



Strategies and Approaches for Developing Hands-On Training for Cold Climate Heat Pumps

Allison Moe

National Renewable Energy Laboratory

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Office of Energy Efficiency & Renewable Energy
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List of Acronyms

ASHP	Air source heat pump
BBWA	Better Buildings Workforce Accelerator
BIL	Bipartisan Infrastructure Law
BLS	Bureau of Labor Statistics
BPI	Building Performance Institute
CB ECS	Commercial Buildings Energy Consumption Survey
CCHP	Cold climate heat pump
CPR	Cardiopulmonary resuscitation
CTE	Career and technical education
DEI	Diversity, equity, and inclusion
DOE	U.S. Department of Energy
EIA	U.S. Energy Information Administration
HVAC	Heating, ventilating, and air conditioning
HVAC/R	Heating, ventilating, air conditioning, and refrigeration
ICAST	International Center for Appropriate and Sustainable Technology
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NATE	North American Technician Excellence
NREL	National Renewable Energy Laboratory
NYSERDA	New York State Energy Research and Development Authority
OSHA	Occupational Safety and Health Administration
RECS	Residential Energy Consumption Survey
SFCC	Santa Fe Community College
WIOA	Workforce Innovation and Opportunity Act

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1 Introduction

The International Center for Appropriate and Sustainable Technology (ICAST) is in the process of implementing a program funded by the U.S. Department of Energy (DOE) in which they are providing cold climate heat pump (CCHP) curriculum and training for entry-level to experienced heating, ventilating, and air conditioning (HVAC) workers. They have coordinated with Santa Fe Community College (SFCC) to develop online curricula, and through their involvement with the DOE Better Buildings Workforce Accelerator, they requested technical assistance from the National Renewable Energy Laboratory (NREL) to help them develop programs that incorporate hands-on and on-the-job skills training¹ and job placement services in coordination with local employers.

This report offers a step-by step overview of the process for developing a new workforce development and hands-on training program in a new region, outlining practices to better understand the market and effectively recruit, train, and connect people to HVAC jobs installing cold climate heat pumps. The main process elements are outlined below, and they provide the structure for this report.

1. Regional Market Analysis
2. Program Development
3. Partner Engagement
4. Program Implementation
5. Program Evaluation.

Unless otherwise cited, all information offered in the report is based on the expertise and experience of NREL staff.

In addition to these more general steps, the final section of this report offers considerations specific to ICAST and its project goals. The appendices also include resources and instructions to assist with conducting the market analysis, case studies that illustrate successful training programs that have incorporated the above components, and additional resources. The case studies do not necessarily include HVAC or heat pump training programs, but are in related fields and may be useful for ICAST to review and potentially connect with program managers to understand their lessons learned and recommended approaches.

Finally, it is important to note that this report focuses on developing hands-on skills training and partnerships with employers. Educational curriculum is a key component of the overall training package; however, this has already been developed by ICAST in coordination with SFCC. This report makes reference to the curricula, to ensure that any hands-on training is clearly aligned

¹ For the purposes of this report, hands-on training refers to specific skills training that is incorporated into a formalized training program. It can take place in a controlled or simulated environment such as a classroom, lab, or warehouse space, or it can be on “real world” projects depending on how a training program is structured. On-the-job training refers to education and skills training that happens as part of employment. It can refer to participation in a paid training program that includes placement with an employer (such as an internship or apprenticeship), or it can refer to the learning that takes place during the normal course of employment.

with the online education. However, it is not intended to address curricula design or development.

1.1 Foundations of a Successful Training Program

Most of this report focuses on specific steps for developing a CCHP training program; however, there are some foundational concepts that can help ensure success for both trainees and employers. These concepts are described below and have been woven into all sections of this report.

Keep the focus on your audience

At every step in the process for researching, developing, implementing, and evaluating a training program for heat pump technology, it is essential to keep the audience in mind. The audience here refers to the people participating in the training. When making decisions along the way, you should always be guided by the question: *how/why will this support my trainees' employment goals?*

Know your product/service

Just as every decision must be centered on the audience, it is important from the start to understand the specific product or service you intend to deliver. It can be tempting to keep things broad and flexible, especially at the beginning of a process. While it is helpful to stay open to what might improve your program for specific communities, having clear goals from the start will help you make informed and consistent decisions about approaches, partners, and realistic expectations for outcomes.

It is important to note that a healthy process will be iterative, incorporating regular program evaluation and revisions. Knowing your product does not imply that the product cannot evolve; it means that at each step along the way, you should craft your approach based on what you intend to provide. Have a system in place ahead of time for how often you will review, revisit, and make adjustments so that things are not constantly in flux. When you make changes, fully incorporate them into your message and approach moving forward.

Have a central program lead

Although partnerships are core to successful workforce development programs as described in the following sections, there must be a central organization—and when possible, one individual—that is the lead and point of contact for the trainees and all partners. To help ensure clarity and consistency in outreach and advertisement, make sure you clearly identify and communicate each of the following:

- Program name(s)
- Program sponsor (the lead offering the program)
- One-stop shop web presence (even if partners and partners' websites are involved, for example in providing online curricula, there needs to be one central place the potential trainees, program participants, and program graduates can go to get information including:
 - Program overview (flyer)
 - Application

- Whom to contact
 - Job board (if applicable)
- Physical location/phone number with a person (related to the contact item above, it needs to be clear whom people can reach out to with questions. This could be a generic email [e.g., hptraining@xyz.org] that is directed to multiple people)
- Central location from which as much of the program is conducted as possible (application drop-off, classroom/lab training, Occupational Safety and Health Administration [OSHA] training, employer engagement)
 - Consider accessibility issues such as parking and public transit options.

Make time to build relationships

No matter how well you as a lead plan a program, it is your partners that will help ensure success in implementation and outcomes. We discuss partner identification and engagement in steps 1 and 3, but at every stage, you must make time to develop honest and meaningful connections with partners (community partners and employers) as well as trainees. For partners, building trust is necessary for them to commit time and resources to this effort. For trainees, knowing that the people behind this program are dedicated to their individual education and employment goals makes it more likely that they will complete the program (Ross et al. 2020). Although this can take time, it is a necessary investment for a successful program.

