

Weatherization Workforce Plan

Workgroup Report to the Vermont General Assembly
on the Coordinated Delivery of a Standardized
Statewide Building Sciences Curriculum

October 1, 2021

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Contents

Executive Summary	3
Background.....	6
The Response	7
Workforce Group Assignment	8
Early Findings That Informed the Workforce Group’s Work.....	9
Methods of the Weatherization Workforce Group.....	9
Stakeholders	10
Results.....	13
Industry Survey	13
Employers.....	13
Trainers and Training Programs.....	14
Others Interested in Weatherization Workforce Development.....	16
Training & Certification	16
Curriculum	16
Certification.....	18
Administrator	18
Next Steps	19
Recommendations	20
Conclusion.....	22
Appendix A: Weatherization Workforce Industry Survey Results.....	23
Appendix B: Vermont Weatherization Worker Training & Certification Framework	76

Executive Summary

Standard weatherization practices apply building science solutions to improve home health, comfort, safety, indoor air quality, durability, moisture management, and resource preservation. These practices primarily involve electrical and thermal energy efficiency measures, and adhere to a “house-as-a-system” approach.

Vermont’s new greenhouse gas reduction targets demand aggressive increases in home weatherization from the current rate of 2,000 to 2,500 homes a year in 2020 to 12,500 homes weatherized annually by 2025, and 13,400 weatherized annually by 2030.¹ **To meet these targets, the Energy Action Network has estimated that Vermont’s qualified weatherization workforce needs to grow five-fold in fewer than five years.**²

Meeting the five-fold target will require the State to address the following barriers:

1. A “four-year college-or-bust” mindset promoted to the state’s young people preparing to graduate from high school, and unclear career pathways in Vermont’s construction trades
2. A shortage of workers in general—and specifically, a shortage of skilled workers willing to undertake weatherization projects under uncomfortable conditions (hot attics and damp crawlspaces, for example)
3. Wage competition with jobs requiring less-strenuous working conditions, and current low unemployment rates
4. Historical volatility in funding and the availability of incentives supporting weatherization; this drives market fluctuation, which creates instability for local construction contractors and affiliated businesses
5. A shortage of affordable housing for construction workers

Act 74 of 2021 created a Weatherization Workforce Group led by Efficiency Vermont to

... develop plans for the coordinated delivery of a standardized statewide Building Sciences curriculum that includes weatherization. The curriculum shall be designed to establish a career pathway in energy efficiency construction and shall include a certification that is broadly recognized, transparent, and portable.³

The Weatherization Workforce Group convened more than 50 cross-sector industry representatives to discuss what is needed to meet the five-fold target. Together with partners in the weatherization industry and training providers, the Group also outlined a curriculum and certification delivery framework. The Group identified four areas of training for entry-level

¹ Energy Action Network (EAN), 2021. [Annual Progress Report for Vermont 2020-2021](#). Montpelier, VT: 23.

² Smith, Raquel, 2021. “Workforce Development in Vermont’s Thermal Sector: Challenges and Opportunities for Meeting Vermont’s 2030 Climate Goals.” Internship presentation. Montpelier, VT: EAN. <https://www.eanvt.org/ean-interns/ean-summer-2021-interns/workforce-development-thermal-sector/>.

³ Vermont General Assembly, 2021. Act 74, “An act relating to making appropriations for the support of government.” (“BIG BILL – Fiscal Year 2022 Appropriations Act”): 142. <https://legislature.vermont.gov/Documents/2022/Docs/ACTS/ACT074/ACT074%20As%20Enacted.pdf>.

weatherization workers, along with advanced topics for career progression in weatherization. Figure 1 describes the proposed weatherization career training progression.

Wx Installer	Wx Apprentice	Wx Journeyman	Residential HVAC Contractor	Wx Expert
<ul style="list-style-type: none"> Soft skills for employees Carpentry basics Building science basics Air sealing & insulation installation 	<ul style="list-style-type: none"> Building codes for weatherization Weatherization installers & technician registered apprenticeship / energy audits & building diagnostics Historic building weatherization Carpentry applications Managing water in buildings Building & product certifications, standards & codes 	<ul style="list-style-type: none"> Healthy buildings Residential energy modeling basics Building management systems & integrated control technologies (smart homes) basics Industrialized weatherization 	<ul style="list-style-type: none"> HVAC design HVAC installation & commissioning HVAC installation & commissioning – hydronics Domestic hot water systems 	<ul style="list-style-type: none"> Building science applications Crew leader Crew leader & manager soft skills Running a weatherization business Train the trainer

Figure 1. Proposed weatherization career training progression, from Vermont Weatherization Installer to Expert, with required topics to be completed to gain certification for each level, to the extent that Vermont chooses to follow this progression.

The framework offers market consistency in worker knowledge, skills, and abilities, while also accommodating existing and new training programs. This built-in flexibility will help meet the needs of weatherization workforce candidates, or “target participants,” for the five-fold effort. That is, the framework recognizes that the target participants will have varying levels of experience.



Figure 2: Vermont Weatherization Installer training program by Vermont Adult Learning in partnership with WAP held at BROCC in Rutland, September 2021.

New entrants in the weatherization workforce will be trained to earn the **Vermont Weatherization Installer** certification by completing each of the four topical requirements presented in the framework, shown in Figure 1. The Vermont Weatherization Installer certification aligns with the existing training program delivered by the Vermont Weatherization Assistance Program (WAP). Workers are not required to have these certifications to be employed by weatherization contracting companies. Workers with these certifications may be more qualified for construction and weatherization-related job

positions and may command a higher wage than uncertified workers.

Beyond the Installer certification, the framework allows the State to choose to add levels of certification commonly used in the construction trades: Weatherization Apprentice, Weatherization Journeyman, and Weatherization Expert. There is also an option for a Residential HVAC Contractor, reflecting a designation for specialists in a critical component of weatherization: heating, ventilation, and air conditioning for cold climates. A decision to adopt this progression for the Weatherization Workforce will further define the weatherization career ladder, and thus address Barrier 1. The certification framework proposed in this report assumes the five-fold increase in weatherization projects will result in a maturing industry and a market that finds value in worker certification. It is important to note that such an increase in weatherization projects will not occur unless there is a concerted effort on the part of Vermont policymakers to also address Barriers 2-5.

The Group has also determined that the framework will operate optimally with an Agency of State or its appointed designee to serve as administrator. An administrator can ensure the delivery of high-quality services, while helping to expand the effort between now and 2025, and course-correct, as needed, as the industry matures. The administrator(s) will be responsible for establishing two directories for registering and tracking training programs and individuals: the **Vermont Weatherization & Building Science Training Program Directory** and the **Vermont Weatherization & Building Science Professionals Workforce Directory**.

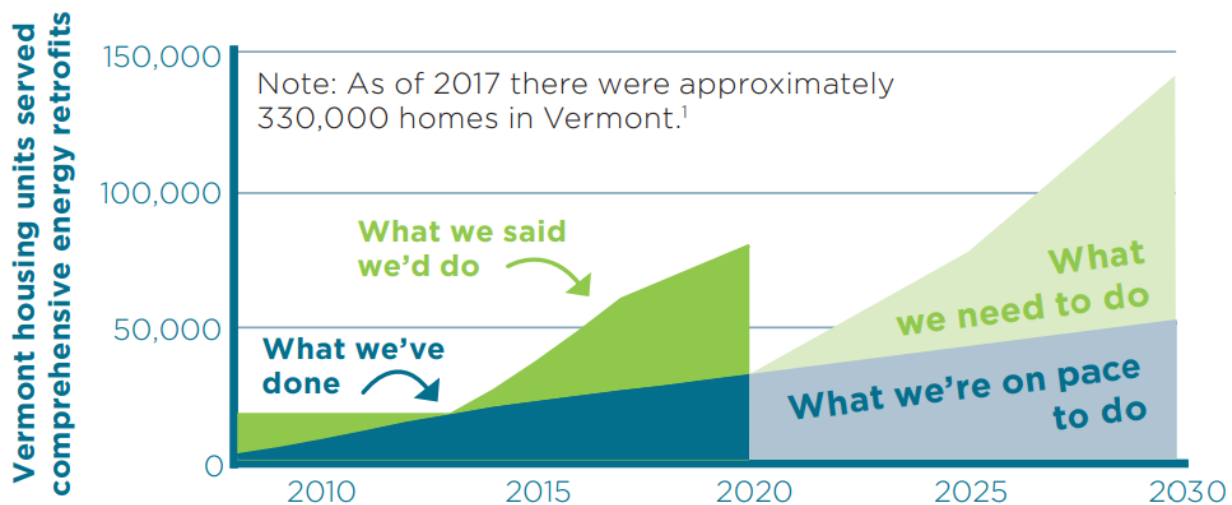
The Training Program Directory will support aspiring and current workers, and employers, in identifying training opportunities. It will also verify training program eligibility for meeting certification-specific criteria. The Workforce Directory will support training programs in identifying qualified trainers and inspectors, and other relevant stakeholders, in tracking the state's workforce capacity, to inform future policy decisions.

Although this training and certification structure makes the weatherization-related career pathways visible (Barrier 1), Vermont will also need to address how it can effectively promote to young people the benefits of working in the weatherization trades, especially to workers who are not inclined to proceed on a four-year college track. A well-operated weatherization workforce program will support resolutions of the barriers related to working conditions (Barriers 2 and 3). The State will need to determine the extent to which it can support greater stability in setting incentives and thus stabilizing contractor workflows (Barrier 4), while not ignoring Barrier 5, the availability of affordable workforce housing. Those latter two barriers are beyond the scope of the Weatherization Workforce effort, but we report them because the Group identified them as core challenges impacting Vermont's ability to grow its weatherization workforce and meet climate goals.

Background

Vermont must reduce greenhouse gas (GHG) emissions to 26 percent below 2005 levels by 2025, 40 percent below 1990 levels by 2030, and 80 percent below 1990 by 2050.⁴ To meet this goal, the Vermont Energy Action Network (EAN) proposes (1) weatherizing 80,000 homes by 2025 and reducing 0.10 million metric tons of carbon dioxide equivalent (MMT_{CO₂e}) emissions; and (2) weatherizing an additional 68,000 homes by 2030 (totaling 148,000 homes by that date), and reducing 0.13 MMT_{CO₂e}. Figure 1 illustrates the scope of the proposal.

Weatherization: actual & projected



Sources: What We've Done: Vermont Department of Public Service, "2019 Report on VT's Progress Toward Building Energy Fitness Goals"; What we said we'd do: 10 V.S.A § 581. Others: EAN.

1. Vermont Housing Finance Agency (VHFA), Vermont Housing Needs Assessment: 2020-2024, 2020.

Figure 3. EAN's proposed number of homes that must be weatherized to meet Vermont greenhouse gas reduction goals for 2025 and 2030.⁵

Standard weatherization practice uses a house-as-a-system approach and applies building science-based solutions to improve home health, occupant comfort, safety, indoor air quality, durability, moisture management, and resource preservation through electrical and thermal energy efficiency measures.

The Vermont Office of Economic Opportunity Weatherization Assistance Program (WAP) and independent contractors deliver weatherization services. WAP providers serve low-income households, whereas other contractors typically serve households that do not qualify for WAP

⁴ Vermont General Assembly, 2020. Act No. 153, An act relating to addressing climate change, also known as The Vermont Global Warming Solutions Act. Section 3, 10 VSA, § 578(a)(1), (2), and (3).

<https://legislature.vermont.gov/Documents/2020/Docs/ACTS/ACT153/ACT153%20As%20Enacted.pdf>

⁵ Energy Action Network (EAN), 2021. [Annual Progress Report for Vermont 2020-2021](#). Montpelier, VT: 27.

assistance. Vermont’s WAP and energy efficiency utility program partners weatherize 2,000 to 2,500 homes per year.⁶ Meeting the GHG (carbon dioxide equivalent) reduction targets for homes will require weatherizing five to six times more homes, or 12,000, annually.⁷

Weatherization jobs require deep technical knowledge and physical skill in unpleasant working conditions. Buildings can be cold or hot; and their attics, crawlspaces, and basements dirty and often infested with rodents. With inadequate knowledge of building science and with

Workforce capacity

To meet carbon reduction targets for homes, Vermont’s weatherization workforce capacity and production rate need to increase five-fold in fewer than five years from now.

insufficient health and safety precautions in place, buildings can create unsafe working conditions for weatherization workers. Further, when a building is weatherized without building science knowledge, it can lead to unsafe living conditions for its occupants. On-boarding new hires requires significant investment in months-long training and hands-on experience before employees reach adequate proficiency levels. Prior knowledge in residential design and construction can flatten the learning curve, provided that knowledge was grounded in building science and appropriate on-site measures for personal protection.

Weatherization businesses, and businesses related to weatherization—such as roofing companies, insulation-only businesses hired by weatherization

contractors, and general contractors—express challenges in recruiting, hiring, training, and retaining skilled weatherization workers to meet current market demand. To meet the 12,000-home annual target, Vermont’s weatherization workforce needs to increase five-fold.⁸

Vermont’s unemployment rate has persistently been very low, at 3.1 percent, indicating an entrenched shortage of available workers.⁹

Weatherization installation work can be rewarding for people driven to combat carbon emissions and help fellow Vermonters, but the necessary level of skill and the comparatively low wages create significant challenges to that particular labor market.

The Response

Meeting the GHG targets, especially with a worker shortage, has prompted legislative action in Vermont. Act 74 (signed June 8, 2021), has highlighted the importance of the weatherization

⁶ EAN, Annual Progress Report, 2021: 23.

⁷ EAN, Annual Progress Report, 2021: 23.

⁸ Smith, Raquel, 2021. “Workforce Development in Vermont’s Thermal Sector.” Intern presentation. Montpelier, VT: EAN. <https://www.eanvt.org/eas-interns/eas-summer-2021-interns/workforce-development-thermal-sector/>.

⁹ Vermont Department of Labor, 2021, “Vermont’s Unemployment Rate Increases to 3.1 Percent in June” Press release, July 16, 2021. <https://labor.vermont.gov/press-release/vt-unemployment-jobs-report-june-2021>

workforce and the need to further study relevant professional development services for the construction industry.

WORKFORCE GROUP ASSIGNMENT

Act 74 of 2021, Section E. 234.3 Development of Weatherization Workforce and Counseling Services, says:

- (1) On or before June 15, 2021, the Chairs of the Senate Committee on Natural Resources and Energy and the House Committee on Energy and Technology, or their designees, shall meet with the Department of Labor, the Agency of Education, Efficiency Vermont, representatives of the community action agencies, NeighborWorks of Western Vermont, the Vermont Fuel Dealers Association, and other parties currently delivering programming to train workers to perform services related to thermal energy savings and weatherization.
- (2) Thereafter, Efficiency Vermont shall lead the Weatherization Workforce Group that shall develop plans for the coordinated delivery of a standardized statewide Building Sciences curriculum that includes weatherization. The curriculum shall be designed to establish a career pathway in energy efficiency construction and shall include a certification that is broadly recognized, transparent, and portable.
- (3) On or before October 1, 2021, Efficiency Vermont shall report to the Senate Committee on Natural Resources and Energy and the House Committee on Energy and Technology a plan for enhancing the coordinated delivery of the standardized Building Sciences training program in order to support the goals of 10 V.S.A. § 581.”

The Weatherization Workforce Group assignment is part of a broader [Weatherization at Scale – Network Action Team](#) strategy led by the Energy Action Network. Related efforts for statewide weatherization workforce development are:

- Act 189
 - [Implementation Report](#)
 - [2019 Regional Workforce Summits Report](#)
 - [Career Technical Education Funding Pilot Projects and Middle School Collaboration](#)
- Vermont Legislature’s Climate Caucus, Workforce Development Subcommittee
- Vermont Skilled Trades Workforce Stakeholder Group

Early Findings That Informed the Workforce Group’s Work

Efficiency Vermont launched the Weatherization Workforce Group on June 24, 2021, and led a stakeholder kick-off meeting on June 30 (see **Methods of the Weatherization Workforce Group**, below). The Group initially surveyed contractors, trainers, and other interested parties to capture challenges in hiring and training weatherization workers.

The survey of weatherization employers ranked finding qualified applicants, and any applicants, as the top two greatest challenges they have in hiring new weatherization employees.¹⁰ Additional hiring challenges were market irregularity in weatherization demand, on-boarding new hires, wage competition, screening and interviewing potential hires, employee burnout, unrealistic expectations, and lack of interest in weatherization work.¹¹

When asked about employee retention, the weatherization employers cited working conditions associated with comfort as the Number 1 reason that disaffects workers in the industry. The Number 2 reason was wage competition, followed by working conditions associated with health, and irregularity in demand for weatherization services.¹² The *2019 Vermont Clean Energy Industry Report* notes that wages for energy efficiency jobs in installation, maintenance, and repair occupations earn a 9 percent market premium, but that premium drops to -4 percent for mid-experience workers and -8 percent for high-experience workers.¹³

Methods of the Weatherization Workforce Group

Following Efficiency Vermont’s launch of the Weatherization Workforce Group in late June 2021, the work involved monthly stakeholder calls and separately scheduled subgroup meetings to complete the following:

1. Surveys of:
 - a. **Weatherization and weatherization-related contracting companies**, to identify entry level and senior-level skill needs for weatherization crew members
 - b. **Construction-related training centers and trainers**, to identify existing training available in the state
 - c. **Others interested in weatherization workforce development**, to capture general feedback about weatherization crew member training
2. Drafting of relevant training topics, learning objectives, and core competencies, based on:
 - a. Survey responses

¹⁰ See the **Results** section of this report, *Industry Survey*.

¹¹ See *Industry Survey*.

¹² See *Industry Survey*.

¹³ Jordan, Philip, Ryan Young, Mitchell Schirch, Josh Williams, Veronica Williams, and Nathaniel Hunt, 2020. *2019 Vermont Clean Energy Industry Report*. Montpelier, VT: Vermont Department of Public Service: Table 3, p. 19.

https://publicservice.vermont.gov/sites/dps/files/documents/Renewable_Energy/CEDF/Reports/VCEIR%202019%20Final%20Signed.pdf

- b. Existing material from the U.S. Department of Energy, Building Professionals Institute, and Vermont WAP, specific to training weatherization crew members
 - c. Subgroup examination and refinement of existing resources
 - d. Stakeholder feedback on draft materials from the Group and industry survey respondents who were interested in drafting the learning objectives
3. Design of curriculum and certification delivery and maintenance framework, based on:
- a. Survey responses
 - b. Availability of training providers and certification programs applicable to weatherization industry in Vermont and nationally,
 - c. Subgroup drafting of a relevant delivery and maintenance framework
 - d. Stakeholder feedback on draft materials from the Group, weatherization and weatherization-related contracting companies, and industry survey respondents who were interested in drafting and delivering the training

The separately scheduled work meetings involved:

- **Subgroup 1 - Survey dissemination:** reaching out to and engaging industry members in completing the survey
- **Subgroup 2 - Survey analysis:** summarizing survey results to identify curriculum foci and industry workforce development issues for this report
- **Subgroup 3 - Core competencies & learning objectives:** determining competencies expected of trainees upon completion of the curriculum and learning objectives to meet identified market training needs
- **Subgroup 4 - Training and certification delivery and maintenance:** Creating the framework for adapting the curriculum into the training sessions, and aligning it with certification pathways; and creating a process for approval and maintenance of training and certification
- **Subgroup 5 - Final report:** Drafting a definitive report capturing workgroup activity and outcomes

Stakeholders

Table . List of Group stakeholders and their affiliations

Organization or company	Participant
3E Thermal	Randy Drury
BROC Community Action	Marc Therrien
Building Performance Professionals Association	Chuck Reiss
Burlington Community and Economic Development Office	Gillian Nanton
Burlington Community and Economic Development Office	Todd Rawlings
Burlington Electric Department	Jen Green

Organization or company

Participant

Burlington Technical Center	Jason Gingold
Burlington Technical Center	Stacy Clark
Capstone Community Action	Paul Zabriskie
Center for Technology, Essex	Joe Teegarden
Center for Technology, Essex	Robert Travers
Champlain Valley Office of Economic Opportunity	Dwight Decoster
Community College of Vermont	Tiffany Walker
Efficiency Vermont	Dan Reilly
Efficiency Vermont	Steve Spatz
Energy Action Network	Cara Robechek
Energy Action Network	Raquel Smith
Energy Co-op of Vermont	Brian Gray
Energy Futures Group	Gabrielle Stebbins
Energy Futures Group	Richard Faesy
Institute for Multi-track Diplomacy	John McCormick
NeighborWorks of Western Vermont	Heather Starzynski
NeighborWorks of Western Vermont	Ludy Biddle
NeighborWorks of Western Vermont	Melanie Paskevich
Northeast Employment and Training Organization	Martha Stevens
Northeast Kingdom Learning Center, Inc.	Michelle Faust
Northwest Technical and Career Center	Lisa Durocher
Preservation Trust of Vermont	Alex Tolstoi
Randolph Technical Career Center	Tim Murphy
ReSOURCE	Andrew Jope
ReSOURCE	Pam Laser
ReSOURCE	Tom Longstreth
Rights and Democracy Vermont	Tom Proctor
Southeastern Vermont Community Action	Victor Baisley
Stafford Technical Center	Bill Lucci

Organization or company

Participant

Sustainable Energy Outreach Network	Guy Payne
Vermont Adult Career and Technical Education Association	Len Schmidt
Vermont Adult Learning	Chrispin White
Vermont Adult Learning	Hal Cohen
Vermont Agency of Commerce and Community Development	Ken Jones
Vermont Agency of Education	Jay Ramsey
Vermont Builders and Remodelers Association	Chris West
Vermont Builders and Remodelers Association	Jim Bradley
Vermont Department of Labor	Sarah Buxton
Vermont Department of Public Service	Brian Cotterill
Vermont Department of Public Service	Keith Levenson
Vermont Department of Public Service	Kelly Launder
Vermont Energy	Mark Stephenson
Vermont Fuel Dealers Association	Matt Cota
Vermont Gas Systems	Chris Charuk
Vermont Gas Systems	Tim Perrin
Vermont Office of Economic Opportunity	Geoff Wilcox
Vermont Office of Economic Opportunity	Sarah Phillips
Vermont Passive House	Chris West
Vermont Passive House	Enrique Bueno
Vermont Public Power Supply Authority	Melissa Bailey
Vermont Representative	Peter Anthony
Vermont State Labor Council	Danielle Bombardier
Vermont Technical College	Maureen Hebert
Vermont Works for Women	Missy Mackin
Vermont Division for Historic Preservation	Laura Trieschmann
Yestermorrow	Britton Rogers

Results

INDUSTRY SURVEY

The Group delivered a tailored survey to each of three industry audiences, to capture weatherization workforce development needs and challenges.

1. Vermont Construction Career Pathways: to employers
2. Building Science Curriculum & Training: to trainers and training programs
3. Workforce Development Needs: to employees and all others interested in this topic

Employers

Ten employers completed the survey. Employers emphasized the following skills and knowledge needed for entry-level new hires:

- Insulation and air sealing measure installation
- Building science—defined as the *movement of heat, air, and moisture in buildings*
- Water vapor management
- Basic carpentry
- Personal protection / understanding of Occupational Safety and Health Administration guidelines
- Proficiency with power tools
- Soft skills necessary for employment in construction trades

Employers described a wider skill set for senior-level employees, noting that finding a senior-level new hire was not likely because of the shortage of applicants.

Most employers provide on-the-job training. Over half of the respondents said they were willing to sponsor registered apprenticeship programs. Less than half required or desired Building Performance Institute (BPI) certification. BPI provides national credentialing and certification for the residential building performance industry.

Other certifications required or desired by employers were:

- | | |
|------------------------------------|---|
| • OSHA 10 Construction | • LEED |
| • OSHA 30 Construction | • North American Board of Certified Energy Practitioners (NABCEP) |
| • RESNET Home Energy Rating System | • Vermont oil, gas, natural gas, and plumbing licenses |
| • OSHA 29 Aerial & Scissor Lift | |
| • OSHA Forklift | |

All employers agreed that there are advantages to having staff certification. Benefits to certification are competency, efficiency, independence, compliance, problem solving, increased work value, professional credibility, market quality control, increased production, deeper knowledge, and broader skill sets.

Most employers were willing to pay staff to attend training. Half were willing to pay for training tuition; the others were unsure of whether they'd be willing to pay employees for training or for the training tuition.

The biggest challenges in hiring and retaining employees were, by priority, the availability of qualified applicants, the availability of any applicants, adverse working conditions relating to workday comfort, and wage competition.

Most employers reported entry-level hourly wages of \$16 to \$19. Wages for responsible workers with 5 years of experience were typically from \$17 to \$26, with some employees receiving more than that; for those with 10 years of experience, the hourly rate was from \$20 to \$35. Those with 20 years of experience had an hourly rate of \$30 to \$45; half of the employers were unsure about wages for workers with 20 years of experience, given the wide variability in jobs conducted by those individuals (that is, they can and do perform more than weatherization-specific tasks).

Most employers pay entry-level worker benefits for time off and bonuses; half of the employers also offered health insurance, professional development, and flexible hours as benefits. Some reported offering contributions to retirement plans, dental insurance, vehicle use, uniforms, tool allowance, and / or profit sharing.

The survey also asked if employers were able to find qualified workers, how many employees they would need across the next three years, and at what skill level. Nine of the employers collectively anticipated hiring 14 to 19 entry-level workers, 14 to 20 mid-level workers, and 6 to 7 senior-level workers.

The respondents cited several market conditions they felt were conducive to expanding the workforce. In order of priority, they said:

1. High weatherization incentives,
2. Available workers,
3. Low-interest accessible financing for weatherization,
4. Better trained / skilled workers, high consumer demand, and
5. Mandates and policies requiring weatherization.

Full survey results can be found in **Appendix A**.

Trainers and Training Programs

Fourteen trainers and training programs completed the survey. Of the programs, 29 percent are offered in person, and 71 percent are offered online and in person. Most training uses lecture, hands-on, and actual jobsite training methods.

Two respondents delivered training in more than one county. Figure 3 shows the statewide distribution.

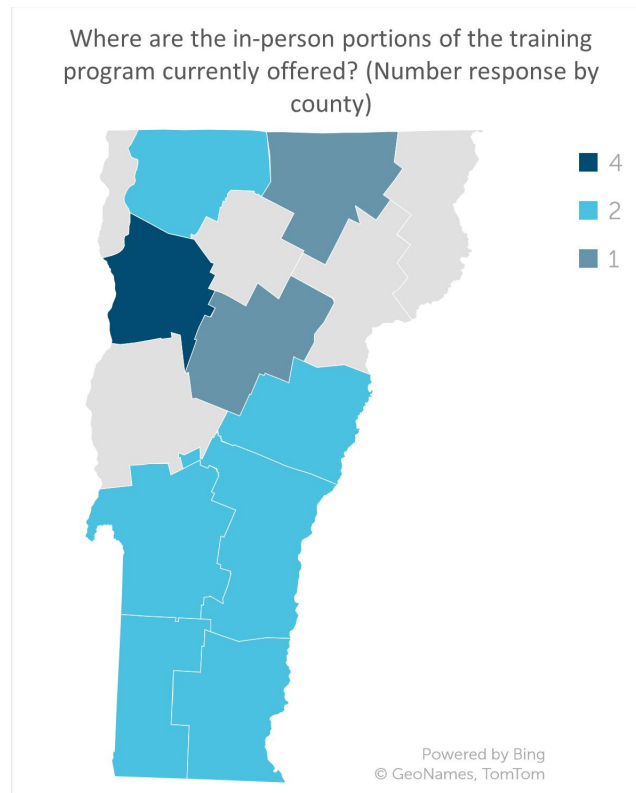


Figure 4. Locations where survey respondents reported the availability of training programs.

Regarding skills valued by employers seeking entry-level employees, most training programs spend over 9 hours covering carpentry, personal protection / general Occupational Health and Safety Administration (OSHA) requirements, and proficiency with power tools. They also spend between 4 and 8 hours on soft skills such as self-motivation, time management, teamwork, leadership, problem solving, and flexibility. Most training programs spend less time on air sealing and insulation measure installation, building science, and water vapor management.

Most training program representatives were unsure which BPI certifications the program prepares participants to take, or they knew that the program does not prepare participants for BPI exams. Three training programs prepare participants for multiple BPI certifications, and one program proctors BPI exams.

Most training programs said they offered OSHA 10 and National Center for Construction Education and Research (NCCER) certifications; a few also offer Aerial Lift Training, First Aid, CPR (resuscitation), and AED (defibrillation) certification. Training tuition ranged from \$20 to \$6,000, depending on the program.

Most training programs reported partnering, or willingness to partner, with other organizations to deliver the training.

The biggest challenges training programs face when training weatherization workers are, by priority, finding interested participants, participants' ability to attend training, participants' ability

to pay for training, finding qualified instructors, accessing employers for job shadow / apprenticeship, and the cost of running training programs. Among the training programs surveyed, 21 percent have not specifically offered building science training targeting weatherization professionals; 50 percent have not offered weatherization auditing training; and 71 percent have not offered combustion safety training.

Respondent comments emphasized the need for well-paying jobs and direct job placement to attract participants into training.

Others Interested in Weatherization Workforce Development

Five respondents completed the survey, which contained an open-ended question about weatherization-related workforce constraints in Vermont. Respondents cited needs for sustainable channels for qualified workers to enter the industry, long-term work demand, incentives for weatherization (to drive the market), knowledge of historical building weatherization, lack of knowledge about building science, and a lack of understanding about building-as-a-system strategies.

TRAINING & CERTIFICATION

The full Vermont Weatherization Worker Curriculum and Certification Framework are available in **Appendix B**.

