



2023

# Pennsylvania Energy Efficiency Workforce Needs

PRODUCED FOR THE PENNSYLVANIA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION



# Executive Summary

## Introduction

The Pennsylvania Department of Environmental Protection (PA DEP) contracted with BW Research to conduct a workforce needs assessment of key occupations within energy efficiency. This assessment will assist PA DEP in developing its application to the State and Community Energy Programs grant funding available through the Inflation Reduction Act. This report highlights key challenges that the energy efficiency industry is facing from an array of perspectives, including employers and training providers. The findings and recommendations of this report outline several opportunities to enhance and support Pennsylvania's energy efficiency industry and its current and prospective workers and employers.

## Key Findings

- 1 A significant number of additional energy efficiency and building electrification workers<sup>1</sup> will be needed over the next ten years.**

Our models forecast increased energy efficiency and building electrification worker demand spurred by the Inflation Reduction Act and demographic trends, amounting to an additional 2,045 Heating, Air Conditioning, and Refrigeration (HVAC/R) Mechanics and Installers working full-time every year for ten years on average (Table 3). This rate is considerably higher than the ten-year historical average of 440 additional jobs every year.<sup>2</sup> Construction and Building Inspectors, which is the SOC code that includes energy auditors and building performance specialists, is expected to require an average of 145 additional full-time workers for ten years.

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<sup>1</sup> PA DEP and BW Research identified seven occupations/ six SOC occupations as the most important energy efficiency roles. These occupations are: Construction and Building Inspectors; Electricians; Heating, Air Conditioning, and Refrigeration Mechanics and Installers; Insulation Workers, Floor, Ceiling, and Wall; Miscellaneous Construction and Related Workers; and Plumbers, Pipefitters, and Steamfitters.

<sup>2</sup> Source: JobsEQ®. 2023Q1

- 2** **Current energy efficiency and building electrification contractors have varied outlooks on hiring over the next three years, which is in sharp contrast to the anticipated number of workers needed.**
- Across the identified priority occupations, between 22 percent and 34 percent of employers expect to have more employees in these occupations three years from now than they currently employ. A substantial 61 percent to 67 percent of employers expect to have the same number of workers (Figure 12). Interest in hiring is even more drastic among smaller firms; only 5 percent of firms with fewer than ten workers expect to add workers over the next three years. This is particularly important when considering that 81% of these small businesses primarily work on single-family residential buildings and these small businesses account for a large share of repair and maintenance work in single-family homes.
- 3** **While there is some interest in supporting technical knowledge, the existing system of learning through manufacturers and distributors seems to work well for most employers.**
- Respondent employers reported high rates of at least having heard of the Home Efficiency Rebate (HER) (formerly known as Performance-Based Whole House Rebate, or HOMES) and Home Electrification and Appliance Rebate (HEAR) programs (Figure 11). While survey respondents were generally interested in additional employee training and certification in new HVAC or Plumbing technologies (46 percent ‘very interested’ and 35 percent ‘somewhat interested’) (Figure 25), most reported that additional training was not needed (42 percent) or that they did not plan on offering additional training to staff (29 percent) (Figure 23).
- Among those interested but not planning to offer new training, time and the cost of training were the main barriers identified (Figure 24). Interviews with contractors and distributors suggest that training around rebate programs, funding and financing options, and customer services and sales were of particular interest rather than technical training.
- 4** **Licenses are useful and attractive for some employers, but work experience is the primary requirement and characteristic of interest.**
- Between 22 percent and 43 percent of employers reported specific certifications they require or prefer for priority occupations (Figure 17). Employers most often reported that 12 months or less of experience is required for most entry-level roles (Figure 18), highlighting the premium that employers place on having experience on-site experience via pre-apprenticeship programs, apprenticeships, or other on-the-job training programs.

- 5** **There is a need to diversify the energy efficiency workforce, as the current workforce is more White and more male than the statewide working population.**

At least nine in ten workers in the priority occupations are male, compared to about 52% of the overall workforce (Figure 1), and White workers account for a greater proportion of these occupations (Table 4). About one in five of these workers are also 55 years of age or older, and, given the physical nature of this work, a higher rate of retirements among these workers may also be impending. One particularly troubling figure is that more than half of Construction and Building Inspectors—which include energy auditors and building performance specialists—are 55 years of age or older.
- 6** **Energy efficiency jobs in Pennsylvania typically offer living wages and tend not to require a four-year degree. Workers in the energy efficiency space are also generally not members of unions, particularly among firms that primarily work in single-family residential markets.**

All priority occupations highlighted in this research have median hourly wages that exceed the living wage—which accounts for regional cost differences in energy, insurance, housing, and food—for a single adult and for a family of four with two working adults (Table 6), and few employers ask for a two-year degree or more (Table 7).
- 7** **Employers highly value worker experience, which means connecting talent with workforce training programs and connecting those programs to employers may be a first step for building a more robust talent pipeline.**

Aside from a general lack of applicants, a lack of prior work experience was cited as the most significant reason for hiring difficulty for many roles, including HVAC/R Mechanics and Installers (Figure 16).

Furthermore, even though only 14% of employers stated that applicants from pre-apprenticeship or other job training programs are typically missing or deficient in skills (Figure 20), only 10% reported actually working with training and education providers (Figure 22). Better connections between job seekers and workforce programs—and better connections between employers to these programs—may help alleviate some hiring obstacles identified. Programs like PowerCorps and the Philadelphia Energy Authority’s Green Training programs already highlight proven models to connect talent from disadvantaged backgrounds into gainful energy efficiency and building electrification employment.
- 8** **Program design may help boost demand for energy efficiency and building electrification activities.**

Several interviewees noted that there are some administrative aspects that require additional consideration. First, the system through which contractors learn about rebates is scattered—one contractor told the research team it was not uncommon to hear about rebates from distributors, utilities, non-profits, and even customers. There is currently no centralized resource (or at least one that contractors were aware of). Another issue is an aging housing stock

in some parts of the state will mean that many homes will have to undergo weatherization and insulation, as well as updated electrical work, before heat pump systems can be installed. Furthermore, the cost of these actions—even with the extensive IRA rebates—may be cost-prohibitive for some homeowners, so the ability to finance this work across contractors may increase uptake rates for some programs.

## Recommendations

**1 Create early education and awareness programs to increase the awareness of the well-paying jobs in the energy efficiency field.**

Many interviewees reported that there was a significant need to educate young job seekers about the potential career pathways within the trades while highlighting wages and the potential for entrepreneurship. Some recommendations from interviewees included information campaigns in schools and hands-on field trips, primarily in middle and high school when students are considering career possibilities. Job-readiness “bootcamps” and pre-apprenticeships are also useful for giving job seekers an opportunity to experiment with different roles to ensure that they are interested in the field before committing to a career or further education while also preparing them for the expectations and demands of the professional world.

**2 Increase access to support and wraparound services.**

Support and wraparound services are critical to removing barriers for potential workers getting the training and education needed for a career in the energy efficiency field. Two significant barriers reported by stakeholders included transportation and childcare, though other services like career counseling, mental health support, specific support for individuals returning from the justice system, and emergency housing support are important. Paid training opportunities are also important to ensure job seekers do not have to risk making ends meet in the short run to build their long run career.

**3 Reinforce existing training programs.**

None of the training programs we spoke with had challenges filling the seats for their programs, and most were looking to scale their programs. The size of facilities, the cost of equipment and systems to train on, and additional high-quality instructors are all costs to these programs that increase significantly when more seats are being considered. Some stakeholders also mentioned that some programs may benefit from an update in curriculum that is paired with modern equipment that the programs cannot afford.

- 4 Support diversity in the talent pipelines.**

Intentionally focusing outreach and awareness campaigns to be inclusive of more diverse and lower-wealth communities is one important step. Supporting the funding, equipment, facilities, and curriculum of training and education programs that primarily serve diverse and lower-wealth communities is another important step. The provision of wraparound support services can also help ensure that interested job seekers of any background are able to enter and succeed within training opportunities.
- 5 Foster small businesses and entrepreneurs.**

Hiring challenges may be one reason for diminished interest growing a successful business, but survey and interview results suggest that many small business owners may be hesitant to add more employees because of the additional administration and resources it would require. For example, a small business owner may need to buy another service van or hire a devoted Human Resources manager if they were to staff up to fully meet their current demand. A small business case management service—which supports small businesses as they look to grow their operations—may help bridge some of these barriers that are keeping employers from increasing their staffing to meet the demand they’re currently experiencing.
- 6 Consider opportunities to streamline contractor knowledge of rebates, incentives, and financing options across programs.**

Contractors reported getting knowledge of these critical program details from a range of sources, and inconsistency and uncertainty can lead some contractors to try to circumvent the conversation around rebates and incentive altogether, which could dampen demand for energy efficiency programs in the long run.

## About the Project Team

### **BW Research Partnership**

BW Research delivers research and strategic consulting that supports stronger communities, and drives healthier economies, ecologies, and employment. We are problem solvers who use rigorous methodologies to make sure our conclusions are based on empirical data and immersive engagement with stakeholders and communities, all backed by deep experience navigating economic, workforce, technology, and policy issues. Over the years, our comprehensive understanding of workforce and economic development issues has made us a sought-after partner for governmental agencies, nonprofits, and commercial enterprises in sectors ranging from healthcare and education to technology. Our practice emphasizes the climate and clean-energy sectors, and we have led hundreds of workforce, supply chain, community benefit, policy and market research studies within the climate and clean-energy sectors, integrating needs for equitable access to opportunities and investments throughout.

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### **SPECIAL THANKS TO ORGANIZATIONS WE SPOKE WITH**

The Air Conditioning Contractors Association

The Clean Energy Center at Penn College

Community College of Allegheny County

Donahue's Heating and Cooling

Eastern PA IBEW

Mitsubishi Electric Trane HVAC

Peirce-Phelps LLC

Pennsylvania Department of Labor and Industry

Pennsylvania Housing Research Center

The Philadelphia Energy Authority

PowerCorps

Standard Air & Lite

Sustainable Pittsburgh

Thaddeus Stevens College of Technology

Wes's Heating & Cooling Inc.

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# The Energy Efficiency Landscape in PA

**The energy efficiency and electrification industry in Pennsylvania (PA) is significant, and growing consumer demand paired with federal and state incentives means this industry is poised to see substantial growth.** The research team identified six<sup>3</sup> occupations that are important to study given their heavy involvement in decarbonizing homes. Five of the six occupations of interest are found within the construction and extraction occupational group: (1) Electricians; (2) Floor, Ceiling, and Wall (FCW) Insulation Workers; (3) Plumbers, Pipefitters, and Steamfitters (Plumbers); (4) Construction and Building Inspectors, including energy auditors and Home Energy Rating System (HERS) raters; and (5) All Other Construction and Related Workers. The remaining occupation— (6) Heating, Air Conditioning, and Refrigeration (HVAC/R) Mechanics and Installers—is classified as an installation, maintenance, and repair occupation. Each of these occupations play a vital role in the energy efficiency and electrification sector. While all six of these occupations are discussed throughout this report, HVAC/R Mechanics and Installers receive special focus and attention because efficient heating and cooling programs are of particular focus for the Pennsylvania Department of Environmental Protection. Energy auditors also receive greater attention as they evaluate a home’s current efficiency, which is the first crucial step in decarbonizing residences and making them eligible for grants.

**Electricians are the most numerous priority occupation, followed by Heating, Air Conditioning, and Refrigeration Mechanics and Installers.** Pennsylvania has 6.3 million workers and an unemployment rate of 4.3 percent. Among the six priority occupations, electricians are the most numerous, almost 24,000 are found across the state. While lower than the state average, both Plumbers and Electricians have unemployment rates closest to the state average, at 4.1 percent and 4.0 percent, respectively. The lowest unemployment rate (2.0 percent) of the six occupations is found among Construction and Building Inspectors (Table 1).

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<sup>3</sup> Because Building Performance Specialists and Energy Auditors/HERS Raters fit into the same Standard Occupation Classification (Construction and Building Inspectors), there are only six occupations listed in tables containing Bureau of Labor Statistics data, while survey responses contain the full set of seven occupations. Weatherization Technicians are classified under the Construction and Related Workers, All Other in the Standard Occupation Classification. Six/seven occupations will be utilized depending on if formal SOC definitions or job titles are used for that particular analysis.

HVAC/R Mechanics and Installers have the highest location quotient, while FCW Insulation Workers have the smallest.<sup>4</sup> HVAC/R Mechanics and Installers have a location quotient of 1.14, the highest of the six occupations, meaning that there is a higher concentration of these workers in PA than there is in the United States as a whole (Table 1).

**TABLE 1. OCCUPATIONAL EMPLOYMENT IN PENNSYLVANIA, 2023Q1<sup>5</sup>**

6-digit SOC Code	Occupation	Total Employment	Unemployment	Location Quotient
<b>Pennsylvania Overall Workforce</b>		<b>6,283,677</b>	<b>4.3%</b>	<b>1.00</b>
47-2111	Electricians	23,824	4.0%	0.80
47-2131	Insulation Workers, Floor, Ceiling, and Wall <sup>6</sup>	449	2.4%	0.38
47-2152	Plumbers, Pipefitters, and Steamfitters	16,824	4.1%	0.87
47-4011	Construction and Building Inspectors (Energy Auditors/HERS Raters and Building Performance Specialists)	5,159	2.0%	1.00
47-4099	Construction and Related Workers, All Other (includes Weatherization Technicians)	1,170	3.3%	0.94
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	18,401	3.3%	1.14

**The number of HVAC/R Mechanics and Installers has seen the fastest growth of all analyzed occupations.** Since 2015, employment among HVAC/R Mechanics and Installers increased by 25.3 percent, and employment among Plumbers grew the slowest (5.5 percent). All Other Construction and Related Workers are the only occupation that lost employment between 2015 and 2023, a 24.2 percent reduction (Table 2).

<sup>4</sup> Location quotients (LQ) are a way to measure concentration of an occupation. A LQ that is greater than one means that there are more of those occupations in the region relative to the national average. A LQ lower than 1 suggests there are proportionally fewer of those jobs relative to the national average.

<sup>5</sup> Source: JobsEQ®. 2023Q1. Based on a four-quarter moving average and on Place of Work estimates.

<sup>6</sup> This number may be artificially low because of a classification issue. Some employers may identify their insulation workers as General Construction Laborers, which would not be counted here.

TABLE 2. OCCUPATIONAL EMPLOYMENT OVER TIME IN PENNSYLVANIA<sup>7</sup>

6-digit SOC Code	Occupation	Employment Growth (2015-2023 Q1)	Employment Growth (2021-2022)
Pennsylvania Overall Workforce		3.5%	4.4%
47-2111	Electricians	6.1%	4.0%
47-2131	Insulation Workers, Floor, Ceiling, and Wall	14.6%	0.1%
47-2152	Plumbers, Pipefitters, and Steamfitters	5.5%	3.2%
47-4011	Construction and Building Inspectors	16.3%	4.2%
47-4099	Construction and Related Workers, All Other (includes Weatherization Technicians)	-24.2%	-1.3%
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	25.3%	6.2%

## GAP ANALYSIS FOR FUTURE DEMAND AND EXPECTED GROWTH

Utilizing The Nature Conservancy's *Potential Reconciliation Climate Policies: An Economic Impact Analysis Report, Pennsylvania* report and modeling effort, this analysis identifies the gap between the anticipated number of jobs created through 2032 and the share of workers in Pennsylvania who are currently available or employed. The workforce projections were developed by combining BLS occupation-level demographic forecasts and the predicted additional jobs created through Inflation Reduction Act (IRA) policies, as modeled in the above-mentioned Nature Conservancy report. For a full methodology, please see Appendix A on page 47.

**Three occupations are projected to need more than 2,000 new workers working full-time every year for ten years on average.** The average number of new workers needed over time is even more drastic if all anticipated energy efficiency activities are done over a shorter timeframe. If the number of energy efficiency workers in these occupations does not grow for the first five years, the number of additional new workers needed every year for five years roughly doubles, which would mean that between the years 2028 and 2032, 4,100 new HVAC/R Mechanics and Installers would be needed to work on these projects full time for five years, which would be a 22 percent increase from the current number of HVAC/R Mechanics and Installers. An estimated 145 new Construction and Building Inspectors (which includes energy auditors and building performance specialists) will need to work full-time to meet the anticipated demand (Table 3). Although this represents only a three percent increase in the total number of workers within this occupation, the true growth rate is likely higher as the SOC-designated occupation also includes municipal building codes inspectors, resulting in an artificially lower growth rate.

<sup>7</sup> Source: JobsEQ®. Based on a four-quarter moving average and on Place of Work estimates.

TABLE 3. FORECASTED DEMAND FOR KEY OCCUPATIONS

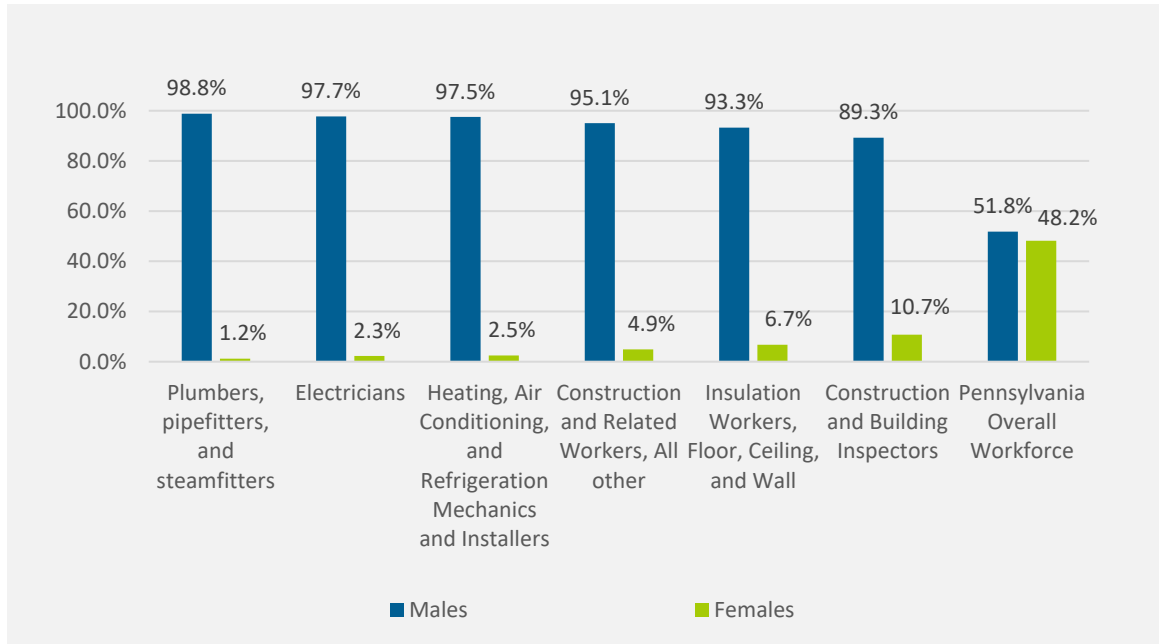
Occupation Description	2022 Jobs	2032 Jobs <sup>8</sup>	Average Number of Additional Workers Employed Full-Time for Ten Years
Construction and Building Inspectors	5,159	5,423	145
Electricians	23,824	27,950	2,213
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	18,401	22,234	2,045
Insulation Workers, floor, ceiling, and wall	449	547	52
Construction and Related Workers, All Other (includes Weatherization Technicians)	1,170	1,299	68
Plumbers, Pipefitters, and Steamfitters	16,824	20,609	2,117

## DEMOGRAPHICS

**Males account for almost all energy efficiency and electrification workers among the six occupations of interest.** While the PA overall workforce is more generally balanced between males (51.8 percent) and females (48.2 percent), all six building decarbonization occupations have a significantly higher proportion of males than females employed. The largest concentration of females (10.7 percent) who are employed in the building decarbonization field work as Construction and Building Inspectors (Figure 1). Increasing the share of women working in these occupations that are set to see high growth and offer strong wages (Table 6) should be a priority.

<sup>8</sup> Growth rates here have been calculated at a compound annual growth rate to account for a steady ramping up of workers and the training and education infrastructure needed to support them.

FIGURE 1. GENDER COMPOSITION OF OCCUPATIONS IN PENNSYLVANIA, 2023Q1<sup>9</sup>



**Continuing to support the racial and ethnic diversity of the energy efficiency workforce should be a priority.** The workforces of these six occupations are primarily comprised of White and Black or African American workers, and White workers are more highly concentrated in these occupations than in the overall workforce of PA. Among the six priority occupations, FCW Insulation Workers have the lowest proportion (82.0 percent) of the workers identifying as White and the highest proportion (16.2 percent) identifying as Black or African American. Just over one-in-five (21.8 percent) FCW Insulation Workers were Hispanic or Latino, the largest proportion across all occupations (Table 4).

Hispanic or Latino workers are most represented among FCW Insulation Workers (21.8 percent) and All Other Construction and Related Workers (16.5 percent), compared to 7.3 percent representation across the state’s overall workforce (Table 4).

<sup>9</sup> Source: JobsEQ®, 2023Q1. Based on Place of Residence estimates.

**What HVAC/R Stakeholders Said About Diversity of Workers**

*“There is a better return on [training individuals from low-income communities to increase the workforce and help them obtain well-paying jobs] than encouraging [distributors] to carry on with what they are doing, and [the distributor’s] are doing a pretty good job.”*

*“There is a low percentage of racial diversity in the trades. If giving access to low-income folks to escape from that, this is a great opportunity to rise out of poverty by getting into well-paying trades jobs. The diversity is changing, slowly.”*

*“Because trade jobs are in high demand locally, there seems to be more interest [in our trades training programs] than there was. We’re focusing on marginalized populations because it is typically white males that are drawn to the programs—though we do have a handful of women. The average student age is 27 so we’re not getting folks right after HS.”*

**TABLE 4. RACIAL AND ETHNIC COMPOSITION OF OCCUPATIONS IN PENNSYLVANIA, 2023Q1<sup>10</sup>**

6-digit SOC Code	Occupation	White	Black or African American	American Indian or Alaska Native	Asian	Native Hawaiian or Other Pacific Islander	Two or More Races	Hispanic or Latino (of any race) <sup>11</sup>
<b>Pennsylvania Overall Workforce</b>		<b>81.4%</b>	<b>10.5%</b>	<b>0.1%</b>	<b>4.1%</b>	<b>0.0%</b>	<b>3.8%</b>	<b>7.3%</b>
47-2111	Electricians	89.9%	7.5%	0.2%	1.1%	0.0%	1.3%	8.8%
47-2131	Insulation Workers, Floor, Ceiling, and Wall	82.0%	16.2%	0.2%	0.0%	0.0%	1.7%	21.8%
47-2152	Plumbers, Pipefitters, and Steamfitters	85.0%	8.9%	0.4%	1.2%	0.0%	4.4%	10.8%
47-4011	Construction and Building Inspectors	87.1%	10.2%	0.0%	2.4%	0.0%	0.3%	3.4%
47-4099	Construction and Related Workers, All Other	86.0%	9.2%	0.3%	0.9%	0.0%	3.6%	16.5%
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	86.6%	10.1%	0.1%	0.9%	0.0%	2.3%	8.5%

<sup>10</sup> Source: JobsEQ®. 2023Q1. Based on Place of Residence estimates.