Be conscious of diversity, equity, and inclusion (DEI)

This final item is related to the one above, in the sense that a successful program must support its participants as individuals and meet them where they are. Although data are not available on the demographic DEI metrics of the HVAC workforce specifically, the Bureau of Labor Statistics offers a snapshot of construction laborers and supervisors. As shown in the figure below, the construction industry is considerably less diverse than the U.S. workforce as a whole in terms of race, ethnicity, and gender.

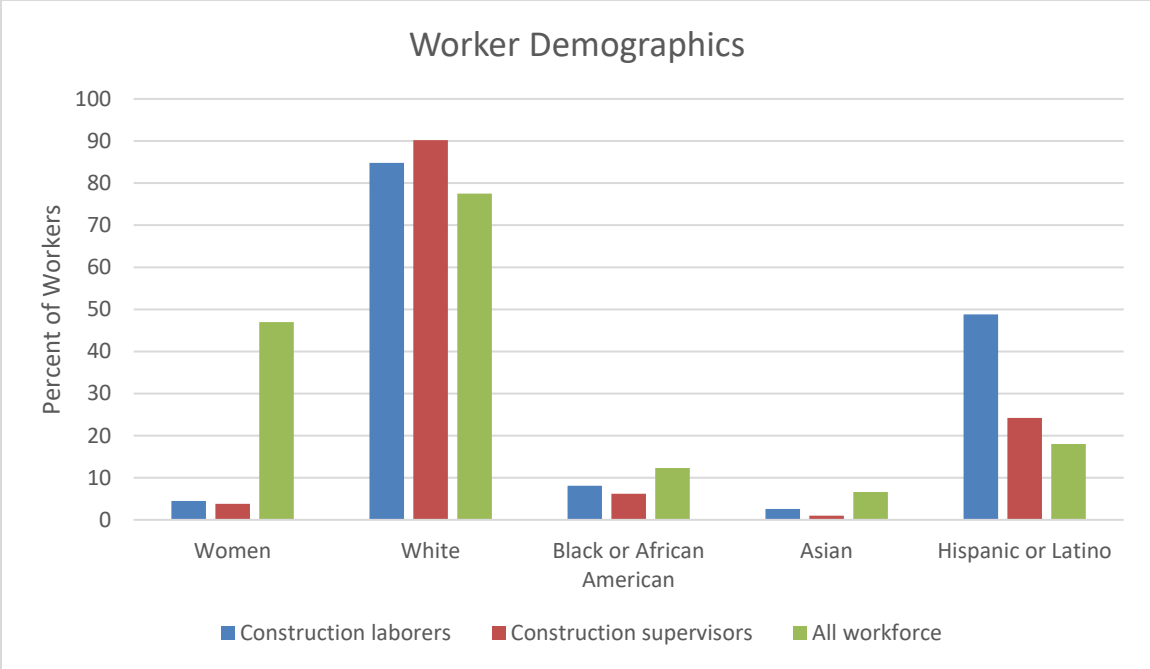


Figure 1. Demographics of U.S. construction laborers, construction supervisors, and the general U.S. workforce.

Source: U.S. Bureau of Labor Statistics (2021)

Research has shown that work-based learning and training programs can advance equity in employment, especially for young people (Ross et al. 2020). At the same time, growing a workforce for a new technology requires the incorporation of concepts and approaches that address trainee diversity, equity in outreach, and inclusion in implementation. We have incorporated DEI throughout this project, but it is up to ICAST and its partners to ensure that DEI is addressed in implementation and evaluation. Appendix C includes DEI resources.

2 Step 1: Regional Market Analysis

When you have identified a potential location (e.g., city, county, or region) for implementing your training, the first step is to conduct a regional landscape analysis to understand the local need or demand for your training, the opportunities, and who can help you get there. This includes understanding the demand and job market in your area and researching potential partners.

2.1 Demand and Opportunity

In this first step, you will gain a sense of the general levels of heat pump technology adoption in your region, and what programs may already exist to support this demand.

National and Regional Data – Energy Information Administration

The U.S. Energy Information Administration (EIA) periodically conducts surveys to provide a detailed snapshot of energy usage in buildings across the country. This information can be accessed at the following links:

- *Residential Energy Consumption Survey (RECS)*
<https://www.eia.gov/consumption/residential/>
The RECS includes information on space heating, air conditioning, and water heating system types (including heat pumps) as well as fuel type. This data is available at a national scale, as well as by U.S. region (e.g., Northeast, Midwest) and by climate region (e.g., very cold, hot-humid, marine).
- *Commercial Buildings Energy Consumption Survey (CBECS)*
<https://www.eia.gov/consumption/commercial/data/2018/>
CBECS offers less detail than RECS regarding heating and cooling systems, mostly because commercial buildings are more likely to have multiple systems in place, versus residences which tend to have just one system for heating and one for cooling. With CBECS you can review energy sources (fuel types) and the uses of that energy organized by the number of buildings or by floorspace (square feet). This information is available at a national scale only.
- *Manufacturing Energy Consumption Survey*
<https://www.eia.gov/consumption/data.php#mfg>
As with CBECS, the Manufacturing Energy Consumption Survey only offers high-level information such as energy/fuel source and electricity demand for each manufacturing industry subsector. This is available at a national level and by U.S. region (e.g., Northeast, Midwest, South).

State and Local Data – NREL End-Use Load Profiles for the U.S. Building Stock

<https://www.nrel.gov/buildings/end-use-load-profiles.html>

NREL has developed a suite of building stock analysis tools, known as ResStock and ComStock. These tools provide a higher level of granularity for understanding building energy usage in the United States. Depending on the tool, you can access rough data on heating and cooling systems based on state, county, and even census-derived Public Use Microdata. These tools are presented

below. Instructions for using these tools to identify rates of heat pump adoption for different geographies are offered in Appendix A.

Local Utility Data & Programs

Some utilities may have data related to heating and cooling system usage in their area. You will need to contact the local utility or search their website to see what data and reports are available.

In addition, utility websites will easily show you what rebate and incentive programs may exist for supporting the adoption of heat pump technology. This is an important step towards understanding what broader support might be needed for a technology at a regional level. It is also useful information to have when engaging with trade organizations and employers.

Local Jurisdiction Policies and Programs

In addition to utility programs, some local jurisdictions (often mid-to-large-size cities) may have their own policies or programs that support heat pump adoption. Identify the major cities and counties in the region you are studying to learn what the local policies and programs are using web search or tools like the DSIRE Database of State Incentives (<https://www.dsireusa.org/>).