Curriculum

Based on the employer survey responses, the Group identified four areas of training for entry-level weatherization workers interested in a career pathway to weatherization expertise, or to any construction-related profession. The training areas also contain topics that, once learned with proficiency, will prepare them for the next professional level in weatherization. Figure 4 shows the proposed weatherization career training progression.

Wx Installer	Wx Apprentice	Wx Journeyman	Res HVAC Contractor	Wx Expert
<ul style="list-style-type: none"> Soft skills for employees Carpentry basics Building science basics Air sealing & insulation installation 	<ul style="list-style-type: none"> Building codes for weatherization Weatherization installers & technician registered apprenticeship / energy audits & building diagnostics Historic building weatherization Carpentry applications Managing water in buildings Building & product certifications, standards & codes 	<ul style="list-style-type: none"> Healthy buildings Residential energy modeling basics Building management systems & integrated control technologies (smart homes) basics Industrialized weatherization 	<ul style="list-style-type: none"> HVAC design HVAC installation & commissioning HVAC installation & commissioning – hydronics Domestic hot water systems 	<ul style="list-style-type: none"> Building science applications Crew leader Crew leader & manager soft skills Running a weatherization business Train the trainer

Figure 5. Weatherization Workforce Group’s proposed weatherization career training progression.

The market already offers training, but the Industry Survey results indicated that there is room to evolve weatherization-specific training so that it is standardized. The results also indicated that the training should produce consistent learning outcomes, regardless of training provider. Thus, the Group determined specific learning objectives for each training topic, and core competencies expected upon completion of the entry-level topics.

An emphasis on learning objectives allows training programs to be flexible in how they design and deliver content appropriate for their own target audiences—while meeting weatherization industry needs for worker knowledge and skills. For example, Building Science Basics taught to high school students will have a different structure and duration from what might be taught to industry-experienced adult learners. Nevertheless, the learning objectives must be the same. Likewise, employed and highly functional professionals require fewer soft-skills training and mentorship than do workers who are under-employed, new to the workforce, or otherwise struggling with employment. However, both categories of worker must be able to deliver the same level of professionalism when working on a team.

The curriculum complements and does not replace Vermont’s WAP and Home Performance with ENERGY STAR program training and certification protocols. Training programs can adopt the curriculum to meet existing Programs of Study, accelerating workforce development in existing high school and adult education courses.

Programs might offer classroom, online, hands-on, and on-the-job delivery methods, depending on the specific content being taught and the target audience. Understanding the value of hands-on application for adult learners, the curriculum emphasizes apprenticeship-style learning. Additionally, the certification pathways recognize and give credit towards prior construction experience.

Certification

The Group debated several certification programs for weatherization professionals. Vermont's WAP and Home Performance with ENERGY STAR® program require BPI certifications for professional credentialing. Although BPI is nationally recognized and designed for the residential building performance industry, the specific certification and exam criteria do not align well with Vermont's weatherization workforce certification needs. Stakeholder concerns about BPI certification were: applicability of specific certification schema to entry-level worker job functions, quality of examination questions, and upfront costs of training and re-certification.

NCCER also offers national certification for the construction industry, and Vermont training providers align with NCCER curricula. However, the weatherization-specific assessments are not stratified enough for common weatherization jobs in Vermont.

Using NCCER curricula and assessments, the Sustainable Energy Outreach Network, ReSOURCE, Vermont Works for Women, and the Career and Technical Education Centers each offers training programs and certification applicable to the weatherization industry. They tailor each program and certification to their respective target participant audiences.

Keeping existing training programs in mind, along with stakeholder comments about the pros and cons of national certification, the Group proposes several certification opportunities. These opportunities align with a direct, transparent, and consistent path for worker certification. The Group proposes certificates for participating in training, demonstration of competence in the field, and demonstrating individual proficiency. The certificates align with national certifications where applicable. The Group also acknowledges that there should be allowances for deeming alternate certification and prior experience as equivalents for the proposed certification levels.

New entrants in the weatherization workforce may earn the Vermont Weatherization Installer certification by completing each of the curriculum requirements. Vermont could choose to add additional levels of certification commonly used in the construction trades such as Vermont Weatherization Apprentice, Vermont Weatherization Journeyman, and Vermont Weatherization Expert, further defining the weatherization career ladder as the industry matures and the market finds value in worker certification.

The backbone of this structure to ensure high quality, while allowing for expansive flexibility and future refinement as the industry matures, is an Agency of State or its appointed designee to serve as administrator.

Administrator

The Group created two directories for registering and tracking training programs and individuals: the Vermont Weatherization & Building Science Training Program Directory and the Vermont Weatherization and Building Science Professionals Workforce Directory.

The Training Program Directory will support individuals and employers in identifying training opportunities, and in verifying training program eligibility for meeting certification-specific

criteria. It will also integrate with the state's existing training directories, as appropriate, to provide a centralized and up-to-date calendar of training opportunities in the state.

The Workforce Directory will support training programs in identifying qualified trainers and inspectors, and stakeholders in tracking workforce capacity in the state. It will also integrate with the state's existing contractor directories, as appropriate. At a minimum, these would be the Efficiency Excellence Network list and the proposed Vermont contractor registry. It is not intended to be a consumer-facing tool for finding contractors for hire.

The State will appoint the administrator responsible for establishing and maintaining these directories. One or more Agency of State or State-appointed administrator entities may be selected for this work and will require funding for the initial development and ongoing maintenance of these resources.

The administrator(s) will be responsible for supporting training programs in developing applications for demonstrating compliance with the State's curriculum and certification framework, and reviewing applications and verifying compliance, including verifying trainer and inspector qualifications. Given the flexibility in compliance pathways, the administrator will need to have a solid foundation in the scope of local and national certifications, familiarity with local training providers, knowledge of youth and adult learning styles and best-practice teaching methods, and a deep understanding of the learning objectives in the curriculum. The administrator must be competent in identifying the least-burdensome pathways for training programs to register, provide program updates, and provide training event dates.

The administrator will also be responsible for registering and tracking weatherization workers throughout the state. In addition to the skills already listed, this will require dedicated and ongoing outreach to ensure individuals are registering, and to ensure continuing education is made available to these individuals and reported annually.

The framework provides an outline for operation. The administrator(s) will be responsible for filling in the many details to launch and run the program. They will also be responsible for its effectiveness to all stakeholders, so that it can add value to the industry and expand with industry maturation.

Next Steps

Efficiency Vermont, in partnership with industry stakeholders, will request proposals from training organizations to design and deliver training programs meeting the Vermont Weatherization Workforce Curriculum. The State has allocated \$2 million for training and certification delivery and program maintenance, and - separately - for the expansion of NeighborWorks of Western Vermont's HEAT Squad.¹⁴

¹⁴ HEAT Squad is a service of NeighborWorks of Western Vermont, providing low-cost energy audits for homes and businesses, project coordination, and access to financing options and rebates.

The funding will be available in 2022 and carry through 2024. The request for proposal description will encourage programs that:

- Meet the requirements of the American Rescue Plan Act (ARPA),¹⁵ the source of the \$2M allocation
- Target young people and other new entrants to the weatherization workforce, including non-traditional labor pools and under-employed populations, with effective screening and mentorship to increase participation completion and success rates
- Provide hands-on experiential learning opportunities for participants
- Offer direct job placement and on-the-job training / apprenticeship
- Apply the curriculum, certification, and training delivery framework recommended in the Vermont Weatherization Workforce Curriculum tailoring training to target audiences
- Offer training across Vermont or in underserved markets
- Rely on Vermont-based partnerships
- Maximize participation rates and job placement
- Create lasting infrastructure for training new workers beyond the grant funding period
- Provide train-the-trainer services to increase the number of qualified trainers and number of participants reached

Recommendations

Worker training and certification represent a small slice of the pie that makes up the weatherization workforce capacity constraint in Vermont. For some employers, such as the Vermont WAP Partners, training and certification are not a challenge at all.

Stakeholders reported the following challenges and recommendations, when the Group asked them about weatherization workforce capacity constraints. The stakeholders also provided information to Raquel Smith, an Energy Action Network summer intern, who wrote *Workforce Development in Vermont's Thermal Sector*.¹⁶

Aggressively marketing the trades to young people and the under-employed

Contractors retire, but few young people are encouraged to join the trades as a viable career opportunity. Vermont needs a strategy for attracting young people and under-employed workers to trade professions. The strategy should consider providing early field experiences (age 16 or younger), cultivating a trade-oriented mindset, and demonstrating long-term career

<https://www.heatsquad.org/#::~:~:text=MORE%20INFO-.HEAT%20Squad%20is%20a%20service%20of%20NeighborWorks%20of%20Western%20Vermont.of%20your%20home%20or%20building>.

¹⁵ "Federal Register Vol 86, No 93, of May 17, 2021 Rules and Regulations Coronavirus State and Local Fiscal Recovery Funds." *Code of Federal Regulations*, 31 Part 35 (2021): 3-26. <https://www.govinfo.gov/content/pkg/FR-2021-05-17/pdf/2021-10283.pdf>

¹⁶ Smith, *Workforce Development in Vermont's Thermal Sector*, 2021.

growth and salary potential. The strategy can also emphasize the environmental and community benefits of careers in weatherization.

The strategy should include provisions for supporting New Americans in joining the construction industry with construction-oriented English as a second language and expanded soft-skills training. Training is need for New Americans entering the trades and employers hiring New Americans to support cultural awareness and improve communication.

Tracking and reporting wages, and employee retention

For trade professions to be viewed as viable career paths, young people and adults seeking a career change need assurance of livable wages associated with careers in residential construction. Tracking and reporting wages by position and level of experience and completed certification will spotlight any wage disparities that need to be addressed and highlight potential for licensure requirements to increase wages in the industry. Tracking and reporting will also demonstrate the viability of long-term trade careers.

The State could add this responsibility to the expectations for the Vermont Weatherization and Building Science Professionals Workforce Directory administrator, or collect the information through regular channels such as the *2019 Vermont Clean Energy Industry Report*.¹⁷ In time, the wages could be aligned to Vermont Weatherization Installer, Vermont Weatherization Apprentice, Vermont Weatherization Journeyman, and Vermont Weatherization Expert certification as is done in the electrical and plumbing trades.

Researching, and support employers with implementing, effective employee retention strategies can help keep workers in the construction field. Tracking retention rates by weatherization job scope, age class, method of recruitment, employer, experience level, business culture, and benefits will demonstrate the factors most influential to retention.

Creating workforce housing

Vermont's lack of affordable housing for entry- to mid-level workers prevents new hires from moving to the state, and pushes Vermont young people to move elsewhere for work. Facilitating statewide affordable housing development is paramount for increasing workforce capacity.

Other markets have demonstrated success in pairing workforce housing development with workforce development. That is, such programs involve having trainees build and repair homes that they subsequently purchase or rent. Public-private partnerships are needed because costs of this type of development in Vermont are greater than those that can sustain affordable rents and home prices.

¹⁷ *2019 Vermont Clean Energy Industry Report*

https://publicservice.vermont.gov/sites/dps/files/documents/Renewable_Energy/CEDF/Reports/VCEIR%202019%20Final%20Signed.pdf

Sustaining demand for weatherization jobs

For training programs and businesses to maintain a steady stream of participants and new hires, the weatherization industry needs to sustain increased demand. In Vermont, this demand is traditionally fueled by incentive programs and funding for weatherization. Current federal funding sources enable Vermont to invest in weatherization through the end of 2023 to maintain the current level of market activity. How the State manages those investments to generate a steady increase in demand over time will be critical for workforce recruitment and retention. Weatherization incentives need to be predictable, too, and reliable across time and scalable with inflation, to keep pace with competitive wages.

Additional weatherization funding needs to be investigated and promoted from local sources such as on-bill financing, real estate valuation of weatherization, and public-private partnerships.

Conclusion

Addressing all the challenges affecting weatherization workforce development is necessary to meet State goals for increasing weatherization as a method for driving down greenhouse gas emissions. The Vermont Weatherization Worker Curriculum provides standardized learning objectives for training Vermont's weatherization workforce.

The standardized curriculum enables training organizations to deliver audience-specific programs that meet the needs of participants and the industry. Young people and other new entrants in a successful effort that improves the size and quality of the weatherization workforce can begin visualizing a productive career pathway. This pathway can be solidified over time by the State administrator, in partnership with industry stakeholders.

With a successful effort under way, the State can track the weatherization workforce through the Vermont Weatherization and Building Science Professionals Workforce Directory and use the data to inform future policy decisions.

Appendix A: Weatherization Workforce Industry Survey Results

Vermont Construction Career Pathways

Efficiency
Vermont

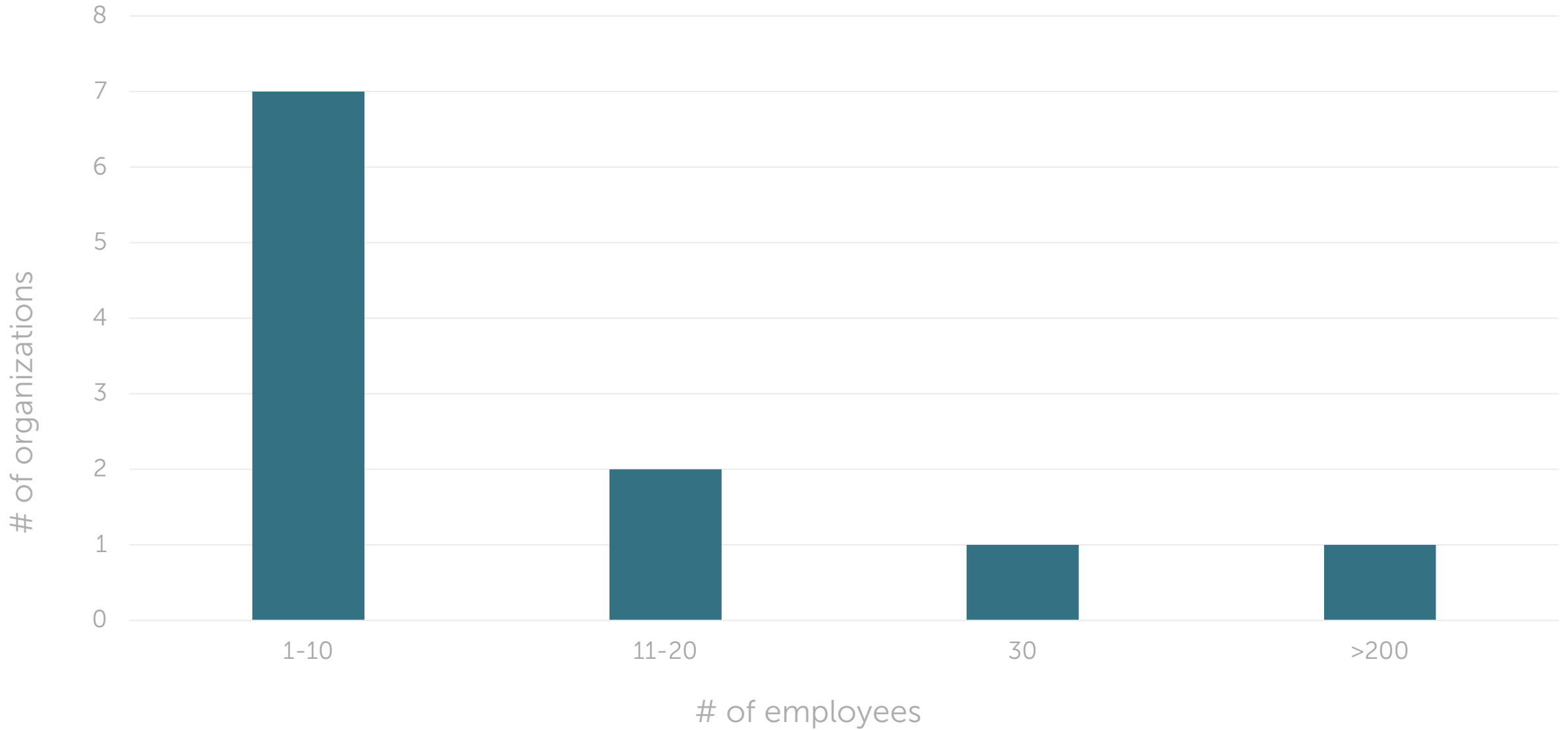


Vermont Construction Career Pathways

Employers

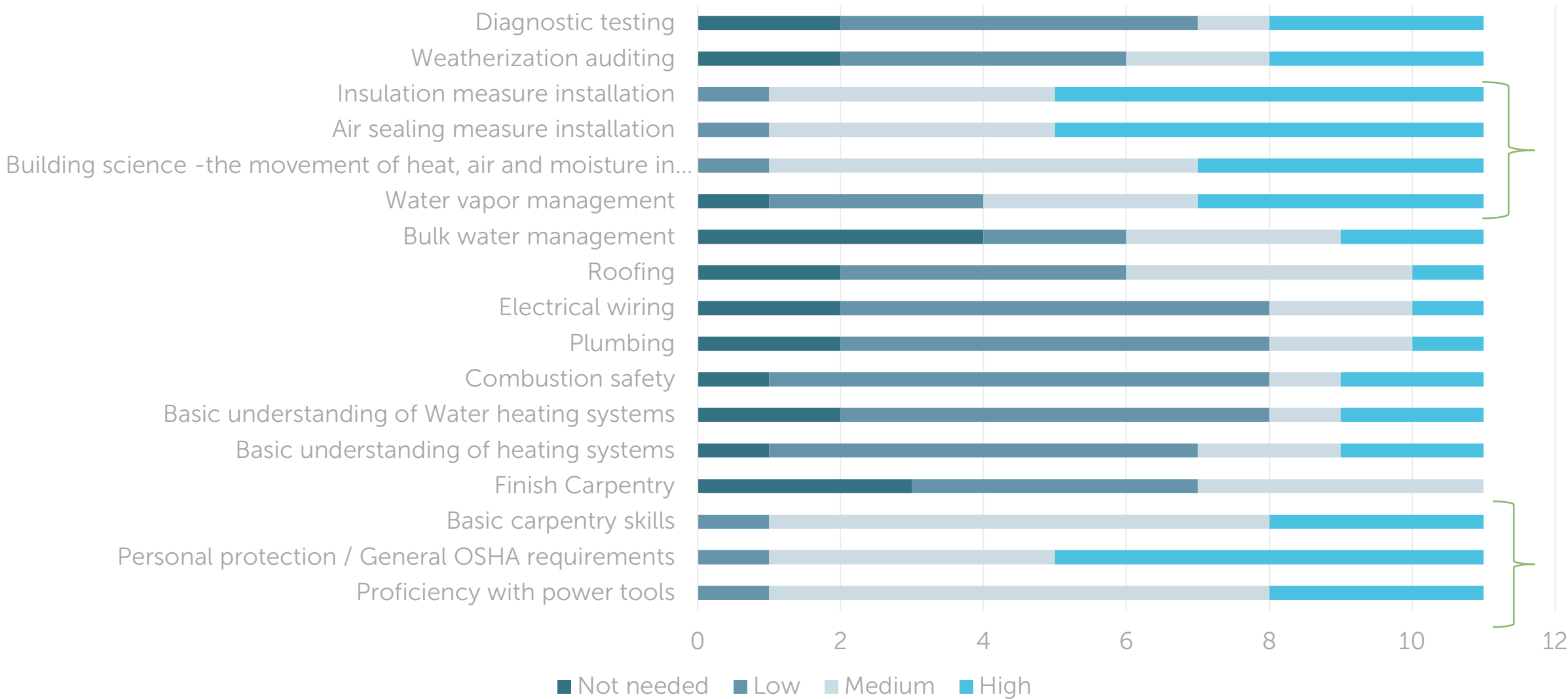
- 10 respondents completed full survey
 - Avg. time 22 min
 - Organizations represented:
 - Building Energy
 - Energy Co-op of Vermont
 - Green Foam Insulations
 - Harvestar
 - MacIntyre Services
 - NeighborWorks of Western VT HEAT Squad
 - NPFoam
 - Vermont Comfort
 - Vermont Homebuilders and Remodelers Association
 - Weatherization and Renovation of Montpelier
- 3 incomplete responses
 - Avg. time 3 min; partially complete survey 21 min*
 - Organizations represented:
 - Northern precision Foam
 - Solsa Building and Energy
 - SOV Division for Historic preservation

Including you, how many people are currently employed by your organization?



**includes response from partially completed survey*

How important are the following skills for ENTRY LEVEL new hires in your organization? **All respondents**

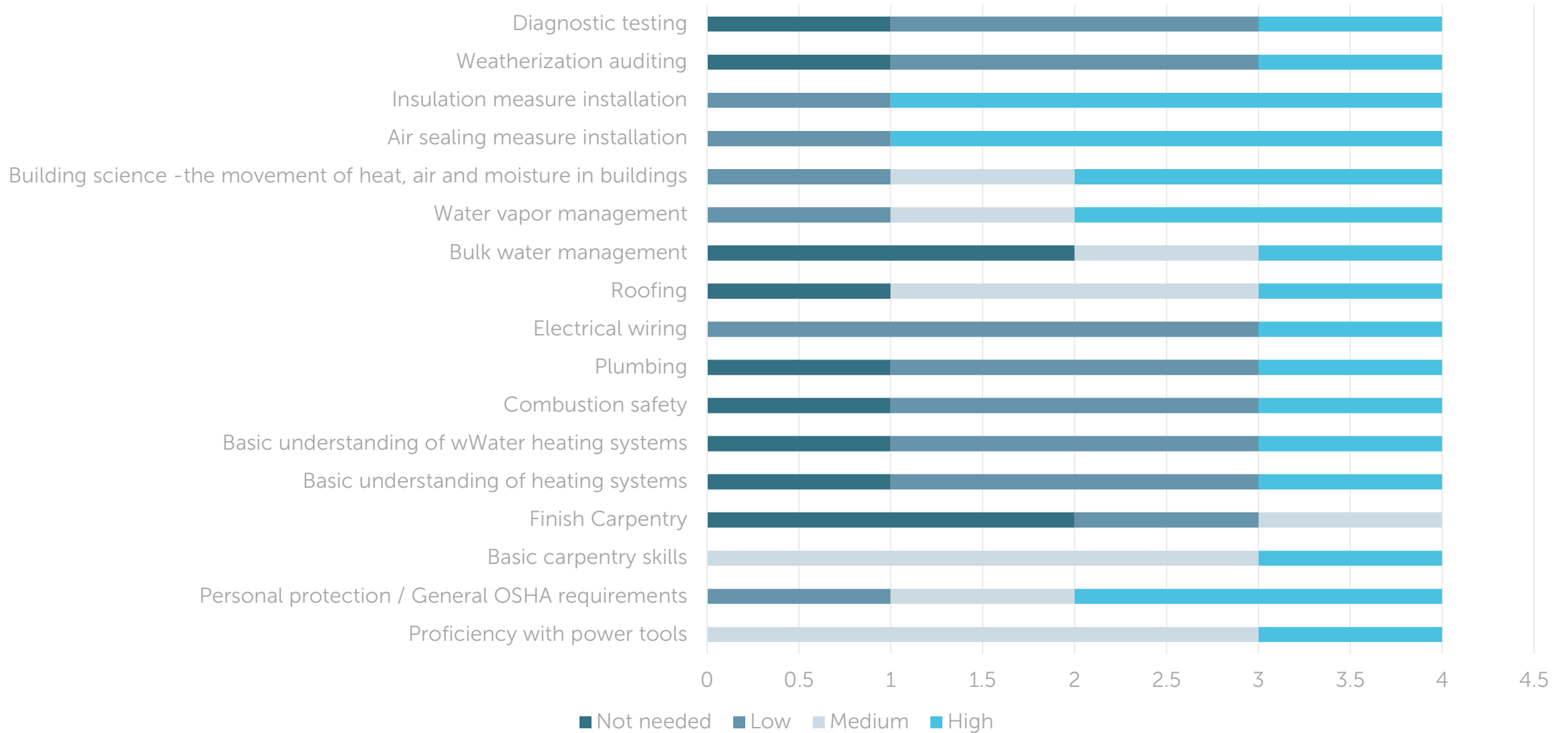


N=11

**includes response from partially completed survey*

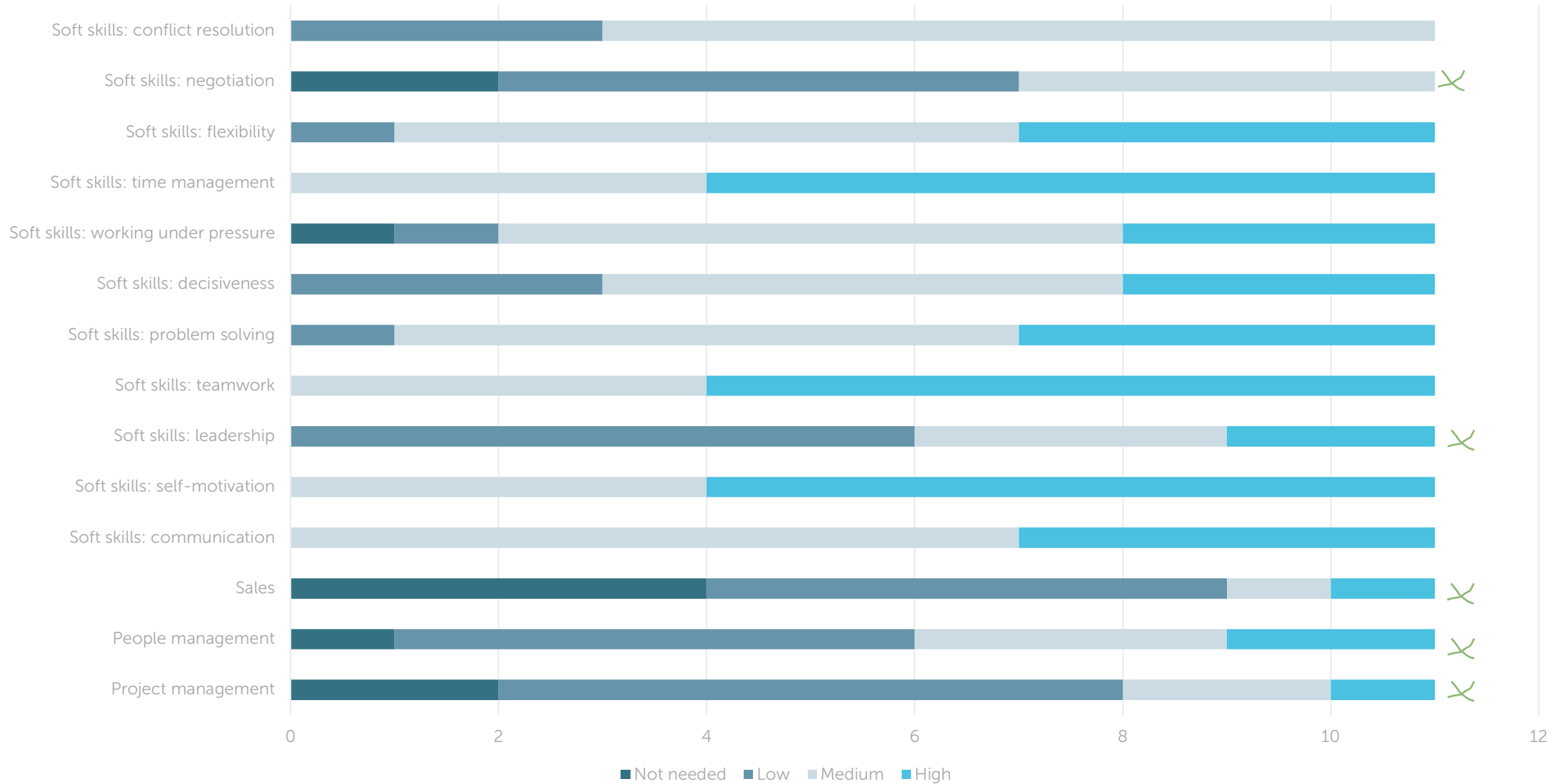
Organizations with >10 employees

How important are the following skills for ENTRY LEVEL new hires in your organization?



How important are the following skills for ENTRY LEVEL new hires in your organization?

