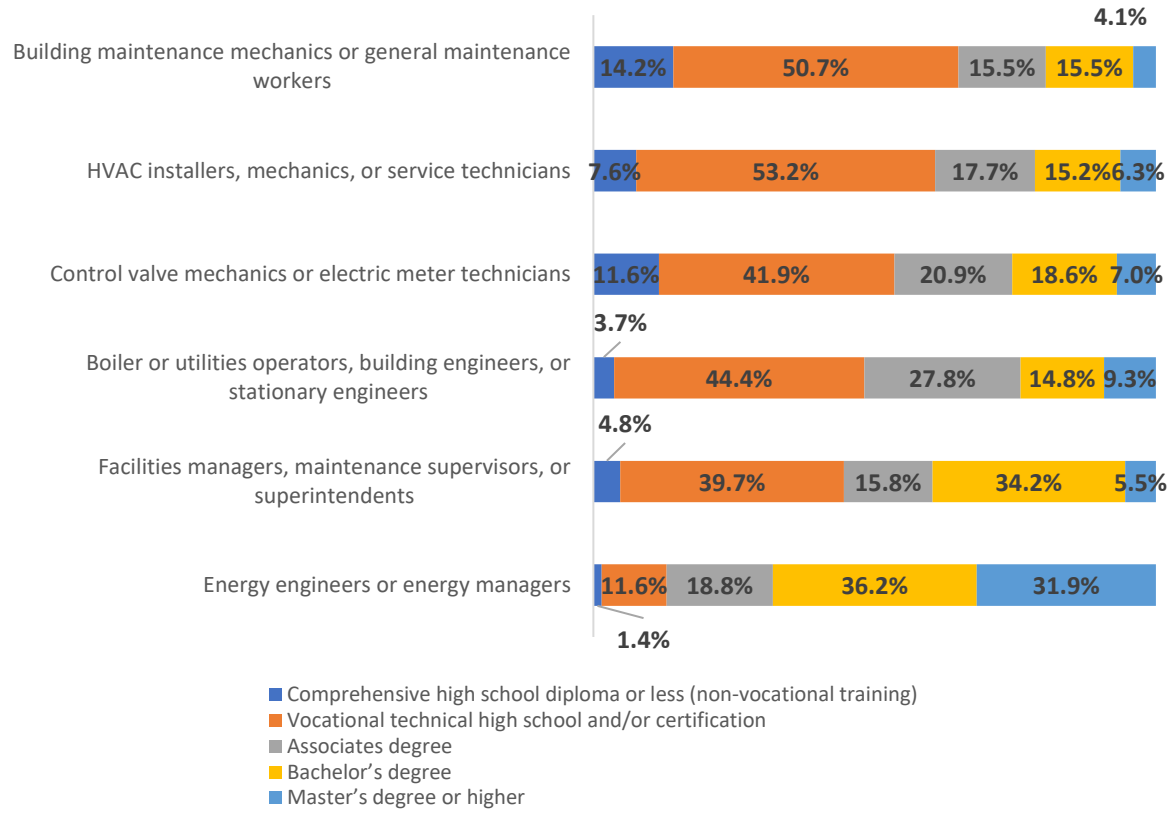
[18] IoT is a network of sensors, meters, appliances, and other devices that are capable of sending and receiving data. In the case of building operations, IoT allows for data to be collected across all parts of a facility in order to identify how energy is being used.

Training, Experience, & Certifications

Educational attainment is variable by occupation, though most building operator positions surveyed are more likely to require less than a four-year college degree. About six in ten employers indicated that they do not require more than a vocational technical certification for building maintenance mechanics (65 percent) and HVAC installers (61 percent). More than half of employers reported the same for control valve mechanics (54 percent). Forty-eight percent of employers indicated that boiler or utilities operators also only require no more than vocational technical training.

The majority of employers require their energy engineers or managers to possess a Bachelor's degree or more. Educational attainment for facilities managers is variable, with 40 percent of employers requiring no more than vocational technical training and another 34 percent indicating they require a Bachelor's degree.

FIGURE 5. REQUIRED EDUCATION LEVEL BY OCCUPATION

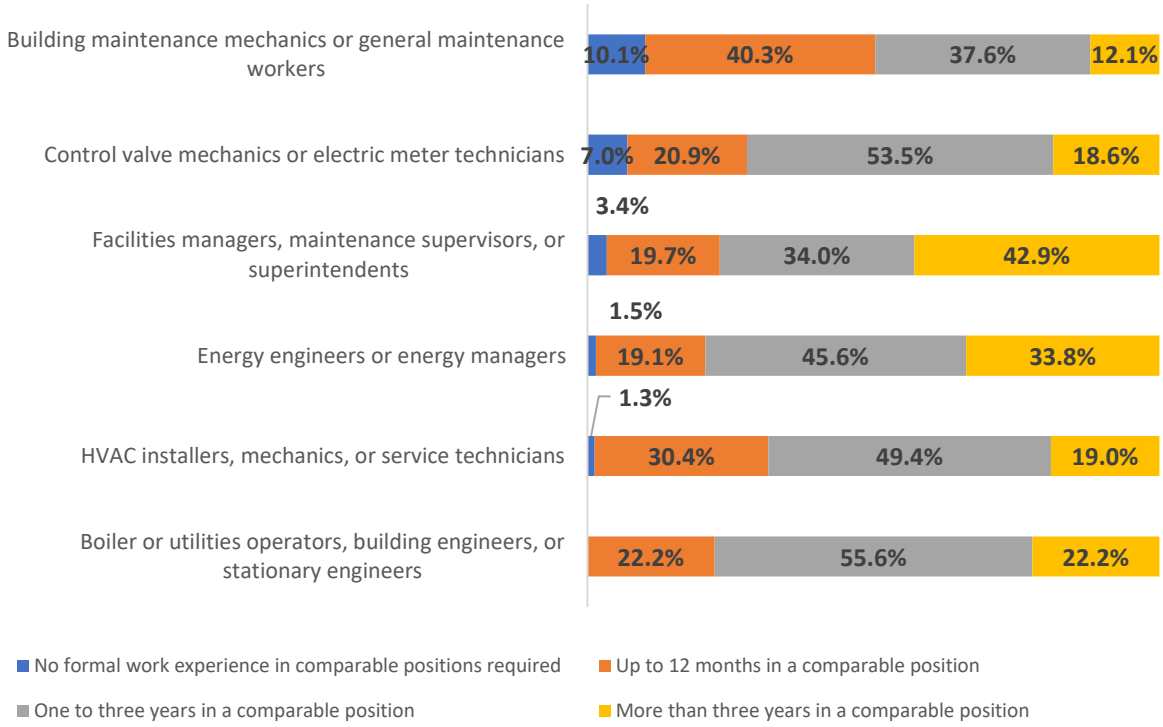


Experience is key to building operator positions. Few employers indicated that they require no formal work experience for their building operator-related occupations. In fact, only one to 10 percent of employers across each surveyed occupation reported that they do not require work experience in a comparable position. The majority of employers—roughly 50 to 79 percent—require up to 12 months of work experience, if not more, across all occupations.[19] Positions that require the most experience include:

1. Energy engineers (79 percent require at least a year or more)[20]
2. Boiler or utilities operators (78 percent)
3. Facilities managers (77 percent)
4. Control valve mechanics (72 percent)

The importance of experience and on-the-job training was equally stressed during executive interviews, where most individuals indicated that there were few opportunities to achieve on-the-job training for building operator trades. One individual noted during executive interviews that there is also a retention issue, creating a disincentive to train building operators as they would likely find employment elsewhere in the future.