Local Business or Nonprofit Coalitions

Some states and/or regions may have business groups or coalitions focused on energy efficiency, beneficial electrification, and/or heat pump technology. For example, in Colorado, the following groups are involved in research and industry engagement to support the deployment of heat pump technology:

- Southwest Energy Efficiency Project (<https://www.swenergy.org/heat-pump-study-2022>)
- Energy Efficiency Business Coalition (<https://eebco.org/hvac-hp-action-group>)
- Love Electric (<https://loveelectric.org>).

Reaching out to partners or conducting a web search may help you in identifying some of these groups.

2.2 Job Market

There are several methods for gaining an understanding of the job market related to HVAC and heat pumps in your region. Two options are described below:

Bureau of Labor Statistics (BLS): Occupational Employment and Wage Statistics
<https://www.bls.gov/oes/current/oes499021.htm>

There are several ways to navigate BLS data. The first is through their Occupational Employment and Wages information. For more detail, you can use their Query System to find specific information on specific geographies. Step-by-step instructions are included in Appendix B.

Job postings

To get more detailed information on what type of employment demand there may be for HVAC

workers with heat pump experience, a simple search on any major job search engine platform can provide a regional snapshot in time.

Consider using the DOE-funded Career Map for Careers in Climate Control Technology (Heating, Ventilating, Air Conditioning, and Refrigeration [HVAC/R]) to identify the best job titles for your search: <https://hvaccareemap.org/about-this-map>.

2.3 Potential Partners

Once you have a sense of the market and demand for heat pump technology in your region—the opportunity—you must then research potential partners. These are existing organizations and agencies in your region that have related programs and networks to help you connect with potential employers, workers, or trainees (GPS Education Partners 2022).

The following list includes the types of organizations you will want to research. More detail on the roles of partners is provided in section 4, and a list of potential questions to bring to initial conversations with partners is included in Appendix C.

Community Partners

These are organizations that work with a diversity of individuals and potential workers. These types of groups will be key to promoting and recruiting for your training program for new entrants. General categories for community partners are listed below, with links shown in Appendix B.

- Workforce Centers/Workforce Innovation and Opportunity Act (WIOA)-funded programs
- Career and technical education (CTE) construction programs (high school and community college)
- Community and technical colleges
- Building Performance Institute (BPI) Test and Training Centers
- Local governments
- Nonprofits
 - Housing authorities
 - Corps programs

Industry/Employer Partners

These are local HVAC employers, manufacturers or product representatives, or organizations such as unions and trade associations that work with or represent existing workers and employers. They can help provide qualitative information related to the raw data about heat pump demand; help you understand existing programs and process in your region; and help recruit existing workers who may be seeking upskilling, professional development, or continuing education credits. They can also connect you to employers that are interested in providing heat pump services and who may want to hire new workers that complete your training program. Appendix B contains a list of potential industry partners that can serve as a starting point.

3 Step 2: Program Development

This second step involves exploring, developing, and determining details about how your training program will operate. In general, you will want to go through some version of this step before engaging with potential partners (Step 3), so that you can present a clear message about what you want to accomplish and how your strategic partners can contribute to that. Many of the details described here may be reworked or amended once partners are brought on board. This process can therefore be revisited multiple times prior to program implementation. This ensures that the program meets the needs, and utilizes the expertise, of all involved to the highest level possible.

3.1 Program Overview

This first step outlines the major elements of your training program. It should be established first, with details on implementation and tracking discussed in the following sections. The following describes the elements to consider, with specific questions and examples to prompt discussion and consideration.²

Define Audience

Define who should be taking your program.

Examples:

- Anyone interested in a career in HVAC and/or heat pump installation
- Existing HVAC workers with an interest in learning about heat pump technology and installation practices.

Set Program Goals

You will want to establish one to three goals for the program. Each should take the form of a one-sentence overview of what the training program will accomplish and what will be different for trainees or the local industry as a result of your program.

Examples:

- This program will build a pipeline of workers who can help increase deployment of CCHP technology in the region.
- This program will enable existing HVAC workers in the region to offer CCHP installation and maintenance services to their customers.

Set Program Objectives

Develop a minimum of three to five succinct objectives that explain how the goal will be met. Objectives should be SMART (specific, measurable, achievable, relevant, and time-bound).

² The information in this section is based loosely on the ADDIE model for instructional design, available at <https://www.instructionaldesign.org/models/addie/#:~:text=The%20ADDIE%20model%20is%20the,training%20and%20performance%20support%20tools>.

Examples:

- This program will enroll XX trainees each session, in XX sessions each year.
- XX% of registrants will complete the training.
- XX% of program graduates will be employed in HVAC or related fields within XX months of program completion.

NOTE: You should also conduct a goals/objectives process specific to the training curriculum. This will focus on learning outcomes as opposed to broader program employment outcomes. Examples of learning objectives could answer the question, “What will program graduates know or be able to do as a result of this training?” Examples include:

- Safely install a heat pump in a building
- Engage with XX HVAC employers
- Be prepared for XYZ exam/certification.

Identify Desired Training Elements

This decision may be based on several factors, including your space and instructional staff availability.

- Educational learning: Trainees gain an understanding of foundational concepts and an overview of the technology and how it works. This can be online or in person.
 - Do you have space or staff to teach this?
 - Do you require this as a prerequisite for the hands-on or on-the-job training?
- Hands-on training: Trainees gain experience working directly to install or repair the technology in a controlled or simulated environment.
 - Do you have a lab/warehouse space for this?
 - Do you have heat pumps that can be purchased or donated that students can practice with?
- On-the-job training
 - Have you established partnerships with employers who are prepared to hire trainees?
- General industry-recognized certifications (e.g., OSHA 10, cardiopulmonary resuscitation [CPR]/First Aid).

3.2 Program Details

Building on the previous section, this section describes elements to consider in the development of your program, including specific questions and examples.

Align With Classroom Curricula

ICAST has already developed and launched its online curriculum to educate HVAC students and existing workers on heat pump technology, system design, and installation. As mentioned previously, this report does not address curriculum design; however, it is important that all the

steps that follow incorporate and align with the goals, objectives, and approaches for the classroom curriculum.