<sup>11</sup> Source: JobsEQ®. 2023Q2. Based on Place of Residence estimates. The U.S Census Bureau considers race and Hispanic origin to be two distinct concepts. Hispanic or Latino is considered to be an ethnicity and may be of any race. Therefore, the percentage of Hispanic or Latinos should not be added to percentages for racial categories.

**For four of the six energy efficiency and building electrification occupations, the largest age group of workers is between 35 and 44 years old.** Electricians (23.2 percent), FCW Insulation Workers (27.0 percent), Plumbers (22.8 percent), and All Other Construction and Related Workers (23.7 percent) are between 35 and 44 years old, while the largest concentration of HVAC/R Mechanics and Installers are between 25 and 34 years of age (Table 5).

Most occupations listed have roughly 20% of workers over the age of 54, but over half (51.3 percent) of Construction and Building Inspectors are in this 55 or older, which aligns with the role's greater requirements for work experience and training (Table 7). This data suggests that one-in-five workers may be considering retirement in the near term, and over half of the Construction and Building Inspector workers could be nearing retirement. The relative age of Construction and Building Inspectors is particularly troubling, and suggests that a push to support a younger generation of these workers is warranted.

TABLE 5. AGE COMPOSITION OF OCCUPATIONS IN PENNSYLVANIA, 2023Q1<sup>12</sup>

6-digit SOC Code	Occupation	16-24 Years	25-34 Years	35-44 Years	45-54 Years	55+ Years
<b>Pennsylvania Overall Workforce</b>		<b>12.1%</b>	<b>21.5%</b>	<b>19.8%</b>	<b>20.7%</b>	<b>25.8%</b>
47-2111	Electricians	10.2%	22.1%	23.2%	21.6%	22.8%
47-2131	Insulation Workers, Floor, Ceiling, and Wall	9.7%	20.7%	27.0%	24.3%	18.3%
47-2152	Plumbers, Pipefitters, and Steamfitters	10.0%	22.2%	22.8%	22.5%	22.5%
47-4011	Construction and Building Inspectors	1.9%	14.2%	12.6%	20.0%	51.3%
47-4099	Construction and Related Workers, All Other	9.8%	22.5%	23.7%	21.7%	22.3%
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	8.5%	25.2%	23.2%	21.3%	21.8%

## WAGES

**Workers in all priority occupations earn an average hourly wage that is higher than the estimated hourly living wage for both a single adult (\$16.41) and a four-person family of two working adults and two children in PA (\$24.44).** FCW Insulation Workers, who have the greatest concentration (18.0 percent) of non-White workers compared to the other five priority occupations, earn the lowest average wage among the occupations of interest at \$24.63 an hour. Electricians, who have the highest concentration (89.9 percent) of workers identifying as White, earn the highest average wage of \$35.82 an hour (Table 6).

<sup>12</sup> Source: JobsEQ®, 2023Q1. Based on Place of Residence estimates.

The high earning opportunities for these jobs is something that should be included in any marketing or information campaigns that aim to draw talent to these fields.

TABLE 6. OCCUPATIONAL WAGES IN PENNSYLVANIA, 2023Q1<sup>13</sup>

6-digit SOC Code	Occupation	Average Hourly Wages	Average Annual Wages
<b>Pennsylvania Overall Workforce</b>		<b>\$28.88</b>	<b>\$60,000</b>
PA LIVING WAGE PER WORKING ADULT (2 WORKING ADULTS AND 2 CHILDREN)		\$24.44	\$50,835
PA LIVING WAGE PER WORKING ADULT (1 WORKING ADULT AND NO CHILDREN)		\$16.41	\$34,133
47-2111	Electricians	\$35.82	\$74,500
47-2131	Insulation Workers, Floor, Ceiling, and Wall	\$24.63	\$51,200
47-2152	Plumbers, Pipefitters, and Steamfitters	\$33.79	\$70,300
47-4011	Construction and Building Inspectors	\$32.12	\$66,800
47-4099	Construction and Related Workers, All Other	\$29.14	\$60,600
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	\$28.24	\$58,700

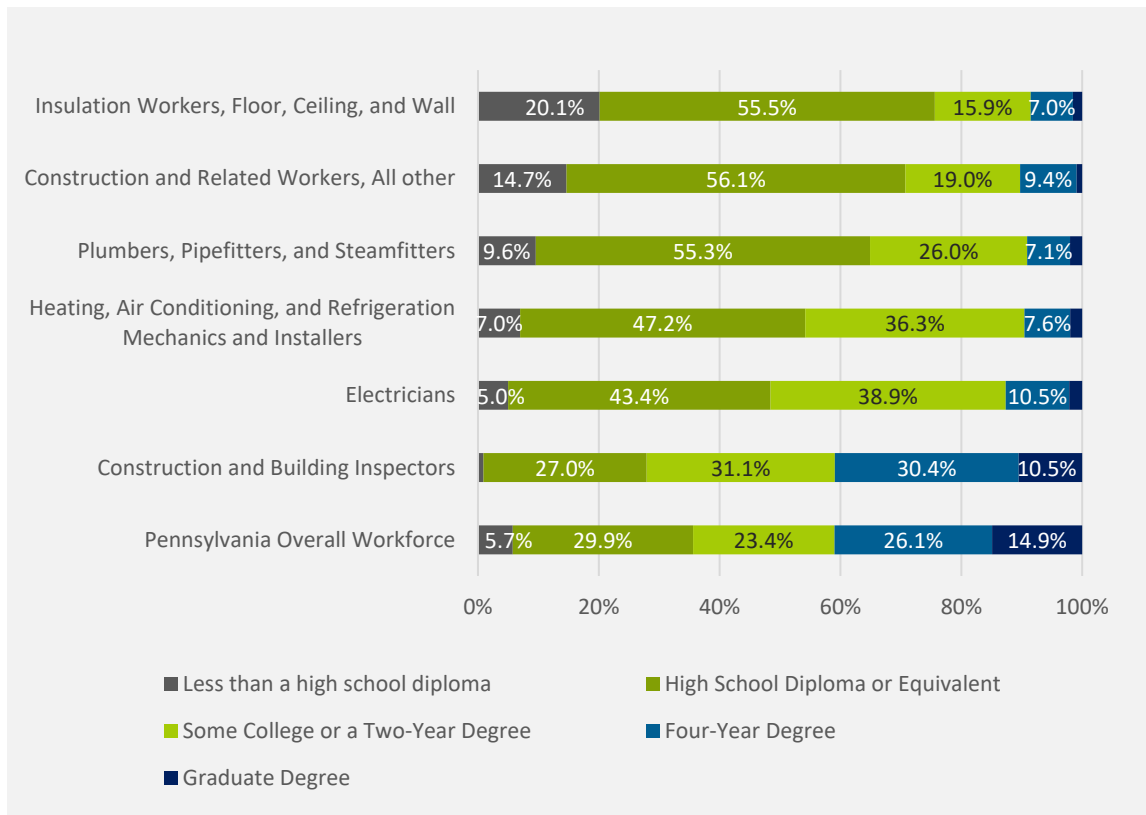
## EDUCATION AND CERTIFICATION REQUIREMENTS

**Across all six occupations and the state’s overall workforce, a high school diploma or equivalent is the highest educational attainment most common among workers.** Most FCW Insulation Workers, All Other Construction and Related Workers, and Plumbers have attained a high school diploma or equivalent. The highest concentration of workers who have not attained a high school diploma or equivalent is among FCW Insulation Workers (20.1 percent) (Figure 2). This data shows that all of these occupations are broadly accessible, even for those not interested in pursuing longer-term education after high school.

<sup>13</sup> Sources: JobsEQ®. 2023Q1. Based on Place of Work estimates.  
Living Wages from *Living Wage Calculator*. Massachusetts Institute of Technology. Accessed September 2023.  
<https://livingwage.mit.edu/states/42>



**FIGURE 2. EDUCATIONAL ATTAINMENT OF CURRENT WORKERS IN SELECTED OCCUPATIONS IN PENNSYLVANIA, 2023Q1<sup>14</sup>**



**Four of the six occupations typically require a high school diploma or equivalent at the entry-level, and five of the six occupations do not have any previous work requirements.** FCW Insulation Workers are the only workers who do not have a typical entry-level education requirement to meet. HVAC/R Mechanics and Installers often must earn a postsecondary non-degree award to obtain an entry-level position, though interviews suggest that employers were willing to make exemptions for candidates that were otherwise a good fit. Only Construction and Building Inspectors require any sort of previous work experience and must have five years or more of this experience (Table 7).

Apprenticeship and on-the-job training are commonly required for these six occupations. Electricians and Plumbers typically gain sufficient training via apprenticeships. Construction and Building Inspectors and All Other Construction and Related Workers typically complete moderate-term on-the-job training, while HVAC/R Mechanics and Installers complete long-term on-the-job training. Only FCW Insulation Workers have short-term on-the-job training to complete upon entering the workforce (Table 7).

<sup>14</sup> Source: JobsEQ®, 2023Q1. Based on Place of Residence estimates.

TABLE 7. OCCUPATIONAL EDUCATION AND WORK REQUIREMENTS IN PENNSYLVANIA<sup>15</sup>

6-digit SOC Code	Occupation	Typical Entry-Level Education	Previous Work Experience	Typical On-the-Job Training <sup>16</sup>
47-2111	Electricians	High school diploma or equivalent	None	Apprenticeship
47-2131	Insulation Workers, Floor, Ceiling, and Wall	None	None	Short-term on-the-job training
47-2152	Plumbers, Pipefitters, and Steamfitters	High school diploma or equivalent	None	Apprenticeship
47-4011	Construction and Building Inspectors	High school diploma or equivalent	5 years or more	Moderate-term on-the-job training
47-4099	Construction and Related Workers, All Other	High school diploma or equivalent	None	Moderate-term on-the-job training
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	Postsecondary non-degree award	None	Long-term on-the-job training

<sup>15</sup> Source: JobsEQ®. 2023Q1. Based on Place of Work estimates.

<sup>16</sup> An **apprenticeship** is a formal relationship between a worker and a sponsor that consists of a combination of on-the-job training and related occupation-specific instruction in which the worker learns the practical and theoretical aspects of an occupation. Apprenticeship programs usually provide at least 144 hours of occupation-specific technical instruction and 2,000 hours of on-the-job training per year over a 3- to 5-year period.

**Long-term on-the-job training** is more than 12 months of on-the-job training, or, alternatively, combined work experience and formal classroom instruction (not including apprenticeships), that is needed for the worker to attain competency in the skills needed in the occupation.

Source: *Glossary*. Occupational Outlook Handbook. U.S. Bureau of Labor Statistics. Accessed November 2023. <https://www.bls.gov/ooh/about/glossary.htm>

TABLE 8. OCCUPATIONAL CERTIFICATION REQUIREMENTS AND OPTIONS IN PENNSYLVANIA<sup>17</sup>

6-digit SOC Code	Occupation	Required Certifications	Optional Certifications
47-2111	Electricians	Municipal licenses	Solar PV, Electrical Generating, Lighting Systems certifications
47-2131	Insulation Workers, Floor, Ceiling, and Wall	Certification for asbestos abatement and lead removal (if applicable)	
47-2152	Plumbers, Pipefitters, and Steamfitters	Municipal licenses	Gas line license, plumbing design certification
47-4011	Construction and Building Inspectors	Municipal licenses, Home Inspector license, Membership in a National Home Inspection Association	International Association of Certified Home Inspectors, Building Performance Institute (BPI) Energy Auditing Certification
47-4099	Construction and Related Workers, All Other	Municipal licenses for home improvement contractors	
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	Municipal licenses, U.S. Environmental Protection Agency (EPA) certification for refrigerant handling	North American Technician Excellence (NATE) Certification, HVAC Excellence Certification

<sup>17</sup> Sources (Accessed September 2023): *Occupational Outlook Handbook*. Bureau of Labor Statistics. <https://www.bls.gov/ooh/#startcontent> & *Contractor Licensing*. Pennsylvania Department of Labor & Industry. <https://www.dli.pa.gov/ucc/Pages/Contractor-Licensing.aspx> & *Pennsylvania HVAC Certification and License Requirements*. HVACCertification.org. <https://www.hvaccertification.org/pennsylvania-hvac-license/>



# Survey of Energy Efficiency Contractors

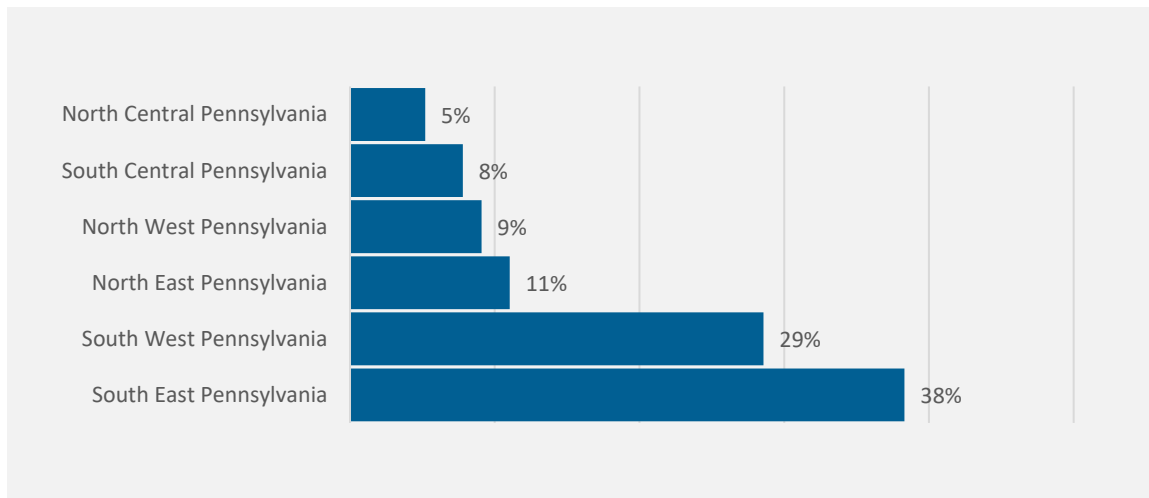
The research team surveyed firms involved in any activity related to energy efficiency and building electrification with business locations in Pennsylvania. This section

details the findings from the survey. A full methodology is included in Appendix A on page 47.

## Characteristics of Energy Efficiency and Building Electrification Firms Surveyed

The greatest percentage (38.3) of surveyed establishments were in the southeastern part of the state, followed by 28.6 percent based in southwestern Pennsylvania.<sup>18</sup> The North Central region had the smallest representation in the survey data, as only 5.2 percent of the firms were located there (Figure 3). These estimates align closely with 2021 census data on overall establishments within these regions.<sup>19</sup>

**FIGURE 3. PENNSYLVANIA REGIONS OF SURVEY RESPONDENT BUSINESS LOCATIONS**



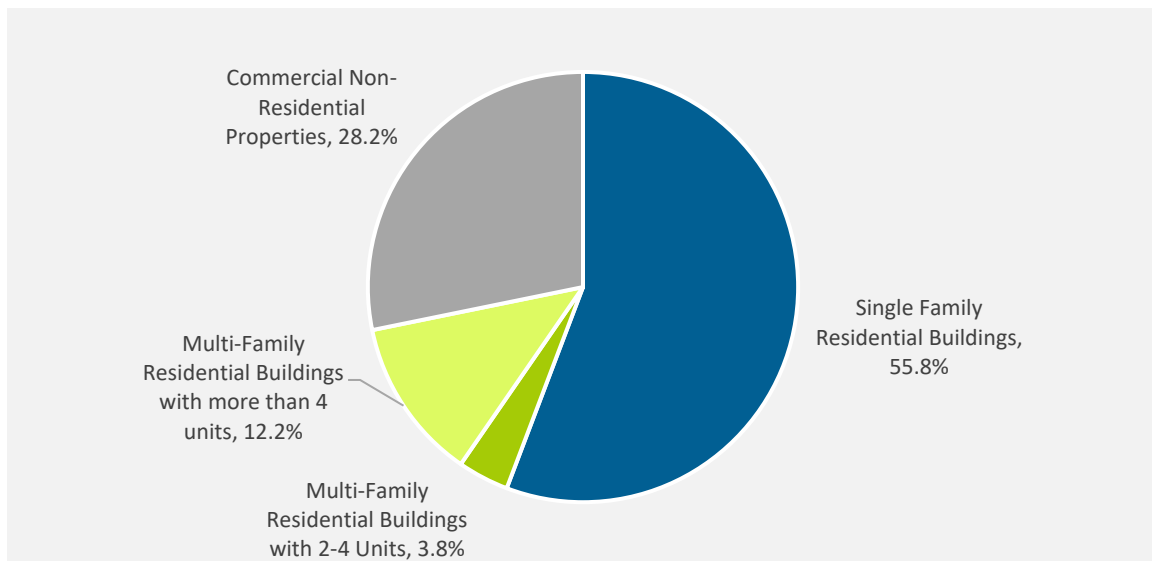
<sup>18</sup> Based on the Pennsylvania Department of Health regions: <https://www.health.pa.gov/topics/programs/Patient-Advocacy/Pages/County-Regional-Resources.aspx>

<sup>19</sup> U.S. Census Bureau. "Business Dynamics Statistics: Establishment Size: 1978-2021." *Economic Surveys, ECNSVY Business Dynamics Statistics*, Table BDSESIZE, 2021, [https://data.census.gov/table/BDSTIMESERIES.BDSESIZE?g=040XX00US42\\$0500000&d=ECNSVY](https://data.census.gov/table/BDSTIMESERIES.BDSESIZE?g=040XX00US42$0500000&d=ECNSVY) Business Dynamics Statistics. Accessed on November 27, 2023.

Among the firms surveyed, more than half (55.8 percent) were primarily involved in single-family residential building work, while almost three-in-ten (28.2 percent) largely focused on commercial non-residential properties.

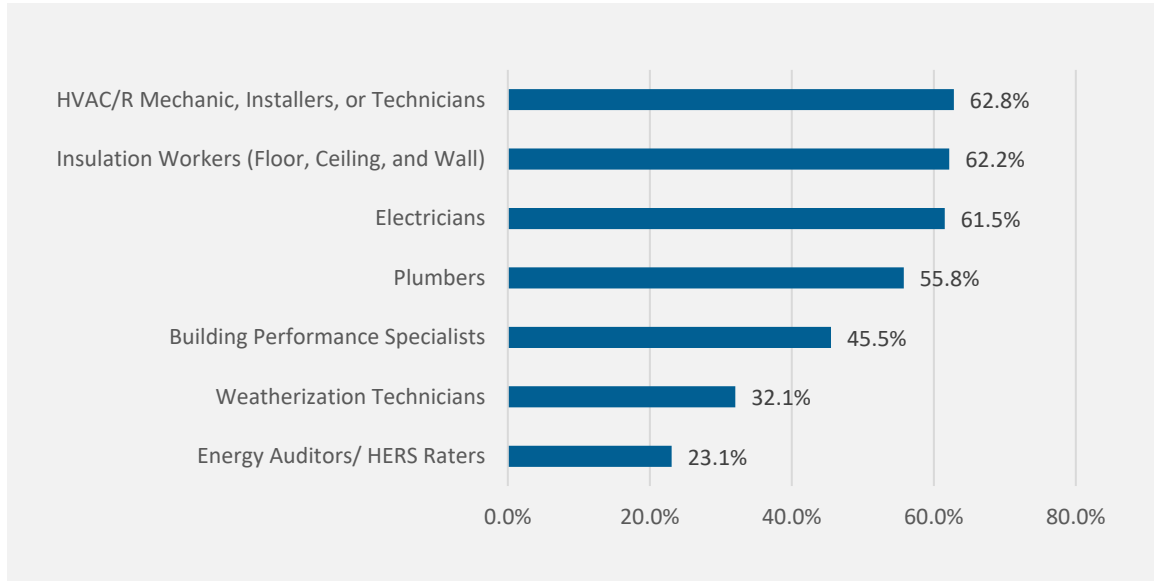
**Non-union firms more often work in single-family residential.** Firms that had less than 50.0 percent of their HVAC/R employees covered under a union were more likely to primarily work on single-family residential buildings (66.7 percent) when compared to firms who had 50.0 percent or more of their HVAC/R employees covered under a union (40.5 percent) (Figure 4).

**FIGURE 4. PRIMARY TYPE OF BUILDING IN WHICH SURVEYED FIRMS WORK**



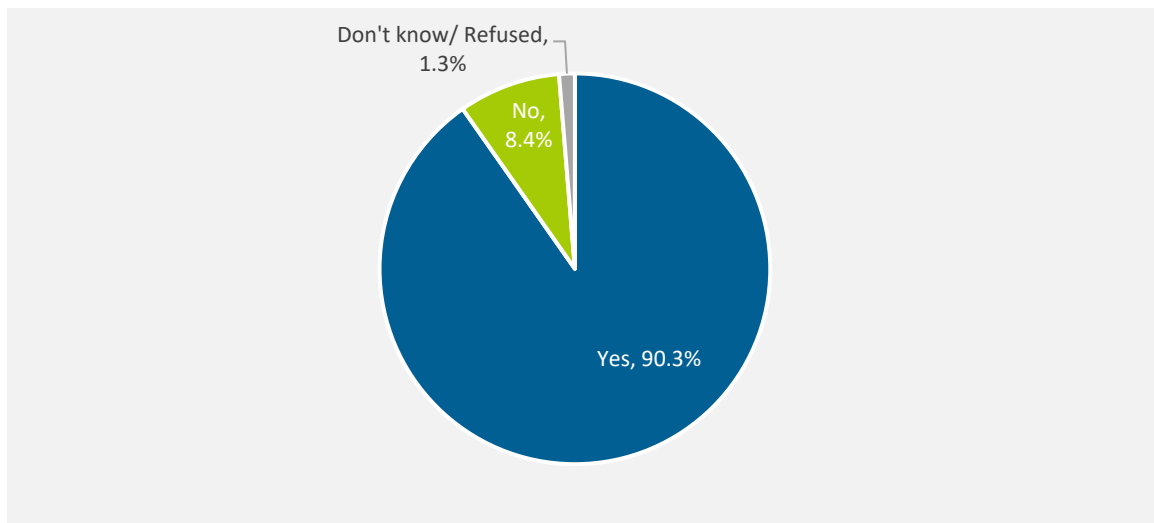
Most surveyed businesses involved in energy efficiency and electrification employed HVAC/R Mechanics, Installers, or Technicians (62.8 percent); Electricians (62.2 percent); Floor, Ceiling, and Wall Insulation Workers (61.5 percent); and Plumbers (55.8 percent) (Figure 5).