FIGURE 6. REQUIRED LEVEL OF WORK EXPERIENCE



[19] It is possible and highly likely that employers would accept internships or apprenticeships to count towards experience in the "up to 12 months" category (and perhaps even beyond). However, the survey did not specifically test what type of experience is required.

[20] This percentage is the sum of respondents who reported "one to three years" and "more than three years.

Each of the tested certifications are required by a third or less of employers. However, about half of employers indicated that they do prefer for their workers to have these certifications. The top two certifications that were required by at least 30 percent of employers are the Certified Energy Manager (CEM) and Certified Facility Manager Certification (CFM).

FIGURE 7. EMPLOYER-REPORTED CERTIFICATION REQUIREMENTS

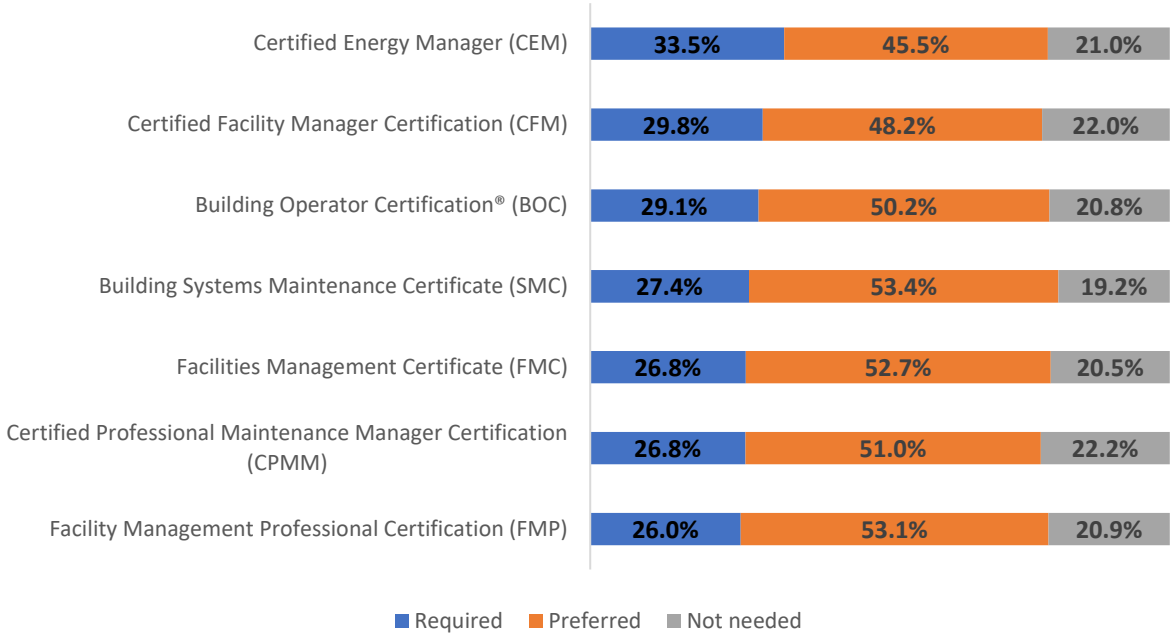


Table 2 below highlights the percent of employers that indicated these certifications are *required* for each occupation. At least 30 percent of employers required the Certified Energy Manager (CEM) for nearly all surveyed occupations except for facilities managers. Similarly, at least 30 percent of employers require the Certified Facility Manager Certification (CFM) for nearly all occupations except HVAC installers and control valve mechanics.

The Building Operator Certification (BOC) is also required by at least 30 percent of employers for building maintenance mechanics, HVAC installers, and energy engineers.

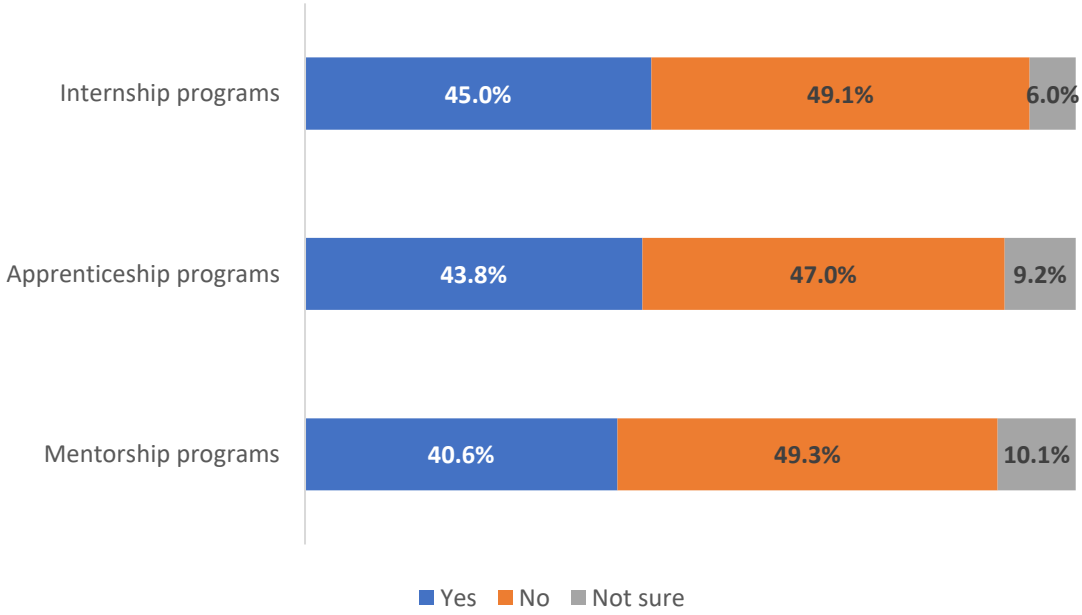
TABLE 2. EMPLOYER-REPORTED "REQUIRED" CERTIFICATIONS BY OCCUPATION[21]

	Building Operator Certification® (BOC)	Facilities Management Certificate (FMC)	Certified Professional Maintenance Manager Certification (CPMM)	Building Systems Maintenance Certificate (SMC)	Facility Management Professional Certification (FMP)	Certified Facility Manager Certification (CFM)	Certified Energy Manager (CEM)
Building maintenance mechanics or general maintenance workers	30.3%	25.9%	24.3%	29.0%	25.7%	30.6%	30.1%
HVAC installers, mechanics, or service technicians	34.2%	23.4%	23.1%	35.9%	26.9%	25.0%	32.9%
Facilities managers, maintenance supervisors, or superintendents	23.5%	25.4%	25.2%	25.9%	22.8%	30.2%	24.4%
Control valve mechanics or electric meter technicians	29.7%	27.5%	23.7%	24.4%	39.0%	27.5%	42.5%
Energy engineers or energy managers	32.8%	31.7%	35.5%	19.4%	25.4%	31.3%	49.2%
Boiler or utilities operators, building engineers, or stationary engineers	27.5%	32.0%	35.3%	26.0%	24.0%	33.3%	40.4%

[21] The percentages in this table indicate those employers that reported these certifications are "required" as opposed to "preferred" or "not needed", which are indicated in Figure 7. Please note that these are not additive, meaning that a specific occupation is not required to have all of the listed certifications. The table profiles the proportion of employers that indicated each certification is required for a particular occupation.

Forty-five percent of surveyed employers report that their company participates in internship programs for their building operator-related employees; 44 percent indicated they participate in apprenticeship programs, and 41 percent reported participation in mentorship programs.

FIGURE 8. PROGRAM PARTICIPATION



Forty-four percent of surveyed building operator employers are aware of the MassCEC Vocational Internship Program. Of those that reported they are not aware, 59 percent indicated that they would be interested in participating.