As such, any hands-on skills taught should reflect the same context, verbiage, and offerings as the online education (examples include specific terminology, approaches, etc.), and the organization of the hands-on training should be similar as well.

Design the Hands-On Learning Format

Once learning goals and objectives are solidified, you need to determine the format for hands-on learning. There are two main categories for structured hands-on training programs, which depend on the audience for the training. The first is on-the-job training, which is activity-specific training conducted as part of employment and is usually provided for existing workers. The second is for new learners, or people not yet in the workforce, and that is work-based learning, which incorporates on-the-job training into a more comprehensive learning program with a broader educational objective. The information in this section is based on the work-based learning approaches outlined by GPS Learning Partners (2022) and resources from Association for Career & Technical Education.³

New Learners

- Career exploration: simulated learning (e.g., real hands-on experience in a controlled environment such as a lab)
- Career experience: internships, pre-apprenticeships (duration of less than three months)
 - Agreed-upon pay and hours
 - Establish a point of contact at employer
 - Need regular check-ins with trainee
 - Need process for evaluation
- Career Preparation: apprenticeships, on-the-job training (three months to one year)

Existing Workers

- Career development: simulated learning, on-the-job training

Each of the above options can be appropriate in different situations, depending on goals/objectives, staff and partner availability, and other considerations. Recommendations specific to ICAST are provided in section 7, Considerations and Next Steps for ICAST.

³ <https://www.acteonline.org/professional-development/high-quality-cte-tools/high-quality-cte-library/work-based-learning/#tab-id-4>

Create Program Timeline/Schedule

The first step in creating a program timeline and schedule is to determine how long the structured training will be provided for, and what the daily schedule looks like. Examples include:

- 40 hours of classroom learning + 1 week of simulated learning + 4-week internship.
Options for classroom learning include:
 - 1 week, 9am–5pm each day, Monday–Friday
 - Evenings only
 - Several weekends in a row
 - One weekend day a month for five months.

It is important to work with your program partners to understand the demands and schedules of your target audience, so that you craft a program most likely to be successful in terms of participant attendance and completion.

The second item to determine is how frequently the training program will be offered. Examples include:

- One offering per year
- One offering per quarter
- One offering per month
- Ongoing.

Think about the demand in the area, as well as your staff and your partners' availability. For example, you don't want to train more people than there are jobs available. You also don't want to schedule your training at the same time that your partners are recruiting for related trainings. Finally, talk to employer partners about the most convenient or strategic time(s) of the year based on their typical work schedules or seasonal changes, so that you are not offering upskilling or professional development opportunities when they are most busy.

Finally, this report does not get into the details of training/curriculum design—meaning a detailed day-by-day/hour-by-hour schedule for the training program. This is intended to be an overview of the structure instead. When you do get to detailing the schedule, make sure to address and agree with your partners on all the items in this section.

Establish Trainee Compensation Options

Work with your partners to determine whether the classroom and simulated learning portions of your training include any compensation or wrap-around, such as:

- Hourly pay/stipends
- Transportation vouchers
- Childcare assistance/reimbursement

What is the compensation for the on-the-job training component? Examples include:

- Hourly pay
 - Are there scheduled increases after a trial period, for example, 30 days or 90 days?

- Benefits
 - Who is paying for this?
 - Training lead
 - Employer
 - Other funding sources
 - Contact your local Workforce Development Board to see if you can access Workforce Development Board/WIOA training funds to help pay: <https://www.careeronestop.org/LocalHelp/WorkforceDevelopment/find-workforce-development-boards.aspx>
 - Contact your state energy office for possible funding: <https://www.energy.gov/eere/femp/state-energy-offices-and-organizations>
- Contact local government economic development offices about other financial support that may be available.

Determine Eligibility Criteria

Who is eligible to apply to this training? Examples:

- Are there knowledge, educational, or experiential prerequisites?
- Are there citizenship requirements?
- Are there age or other background requirements (e.g., justice system)?
- Do you have income qualifications?
- How do you define program completion?
 - Attended XX%
 - Achieved a graded score above XX%
 - Written or skills test at the end
 - Demonstrated skill
 - XX hours of experience
- How will applicants be evaluated/how will you choose if you have more applicants than spots? Established clear criteria helps support equitable administration of the program.

Trainee Evaluation

In order to gauge the success of your program (discussed in a later section), you need to establish ahead of time how you will evaluate what your trainees learn and what skills they have gained. This is also important for trainees so that they can clearly communicate with potential employers about what they have learned, whether on resumes or during interviews. Consider:

- How will you evaluate knowledge gained?
 - Example: the test/exam incorporated into the online curricula through SFCC
- How will you track skills learned?
 - Consider developing a badging system. Appendix D includes a link to a free customizable home energy badging toolkit.

- Does training align with/prepare learners for industry-recognized certificates or certifications? Some examples include:
 - BPI Air Conditioning & Heat Pump Professional
<https://www.bpi.org/certified-professionals/ac-heat-pump>
 - North American Technician Excellence (NATE) Competency and Certifications
<https://natex.org/proctor-testing-organization/industry-competency-exams-overview>

Staffing, Responsibilities, and Locations

If there are multiple partners involved, who will be responsible for what? You will want to think about:

- Who is creating advertising material and application forms?
 - Where are these located? (Virtual and physical location)
- Who is doing trainee intake and application evaluation/approval?
- Who is responsible for conducting classroom and lab/simulation-based training?
 - Where will this take place?
- Who will lead field-based training with employers?
 - Where will this take place?
 - How will trainees get here? (Do they come to your main training location and you transport them to site, or are they responsible for getting themselves to the training?)
- Who will be checking in regularly with trainees during their program?
- Who will hire and pay on-the-job trainees?
 - Ensure proper safety training and liability insurance is provided
- Who will conduct follow-up with program graduates to track employment outcomes?
- Who will maintain regular contact with program partners?
 - Conducting outreach and recruitment
 - Schedule networking, hiring, or other activities with employers

Trainee Safety and Legal Considerations

Depending on how you structure your training program with your partners, someone will take responsibility for ensuring the safety of trainees. This falls into two main categories:

- *Trainee preparation:* This is ensuring that trainees have received some level of job site safety instruction prior to arriving on site. This could include OSHA 10 or something similar, as well as basic HVAC/heat pump training so that they can better understand what they see and learn on site. It is important to coordinate with your employer partners to ensure that they understand and are comfortable with the instruction trainees will receive.
- *Trainee insurance:* Some level of insurance will need to be provided for any type of ride-alongs or in-person training being offered. The information provided here is general, as

every company and insurance provider will be different. Requirements may vary by jurisdiction.