**FIGURE 5. ENERGY EFFICIENCY AND ELECTRIFICATION OCCUPATIONS EMPLOYED AT SURVEYED FIRMS**

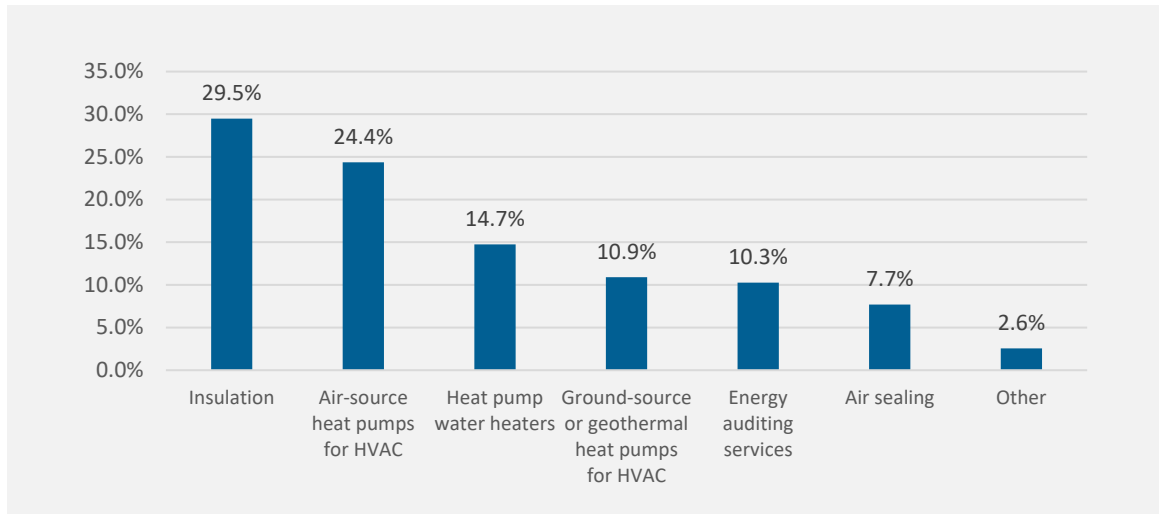


**Nine-in-ten (90.3 percent) of surveyed establishments were involved with HVAC or plumbing activities (Figure 6). Exactly half engaged primarily with heat pump technologies.** One-quarter (24.4 percent) worked with air-source heat pumps for HVAC as their primary technology, 14.7 percent with heat pump water heaters, and 10.9 percent with ground-source or geothermal heat pumps for HVAC. Roughly three-in-ten (29.5 percent) of surveyed firms predominately worked with insulation (Figure 7).

**FIGURE 6. IS YOUR FIRM INVOLVED IN ANY ACTIVITIES RELATED TO HVAC OR PLUMBING?**

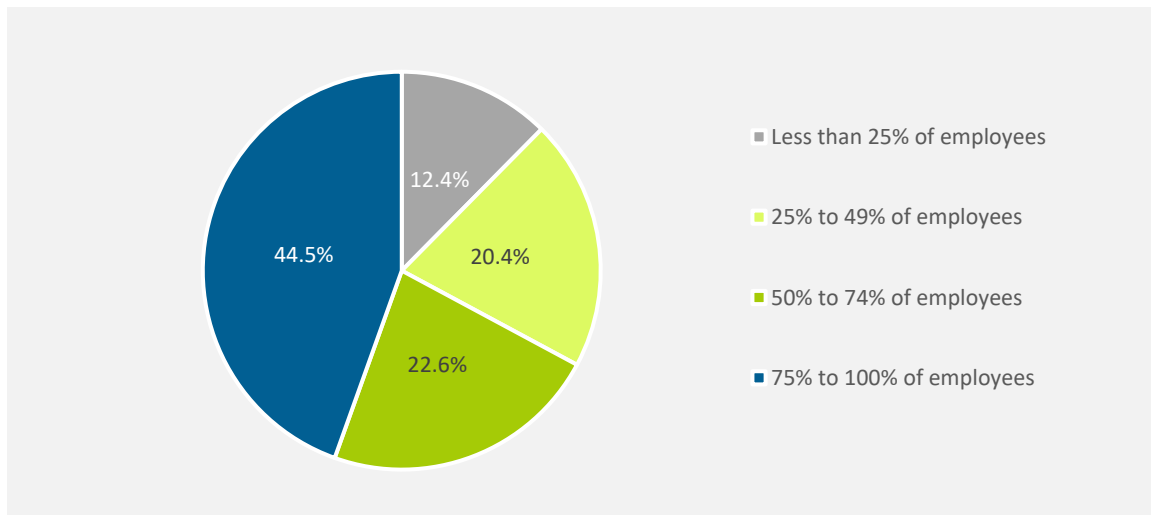


**FIGURE 7. TECHNOLOGY WHICH SURVEYED FIRMS WORK MOST CLOSELY**



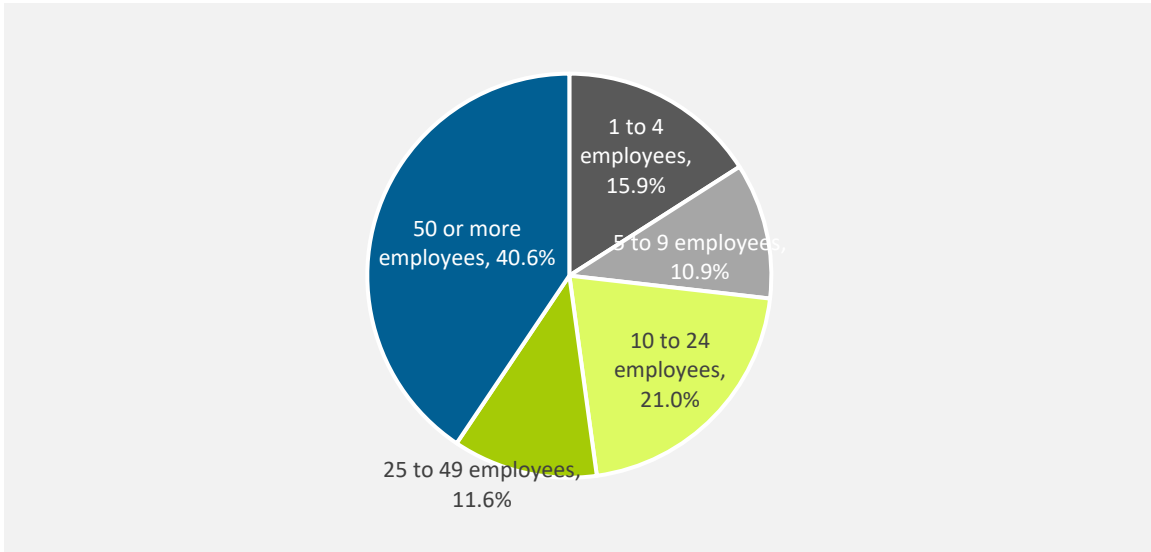
**A majority of workers at surveyed firms spend most of their time on energy-related activities.** Among two-thirds (67.2 percent) of surveyed firms, more than half of the permanent workers directly supported the energy portion of the businesses. Fewer establishments (12.4 percent) had less than one-quarter of their permanent employees involved in the energy segments of the overall business (Figure 8).

**FIGURE 8. NUMBER OF PERMANENT EMPLOYEES DIRECTLY SUPPORTING THE ENERGY PORTION OF BUSINESSES**



Roughly two-fifths (40.6 percent) of energy efficiency and electrification businesses surveyed were large firms with 50 or more permanent employees, including both full-time and part-time workers. One-quarter (26.8 percent) were small firms with less than ten permanent hires. Surveyed firms reported an average of 96 employees and a median value of 25 (Figure 9).

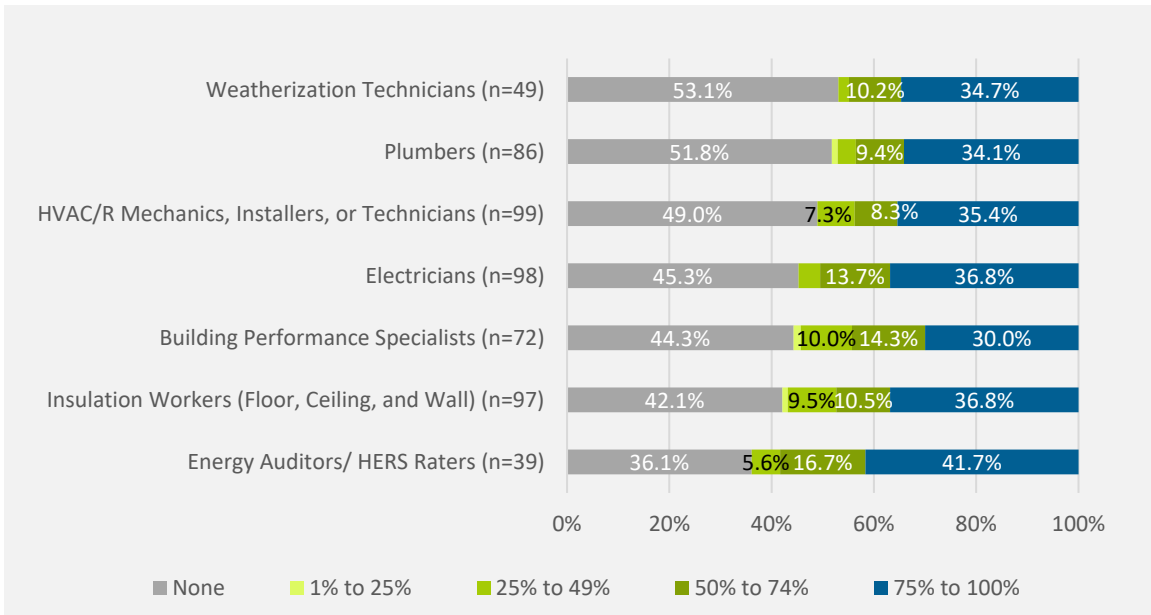
**FIGURE 9. NUMBER OF PERMANENT EMPLOYEES AT SURVEYED FIRMS' BUSINESS LOCATIONS**



### UNIONIZATION

Union representation among survey respondents was relatively bifurcated. While about half of the firms had no permanent energy efficiency and electrification workers represented or covered by unions or labor-related agreements, another large cohort (between 30 to 42 percent) of firms had 75 to 100 percent of workers represented by unions or covered under project labor agreements. Energy Auditors and HERS Raters tended to be most frequently represented or covered by unions based on survey responses (Figure 10).

**FIGURE 10. NUMBER OF WORKERS REPRESENTED BY A UNION OR COVERED UNDER A COLLECTIVE BARGAINING AGREEMENT OR A PROJECT LABOR AGREEMENT, BY OCCUPATION**

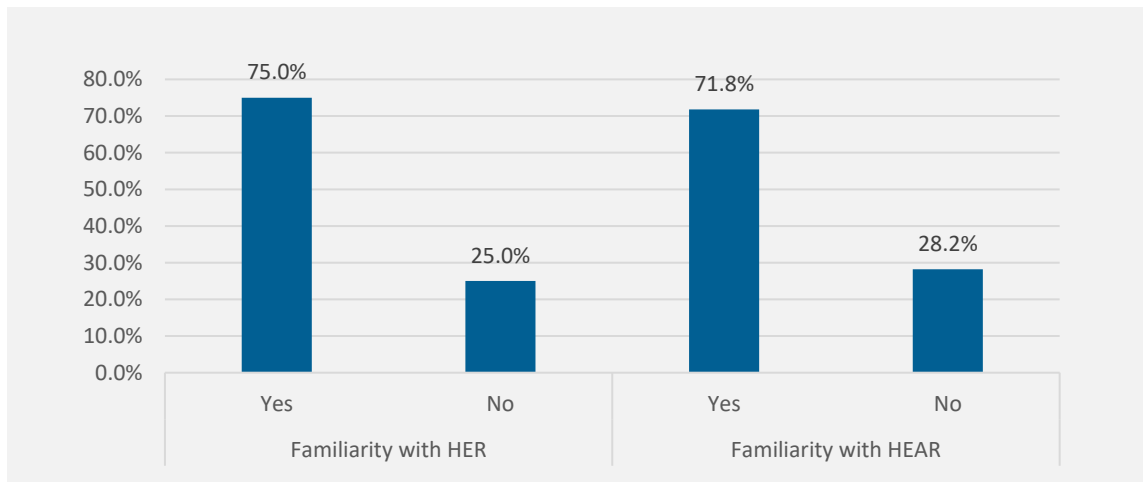




## Awareness of Current Energy Efficiency and Home Electrification Rebate Programs

Based on survey responses, most energy efficiency and electrification firms had a general familiarity with the Home Efficiency Rebates (HER)<sup>20</sup> and Home Electrification and Appliance Rebate (HEAR) programs. Still, for each of these programs, roughly one-quarter of firms were unfamiliar, which may highlight a need for continued and expanded marketing. Firms that had 50.0 percent of their HVAC/R employees covered under a union were more likely to have familiarity with HER (90.5 percent) and HEAR (88.1 percent) programs than firms with less than 50.0 percent of their HVAC/R employees covered by a union. Similarly, almost all firms with at least half of their Energy Auditors or HERS Raters covered under a union were more familiar with HER (95.2 percent) and HEAR (90.5 percent) programs than firms with less than 50.0 percent union coverage among these workers. It is also worth noting that the survey question merely asked about familiarity with the programs, not depth of knowledge or comfort in applying that information to business decisions (Figure 11).

FIGURE 11. FAMILIARITY WITH THE HER AND HEAR PROGRAMS



### What HVAC/R Stakeholders Said About Rebates and Financing for Customers

*“Heat pumps in the low are high end, they’re not “bread and butter” that we sell. Mid-tier might be 12k high end is 20k. The rebate brings that down. Contractors are coming to [distributors] with questions of what the mechanics of the funding are. Where’s the money coming from and what’s the timeline.”*

<sup>20</sup> Formerly known as HOMES, which was the program name used in this survey instrument.

*"[There should be] case management for small businesses because they can't pull folks out of the field. They need someone to access rebates and raise awareness."*

*"Is important that [contractors] get knowledge behind rebates & incentives. A lot of companies and contractors rely on frontline workers to have knowledge of tax breaks and the sales knowledge behind it. [Original Equipment Manufacturers] and distributors should be teaching that. They should be going to contractor and saying 'here are the incentives offered for this equipment'."*

*"A lot of contractors will try to avoid even having the conversation [about rebates] with consumers. The information is out there, we try to guide [contractors] to show them where the resources are. How do you obtain an AHRI certificate that will qualify the consumer for the tax credit? [The distributor does] a lot of different trainings to try to get them to not be fearful of those conversations."*

*"Replacing oil heat sources for heat pumps has been happening, that's not new. Replacing natural gas heat with a heat pump is newer, much less common. When homes already have propane as heat source, heat pumps are typically brought in as a hybrid system."*

*"Address the flow of funds such that a homeowner is not having to come up with a big sack of money and the contractor doesn't have to sit around waiting for the money for long periods of time. If the flow of money does not happen at the right times (does not get to the right hands in time), contractors can go bankrupt – this was an issue with geothermal tax credits 10-15 years ago."*

*"Very rarely do [system] replacements get flipped to anything else. Pretty much always get replaced with [the same system as before]. Some of that is availability and some of that is folks not planning for huge expense. They usually go back to system that they had."*

*"People [interested in heat pumps] will have made their mind up. Most cases folks still pursue heat pumps even without with the rebate."*

*"People are interested in rebates but can't even afford the system to get the rebate. 90% don't even qualify for the rebates. "It's a rich man's rebate.""*

*"[Knowledge about the rebate] was grey at the beginning but I feel better about it now. It was grey because of contradicting information. Distributors would tell you one thing, internet would tell you another. Carrier really stepped up their game on what units qualify and why and how."*

## Growth Expectations and Hiring Difficulties of Energy Efficiency and Building Electrification Firms

**Most (61 to 67 percent by occupation) employers surveyed expect to keep the same number of workers in the next three years for each of the priority occupations.** Only between 22 and 34 percent plan on increasing the number of these workers over this timeframe (Figure 12). Among the firms that anticipate

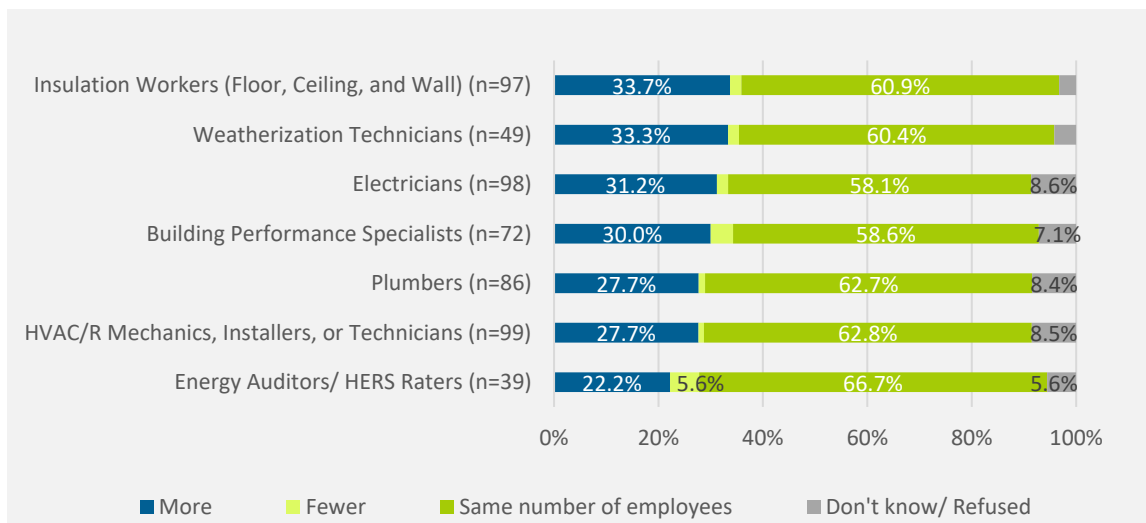
**Very small and very large firms were less likely to expect employee growth over the next three years compared to small-to-medium and medium-to-large firms.**

With regards to HVAC/R Technicians, approximately two-in-five (39.3 percent) small-to-medium (10 to 49 employees) firms and 43.8 percent of medium to large (50 to 99 employees) firms expect their number of HVAC/R Technicians to grow. In contrast, four-in-five (78.9 percent) firms with less than 10 employees and two-thirds (67.7 percent) of firms with 100 or more employees expect their number of HVAC/R Technicians to remain the same.

For Energy Auditors/HERS Raters employers, only small-to-medium (37.5 percent) and large (27.8 percent) firms anticipate growth over the next three years. All small firms and most medium-to-large (83.3 percent) and large (66.7 percent) firms with Energy Auditors/HERS Raters expect to have the same number of employees in three years. Roughly two-in-five (37.5 percent) of small-to-medium Energy Auditor/HERS Rater firms expect to remain the same size.

growth over the next few years, projected growth rates ranged across occupations. Insulation Worker employers and Weatherization Technician employers were the most optimistic about growth over the next three years. Low rates of anticipated hiring may be driven by several factors. One factor may be that small business owners do not see the risks of expansion outweighed by the benefits of trying to do so. A tight labor market driving sustained hiring challenges may also be playing a role in constraining hiring ambitions.