FIGURE 9. MASSCEC VOCATIONAL INTERNSHIP PROGRAM AWARENESS

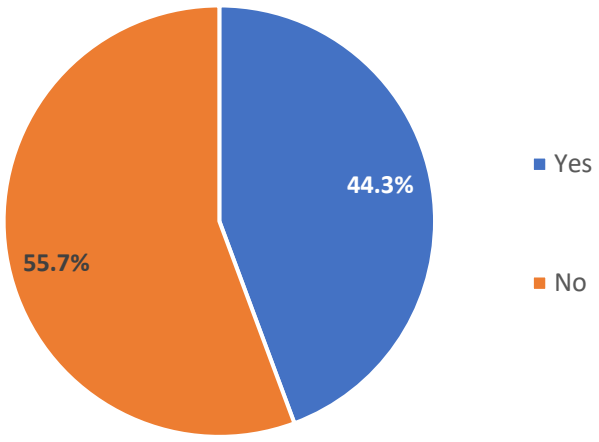
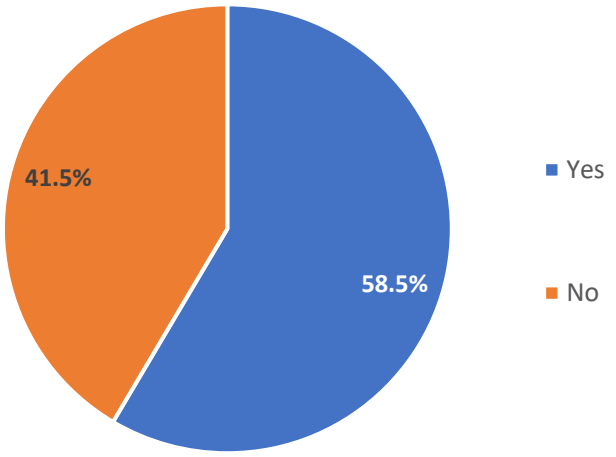


FIGURE 10. MASSCEC VOCATIONAL INTERNSHIP PROGRAM – INTEREST IN PARTICIPATION[22]



[22] This question was only asked of employers who indicated they are not aware of the MassCEC Vocational Internship Program.

Demographics & Diversity

Over half of employers participate in formal diversity training or diversity awareness events (56 percent). About three in ten employers indicated they also participate in recruitment programs for ethnic and racial minorities and just under a quarter reported participation in formal mentorship programs for ethnic and racial minorities. Only 19 percent of employers reported that they do not have any formal diversity programs at their company.

Overall, 97 percent of building operator occupations are male, and 84 percent are White. Engineers tend to have a higher proportion of women in the workforce, at 12 percent, as well as Asians (16 percent). On average, about 16 percent of building operators are Hispanic or Latinx, with building maintenance mechanics (19 percent) having a higher proportion of Hispanic or Latinx workers of all occupations. Roughly nine percent of building operators are Black or African American, four percent are Asian, and one percent are two or more races.

FIGURE 11. FORMAL DIVERSITY PROGRAMS

TABLE 3. DEMOGRAPHICS BY OCCUPATION[23]

	Male	Female	Hispanic or Latinx	White	Black or African American	American Indian or Alaska Native	Asian	Native Hawaiian or Other Pacific Islander	Two or More Races
Energy engineers or energy managers	88%	12%	5%	74%	3%	0%	16%	Insf. Data	1%
Facilities managers, maintenance supervisors, or superintendents	95%	5%	10%	80%	7%	0%	2%	0%	1%
Control valve mechanics or electric meter technicians	95%	5%	9%	76%	13%	0%	1%	Insf. Data	1%
HVAC installers, mechanics, or service technicians	99%	1%	11%	80%	6%	0%	2%	0%	1%
Building maintenance mechanics or general maintenance workers	97%	3%	19%	65%	10%	0%	4%	0%	1%
Boiler or utilities operators, building engineers, or stationary engineers	97%	3%	11%	70%	12%	0%	5%	Insf. Data	1%
Overall Average	**97%**	**3%**	**16%**	**84%**	**9%**	**0%**	**4%**	**0%**	**1%**

[23] Demographic distribution is pulled from Emsi Q1 2020 by the corresponding SOC code for each of the surveyed occupations and for all Northeastern states.

Current Worker Survey Results

Training, Experience, & Certifications

Educational attainment of current building operator employees roughly matches employer-reported requirements. Just under half (48 percent) of current workers indicated they have either a comprehensive high school diploma or vocational technical training and 35.2 percent reported possessing a Bachelor's degree or higher.

In general, HVAC installers and control valve mechanics tended to report lower educational attainment, which is in line with employer-reported requirements. Building maintenance mechanics, facilities managers, energy engineers, and boiler or utility operators tend to have educational attainment that spans the spectrum from vocational technical training to a college degree. As discussed in more depth in the executive summary, this variability is likely the result of industry type and building size, where individuals that work with larger and more complex building energy systems, such as those in hospitals or research centers, are likely to require more skillsets and education to operate these building controls technologies.

Building operators across the Northeast are more likely to report vocational technical high school as their highest level of education (28.5 percent) compared to building operators in states outside the Northeast (15.5 percent). Similarly, building operators in the Northeast are less likely to have a Bachelor's degree or higher (35.2 percent) compared to building operators outside the Northeast (51.5 percent).

FIGURE 12. HIGHEST LEVEL OF EDUCATIONAL ATTAINMENT

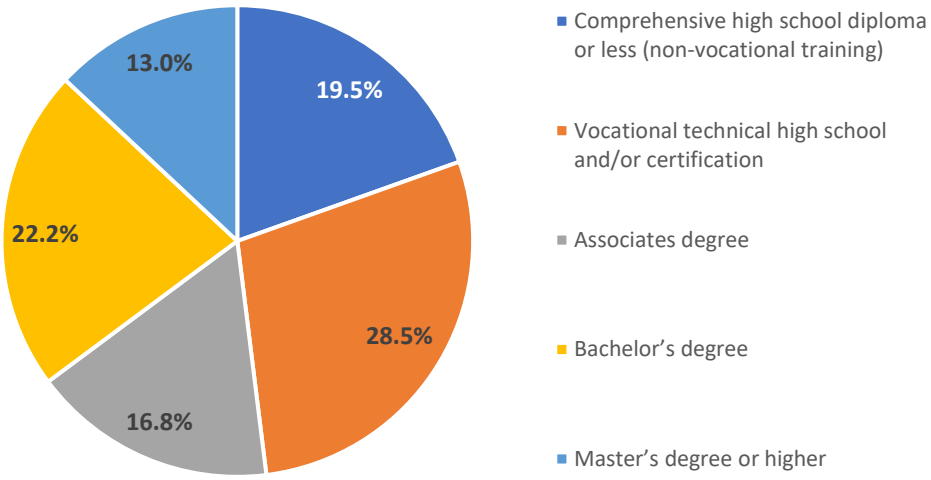


TABLE 4. HIGHEST LEVEL OF EDUCATIONAL ATTAINMENT BY OCCUPATION

	Building maintenance mechanic or general maintenance worker	HVAC installer, mechanic, or service technician	Facilities manager, maintenance supervisor, or superintendent	Control valve mechanic or electric meter technician	Energy engineer or energy manager	Boiler or utility operator, building engineer, or stationary engineer
Comprehensive high school diploma or less (non-vocational training)	16.2%	25.7%	19.4%	92.4%	24.2%	2.0%
Vocational technical high school and/or certification	35.2%	44.3%	27.4%	0.0%	16.1%	24.0%
Associates degree	24.1%	25.7%	15.9%	0.0%	0.0%	24.0%
Bachelor's degree	20.2%	2.1%	21.6%	7.6%	42.3%	0.0%
Master's degree or higher	4.3%	2.1%	15.6%	0.0%	17.4%	50.0%

Thirty-six percent of current workers reported that they do not have one of the seven tested building operator certifications. The top two certifications current workers have include the Building Systems Maintenance Certificate (SMC) (21 percent) and the Facilities Management Certificate (FMC) (15 percent). This is in contrast with what employers reported as their top required certifications—the CEM and CFM.