- For passive activities like job shadowing, or short-term hands-on training in a warehouse or other simulated environment, it may be easier for the main training provider to hold insurance policies covering trainees for all activities included in the training.
- For longer-term hands-on or work-based learning, such as a paid or unpaid internship, workers' compensation insurance will likely need to be provided. Your employer partner will need to have their administrative or human resources staff talk with their insurance providers to understand what their existing plans allow them to do with existing insurance plans, and what the costs or requirements may be to incorporate new elements of your proposed training program.
- *Consent Form/Liability Waiver*: Although it will not cover everything, it is best to include a consent or liability waiver as part of your training application form. Training providers should work with their legal or insurance teams to craft appropriate language for trainees to sign.

Although specific safety precautions and requirements will vary by location and partners, we have included a resource in Appendix D that outlines safety considerations for CTE programs in the state of Virginia as a reference.

4 Step 3: Partner Engagement

As mentioned previously, steps two and three can be somewhat interchangeable in terms of the order of activities. While it is important to establish basic program information before approaching potential partners, many of the details outlined in step two will need to be decided with the help of dedicated program partners. Below are some considerations when you begin to reach out to and engage with partners. Appendix C includes a list of potential questions to bring to initial conversations with partners.

4.1 Partner Responsibilities

When reviewing your market research addressed in step one, be sure you reach out to potential partners that can help in each of the following areas.

- Recruit trainees
 - For recruiting trainees new to the industry, community partners will be instrumental to reaching diverse groups in the most effective ways possible (see section 5, Program Implementation).
 - For recruiting existing HVAC workers, work with industry and employer partners to reach existing workers.
- Support trainees
 - If you are recruiting individuals who may be new to the workforce, they may require wrap-around services to help them be successful. Your community partners can help identify what services would be most valuable and may also be able to provide these services themselves in coordination with your program.
 - For existing workers, it may be helpful to coordinate with their employers to ensure that you are offering trainings on topics that can support their goals and needs, and at times that work best for their production schedules.
- Provide opportunities for trainees to engage with employers
 - Presentations at the beginning of a training can help trainees understand potential job opportunities and provide context on what day to day work may be like.
 - Coordinate mock/real interviews with employer partners at the end of a training.
 - Identify internship/apprenticeship/employment opportunities for when training is complete.

This final element is critical to the success of your program. First, be sure to work with your employer partners to identify appropriate opportunities for them to engage with trainees. While all the items above will help your trainees prepare for the job market, when possible, try to identify one or more that can guarantee some type of paid employment. Even a short-term paid internship can give trainees the experience they need to improve and be confident in their skills and gives them important employment history to include in resumes and future job interviews. Examples of different types of employment opportunities built into training programs are offered in Appendix A.

4.2 Building Trust

Establishing trust has been a theme throughout this report; however, below is a summary of items to keep in mind as you engage with partners to help build trust and support the success of your program:

- *Find Common Acquaintances:* Where possible, look for people or organizations you know who can provide introductions to new partners. This can help establish a base level of trust and validation from the start.
- *Know Your Pitch:* Be prepared going in to meetings with your market research, program goals and proposed structure, any other partners that have committed to the process, and how, specifically, you are asking this potential partner to be involved. When possible, be prepared with some details such as how this can align with or support their existing efforts, what it might cost them in terms of time or money, and what resources you can offer in support.
- *Stay Open to Change:* A partnership is more likely to be successful if everyone involved has a clear role and clear benefit. While you may have ideas about the best ways for a particular partner to be involved, stay open to their reactions and suggestions. They know their goals, needs, and capacity, and may have insights into the market or your target audiences that you do not. Staying receptive and flexible to suggestions or changes that work for your potential partners helps establish trust and makes it more likely they will get and stay involved.
- *Establish Clear Expectations:* At the end of each meeting with potential partners, try to identify clear next steps and expectations for them and for yourself. If they have questions, concerns, or suggestions then identify how and when you will address these and reach back out. If they are to provide information or resources to you, send them a follow-up reminder about it.

4.3 Formalizing the Partnership

Finally, when appropriate, consider having all partners sign a contract, partner agreement, or memorandum of agreement or understanding with your organization to clearly lay out program goals, timeline, and key responsibilities described in sections 2 and 3. This may require input from your organization's legal staff or counsel. Resources to support the development of these agreements is included in Appendix C.

5 Step 4: Program Implementation

Once your program structure, details, and partnerships are in place, you can launch your program. Because every program is so different, this section will only address some common elements to consider when planning, performing trainee recruitment, engaging with your trainees, and tracking trainees' progress through and completion of your program.

5.1 Materials Development

This has been discussed in previous sections, but there are several materials or deliverables you will need to develop prior to starting your recruitment efforts. Some examples are included below.

- Trainee Application Form: Suggested minimum elements to include are shown below; however, you should coordinate with your partners to ensure you are collecting information they may need for their own tracking or reporting.
 - Name
 - Contact information
 - Relevant experience or knowledge/highest level of education
 - Demographics (must be optional)
 - Gender, race/ethnicity
 - Income
 - Veteran status
 - Formerly incarcerated
 - Eligibility criteria you have identified
 - How they heard about the program
 - Liability waiver
- Training program website/webpage (see section 5.2 for more detail)
- Training program advertisement (see section 5.2 for more detail)
- Program evaluation survey (for trainees to complete, evaluating their experience in the program)
- Trainee evaluation tool (for your organization or employer partners to use in evaluating skills learned at the completion of hands-on or on-the-job training)

5.2 Trainee Recruitment

In step one you identified your target audiences for your training, and in step two you identified the partners that have existing trusted connections and relationships with these groups. You must now work with your partners to identify the best ways to reach these groups, understanding that the approach may be different for different populations or different trainings. This is hugely

important when considering the DEI aspects of your program. Again, your partners will know how best to connect to diverse audiences. Elements to discuss with your partners include:

- How you message/talk about your program
 - What will resonate with your group? You may highlight different aspects or benefits of the program if you are talking to unemployed youth versus existing employed HVAC workers.
 - Do you need to translate your information into different languages?
- What materials and methods you use to advertise
 - Flyers posted at specific locations
 - Website (mobile-friendly versus sites designed for desktop/laptop)
 - Social media posts
 - Partner newsletters
 - Radio spots
 - Direct recruitment through existing employers.

