Climate Solutions for Our Homes and Schools

Teacher Manual: Lesson 3

Essential Question

How can climate technologies help homes and schools become part of the climate solution?

Learning objectives. Students will be able to

1. Explain how solutions such as weatherization, heat pumps, solar energy, efficient appliances, and battery storage make homes and schools climate solutions
2. Discuss how their own home, school, and community can be part of the climate solution.

Lesson Summary

This lesson is focused on how we can make everyday spaces more climate-friendly, in addition to exploring what's being done and what else can be done by individuals and institutions to adopt and integrate climate technologies that reduce energy usage and shift Massachusetts toward cleaner sources of energy.

Technology referenced in this lesson:

- Solar panels
- Energy-efficient appliances
- LED light bulbs
- Heat pumps
- Electric vehicles
- Improving building weatherization
- Industrial recycling

Careers referenced in this lesson:

- Energy auditor

Agenda	Timing	PPT Slide
Opening Activity	5 minutes	4
Present agenda and learning objectives	5 minutes	6–8
Direct Instruction Video Technology introduced Careers introduced	20 minutes	8–11
Primary Learning Activity Partner or small group work Reinforce what was learned	20 minutes	12–13
Closing Review learning objectives Closing activity Reflection	5 minutes	14–17
Extension		
Handouts		
TOTAL TIME	**55 mins**	

Pre-lesson

preparation:

- Read Student Presentation Deck (PPT).
- Watch the video(s) included in the Student Presentation Deck (Most are available on the MassCEC YouTube channel).
- Print the worksheets and handouts prior to 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 make sure they work as intended, and then review the content below.

Where to learn more about the lesson's content

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

- MassCEC/Clean Energy Lives Here/Clean Energy Solutions for Your Home
  An extensive (subdomain) website loaded with information on why and how to use clean energy alternatives in the home.

- Brighter Future: A Study on Solar in US K-12 Schools
  Download this 40-page report from September 2022 and/or review its key findings on the generation180.org website.

Overview and Opening Activity (10 mins)

Materials and resources:

- Slide deck
- Student worksheets

Opening activity: Get students thinking and talking right away.

Activity objective: To introduce critical vocabulary related to climate technology in a nontechnical way that encourages curiosity, engages critical thinking, and prepares students for the concepts covered in the lesson. This allows students to make educated guesses and become familiar with terms they'll encounter throughout the lesson and course.

Instructions:

Students will explore new vocabulary related to climate solutions that help homes and schools use energy more efficiently and reduce carbon emissions. They may not know all the terms, but they should try to guess the meaning before the answer is revealed.

- Show each word one at a time. Click to display each vocabulary word, then click again to reveal the definition (on animations).
- For each word, ask students what it means and call on two or three students to share their response before revealing the answer.
- Encourage creative thinking and collaboration between students; the purpose is to engage students rather than insist on correct answers.
- Close the activity by explaining that today's lesson will explore how some of these solutions relate to spaces that students occupy every day: homes and schools.

- **Present the agenda.** Students should be gaining familiarity with the format:
  - After the opening activity, they will learn new information. The main activity is intended to put them in the role of the school's energy auditor. The closing activity helps them identify specific ways they will commit to facilitating change and/or learning more.

- **Present the big question and lesson objectives** (see top of page 1):
  - Ask students for one example of something they've seen that helps reduce emissions at home or school. Their answers could all be examples of climate technologies.

- Today, we'll explore technologies that make everyday spaces more sustainable and energy efficient.

Key points to emphasize:

- Stress the learning goals for the lesson.
- Accentuate the tools in today's lesson that students can use in their lives today and in pursuit of future careers.
- Describe how today's learning goals connect directly to real-world skills and solutions to the climate crisis.

Possible discussion questions:

- In what ways do our homes and schools use energy?
- Which of those ways do you think consume the most/least amount of energy?

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.

Show the video *Fitchburg High School Solar Project* (3–5 minutes) and follow it with a brief check-in to hear what students took away.

Video debrief:

- What are some of the benefits of a solar canopy at the school?
- What are some of the job roles needed for a commercial solar project like this one? Which ones sound most interesting?
- Why are so many schools in Massachusetts investing in solar electric systems?