Overall, building operators in the Northeast were less likely to report having the majority of tested certifications compared to building operators outside the Northeast.

FIGURE 13. EMPLOYEE-REPORTED CERTIFICATIONS

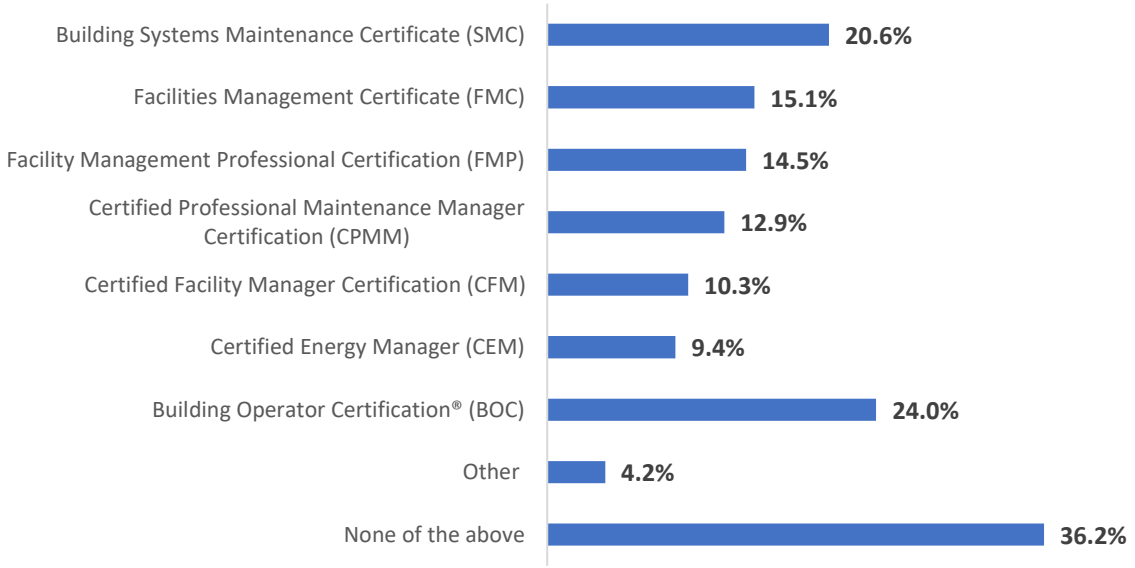


TABLE 5. EMPLOYEE-REPORTED CERTIFICATIONS BY OCCUPATION

	Building maintenance mechanic or general maintenance worker	HVAC installer, mechanic, or service technician	Facilities manager, maintenance supervisor, or superintendent	Control valve mechanic or electric meter technician	Energy engineer or energy manager	Boiler or utility operator, building engineer, or stationary engineer
Building Operator Certification® (BOC)	24.1%	2.1%	11.8%	0.0%	49.7%	50.0%
Facilities Management Certificate (FMC)	7.8%	20.7%	12.4%	0.0%	40.3%	0.0%
Certified Professional Maintenance Manager Certification (CPMM)	4.0%	53.6%	8.6%	0.0%	24.2%	26.0%
Building Systems Maintenance Certificate (SMC)	28.1%	2.1%	9.9%	7.6%	32.9%	26.0%
Facility Management Professional Certification (FMP)	11.9%	2.1%	12.4%	92.4%	17.4%	26.0%
Certified Facility Manager Certification (CFM)	8.3%	2.1%	8.3%	7.6%	16.8%	24.0%
Certified Energy Manager (CEM)	8.9%	4.2%	0.6%	0.0%	26.2%	24.0%

Of the 36.2 percent of current workers that reported "none of the above" certifications in Figure 13, the below is a breakout by each occupation surveyed. Overall, facilities managers (47.1 percent) and building maintenance mechanics (35.7 percent) were least likely to have any of the seven tested certifications.

TABLE 6. PERCENT OF EMPLOYEES WITHOUT TESTED CERTIFICATION

Occupation	% that Reported "None of the Above" Certifications
Building maintenance mechanic or general maintenance worker	35.7%
HVAC installer, mechanic, or service technician	25.7%
Facilities manager, maintenance supervisor, or superintendent	47.1%
Control valve mechanic or electric meter technician	0.0%
Energy engineer or energy manager	24.8%
Boiler or utility operator, building engineer, or stationary engineer	24.0%

Only 34 percent of current workers report having had prior work experience in the building operator trades. Occupations most likely to have had prior work experience including HVAC installers and technicians (56 percent), energy engineers (42 percent), and boiler or utility operators (50 percent).

FIGURE 14. PRIOR WORK EXPERIENCE

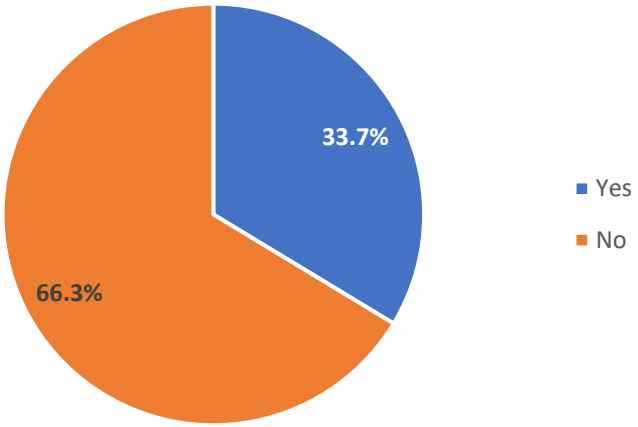


TABLE 7. PRIOR WORK EXPERIENCE BY OCCUPATION

	Building maintenance mechanic or general maintenance worker	HVAC installer, mechanic, or service technician	Facilities manager, maintenance supervisor, or superintendent	Control valve mechanic or electric meter technician	Energy engineer or energy manager	Boiler or utility operator, building engineer, or stationary engineer
Yes	27.6%	55.7%	31.2%	0.0%	41.6%	50.0%
No	72.4%	44.3%	68.8%	100.0%	58.4%	50.0%

About 20 to 28 percent of current workers have participated in an apprenticeship, mentorship, or internship program. Of those that have participated in such a program, the majority agree that these programs have been key to improving their job prospects. All surveyed workers reported that internships and apprenticeships have been helpful in their ability to acquire a job, with 71 percent indicating that they "strongly" agree that apprenticeship programs have helped them land their current job. Ninety-four percent of respondents also reported that mentorship programs have been pivotal to their current career success in the building operator trades.