**FIGURE 12. EMPLOYER EXPECTATIONS FOR NUMBER OF WORKERS IN THREE YEARS, BY OCCUPATION**



## What HVAC/R Stakeholders Said About Employer Growth Expectations

*“Companies never returned to risk tolerance following recession. Lot of small businesses have retained risk aversion which prevents a lot of companies from expanding their crews or their markets. That’s the biggest concern. It would be nice if more business owners viewed this market as viable and profitable. Can’t argue with a contractor who has a backlog of work - nothing wrong with that. Lot of younger people who want to start a small business. People are also burned out from the hiring market.”*

*“Most contractors, if they have good people, will keep the workers – it’s too long of a cycle to bring in new people, train them, have them work, and then shed them at end of the season. Most of the good workers are booked out so that results in a more leveled workflow over time.”*

*“Yes, [finding talent] is a challenge, but overall, more issues lie with ensuring current HVAC contractors can find work all year round. A typical HVAC contractor has more work than they can do / have the capacity for from May to July in PA; for the rest of the year, August to April, HVAC contractors have capacity that they cannot find work for.”*

*“You could go to 90% of HVAC contractors and every one of them is looking for people. I hear about struggles of guys in the field who have not enough technicians or folks not showing up to work. It’s just a struggle. When a contractor gets a good technician and communicator, they’ll do everything they can to hold onto them. Everyone needs to gather together to support vocational and trade schools and community colleges. Need to refocus and get back to the basics.”*

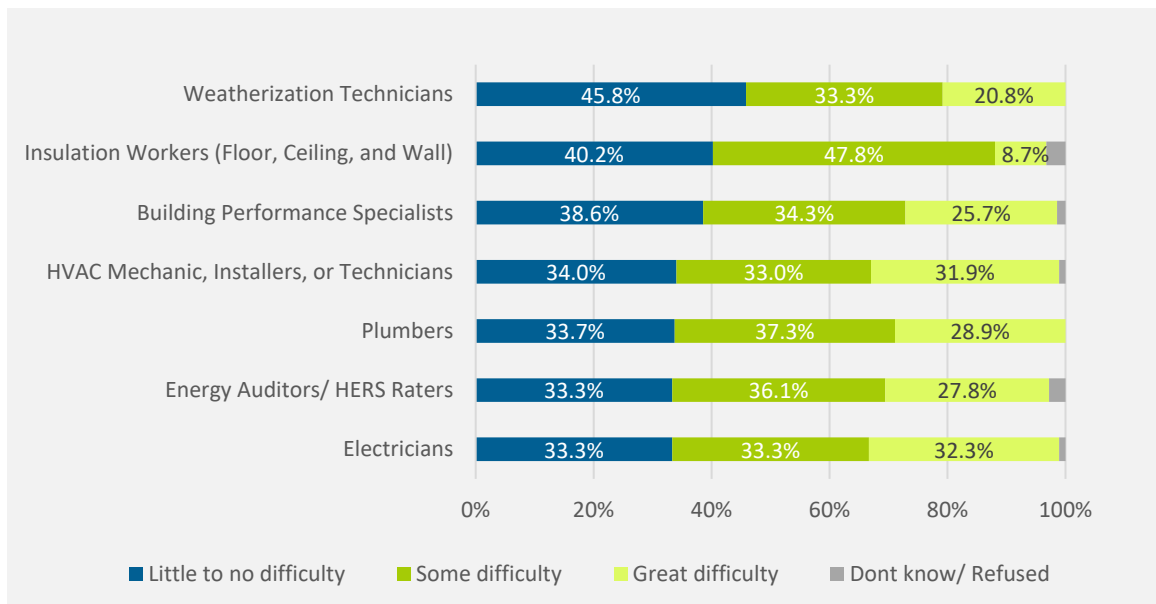
*“Energy Efficiency work is so specialized, Weatherization Assistance Program has some challenges with attracting contractors, doesn’t pay contractors the same as private sector work, and there are barriers in attracting companies who will do this work. They’re starting to find more contractors, increasing sub-contractors filling courses and completing work in the field. But overall, it’s a tough sell – how can they see the benefit in their business plan?”*

**Overall, hiring difficulty did not seem to pose major challenges to many of the firms surveyed.** Within each priority occupation, less than one-third of employers reported “great difficulty” with finding qualified workers for open positions. Employers most frequently had either “some difficulty” or “little to no difficulty.” Employers of Insulation Workers seemed to have the least challenging experience with hiring for these roles (Figure 13).

**Smaller firms had higher rates of “great difficulty” in hiring HVAC/R employees than larger firms.** Two-in-five (42.1 percent) firms with less than 10 employees reported great difficulty in hiring HVAC/R employees, the highest proportion across all firm sizes.

Among employers of Energy Auditors/HERS Raters, half (50.0 percent) of those with 10 to 49 employees reported “great difficulty.” Conversely, most (66.7 percent) larger firms with 50 to 99 employees experienced “some difficulty.”

**FIGURE 13. REPORTED HIRING DIFFICULTY OF ENERGY EFFICIENCY AND ELECTRIFICATION EMPLOYERS, BY OCCUPATION**

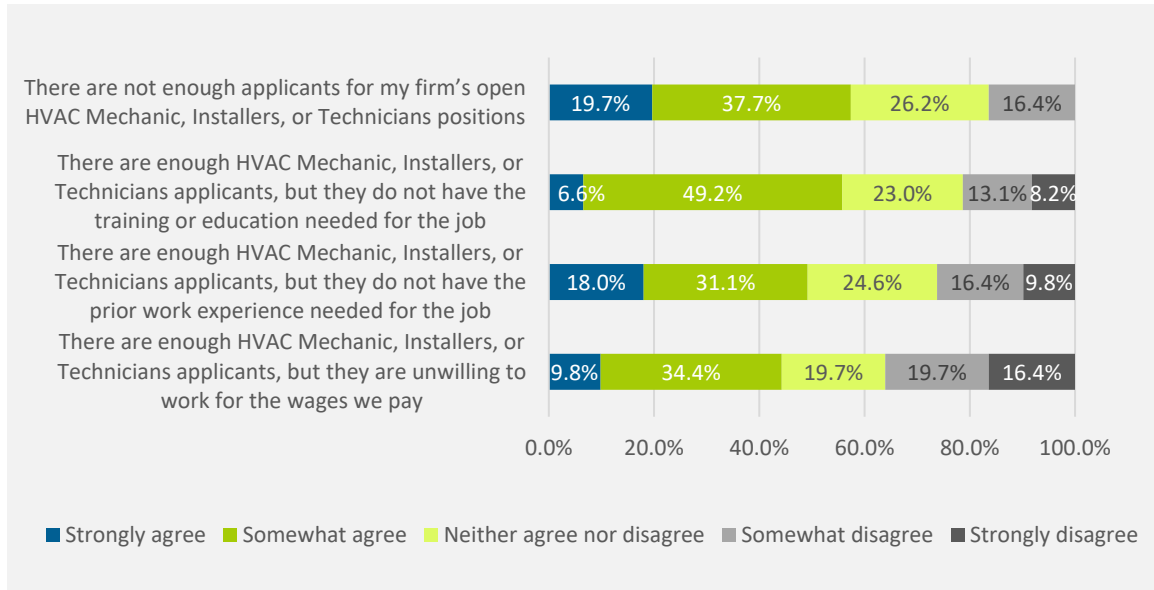


**Employers of different occupations experienced different levels of agreement with the reasons for reported hiring difficulties.**<sup>21</sup> Those employing HVAC Mechanics, Installers, or Technicians, for example, more frequently attributed hiring difficulty with a lack of training or education among applicants or a general lack of applicants (Figure 14), compared to employers of Energy Auditors/HERS Raters who were more likely to cite the applicants’ lack of prior work experience as a barrier for hiring (Figure 15). This

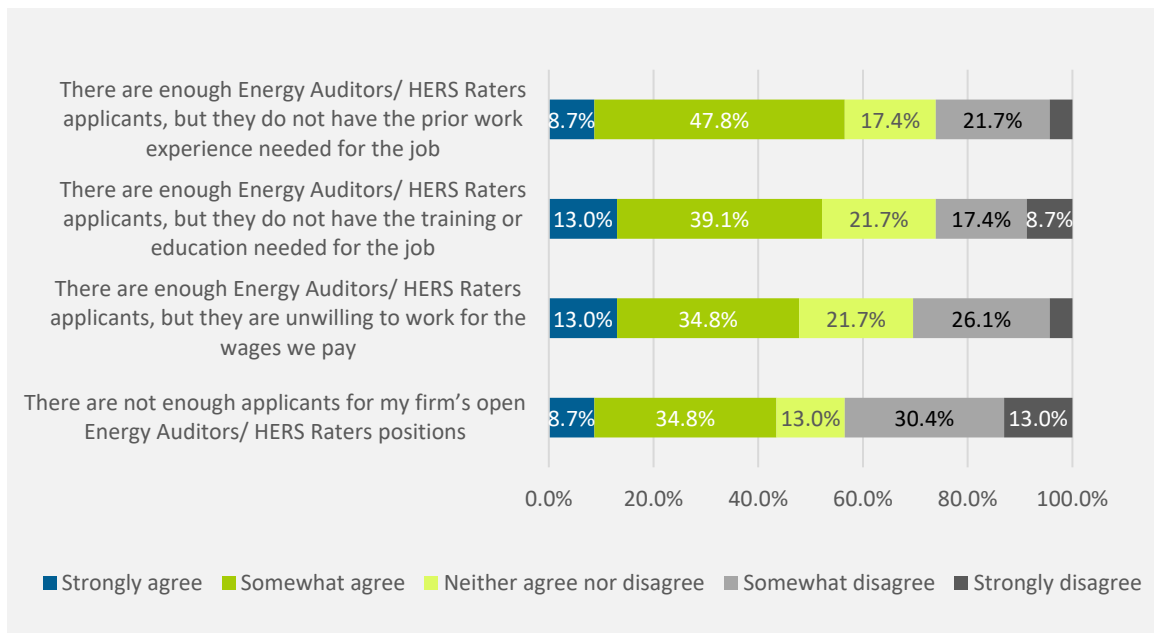
<sup>21</sup> Hiring difficulty perceptions of employers for each occupation are included in Appendix B.

difference in challenges reveals the importance of actions to alleviate these challenges that are tailored and specific to the occupation for which employers are hiring.

**FIGURE 14. LEVEL OF AGREEMENT WITH HIRING DIFFICULTY REASONS BY EMPLOYERS OF HVAC MECHANICS, INSTALLERS, AND TECHNICIANS**



**FIGURE 15. LEVEL OF AGREEMENT WITH HIRING DIFFICULTY BY EMPLOYERS OF ENERGY AUDITORS/HERS RATERS**



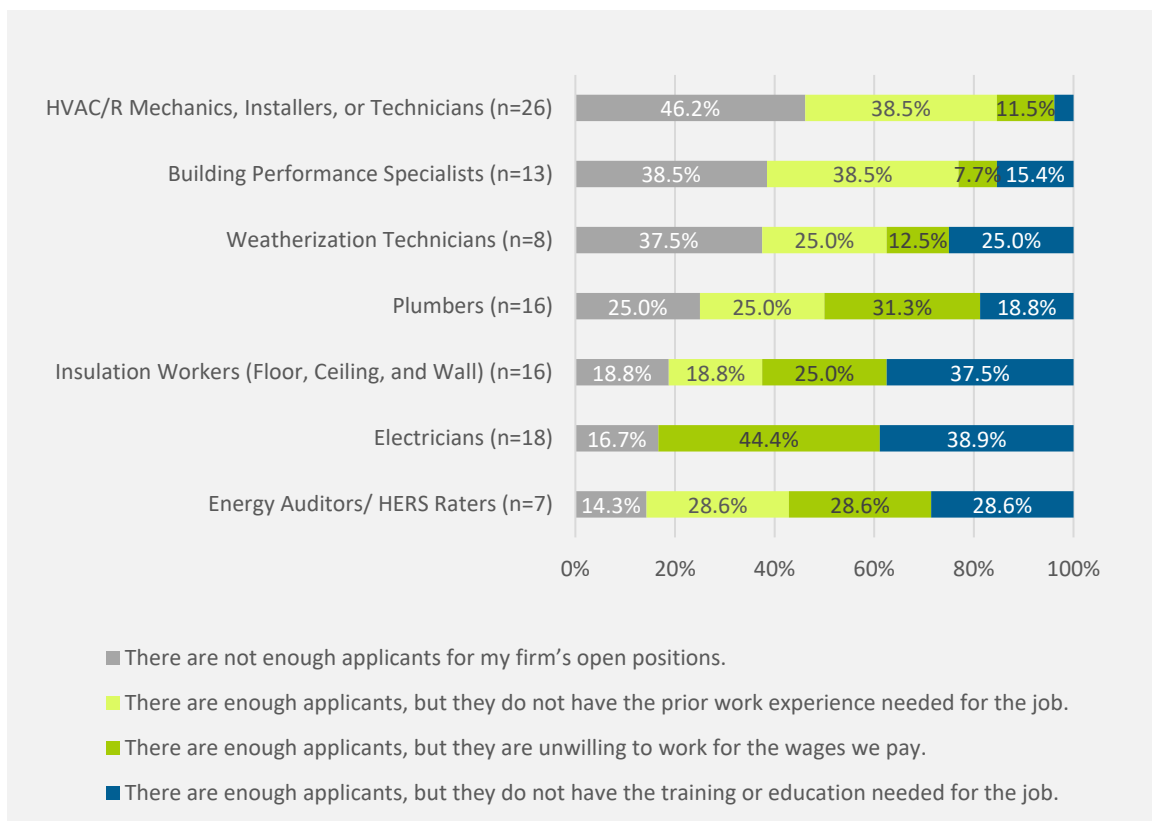
When asked about the single most significant reason for the reported hiring difficulty, employers of HVAC/R Mechanics, Installers, or Technicians identified a lack of applicants for open positions. For those

hiring Electricians, the greatest driver of hiring difficulty was applicants’ unwillingness to work for the offered wages. Employers of Energy Auditors or HERS Raters were more evenly divided as one reason did not stand out as significantly more pressing than the other reasons (Figure 16).

**A lack applicants for open HVAC/R positions was identified as the most common hiring challenge for small firms.** Among the small (fewer than 10 employee) firms who reported the hiring difficulty for HVAC/R employees, 80 percent reported that “there are not enough applicants for open positions” was the most significant reason for hiring challenges. Larger firms were more likely to cite challenges finding workers with experience.

**Business size had a large impact on the common hiring challenges for Energy Auditor/HERS Rater employers.** Large firms (100 or more employees) with Energy Auditors/HERS Raters most frequently (66.7 percent) attributed their hiring difficulty to a lack of applicants for open Energy Auditor/HERS Rater positions and 100 percent of medium-to-large employers believe hiring challenges stem from applicants’ unwillingness to work for the offered wages. Meanwhile, two-thirds (66.7 percent) of small-to-medium businesses with Energy Auditors/HERS Raters do not believe applicants have the training or education they are looking for.

**FIGURE 16. MOST SIGNIFICANT REASON FOR REPORTED HIRING DIFFICULTY OF EMPLOYERS, BY OCCUPATION**



### **What HVAC/R Stakeholders Said About Career Awareness:**

*“We need more field trips here to expose kids to these types of jobs and give them a sense of what’s for them or what’s not for them.”*

*“Need to increase awareness of jobs available in the energy space. Everyone knows what a healthcare job is, but there is less familiarity what a clean energy job is.”*

*“Most successful [talent pipeline] is connections with [Career and Technical Education] (CTE) Centers in PA. The most promising development is connecting building weatherization content within construction programs at K-12 CTE level.”*

*“[Other successful attraction tools are] using Corps style groups, utilizing short-term trainings that give field-experience and connections with employers (e.g. shadowing). [Students] just need some job readiness training.”*

*“Apprenticeship [is another] promising recruitment tool. [There’s an effort to roll] out apprenticeship programs in weatherization, to let people know there is a set plan for training and wage progression, etc.”*

*“[We need to] address diversity through K-12 programs. We need career awareness. There needs to be some conversations early to let kids know that the education is short term, provide family sustaining wages, and that the jobs are in high demand. The current generation thinks of trades as “less than” and that they are for kids that can’t get to college. Conversations need to happen earlier...Consumers are getting more savvy about tuition burden and jobs, but the conversation has to be early otherwise they don’t know.”*

*“The whole realm of vocational and technical schools has changed. Now you get a lot of kids who go to votech because they don’t know what else to do with them and they have troubles. Need to put higher emphasis on promoting these technical trade schools and make sure the right curriculum.”*



## Certifications and Previous Experience Required and Preferred by Energy Efficiency and Building Electrification Employers

**Employers of HVAC/R workers were most likely to require or prefer certifications** while employers of Weatherization Technicians, Plumbers, and Building Performance Specialists were less likely to report any certification requirements or preferences for workers to meet. Almost two-in-five (38.9 percent) of firms require or prefer certifications for Energy Auditor/HERS Rater (Figure 17).

OSHA Certification was more often a requirement than a preference of employers. The Environmental Protection Agency (EPA) 608 Universal Certification was most frequently required or preferred for HVAC/R workers. The North American Technician Excellence (NATE) certification was identified as “nice to have” and a way to certify true proficiency of HVAC/R material in the absence of a state-sponsored license. Some distributors reported using the NATE certification as a way to guarantee contractor quality for Original Equipment Manufacturers (OEMs) official service provider lists.

### What HVAC/R Stakeholders Said About NATE Certifications:

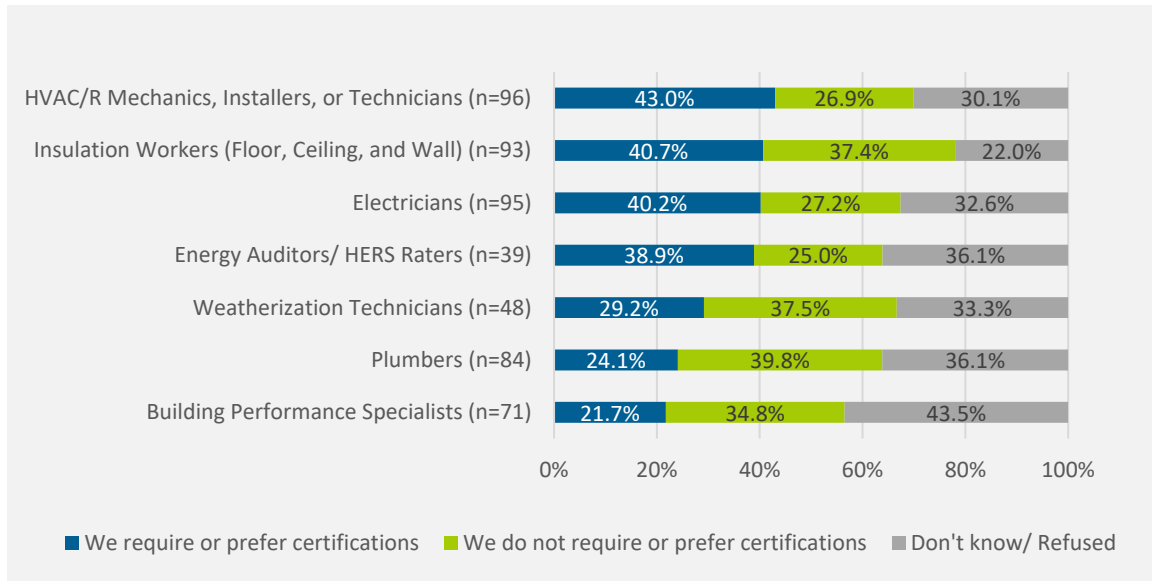
*“We’re working on getting our proctor stuff from NATE. [The instructor] will get recertified so that he can teach for the test. There’s a lot of value in [NATE certifications] for technicians. Certain students would be fine taking the exam, others might have an issue.”*

*“NATE just demonstrates that you know the material and you’re very proficient in what you’re working on. State of PA doesn’t have any type of licensing for HVAC, so NATE is a good stand-in for that. NATE gives you confidence that they’re very qualified for the job.”*

Among Energy Auditor or HERS Rater and Building Performance Specialist employers, the Certified Energy Manager (CEM) and Building Performance Institute (BPI) certifications were most frequently noted by survey respondents. All employers of these occupations required the BPI certifications, while only employers of Energy Auditors or HERS Raters required CEM certifications.

A detailed overview of certifications required and preferred for each occupation can be found in Appendix C.

**FIGURE 17. CERTIFICATION REQUIREMENTS OR PREFERENCES OF SURVEYED FIRMS, BY OCCUPATION**



**TABLE 9. COMMON CERTIFICATIONS REQUIRED/PREFERRED BY EMPLOYERS, BY OCCUPATION<sup>22</sup>**

	Insulation Workers	HVAC/R Workers	Electricians	Energy Auditors/ HERS Raters	Building Performance Specialists	Weatherization Technicians	Plumbers
<b>CERTIFICATION</b>	OSHA cert.	EPA 608 Universal cert.	Electrical license	Certified energy manager or auditor	OSHA cert.	OSHA cert.	Plumbing license
	Asbestos or lead removal cert.	Grade B Refrigeration cert. or contractor license	OSHA cert.	RESNET home energy cert.	Leadership in Energy and Environmental Design (LEED) cert.	Journeyman insulator	OSHA cert.
	Insulation cert. (NIA, HFIWA, NAIMA-R-Value, etc.)	OSHA	EPA cert.	HERS rating cert.	Building Performance Institute (BPI) cert.	National Center for Construction Education & Research (NCCER) cert.	
	EPA cert.	Apprenticeship or trade school completion		OSHA cert.	3C-REN cert.	Building Performance Institute (BPI) cert.	
	National Center for Construction Education & Research (NCCER) cert.	NATE cert.		Building Performance Institute (BPI) cert.	Multifamily Building Analyst (MFBA) cert. OR Certified Energy Manager or Auditor	EPA cert.	

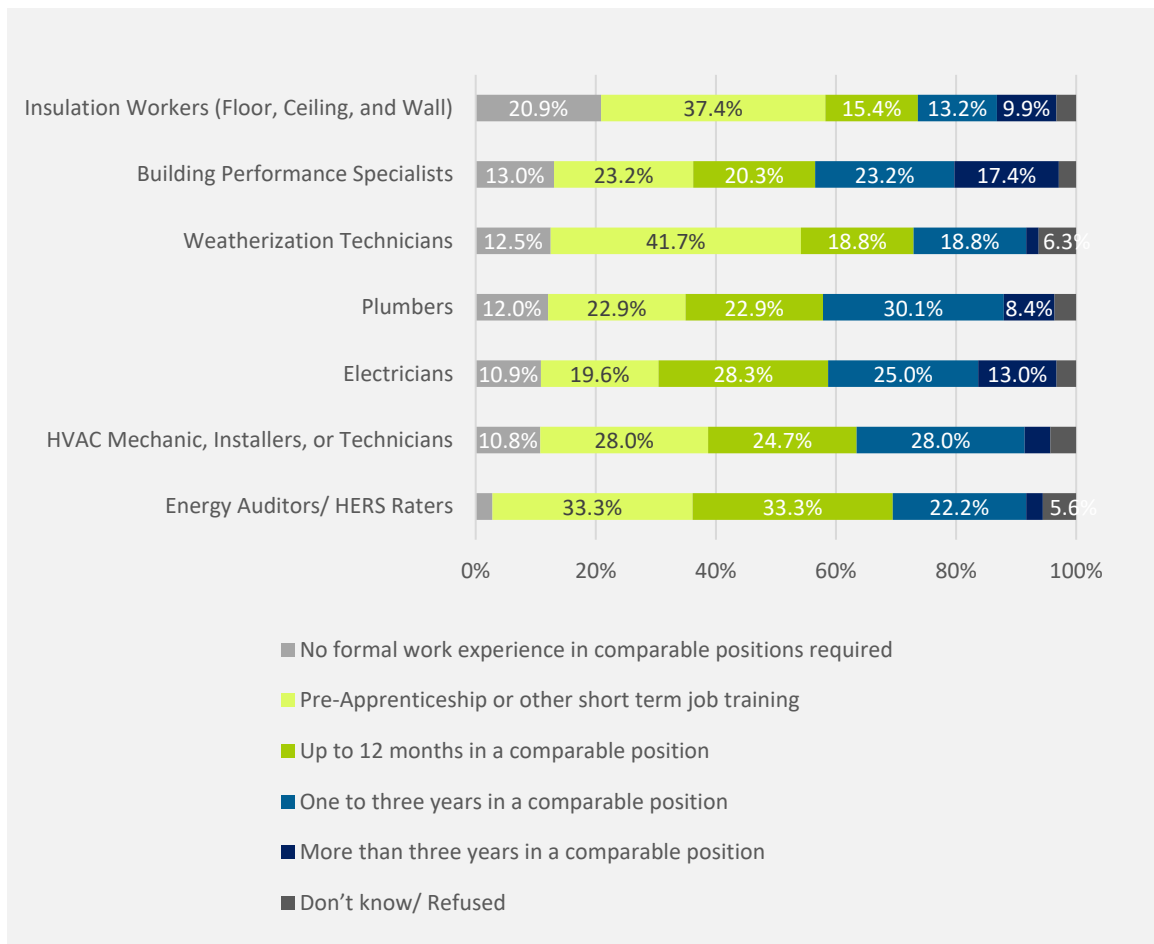
<sup>22</sup> Occupational Safety and Health Administration (OSHA)

In general, employers were more likely to require that applicants complete a pre-apprenticeship or other short-term job training or work experience of up to three years in a comparable position for all occupations surveyed. Only 2.8 percent of firms employing Energy Auditors or HERS Raters did not report requirements for formal work experience in a comparable position of applicants, compared to one-fifth (20.9 percent) of employers of Insulation Workers. Employers of HVAC/R Mechanics, Installers, or Technicians were more equally distributed across prior work experience requirements (Figure 18).

