



Spotlight: Construction, Installation, and Maintenance Workers

Teacher Manual: Lesson 15

Essential Question

How do construction, installation, and maintenance workers contribute to climate solutions?

Learning objectives: Students will be able to

1. Identify various construction and maintenance careers in climate solutions
2. Understand the growing demand for these roles due to state climate goals
3. Explore the skills and training needed for these careers
4. Discuss how these careers align with their personal interests and skills.

Lesson Summary

This is one of seven lessons to highlight specific climate-critical in-demand careers.

The career-specific lessons include:

11. Electricians
12. Engineers
13. Lineworkers
14. Managers and Analysts
15. Construction, Installation, and Maintenance Workers
16. Wind Turbine Technicians
17. Sales and Customer Services Workers

Technology referenced in this lesson:

- Solar
- Wind
- Heating, ventilation, and air conditioning (HVAC)
- Building electrification
- Transportation electrification

Careers referenced in this lesson:

- Construction workers and construction managers
- HVAC technicians
- Weatherization technicians
- Plumbers and pipefitters
- Sheet metal workers
- Insulation specialists
- General laborers
- Solar installers
- Carpenters
- Electricians

Agenda	Timing	PPT Slide	Pre- lesson
Opening Activity	5 minutes	2	
Present agenda and learning objectives	5 minutes	3–5	
Direct Instruction Video Introduce technology Introduce careers	20 minutes	6–10	
Primary Learning Activity Partner or small group work Reinforce what was learned	20 minutes	11–12	
Closing Review learning objectives Closing activity Reflection	5 minutes	13–15	
Extension			
Handouts			
TOTAL TIME	55 mins		

Preparation:

- Read the Student Presentation Deck (PPT)
- Watch the video(s) included in Student Presentation Deck (most are available on the [MassCEC YouTube channel](#))
- Print the worksheets before the class.
- Verify that the computer hosting the presentation deck is connected to the internet for video and hyperlink viewing.
- Check any links in the slide deck to ensure they work as intended, then review the content below.

Where to Learn More About the Lesson's Content

If additional preparation time is available, these resources will provide further background on the topics covered in this lesson.

1. [Massachusetts Clean Energy Workforce Needs Assessment](#). This report describes the most in-demand jobs needed to achieve MA's 2025 and 2030 climate goals.
2. [MA Building Pathways pre-apprenticeship](#)
3. [Recommendations of the MA Climate Chief](#), Oct 2023

Overview and Opening Activity (10 mins)

Materials and resources:

- Slide deck
- Worksheets

Opening activity: Get the students thinking and talking right away.

Instructions:

- Divide the students into small groups of two or three.
- Ask the students to think about an activity they did for any previous lesson in this class.
- Instruct the students to discuss the following question within their groups: *How do construction, installation, or maintenance workers make that project possible?*

Examples:

- Energy efficiency improvements to the building envelope
- High-performance buildings with efficient HVAC systems.
- Community solar projects
- Networked geothermal projects
- Offshore wind projects
- Electric vehicle (EV) charging networks
- Encourage the students to discuss with their partner(s) how construction or installation workers made that project possible and what key role these workers contributed.
- Ask one or two groups to share aloud with the rest of the class.

Present the agenda. Students should be familiar with the format:

- After the opening activity, they will learn new information. The main activity helps them apply the new information and practice in the climate-critical occupation. The closing activity helps them synthesize what they learned and helps with knowledge transfer.

Present the big question and lesson objectives:

- Ask the students how construction, installation, and maintenance workers contribute to climate solutions.
- Identify various construction and maintenance careers in the field of climate solutions.
- Understand the growing demand for these roles due to state climate goals.
- Explore the skills and training needed for these careers.
- Discuss how these careers align with their interests and skills.

Direct Instruction (20 mins)

Provide information to help the students achieve the learning objectives and prepare them to actively engage with the activity.

- Use inquiry-based learning strategies to engage learners where possible.
- Highlight careers related to the technologies.
- Help the learners to relate the learning to themselves and their communities.

Job types:

Review each type of worker by asking the students to explain briefly what they believe each job type is and then fill in what they miss.

- **Construction workers:** Build the infrastructure for clean energy projects. They work on everything from setting up solar array foundations to installing insulation.
- **HVAC technicians:** install energy-efficient systems.
- **Weatherization technicians:** make buildings more energy-efficient by adding insulation.
- **Plumbers and pipefitters:** install efficient heating systems and reduce water waste.
- **Sheet metal workers:** manufacture and install energy-efficient duct systems.
- These roles all directly impact building a cleaner, healthier Massachusetts.
- Meeting our climate goals means there will be an increased demand for these roles.
- Construction workers will be needed for all clean energy projects, including energy-efficient building projects and retrofits, and for installing the infrastructure to support electric vehicles and utility-scale solar projects.
- Weatherizing homes to improve their efficiency and envelope requires adding insulation, sealing air leaks, updating windows and doors, and making other upgrades. Weatherization techs help with all of these projects.