FIGURE 15. PROGRAM PARTICIPATION

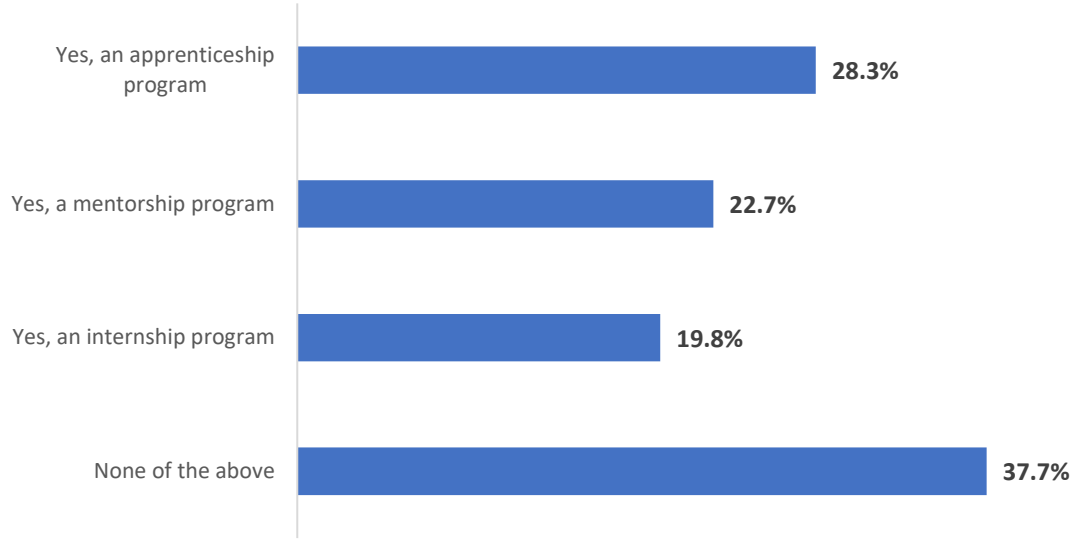
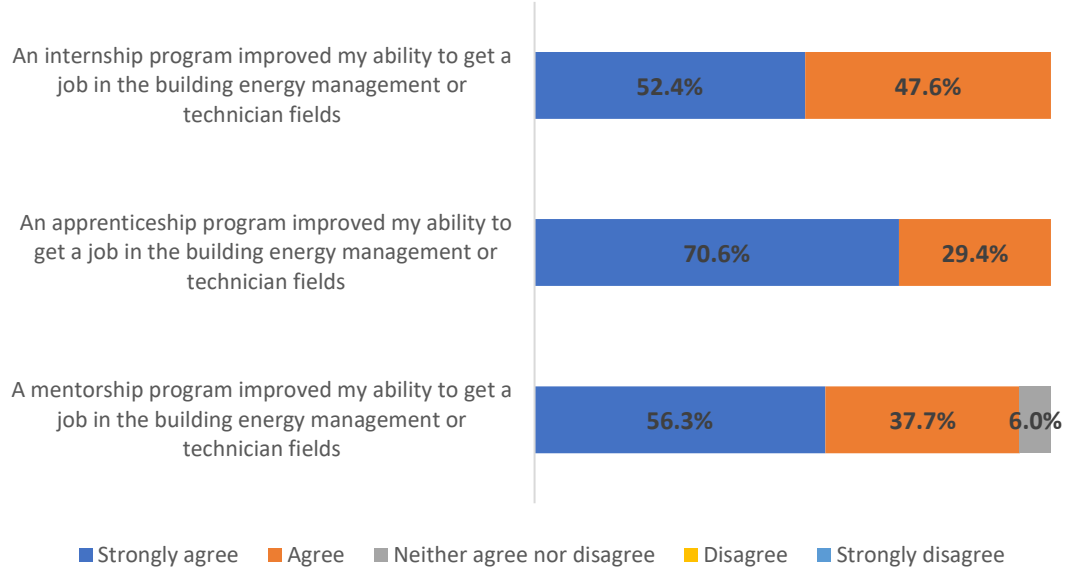


FIGURE 16. IMPORTANCE OF PROGRAM PARTICIPATION[24]

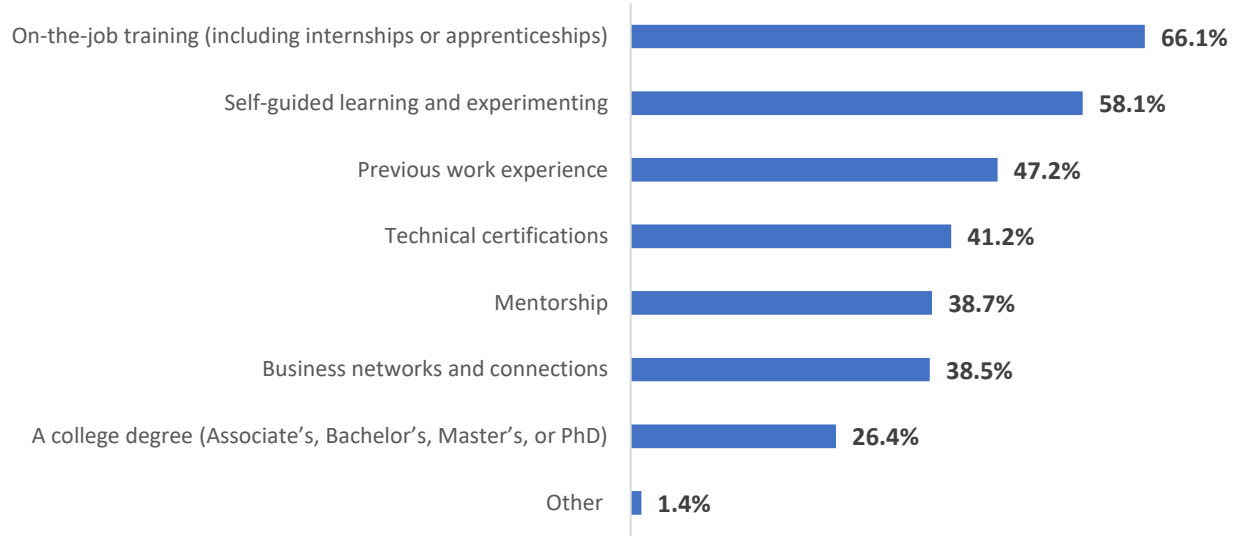


[24] This question was only asked of respondents who indicated that they have participated in an apprenticeship, mentorship, or internship program.

On-the-job training is the most important element to successful career navigation in building operations and facilities maintenance trades according to current workers; 66 percent of surveyed workers selected this as important, followed by self-guided learning and experimenting[25] (58 percent), previous work experience (47 percent), and technical certifications (41 percent).

Building operators in the Northeast were less likely to indicate that a college degree has been important in their successful career navigation (26.4 percent) compared to building operators outside the Northeast (48.4 percent).