All respondents

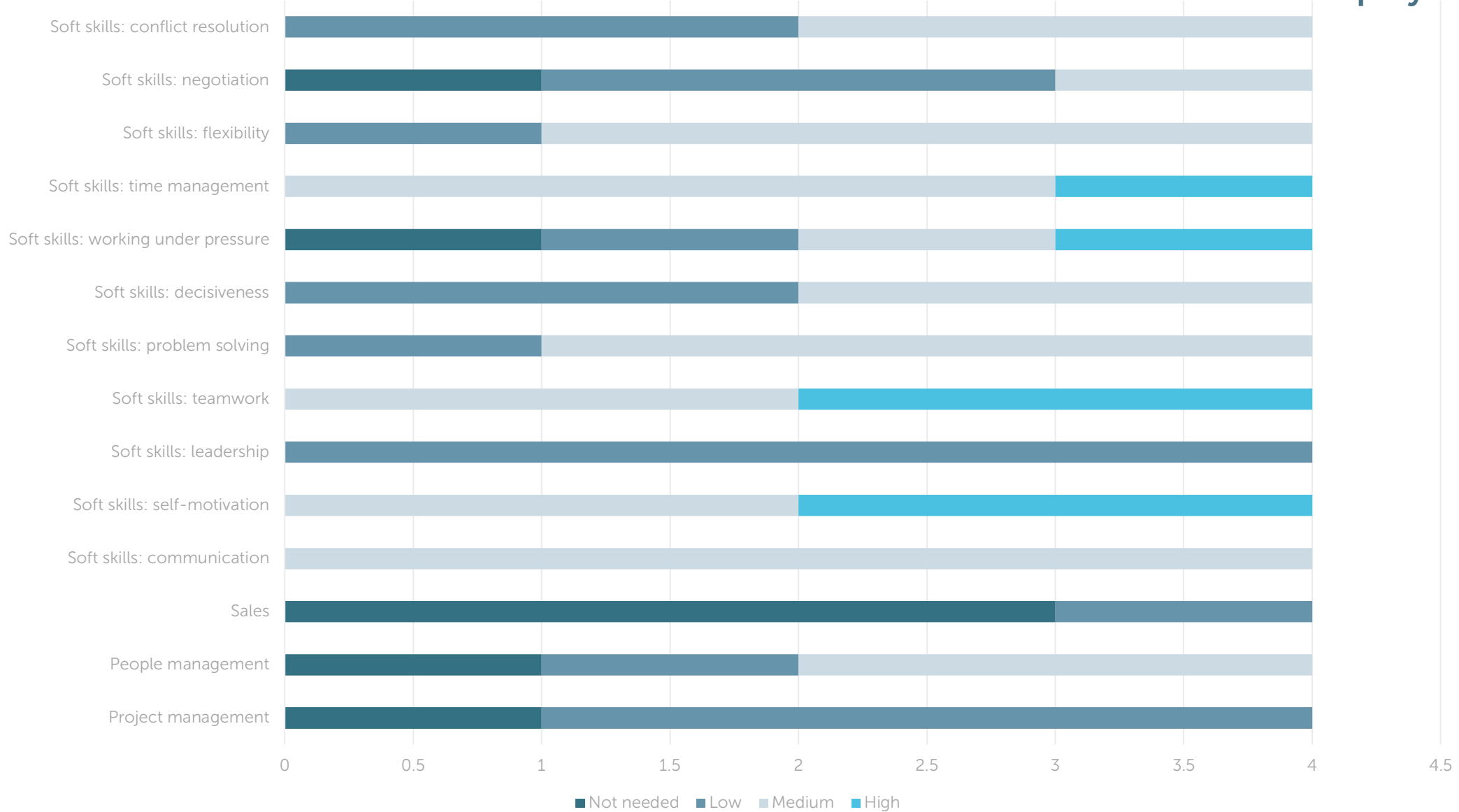


N=11

**includes response from partially completed survey*

How important are the following skills for ENTRY LEVEL new hires in your organization?

Organizations with >10 employees

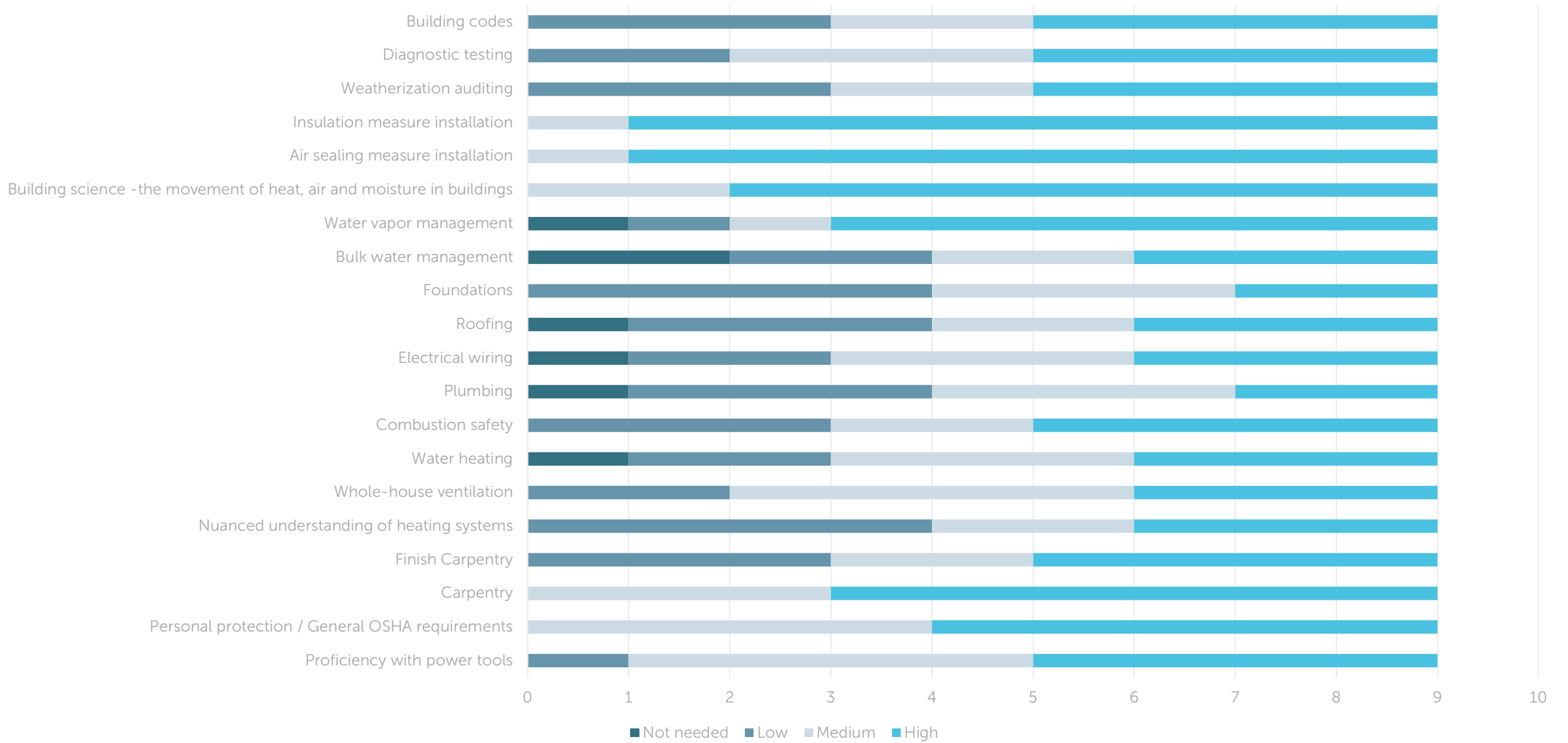


N=4

Describe other ENTRY LEVEL skills new hires need in your organization, but seldom have:

- Building Science understanding, refrigeration
- work ethic
- you covered most of them.
- We seek persons who are dedicated, reliable, and are willing to work.
- Willing to learn.
- Having all the skills: technical, personable, communication, organized, self-driven, creative, problem-solver, customer-service, general construction knowledge.
- Willingness to get dirty and work hard
- self motivation and direct communication with bosses

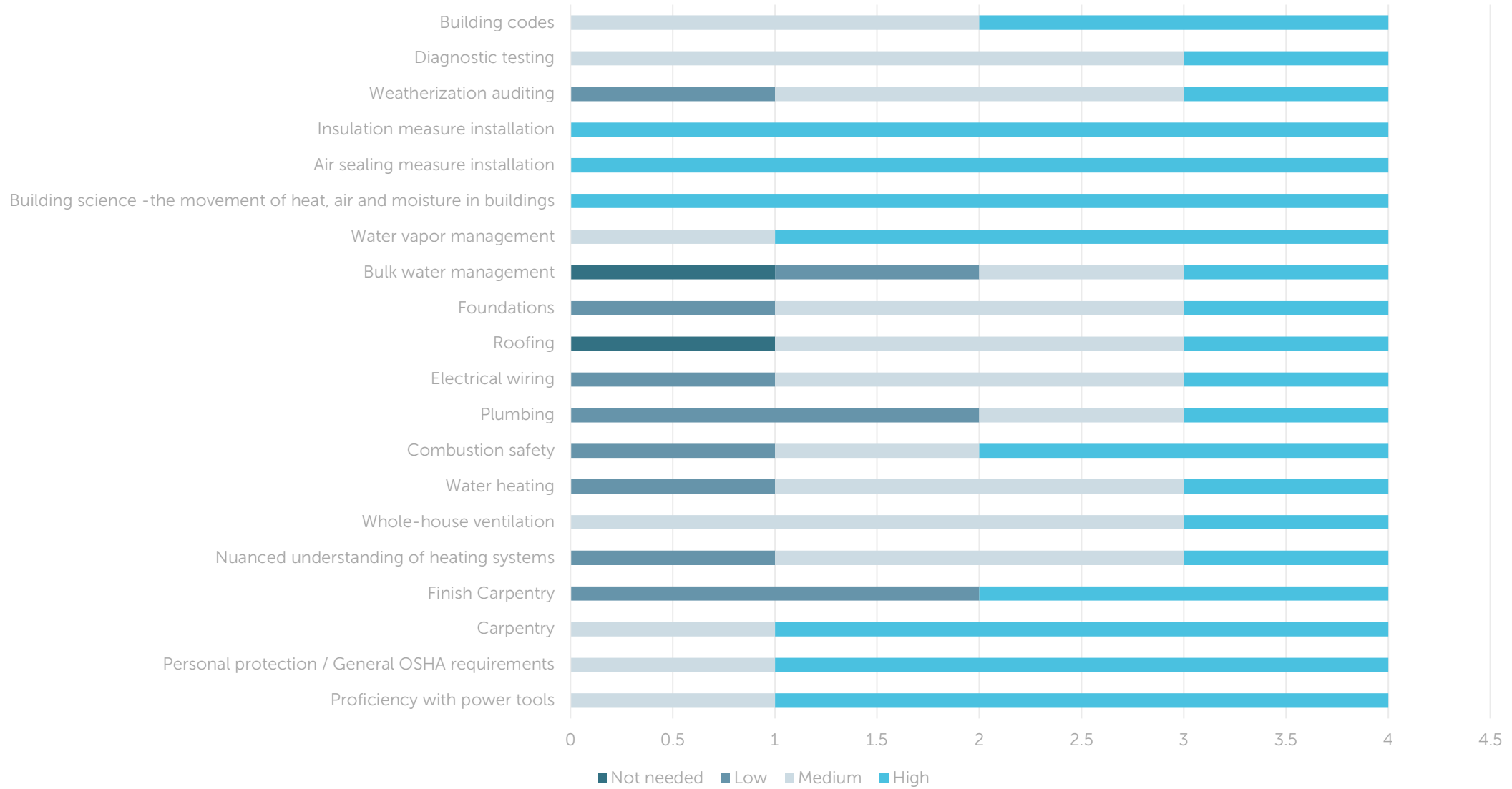
How important are the following skills for SENIOR LEVEL new hires in your organization? **All respondents**



N=10

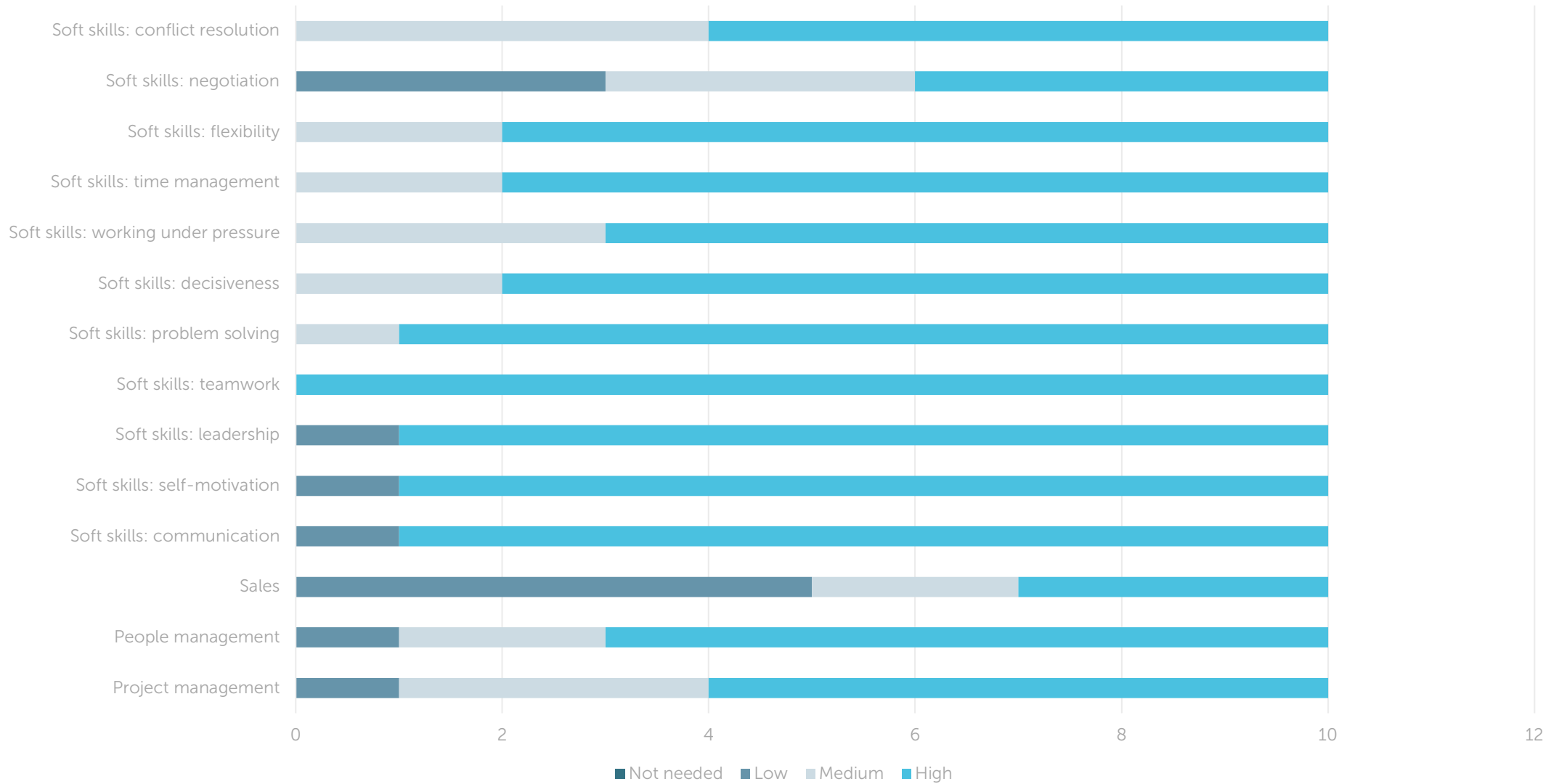
Organizations with >10 employees

How important are the following skills for SENIOR LEVEL new hires in your organization?



How important are the following skills for SENIOR LEVEL new hires in your organization?

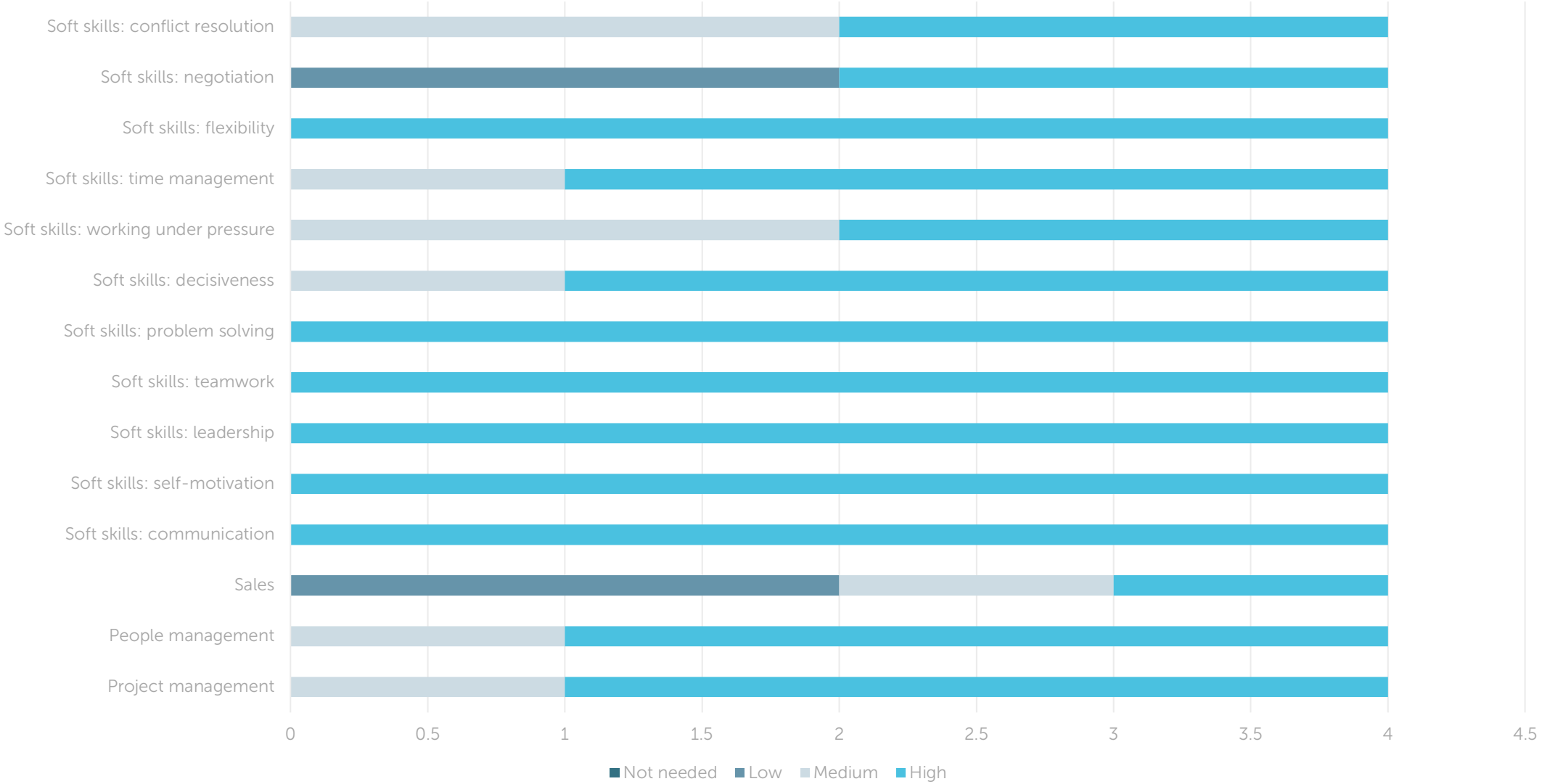
All respondents



N=10

Organizations with >10 employees

How important are the following skills for SENIOR LEVEL new hires in your organization?

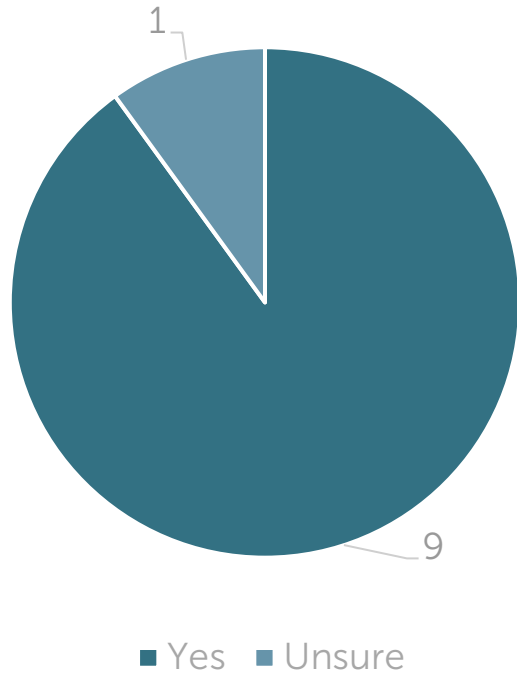


N=4

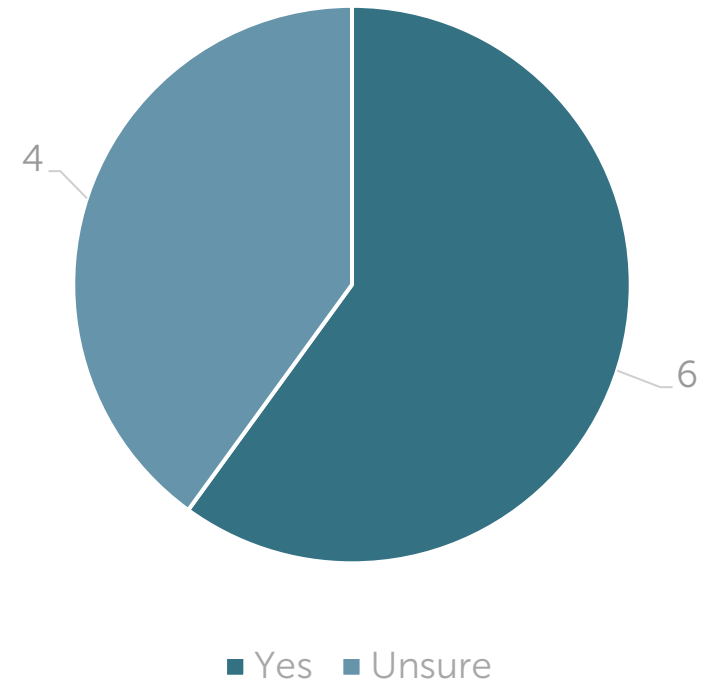
Describe other SENIOR LEVEL skills new hires need in your organization, but seldom have:

- Building Science
- The ability to work with younger generations
- CDL
- Willing to learn be a team player
- Same as Entry Level Skills.
- Willing to adapt to the way we want things done.
- Patience with training new hires

Do you provide on-the-job training specific to building science and/or weatherization?



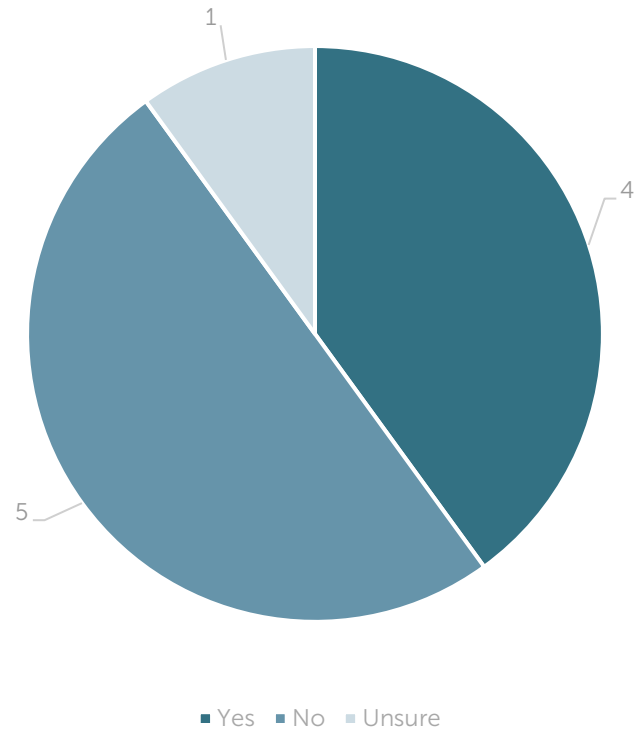
Would you be willing to sponsor registered apprenticeship programs?



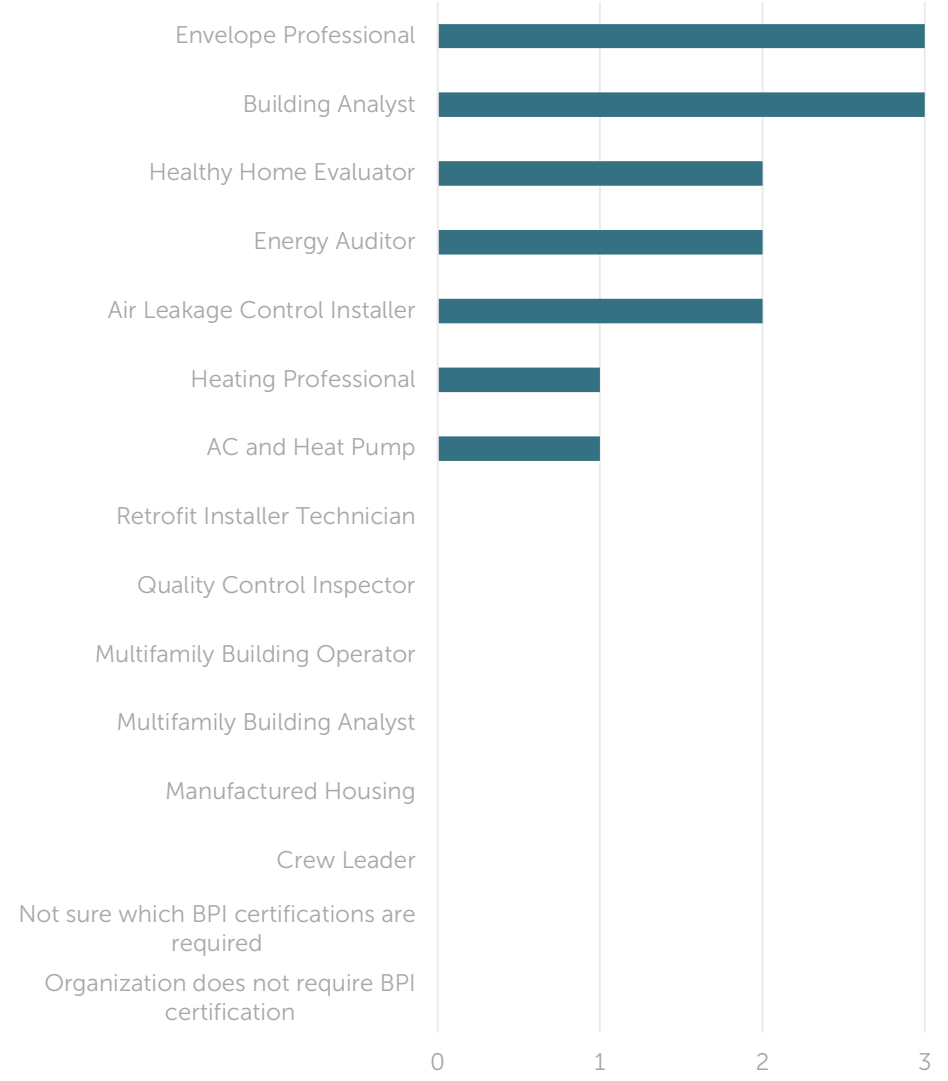
Briefly describe your on-the-job training related to building science and/or weatherization.

- We typically make it a point to take time on the job to talk about why and how to do things. During slow times we also take training classes online.
- site visits and group discussions as well as vendor classes
- the senior employees train the newbies.
- We train personnel with basic building science principles, work related machinery, and measuring effectiveness.
- Hands on
- Mentorship, field training, collaboration, team meetings, continued education, software training.
- We want everyone to succeed. We have many experienced employees that are willing to pass along their knowledge to the next generation of workers. This is not a formal operation and are open to flexible ways of training new incoming employees.
- Work and learn with the crew by doing.
- We do cellulose and closed cell foam applications. Our training is specific to the jobs required to perform.

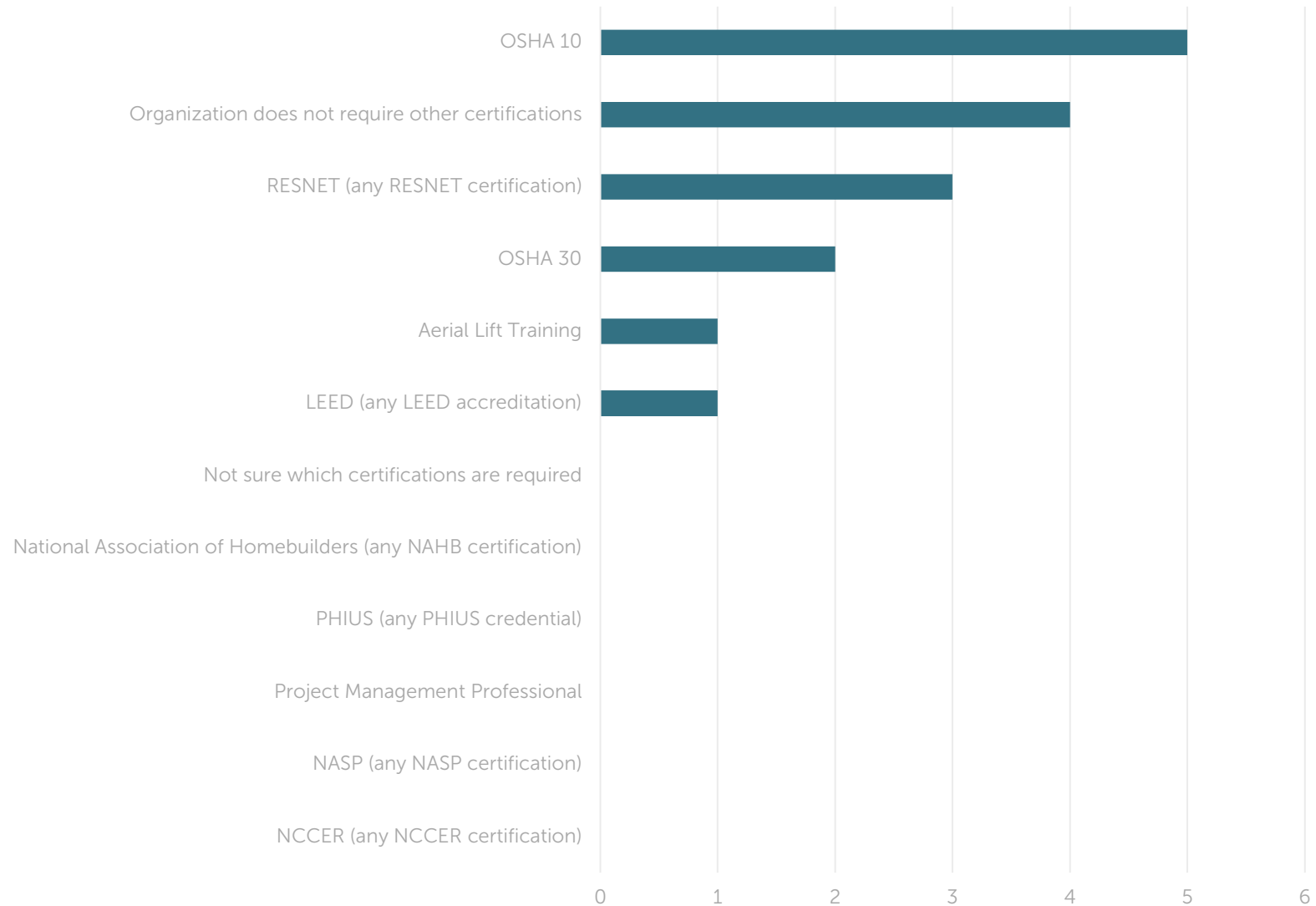
Does your organization require or desire staff to have certifications from Building Performance Institute (BPI)?