Electricity Grid Mix in Massachusetts

Discussion guidance:

- Let's look at where our electricity comes from here in Massachusetts.
- Massachusetts relies heavily on natural gas, a fossil fuel like oil or coal.
- Its extraction, transport, and use (burning) release greenhouse gasses that drive climate change.
- In some buildings, natural gas is burned directly for heating, cooking, or specific

industrial processes (manufacturing and agriculture, for example).
- Natural gas is also burned in power plants to generate electricity used to power homes, schools, businesses, hospitals, coffee shops, or anywhere on the grid.

Key points to emphasize:
- This data is from 2022, so it may have changed slightly, but it's likely to be accurate even today.
- New technologies are constantly being introduced that help reduce carbon emissions, make our homes and vehicles more efficient, and lower the demand for energy use.
- You are probably familiar with many of them already.

Possible student questions: "*What are the two main ways we can lessen the impact of our energy use on the climate?*"
- Change the power source (generate power from solar or wind energy).
- Using less energy lowers the demand for energy sources such as natural gas.

Climate Solutions Are Everywhere

Discussion guidance:
- Review the climate solution technologies listed on the slide.

Key points to emphasize:
- These technologies are available today and are key to reducing our carbon footprint.
- By reducing the carbon footprint, we help combat climate change and are part of the solution.
- These solutions require people to design, implement, and manage them.
- The more climate solutions pop up in our homes, schools, communities, and everywhere else, the more demand for all kinds of clean energy jobs will increase.

Possible discussion questions:
- Do you know of other climate solution technologies that are not listed here?
- Do these climate solution technologies exist in your homes, neighborhoods, or schools?

Massachusetts Schools Lead Clean Energy

Discussion guidance:
- Call attention to how Massachusetts stands out among all US states for its leading role is the adoption and promotion of climate solution technologies.
- The rooftop solar array at Heights Elementary School in Sharon, Massachusetts, generates almost 95 percent of the school's electricity use. The system offsets 540,000 pounds of CO_2 annually and saves the town an estimated $30,000. Over its 20-year life, this is a savings of 5,200 metric tons of CO_2 and $850,000!

Key points to emphasize:

- Encourage students to reflect on the school's potential emissions.
- By demonstrating the adoption and use of clean energy on their campuses, Massachusetts schools emphasize a commitment to clean energy beyond classroom curricula—leading by example and turning ideas into actions.

Possible discussion questions:

- Do you know of other Massachusetts schools working to lower their climate impacts?
- What changes could make a difference in the emissions produced by and for this school?

Primary Learning Activity (20 mins)

Materials:

- Slide deck
- Student worksheets

Activity objective: To help students think critically about energy usage in their school and how simple changes can lead to significant energy savings while connecting to their potential future role in clean energy careers.

Introduction: One clean energy career path you may not have heard much about before is an energy auditor. That's someone who evaluates buildings such as homes and schools and recommends ways to improve efficiency, reduce energy use, and minimize a building's carbon footprint or impact on the environment. **Today, you are going to be the energy auditors for our school.**

Instructions:

- Divide the class into groups of three to four students.
- Students will do a brief energy audit of their school, focusing on lighting, heating, and electricity use. (12 mins)
- (If possible) Have groups walk around the classroom or nearby areas (e.g., hallways and restrooms) to identify things such as the following:
    - Are the lights always on, even when no one is in the room?
    - Are computers, screens, or projectors left on?
    - Are windows closed when the heating or cooling is on?
- Groups will list three to five things they found that use energy unnecessarily or could be improved, make suggestions for improvements, and share their findings with the class.

Presentations/debrief discussion guidance: (7 mins)

- Ask each group to share one finding with a suggestion for improvement.

- Ideas might include automatic lights, energy-efficient appliances, or better heating controls.
- Ask students if they were surprised by anything they discovered in their audits or excited by any of their or their classmates' suggestions for improvements.

Conclusion: Saving energy is one of the easiest ways to reduce our carbon footprint. What we did today is similar to what energy auditors do—they help people and businesses save energy so that they can implement simple changes with a big impact.

Summarize key takeaways:

1. Any building or space can adopt clean energy technologies such as weatherization, heat pumps, efficient appliances, and battery storage.
2. Several careers work to improve energy efficiency.
3. Climate solutions require creativity more than complexity.