FIGURE 17. IMPORTANCE TO SUCCESSFUL CAREER NAVIGATION

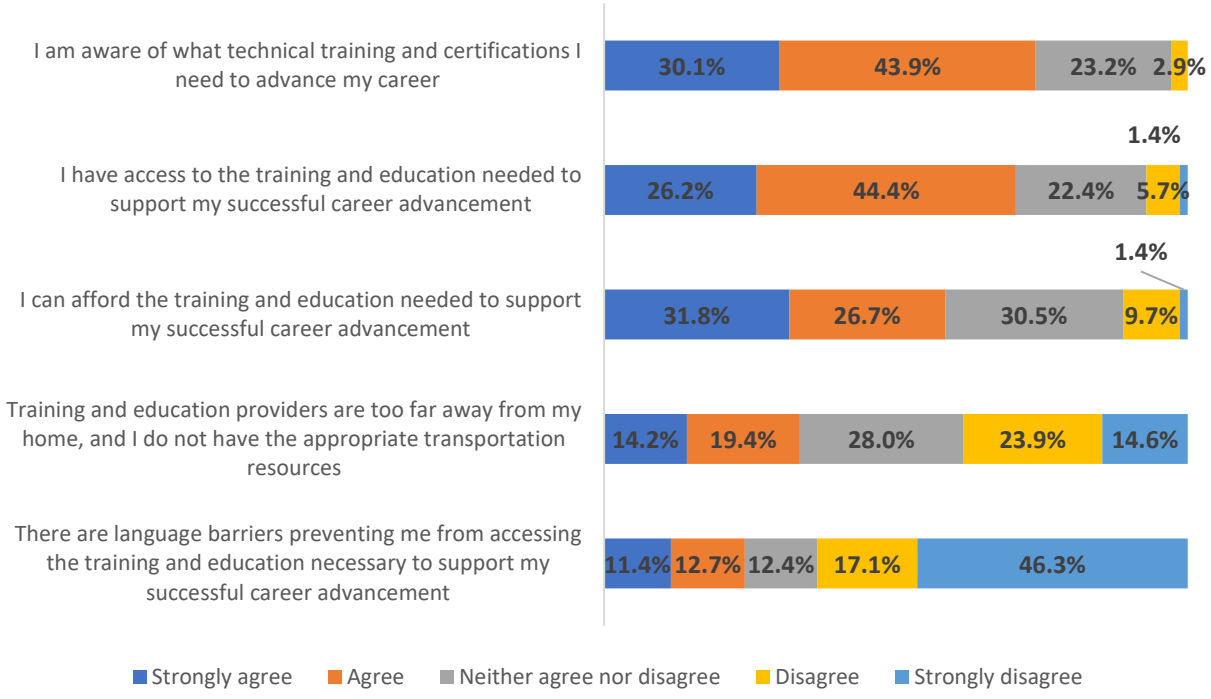


Few surveyed workers reported barriers to entry—either financial, language, or geographic—to career navigation in the building operator trades. Seventy-four percent of current workers are aware of what technical training and certifications they need to advance their career and 71 percent reported having access to the training and education needed. Over half (58 percent) indicated they can afford the training and education required to advance their career.

The majority of respondents (64 percent) do not feel there are language barriers preventing them from accessing the necessary training and education, and only a third (34 percent) report that training providers are too far or they do not have access to the appropriate transportation resources.

FIGURE 18. BARRIERS TO ENTRY

[25] This includes taking the initiative to achieve personal and professional development, identifying goals and learning needs, implementing the appropriate strategies to achieve these goals and learning outcomes, etc.


I am aware of what technical training and certifications I need to advance my career
30.1%
43.9%
23.2%
2.9%
I have access to the training and education needed to support my successful career advancement
26.2%
44.4%
22.4%
5.7%
1.4%
I can afford the training and education needed to support my successful career advancement
31.8%
26.7%
30.5%
9.7%
1.4%
Training and education providers are too far away from my home, and I do not have the appropriate transportation resources
14.2%
19.4%
28.0%
23.9%
14.6%
There are language barriers preventing me from accessing the training and education necessary to support my successful career advancement
11.4%
12.7%
12.4%
17.1%
46.3%
Strongly agree
Agree
Neither agree nor disagree
Disagree
Strongly disagree

Employment Benefits

The majority of current workers report receiving some level of healthcare as well as retirement benefits through their employer. Eighty-one percent of current workers receive healthcare, and 50 percent reported that their company pays for all of their health insurance; 31 percent indicated their company pays for partial health insurance. Seventy-eight percent of current workers receive retirement benefits.

Some occupations are more likely to receive healthcare benefits compared to others, but the majority of workers across all occupations receive retirement benefits. The majority of building maintenance mechanics, HVAC installers, and energy engineers reported that their company pays for all of their health insurance. On the other hand, 92 percent of control valve mechanics that participated in the survey do not receive any contributions to health insurance from their employer. Seventy-two percent of boiler or utility operators receive only partial health insurance coverage from their employer.

FIGURE 19. HEALTHCARE BENEFITS

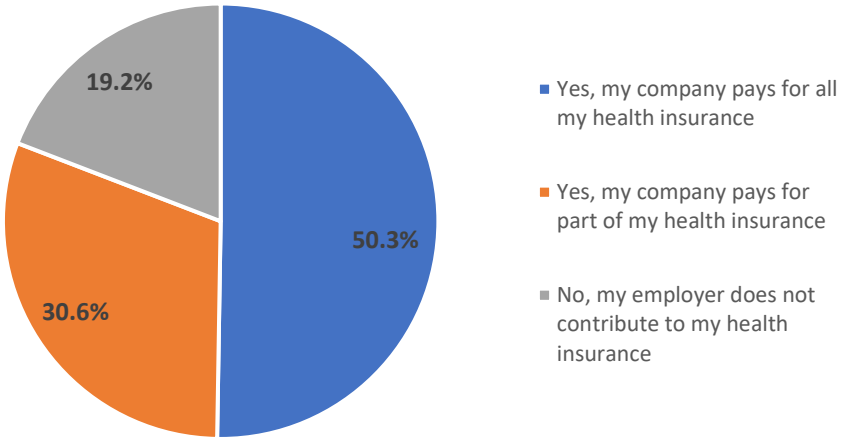


TABLE 8. HEALTHCARE BENEFITS BY OCCUPATION

	Building maintenance mechanic or general maintenance worker	HVAC installer, mechanic, or service technician	Facilities manager, maintenance supervisor, or superintendent	Control valve mechanic or electric meter technician	Energy engineer or energy manager	Boiler or utility operator, building engineer, or stationary engineer
Yes, my company pays for all my health insurance	69.1%	53.6%	36.9%	7.6%	51.0%	26.0%
Yes, my company pays for part of my health insurance	16.2%	46.4%	43.3%	0.0%	16.8%	72.0%
No, my employer does not contribute to my health insurance	14.8%	0.0%	19.7%	92.4%	32.2%	2.0%

FIGURE 20. RETIREMENT BENEFITS

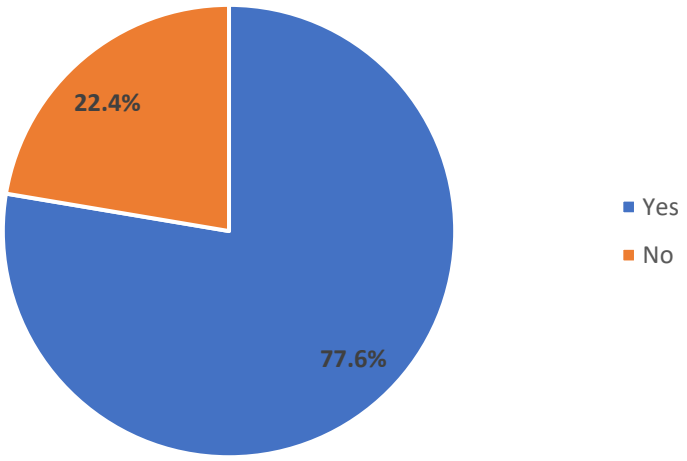


TABLE 9. RETIREMENT BENEFITS BY OCCUPATION

	Building maintenance mechanic or general maintenance worker	HVAC installer, mechanic, or service technician	Facilities manager, maintenance supervisor, or superintendent	Control valve mechanic or electric meter technician	Energy engineer or energy manager	Boiler or utility operator, building engineer, or stationary engineer
Yes	69.1%	100.0%	75.2%	100.0%	83.9%	100.0%
No	30.9%	0.0%	24.8%	0.0%	16.1%	0.0%

In addition to healthcare and retirement benefits, 82 percent of surveyed workers reported receiving paid vacation from their company.