Which Building Performance Institute (link to BPI) certifications do you require? (select all that apply)



Which of the following other certifications do you require or desire?
(select all that apply)



Describe other staff certifications you require or desire:

- BPI, NABCEP
- Rees, all state of Vermont oil, gas, Nat Gas, and plumbing lic.
- Forklift

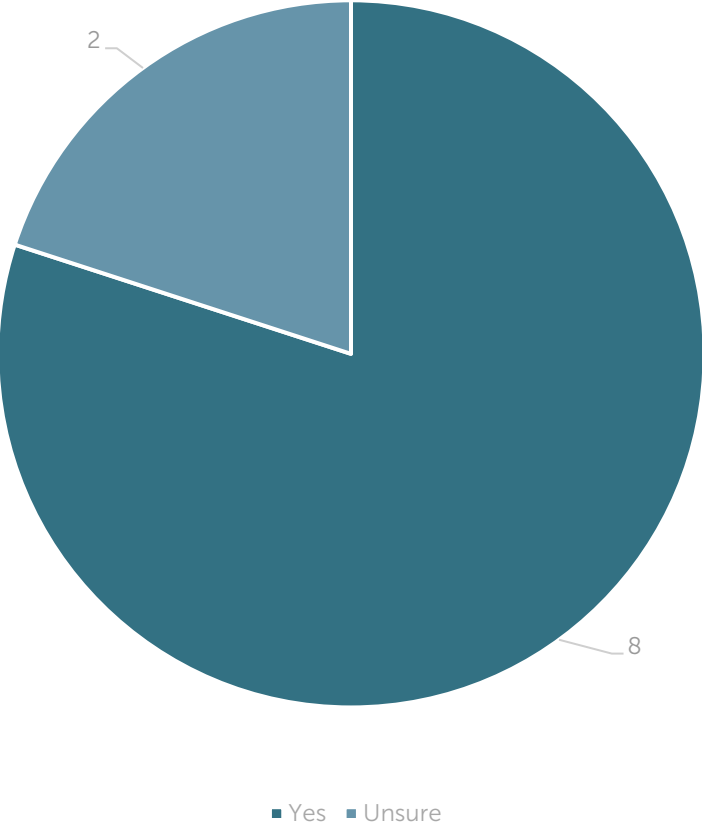
Is there an advantage to staff having certification(s)?

- Unanimous yes

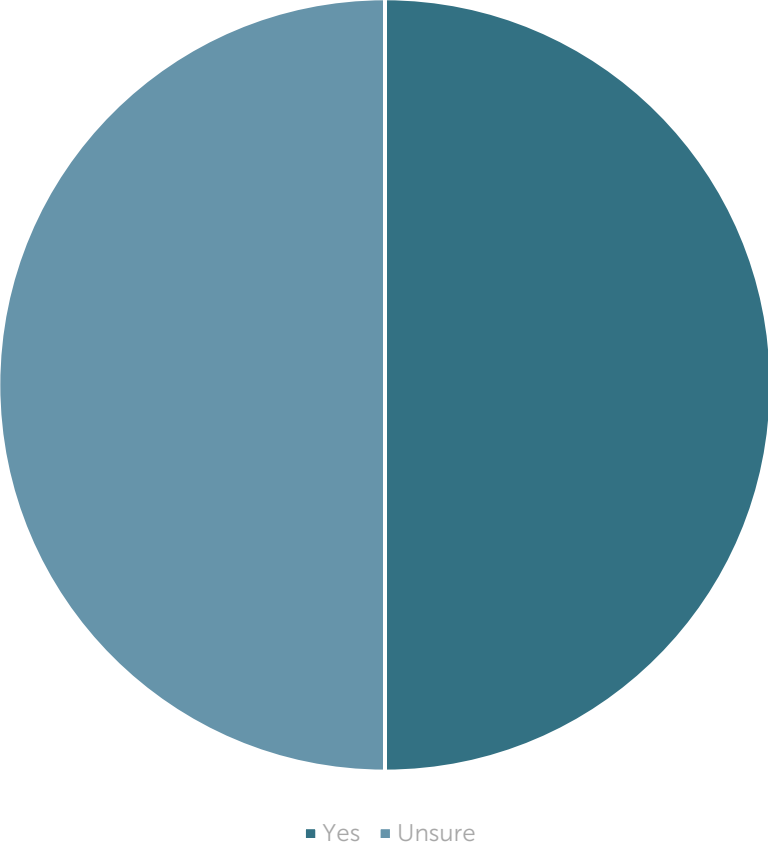
Describe the benefits of staff having certification(s):

- It proves a level of Competence, which allows teams to work more efficiently and independent.
- They get paid more because they provide more value to the company
- CDL is good osha is good so we stay out of trouble
- Certified personal who understand building science are able to think on their own and are able to help contribute to actions required to remediate problems.
- Pay
- Customer and other trades credibility, required by the statewide program, certifications provide the education for the program, market quality control.
- The person would just be a more well rounded and educated.
- Certified employees have received formal education in the topic and can be expected to know at least some of the information that the course provided. This basic and initial information can be reenforced during work.
- Their knowledge is deeper and it is easier to sell jobs when employees are certified.
- Less time to ramp up for production.

Would you be willing and able to pay an employee to attend training? Meaning pay their salary for the day(s) they are at the training?



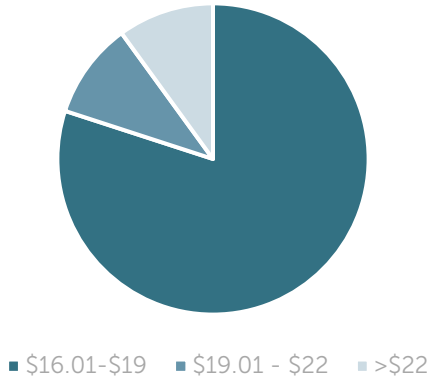
Would you be willing and able to pay tuition for an employee to attend a training?



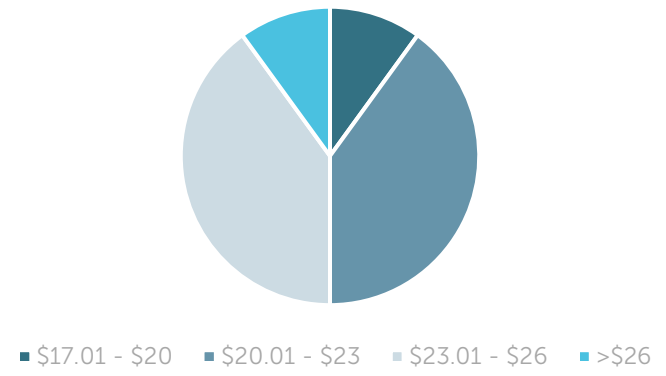
How much tuition would you be willing and able to pay per day for training that meets your business needs?

- Not sure, \$50?
- Depends.
- \$300-500
- TBD
- \$250 per day

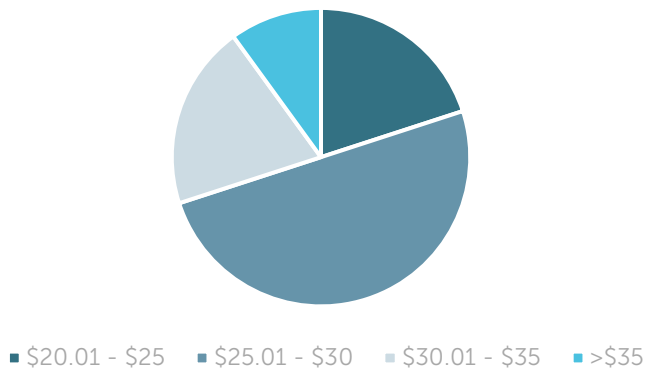
What is your **entry-level** starting wage per hour?



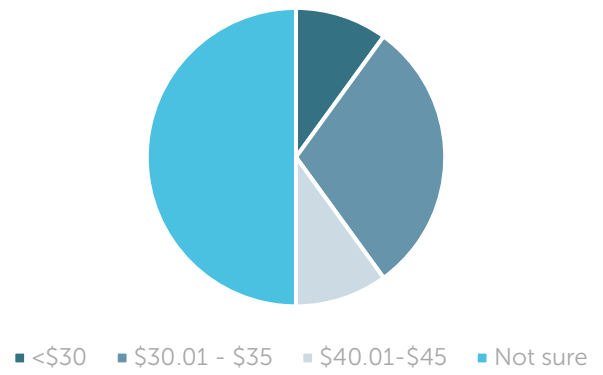
What is the average hourly wage for a responsible worker with **5 years** of relevant experience?



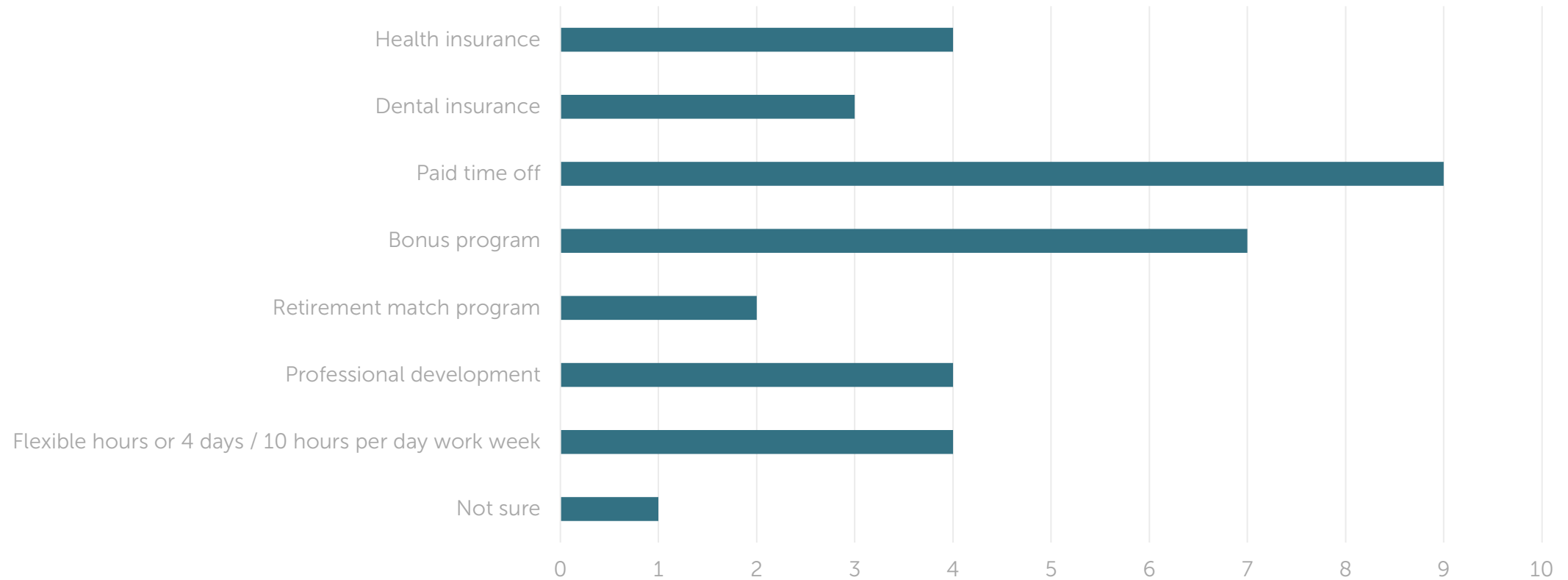
What is the average hourly wage for a responsible worker with **10 years** of relevant experience?



What is the average hourly wage for a responsible worker with **20 years** of relevant experience?



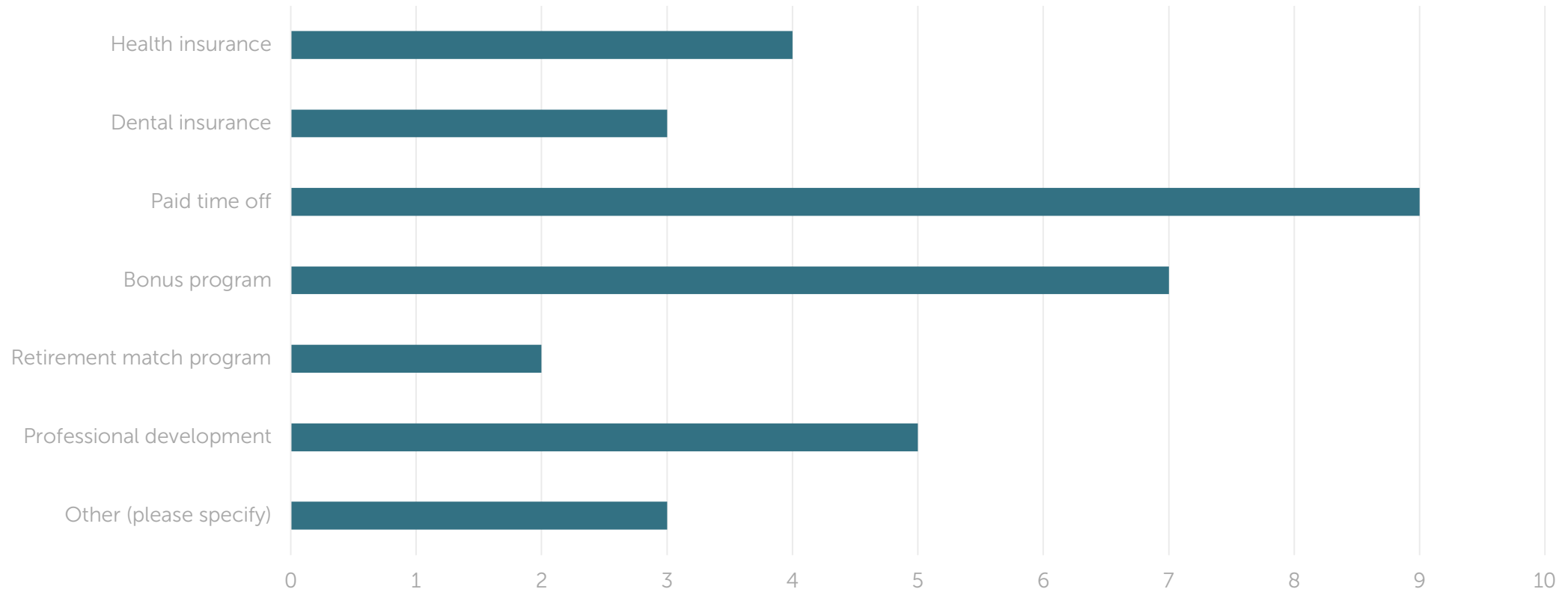
Which of the following benefits does your company offer entry-level new hires? (select all that apply)



Other specified responses:

- Vehicle use, uniforms, tool allowance.
- profit sharing
- Depends on the individual company

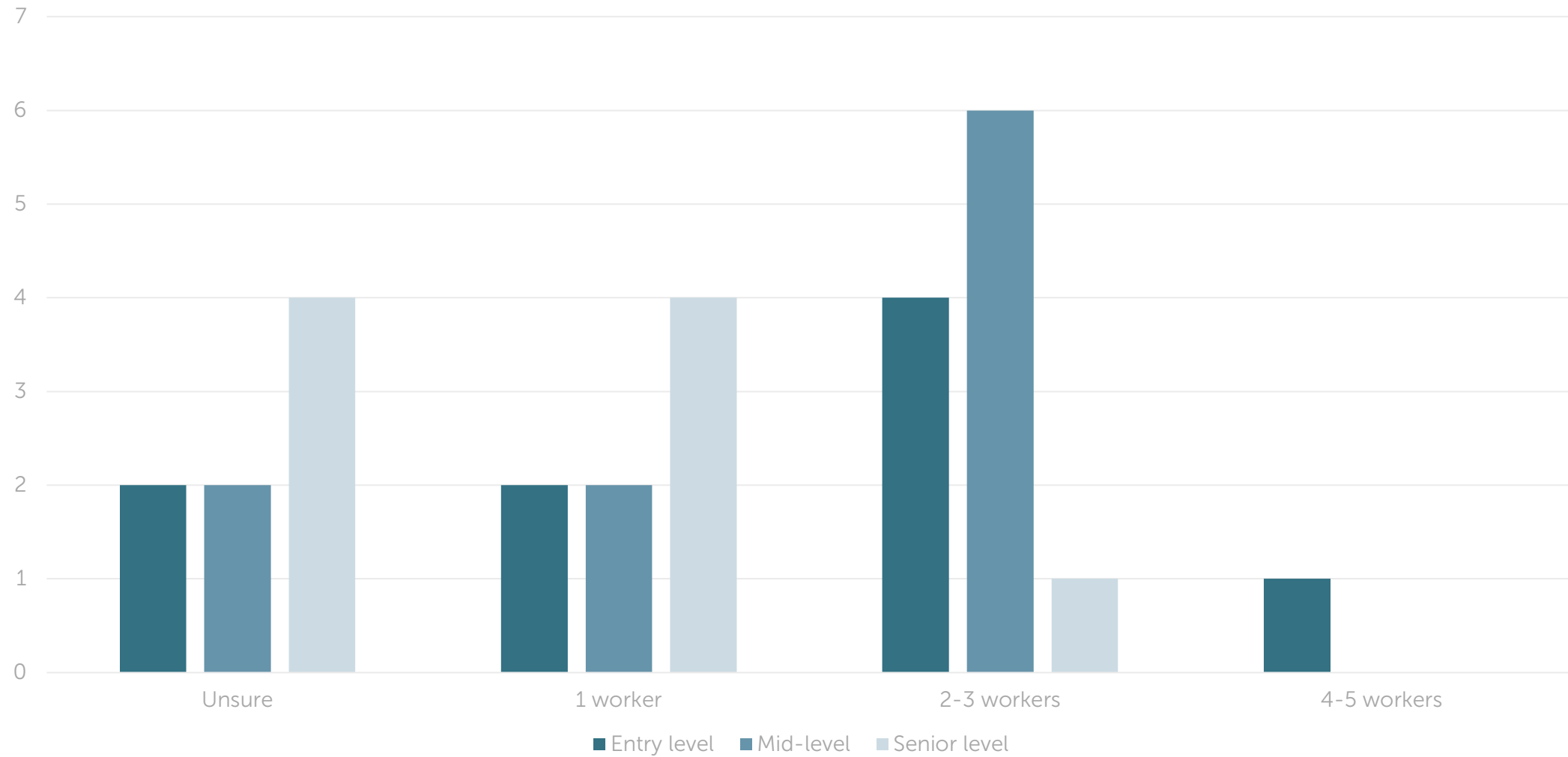
Which of the following benefits does your company offer senior-level new hires? (select all that apply)



Other specified responses:

- same as above
- profit sharing
- depends on the company

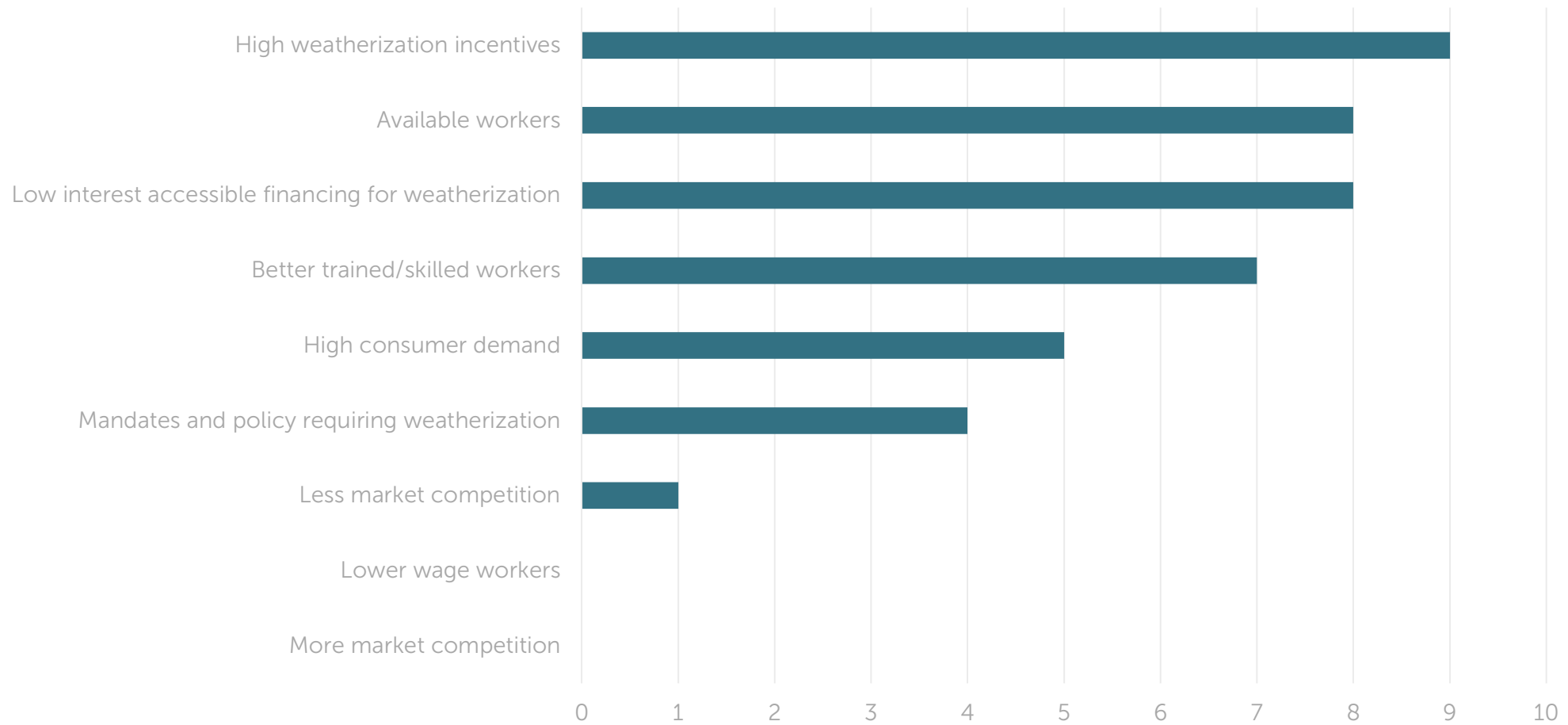
If you are able to find qualified workers, how many entry, mid, and senior level workers do you plan to hire in the next 1-3 years?



If you indicated you are unsure of how many workers you plan to hire in the next 1-3 years, what is needed for you to become sure?

- how the market continues. with all of the money being paid out by the government we may be in for a correct/inflation
- Steady work flow.
- depends on the company.
- Qualifications

What market conditions would you like to see in place to plan for expanding your workforce?
(select all that apply)

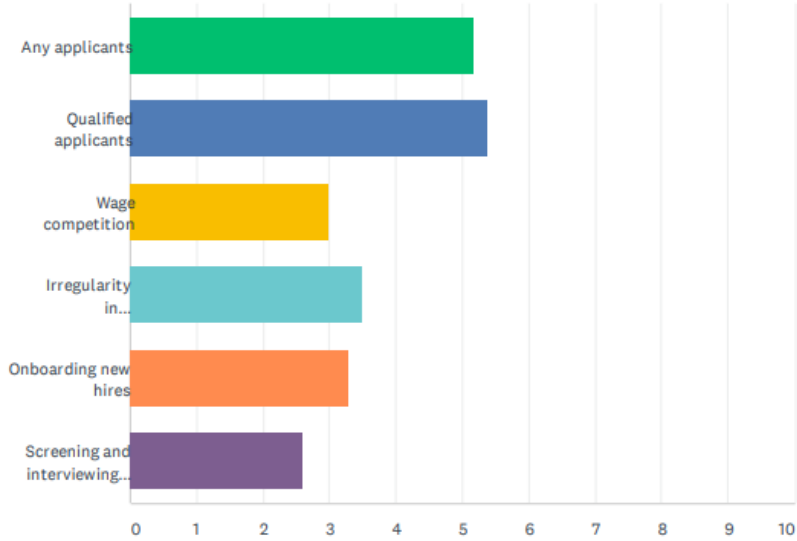


Other specified responses:

- Housing and broadband

Q32 Rank, in order of priority / difficulty, your biggest challenges in hiring new weatherization employees:

Answered: 10 Skipped: 3



Any applicants

Qualified applicants

Wage competition

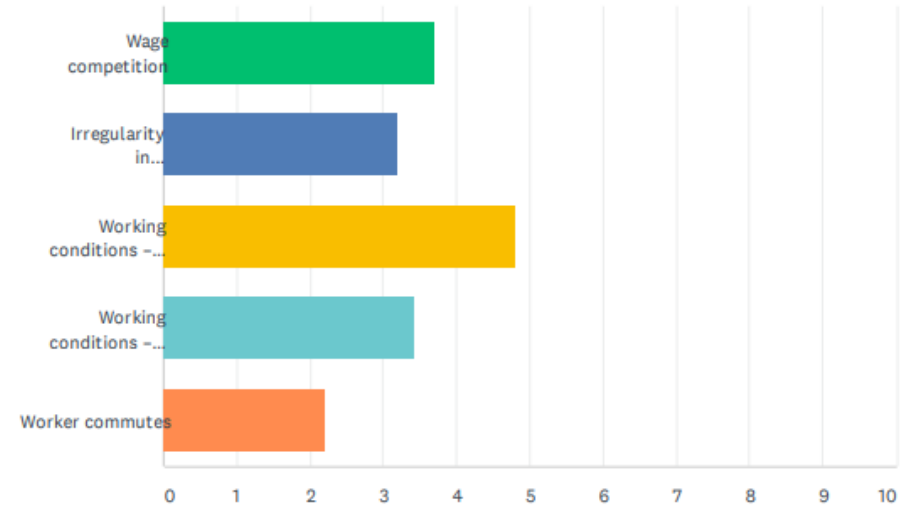
Irregularity in weatherization demand

Onboarding new hires

Screening and interviewing potential hires

Q33 Rank, in order of priority / difficulty, your biggest challenges in retaining weatherization employees:

Answered: 10 Skipped: 3



Wage competition

Irregularity in weatherization demand

Working conditions – comfort

Working conditions – health

Worker commutes

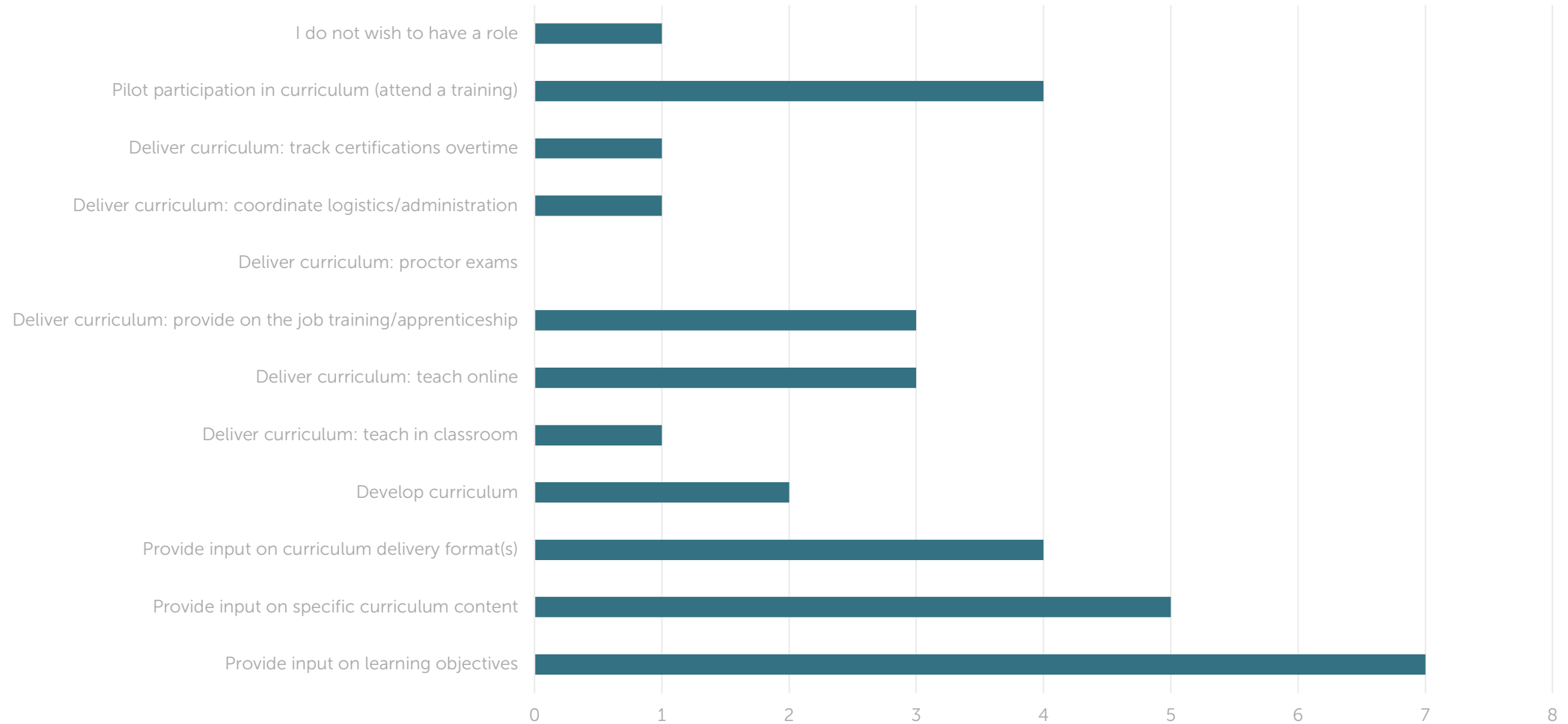
Describe any additional challenges in worker skill sets and hiring / retaining weatherization employees:

- Burn-out, repetitive, launching own business
- They do not show up to work on time and request inordinate amounts of time off.