**Small firms are less likely require experience when hiring HVAC/R applicants.** Firms with less than 10 employees had the highest proportion of not requiring any formal work experience for HVAC/R applicants (31.6 percent) across all firm sizes. Small firms also had the highest proportion of respondents citing that applicants coming from pre-apprenticeship or other job training programs are typically missing or deficient in skills at one-in-five (20.6 percent).

**Larger firms were more likely to seek applicants with experience for open Energy Auditor or HERS Rater positions.** Large (100 or more employees) and medium-to-large (50 to 99 employees) with Energy Auditors/HERS Raters most frequently (38.9 percent and 50.0 percent, respectively) required applicants to have up to 12 months of previous work experience in a comparable position. Small-to-medium (10 to 49 employees) employers were more likely to require a pre-apprenticeship or other short-term job training while small firms were split across the different work experience requirements they look for in applicants.

**FIGURE 18. MINIMUM REQUIRED LEVEL OF PRIOR WORK EXPERIENCE EMPLOYERS EXPECT FOR ENTRY-LEVEL APPLICANTS, BY OCCUPATION**



**What HVAC/R Stakeholders Said:**

*“A good part of industry is ready to go [when it comes to training]. Lots of training comes from OEMs. They need help recruiting people to do installs. They’re all starving for people.”*

*“[Most technicians] have great technical competency. Don’t see training need for heat pumps. Our distributor provides good training.”*

*“We have hired 3 people since April. In the next month we’re looking to create an internal training program so they’re sharing knowledge within their team.”*

*“[Technicians are] pretty set technically.”*

*“[Heat pumps] are not new for any of the members. [The installations are] mostly residential.”*

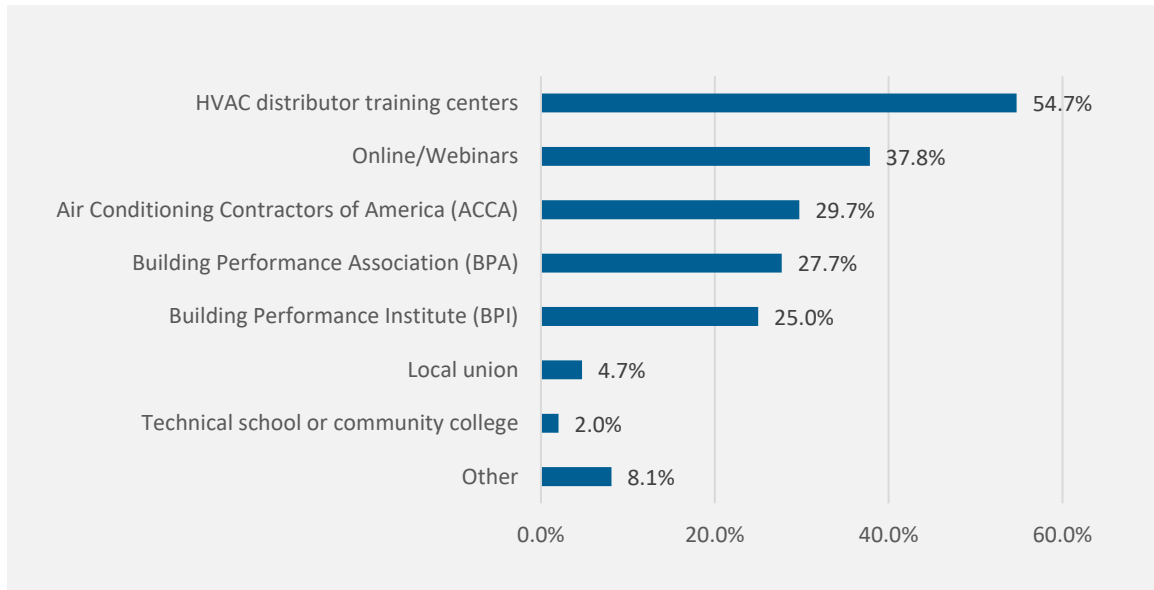
*“[The challenge] is not a technical knowledge gap, there is a demand of all people in the trades that is not directly related to heat pumps. There is just an overall demand for installers and tradespeople and a limited number of people interested in these careers in general.”*

*“Most distributors and manufactures are already working hard to educate contractors on heat pumps, they have reasonably good penetration. Therefore, investing in that is a waste of time, the ship has sailed. There is more opportunity in workforce development of non-skilled people into skilled jobs. Looking at certain communities, target under-resourced and historically disadvantaged communities who haven’t seen the trades as a potential career path for them.”*

*“Students are pretty green. They have a lot to learn. Kids just aren’t mature. A lot of kids that are just too much of kids. Work ethic and things like that. We can teach the skills side but professionalism and customer service takes time.”*

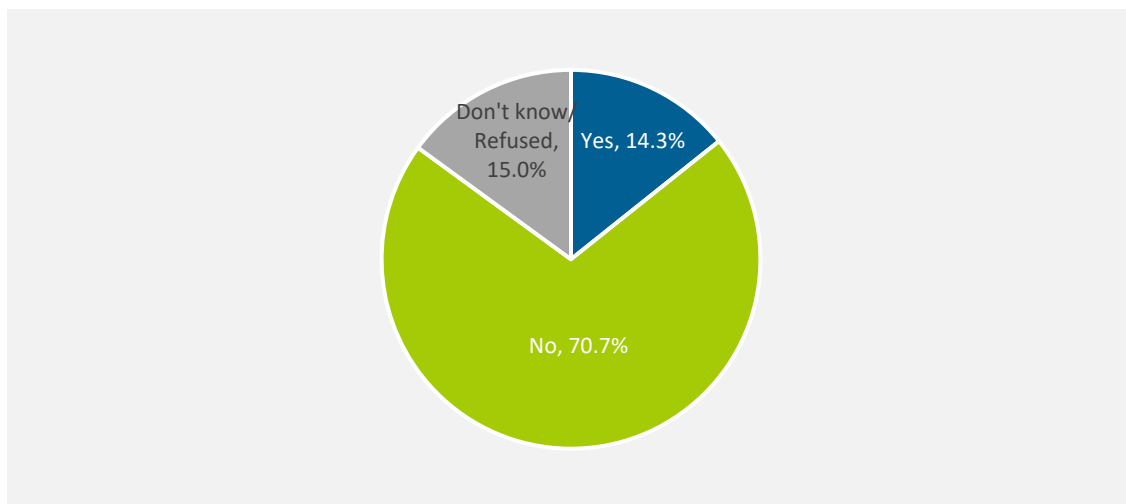
**In order to obtain the required or preferred certifications of energy efficiency and building electrification employers, firms most frequently (54.7 percent) reported using HVAC distributor training centers.** Online training sessions or webinars were also a common resource for 37.8 percent of firms. Local unions and technical schools or community colleges were not utilized much among these businesses. Firms in urban areas were more likely to report that their employees had used Air Conditioning Contractors of America (ACCA, at 33.9 percent), Building Performance Association (BPA, at 30.7 percent), and Building Performance Institute (BPI, at 29.1 percent) than firms in rural areas (Figure 19). This may reflect that there is a geographic challenge for certain types of trainings.

**FIGURE 19. METHODS EMPLOYEES UTILIZE FOR EARNING CERTIFICATIONS REQUIRED OR PREFERRED BY EMPLOYERS**



For energy efficiency and electrification establishments, seven in ten (70.7 percent) of those surveyed reported that job applicants from pre-apprenticeship or other job training programs typically have all the skills desired for employment. Only 14.3 percent disclosed a deficit in or missing applicant skills, most frequently citing the need for improved soft skills and professionalism (Figure 20).

**FIGURE 20. ARE THERE ANY SKILLS THAT APPLICANTS COMING FROM PRE-APPRENTICESHIP OR OTHER JOB TRAINING PROGRAMS ARE TYPICALLY MISSING OR DEFICIENT IN?**





# Training and Education for Energy Efficiency and Building Electrification

## Training Inventory

After a deep review of publicly available residential energy contractor training programs, school programs, and credentialing organizations, the research team found just under 300 unique training programs available in Pennsylvania that are relevant to the five occupational focus areas. A large share of the programs focus on electrical (41.5 percent), followed by HVAC/R (38.1 percent). A smaller share of programs is targeted at Building Performance Analysts and Energy Auditors, with 39 programs (13.5 percent) available across the state. Trainings hosted by distributors such as Mitsubishi, Carrier, and Standard Air have been excluded from this analysis because their training offerings are specific to the technology products they have in inventory and are targeted to their contractors or customers and not publicly marketed.

**TABLE 10. PENNSYLVANIA RESIDENTIAL ENERGY CONTRACTOR TRAINING PROGRAMS BY OCCUPATIONAL FOCUS**

Occupational Focus	Number of Programs
Electrical	120
HVAC/R	110
Building Performance, Home Energy Rating & Energy Auditing	39
Plumbing	11
Weatherization	9
<b>Total Programs</b>	<b>289</b>

A variety of different providers offer training programs throughout the state. Most of the training programs offered in the state are administered by community, junior, or technical colleges (44.6 percent) followed closely by vocational-technical schools (44.3 percent).

**TABLE 11. PENNSYLVANIA RESIDENTIAL ENERGY CONTRACTOR TRAINING PROGRAMS BY PROGRAM TYPE**

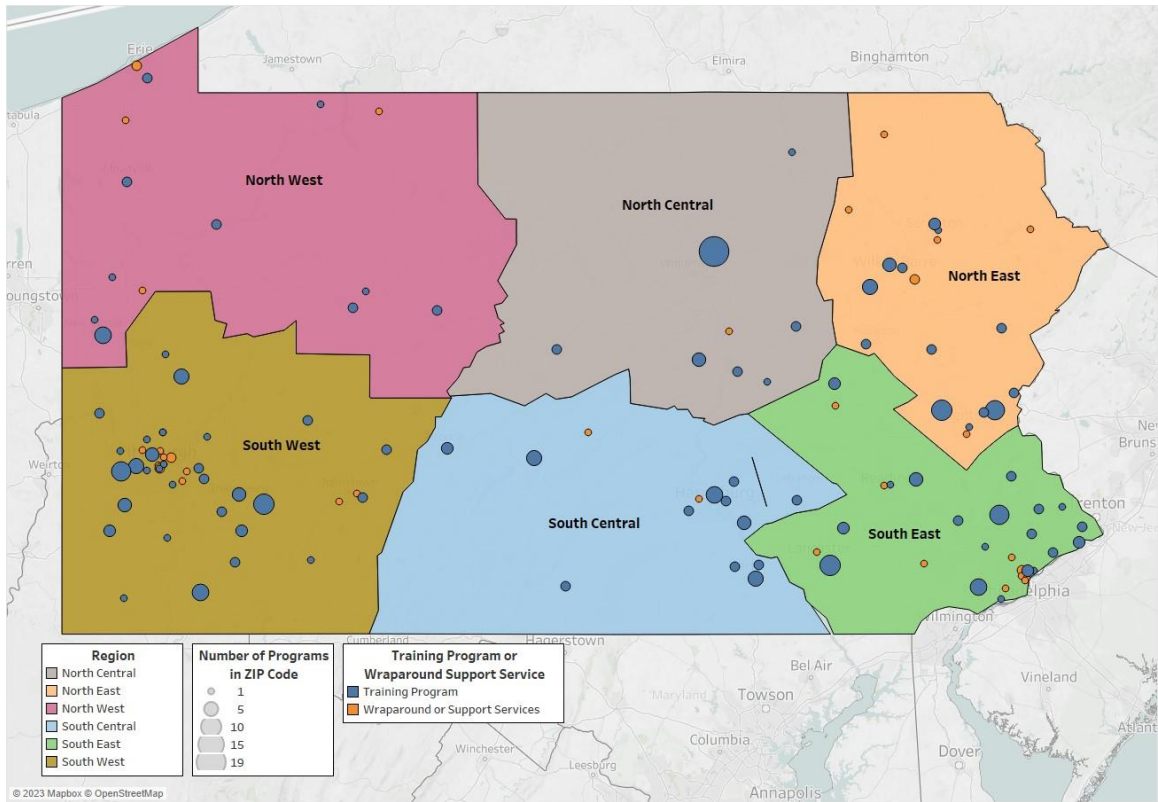
Program Type	Number of Programs
Community/Junior/Technical College	129
Vocational-Technical School	125
Trade Association	17
Union	8
Private Training Organization	7
Non-Profit Organization	3
<b>Total Programs</b>	<b>289</b>

The research team also developed a list of available wraparound services offered in Pennsylvania. While there are many organizations offering critical support services to a wide range of individuals and families across the state, the research team identified a handful that target those seeking job training, job readiness, and/or education programs. However, generally speaking, support services directly tied to work and career advancement programs are difficult to find. Many education and training providers include referrals to other organizations offering needed support, but do not specify the exact organizations. Only the few support services directly listed were included in the inventory. Improved communication or streamlined processes to identify and connect available services to individuals participating in workforce development or education programs could help bridge any disconnect. Identified wraparound services in this inventory mostly comprise of transportation and childcare assistance programs.

The largest proportion of training programs were found in the South West (27.3 percent) and South East regions (19.4 percent) of the state. Most of these programs were community, junior, and technical colleges and vocational-technical schools. Support services also tend to be concentrated in the South West and South East regions of the state, closest to urban areas of Philadelphia and Pittsburgh.



**FIGURE 21. PENNSYLVANIA RESIDENTIAL ENERGY CONTRACTOR TRAINING PROGRAMS BY REGION**



### **What HVAC/R Stakeholders Said About Trainer Needs:**

*“We have a waiting list—three freshman classes at max capacity and a waiting list of 200. Been approached by the college about how to fit a fourth cohort and we can’t make the room for it [in our facility].”*

*“Been at max capacity for five years with a waiting list. Would need more trainers and more equipment.”*

*“Acquiring equipment is often a challenge that we face. It is troublesome to try to keep equipment up to date.”*

*“Currently we have no issues with getting students hired. If the student wants a job they have multiple opportunities. I get a list every other week with opportunities. We work with many employers and they are constantly asking us for more help.”*

*“Folks need basic understanding of electricity and refrigeration process—that’s where training needs to start--before heat pump side of things. A lot of contractors I work with get their people from [vocational-technical schools] and that training seems to be underwhelming because of the curriculum. Training is underwhelming across many locations, and there’s a need to evaluate it.”*

*“[When revamping curriculum] NATE certification could be a good place to start. It would also be wise to have a round table with contractors, owners, and manufacturer-distributors.”*

### **What HVAC/R Stakeholders Said About Support Services:**

*“There’s a lot of challenges and barriers to getting folks employed. Childcare, transportation, food, energy insecurities. Transportation, childcare, and food. Wraparound services extend beyond. We’re starting to do some “assessing and prepping” bootcamp that gets people ready before we get them in the classroom. Bare minimum a week but up to six weeks.”*

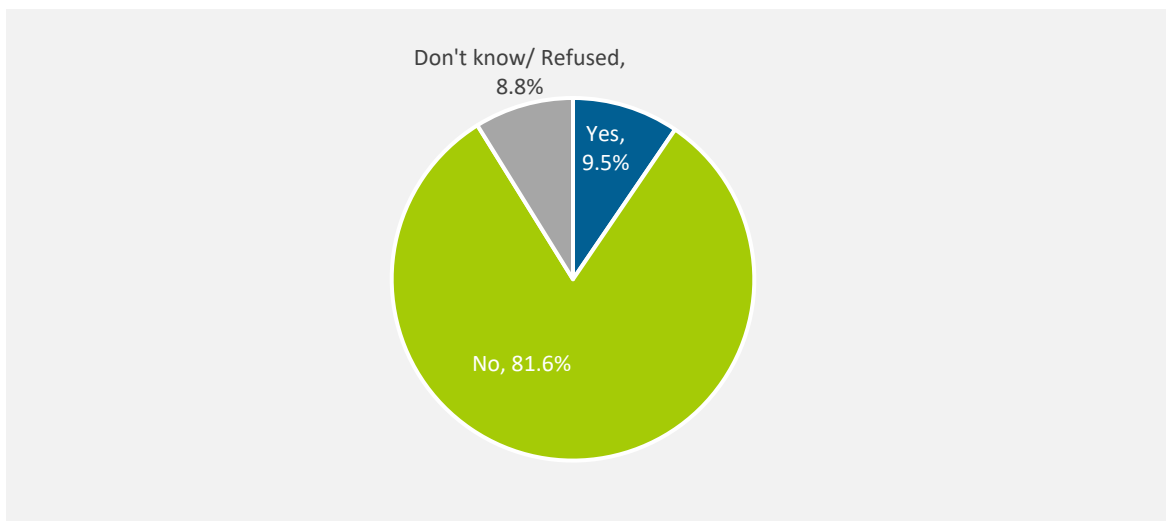
*“There were so many challenges of getting people to transportation, that we started offering transportation to job support and training. Took us from 70% retention to 80% retention rate and to an 80% placement rate post-internship.”*

*“It’s clear that there needs to be a complete pathway for people to pursue, involves partnership development, identification of barriers for certain populations. Background checks and driver’s license requirements are the biggest barriers now.”*

## Employer Survey Responses on Training and Education

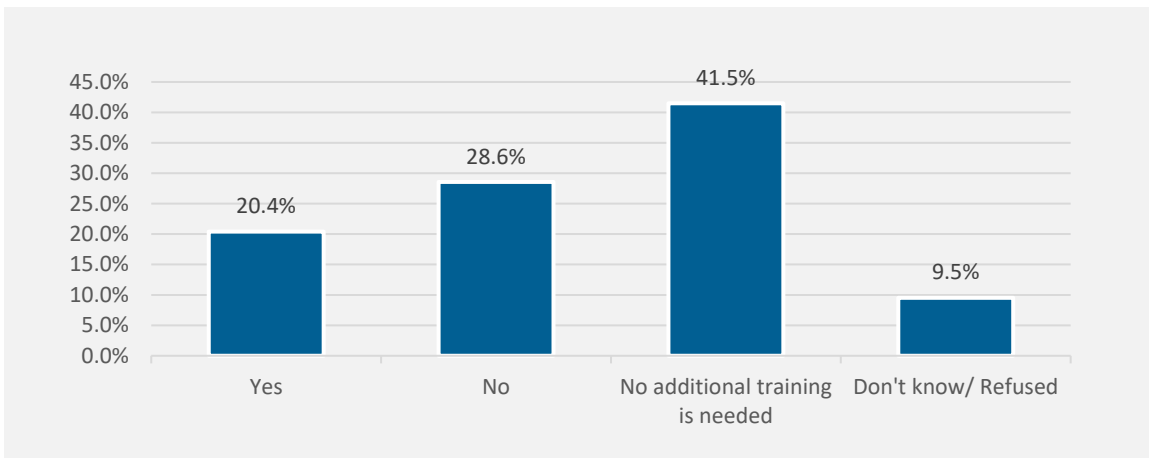
Roughly eight in ten (81.6 percent) energy efficiency and electrification employers did not report working directly with any education or training providers. Among the 9.5 percent with these types of partnerships, the education or training providers typically included vocational and technical schools and local unions (Figure 22). This finding highlights an opportunity to better connect education and training providers with employers to ensure that the curriculum is up to date and help job seekers and employers find one another.

FIGURE 22. DO YOU WORK DIRECTLY WITH ANY EDUCATION OR TRAINING PROVIDERS?



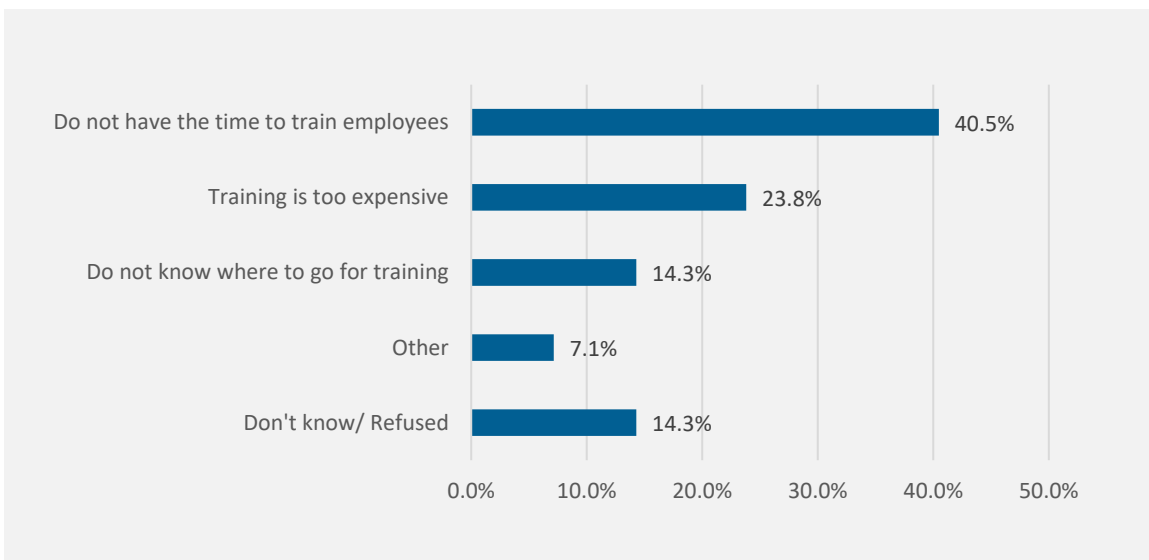
**Only one-fifth (20.4 percent) of employers reported they are planning on training their workers on weatherization or new HVAC or plumbing technologies.** Two-fifths (41.5 percent) of surveyed firms said they do not believe any additional training is needed, and almost three in ten (28.6 percent) stated they do not plan on having their workers participate in these types of trainings (Figure 23).