Additional employment benefits for building operator trades include flexible work schedules (49 percent), company vehicles (37 percent), tuition support (30 percent), and transportation stipends (27 percent).

Building operators in the Northeast are less likely to receive paid vacation (82.2 percent) compared to building operators outside the Northeast (91.5 percent). However, Northeastern building operators are more likely to receive a transportation stipend (27.2 percent) compared to those outside the Northeast (15.8 percent).

FIGURE 21. PAID VACATION

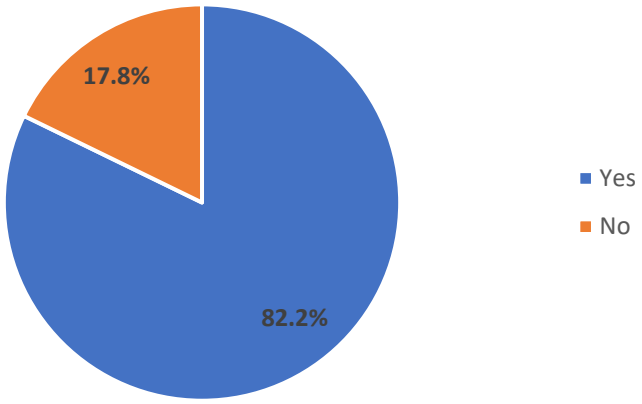


FIGURE 22. ADDITIONAL EMPLOYMENT BENEFITS

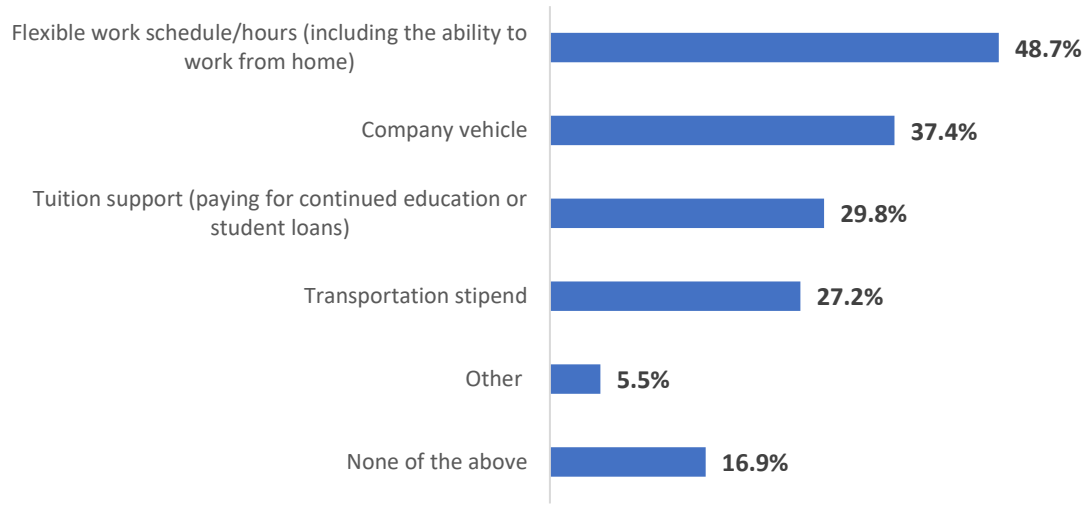


TABLE 10. ADDITIONAL EMPLOYMENT BENEFITS BY OCCUPATION

	Building maintenance mechanic or general maintenance worker	HVAC installer, mechanic, or service technician	Facilities manager, maintenance supervisor, or superintendent	Control valve mechanic or electric meter technician	Energy engineer or energy manager	Boiler or utility operator, building engineer, or stationary engineer
Transportation stipend	24.4%	2.1%	27.7%	0.0%	33.6%	52.0%
Flexible work schedule/hours (including the ability to work from home)	40.2%	79.3%	52.5%	7.6%	67.1%	4.0%
Company vehicle	27.6%	46.4%	39.2%	92.4%	40.9%	52.0%
Tuition support (paying for continued education or student loans)	24.1%	72.2%	21.0%	0.0%	34.2%	74.0%
Other (Specify)	7.9%	0.0%	3.8%	0.0%	8.1%	0.0%
None of the above	15.9%	2.1%	20.1%	0.0%	16.1%	24.0%

Wages

Overall, entry-level positions for the six building operator-related occupations pay a premium over the statewide average. Massachusetts' overall entry-level wage is $11.95, while building operator jobs pay roughly $2 to $18 more per hour. For mid-level positions, nearly all building operator occupations, except for building maintenance mechanics earn a premium over the statewide median.

While the overall average wages for building operator occupations are high, it is likely that building operator wages vary by sector, industry, and building types. For instance, facilities managers for smaller residential units that conduct more general maintenance work are likely to make less than the overall occupational average. In an executive interview, one individual noted hiring difficulty in the public sector was due to the fact that the city or state government was unable to offer prevailing wages for open building operator position.

TABLE 11. MASSACHUSETTS BUILDING OPERATOR OCCUPATIONAL WAGES[26]

	Entry	Median Wage	Senior
Massachusetts Overall	$12.50	$24.14	$59.88
Building maintenance mechanics or general maintenance workers	$14.71	$22.48	$34.82
HVAC installers, mechanics, or service technicians	$19.54	$29.87	$42.56
Facilities managers, maintenance supervisors, or superintendents	$22.13	$35.73	$55.97
Control valve mechanics or electric meter technicians	$19.48	$36.42	$47.74
Energy engineers	$29.71	$52.38	$82.00
Boiler or utilities operators, building engineers, or stationary engineers	$22.00	$29.65	$47.39

[26] Massachusetts overall wages are from the Bureau of Labor Statistics, Occupational Employment Statistics (BLS OES), May 2019. Occupation-specific wages are from Emsi, Q3 2020. Entry-level wages are taken at the 10th percentile while senior-level wages are taken from the 90th percentile. Occupational wages are pulled using the corresponding SOC codes.

Career Satisfaction & Navigation

The majority of building operators (93 percent) are satisfied with their career in building energy management, and 58 percent are "very" satisfied. This holds true across all occupations, with HVAC installers, boiler or utility operators, and building maintenance mechanics reporting the highest levels of "very" satisfied.

FIGURE 23. CAREER SATISFACTION

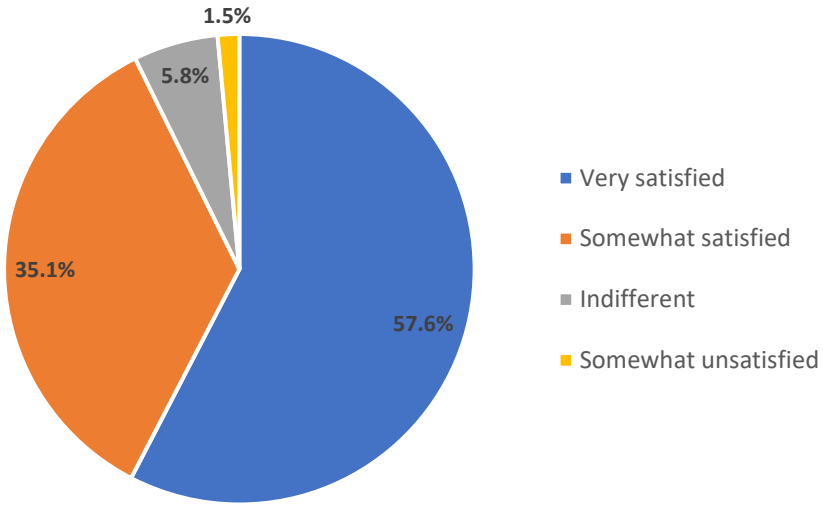


TABLE 12. CAREER SATISFACTION BY OCCUPATION

	Building maintenance mechanic or general maintenance worker	HVAC installer, mechanic, or service technician	Facilities manager, maintenance supervisor, or superintendent	Control valve mechanic or electric meter technician	Energy engineer or energy manager	Boiler or utility operator, building engineer, or stationary engineer
Very satisfied	67.9%	100.0%	51.3%	7.6%	34.9%	76.0%
Somewhat satisfied	27.8%	0.0%	36.3%	92.4%	65.1%	0.0%
Indifferent	4.3%	0.0%	12.1%	0.0%	0.0%	0.0%
Somewhat unsatisfied	0.0%	0.0%	0.3%	0.0%	0.0%	24.0%
Very unsatisfied	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