Provide any additional thoughts on with weatherization-related workforce constraints in Vermont. You do not need to repeat information collected elsewhere in this survey.

- Weatherization is HARD work, nobody WANTS to do it. Incentivizing the crews (not the business owner) for the hard work they perform would be a really neat way to get our team excited about that type of work. which would mean we would do more weatherization work.
- There is just not enough people interested in weatherization work.
- Those applicants who lie about having a driver's license that we require hold us up and waste our time.

What role do you desire to have in the identification and development of a standardized statewide building sciences curriculum that includes weatherization, and establishes a career pathway in energy efficiency construction?



Building Science Curriculum Training

Efficiency
Vermont

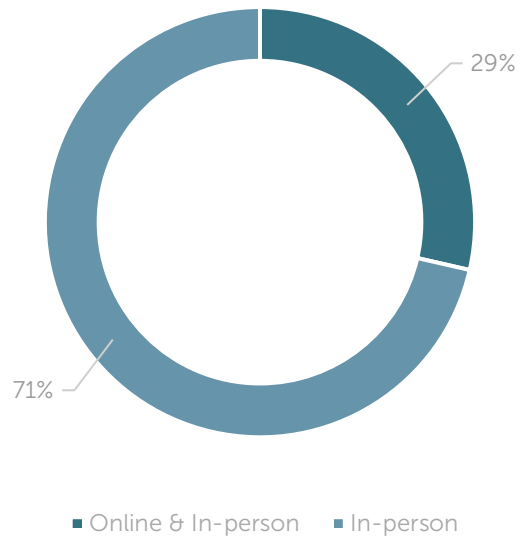


Building Science Curriculum Training

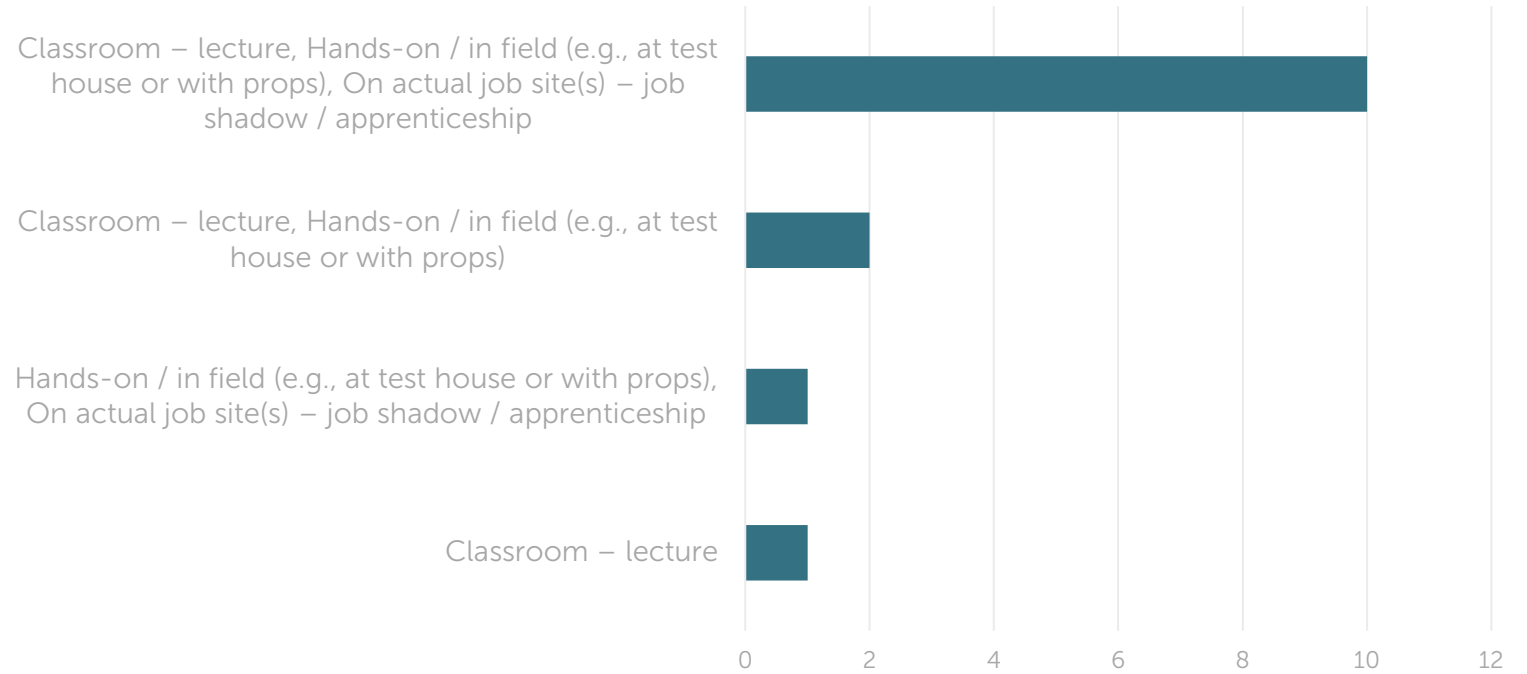
Trainers & training programs

- 14 respondents completed full survey
 - Avg. time 22 min
 - Organizations represented:
 - Canaan Career Center
 - Center for Technology, Essex
 - Cold Hollow Career Center
 - Northwest Career and Technical Center
 - Randolph Technical Career Center
 - River Bend Career & Technical Center
 - River Valley Technical Center
 - Southwest tech
 - Stafford Technical Center
 - Sustainable Energy Outreach Network (SEON)
 - Vermont Fuel Training Center, VFDA
 - Vermont Passive House
 - Vermont Works for Women
 - Windham Regional Career Center
- 12 incomplete responses
 - Avg. time 3 min
 - Organizations represented:
 - Bellwether Craftsmen
 - Building-Wright
 - Burlington Technical Center
 - ReSOURCE A Nonprofit Community Enterprise
 - Southwest Vermont Regional Technical School District
 - Stafford Technical Center
 - Stafford Technical Center
 - The Tutorial Center
 - VACTEA - Vermont Adult CTE Association
 - Vermont Agency of Education
 - Vermont Homebuilders and Remodelers Association
 - Weatherization and Renovation of Montpelier

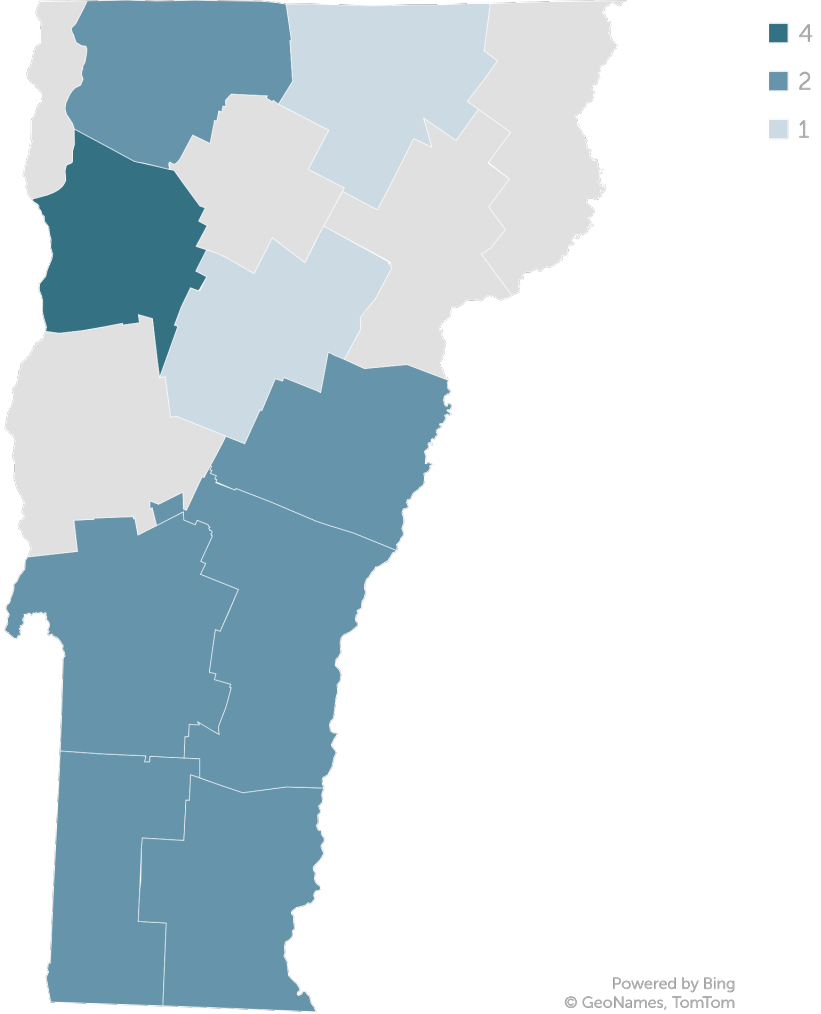
How is the training delivered?



How is the in-person training delivered? (select all that apply)



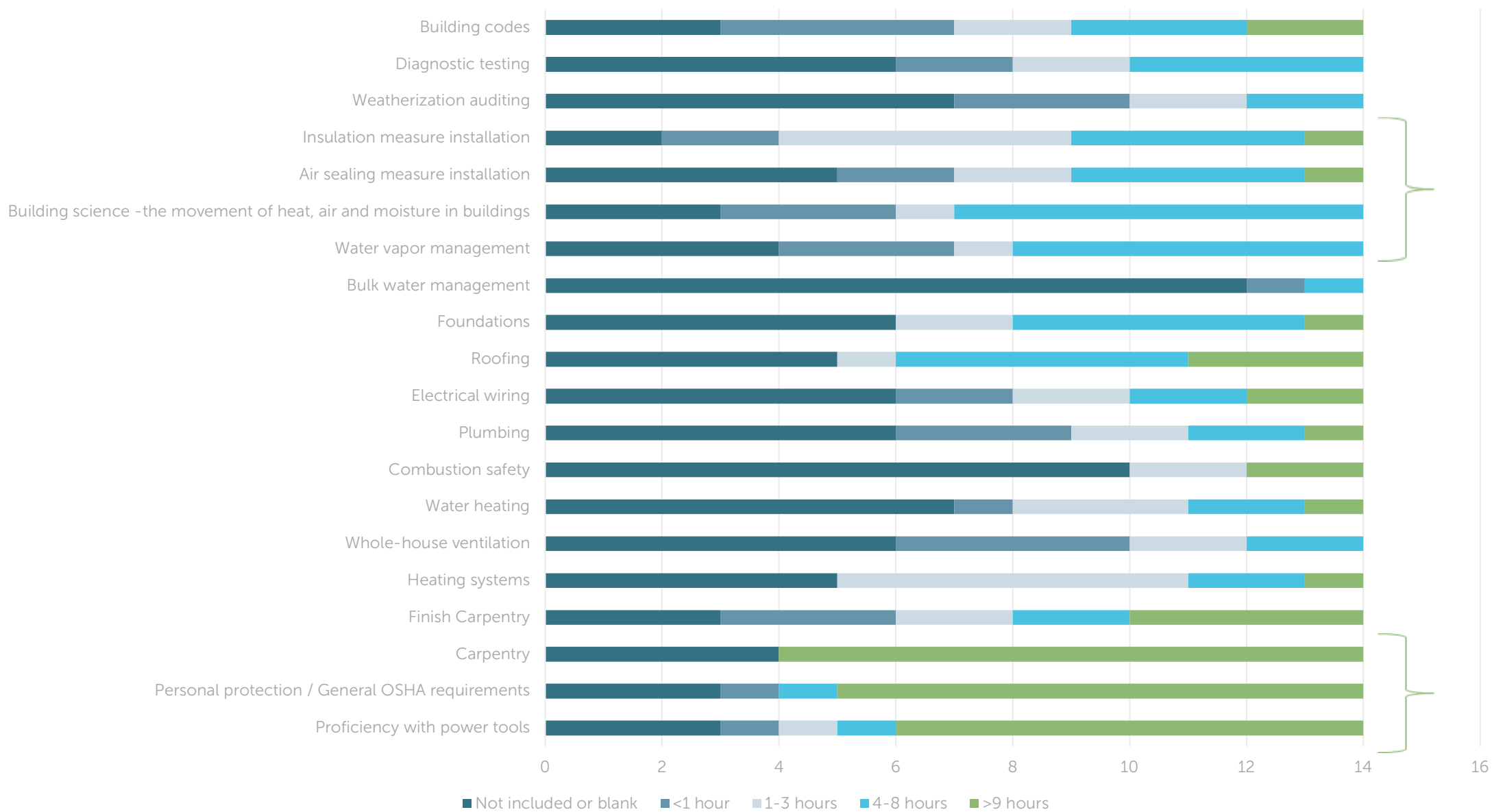
Where are the in-person portions of the training program currently offered? (# response by county)



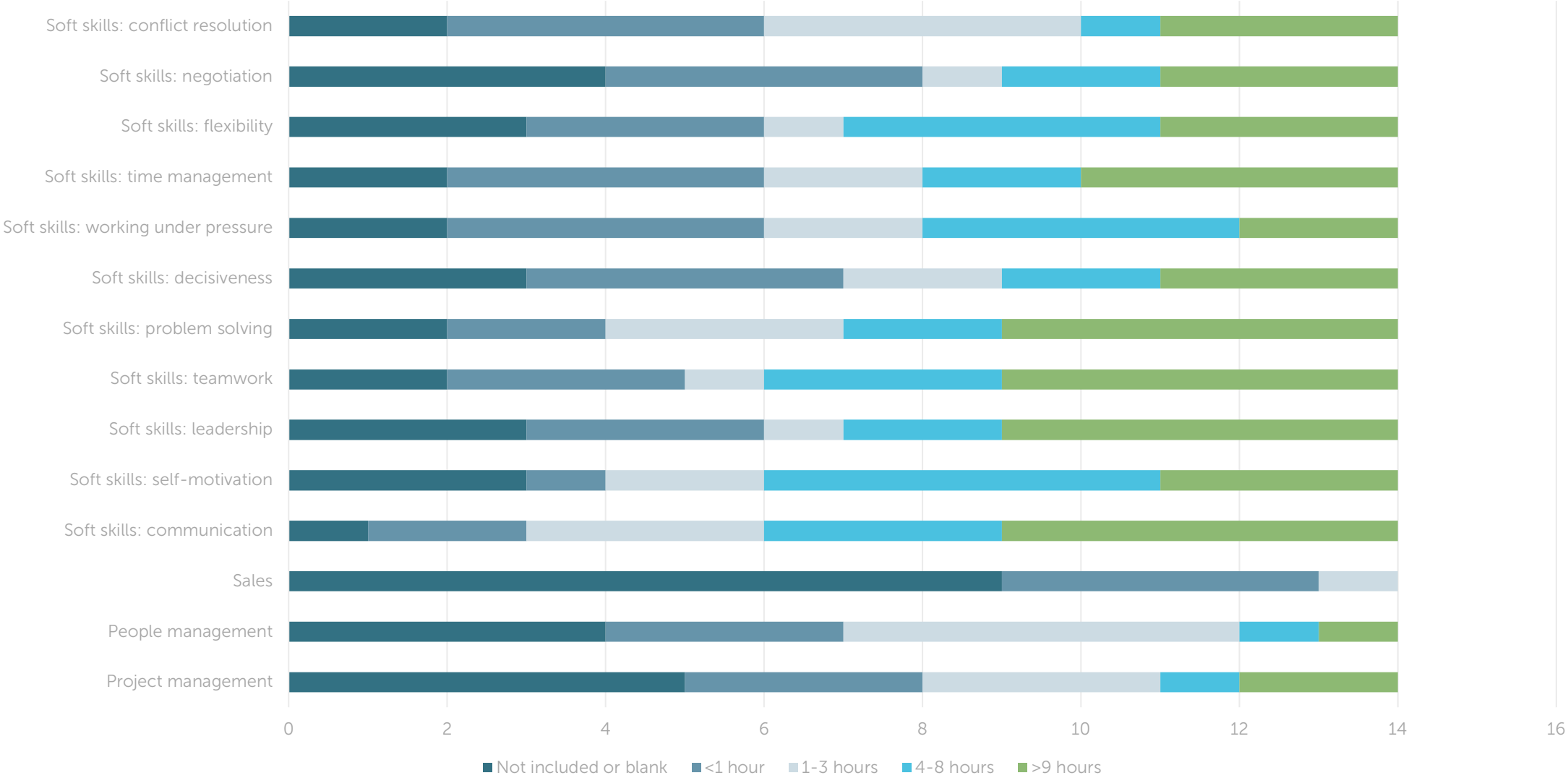
Programs offering in-person portions in more than one county:

- SEON
- Vermont Fuel Training Center, VFDA

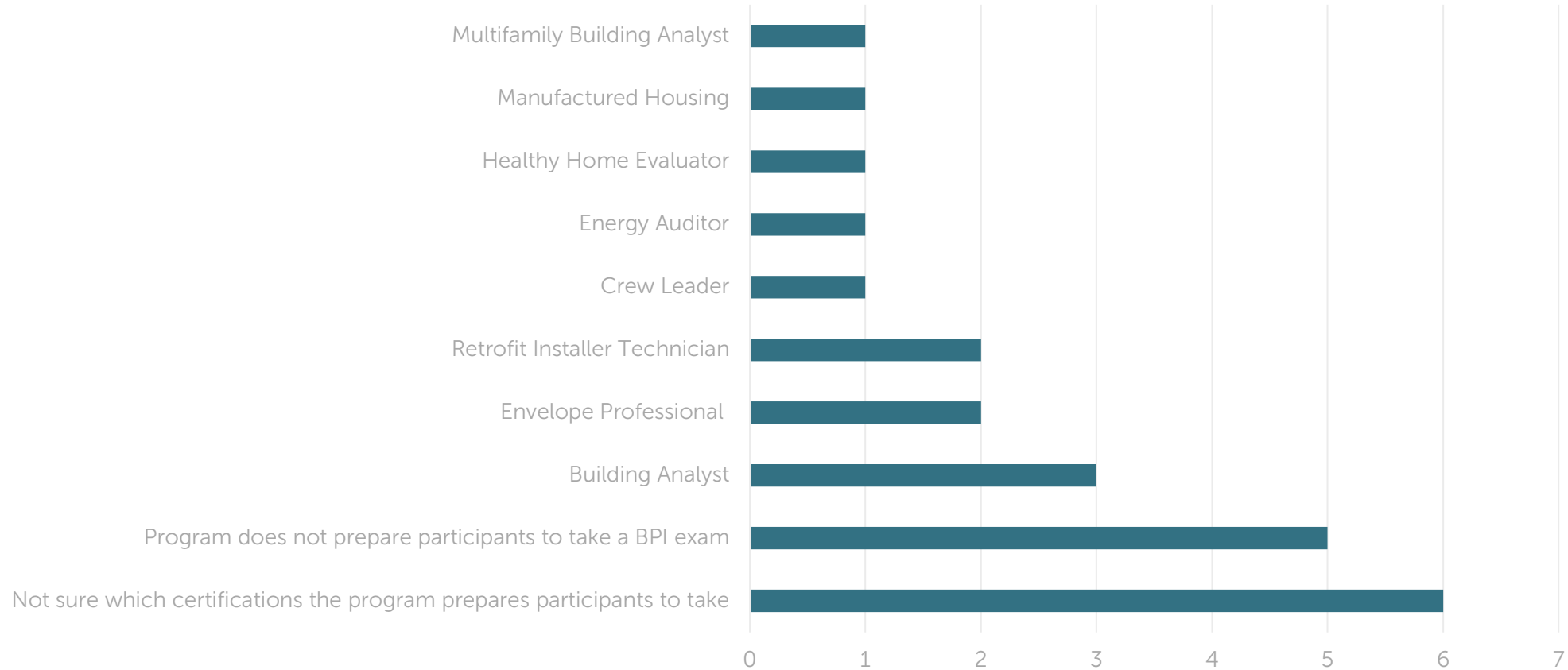
What topics are covered and for how much time?



What topics are covered and for how much time?



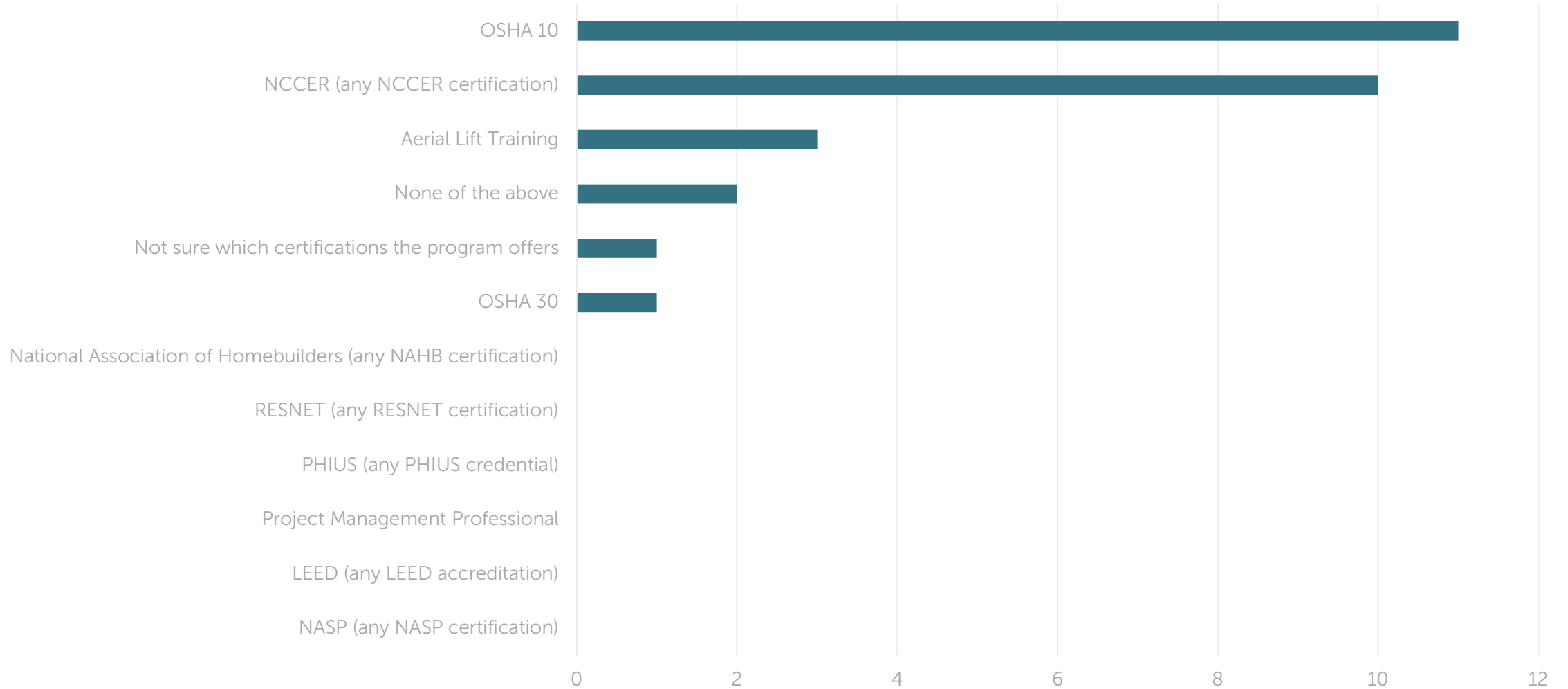
Which Building Performance Institute (link to BPI) certification exams does the training prepare participants to take? (select all that apply)



VT Passive House, Randolph Technical Center and Canaan Career Center prepare participants for multiple BPI certifications.

Canaan Career Center proctors BPI exams.

Which of the following other certifications does the program offer? (select all that apply)



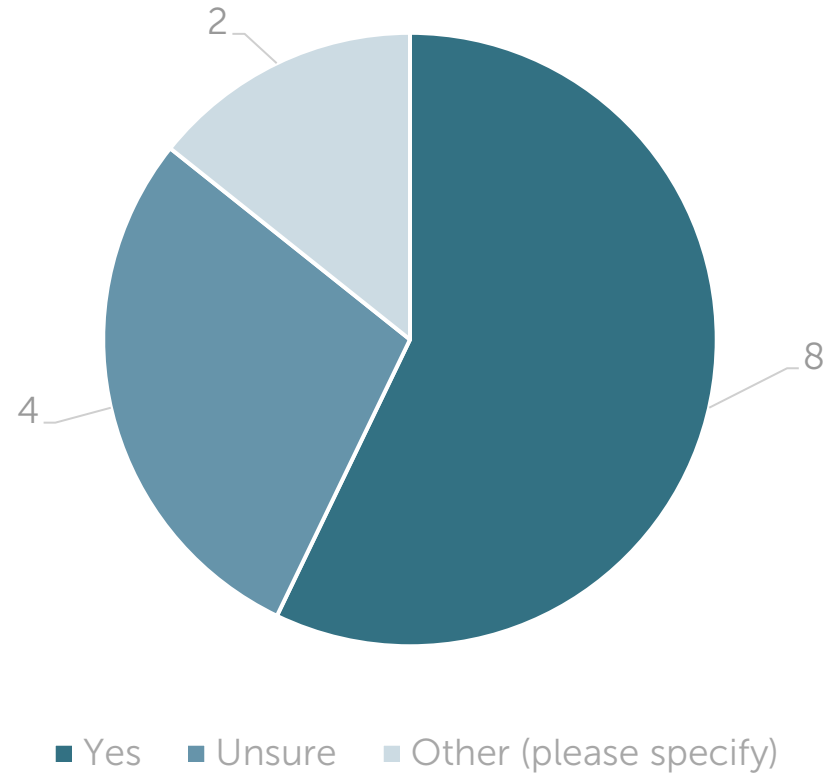
Describe other broadly recognized, transparent, and portable certifications the training program prepares participants to earn:

- Basic Life Saving/CPR
- First Aid/ CPR/ AED
- CPR & Basic First Aid
- CPR/AED/First Aid
- Forklift/ hydraulic lift training
- NCCER Core Curriculum
- Unit I - Think Like Air, Think Like Water is part of a 4 phase private certification program of SEON for carpenters - easily modified for weatherization technicians
- Vermont Oil Installer Certification Vermont Propane Installer Certification Vermont Natural Gas Installer Certification Vermont Specialty Plumbing License Vermont Specialty Electrician License National Propane Gas Association (NPGA) Certified Education Training Program (CETP) Certification National Oilheat Research Alliance (NORA)- Bronze, Silver & Gold Certification Vermont Certified Tank Inspector Certification

Describe any training program fees or participant stipends:

- Unit I and II cost \$475. Each unit lasts for 4 hours.
- Tuition is \$2500, covered by VWW or VSAC. Stipend of \$1000 is paid to each participant who does the optional onsite work experience.
- Fees vary from \$20 to \$6000 depending on certification and training program.
- Skills/USA offered to enhance leadership skills
- Public tuition dollars
- N/A
- TBD

Do you currently, or are you willing to, partner with other organizations in delivering the training program?