**FIGURE 23. ARE YOU PLANNING ON TRAINING YOUR STAFF ON WEATHERIZATION OR NEW HVAC OR PLUMBING TECHNOLOGIES?**



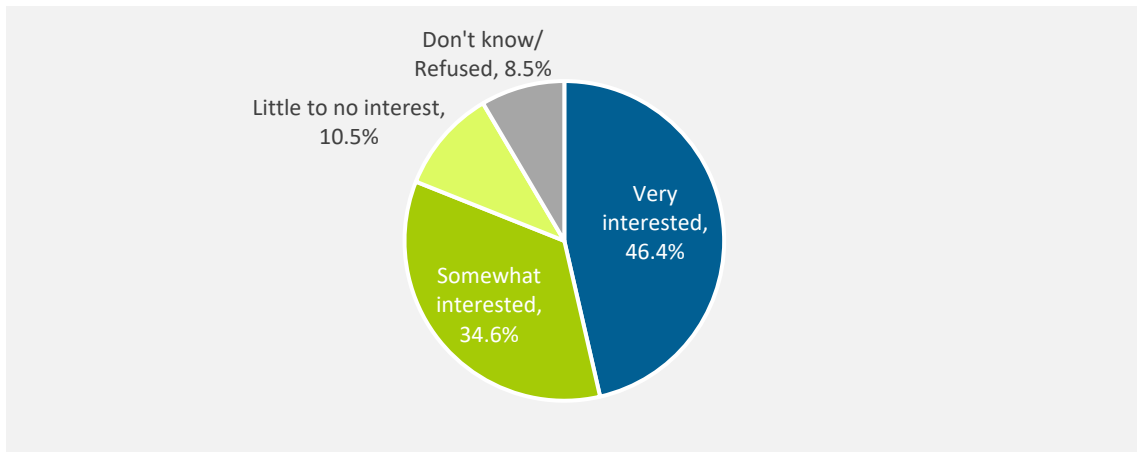
The lack of time and funds available for training were the two most common reasons reported for why certain energy efficiency and electrification firms surveyed do not plan on training their workers in weatherization or new HVAC or plumbing technologies. A smaller proportion (14.3 percent) of employers said they do not know where to go for these types of trainings (Figure 24). This information suggests that training programs may need to consider accessibility (through recorded webinars or stacked on top of existing training through distributors) as well as potentially funding any in-person workshop requirements.

**FIGURE 24. WHY DO YOU NOT PLAN ON TRAINING YOUR STAFF ON WEATHERIZATION OR NEW HVAC OR PLUMBING TECHNOLOGIES?**



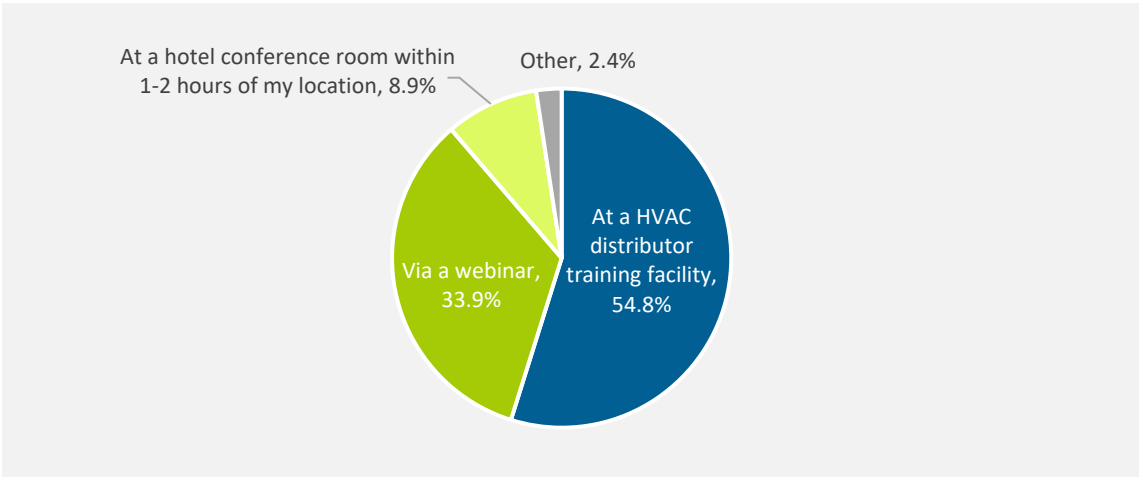
Most (81.0 percent) survey respondents reported interest in training or certification opportunities for their employees in new HVAC or plumbing technologies, including air-source heat pumps, ground-source heat pumps, heat pump water heaters, and more (Figure 25).

**FIGURE 25. INTEREST IN OPPORTUNITIES FOR EMPLOYEE TRAINING OR CERTIFICATION IN NEW HVAC OR PLUMBING TECHNOLOGIES**



**Over half (54.8 percent) of surveyed energy efficiency and building electrification firms who reported interest in new HVAC or plumbing training or certification opportunities for their employees said that the best way for the Pennsylvania Department of Environmental Protection to deliver this education is at an HVAC distributor training facility.** One-third (33.9 percent) felt the best delivery method was via a webinar (Figure 26). Our interviews suggest that the most useful training materials would not necessarily be technically oriented but rather contain information about rebate programs, financing opportunities, and other state and federal program details. Information about rebates is typically disseminated through a range of sources, including OEMs, distributors, utilities, and sometimes even customers themselves. A central clearinghouse of information on available rebates for geographies across the state may be particularly useful.

**FIGURE 26. BEST WAY FOR THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION TO DELIVER HVAC OR PLUMBING TECHNOLOGY EDUCATION TO EMPLOYEES**



# Appendix A: Report Methodology

## Survey Methodology

BW Research conducted employer interviews with energy efficiency and electrification (includes energy auditing or HERS rating, building envelope activities such as air sealing and insulation, heat pumps water heaters, or heat pump space heating and cooling systems) organizations throughout Pennsylvania. The survey sample included a compilation of known energy efficiency and electrification firms that had completed surveys for the United States Energy and Employment Report (USEER) in the last three years, samples from industry associations, online panel through a third party of relevant businesses, and a sample of firms known to employ the relevant industry codes (NAICS) from DataAxleUSA. The survey instrument was programmed internally by BW Research, and each respondent was assigned a unique ID to prevent duplication.

To qualify for the survey, responding organizations needed to employ at least one of the following occupations:

- HVAC/R mechanics, installers, or technicians
- Electricians
- Insulation workers (floor, ceiling, and wall)
- Plumbers
- Building performance specialists
- Weatherization technicians
- Energy auditors/ HERS raters

The employer survey was fielded between September 26<sup>th</sup> and October 13<sup>th</sup>, 2023, and resulted in 156 total completes by firm, accounting for 526 occupational completes. The average survey duration was 7.3 minutes.

## Employment Forecasting

The research team derived estimated occupational demand from The Nature Conservancy *Potential Reconciliation Climate Policies: An Economic Impact Analysis Report, Pennsylvania*, which “analyzes the economic impacts of federal investments in climate policies, including clean energy tax credits, infrastructure investments, transportation and building electrification investments, and reforestation and conservation grants.” The analysis estimated about \$12.6 billion in federal funding in Pennsylvania, which supports employment in the state across construction, manufacturing, professional services, and other supply chain industries. From these industry employment estimates, the research team used industry staffing patterns to develop occupational projections, assumed to be supported consistently for 10 years, resulting in the detailed estimates reported here. For more information on The Nature Conservancy’s analysis, please visit [the full report](#).

In addition to the jobs gained spurred by federal investments, the research team used national-level 10-year occupational projections from the Bureau of Labor Statistics (BLS) Occupational Employment and

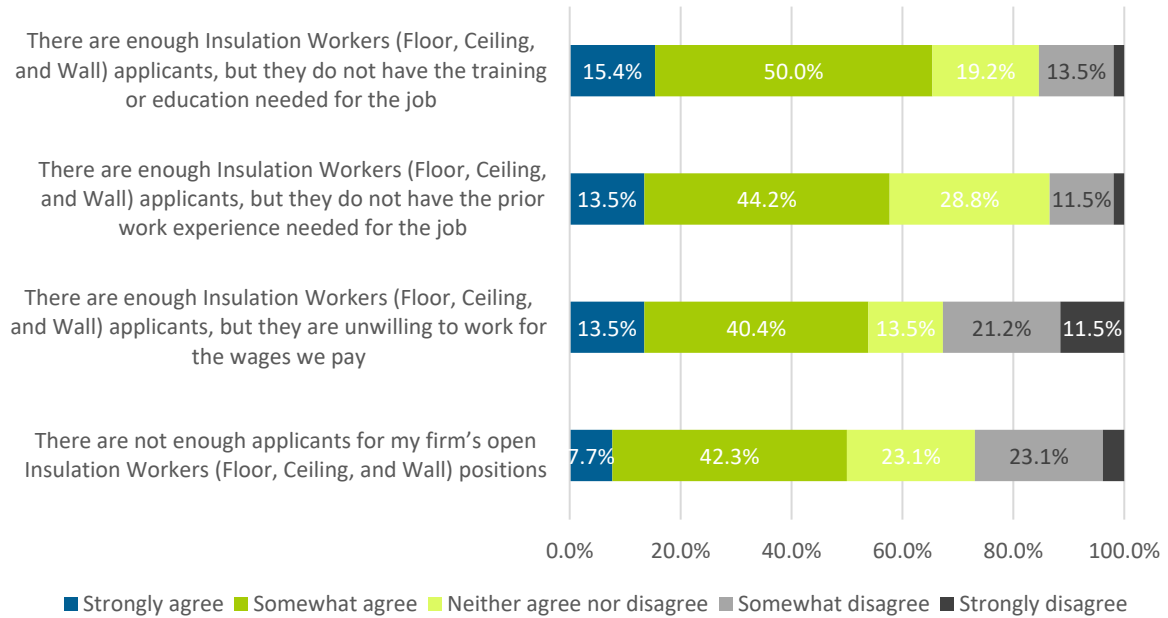
Wage Statistics (OEWS). This means the growth rates highlighted in this report are a combination of BLS-demographic-driven occupation growth as well as the anticipated jobs created through energy efficiency and electrification federal policies. The research team took job-year estimates and translated them into levelized CAGR employment estimates that match the total number of additional job-years added but at a steady compounding growth rate to mimic a steady scaling of training and education infrastructure.



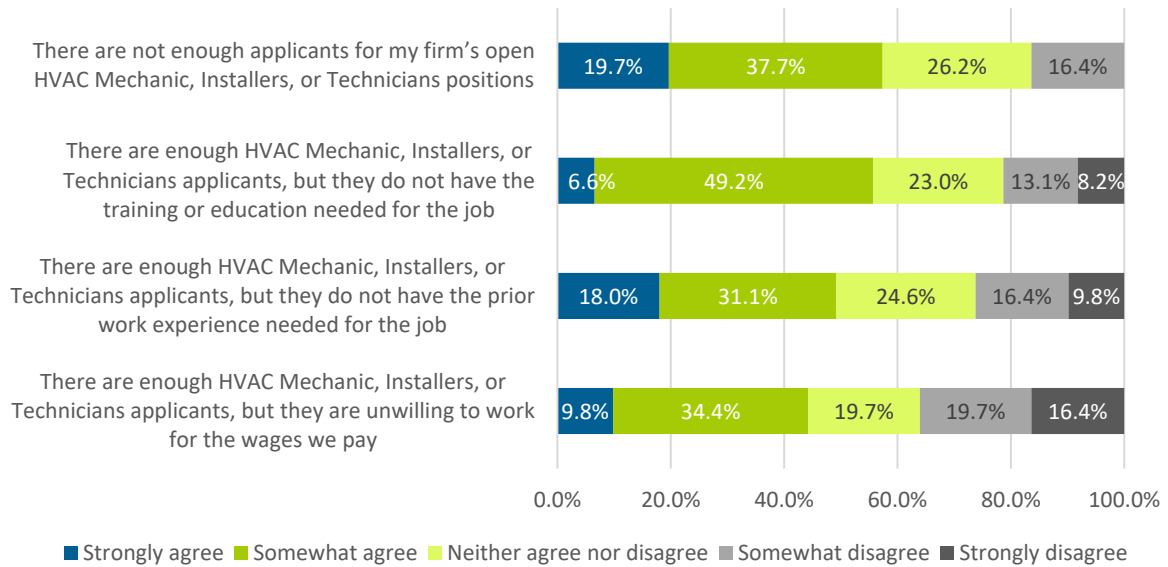
# Appendix B Hiring Difficulty

## Deep Dive:

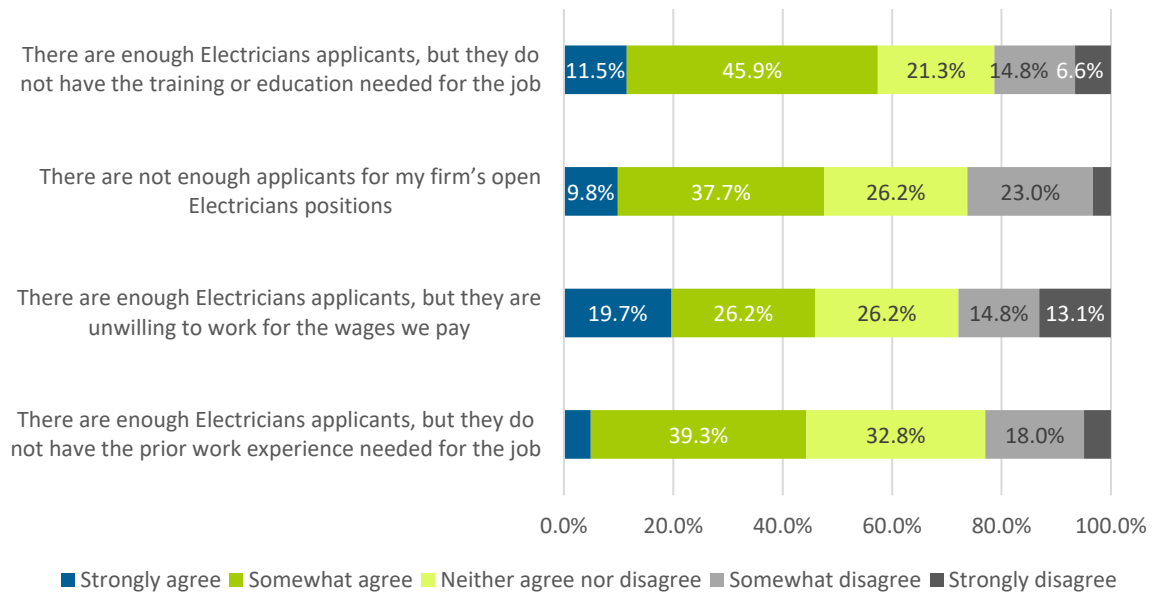
**FIGURE 27. LEVEL OF AGREEMENT WITH HIRING DIFFICULTY REASONS BY EMPLOYERS OF INSULATION WORKERS (FLOOR, CEILING, AND WALL)**



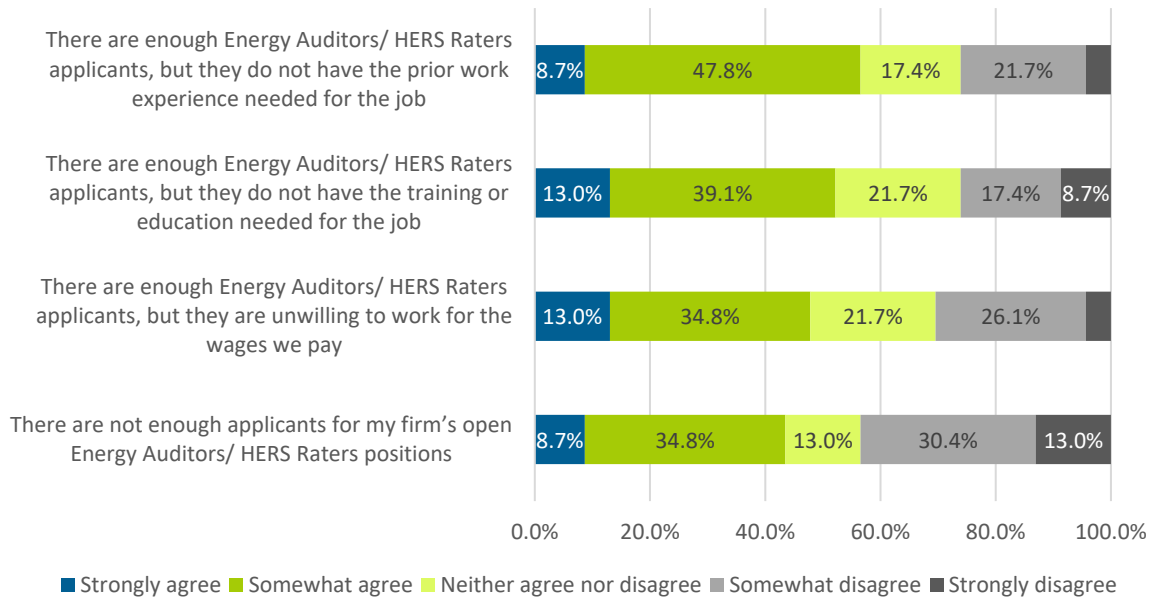
**FIGURE 28. LEVEL OF AGREEMENT WITH HIRING DIFFICULTY REASONS BY EMPLOYERS OF HVAC MECHANICS, INSTALLERS, AND TECHNICIANS**



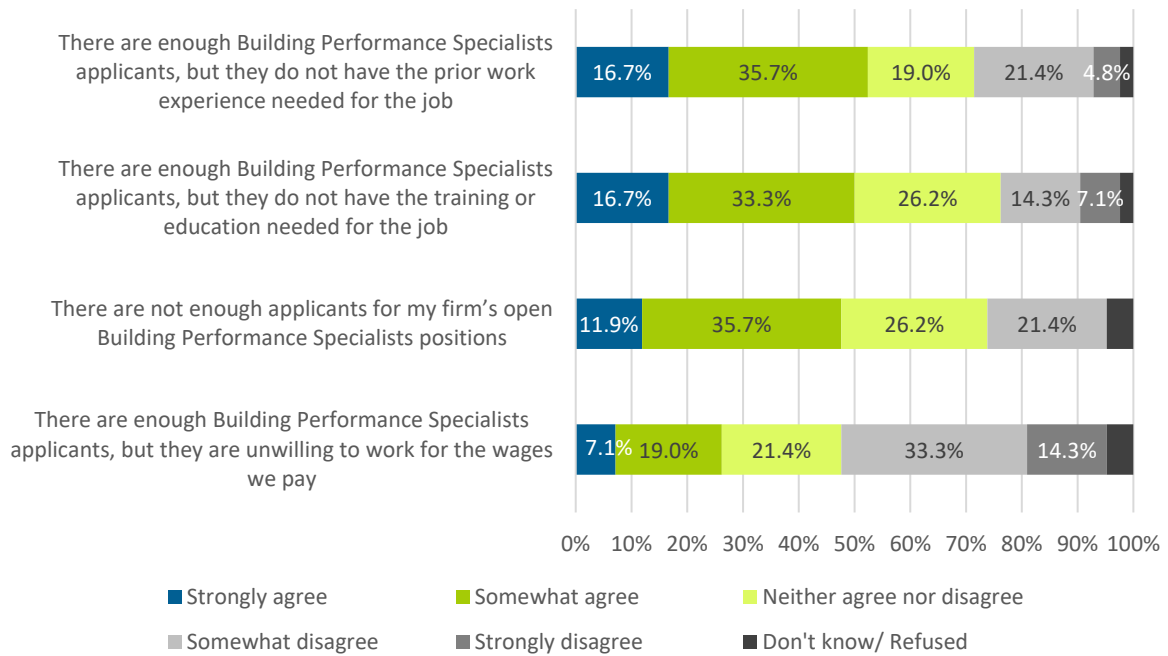
**FIGURE 29. LEVEL OF AGREEMENT WITH HIRING DIFFICULTY REASONS BY EMPLOYERS OF ELECTRICIANS**



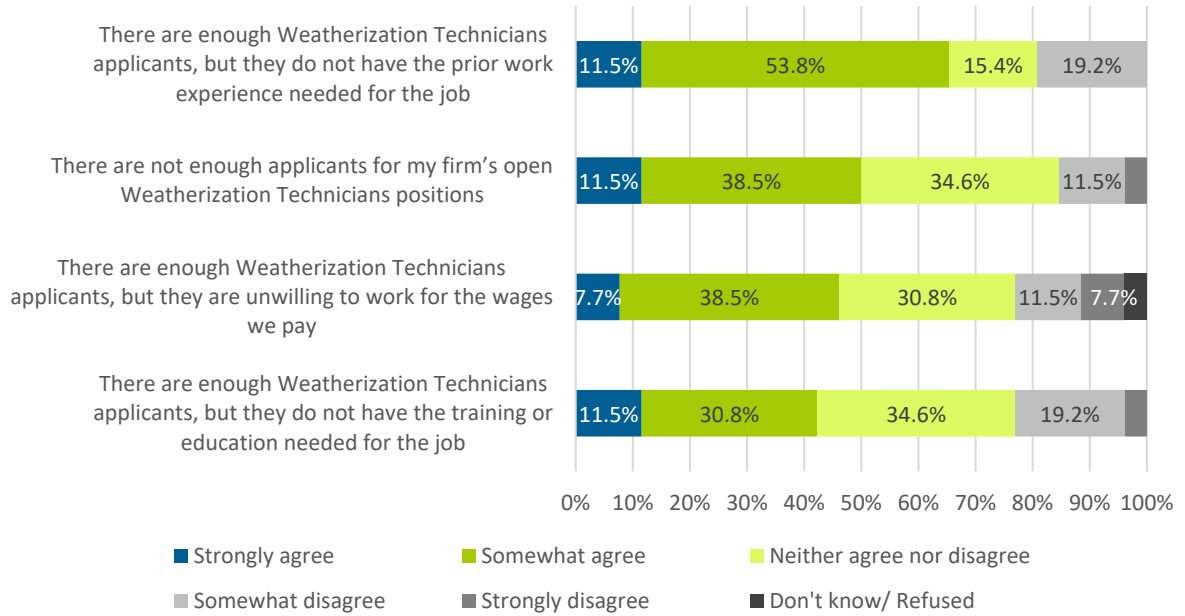
**FIGURE 30. LEVEL OF AGREEMENT WITH HIRING DIFFICULTY REASONS BY EMPLOYERS OF ENERGY AUDITORS/HERS RATERS**