- Technicians who install efficient heat pumps, water heaters, and other HVAC systems will continue to help residents move away from fossil-fuel-dependent systems.
- Those same HVAC systems and other duct systems require sheet metal workers, who are also involved in constructing new energy-efficient buildings and retrofitting older buildings.
- No matter the project, these people are essential to getting it done.

MA climate goals:

- Build on previous knowledge. MA has ambitious goals to achieve net-zero energy by 2050.
- As Massachusetts works toward climate goals, demand for HVAC technicians, insulation experts, weatherization technicians, and other skilled workers is rising.
- According to the Massachusetts Energy Efficiency and Decarbonization Plan, between 2025 and 2027, the state plans to weatherize over 185,000 homes and small businesses.

Skills and training:

- Careers in these fields are accessible in part because training opportunities are widely available, even if you are looking for highly specialized training in a specific skill set.
- These are some of the primary skills that you need to be successful in these careers:
 - **Strength and stamina:** All of these careers are physical and labor-intensive, at least some of the time. Even if you are interested in a specialization that focuses on something requiring less strength, you would need to be trained more generally first.
 - Most of these roles require a decent math level, especially regarding measurement. **Geometry and measurement** are critical in any building project.
 - Most of these roles require the ability to read **blueprints** or other **schematic diagrams**. If you enjoy reading these kinds of visual maps, this might be something to consider.
 - Finally, all of these roles rely on **specific tools and machinery**. It is critical to recognize tools, learn how to use them, and know what to use when.
- Training depends on what specific field you want to go into. Some general training offerings are probably required or recommended, no matter how you specialize.
- An OSHA 10 certificate is a safety certification that is required for anyone who will be working on a job site. In most cases, you won't be allowed on a job site without this certification. Sometimes, jobs may require a higher certification, such as an OSHA 30, but an OSHA 10 is the minimum.
- The New England Laborers' Training Academy in Hopkinton, MA is a union training center where workers can receive training even if they have little or no formal training.

- Workers can also seek out specific licenses and certifications. For example, you could get a Construction Supervisor License, which would allow you to receive a higher pay rate and would allow you to be a supervisor or manager on a job site.

Primary Learning Activity (20 mins)

Materials:

- Worksheets

Activity Objective: Students will develop critical thinking, teamwork, and problem-solving skills while learning about the unique and specialized contributions of construction, maintenance, and installation workers to clean energy projects.

Recruit Your Project Dream Team

Determine which construction or installation workers are needed to complete your clean energy project:

- What workers are needed?
- What skills are required?
- What challenges might the project face?

Instructions:

- Divide the students into groups and assign each group one of the four clean energy projects from their worksheets:
 - Group 1: Solar panel installation on a school building
 - Group 2: Weatherization of an apartment building to improve energy efficiency
 - Group 3: Installation of EV charging stations in a downtown community parking lot
 - Group 4: Installation of heat pumps in a community of residential homes to replace oil or gas heating
- Instruct the students to work within their groups to assemble their “dream team” of construction, installation, and maintenance workers to complete the project. They should
 - Consider the skills, tools, and expertise needed to complete the project
 - Consider the challenges the project is likely to face and the roles that will be best suited to help overcome them
 - Decide which roles they want to “hire” on their project crew
- Ask the students to present their project and assembled crew to the class (approximately one minute per presentation).

Presentations and debrief:

- Discuss the different approaches the groups took to build their team.
- Identify how these teams contribute to clean energy and climate goals.
- Draw attention to any recurring skills (technical skills such as electrical work or general skills such as problem-solving):
 - Which skills were needed most often across these projects?
 - Which skills can help meet the everyday challenges these projects would face?
- Connect each group’s project and presentation to the Big Question: how do these workers contribute to climate solutions?
- Connect each group’s presentation back to the learning objectives.
- Point out common challenges, such as weather, space limitations, and safety concerns; the success of these projects requires workers who can adapt to these circumstances.
- Highlight that the students’ “dream teams” reflect the real-world teams that Massachusetts needs to reach its climate goals.

Summarize key takeaways:

1. Construction and maintenance careers are critical to climate goals.
2. These jobs require hands-on skills, and there are many ways to gain training.
3. Exploring these careers can lead to meaningful work in clean energy sectors.

Differentiations and Adaptations: Learning Activity

For students who benefit from visual supports: Create a role-matching chart.

Adaptation: Provide a chart or infographic with visuals for each worker’s role, including icons or images representing their tools and everyday tasks. Students can use this as a reference to match roles to tasks during their planning process.

Goal: To help students who process information more easily when presented visually better understand the roles and how they connect to specific tasks. This makes it easier for them to select their project crew.

For students who benefit from tactile activities: Use a physical role-matching activity.

Adaptation: Create task and role cards that students can physically sort and match during their planning. Each card could represent a task (e.g., installing solar panels, wiring, or conducting safety checks) or a worker role (e.g., electrician, installer, safety officer). Groups can arrange these cards on a board or table to visualize their project crew setup.

Goal: To engage students who learn best through hands-on activities by making the task selection process interactive and tactile.

For students who struggle with open-ended tasks: provide a pre-scaffolded example.