As stated earlier, no matter what methods you use, be sure to have one central place where people can get all the information they need (e.g., program overview, application) to eliminate confusion. There should be both a virtual location/webpage and a physical location, as well as a designated phone number and email. Be sure that all information is updated consistently.

An online web presence can also serve many other purposes if desired, including as a user portal for trainees where they can log in and access:

- Online education content
- Skills attainment
- Certificate of completion
- Job listings or links to employer partners.

Finally, before you launch your program, work with your partners to create a schedule for both training and recruitment efforts for up to a year out if possible. This may change, but will help ensure that everyone knows when to plan for updating materials, promotional activities, etc.

5.3 Trainee Engagement

In general, research shows that incorporating hands-on and work-based learning, and developing meaningful relationships are all approaches that can help improve student retention and trainee completion rates (Ross et al. 2020). In addition, conscientious approaches to address DEI in your recruitment and program implementation may also encourage trainees to complete their program.

In addition, there are specific approaches to trainee engagement that could vary depending on the type of trainee and their motivation for being there, their time and availability, and their individual life and employment situation and goals. Some items to consider include:

New Learners

- *Make the training content and schedule accessible:* Work with your community partners to ensure the training schedule (e.g., time of day, duration) makes sense for your audiences. For some, evenings or weekends over a long stretch of time may be better; for others, getting everything done in a “bootcamp” style is more effective. In addition, understand how the classroom/online educational curricula tie into your hands-on training. If trainees are expected to complete this on their own time, know if they are likely to have computer and/or internet access. Similarly, consider whether your target audience may have barriers such as transportation or childcare. Work with your community partners to craft your program to make it more likely that people interested in the training can access it and be successful.
- *Engage with employers:* New learners are people who want to get a job in your field. Whether or not your program offers guaranteed employment for graduates, take every opportunity to allow trainees to not just learn about job opportunities, but to talk to and hear from existing workers and employers. Doing this on the first day of training and as they are nearing completion can help keep their goals and motivations in clear view.
- *Encourage career exploration:* Although your program goals are to grow the CCHP workforce, it is important to understand that much of the knowledge and skills you are providing are transferable to other HVAC, construction, and clean energy career paths. Encouraging trainees to explore possible occupations and career pathways and helping them understand how their skills can transfer to other areas will help them be more marketable as workers and increase opportunities for them to be hired. Appendix C includes links to some DOE-funded career mapping tools that you can use or encourage trainees to use.
- *Identify trainee strengths:* Workers that are new to the field and job market generally may not have a clear sense of their strengths. Consider adopting some process or tool that can help your training providers and partners identify specific soft and technical skills for each trainee beyond program completion and associated certificates and certifications. This could include informal approaches such as exit interviews with trainees, or more formal systems such as a badging system. This can help trainees build confidence and an understanding of how they can “market” themselves to potential employers. An example of an energy efficiency badging program is linked in Appendix C.

Existing Workers

- *Make the training content and schedule accessible:* Just as with new learners, the content and schedule of your training offerings for existing workers will greatly impact how likely they are to register for and complete your training program. Work with industry and employer partners to determine ideal schedule and calendars for existing HVAC workers.
- *Clearly communicate career opportunities and benefits:* While some HVAC workers may be motivated to take this CCHP training because of interest in the technology and the

environmental benefits, many are likely taking it because their companies are pursuing or interested in breaking into a relatively new market. Be clear when recruiting and engaging with trainees about what industry-recognized certifications or knowledge are being included, and what the market potential is in their region. In addition, talking to employer and industry partners and surveying trainees will help identify what their motivations and goals are, and clearly communicating these throughout the training process will make it more likely trainees will take the time and effort to complete the program.

5.4 Trainee Tracking

Although tracking is listed last here, you will need to think through these elements when crafting your program structure and developing your application and trainee evaluation tools. Talk with all partners involved in the training program to make sure you track and collect data they may need for their funders, leadership, or marketing efforts. Examples of baseline items to track include:

- Number of participants
 - Registration
 - Attended at least part
 - Completed training
- Demographics of participants
- Employment outcomes
 - Placed in employment
 - Still employed after XYZ amount of time
 - Employment in related fields (and how do you define this?)
 - How will you collect this information (e.g., follow-up phone calls, emails, surveys, trainees or the employer partners)? Talk to your partners to learn the best method for different populations.

Finally, think through ahead of time what method you will use to track this data. Examples of possible methods include:

- Excel spreadsheet
- Database
- Other software.

When deciding on a system, consider what types of data you will need to share with different stakeholders, and how frequently you will report on it.

6 Step 5: Program Evaluation

The final step in this process is to regularly evaluate the effectiveness of your programs and the processes you have put in place. The first method for evaluation is hearing directly from the participants about their experience. Evaluation methods here could include:

- Questionnaire for trainees at the end of program
- Interviews/survey for employer partners
 - Do trainees have the skills and knowledge you expected?
 - What elements are lacking?

In this approach you are looking for overall trends and also to understand individual experiences and how you may need to make adjustments to ensure your process is accessible and equitable in its impact.

The second type of evaluation is an internal review of training outcomes, related to the tracking you have done in step 4 and the goals you set in step 2.

During your programs' first year it may be helpful to conduct this activity after each round of training. Once your program is established, this may only be needed once per year. Questions to ask include:

- Are you meeting your program goals and objectives?
- Why or why not? Review steps 1–4 with your partners and identify what elements may need to be adjusted. For example:
 - Do you need to recruit new/different partners?
 - Do you need to restructure your training to add focus to certain areas?
 - Do you need to change the timeline or schedule?

Although this is listed as the final step, the overall process is cyclical, so that any information learned through evaluation can help you rethink program design and implementation in the future, so that you are offering the highest quality training and education experience possible for trainees and partners.