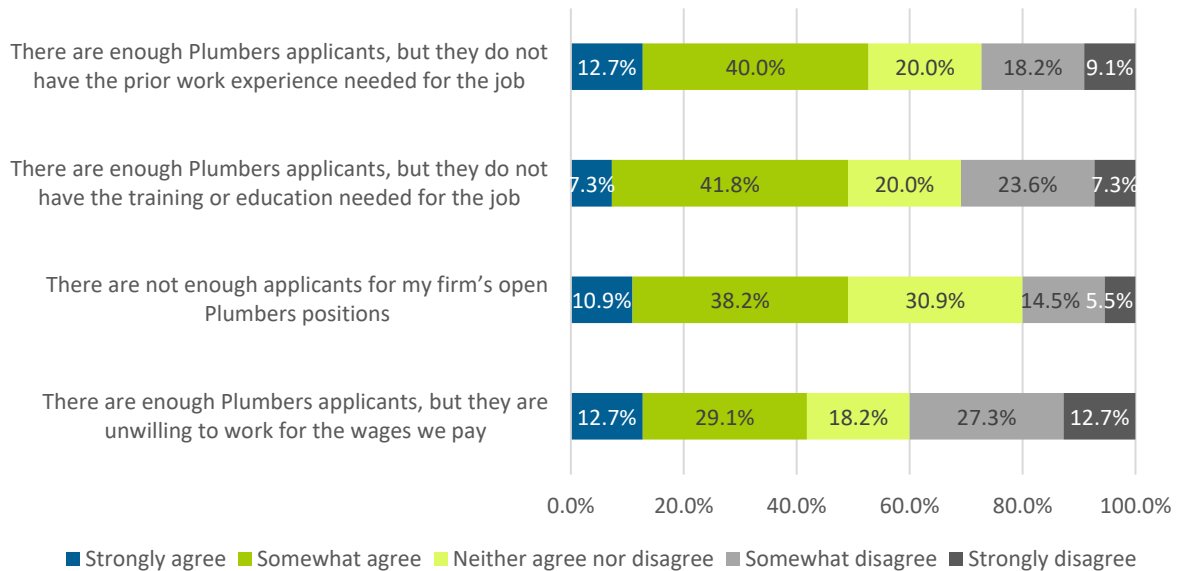
**FIGURE 31. LEVEL OF AGREEMENT WITH HIRING DIFFICULTY REASONS BY EMPLOYERS OF BUILDING PERFORMANCE SPECIALISTS**



**FIGURE 32. LEVEL OF AGREEMENT WITH HIRING DIFFICULTY REASONS BY EMPLOYERS OF WEATHERIZATION TECHNICIANS**

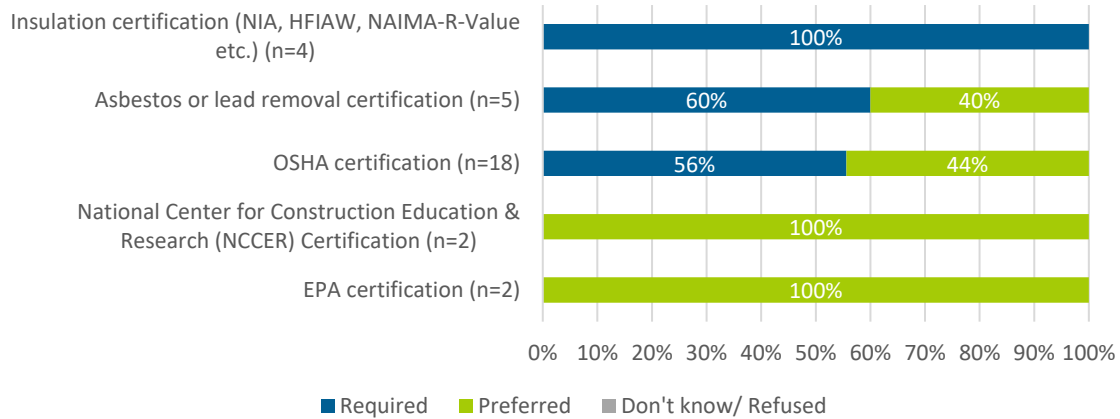


**FIGURE 33. LEVEL OF AGREEMENT WITH HIRING DIFFICULTY REASONS BY EMPLOYERS OF PLUMBERS**

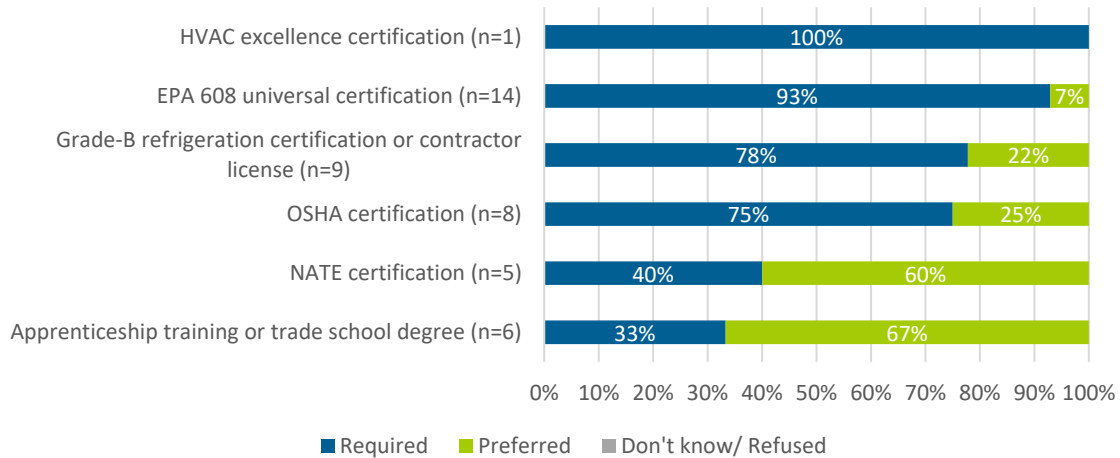


# Appendix C: Certifications for Occupations

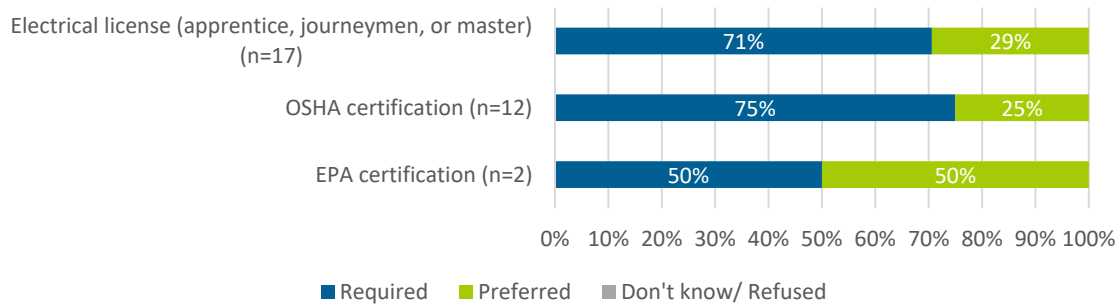
**FIGURE 34. REQUIRED/PREFERRED CERTIFICATIONS FOR INSULATION WORKERS (FLOOR, CEILING, AND WALL)**



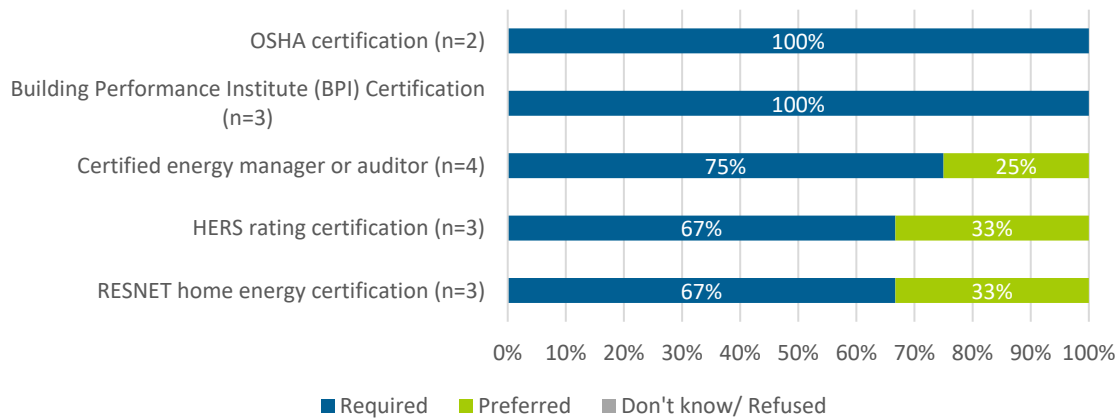
**FIGURE 35. REQUIRED/PREFERRED CERTIFICATIONS FOR HVAC/R MECHANICS, INSTALLERS, OR TECHNICIANS**



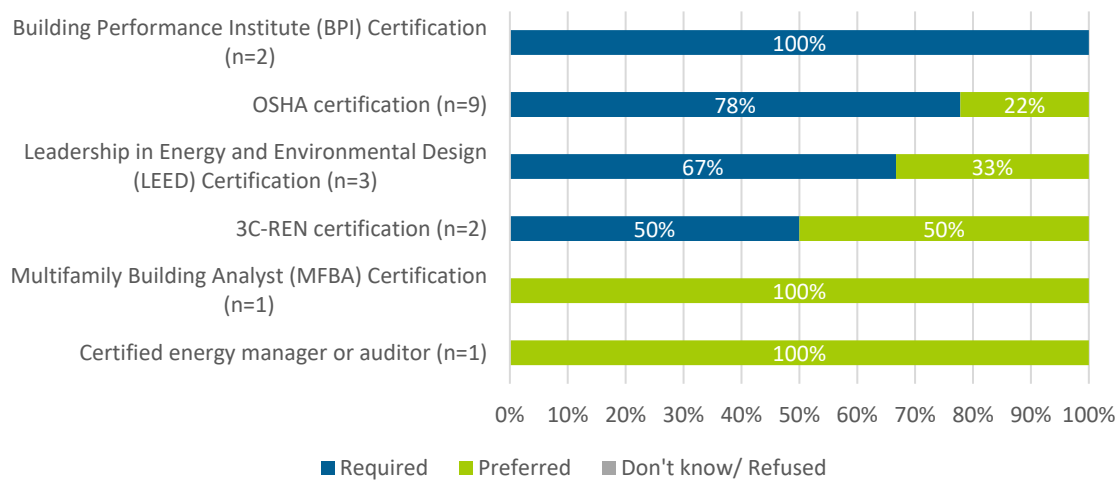
**FIGURE 36. REQUIRED/PREFERRED CERTIFICATIONS FOR ELECTRICIANS**



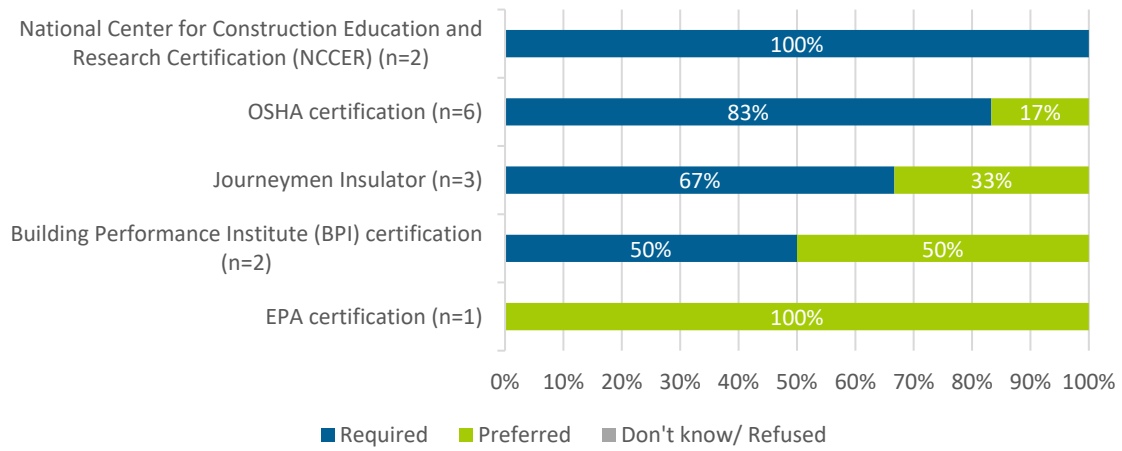
**FIGURE 37. REQUIRED/PREFERRED CERTIFICATIONS FOR ENERGY AUDITORS/HERS RATERS**



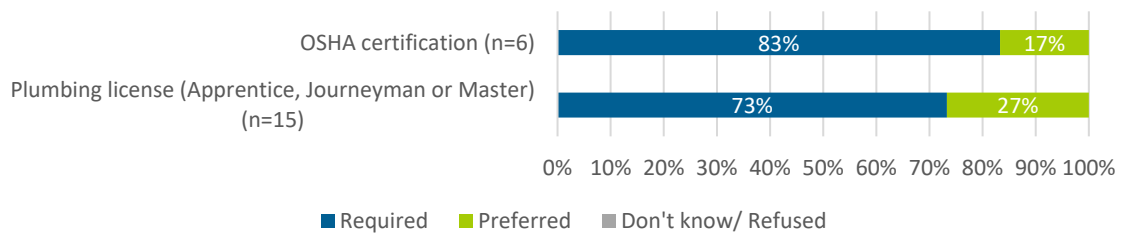
**FIGURE 38. REQUIRED/PREFERRED CERTIFICATIONS FOR BUILDING PERFORMANCE SPECIALISTS**



**FIGURE 39. REQUIRED/PREFERRED CERTIFICATIONS FOR WEATHERIZATION TECHNICIANS**



**FIGURE 40. REQUIRED/PREFERRED CERTIFICATIONS FOR PLUMBERS**



# Appendix D: Survey Toplines



PA DEP  
Clean Energy Workforce Needs Assessment

Employer Survey

October 2023

Preliminary Toplines 2.0

n = 156

## Introduction:

Hello, my name is \_\_\_\_\_ and I am calling on behalf of the **Pennsylvania Department of Environmental Protection (DEP)**. We are conducting a statewide survey to better understand the workforce and staffing needs of clean energy businesses, as DEP is currently developing a training program for contractors in PA. May I please speak to the person most knowledgeable about staffing at your firm?

**[IF NEEDED]:** This survey has been commissioned by the **Pennsylvania Department of Environmental Protection**.

**[IF NEEDED]:** The survey is being conducted by BW Research, an independent research organization, and should take approximately 10 to 15 minutes of your time.

**[IF NEEDED]:** Your individual responses will **not** be published; only aggregate information will be used in the reporting of the survey results.



### Screener Questions

A. Is your firm involved with any activity related to **energy efficiency and electrification**, which includes energy auditing or HERS rating, building envelope activities such as air sealing and insulation, heat pumps water heaters, or heat pump space heating and cooling systems?

**100.0% Yes**

**0.0% No**

**0.0% Don't know/ Refused**

B. Does your firm have any business locations in Pennsylvania?

**100.0% Yes**

**0.0% No**

**0.0% Don't know/ Refused**

C. Please enter the ZIP code of your primary Pennsylvania location.. \_ \_ \_ \_ \_

**100.0% Enter zip code:**

**0.0% Don't know/ Refused**

D. Which does your business primarily work on? [SELECT ONE]

**55.8% Single Family Residential Buildings**

**3.8% Multi-Family Residential Buildings with 2-4 Units**

**12.2% Multi-Family Residential Buildings with more than 4 units**

**28.2% Commercial Non-Residential Properties**

**0.0% Other**

E. Please indicate which of the following occupations are employed at your location. [SELECT ALL THAT APPLY] – *Multiple response permitted: Percentages may sum to more than 100%.*

**RANDOMIZE**

- 62.8% HVAC/R Mechanic, Installers, or Technicians**
- 62.2% Electricians**
- 61.5% Insulation Workers (Floor, Ceiling, and Wall)**
- 55.8% Plumbers**
- 45.5% Building Performance Specialists**
- 32.1% Weatherization Technicians**
- 23.1% Energy Auditors/ HERS Raters**
- 0.0% None of the above**

F. Please tell us which type of technology your company works most closely with [SELECT ONE]:

- 29.5% Insulation**
- 24.4% Air-source heat pumps for HVAC**
- 14.7% Heat pump water heaters**
- 10.9% Ground-source or geothermal heat pumps for HVAC**
- 10.3% Energy auditing services**
- 7.7% Air sealing**
- 2.6% Other**

**Section 1. Awareness and Activity**

1. Are you familiar with the Home Energy Performance-Based, Whole House Rebate (HOMES) Program<sup>23</sup> for whole house energy retrofits? This is a rebate program funded by the Inflation Reduction Act (IRA) and is also known as the Home Efficiency Rebate Program.

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<sup>23</sup> The program is now identified by the Department of Energy as the Home Efficiency Rebate (HER) program.

**75.0% Yes**

**25.0% No**

2. Are you familiar with the Home Electrification and Appliance Rebate (HEAR) Program for energy efficient building materials and electric appliances? This is a rebate program funded by the Inflation Reduction Act (IRA).

**71.8% Yes**

**28.2% No**

**Section 2. Employment & Hiring Profile**

3. Including all full-time and part-time employees, how many **permanent** employees work at your current location? Please include any employees working remotely who report out of this location. [DO NOT ACCEPT 0 AS A RESPONSE] (n=138)

<b>Average</b>	<b>Median</b>
<b>96</b>	<b>25</b>

**15.9% 1 to 4 employees**

**10.9% 5 to 9 employees**

**21.0% 10 to 24 employees**

**11.6% 25 to 49 employees**

**40.6% 50 or more employees**

4. Of all permanent employees working at your current location, how many directly support the energy portion of your business? (n=137)

**12.4% Less than 25% of employees**

**20.4% 25% to 49% of employees**

**22.6% 50% to 74% of employees**

**44.5% 75% to 100% of employees**

5. Is your company/organization involved in any activities related to HVAC or plumbing? (n=154)

- 90.3% Yes**
- 8.4% No**
- 1.3% Don't know/ Refused**

6. Would your organization/company be interested in opportunities to get your employees trained or certified in new HVAC or plumbing technologies? (Includes Air-Source Heat Pumps, Ground-Source Heat Pumps, Heat Pump Water Heaters etc.) (n=153)

- 46.4% Very interested**
- 34.6% Somewhat interested**
- 10.5% Little to no interest**
- 8.5% Don't know/ Refused**

**ASK Q7 IF Q6 = "VERY INTERESTED" OR "SOMEWHAT INTERESTED" OTHERWISE SKIP**

7. What is the best way for the Pennsylvania Department of Department of Environmental Protection to deliver HVAC or plumbing technologies education to your employees? (n=124)

- 54.8% At a HVAC distributor training facility**
- 33.9% Via a webinar**
- 8.9% At a hotel conference room within 1-2 hours of my location**
- 2.4% Other**

**Section 3. Occupation Composition**

**[PIPE IN ALL OCCUPATIONS SELECTED AT SE]**

8. Record # of employees \_\_\_\_\_

	<u>Average</u>	<u>Median</u>	<u>1 to 4 employees</u>	<u>5 to 9 employees</u>	<u>10 to 24 employees</u>	<u>25 to 49 employees</u>	<u>50 to 99 employees</u>	<u>100 or more employees</u>
<b>A. Insulation Workers (Floor, Ceiling, and Wall) (n=95)</b>	27.9	10.0	27.4%	18.9%	21.1%	7.4%	11.6%	13.7%
<b>B. HVAC/R Mechanics, Installers, or Technicians (n=96)</b>	33.8	10.0	32.3%	12.5%	21.9%	11.5%	7.3%	14.6%
<b>C. Electricians (n=95)</b>	19.9	5.0	46.3%	13.7%	17.9%	2.1%	9.5%	10.5%
<b>D. Energy Auditors/ HERS Raters (n=36)</b>	12.4	5.0	41.7%	13.9%	11.1%	13.9%	5.6%	13.9%

E. Building Performance Specialists (n=70)	17.4	6.5	37.1%	17.1%	20.0%	7.1%	11.4%	7.1%
F. Weatherization Technicians (n=49)	18.9	5.0	46.9%	20.4%	14.3%	4.1%	8.2%	6.1%
G. Plumbers (n=85)	16.0	5.0	44.7%	11.8%	22.4%	8.2%	5.9%	7.1%

9. Of your (INSERT Q8#) [PIPE IN SE OCCUPATIONS SELECTED], how many are represented by a union or covered under a collective bargaining agreement or project labor agreement? [MULTIPLE RESPONSES PERMITTED]

	1% to 25% of employees	25% to 49% of employees	50% to 74% of employees	75% to 100% of employees	None
A. Insulation Workers (Floor, Ceiling, and Wall) (n=95)	1.1%	9.5%	10.5%	36.8%	42.1%
B. HVAC/R Mechanics, Installers, or Technicians (n=96)	0.0%	7.3%	8.3%	35.4%	49.0%
C. Electricians (n=95)	0.0%	4.2%	13.7%	36.8%	45.3%
D. Energy Auditors/ HERS Raters (n=36)	0.0%	5.6%	16.7%	41.7%	36.1%
E. Building Performance Specialists (n=70)	1.4%	10.0%	14.3%	30.0%	44.3%
F. Weatherization Technicians (n=49)	0.0%	2.0%	10.2%	34.7%	53.1%
G. Plumbers (n=85)	1.2%	3.5%	9.4%	34.1%	51.8%

10. If you currently have [INSERT Q8#] [PIPE IN SE OCCUPATIONS SELECTED] at your location, how many more or fewer employees do you expect to have at your location three years from now?