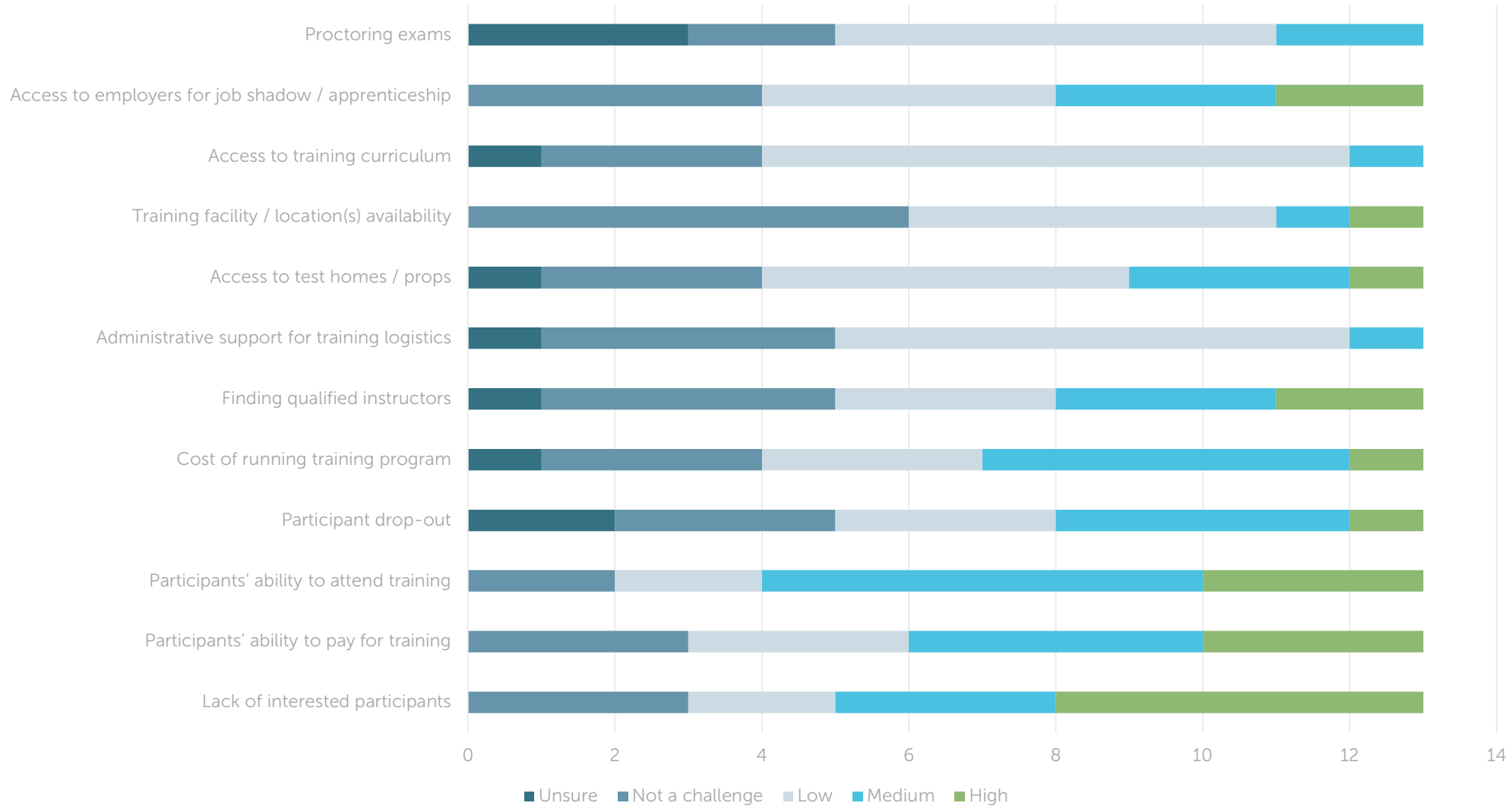
Other specification responses:

- We would be open to the conversation
- We do partner with tech centers and equipment supply facilities as well as heating service businesses.

Provide any additional, critical information about the training program:

- Would like to see it relate to local jobs and pay increases
- Unit I is part of an 8 hour program that includes Unit II The Big Picture: Integration of the Whole House System
- It is for women and gender non-conforming individuals only, ages 16 and up.
- This is a tech program for students in 11th and 12th grades
- We are a Building Trades program that renovates old homes and do complete building weatherizations
- WRCC Adult Ed SEON Brattleboro
- We deliver training that allows individuals to obtain the licenses and certification required by the state of Vermont to work on heating equipment.
- First year students earns NCCER "Core", OSHA 10 and Basic Life Saving Industry Recognized Certifications. Second Year students earn NCCER Carpentry Level 1 cert.

To what degree do you experience the following challenges when training weatherization workers?



What other challenges do you experience as a weatherization worker trainer?

- 1. Recruiting qualified candidates; 2. Experienced crew leaders to reinforce the learning, 3. Program consistency across the state, 4. Moving beyond traditional interior weatherization approaches to whole house building performance issues.
- Haven't trained for this specifically
- Our current project had problems with the NH Saves Program. Our current project in NH
- equipment availability
- I don't do a lot of this type of curriculum.

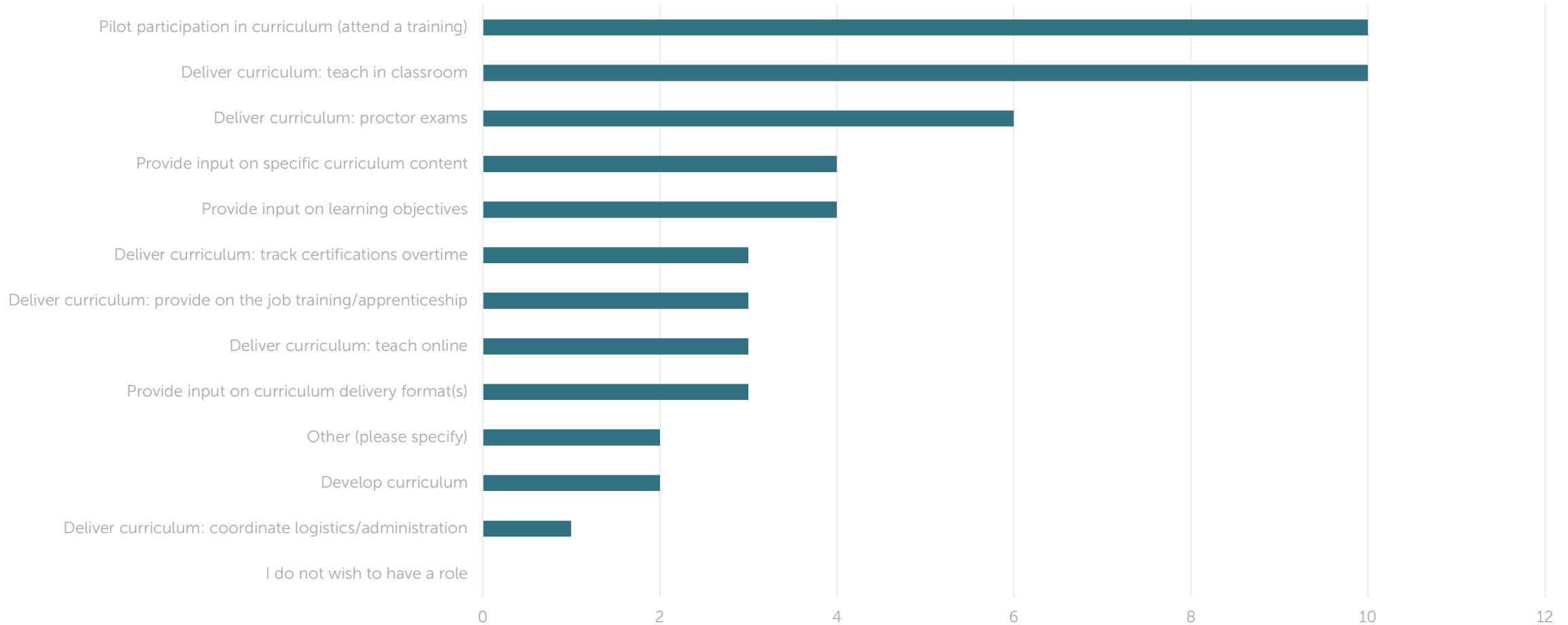
Is there anything else you'd like to share regarding training weatherization workers?

- The job wages are low

Provide your additional thoughts on with weatherization-related workforce constraints in Vermont. You do not need to repeat information collected elsewhere in this survey.

- I think the students need to see a link to good paying jobs and that the certifications are relevant
- It's not a glamorous job so their needs to be some incentives I believe.

What role do you desire to have in the identification and development of a standardized statewide building sciences curriculum that includes weatherization, and establishes a career pathway in energy efficiency construction?



Other specification responses:

- Given that we are under a time crunch every year in constructing a student built house, I'm unsure of the time I will have available to be involved at this time.
- Please keep me informed on the ways that input is needed. I will try to help as schedule/ life permits. Thank you

Workforce Development Needs

Efficiency
Vermont



Workforce Development Needs

Employees and all others interested

- 5 respondents completed full survey
 - Avg. time 16 min
 - Organizations represented:
 - NeighborWorks of Western VT
 - Preservation Trust of Vermont
 - SOV Division for Historic Preservation
 - Vermont Gas Systems
 - Vermont Homebuilders and Remodelers Association
- 2 incomplete responses
 - Avg. time 32 seconds
 - Organizations represented:
 - Bellwether Craftsman
 - Weatherization and Renovation of Montpelier

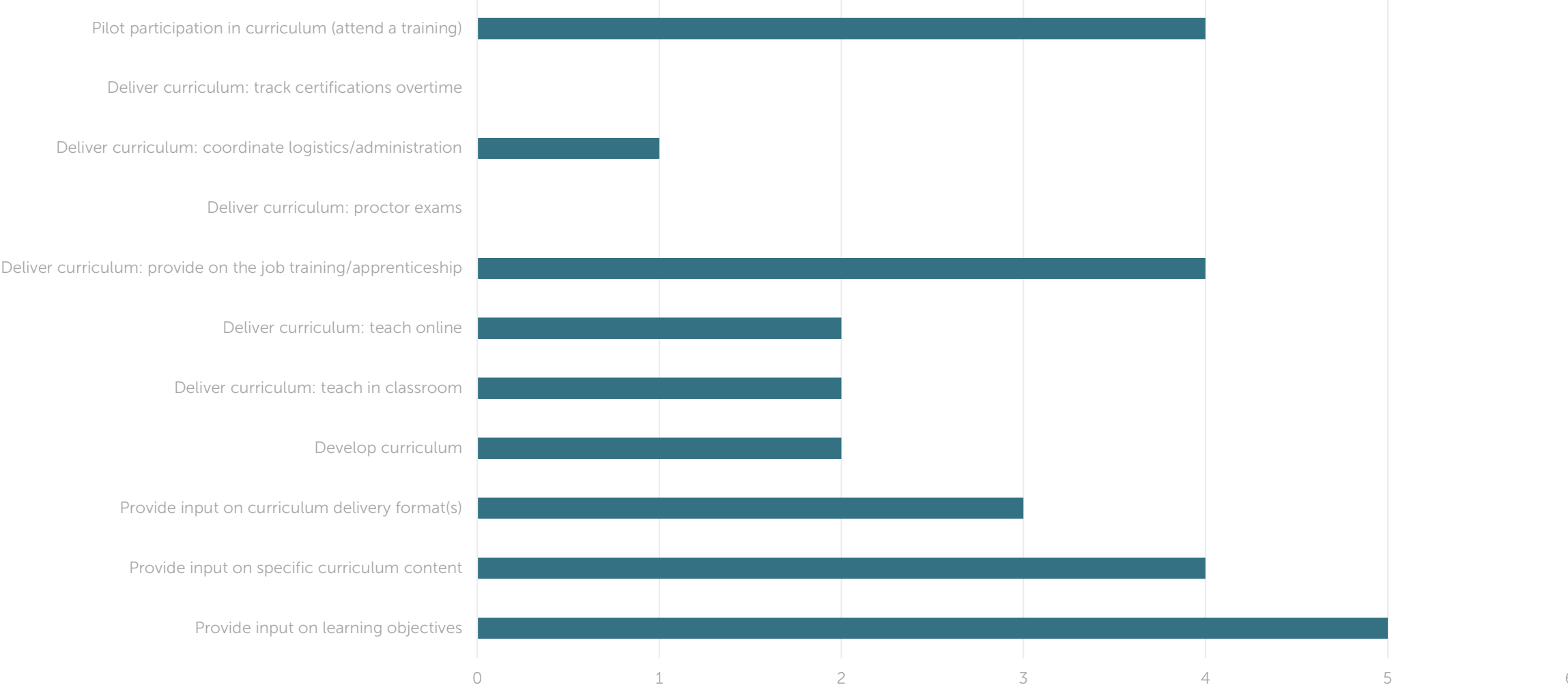
What is your role in weatherization workforce development in Vermont? (select all that apply)

- Weatherization employer
- Trainer/educator
- Energy Auditing, Project Coordination
- Builder and Remodeler Association
- Preservation Contractor and Consultant
- provide guidance and regulation when weatherizing historic buildings

Provide your thoughts on weatherization-related workforce constraints in Vermont. You do not need to repeat information collected elsewhere in this survey.

- Identifying long term sources of work or channels for new contractors looking to enter the industry. Programs and prices paid for related work. Incentive structures that drive consumer demand curves, where are they currently and does the funding look robust into the future. This will determine factors that go into planning and vetting business models for new weatherization companies.
- Lack of sustained system to provide qualified workers.
- More training is needed to help contractors weatherize historic buildings.
- Lack of wholistic understanding of building science when altering one part of a building, or installing a new system. Lack of education related to historic buildings, alterations, character-defining features and inherent energy-efficient elements, and reality that there are options

What role do you desire to have in the identification and development of a standardized statewide building sciences curriculum that includes weatherization, and establishes a career pathway in energy efficiency construction?



Appendix B: Vermont Weatherization Worker Training & Certification Framework

Vermont Weatherization Worker Training & Certification Framework

September 2021

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Contents

Introduction	4
Defining Weatherization	4
Process.....	4
Curriculum & Certification Overview.....	5
Training & Certification Delivery & Maintenance.....	7
Careers from Weatherization.....	10
Vermont Weatherization Training & Certification Matrix	11
Soft Skills for Employees.....	16
Core Competencies.....	16
Learning Objectives	16
Carpentry Basics.....	18
Core Competencies.....	18
Learning Objectives	18
Building Science Basics.....	19
Core Competencies.....	19
Learning Objectives	19
Air Sealing & Insulation Installation	21
Core Competencies.....	21
Learning Objectives	21
Thermal Control Demonstration Checklist.....	25
Appendix A – Advanced Course Topics.....	31
Building Codes for Weatherization	31
Weatherization Installers & Technician Registered Apprenticeship / Energy Audits & Buildings Diagnostics	31
Historic Building Weatherization	34
Carpentry Applications.....	34
Managing Water in Buildings.....	34
Building & Product Certification, Standards & Codes	35
Healthy Buildings.....	35
Residential Energy Modeling Basics.....	35
Building Management Systems & Integrated Control Technologies (Smart Homes) Basics.....	36
Industrialized Weatherization.....	36

HVAC Design.....	36
HVAC Installation & Commissioning.....	37
HVAC Installation & Commissioning – Hydronics	37
Domestic Hot Water Systems	37
Building Science Applications	37
Crew Leader	38
Crew Leader & Manager Soft Skills.....	38
Running a Weatherization Business	39
Train the Trainer	39
Appendix B – Example Curriculum Alignment.....	41
Appendix C – Resources	45

Introduction

Vermont Act 74 of 2021, has called for a Weatherization Workforce Group (Group) led by Efficiency Vermont to

... develop plans for the coordinated delivery of a standardized statewide Building Sciences curriculum that includes weatherization. The curriculum shall be designed to establish a career pathway in energy efficiency construction and shall include a certification that is broadly recognized, transparent, and portable.

The Vermont Weatherization Worker Training & Certification Framework (Framework) outlines the statewide building-science based weatherization curriculum and certification program developed by the Group. The Framework offers a standardized career pathway for construction industry members with a weatherization focus and establishes consistency in Vermont building science and weatherization training curricula and certification. The Framework provides training programs seeking to prepare individuals for careers in the weatherization industry with guidelines for delivering training and certification that is valued and recognized by the industry.

The Framework is not intended to serve as a pre-requisite for construction industry employers seeking to hire workers. Workers are not required to have the certification outlined in the Framework to be employed by weatherization contracting companies. Certified workers may be more qualified for construction and weatherization-related jobs and may command a higher wage than uncertified workers.

For additional information on the Group members, processes, and outcomes, see the Weatherization Workforce Plan: Workgroup Report to the Vermont General Assembly on the Coordinated Delivery of a Standardized Statewide Building Sciences Curriculum.

DEFINING WEATHERIZATION

Standard weatherization practice uses a house-as-a-system approach and applies building science-based solutions to improve home health, occupant comfort, safety, indoor air quality, durability, moisture management, and resource preservation through electrical and thermal energy efficiency measures.

The Vermont Office of Economic Opportunity Weatherization Assistance Program (WAP) and independent contractors deliver weatherization services. WAP providers serve low-income households, whereas other contractors typically serve households that do not qualify for WAP assistance.

PROCESS

The Group utilized the following process in developing this curriculum and certification program:

1. Surveys of:
 - a. Weatherization and weatherization-related contracting companies, to identify entry level and senior-level skill needs for weatherization crew members
 - b. Construction-related training centers and trainers, to identify existing training available in the state

- c. Others interested in weatherization workforce development, to capture general feedback about weatherization crew member training
- 2. Drafting of relevant training topics, learning objectives, and core competencies, based on:
 - a. Survey responses
 - b. Existing material from the U.S. Department of Energy, Building Professionals Institute, and Vermont WAP, specific to training weatherization crew members
 - c. Subgroup examination and refinement of existing resources
 - d. Stakeholder feedback on draft materials from the Group and industry survey respondents who were interested in drafting the learning objectives
- 3. Design of curriculum and certification delivery and maintenance framework, based on:
 - a. Survey responses
 - b. Availability of training providers and certification programs applicable to weatherization industry in Vermont and nationally,
 - c. Subgroup drafting of a relevant delivery and maintenance framework
 - d. Stakeholder feedback on draft materials from the Group, weatherization and weatherization-related contracting companies, and industry survey respondents who were interested in drafting and delivering the training

CURRICULUM & CERTIFICATION OVERVIEW

The Group identified four areas of training for entry-level weatherization workers, along with advanced topics for career progression in weatherization. New entrants in the weatherization workforce may earn the Vermont Weatherization Installer certification by completing each of the curriculum requirements. Vermont could choose to add additional levels of certification commonly used in the construction trades such as Vermont Weatherization Apprentice, Vermont Weatherization Journeyman, and Vermont Weatherization Expert, further defining the weatherization career ladder as the industry matures and the market finds value in worker certification. Figure 1 describes the proposed weatherization career training progression.

Wx Installer	Wx Apprentice	Wx Journeyman	Res HVAC Contractor	Wx Expert
<ul style="list-style-type: none"> Soft skills for employees Carpentry basics Building science basics Air sealing & insulation installation 	<ul style="list-style-type: none"> Building codes for weatherization Weatherization installers & technician registered apprenticeship / energy audits & building diagnostics Historic building weatherization Carpentry applications Managing water in buildings Building & product certification, standards & codes 	<ul style="list-style-type: none"> Healthy buildings Residential energy modeling basics Building management systems & integrated control technologies (smart homes) basics Industrialized weatherization 	<ul style="list-style-type: none"> HVAC design HVAC installation & commissioning HVAC installation & commissioning – hydronics Domestic hot water systems 	<ul style="list-style-type: none"> Building science applications Crew leader Crew leader & manager soft skills Running a weatherization business Train the trainer

Figure 1: Proposed weatherization career training progression, from Vermont Weatherization Installer to Expert, with required topics to be completed to gain certification for each level, to the extent that Vermont chooses to follow this progression.

The Vermont Weatherization Training & Certification Matrix below captures worker skill / experience level, approximate learning times, documentation of worker proficiency and minimum certification, alternatively accepted certification, and high-level core competencies for each training.

Complete core competencies and learning objectives are provided following the matrix for the four entry-level topics that make-up the Vermont Weatherization Installer certification:

1. Soft Skills for Employees
2. Carpentry Basics
3. Building Science Basics
4. Air Sealing & Insulation Installation

Learning objectives for the Vermont Weatherization Apprentice, Vermont Weatherization Journeyman, and Vermont Weatherization Expert are captured in Appendix A – Advanced Course Topics.

The Framework recognizes training programs differ based on participant backgrounds, prior experiences, and needs, and based on trainer training styles and methods of training delivery. The Framework enables flexibility in training program design and delivery to support course offerings that best meet the needs of Vermont training programs, participants, and employers.

An emphasis on learning objectives in the Framework allows training programs to be flexible in how they design and deliver content appropriate for their own target audiences—while meeting weatherization industry needs for worker knowledge and skills. For example, Building Science Basics taught to high school students will have a different structure and duration from what might be taught to industry-experienced adult learners; nevertheless, the learning objectives must be the same. Likewise, employed and highly functional professionals require fewer soft-skills training and mentorship than workers who are

under-employed, new to the workforce, new to the State, or otherwise struggling with employment. However, both categories of worker must be able to deliver the same level of professionalism when working on a team.

The Framework complements and does not replace Vermont's WAP and Home Performance with ENERGY STAR program training and certification protocols. Training programs can adopt the curriculum to meet existing Programs of Study, accelerating workforce development in existing high school and adult education courses. An example of aligning the curriculum to an existing training program is provided in Appendix B – Example Curriculum Alignment.

Programs might offer classroom, online, hands-on, and on-the-job delivery methods, depending on the specific content being taught and the target audience. Understanding the value of hands-on application for adult learners, the curriculum emphasizes apprenticeship-style learning. Additionally, the certification pathways recognize and give credit towards prior construction experience.

The backbone of the Framework to ensure high quality, while allowing for expansive flexibility and future refinement as the industry matures, is an Agency of State or its appointed designee to serve as administrator.

TRAINING & CERTIFICATION DELIVERY & MAINTENANCE

The Framework establishes two directories for registering and tracking training programs and individuals: the **Vermont Weatherization & Building Science Training Program Directory** and the **Vermont Weatherization and Building Science Professionals Workforce Directory**. Minimal by design, the directories avoid placing undue burden on training programs and individuals while providing the necessary oversight to ensure consistency and proficiency in learning objectives for Vermont weatherization professional certification.

An Agency of State or its appointed designee will serve as administrator(s) responsible for establishing and maintaining these directories.

Training Program Directory

The Training Program Directory will support individuals and employers in identifying training opportunities, and in verifying training program eligibility for meeting certification-specific criteria. It will also integrate with the state's existing training directories, as appropriate, to provide a centralized and up-to-date calendar of training opportunities in the state. Once approved by the administrator, training programs may use the term "Vermont Weatherization & Building Science Training" and will be listed in the online Training Program Directory.

The administrator(s) will be responsible for supporting training programs in developing applications for demonstrating compliance with the Framework, and reviewing applications and verifying compliance, including verifying trainer and inspector qualifications. Given the flexibility in compliance pathways, the administrator will need to have a solid foundation in the scope of local and national certifications, familiarity with local training providers, knowledge of youth and adult learning styles and best-practice teaching methods, and a deep understanding of the learning objectives in the curriculum. The administrator must be competent in identifying the least-burdensome pathways for training programs to register, provide program updates, and provide training event dates.

Training program registration

Training organizations and employers offering courses or on-the-job training meeting the topics in the Vermont Weatherization Training & Certification Matrix will register with the administrator by providing:

1. Organization name
2. Training name
3. Trainer and Inspector name(s) (see Trainer and inspector below)
4. Confirmation course / on-the-job training delivers core competencies and learning objectives as outlined in the Vermont Weatherization Worker Curriculum
5. Course participant certification information including specific certificate(s) or certification(s) obtained and method for verifying student knowledge/completion

Training program maintenance

Training organizations and employers must update curriculum every five years, or as needed based on industry advancements, and submit an affidavit of curriculum update to administrator. Training programs that fail to meet the maintenance requirement every five years will be moved into an archive directory enabling employers to verify eligibility of expired training programs listed on applicant resumes.

Workforce Directory

The Workforce Directory will support training programs in identifying qualified trainers and inspectors, and stakeholders in tracking workforce capacity in the state. It will also integrate with the state's existing contractor directories, as appropriate. At a minimum, these would be the Efficiency Excellence Network list and the proposed Vermont contractor registry. It is not intended to be a consumer-facing tool for finding contractors for hire.

The administrator will be responsible for registering and tracking weatherization workers throughout the state. In addition to the skills already listed, this will require dedicated and ongoing outreach to ensure individuals are registering, and to ensure continuing education is made available to these individuals and reported annually.

This Framework provides an outline for operation. The administrator(s) will be responsible for filling in the many details to launch and run the program. They will also be responsible for its effectiveness to all stakeholders, so that it can add value to the industry and expand with industry maturation.

Trainer and inspector registration

Trainers are individuals approved to deliver training programs in the Vermont Weatherization & Building Science Training Program Directory. Inspectors are individuals approved to verify quality of measure installation confirming participant proficiency during training programs.

Individuals will register as a member of the Vermont Weatherization & Building Science Professionals Workforce with the administrator by providing:

1. Name
2. Contact information

3. Confirmation trainer has the necessary experience, subject matter expertise, and skills to deliver training and verify participant knowledge and skills
4. Confirmation inspector has the necessary experience, subject matter expertise, and skills to inspect and verify quality of measure installation and identify additional training needed for participant to gain proficiency in specified task (see Crew Leader as an example)

Registration can occur directly by the individual to the administrator, or by employers or training organizations reporting employees and contracted trainers / inspectors. Any ongoing education needed for trainers and inspectors shall be completed and reported, as necessary, as part of the training program maintenance process for any training programs the trainer / inspector delivers.

Once registered, trainers may use the term **Vermont Weatherization Trainer**, and inspectors may use the term **Vermont Weatherization Inspector**.

Weatherization worker registration and certification

The following certification process is for the entry-level Vermont Weatherization Installer. The process can be expanded in the future to include Vermont Weatherization Apprentice, Vermont Weatherization Journeyman, and Vermont Weatherization Expert.

Individuals will register as a member of the Vermont Weatherization & Building Science Professionals Workforce with the administrator by providing:

1. Name
2. Contact information

Registration can occur directly by the individual to the administrator, or by employers or training organizations reporting employees and training participants.

As certificates for participating in training, demonstration of competence in the field, and demonstrating individual proficiency are obtained, individuals, employers, and/or trainers will submit those certificates to the administrator along with any certification expiration date or other applicable criteria. The administrator will review submitted documentation and update the Workforce Directory with training completion and certification information.

Annually, Vermont Weatherization Installers will complete 8-hours of continuing education units (CEU). Documentation verifying CEU completion and relevancy of CEUs to weatherization work and building science will be submitted to the administrator. The administrator will review submitted documentation and update the Workforce Directory with a new certification expiration date.

Once registered, individuals may use the term **Vermont Weatherization Installer in Training**. After completing the four entry-level courses: Carpentry Basics, Building Science Basics, Air Sealing and Insulation Installation Basics, and Soft Skills for Employees, the registered individual may use the term **Vermont Weatherization Installer** as long as the individual is up to date on completing and reporting the 8-hours of annual CEUs.

Continuing education

All courses approved by industry associations count for continuing education. Additionally, industry-relevant courses offered by accredited schools count for continuing education.

Industry associations include:

- American Institute of Architects (AIA)
- Air Conditioning Contractors of America (ACCA)
- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
- Building Performance Institute (BPI)
- Efficiency Vermont Efficiency Excellence Network (EEN)
- Green Building Certification Institute (GBCI)
- National Home Builders Association (NAHB)
- North American Passive House Network (NAPHN)
- North American Technician Excellence (NATE)
- National Center for Construction Education and Research (NCCER)
- Passive House Institute

CAREERS FROM WEATHERIZATION

Many careers stem from a Vermont Weatherization Installer position. Figure 2 demonstrates the magnitude of careers available after building a solid foundation in weatherization installation. Additional career ideas may be found in the [Green Buildings Career Map](#).¹

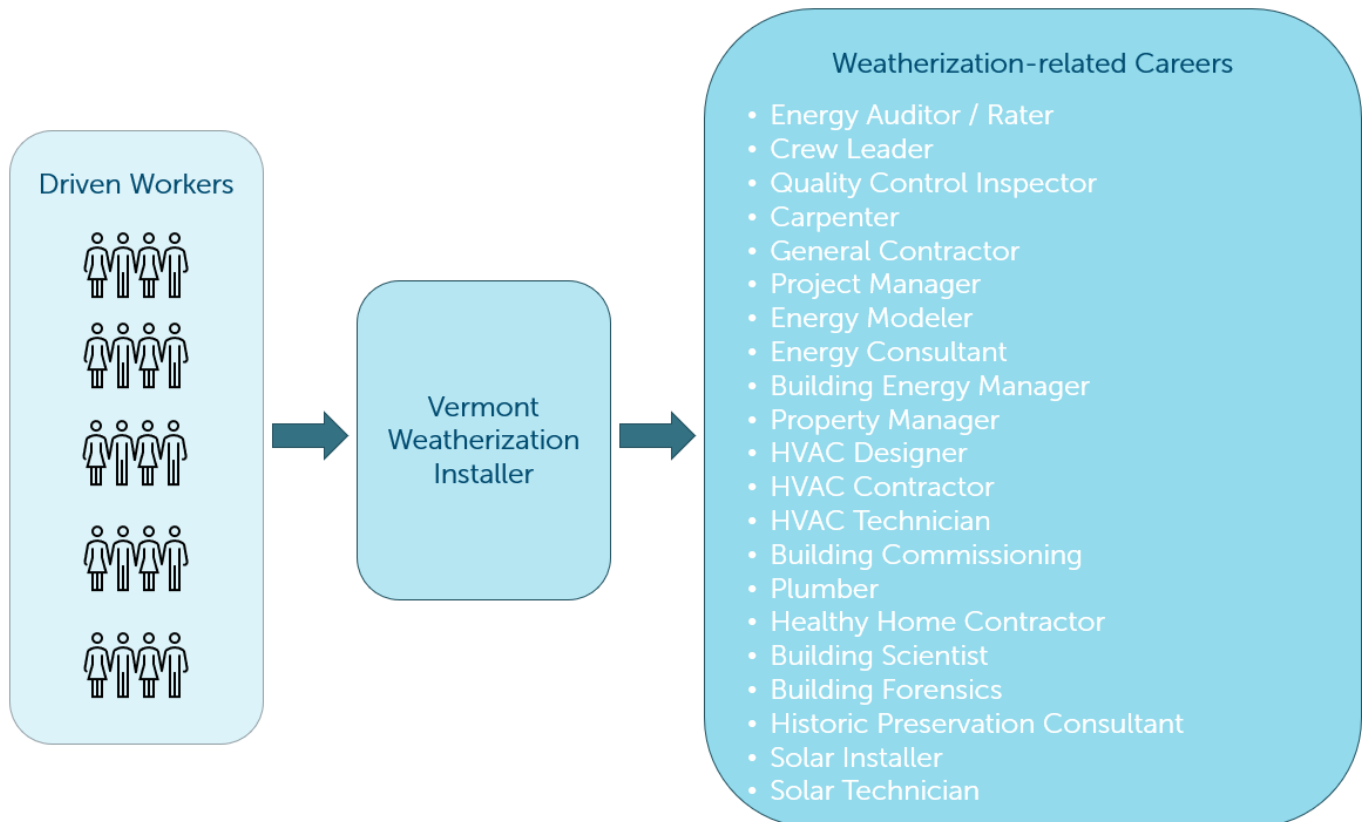


Figure 2: Careers commonly stemming from a foundation in weatherization installation

¹ <https://greenbuildingscareemap.org/>

Vermont Weatherization Training & Certification Matrix

Skill Level	Training & Certification Name	Intended Audience & Prerequisites (where applicable)	Training Duration & Type (estimates) ²	Minimum Certification upon Completion	Alternate Certification deemed Equivalent or Greater	High-level Core Competencies (see full list in course description)
Basic / entry level (Vermont Weatherization Installer)	Soft Skills for Employees	All trades	1-day classroom	VT Weatherization Soft Skills CoP		<ul style="list-style-type: none"> • Effective team membership • Personal drive and professionalism
	Carpentry Basics	All trades	12-days classroom	OSHA 10 NCCER Core First Aid / CPR / AED	SEON Carpentry Level I; ReSOURCE Construction 101 or Weatherization 101; VT Works for Women Trailblazers; Yestermorrow Residential Design & Construction Certificate; >1 yr construction experience + OSHA 10	<ul style="list-style-type: none"> • Construction terms & jobsite safety • Interpreting plans • Hand and power tools • Wood framing • Common weatherization plugs • Materials handling
	Building Science Basics	All trades Prerequisite: Carpentry Basics	2-day classroom	VT Building Science Basics Certificate of Participation (CoP)	BPI Building Science Principals Certificate or Building Analyst; SEON Certified Level 1 High Performance Builder; ReSOURCE Weatherization 101; Yestermorrow Building Science & Net Zero Design Certificate	<ul style="list-style-type: none"> • Building as-a-system • Movement of heat, air, and moisture in buildings • Common Vermont building failures and system solutions
	Air Sealing & Insulation Installation	Weatherization installers Prerequisite: Building Science Basics	3-days classroom & 500-hour on-the-job training, OR 6-week intensive hands-on classroom training	Lead RRP Certified Renovator; Thermal Control Demonstration Checklist	BPI Retrofit Installer; ReSOURCE Weatherization 101	<ul style="list-style-type: none"> • Application of building science principles related to the enclosure • Materials selection & installation • Jobsite safety • Building testing and forensics awareness

² Classroom training includes hands-on props and site visits; minimizing lecture-based instruction and maximizing hands-on experiential learning opportunities.