Differentiations and Adaptations: Learning Activity (If available)

For students who need structured guidance: Provide a checklist or template.
Adaptation: Offer a pre-designed energy audit checklist with simple categories such as lighting, heating/cooling, and appliances. Include guiding questions (e.g., "Are lights turned off in empty rooms?" or "Are windows and doors sealed to prevent drafts?").
Goal: To simplify the audit process by giving students clear steps and focus points, making the activity more accessible for those who might struggle with open-ended tasks.

For students who need help with focus: Create a hands-on observation walk.
Adaptation: Turn the audit into an interactive "energy walk" around the school. Provide students with clipboards, sticky notes, or colored flags to mark areas where energy is being used inefficiently (e.g., a room with lights on when unoccupied).
Goal: To engage students physically and visually by turning the activity into a tangible exploration, which helps them better understand energy use in their surroundings.

Closing Activity (5 mins)

Materials:

- Presentation/slide deck, slides
- Reflection journal

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

Instructions: Ask students to

- Identify one action they can take to increase their understanding or involvement in the climate solutions presented in this lesson
- Write down their next step on a sticky note and place it somewhere visible, such as on the front of their notebook or inside their locker.

Discussion notes:

- Students choose and commit to specific actions they can and will take along with a means by which to regularly remind themselves of that commitment to action.

Examples of possible actions:

- Learn more about how solar energy works.
- Put weatherization seals around the windows in my house.
- Replace my light bulbs with LED bulbs.
- Clarify what can and cannot be recycled in my neighborhood and school.
- Ask my neighbor with solar panels on their roof why they installed them.
- Research careers in energy-efficient building design and construction.
- Talk to a friend or family member who works in the clean energy or climate industry about their job training.

Instructional Steps:

1. Review the learning objectives so that learners can summarize what they have learned.
2. Present the closing activity.
3. Allow time for reflection in the students' career journals.

Extensions—if learners are loving this topic and want more . . .

Design a Green School Blueprint

Prompt: Create a blueprint or drawing of your "ideal green school." Include energy-efficient features such as solar panels, LED lighting, and smart thermostats. Label each feature and explain how it reduces energy use or supports sustainability.

Goal: To encourage students to think creatively about applying energy-efficient solutions to real-world designs and deepen their understanding of sustainable practices.

Interview a School Staff Member About Energy Use

Prompt: Interview a staff member, such as a facilities manager or custodian, about how energy is used and managed at your school. Ask about current energy-saving measures and areas for improvement. Create a short report or presentation summarizing your findings and suggesting additional ways to improve energy efficiency.

Goal: To help students connect classroom learning to real-world practices and develop communication and research skills.

Handouts: Group Activity (below)

Energy Audit and Solutions for Our School

Instructions

Work with your group to complete an energy audit of your school. Use the steps and examples below to assess current energy use and identify three to five ways to make the school more energy efficient. Be prepared to share your findings and solutions with the class.

Step 1: Observing Energy Use

1. Lighting

- Are the lights energy efficient (e.g., LED bulbs)?
- Are lights turned off in unused rooms?
- Are there opportunities to use natural light instead of artificial lighting?

2. Heating and Cooling

- Are the doors and windows closed when heating or air conditioning is on?
- Are there drafts or areas where air is escaping?
- Are the thermostats set to appropriate temperatures?

3. Appliances and Equipment

- Are the computers, projectors, and other electronics turned off when not in use?
- Are there energy-saving settings on devices?
- Are vending machines or kitchen equipment energy efficient?

4. Water Use

- Are the faucets and toilets operating efficiently?
- Are there signs of leaks or water waste?

5. Other Observations

- Are there any areas where energy is being wasted?
- Are renewable energy systems (e.g., solar panels) already in place?
- Does the school provide recycling, composting, electric vehicle charging, or bike storage services?

What do you notice?

Step 2: Identifying Energy-Efficient Solutions

With your group, brainstorm ways for your school to improve energy efficiency. Here are some ideas to get you started:

- Switch to LED lighting or install motion sensors to turn lights off automatically.
- Add weather stripping or insulation to windows and doors to prevent heat loss.
- Use energy-efficient appliances or unplug devices when not in use.
- Install low-flow toilets to reduce water waste.
- Start an awareness campaign to encourage energy-saving habits among students and staff.

What three to five changes would you suggest to make the school more energy efficient?

How will these changes save energy, reduce costs, or improve the school environment?

What actions can your group take to help implement these solutions?