7 Considerations and Next Steps for ICAST

The previous sections outline the general steps needed to develop and implement training programs in new markets. Given their program goals, ICAST may consider developing two separate training program offerings—one for people new to the field, and a separate one for existing workers. Considerations for these two program offerings are outlined below, based on ICAST’s current resources and capabilities as shared with NREL:

1. *New Learners* (people with less than one year of HVAC experience or education)
Self-paced online learning combined with hands-on learning opportunities and opportunities for paid on-the-job training. Specific elements could include:
 - A. Virtual introductory meeting (mandatory)
 - i. Offered once per month
 - ii. Includes program overview and employer meet and greet/Q&A.
 - B. Online learning/training (to be completed at their own pace within a specific period from the time their application is accepted; for example, three or six months)
 - i. Heat pump curricula through SFCC
 - ii. OSHA 10
 - C. Employer connections
 - i. Employer meet and greet
 - ii. One required site visit/job shadowing day (to be organized by ICAST)
 - D. Paid employment (60 or 90 days)
 - i. Trainees are eligible if they complete the above
 - ii. Option to stay on as permanent staff, depending on employer needs/discretion.
2. *Existing Workers* (people with one or more years of HVAC experience)
The online heat pump curricula through SFCC could be available for free to employers that sign on as partners to employ trainees from the “New Learners” program.

The above offer a possible framework to begin thinking about how ICAST can most efficiently and effectively deliver its training program. It is a starting point, and ICAST will need to go through the information provided in sections 2 and 3 to develop further program details. In particular, ICAST will want to work with employer partners to identify clear goals for skills development during the on-the-job component of the training, and a way to track it.

Once the above is completed, ICAST may want to consider developing and piloting the program in one to three select locations where they are performing energy retrofit work and already have some connections with employers and some community-based organizations. Because ICAST does not have funding to cover any paid on-the-job training at this time, early connections with workforce development boards and American Job Centers may be important for not only

recruitment, but as potential sources of funding to further incentivize employers to join in formal partnership to provide paid on-the-job training.

References

GPS Learning Partners. 2022. *Work-based Learning Ecosystems*. Waukesha, WI: GPS Learning Partners. <https://gpsed.org/wp-content/uploads/Interactive-Work-based-Learning-Ecosystems-White-Paper.pdf>.

Ross, Martha, Richard Kazis, Nicole Bateman, and Laura Stateler. 2020. *Work-Based Learning Can Advance Equity and Opportunity for America's Young People*. Washington, DC: Brookings Metropolitan Policy Program. https://www.brookings.edu/wp-content/uploads/2020/11/20201120_BrookingsMetro_Work-based-learning_Final_Report.pdf.

U.S. Bureau of Labor Statistics. 2021. "Employed persons by detailed occupation, sex, race, and Hispanic or Latino ethnicity." Accessed Sept. 13, 2022. <https://www.bls.gov/cps/cpsaat11.htm>.

Appendix A. Case Studies

The following are short summaries of successful hands-on clean energy training programs. Not all are related to heat pump technology, but all offer different combinations of classroom, simulated and hands-on training that can be valuable references for ICAST in developing their programming.

[Bloc Power New York Heat Pump Training](#)

Bloc Power, New York Edge, and the New York State Energy Research and Development Authority (NYSERDA) launched a Heat Pump 101 training program for underserved youth. The training provides a classroom-based introduction to heat pump technology with a follow-up hands-on training component currently under development.⁴

[Center for Energy and Environment Minnesota Home Energy Career Training](#)

The Center for Energy and Environment in Minneapolis, Minnesota worked with their utility (Xcel Energy) to develop their Home Energy Career Training geared towards underrepresented groups. This five-week paid training program includes building science education that prepares students for the Building Science Principles credential, hands-on installation training from industry/employer partners, and job site safety training. Trainees are also eligible for transportation assistance through their community partners. At the end of the training, graduates can be placed in a four-month paid internship that includes health insurance with either their utility partner or the local weatherization agency.

[GRID Alternatives Colorado Solar Training Academy](#)

GRID Alternatives is a nonprofit solar installer focused on supporting low-income households through training and solar photovoltaic installation. Their Solar Training Academy in Colorado is a two-week paid training program that includes classroom education, hands-on training in labs and mock installations, as well as OSHA 10 and CPR/First Aid certifications. Meals are provided, and trainees are eligible for childcare and transportation assistance. GRID Alternatives has established partnerships with employers who meet with trainees and are often prepared to hire program graduates.

[Building Green Futures, Pennsylvania College of Technology](#)

The Pennsylvania College of Technology's Clean Energy Center is a Weatherization Training Center that has launched a three-week collaborative training program. The training includes Building Science Principles education and certification, OSHA 10, as well as career coaching and wrap-around services such as childcare, safety clothing, and travel reimbursement. Community partners help recruit diverse participants, and employer partners offer job shadowing, field visits, and networking opportunities.

⁴ <https://portal.nyserdera.ny.gov/servlet/servlet.FileDownload?file=00Pt000000ats5rEAA>

Appendix B. Market Research Tools

The following resources and explanations are provided to assist with the regional market research described in step 1 of this report.

NREL Building Stock Analysis Instructions

NREL offers two ways to access its building stock analysis data. The first is to access the complete data sets:

<https://www.nrel.gov/buildings/end-use-load-profiles.html#dataset>

NREL has also developed online visualization tools:

<https://public.tableau.com/app/profile/nrel.buildingstock>

For the scope of what ICAST may want, the second option, offered through Tableau, is the easier approach. Explanation is provided below for accessing residential and commercial data on heat pump adoption using this tool.

ResStock/Residential Segments

<https://public.tableau.com/app/profile/nrel.buildingstock/viz/USBuildingTypologyResidential/Segments>

- Click on the “Heating System” tab and you can look at the Electricity Air Source Heat Pump (ASHP) column to see market share by residential building type
- Can filter by state and county.

ComStock/Commercial Segments

<https://public.tableau.com/app/profile/nrel.buildingstock/viz/USBuildingTypologySegmentsCommercial/Segments>

- Click on the “HVAC Types by Floor Area” tab to see what types of HVAC systems are in use
- Can filter by state, county, and climate zone.

BLS Occupational Employment and Wage Statistics Query System

<https://data.bls.gov/oes/#/home>

This source will tell you how many people in a state or metropolitan area are employed in HVAC, and what the mean wages are. You can also use it to compare the region you are interested in with state or national data. To use the Query System, you can follow the following steps:

1. Select: One occupation for multiple geographical areas
2. Select: Installation, Maintenance and Repair Occupations
 - Heating, Air Conditioning, and Refrigeration Mechanics and Installers
 - All data types
3. Select: National/State/Metropolitan Area.