	Median Employer Projected Growth (Only those that expect growth)	More (record #):	Fewer (record #):	Same number of employees	Don't know/ Refused
A. Insulation Workers (Floor, Ceiling, and Wall) (n=92)	50.0%	33.7%	2.2%	60.9%	3.3%
B. HVAC/R Mechanics, Installers, or Technicians (n=94)	25.0%	27.7%	1.1%	62.8%	8.5%
C. Electricians (n=93)	47.2%	31.2%	2.2%	58.1%	8.6%
D. Energy Auditors/ HERS Raters (n=36)	10.0%	22.2%	5.6%	66.7%	5.6%
E. Building Performance Specialists (n=70)	44.2%	30.0%	4.3%	58.6%	7.1%

<b>F. Weatherization Technicians (n=48)</b>	<b>50.0%</b>	<b>33.3%</b>	<b>2.1%</b>	<b>60.4%</b>	<b>4.2%</b>
<b>G. Plumbers (n=83)</b>	<b>40.0%</b>	<b>27.7%</b>	<b>1.2%</b>	<b>62.7%</b>	<b>8.4%</b>

11. Please indicate your level of difficulty hiring qualified workers for the following occupation(s):

[PIPE IN ALL OCCUPATIONS SELECTED AT SE]

	<u>Little to no difficulty</u>	<u>Some difficulty</u>	<u>Great difficulty</u>	<u>Don't know/Refused</u>
<b>A. Insulation Workers (Floor, Ceiling, and Wall) (n=92)</b>	<b>40.2%</b>	<b>47.8%</b>	<b>8.7%</b>	<b>3.3%</b>
<b>B. HVAC/R Mechanics, Installers, or Technicians (n=94)</b>	<b>34.0%</b>	<b>33.0%</b>	<b>31.9%</b>	<b>1.1%</b>
<b>C. Electricians (n=93)</b>	<b>33.3%</b>	<b>33.3%</b>	<b>32.3%</b>	<b>1.1%</b>
<b>D. Energy Auditors/ HERS Raters (n=36)</b>	<b>33.3%</b>	<b>36.1%</b>	<b>27.8%</b>	<b>2.8%</b>
<b>E. Building Performance Specialists (n=70)</b>	<b>38.6%</b>	<b>34.3%</b>	<b>25.7%</b>	<b>1.4%</b>
<b>F. Weatherization Technicians (n=48)</b>	<b>45.8%</b>	<b>33.3%</b>	<b>20.8%</b>	<b>0.0%</b>
<b>G. Plumbers (n=83)</b>	<b>33.7%</b>	<b>37.3%</b>	<b>28.9%</b>	<b>0.0%</b>

[IF Q11 = "Some difficulty" OR "Great difficulty", ASK Q12 FOR EACH OCCUPATION, OTHERWISE SKIP]

12. Please indicate your level of agreement with each of the following statements:

[PIPE IN ALL OCCUPATIONS SELECTED AT SE]

**Insulation Workers (Floor, Ceiling, and Wall) (n=52)**

**RANDOMIZE**

	<u>Strongly agree</u>	<u>Somewhat agree</u>	<u>Neither agree nor disagree</u>	<u>Somewhat disagree</u>	<u>Strongly disagree</u>	<u>Don't know/Refused</u>
<b>A. There are not enough applicants for my firm's open Insulation Workers (Floor, Ceiling, and Wall) positions</b>	<b>7.7%</b>	<b>42.3%</b>	<b>23.1%</b>	<b>23.1%</b>	<b>3.8%</b>	<b>0.0%</b>

B. There are enough Insulation Workers (Floor, Ceiling, and Wall) applicants, but they do not have the training or education needed for the job	15.4%	50.0%	19.2%	13.5%	1.9%	0.0%
C. There are enough Insulation Workers (Floor, Ceiling, and Wall) applicants, but they do not have the prior work experience needed for the job	13.5%	44.2%	28.8%	11.5%	1.9%	0.0%
D. There are enough Insulation Workers (Floor, Ceiling, and Wall) applicants, but they are unwilling to work for the wages we pay	13.5%	40.4%	13.5%	21.2%	11.5%	0.0%

HVAC Mechanic, Installers, or Technicians (n=61)

RANDOMIZE

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Don't know/Refused
A. There are not enough applicants for my firm's open HVAC Mechanic, Installers, or Technicians positions	19.7%	37.7%	26.2%	16.4%	0.0%	0.0%
B. There are enough HVAC Mechanic, Installers, or Technicians applicants, but they do not have the training or education needed for the job	6.6%	49.2%	23.0%	13.1%	8.2%	0.0%
C. There are enough HVAC Mechanic, Installers, or Technicians applicants, but they do not have the prior work experience needed for the job	18.0%	31.1%	24.6%	16.4%	9.8%	0.0%

D. There are enough HVAC Mechanic, Installers, or Technicians applicants, but they are unwilling to work for the wages we pay	9.8%	34.4%	19.7%	19.7%	16.4%	0.0%
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Electricians (n=61)

RANDOMIZE

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Don't know/Refused
A. There are not enough applicants for my firm's open Electricians positions	9.8%	37.7%	26.2%	23.0%	3.3%	0.0%
B. There are enough Electricians applicants, but they do not have the training or education needed for the job	11.5%	45.9%	21.3%	14.8%	6.6%	0.0%
C. There are enough Electricians applicants, but they do not have the prior work experience needed for the job	4.9%	39.3%	32.8%	18.0%	4.9%	0.0%
D. There are enough Electricians applicants, but they are unwilling to work for the wages we pay	19.7%	26.2%	26.2%	14.8%	13.1%	0.0%

Energy Auditors/ HERS Raters (n=23)

RANDOMIZE

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Don't know/Refused
A. There are not enough applicants for my firm's open Energy Auditors/ HERS Raters positions	8.7%	34.8%	13.0%	30.4%	13.0%	0.0%
B. There are enough Energy Auditors/ HERS Raters applicants, but they do not have the training or education needed for the job	13.0%	39.1%	21.7%	17.4%	8.7%	0.0%
C. There are enough Energy Auditors/ HERS Raters applicants, but they do not have the prior work experience needed for the job	8.7%	47.8%	17.4%	21.7%	4.3%	0.0%



D. There are enough Energy Auditors/ HERS Raters applicants, but they are unwilling to work for the wages we pay	13.0%	34.8%	21.7%	26.1%	4.3%	0.0%
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**Building Performance Specialists (n=42)**

**RANDOMIZE**

	Strongly <u>agree</u>	Somewhat <u>agree</u>	Neither agree nor <u>disagree</u>	Somewhat <u>disagree</u>	Strongly <u>disagree</u>	Don't know/ <u>Refused</u>
A. There are not enough applicants for my firm's open Building Performance Specialists positions	11.9%	35.7%	26.2%	21.4%	0.0%	4.8%
B. There are enough Building Performance Specialists applicants, but they do not have the training or education needed for the job	16.7%	33.3%	26.2%	14.3%	7.1%	2.4%
C. There are enough Building Performance Specialists applicants, but they do not have the prior work experience needed for the job	16.7%	35.7%	19.0%	21.4%	4.8%	2.4%
D. There are enough Building Performance Specialists applicants, but they are unwilling to work for the wages we pay	7.1%	19.0%	21.4%	33.3%	14.3%	4.8%

**Weatherization Technicians (n=26)**

**RANDOMIZE**

	Strongly <u>agree</u>	Somewhat <u>agree</u>	Neither agree nor <u>disagree</u>	Somewhat <u>disagree</u>	Strongly <u>disagree</u>	Don't know/ <u>Refused</u>
A. There are not enough applicants for my firm's open Weatherization Technicians positions	11.5%	38.5%	34.6%	11.5%	3.8%	0.0%
B. There are enough Weatherization Technicians applicants, but they do not have the training or education needed for the job	11.5%	30.8%	34.6%	19.2%	3.8%	0.0%
C. There are enough Weatherization Technicians applicants, but they do not have the prior work experience needed for the job	11.5%	53.8%	15.4%	19.2%	0.0%	0.0%

D. There are enough Weatherization Technicians applicants, but they are unwilling to work for the wages we pay 7.7% 38.5% 30.8% 11.5% 7.7% 3.8%

Plumbers (n=55)

**RANDOMIZE**

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Don't know/Refused
A. There are not enough applicants for my firm's open Plumbers positions	10.9%	38.2%	30.9%	14.5%	5.5%	0.0%
B. There are enough Plumbers applicants, but they do not have the training or education needed for the job	7.3%	41.8%	20.0%	23.6%	7.3%	0.0%
C. There are enough Plumbers applicants, but they do not have the prior work experience needed for the job	12.7%	40.0%	20.0%	18.2%	9.1%	0.0%
D. There are enough Plumbers applicants, but they are unwilling to work for the wages we pay	12.7%	29.1%	18.2%	27.3%	12.7%	0.0%

**IF Q12 "STRONGLY AGREE" COUNT IS GREATER THAN 1 ASK Q13**

13. What is the most significant reason for the reported hiring difficulty for [INSERT OCCUPATION]?

**PIPE IN "STRONGLY AGREE" SELECTED IN Q12**

**Q13Prime: Insulation Workers (Floor, Ceiling, and Wall) (n=16)**

- 37.5% There are enough Insulation Workers (Floor, Ceiling, and Wall) applicants, but they do not have the training or education needed for the job.
- 25.0% There are enough Insulation Workers (Floor, Ceiling, and Wall) applicants, but they are unwilling to work for the wages we pay.
- 18.8% There are enough Insulation Workers (Floor, Ceiling, and Wall) applicants, but they do not have the prior work experience needed for the job.

**18.8%** There are not enough applicants for my firm's open Insulation Workers (Floor, Ceiling, and Wall) positions.

**Q13Prime: HVAC Mechanic, Installers, or Technicians (n=26)**

**46.2%** There are not enough applicants for my firm's open HVAC Mechanic, Installers, or Technicians positions.

**38.5%** There are enough HVAC Mechanic, Installers, or Technicians applicants, but they do not have the prior work experience needed for the job.

**11.5%** There are enough HVAC Mechanic, Installers, or Technicians applicants, but they are unwilling to work for the wages we pay.

**3.8%** There are enough HVAC Mechanic, Installers, or Technicians applicants, but they do not have the training or education needed for the job.

**Q13Prime: Electricians (n=18)**

**44.4%** There are enough Electricians applicants, but they are unwilling to work for the wages we pay.

**38.9%** There are enough Electricians applicants, but they do not have the training or education needed for the job.

**16.7%** There are not enough applicants for my firm's open Electricians positions.

**0.0%** There are enough Electricians applicants, but they do not have the prior work experience needed for the job.

**Q13Prime: Energy Auditors/ HERS Raters (n=7)**

**28.6%** There are enough Energy Auditors/ HERS Raters applicants, but they do not have the prior work experience needed for the job.

**28.6%** There are enough Energy Auditors/ HERS Raters applicants, but they do not have the training or education needed for the job.

- 28.6% There are enough Energy Auditors/ HERS Raters applicants, but they are unwilling to work for the wages we pay.
- 14.3% There are not enough applicants for my firm's open Energy Auditors/ HERS Raters positions.

**Q13Prime: Building Performance Specialists (n=13)**

- 38.5% There are not enough applicants for my firm's open Building Performance Specialists positions.
- 38.5% There are enough Building Performance Specialists applicants, but they do not have the prior work experience needed for the job.
- 15.4% There are enough Building Performance Specialists applicants, but they do not have the training or education needed for the job.
- 7.7% There are enough Building Performance Specialists applicants, but they are unwilling to work for the wages we pay.

**Q13Prime: Weatherization Technicians (n=8)**

- 37.5% There are not enough applicants for my firm's open Weatherization Technicians positions.
- 25.0% There are enough Weatherization Technicians applicants, but they do not have the training or education needed for the job.
- 25.0% There are enough Weatherization Technicians applicants, but they do not have the prior work experience needed for the job.
- 12.5% There are enough Weatherization Technicians applicants, but they are unwilling to work for the wages we pay.

**Q13Prime: Plumbers (n=16)**

- 31.3% There are enough Plumber applicants, but they are unwilling to work for the wages we pay.
- 25.0% There are not enough applicants for my firm's open Plumber positions.
- 25.0% There are enough Plumber applicants, but they do not have the prior work experience needed for the job.
- 18.8% There are enough Plumber applicants, but they do not have the training or education needed for the job.

**Section 4. Skill & Education Profile (Occupation-Specific)**

14. [Pipe in occupations > 0] What certifications are required or preferred for these occupations?

**[PIPE IN ALL OCCUPATIONS SELECTED AT SE]**

	<u>Yes, we require or prefer certifications</u>	<u>None (No certifications required or preferred)</u>	<u>Don't know/ Refused</u>
A. Insulation Workers (Floor, Ceiling, and Wall) (n=91)	40.7%	37.4%	22.0%
B. HVAC/R Mechanics, Installers, or Technicians (n=93)	43.0%	26.9%	30.1%
C. Electricians (n=92)	40.2%	27.2%	32.6%
D. Energy Auditors/ HERS Raters (n=36)	38.9%	25.0%	36.1%
E. Building Performance Specialists (n=69)	21.7%	34.8%	43.5%
F. Weatherization Technicians (n=48)	29.2%	37.5%	33.3%
G. Plumbers (n=83)	24.1%	39.8%	36.1%

**Insulation Workers (Floor, Ceiling, and Wall) (n=27)**

**66.7% OSHA certification**

- 18.5%** Asbestos or lead removal certification
- 14.8%** Insulation certification (NIA, HFI AW, NAIMA-R-Value etc.)
- 7.4%** EPA certification
- 7.4%** National Center for Construction Education & Research (NCCER) Certification
- 11.1%** Other

**HVAC Mechanic, Installers, or Technicians (n=40)**

- 35.0%** EPA 608 universal certification
- 22.5%** Grade-B refrigeration certification or contractor license
- 20.0%** OSHA certification
- 15.0%** Apprenticeship training or trade school degree
- 12.5%** NATE certification
- 2.5%** HVAC excellence certification
- 7.5%** Other

**Electricians (n=31)**

- 58.1%** Electrical license (apprentice, journeymen, or master)
- 38.7%** OSHA certification
- 6.5%** EPA certification
- 9.7%** Other

**Energy Auditors/ HERS Raters (n=11)**

- 36.4%** Certified energy manager or auditor
- 27.3%** RESNET home energy certification

- 27.3% HERS rating certification
- 18.2% OSHA certification
- 9.1% Building Performance Institute (BPI) Certification
- 0.0% Other

**Building Performance Specialists (n=15)**

- 60.0% OSHA certification
- 20.0% Leadership in Energy and Environmental Design (LEED) Certification
- 13.3% Building Performance Institute (BPI) Certification
- 13.3% 3C-REN certification
- 6.7% Multifamily Building Analyst (MFBA) Certification
- 6.7% Certified energy manager or auditor
- 6.7% Other

**Weatherization Technicians (n=14)**

- 42.9% OSHA certification
- 21.4% Journeymen Insulator
- 14.3% National Center for Construction Education and Research Certification (NCCER)
- 14.3% Building Performance Institute (BPI) certification
- 7.1% EPA certification
- 7.1% Other

**Plumbers (n=20)**

- 75.0% Plumbing license (Apprentice, Journeyman or Master)
- 30.0% OSHA certification
- 10.0% Other

15. Are [PIPE IN Q14 response) required or preferred for the (INSERT OCCUPATION AT SE)?

**Insulation Workers (Floor, Ceiling, and Wall)**

	<u>Required</u>	<u>Preferred</u>	<u>Don't know/ Refused</u>
OSHA certification (n=18)	55.6%	44.4%	0.0%
Asbestos or lead removal certification (n=5)	60.0%	40.0%	0.0%
Insulation certification (NIA, HFIAW, NAIMA-R-Value etc.) (n=4)	100.0%	0.0%	0.0%
EPA certification (n=2)	0.0%	100.0%	0.0%
National Center for Construction Education & Research (NCCER) Certification (n=2)	0.0%	100.0%	0.0%

**HVAC Mechanic, Installers, or Technicians**

	<u>Required</u>	<u>Preferred</u>	<u>Don't know/ Refused</u>
EPA 608 universal certification (n=14)	92.9%	7.1%	0.0%
Grade-B refrigeration certification or contractor license (n=9)	77.8%	22.2%	0.0%
OSHA certification (n=8)	75.0%	25.0%	0.0%
NATE certification (n=5)	40.0%	60.0%	0.0%
Apprenticeship training or trade school degree (n=6)	33.3%	66.7%	0.0%
HVAC excellence certification (n=1)	100.0%	0.0%	0.0%

**Electricians**

	<u>Required</u>	<u>Preferred</u>	<u>Don't know/ Refused</u>
Electrical license (apprentice, journeymen, or master) (n=17)	70.6%	29.4%	0.0%
OSHA certification (n=12)	75.0%	25.0%	0.0%



EPA certification (n=2)	50.0%	50.0%	0.0%
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### Energy Auditors/ HERS Raters

	<u>Required</u>	<u>Preferred</u>	<u>Don't know/ Refused</u>
Certified energy manager or auditor (n=4)	75.0%	25.0%	0.0%
Building Performance Institute (BPI) Certification (n=3)	100.0%	0.0%	0.0%
RESNET home energy certification (n=3)	66.7%	33.3%	0.0%
HERS rating certification (n=3)	66.7%	33.3%	0.0%
OSHA certification (n=2)	100.0%	0.0%	0.0%

### Building Performance Specialists

	<u>Required</u>	<u>Preferred</u>	<u>Don't know/ Refused</u>
OSHA certification (n=9)	77.8%	22.2%	0.0%
Building Performance Institute (BPI) Certification (n=2)	100.0%	0.0%	0.0%
Leadership in Energy and Environmental Design (LEED) Certification (n=3)	66.7%	33.3%	0.0%
Multifamily Building Analyst (MFBA) Certification (n=1)	0.0%	100.0%	0.0%
3C-REN certification (n=2)	50.0%	50.0%	0.0%
Certified energy manager or auditor (n=1)	0.0%	100.0%	0.0%

### Weatherization Technicians

	<u>Required</u>	<u>Preferred</u>	<u>Don't know/ Refused</u>
OSHA certification (n=6)	83.3%	16.7%	0.0%
Journeyman Insulator (n=3)	66.7%	33.3%	0.0%
National Center for Construction Education and Research Certification (NCCER) (n=2)	100.0%	0.0%	0.0%
Building Performance Institute (BPI) certification (n=2)	50.0%	50.0%	0.0%

EPA certification (n=1)	0.0%	100.0%	0.0%
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**Plumbers**

	<u>Required</u>	<u>Preferred</u>	<u>Don't know/ Refused</u>
Plumbing license (Apprentice, Journeyman or Master) (n=15)	73.3%	26.7%	0.0%
OSHA certification (n=6)	83.3%	16.7%	0.0%

16. Where do your employees go to earn these kinds of certifications? (SELECT ALL THAT APPLY) – Multiple responses permitted: Percentages may sum to more than 100%. (n=148)

- 54.7% HVAC distributor training centers
- 37.8% Online/Webinars
- 29.7% Air Conditioning Contractors of America (ACCA)
- 27.7% Building Performance Association (BPA)
- 25.0% Building Performance Institute (BPI)
- 4.7% Local Union
- 2.0% Technical school or Community college
- 8.1% Other

17. Please indicate the minimum required level of prior work experience you expect entry-level [INSERT OCCUPATION] applicants to possess?

**[PIPE IN ALL OCCUPATIONS SELECTED AT SE]**

	No formal work experience in comparable positions <u>required</u>	Pre-Apprenticeship or other short term job <u>training</u>	Up to 12 months in a comparable <u>position</u>	One to three years in a comparable <u>position</u>	More than three years in a comparable <u>position</u>	Don't know/ <u>Refused</u>
A. Insulation Workers (Floor, Ceiling, and Wall) (n=91)	20.9%	37.4%	15.4%	13.2%	9.9%	3.3%
B. HVAC/R Mechanics, Installers, or Technicians (n=93)	10.8%	28.0%	24.7%	28.0%	4.3%	4.3%
C. Electricians (n=92)	10.9%	19.6%	28.3%	25.0%	13.0%	3.3%
D. Energy Auditors/ HERS Raters (n=36)	2.8%	33.3%	33.3%	22.2%	2.8%	5.6%
E. Building Performance Specialists (n=69)	13.0%	23.2%	20.3%	23.2%	17.4%	2.9%
F. Weatherization Technicians (n=48)	12.5%	41.7%	18.8%	18.8%	2.1%	6.3%
G. Plumbers (n=83)	12.0%	22.9%	22.9%	30.1%	8.4%	3.6%

18. Are there any skills that applicants coming from pre-apprenticeship or other job training programs are typically missing or deficient in? (n=147)

**14.3% Yes (please specify): - *verbatim will be provided***

**70.7% No**

**15.0% Don't know/ Refused**

19. Do you work directly with any education or training providers? If so, please tell us which providers: (n=147)

**9.5% Yes (please specify):**

**81.6% No**

**8.8% Don't know/ Refused**

20. Are you planning on training your staff on weatherization, or new HVAC or plumbing technologies? (Includes Air-Source Heat Pumps, Ground-Source Heat Pumps, Heat Pump Water Heaters etc.) (n=147)

**20.4% Yes (please specify): - *verbatim will be provided***

**28.6% No**

**41.5% No additional training is needed**

**9.5% Don't know/ Refused**

**ASK Q21 IF Q20 = NO, OTHERWISE SKIP**

21. Why do you not plan on training your staff on weatherization, or new HVAC or plumbing technologies? (Includes Air-Source Heat Pumps, Ground-Source Heat Pumps, Heat Pump Water Heaters etc.) (n=42)

**40.5% Do not have the time to train employees**

**23.8% Training is too expensive**

**14.3% Do not know where to go for training**

**7.1% Other**

**14.3% Don't know/ Refused**

**Thank you for completing the survey. We would like to verify your contact information.**

- First and Last Name of Respondent \_\_\_\_\_
- Position of Respondent \_\_\_\_\_
- Phone of Respondent \_\_\_\_\_
- Email of Respondent \_\_\_\_\_
- Name of Company \_\_\_\_\_
- Company Address (including City) \_\_\_\_\_

**Those are all the questions I have.**

**Thank you very much for your time.**