Skill Level	Training & Certification Name	Intended Audience & Prerequisites (where applicable)	Training Duration & Type (estimates) ²	Minimum Certification upon Completion	Alternate Certification deemed Equivalent or Greater	High-level Core Competencies (see full list in course description)
1-3 years' experience (Vermont Weatherization Apprentice)	Building Codes for Weatherization	All trades	1-day classroom	VT Building Codes for Weatherization CoP		<ul style="list-style-type: none"> • Energy and building codes for retrofit • RBES, ASHRAE 55 and 62.2 • Permitting & REScheck • Historic preservation
	Carpentry Basics Registered Apprenticeship / Energy Audits & Building Diagnostics	All trades Prerequisite: Building Science Basics & Building Codes for Weatherization	2,000-hour apprenticeship (hours earned in Air Sealing & Insulation Installation count here)	Registered Apprenticeship Program National Credential	BPI Building Analyst with >1 yr weatherization experience; ASHRAE BEAP	<ul style="list-style-type: none"> • House-as-a-system • CAZ testing, building diagnostics • Energy auditing • ASHRAE 62.2 • Radon mitigation • Project scoping
	Historic Building Weatherization	All trades Prerequisite: Air Sealing & Insulation Installation	1-week classroom	Historic Building Weatherization CoP	Historic Preservation degree or continuing education certification from accredited institution	<ul style="list-style-type: none"> • Historic building identification in VT • Materials & techniques for historic preservation during weatherization
	Carpentry Applications	Crew leaders Prerequisite: Carpentry Basics / NCCER Core	13-weeks classroom	NCCER Carpentry Levels 1-3	>3 years experience code-compliant home construction	<ul style="list-style-type: none"> • Residential construction from roof to foundation
	Managing Water in Buildings	All trades Prerequisite: Air Sealing & Insulation Installation	2-day classroom	VT Managing Water in Buildings CoP	SEON Water, Air, and Thermal Continuous Control Layers	<ul style="list-style-type: none"> • Water flow around, in, and through buildings • Hygrothermal analysis and intro to modeling
	Building & Product Certification, Standards & Codes	All trades Prerequisite: Dependent on specific certification / credential	Variable dependent on code, certification, or standard covered.	LEED Green Associate or AP with specialty, WELL AP, SITES AP, Urban Greenhouse Gas Inventory Specialist, HERS Rater or QAD, Passive House Consultant, Certified Green Professional	Dependent on specific certification / credential	<ul style="list-style-type: none"> • Meeting requirements and documenting compliance with green building and energy efficiency certification

Skill Level	Training & Certification Name	Intended Audience & Prerequisites (where applicable)	Training Duration & Type (estimates) ²	Minimum Certification upon Completion	Alternate Certification deemed Equivalent or Greater	High-level Core Competencies (see full list in course description)
4-6 years' experience (Vermont Weatherization Journeyman)	Healthy Buildings	Energy Auditors Prerequisite: Carpentry Basics Registered Apprenticeship / Energy Audits & Building Diagnostics	4-day classroom	VT Healthy Buildings CoP	Efficiency Excellence Network Healthy Home Contractor; BPI Healthy Home Evaluator	<ul style="list-style-type: none"> • Healthy home principals & audits • Healthy materials • Introduction to indoor air quality monitoring & analysis • Customer behaviors & communication
	Residential Energy Modeling Basics	Energy Auditors Prerequisite: Carpentry Basics Registered Apprenticeship / Energy Audits & Building Diagnostics	2-day classroom	Residential Energy Modeling Basics CoP	HERS Rater; Home Energy Score Certified Assessor™; ASHRAE BEMP	<ul style="list-style-type: none"> • Evaluate existing home performance and simulated impacts of energy upgrades through computer-based energy modeling
	Building Management Systems & Integrated Control Technologies (Smart Homes) Basics	All trades Prerequisite: Building Science Basics	5-day classroom	VT Smart Homes Basics CoP		<ul style="list-style-type: none"> • Smart home measure identification, installation & programming • Low voltage wiring • Network configuration & communications • Applicable codes & permitting • Flexible load management • Privacy & security
	Industrialized Weatherization	All trades	TBD	VT Industrialized Weatherization CoP		<ul style="list-style-type: none"> • Laser scanning & drawing fabrication • Prefab panelization for building shell retrofit • Modular mechanical systems

Skill Level	Training & Certification Name	Intended Audience & Prerequisites (where applicable)	Training Duration & Type (estimates) ²	Minimum Certification upon Completion	Alternate Certification deemed Equivalent or Greater	High-level Core Competencies (see full list in course description)
HVAC Focus (Vermont Residential HVAC Contractor)	HVAC Design	HVAC contractors Prerequisite: Building Science Basics	4-day classroom	VT HVAC Design CoP	ASHRAE CHD	<ul style="list-style-type: none"> • ACCA Manuals J, D, S, & T • ASHRAE 55 & 62.2 • Equipment sizing, selection, placement & distribution
	HVAC Installation & Commissioning	HVAC contractors Prerequisite: Building Science Basics & HVAC Design	5-day classroom	VT HVAC Installation & Commissioning CoP, EPA 608	ACCA QA RSI or New Homes; ASHRAE BCxP	<ul style="list-style-type: none"> • ACCA Manuals D, T, & B • Equipment installation, testing & balancing • System diagnostics / troubleshooting & clean & tune • Refrigeration management
	HVAC Installation & Commissioning – Hydronics	HVAC contractors Prerequisite: HVAC Installation & Commissioning	2-day classroom	VT HVAC Installation & Commissioning – Hydronics CoP		<ul style="list-style-type: none"> • Low and high-temp system components, pump sizing & piping • Controls & wiring • Steam piping & venting • Terminations
	Domestic Hot Water Systems	Plumbers & HVAC contractors	2-day classroom	VT Domestic Hot Water Systems CoP		<ul style="list-style-type: none"> • System selection • Distribution design • Heat recovery

Skill Level	Training & Certification Name	Intended Audience & Prerequisites (where applicable)	Training Duration & Type (estimates) ²	Minimum Certification upon Completion	Alternate Certification deemed Equivalent or Greater	High-level Core Competencies (see full list in course description)
Senior Level (Vermont Weatherization Expert)	Building Science Applications	All trades Prerequisite: Carpentry Basics Registered Apprenticeship / Energy Audits & Building Diagnostics	Topic dependent	Topic dependent CoP		<ul style="list-style-type: none"> • Building forensics • Advanced diagnostics • Advanced indoor air quality monitoring & analysis • WUFI modeling
	Crew Leader	Energy Auditors Prerequisite: Carpentry Basics Registered Apprenticeship / Energy Audits & Building Diagnostics	7,500 hours (hours earned in Carpentry Basics Registered Apprenticeship / Energy Audits & Building Diagnostics)	OSHA-30 BPI Crew Leader		<ul style="list-style-type: none"> • Ensure quality and supervise retrofits per the scope of work
	Crew Leader & Manager Soft Skills	All trades Prerequisite: Soft Skills for Employees	1-day classroom	VT Crew Leader & Manager Soft Skills CoP	HELM Lead Carpenter Training; SEON Crew Leadership Development	<ul style="list-style-type: none"> • Leadership and mentoring – styles and motivations • Leading through inquiry • Root cause analysis
	Running a Weatherization Business	All weatherization business administrators and owners	Topic dependent	Topic dependent; PMI PMP	HELM Construction Business Bootcamp	<ul style="list-style-type: none"> • Budgets and accounting • Insurance and liability • Marketing, sales, communication, and customer service • Business and project management software applications • Recruitment, hiring and human resources • Streamlining administration
	Train the Trainer	All trainers and crew leaders Prerequisite: Topic dependent subject matter expertise	Topic dependent	Topic dependent; BPI Proctor; NNCER Master Trainer, Craft Instructor, Safety Specialty Instructor/Technician, Master Craft/Technician Instructor		<ul style="list-style-type: none"> • Adult education concepts • Learning styles • Communication skills • Training strategies • Logistics and allowable activities • Certification & competency testing • Vermont training & certification programs & resources

Soft Skills for Employees

Soft skills training is preferably integrated into the other Vermont Weatherization Installer core courses to allow for direct demonstration of soft skills within the technical application of weatherization job tasks. Stand-alone soft skills training must provide weatherization job-specific case studies and scenarios for participants to experience deploying soft skills in common weatherization job situations.

CORE COMPETENCIES

1. Conflict resolution – managing and resolving disagreements in a constructive manner
2. Flexibility – readily modify, respond to, and integrate change with minimal personal resistance
3. Time management – prioritizing and completing tasks in order to deliver desired outcomes within allotted time frames
4. Following directions – effectively hearing, understanding, and following directions or instructions; postponing making personal decisions, or taking action, until one has openly listened to what one is being asked to do
5. Working under pressure – maintaining a level-head when dealing with constraints outside of one’s control
6. Decisiveness – quick response, fast action; making on-the-spot decisions with good judgement in critical situations; perceiving the impact and implications of decisions; meeting deadlines on time
7. Motivation – finding one’s own motivation for accomplishing a task, and the degree to which one maintains that course in the face of adversity
8. Communication – effectively sharing key and critical information in a timely fashion
9. Work ethic – making a personal commitment to executing specific tasks; punctuality, working productively with others, time management, understanding the importance of a professional work image and demonstrating integrity

LEARNING OBJECTIVES

1. Effective team membership
 - a) Demonstrate mediation techniques in resolving common jobsite conflicts
 - b) Identify alternative solutions to problems and selecting the best option
 - c) Identify the system component that is causing an error and options available for resolving the error and completing the task
 - d) Inspire and foster team commitment, spirit, pride and trust
 - e) Facilitate collaboration and motivation among team members to accomplish team goals
 - f) Articulate lessons from individual and collective mistakes and associated system improvements to prevent future failures
 - g) Organize and motivate people to get things accomplished in a way that everyone feels a sense of order and direction
2. Personal drive and professionalism
 - a) Adapt to unexpected workplace challenges while maintaining personal composure and meeting performance expectations

- b) Follow instructions meeting organizational standards
- c) Prioritize tasks to deliver desired outcomes within allotted time frames
- d) Clearly and professionally communicate and report challenges and deviations in project scope implementation
- e) Share key and critical information in a timely fashion
- f) Make on-the-spot decisions with good judgement in critical situations
- g) Find and employ self-motivation for accomplishing job tasks, particularly during challenging conditions
- h) Demonstrate integrity, punctuality, accountability, collaboration, time management, and a professional work image

Carpentry Basics

Carpentry Basics is designed for entry-level workers in all construction trades. The training program provides a high-level introduction to construction terminology, jobsite safety, tools, materials, and core building assemblies and construction techniques relevant to weatherization.

CORE COMPETENCIES

1. Common construction vocabulary and jobsite rules
2. Jobsite safety, proper use of PPE, and first aid
3. Reading construction drawings and blueprints
4. Construction math and measurements
5. The proper and safe use of hand and power tools
6. General wood framing – walls, floors, window frames, and doorframes
7. Remove and reinstall exterior cladding and trim, and exterior weather resistive assembly plugs
8. Remove and reinstall interior trim and drywall plugs
9. Materials handling and clean-up

LEARNING OBJECTIVES

1. Define common construction vocabulary
2. List common job site rules
3. Practice jobsite safety and deliver first aid / CPR
4. Read and interpret construction drawings and blueprints
5. Prepare jobsite for work
6. Calculate on-site take-offs and measurements for the purpose of identifying appropriate material quantities and material sizing
7. Select and properly use appropriate hand and power tools for common carpentry tasks associated with air sealing and insulation, such as:
 - a) Frame interior wall/partition; observe speed framing
 - b) Describe framing members for floors, window frames, and doorframes
 - c) Remove and reinstall exterior cladding and trim, and exterior weather resistive assembly plugs
 - d) Remove and reinstall interior trim and drywall plugs
 - e) Scribe materials for a tight joint
 - f) Connect materials using the appropriate mechanical fastener and/or adhesive
8. Properly handle and store materials and tools
9. Clean-up job site
10. Describe trades that will follow one's work and how one's finished product does or does not support the subsequent trades' work

Building Science Basics

Building Science Basics is designed for entry-level workers in all construction trades. The training provides a high-level introduction to buildings as systems and the movement of heat, air, and water through buildings.

CORE COMPETENCIES

1. Integration of the Whole-Building System
 - g) The simultaneous consideration of the impact construction details have on health and safety, indoor air quality, assembly durability and resource preservation, historic preservation of the building, energy use, and human comfort
2. Building Science Principles Related to the Enclosure
 - a) Heat transfer and the movement of heat by convection, conduction and radiation.
 - b) Moisture transport (liquid, vapor) and the movement of water. This topic also includes psychometric and phase change effects.
 - c) Convective air transport including the movement of air across building enclosures as a consequence of pressure differences.
 - d) Material selection related to indoor air quality effects of off-gassing, comfort effects related to thermal mass storage and the vulnerability of materials to damage due to moisture accumulation.
 - e) Control layers and the flow of heat, vapor, water air and solar gain through building components.
 - f) Indoor environmental quality including thermal comfort, air movement, moisture content, indoor pollutants and extraction.
3. Building Testing and Forensics Awareness
 - a) Initial exposure to diagnostic strategies used to discover the underlying causes of building system failures and implementing solutions to prevent future failures.
 - b) Common building failures in Vermont – causes and whole-house building science solutions. (e.g. ice damming and icicles, pipe bursts, window icing, CO poisoning, interior mold, elevated indoor radon, elevated CO₂, and indoor particulates)

LEARNING OBJECTIVES

1. Integration of the Whole-Building System
 - a) Define terms of building science
 - b) Examine the health, safety, and comfort issues in buildings
 - c) Define interconnections/inter-relationships among building systems
 - d) Identify historic features of buildings and understand how weatherization activities may impact those features
2. Building Science Principles Related to the Enclosure
 - a) Describe heat transfer and the movement of heat by convection, conduction and radiation.
 - b) Explain moisture transport (liquid, vapor) and the movement of water.

- c) Describe how heat, air, and moisture flows are linked and explain how to control air, heat and moisture flow in buildings
 - i. Explain the role of indoor relative humidity in building performance
 - d) Comprehend specific issues related to pressure- and temperature-induced flows
 - e) Grasp the significance of water flows and their roles in building details related to the drainage plane and other building elements
 - f) Recognize the need to manage relative humidity (condensation)
 - g) Understand the building air change rate and its relationship to above concepts
 - h) Show examples of buoyant forces and the tendency for warm air to move in a particular way
 - i) Recognize by source the pressures acting to move air in a building (air leakage forces)
 - j) Quantify amount of heat loss (or gain) (average) attributable to air leakage
 - k) Recognize psychometric chart and the cause of condensation
 - l) Define dew point and give an example of its occurrence and result
 - m) At a high level, differentiate between different materials based on their porosity and the impact it has on properties, such as wetting and drying, capillarity, etc.
3. Applying Building Science
- a) Compartmentalization
 - i. Identify sources of thermal by-pass (residential air leakage)
 - ii. Name appropriate control methods for thermal by-pass
 - iii. Discuss reasons why work and storage spaces should be isolated from living space
 - iv. Name methods to accomplish isolation
 - v. Generally, describe appropriate methods to seal penetrations (wires, pipes, ducts)
 - b) Describe roof and wall assembly materials and techniques essential to water management, air infiltration, the prevention of vapor intrusion and drying of interstitial spaces through proper implementation of weather-resistive barriers (WRB), vapor control membranes/layers, and rain screens
 - i. Explain what happens when insulation gets wet
 - c) Windows, Doors and Other Penetrations
 - i. Describe radiation effect, conduction and convection heat flows through windows and doors
 - ii. Discuss low E films, gas fills and low conduction spacers
 - iii. Discuss NFRC labels and explain U/R value, visual transmittance, solar heat gain, coefficient & condensation resistance
 - iv. Describe effective flashing details for wall and roof openings
4. Building Testing and Forensics Awareness
- a) Identify methods used in performance diagnostics
 - b) Observe the correct use of blower door, duct blaster, infrared camera, fog machine, and similar diagnostic tools
5. Putting it all Together: Experiential Learning in the Field / Office
- a) Integrate class lessons with field demonstrations
 - b) Identify most important factors affecting building comfort and safety

Air Sealing & Insulation Installation

Air Sealing & Insulation Installation is designed for entry-level workers in weatherization. The training provides in-depth instruction on air sealing and insulation installation. Participants demonstrate proficiency using hands-on props or on-site applications when completing the tasks listed on the Thermal Control Demonstration Checklist.

CORE COMPETENCIES

1. Application of Building Science Principles Related to the Enclosure
 - a) The simultaneous consideration of the impacts air sealing and insulation have on energy use, assembly durability, human comfort and indoor air quality.
 - b) Reducing unintentional heat transfer and the movement of heat by convection, conduction, and radiation.
 - c) Controlling moisture transport (liquid, vapor) and the movement of water; psychrometrics and phase change effects.
 - d) Reducing unintentional convective air transport including the movement of air across building enclosures as a consequence of pressure differences.
 - e) Control layers and the flow of heat, vapor, water air and solar gain through building components.
 - f) Identify historic features of a building and explain how a proposed scope of work may affect those features
2. Building Materials & Safety
 - a) Selecting, handling, installing, disposing of, and storing air sealing and insulation materials.
 - b) Personal protective equipment and job site safety for air sealing and insulation tasks.
3. Building Testing and Forensics Awareness
 - a) Diagnostic strategies used to discover the underlying causes of building system failures and implementing solutions to prevent future failures.
 - b) Common building enclosure failures in Vermont – causes and whole-house building science solutions.
 - c) Quality management as it relates to designing, specifying and verifying the performance of a building's enclosure (air barrier, moisture management and thermal barrier).

LEARNING OBJECTIVES

1. Application of Building Science Principles Related to the Enclosure
 - a) Describe how a building works as a system
 - b) Explain convection, conduction and radiation modes of heat transfer and solutions for reducing unintentional heat transfer in specific building assemblies.
 - c) Explain the flow of air, heat, liquid water and water vapor
 - d) Define and identify control layers and the flow of heat, vapor, water air and solar gain through building components.

- i. Distinguish between vapor control materials and weather barriers and their functions in buildings
 - ii. Explain the concept of drainage planes, gravity flow, roof penetration flashing, and how to keep the house dry
 - e) Identify sources of thermal by-pass (residential heat loss) and propose appropriate solutions for reducing thermal by-pass
 - f) Describe appropriate climatic treatments for flashing (waterproofing) window penetrations
 - g) Identify historic features and describe how proposed scope of work may impact those features
- 2. Building Materials and Safety
 - a) Demonstrate how to research and apply specific material ratings
 - b) Differentiate between different materials based on their porosity and the impact it has on properties, such as wetting and drying, capillarity, etc.
 - i. Define and be able to use:
 - 1. Vapor perm ratings
 - 2. Air perm ratings
 - 3. R-values/U-values – look at all materials, including glazing
 - ii. Explain what happens when insulation gets wet
 - iii. Explain the purpose of a vapor retarder and the reasons for where it is placed
 - c) Differentiate between individual material ratings and the performance of installed materials in the context of the completed assembly
 - i. Thermal by-pass
 - ii. Resistance as R-value
 - iii. Embodied vs operational carbon values
 - iv. Life span of materials
 - v. Health impacts of materials
 - vi. Regional availability and ecological impact
 - d) Demonstrate appropriate personal protective equipment (PPE) and job-site protection necessary for common air sealing and insulation activities and materials (i.e., spray polyurethane foam vs. dense pack cellulose)
 - i. List minimum requirements for lead-safe renovation and repair
 - ii. Demonstrate ability to identify and report unsafe job-site conditions for crew members and occupants
 - iii. Select appropriate tools and report missing or deficient tools
 - e) Demonstrate reduction of uncontrolled air movement and heat loss by creating continuous durable air pressure and thermal boundaries in attics, side attics, crawl spaces and other accessible buffer zones by selecting, installing and connecting appropriate materials in a durable fashion as outlined in the Thermal Control Demonstration Checklist
 - i. Describe the effect of voids and imperfections in insulation, and common challenges in achieving continuous insulation in contact with an air barrier
 - ii. Demonstrate the installation details to manage rodents, and other pests through proper integrated pest management air sealing and insulation strategies

- iii. Describe general considerations specific to historic buildings with respect to their associated building materials and assemblies
 - iv. Practice waste reduction
3. Building Testing and Forensics
- a) Identify methods used in building performance diagnostics for testing and verifying isolation
 - b) Observe the correct use of blower door, duct blaster, and similar diagnostic tools to identify thermal bypasses and test installation performance
 - c) Complete a thermal bypass inspection using ENERGY STAR Thermal By-pass Checklist for foundation, above grade wall, attic, and cantilever assemblies

Thermal Control Demonstration List³

Training participants demonstrate each task on this list. In completing each task, participants must demonstrate selection and donning of appropriate personal protective equipment; jobsite prep, safety, and clean-up; and appropriate equipment and material selection, handling, and maintenance/disposal. Task completion is tracked by the Vermont Weatherization Inspector on the Thermal Control Demonstration Checklist.

1. Properly identify the thermal boundaries of the home.
2. Prep for insulation in unfinished attic. Insulation perimeter pull, air-seal penetrations, build attic hatch damming, install exhaust fan venting, install depth markers, flag electrical boxes, non-IC recessed light cover and clearance
3. Air seal chimney chase with flashing and high temp. silicone. Build insulation dam around chimney maintaining 3" of clearance on all sides.
4. Insulate & weatherstrip attic hatch.
5. Air seal interior and exterior top plates with 1" of 2-part spray foam.
6. Blow insulation in attic that passes inspection 1st time. (correct depth, level blow, within 5% of bag estimate)
7. Demonstrate understanding of knee-wall attic thermal boundaries. Prep attic for insulation/install flexible membrane and strapping; air seal areas where appropriate.
8. Insulate knee-wall slopes with dense packed cellulose.
9. Install ASHRAE bath fan and venting. Crew lead verify performance of installed fan flow.
10. Dense pack an overhead cavity. (flat roof, garage ceiling, cantilever, etc.)
11. Prep crawl for perimeter insulation. Remove existing insulation seal rim boxes and sill plate with 3" of 2-part foam or 2" Polyisocyanurate.
12. Install floor insulation. Mobile homes or unconditioned crawlspaces. This includes flexible membrane with strapping or drilling through existing sheathing.
13. Install vapor barrier. Cut properly sized and oriented vapor barrier. Properly overlap seams.
14. Perform duct sealing using mastic and tie-tons.
15. Build and install basement access door.
16. Dust control measure (Interior) Prep for wall insulation: Identify proper setting for insulation machine.

³ Adapted from Vermont Weatherization Assistance Program New Hire Training Program for Weatherization Field Technician
Vermont Weatherization Worker Training & Certification Framework

17. Set up for Lead Safe Practices.
18. Install wall insulation. Dense pack cavities properly without voids. Splice and fit batts around electrical and plumbing.
19. Patch drill holes using spackle or mud. Taper edges, ensure plugs are secure, minimal spackle thickness.
20. Drill and insulate the rim band between 1st and 2nd floors, using the bag and blow method.
21. Conduct exterior drill and blow on walls. Patch and seal holes replace siding if necessary.
22. Install door jamb and sweep.
23. Install dryer vent and hood.
24. Install storm windows.

THERMAL CONTROL DEMONSTRATION CHECKLIST⁴

Employee Name: _____ Supervisor Name: _____

Start date: _____ Completion date: _____

This training log tracks skills and knowledge advancement for a Vermont Weatherization Installer in Training during the first 3 months of employment, and/or during an intensive hands-on training program.

In completing each task, individuals must demonstrate:

- Selection and donning of appropriate personal protective equipment,
- Jobsite prep, safety, and clean-up, and
- Appropriate equipment and material selection, handling, and maintenance/disposal.

After each task is completed a Vermont Weatherization Inspector must inspect the work and indicate whether the Vermont Weatherization Installer in Training passed, or additional training is needed. The Vermont Weatherization Inspector must be pre-approved by the State administrator. Completion of this checklist constitutes completion of the Vermont Air Sealing and Insulation Installation training.

Submit completed checklist to the State administrator.

Attic

Task: Properly identify the thermal boundaries of the home.				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Prep for insulation in unfinished attic. Insulation perimeter pull, air-seal penetrations, build attic hatch damming, install exhaust fan venting, install depth markers, flag electrical boxes, non-IC recessed light cover and clearance				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

⁴ Adapted from Vermont Weatherization Assistance Program New Hire Training Program for Weatherization Field Technician
Vermont Weatherization Worker Training & Certification Framework

Task: Air seal chimney chase with flashing and high temp. silicone. Build insulation dam around chimney maintaining 3" of clearance on all sides.
Trained By:

Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Insulate & weatherstrip attic hatch.
Trained By:

Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Air seal interior and exterior top plates with 1" of 2-part spray foam.
Trained By:

Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Blow insulation in attic that passes inspection 1st time. (correct depth, level blow, within 5% of bag estimate)
Trained By:

Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Demonstrate understanding of knee-wall attic thermal boundaries. Prep attic for insulation/install flexible membrane and strapping; air seal areas where appropriate.
Trained By:

Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Insulate knee-wall slopes with dense packed cellulose.				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Install ASHRAE bath fan and venting. Crew lead verify performance of installed fan flow.				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Dense pack an overhead cavity. (flat roof, garage ceiling, cantilever, etc.)				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Basement / Crawlspace

Task: Prep crawl for perimeter insulation. Remove existing insulation seal rim boxes and sill plate with 3" of 2-part foam or 2" Polyisocyanurate.				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Install floor insulation. Mobile homes or unconditioned crawlspaces. This includes flexible membrane with strapping or drilling through existing sheathing.				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Install vapor barrier. Cut properly sized and oriented vapor barrier. Properly overlap seams.				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Perform duct sealing using mastic and tie-tons.				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Build and install basement access door.				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Walls

Task: Dust control measure (Interior) Prep for wall insulation: Identify proper setting for insulation machine.				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Set up for Lead Safe Practices.				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Install wall insulation. Dense pack cavities properly without voids. Splice and fit batts around electrical and plumbing.
Trained By:

Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Patch drill holes using spackle or mud. Taper edges, ensure plugs are secure, minimal spackle thickness.
Trained By:

Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Drill and insulate the rim band between 1st and 2nd floors, using the bag and blow method.
Trained By:

Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Conduct exterior drill and blow on walls. Patch and seal holes replace siding if necessary.
Trained By:

Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Other

Task: Install door jamb and sweep.
Trained By:

Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Install dryer vent and hood.				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Task: Install storm windows.				
Trained By:				
Job # / Name	Date	Inspector	Pass / Fail	Additional training needed (notes)

Appendix A – Advanced Course Topics

The following advanced training topics list provides example learning objectives requested by weatherization crew leaders and industry members. The course topics and sample learning objectives represent the types of advanced training valued by the market and are not comprehensive.