Partner Identification

The following table identifies some major national-level organizations that you can start with to identify possible local community, industry, or employer partners.

Organization	Link and Instructions
Community/Educational Groups	
Career and Technical Education (CTE)	https://careertech.org/cte-your-state
Community Colleges/Technical Schools/Colleges and Universities	https://nces.ed.gov/collegenavigator/
Corps Programs	https://corpsnetwork.org/members-by-state/ https://my.americorps.gov/mp/listing/publicRequestSearch.do https://serviceyear.org/
BPI Testing and Training Centers	https://www.bpi.org/bpi-test-centers
North American Technician Excellence (NATE) testing locations	https://natex.org/contractor/locate-a-testing-organization
Searchable database of HVAC training and education providers	https://www.hvacclasses.org/
WIOA and Workforce Services	https://www.careeronestop.org/LocalHelp/AmericanJobCenters/american-job-centers.aspx https://www.careeronestop.org/LocalHelp/EmploymentAndTraining/find-WIOA-training-programs.aspx
Trade/Industry Organizations	
United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry (United Association)	https://ua.org/
Sheet Metal, Air, Rail and Transportation Union (SMART)	https://smart-union.org/
Plumbing, Heating, Cooling Contractors Association	https://www.phccweb.org/
Women in Energy	https://wewomeninenergy.com/
Women in HVACR	https://www.womeninhvacr.org/
ASHRAE	https://www.ashrae.org/
Air Duct Council	https://flexibleduct.org/
Air Conditioning Contractors of America	https://www.acca.org/home

Appendix C. Tools Partner Engagement

Questions for Engaging with Potential Partners

Sections 2–4 of this report summarized the process and approach for identifying and engaging with partners. Below are some potential questions that ICAST specifically can consider when having initial conversations with different types of partners. This is a starting point only and is not intended to be comprehensive or exhaustive. ICAST should be prepared to present its market data and training concepts, as well as any other partner commitments it has secured, before addressing the questions below. Other questions may be relevant for other types of programs.

Community Partners

- What populations does your organization work with?
- How does your organization perform or engage with workforce development or training activities?
- Does your organization have the capacity to support us in any of the following ways?
 - Advertising training and employment opportunities
 - Actively recruiting training participants
 - Providing wrap-around or support services to trainees, for example:
 - Job readiness (help with resumes, interview preparation)
 - Work clothing stipends
 - Transportation assistance
 - Childcare assistance
- Can your agency provide funding to pay or reimburse for paid on-the-job training/short-term employment for our trainees?
 - What is the process for this? What commitments, information, or data is needed from us or our employer partners?
- Does your organization need access to our training or trainee data for your own tracking or reporting? What specific data points will you need?

Employer Partners

- Does your company currently install or service heat pumps?
 - If not, are you interested in developing these capabilities?
- How many staff do you employ?
 - How many have heat pump training or experience?
- How many new technicians/field staff do you intend to bring on in the next 12 months?
- Would you be interested in hiring short-term trainees that have been screened by ICAST and will have already completed online introductory HVAC and heat pump training, as well as OSHA 10?
 - Would you be willing to pay for this short-term employment?

- What is your starting wage for new hires?
- Would you be interested in engaging with our trainees in other ways?
 - Virtual meet and greet
 - Job shadowing or ride-alongs
- Would you be interested in gaining access to free online heat pump training for your existing staff?

Resources for Formalizing Partnerships

Once you have identified partners to help implement your program, it can be helpful for all parties involved to formalize the partnership and responsibilities of all parties through a contract, partner agreement, or memorandum of agreement (MOA) or memorandum of understanding (MOU). Below are some resources that can help in developing a partner agreement:

- [*The MOU: A Tool for Formalizing Partnerships*](#). Jobs for the Future. 2021
 - Guide includes overall information and sample MOUs
- [*Prisoner Reentry Toolkit for Faith-Based and Community Organizations*](#). US Department of Labor Center for Faith-Based and Community Initiatives. 2008.
 - Includes sample MOAs, MOUs, and Subcontractor Agreements for job training partnerships

Appendix D. Additional Resources

This section addresses other resources referenced in the report which may be useful in further developing different elements of your training program.

- Better Buildings Workforce Accelerator (BBWA) Diversity, Equity and Inclusion Fact Sheet
https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/DEI%20Fact%20sheet_Formatted_Final.pdf
- BBWA K-12 Engagement Fact Sheet
https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/K-12_Resource_Factsheet.pdf
- BBWA Technical Assistance Report: Workforce Development Resource Gap Analysis for New York’s Southern Tier Region
This report includes templates and instructions for doing this work in other communities.
- DOE Career Mapping Tools
 - HVAC: <https://hvaccareermap.org/>
 - Green Buildings: <https://greenbuildingscareermap.org/>
 - Solar : <https://www.irecsolarcareermap.org/>
 - Advanced Manufacturing: COMING SOON
- Safety Guide for Career and Technical Education
https://www.doe.virginia.gov/instruction/career_technical/cte-safety-best-practice-guide.docx
Guide developed by the State of Virginia that includes an overview of elements to consider related to safety and risk management in hands-on training programs.
- Weatherization Assistance Program Installer Badging Toolkit
<https://sws.nrel.gov/installerbadges>
This free and customizable toolkit offers resources and structure for hands-on training and skills recognition for the Weatherization Assistance Program and private sector home energy trainers and employers. Although HVAC/R and heat pump technologies are not included as a badging option at this time, ICAST could use the format and templates and work with its employer partners to adapt the resources for its training.
- Work-Based Learning Toolkit, Association for Career and Technical Education (ACTE)
<https://www.acteonline.org/professional-development/high-quality-cte-tools/high-quality-cte-library/work-based-learning/#toggle-id-2>
 - Work-Based Learning Data Collection Toolkit
 - Resource Guide for Building an Employer Partner Engagement Plan
 - Strengthening Employer and Industry Engagement: A Self-Assessment Tool for Youth Apprenticeship Leaders
 - Work-Based Learning Manual
 - Work-Based Learning Toolkit.