Adaptation: Offer a partially completed example of a project crew plan, showing one or two roles and their associated tasks for a similar clean energy project. Students can use this as a starting point to build and customize their own crew plan.

Goal: To support students who may find the activity overwhelming by giving them a concrete example to guide their thinking and reduce decision-making stress.

Closing Activity (5 mins)

Materials:

- Presentation/slide deck, slides
- Reflection journal or worksheets

Activity objective: To encourage students to reflect on key takeaways and identify areas of curiosity for further exploration.

Instructions

- Ask the students to take one minute to think about the lesson and respond to these questions:
 - What specialized skills distinguish construction, installation, and maintenance workers?
 - What questions do you still have about skills and training for these careers?
 - In what ways are construction, maintenance, and installation workers critical to the clean energy transition?
- Go around the room, asking students to share their answers.
- Encourage brief discussions or clarifications if students' questions are particularly thought-provoking.

Check individual understanding of the learning objectives.

Extensions: If learners are loving this topic and want more . . .

Explore Tools and Technology in Clean Energy Construction

Prompt: Research the tools and technologies used by maintenance, installation, and construction workers in clean energy projects, such as specialized cranes for wind turbines,

solar panel mounting systems, or diagnostic tools for maintenance. Create a presentation, model, or poster showcasing one tool, explaining how it works and why it's essential for clean energy projects.

Goal: To encourage students to delve into the technical aspects of these roles, fostering curiosity about the equipment and technology that enable clean energy projects.

Design a Training Program for a Clean Energy Role

Prompt: Choose a clean energy role (e.g., solar panel installer, wind turbine technician, or geothermal driller) and design a training program for someone new to the role. Outline the key skills they need to learn, the tools they should become familiar with, and how they will practice them. Present your training program in a step-by-step format.

Goal: To help students explore the skills and preparation required for clean energy careers, emphasizing workforce development and education.

Investigate Safety in Clean Energy Work

Prompt: Research the safety regulations and challenges for a specific clean energy role (e.g., working at heights on wind turbines, handling high-voltage systems, or drilling for geothermal energy). Create a report or infographic that outlines the major safety concerns, the equipment or procedures used to address them, and why safety is critical in these roles.

Goal: To provide insights into the importance of safety in clean energy careers while connecting students to the real-world challenges workers face.

Handouts: Group Activity (below)

Assembling Your Project Crew

Instructions

You must assemble a project team with the necessary skills and expertise to complete an assigned job. Work with your group to review the details of your assigned project, review the roles available for hire, determine which roles you need on your team, and assemble your ideal crew. Be prepared to share your crew plans with the rest of the class and explain your selections.

Project Details

Group 1: Solar Panel Installation on a School Building

- Install solar panels on the roof of a local school building.
- Ensure the system is safe, efficient, and ready to connect to the school's electrical grid.
- Address challenges such as roof access, securing panels, and system wiring.

Group 2: Weatherization of an Apartment Building

- Seal air leaks, insulate walls, and upgrade windows and doors.
- Ensure that the building is comfortable for residents and reduces energy waste.
- Address challenges such as working around occupied units and ensuring minimal disruption.

Group 3: Installation of Electric Vehicle Charging Stations

- Install charging stations in a community parking lot to support electric vehicles (EVs).
- Ensure the stations are durable, user-friendly, and properly connected to the electrical grid.
- Address challenges such as planning for future EV capacity and accessibility for users.

Group 4: Installation of Heat Pumps in Residential Homes

- Replace oil or gas heating systems with efficient heat pumps in a neighborhood of homes.
- Ensure each home has a properly installed, energy-efficient heating system.
- Address challenges such as varying home layouts and electrical needs.

Available Crew Roles

1. Electrician

Responsibilities: To handle wiring, system connections, and electrical troubleshooting

Skills: Knowledge of electrical systems, safety practices, and grid integration

2. Carpenter

Responsibilities: To build and modify structures to support installations, such as panel mounts or insulation frameworks

Skills: Precision in cutting, assembling, and adapting materials

3. Heating, Ventilation, and Air Conditioning (HVAC) Technician

Responsibilities: Install and maintain heating, ventilation, and air conditioning systems, including heat pumps

Skills: Mechanical skills, system knowledge, and troubleshooting expertise

4. Solar Installer

Responsibilities: To install, secure, and test solar panel systems

Skills: Mechanical aptitude, knowledge of solar systems, and physical stamina

5. Insulation Specialist

Responsibilities: To apply insulation to walls, attics, and other areas to improve energy efficiency

Skills: Attention to detail, material knowledge, and safety practices

6. Construction Manager

Responsibilities: To oversee the project, coordinate team efforts, and ensure timelines are met

Skills: Leadership, organization, and problem-solving

7. General Laborer

Responsibilities: To provide physical support for all tasks, including material handling and site preparation

Skills: Flexibility, physical stamina, and a willingness to assist in various tasks

Discussion Prompts

Use the prompts below to evaluate your project needs and assemble your ideal crew.

What are the key tasks to complete your assigned project?

Which skills are necessary to complete your project?

What challenges might your project face? Which roles can help overcome them?

Which roles do you select for your crew, and how will each contribute to your project's overall success?