BUILDING CODES FOR WEATHERIZATION

- List the energy and building codes applicable retrofits in Vermont and the compliance process associated with these codes
- Describe RBES criteria required for various retrofit project measures
- Explain ASHRAE 55 and it's applicability to weatherization projects
- Perform ASHRAE 62.2 calculation and determine minimum whole-house ventilation level
 - List minimum ventilation requirements for bathrooms and kitchens, and when those are required to be met during retrofit projects
- Describe location-specific permitting requirements and explain when REScheck may be used in the process
- Determine when historic preservation provisions must be met and how to comply with those requirements
- Discuss local public policy; Impact of policy, regulation and enforcement
 - Review the process of policy development and change

WEATHERIZATION INSTALLERS & TECHNICIAN REGISTERED APPRENTICESHIP / ENERGY AUDITS & BUILDINGS DIAGNOSTICS

- Review the carbon impact of buildings (embodied and operational)
- Compare site and source energy
- Describe the characteristics of available fuel choices
- Examine the general context for building solutions (zero carbon green buildings with durability as the goal)
- Explain a basic overview of alternative energy
- Review cash flow to homeowners, i.e. ROI and decreased energy bills and maintenance costs
- Demonstrate ability to find, evaluate and synthesize knowledge regarding building performance and sustainability
- Define Business case – career opportunities and potential salaries and pathways
- Explain appropriate technology and systems and how to research them
- Describe how a building works as a system
- Define and identify the building thermal envelope and its components
- Explain the flow of air, heat, liquid water and water vapor
- Describe the importance of climate-specific design details
- Relate water run-off to site grading

- Discuss proper placement of vegetation, mulch, and other decorative land cover for the purposes of water management
 - Describe the effects of irrigation on the durability of the building
- Describe foundation construction techniques essential for the prevention of moisture and management of soil gas entry (radon)
- Relate foundation systems to overall building energy performance
- Prescribe appropriate air sealing and insulation materials and applications to improve thermal performance and comfort, while reducing negative carbon and health impacts
- Demonstrate material selection related to indoor air quality effects of off-gassing, comfort effects related to thermal mass storage, and the vulnerability of materials to damage due to moisture accumulation in specific assembly applications.
 - Describe methods for reducing spray polyurethane foam, and selecting lower-carbon and healthier material options while still ensuring effective air leakage control, moisture control, and thermal performance
- Describe in detail roof and wall assembly materials and techniques essential to water management, air infiltration, the prevention of vapor intrusion and drying of interstitial spaces, and the interactions of these materials based on material-specific properties (e.g., R-value, permeability)
- Relate indoor environmental quality issues to health
- Explain the role of indoor relative humidity in building performance and the conditions-based need for dehumidification/humidification
- Identify and describe mechanical equipment including heating, ventilation and air conditioning systems, as they relate to pressure drive and the movement of heat, air, and moisture in a building, and to occupant health
- Relate mechanical system design to architectural design
- Explain best practices for selection, installation and maintenance of mechanical equipment
- Describe efficiency standards and appliance ratings
- Explain the air conditioning
- Describe hot water systems
- Explain benefits and issues related to ducts for air distribution
- Describe operation, controls, and applications of cold climate heat pumps
- Describe the operation control and application of combustion appliances
- Explain the use of controls and monitoring and their impact on energy performance
- Identify performance of wood and pellet stoves and list common wood and pellet stove performance issues
- Calculate ventilation rates to meet ASHRAE 62.2
 - Describe how wind influences design location of intake and exhaust
 - Describe the use of spot ventilation to control moisture at its source
 - Describe the use of whole-house ventilation to control indoor pollutants
 - Describe types of ventilation systems and effective applications – exhaust, supply, balanced
- Explain the purpose function operation and maintenance of ventilation systems
- Describe the conditions that cause and effects the result from back draft issues

- Describe control and venting of combustion products and symptoms of failure
- Recognize a sealed combustion system and discuss IAQ effects
- Demonstrate foundation construction techniques essential for the prevention of moisture and management of soil gas entry (radon)
- Relate foundation systems to overall building energy performance
- Explain climate-specific use of alternative foundation insulation systems
- Describe radiation effect, conduction and convection heat flows through windows and doors
- Discuss low E films, gas fills and low conduction spacers
- Discuss NFRC labels and explain U- factor and R-value, visual transmittance, solar heat gain, coefficient & condensation resistance
- Describe the sequence of a gravity-layered flanged window installation
- Recall that there are two types of windows: windows that leak now, and windows that will leak
- Describe appropriate materials for flashing that are waterproof, durable, compatible, formable and their mechanical properties
- Analyze flashing requirements for drainage, continuity, end dams, drip effect and accommodate movement
- Describe where and how to flash wall assemblies, roof lines, top & bottom of doors and windows, penetrations, balconies, doors and decks
- Recognize that some water will get past the cladding, always install a weather barrier that drains
- Describe the importance of installing a weather barrier from the bottom of the building to the top, layered, shingle-fashion
- Identify appropriate methods to seal mechanical penetrations (e.g., wires, pipes, ducts, vents)
- Demonstrate ability to test duct work for air leakage
- Demonstrate ability to identify and report potentially unsafe mechanical, electrical, and plumbing conditions commonly encountered during air sealing and insulation improvements
- Identify combustion ventilation types and discuss IAQ effects of various ventilation configurations
- Perform combustion safety visual inspection and testing on all gas appliances
- Conduct worst case depressurization testing
- Demonstrate air leakage testing and identify contamination pathways
- Identify materials likely to contain asbestos, lead, and PCBs
 - Prescribe testing and remediation processes
- Recognize the ENERGY STAR label and interpret its information
- Describe home energy modeling and list products for disaggregating energy use for consumers
- Explain a “phantom” load and why it affects your utility bill
- Define watt, kWh, BTU (British thermal unit)
- Explain the three different electrical lighting types (compact fluorescent, incandescent, halogen, and LED) and their advantages and disadvantages
- Describe the application of PV & wind generated power to the building load
- Discuss the use of solar thermal systems for water and space heating
- Discuss future technologies such as fuel cells and plug-in hybrid cars
- Discuss the effects of new technologies on the material supply chain and waste stream

- Relate building performance to overall sustainability and resource preservation
- Discuss design intent vs. as-built performance
- Give Vermont-specific examples showing the importance of climate-appropriate design and construction detail
- Examine the roles and responsibilities of the building team
- Conduct energy audits – perform diagnostic and combustion safety testing, identify scopes of work
- Demonstrate effective customer interviewing, communication, and project sales

For additional information, see BPI Building Analyst, BPI Energy Auditor, and Weatherization Installers and Technicians registered apprenticeship.

HISTORIC BUILDING WEATHERIZATION

- Explain how to identify historic building types in Vermont and where to find out whether a building is listed as an historic resource by the Vermont Division for Historic Preservation and National Register of Historic Places (National Park Service)
- Describe the review and compliance process for eligible or listed historic resources
- Describe inherently efficient features of historic buildings and how to maintain, restore, or improve them
- Identify appropriate materials and techniques for maintaining historic features significant for preservation while improving building durability, reducing heat loss, controlling moisture, and increasing occupant comfort and health
- List common failures in historic building weatherization projects and describe appropriate solutions

CARPENTRY APPLICATIONS

For more information, see [NCCER Carpentry](#) Levels 1-3.

MANAGING WATER IN BUILDINGS

- Identify hydro-thermal regions
- Water flow around, in, and through buildings
 - Show capillary effect of wood, concrete and glass
 - Discuss moisture storage of building materials as time and temperature specific, especially in newly constructed buildings with respect to the moisture content in building materials
 - Design to ensure drying; dry-ability = durability; 4D's – deflection, drainage, drying and durability
- Describe the relationship between relative humidity and health, relative humidity and condensation (temperature) and relative and durability (again condensation) and how this affects the building occupants and the building materials
- Describe the interactions between HVAC systems and the enclosure
- Conduct hygrothermal analysis
- Collect and provide field inputs for WUFI modeling

See [Energy-Related Mold and Moisture: awareness and impacts for weatherization](#) for more information.

BUILDING & PRODUCT CERTIFICATION, STANDARDS & CODES

- Earn industry accreditations and professional certification such as HERS Rater or QAD, LEED Green Associate or AP with specialty, NAHB Certified Green Professional, Passive House Certified Builder, Passive House Certified Tradesperson, Passive House Consultant, SITES AP, Urban Greenhouse Gas Inventory Specialist, or WELL AP.

HEALTHY BUILDINGS

- List the 8 principles of a healthy home, and how to identify and remedy deficiencies in a home related to the 8 principles
- Conduct healthy home audits and develop scopes of work
- Identify materials for healthy home improvements and evaluate materials and products for toxicity
- Explain the most common types of indoor air quality monitoring methods and technologies, data collected, and how to analyze results
- Deliver effective customer communication regarding healthy home topics and coach customers on behavior changes to improve the healthfulness of their home

See [Energy-Related Mold and Moisture: awareness and impacts for weatherization](#) for more information.

RESIDENTIAL ENERGY MODELING BASICS

- Review energy modeling software options and rank the options based on project goals and software functionality
- Evaluate existing home performance and simulated impacts of energy upgrades through computer-based energy modeling
 - Apply heating and cooling degree day concept and summer and winter design conditions to construction details
 - Describe passive solar design techniques and indoor and outdoor shading
 - Describe common heat loads in today's homes (e.g., gaming systems, ancillary appliances, home servers)
- Run whole-building cost trade-off analysis simulations to optimize first cost of building/retrofit against future energy use, maintenance, and replacement costs
- Articulate the benefits and challenges of energy modeling, and how to avoid common pitfalls
- Describe on-site energy monitoring techniques and how to compare modeled energy use to actual energy use
- Review energy modeling reports and interpret results into actionable recommendations

BUILDING MANAGEMENT SYSTEMS & INTEGRATED CONTROL TECHNOLOGIES (SMART HOMES) BASICS

- Identify appropriate smart home measures to support customer needs
- Install and program smart home measures, connecting devices, configuring networks and confirming seamless communications between measures
- Describe applicable codes and permitting for measure installation
- Explore impact of peak loads on the utility system
- Explain flexible load management and identify how to connect to available incentive programs with distribution utilities
- Identify rate structure and potential effects on decision- making
- Describe common privacy and security concerns associated with smart home measures and how to evaluate smart home products for privacy and security protocols

INDUSTRIALIZED WEATHERIZATION

- Describe industrialized weatherization at scale, and the benefits of this approach
- Identify and map building typology for multifamily buildings 1 to 3 story and 4 to 7 story high, which were built in three specific periods, pre-1940, from 1940 to 1978, and from 1979 to 2006
- Laser scan buildings meeting typology requirements; process data and define building structural key elements
- Develop fabrication drawings
- Work with panel manufacturer to convert drawings into prefab panels
- Oversee field to factory communications and integration
- Provide customer effective customer communication and engagement
- Prepare site, identify and deploy appropriate equipment and tools, and install prefab panels
- Assemble and install modular integrated mechanical systems

HVAC DESIGN

- Describe and apply ACCA Manuals J, D, S, and T
 - Size, select, and design systems to meet ACCA and ASHRAE standards and deliver occupant comfort, health, and safety
 - Explain systematic relationships among conditioning source, distribution network, and (location and selection) and terminal units with building envelope.
- Explain ASHRAE 55 and evaluate HVAC system for meeting ASHRAE 55
- List ASHRAE 62.2 requirements and best practices
- Calculate ventilation rates and design systems to meet ASHRAE 62.2
 - Describe how wind influences design location of intake and exhaust
 - Describe the use of spot ventilation to control moisture at its source
 - Describe the use of whole-house ventilation to control indoor pollutants

HVAC INSTALLATION & COMMISSIONING

- Explain ACCA Manuals D, T, and B, and how to apply those standards in the field during equipment installation
- Explain the process of building commissioning
- Install equipment meeting HVAC design criteria, and ACCA Manuals D and T
- Given typical commissioning records, interpret system performance
- Test and balance systems in accordance with ACCA Manual B
- Perform system diagnostics / troubleshooting, and clean and tune equipment identifying necessary preventative and corrective maintenance recommendations
- Identify and use appropriate methods to seal mechanical penetrations (e.g., wires, pipes, ducts, vents)
- Demonstrate ability to seal and test duct work for air leakage
- Demonstrate ability to identify and report potentially unsafe mechanical, electrical, and plumbing conditions commonly encountered during air sealing and insulation improvements
- Describe the refrigeration cycle, and refrigerant states and pressures during the cycle
- Test refrigerant pressure and perform leak detection; identify, add, and remove appropriate refrigerant to meet equipment specific refrigerant volume in small appliance, high-pressure, and low-pressure equipment
- Describe the environmental impacts of refrigerant and government regulations
- Demonstrate refrigerant recovery on multiple systems
- Describe health and safety risks of HVAC installation and commissioning
 - Describe how wind influences design location of intake and exhaust
- Discuss design intent vs. as-built performance

HVAC INSTALLATION & COMMISSIONING – HYDRONICS

- Describe low and high-temp system components and considerations
- Determine pump sizing
- Design supply, return and steam piping, venting controls, and wiring for system
- Select appropriate terminals

DOMESTIC HOT WATER SYSTEMS

- Size, select and design system to meet occupant needs while minimizing heat and water loss
- Describe design alternatives and pros/cons of each
 - Explain the impacts of heat pump water heaters on surrounding spaces and options for ducting heat pump water heaters to other spaces

BUILDING SCIENCE APPLICATIONS

- Monitor the performance of a building and assessing the cause and effect of certain building behavior
- Conduct root cause analysis in buildings to identify complex heat, air, and moisture transfer leading to issues with building durability, health, comfort, and performance

- Predict effect of mass and phase change on building performance
- Discuss relationships among temperature, precipitation, and construction techniques
- Explain the relationship between solar geometry and building/window orientation
- Describe methods to control solar gain (shading) to occupants' benefit
- Describe how wind influences design location of intake and exhaust
- Describe methods to apply natural ventilation to occupants' benefit
- Perform advanced diagnostics and computer modeling to confirm root cause and create scopes of work
- Identify building details related to seismic conditions, hurricane-resistance, wind, fire, corrosion and other climate-specific factors that affect structural durability
- Calculate and compare embodied carbon impacts of various building assemblies
- List ways to make a difference in current world energy imbalances
- Discuss current research topics regarding high performance buildings
- Develop reports to effectively communicate findings and recommendations

CREW LEADER

Crew leaders are proficient in managing weatherization teams to efficiently deliver high quality measure installation following a scope of work. See [NREL Crew Leader Job Task Analysis](#) and [BPI Crew Leader certification scheme](#) and Crew Leader & Manager Soft Skills learning objectives below for more information.

CREW LEADER & MANAGER SOFT SKILLS

- Demonstrate effective leadership and mentoring
- Lead through inquiry
- Inspire and foster team commitment, spirit, pride, and trust; facilitate collaboration and motivate team members to accomplish team goals; contribute to team success; openly learn from individual and collective mistakes making system improvements to prevent future failures
- Understand the needs, interest, strengths, and weaknesses of others, and use this information for contributing to the growth and development of others
- Persuade others, build consensus through give and take; gain cooperation from others to obtain information and accomplish goals
- Identify alternative solutions to a problem and select the best option
- Perform root cause analysis; identify the system component that is causing the error, as well as options available for resolving it and completing the task and critical thinking
- Explain the need for communication & respect within the building team
- Describe the integrated building process and name specific responsibilities of each team member within that process
- Organize and motivate people to get things accomplished in a way that everyone feels a sense of order and direction

- Understand, use, and manage your own emotions in positive ways to relieve stress, communicate effectively, empathize with others, overcome challenges, and defuse conflict
- Manage a team based on organizational goals, budget considerations, and staffing needs
- Take action to address performance problems
- Foster an inclusive workplace where diversity and individual differences are valued and leveraged to achieve the vision and mission of the organization
- Deliver conflict management through encouraging creative tension and differences of opinion; anticipating and taking steps to prevent counter-productive confrontations; managing and resolving conflicts and disagreements in a constructive manner
- Develop the ability of others to perform and contribute to the organization by providing ongoing feedback and opportunities to learn through formal and informal methods
- Anticipate and meet the needs of internal and external customers; commit to continuous improvement
- Appropriately apply principles, procedures, requirements, regulations, and policies on jobs
- Hold self and others accountable for measurable high-quality, timely, and cost-effective results; determine objectives, set priorities, and delegate work; accept responsibility for mistakes; comply with control systems and rules
- Build customer rapport and deliver exceptional customer support

RUNNING A WEATHERIZATION BUSINESS

- Develop accurate budgets and record accounting in accordance with business best practices
- Identify, evaluate, and procure appropriate insurance
- Define liability considerations for common jobs/projects and list ways to mitigate risk
- Identify, acquire, and deliver competitive marketing, sales, communication, and customer service
- Find and use business and project management software applications
- Recruit, hire, and on-board new staff
- Deliver exceptional human resources
- Streamline administration through continuous improvement strategies
- Build, maintain, and leverage relationships for business success
- Sell weatherization
 - Identify and deliver customer value proposition
 - Be an active listener
 - Master conveying product knowledge in customer terminology
 - Track marketing and industry insights applicable to consumer engagement
 - Deliver communications across all channels
 - Provide exceptional customer service and support

TRAIN THE TRAINER

- Describe adult learning styles and effective adult training techniques
- Demonstrate engaging training skills and effective communication
- Explain various training strategies and methods for confirming participant engagement and learning

- Describe common training planning and implementation logistics
- Deliver allowable activities and discuss activities to avoid when training
- Articulate certification and competency testing processes
- Deliver Vermont training and certification programs and access available resources
- Demonstrate subject matter expertise and experience in training-specific topic area

Appendix B – Example Curriculum Alignment

The following outline aligns the Vermont Office of Economic Opportunity Weatherization Assistance Program (WAP) new-hire training program with the Vermont Weatherization Worker Training & Certification Framework for Vermont Weatherization Installer (the four entry-level training courses). The outline demonstrates the flexibility of the State curriculum to meet a specific training participant and employer target audience while maintaining consistency in learning objectives and participant proficiency upon training completion. The outline also provides documentation for registering with the Vermont Weatherization & Building Science Training Program Directory and the Vermont Weatherization & Building Science Professionals Workforce Directory as outlined in the Training & Certification Delivery & Maintenance.

Training organization name

Vermont Office of Economic Opportunity Weatherization Assistance Program and Vermont Adult Learning

Training program name

Vermont Weatherization Assistance Program New Hire Training

Target audience

New employees of Vermont Weatherization Assistance Partners. Employees have greater than one-year of construction experience, or otherwise have met the learning objectives of Carpentry Basics upon hire.

Trainers & Inspectors

Name	Qualifications	Role
Dave Keefe	35 years' experience in weatherization contracting and training.	Classroom and field trainer & inspector
Hyle Bates	BPI QCI	Field trainer & inspector
Gordon Brown	BPI QCI	Field trainer & inspector
Russell Champine II	BPI QCI	Field trainer & inspector
Fritz Fay	BPI QCI	Field trainer & inspector
Jeremy Francis	BPI BA, EA, QCI	Field trainer & inspector
Zachary Green	BPI QCI	Field trainer & inspector
Jeff Hall	BPI QCI	Field trainer & inspector
Scott Hall	BPI ENV, BA, QCI	Field trainer & inspector
Kevin Kurkul	BPI BA, EA, QCI	Field trainer & inspector
Daniel LaBarron	BPI QCI	Field trainer & inspector
Charles Patullo	BPI BA, EA, QCI	Field trainer & inspector
Travis Payette	BPI ENV, BA, QCI	Field trainer & inspector
Daniel Perambo	BPI QCI, HHE	Field trainer & inspector
David Smith	BPI QCI	Field trainer & inspector
Charles Toohey	BPI QCI	Field trainer & inspector
Geoff Wilcox	BPI QCI	Field trainer & inspector

Training components

The Vermont Weatherization Assistance Program New Hire Training delivers core competencies and learning objectives as outlined in the Vermont Weatherization Installer curriculum as follows:

1. Week-long introduction to weatherization (see Week-long Introduction to Weatherization Curriculum for outline) that covers:
 - a) Soft Skills for Employees applicable to the selected new hires; additional soft skills will be provided during on-the-job mentorship
 - b) Building Science Basics, except:
 - i. “Windows, Doors and Other Penetrations” under “Applying building science”
 - c) Air Sealing & Insulation Installation, except:
 - i. Thermal Control Demonstration Checklist which is met through the WAP New Hire Training Log / Passport
2. WAP New Hire Training Log / Passport
 - Covers the Thermal Control Demonstration Checklist and is delivered by the Vermont Weatherization Inspector (WAP Partner QCI) during the first three months of employment

Training certification

Upon completion of the Week-long Introduction to Weatherization course, participants will receive a certificate of course completion. Participants will be prepared to sit for the BPI Building Science Principals Certificate exam. Participants will have the opportunity to take the exam, but taking the exam is not required as part of the course.

After 6-months of employment, new-hires will have completed OSHA-10, First Aid / CPR / AED and Lead RRP Certified Renovator, and will be eligible to submit for Vermont Weatherization Installer certification through the State administrator.

Week-long Introduction to Weatherization Curriculum

Vermont Weatherization Trainer: Dave Keefe

Tentative, sequence subject to change:

Monday morning

Introductions, schedule for the week

Overview of Weatherization / Home Performance.

What we are trying to accomplish,

A brief history of the trade

What the work is like, what skills are required

How this work is different than most construction/building trades

A look at the current and planned activity in Vermont

Weatherization Assistance Program

Efficiency Vermont’s Home Performance program

What the job prospects look like

Intro to how heat, air and moisture move around in buildings

Monday afternoon

Site visit to Weatherization project in progress

Tuesday morning

Terminology, units of measure

What "efficiency" means

Household moisture

How water moves around in buildings

Moisture sources

Solving moisture problems

Indoor air quality

Basic overview

How weatherization can help (or hurt)

Mechanical ventilation

Why we do it

Types of ventilation equipment

How ventilation should be installed

Tuesday afternoon

Combustion

Fuel types

System types

Basics of venting systems

Description of combustion safety testing

Electrical efficiency

Terms, units of measure

Common electrical upgrades

Wednesday morning

Intro to air movement and air sealing

Why air tightness matters

Where buildings leak

Explanation and demo of blower door test

Discussion of common air sealing materials

Wednesday afternoon

Demo and practice with air sealing props

Thursday morning

Insulation

Basics of how insulation works

Common types of insulation, their characteristics and recommended uses
How insulation should be installed
Discussion of vapor barriers

Thursday afternoon

Demo and practice with insulation props

Friday morning

Site visit to weatherization job in progress

Friday afternoon

A look at BPI's Building Science Principles certification

Building Science Principles handbook

Coverage of topics outside of weatherization that might be on the exam

Review of items the group would like to review

Questions, wrap-up

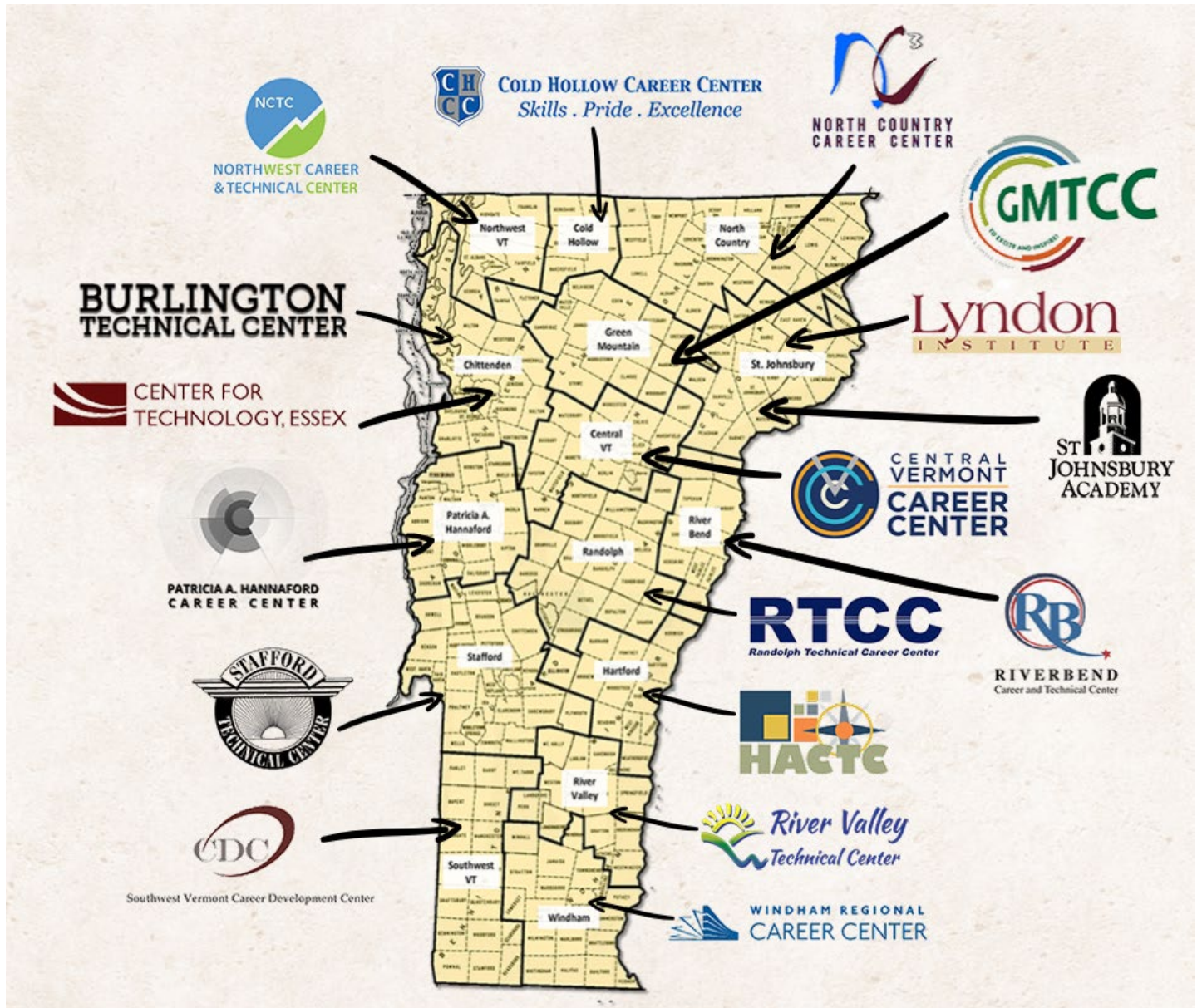
Appendix C – Resources

Vermont Training Centers

Many organizations provide weatherization-related adult training programs in Vermont, including:

Organization Name	Target Audiences	Locations
Career & Technical Education Centers (CTE)	High school students and adults	Burlington, Barre, Enosburg Falls, Essex Junction, Hyde Park, White River Junction, Lyndon Center, Newport, St. Albans, Middlebury, Randolph, Bradford, Springfield, St. Johnsbury, Rutland, Bennington, & Brattleboro
Community College of Vermont	High school and post-high school students	Bennington, Brattleboro, Middlebury, Montpelier, Morrisville, Newport, Rutland, Springfield, St. Albans, St. Johnsbury, Upper Valley, & Winooski
Efficiency Vermont	Adult workers	Training specific
ReSOURCE	Youth, adults seeking career readiness and entry-level skills	Chittenden, Lamoille, & Washington Counties
Sustainable Energy Outreach Network	Adult workers	Bennington, Chittenden, Orange, Windham, & Windsor Counties
Vermont Adult Education	Adults seeking high school diploma, English for Speakers of Other Languages, soft skills, and college and career readiness	Addison, Bennington, Caledonia, Chittenden, Essex/Orleans, Franklin/Grand Isle, Lamoille, Orange, Rutland, Washington, Windham, & Windsor Counties
Vermont Fuel Training Center	Adult workers	Chittenden, Orleans, Rutland, & Washington Counties
Vermont Technical College	High school and post-high school students	Randolph
Vermont Works for Women	Women and gender non-conforming adults	Chittenden and Rutland Counties
Weatherization Assistance Program Partners	Employed workers of Weatherization Partners	Central VT, Champlain Valley, Northeast VT, Southeast VT, Southwest VT
Yestermorrow Design / Build School	Adult DIYers and professionals	Washington County

Map of Vermont CTEs:⁵



Weatherization Training Resources

- [Vermont Weatherization Technical Policies & Procedures Manual](#)
- [Vermont Weatherization Insulation Blowing 101 Training Videos](#)
- [Building America Building Science Education Roadmap, Guidelines & Tools](#)
- [Department of Energy Guidelines for Home Energy Professionals](#)
- [NREL Job Task Analyses](#)
- [NREL Standard Work Specifications](#)
- [National Center for Construction Education & Research disciplines](#)

⁵ <http://www.vtcte.org/>

- [IREC Career Maps](#)
- [Energy-Related Mold and Moisture: Awareness and Impacts for Weatherization](#)
- [Texas Weatherization Training Video Archive](#) (note TX is a very different climate zone)
- [BPI Air Leakage Control Demonstration Checklist](#) (begins on pg. 6)

Certification & Credentialing

- [Building Performance Institute](#) - 13 certification options
- [LEED](#) - 29 accreditations, certificates & badges
- [National Association of Homebuilders](#) - 13 designations
- [National Association of Safety Professionals](#) - 24+ designations & certification options
- [NCCER](#) - 37 certification options
- [OSHA 10, 30](#)
- [PHIUS](#), [PHI](#), [NAPHN](#) Certified Designer, Consultant, Builder, Tradesperson, QA/QC
- [Project Management Institute](#) - 14 certification options
- [RESNET](#) Rater, RFI, QAD, QADD

U.S. Department of Labor & American Job Center Registered Apprenticeship Programs:

- [Insulation Installer](#)
- [Carpenter's Helper](#)
- [Carpenter](#)
- [Weatherization Installer / Energy Auditor](#)

Vermont Market Analysis

- [Vermont Clean Energy Industry Report, 2019](#)
- Weatherization Workforce Plan: Workgroup Report to the Vermont General Assembly on the Coordinated Delivery of a Standardized Statewide Building Sciences Curriculum