The majority of surveyed current workers (78 percent) reported that they believe there are opportunities for advancement with their current employer, including promotion to a higher position with more responsibilities and increased wages. Only 21 percent indicated they do not feel there are opportunities for advancement at their company. This is true across all occupations, with control valve mechanics, building maintenance mechanics, energy engineers, and HVAC installers and mechanics more likely to believe there are opportunities for career advancement.

Building operators in the Northeast are less likely to feel there are opportunities for advancement (77.5 percent) compared to building operators outside the Northeast (88.8 percent).

FIGURE 24. ADVANCEMENT OPPORTUNITY

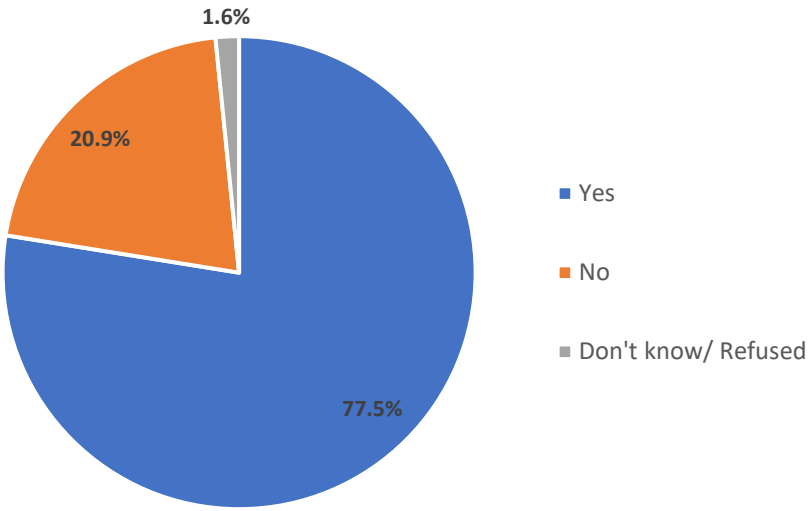
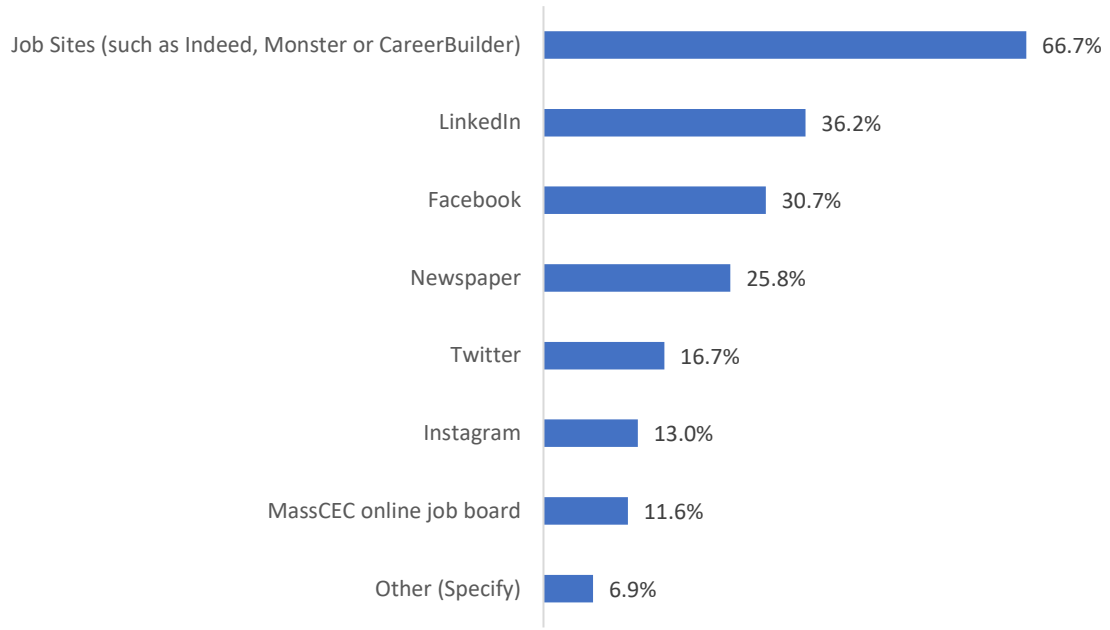


TABLE 13. ADVANCEMENT OPPORTUNITY BY OCCUPATION

	Building maintenance mechanic or general maintenance worker	HVAC installer, mechanic, or service technician	Facilities manager, maintenance supervisor, or superintendent	Control valve mechanic or electric meter technician	Energy engineer or energy manager	Boiler or utility operator, building engineer, or stationary engineer
Yes	91.7%	81.4%	59.6%	100.0%	83.9%	76.0%
No	8.3%	18.6%	36.0%	0.0%	16.1%	24.0%
Don't know/ Refused	0.0%	0.0%	4.5%	0.0%	0.0%	0.0%

The majority of current workers (67 percent) reported that they would use general online job sites such as Indeed, Monster, or CareerBuilder if searching for a new job. Additionally, 36 percent indicated they would use LinkedIn to search for a new job.

FIGURE 25. JOB SEARCH SOURCES



Appendix A: Methodology

BW Research conducted employer interviews with organizations that had locations with 50 or more employees throughout Massachusetts. This was to ensure that locations were large enough to employ dedicated building operators. All industry types were included for the survey effort. BW Research conducted phone interviews with in-house phone bank. Employers were called between 8:30am and 5:30pm EST Monday through Friday. BW Research also programmed the online survey instrument in-house and distributed via email to a known database of large firms in Massachusetts.

The employer survey was fielded between February 12th and March 12th, 2020 and resulted in 232 total completes. The margin of error for questions answered by all respondents is +/- 6.38 percent at the 95 percent confidence interval.

BW Research also conducted online surveys of current workers in the Northeast (Massachusetts, Maine, New Hampshire, Vermont, Connecticut, Rhode Island, New York) that were employed in relevant building operator occupations:

1. Building maintenance mechanics or general maintenance workers
2. HVAC installers, mechanics, or service technicians
3. Facilities managers, maintenance supervisors, or superintendents
4. Control valve mechanics or electric meter technicians
5. Energy engineers or energy managers
6. Boiler or utilities operators, building engineers, or stationary engineers

Current workers were recruited through third party online panels of pre-screened potential respondents. The survey was programmed in-house by BW Research.

The current worker survey was fielded between February 19th and March 12th, 2020. There were 293 respondents in total. The combined margin of error for the current worker survey is +/- 5.72 percent at the 95 percent confidence interval for questions answered by all respondents.

The research team also conducted executive interviews with individuals from the following organizations: the Northwest Energy Efficiency Council, the City of Boston, the Massachusetts Facilities Administrators Association, the Boston Medical Center, Green Jobs Academy, and EMCOR.