# Harnessing the Power of the Sun for Our Communities

**Teacher Manual: Lesson 5**

**Essential Question ("the Big Question")**
What is community solar, and what are its benefits?

**Learning objectives**. Students will be able to

1. Explore examples of community solar projects in Massachusetts
2. Identify some examples of climate-critical professionals who work together to make community solar projects successful, from the design to the outreach to the installation and maintenance phases
3. Discuss how individual solar and community solar projects can support various individual and community needs.

**Lesson Summary**

Community Solar allows people to share the benefits of solar energy—including lower emissions and reduced energy costs—without individual systems. Previous lessons have covered several ways to improve energy efficiency and lower carbon emissions. This lesson explores how communities can work together to harness the sun's power through solar energy projects and provides an opportunity to try designing solar projects for different types of communities.

**Technology referenced in this lesson:** Solar electricity

**Careers referenced in this lesson:**

- Solar site surveyor
- Community outreach specialist
- Distributed generation operator

| Agenda | Timing | PPT slide |
|---|---|---|
| | | |
| **Opening Activity** | 5 minutes | 3 |
| Present agenda and learning objectives | 5 minutes | 4–6 |
| **Direct Instruction**<br>Video<br>Technology introduced<br>Careers introduced | 20 minutes | 7–14 |
| **Primary Learning Activity**<br>Partner or small group work<br>Reinforce what was learned | 20 minutes | 15–17 |
| **Closing**<br>Review learning objectives<br>Closing activity<br>Reflection | 5 minutes | 18–20 |
| **Extension** | | |
| **Handouts** | | |
| **Total time** | **55 minutes** | |

**Pre-lesson preparation:**

- Read the Student Presentation Deck (PPT).
- Watch the video(s) included in the Student Presentation Deck (most are available on the MassCEC YouTube channel).
- Print out the worksheets and handouts prior to 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, and then review the content below.

## Where to Learn More About This Lesson's Content

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

- US Department of Energy / Community Solar Basics
  USDOE's Solar Energy Technologies Office explains the what, why, how, and where of community solar.

- MassCEC / Community Solar
  This is an introduction to Massachusetts community solar resources, opportunities, and programs.
- EnergySage: Go Solar Without Installing Panels
  Authored by Boston-based energy company EnergySage, this article details the case for community solar in Massachusetts.

---

## Overview and Opening Activity (10 mins)

**Materials and resources:**

- Slide deck
- Student worksheets

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

**Activity objective:** To encourage students to evaluate what they already know about solar projects and be ready to challenge and expand their understanding of how solar power is used in their communities.

**Instructions:**
Read the statements below one at a time. Invite students to raise their hands if they believe the statements are true. For a more physical version of the activity, designate areas of the room for "True" and "False" and ask the students to move from one location to the other depending on their answer. After the students declare their choices, ask one or two to share their reasoning. Then, reveal the answer. This is not a quiz and should not be graded or scored, though it will provide insight into what the students already know and believe about solar energy.

True/False statements:

1. Solar panels convert sunlight directly into electricity.
   **True.** Solar panels use photovoltaic cells to convert sunlight into electrical energy.
2. Solar panels can only generate electricity on sunny days.
   **False.** Solar panels can generate electricity on cloudy days, although they are more efficient in direct sunlight.
3. Solar power makes a noticeable impact on carbon emissions only in places with a lot of sunlight, such as deserts.
   **False.** Solar energy can benefit many climates, including places that experience colder or cloudy weather.
4. Community solar projects are only available to businesses and large facilities, not individual households.

**False.** Community solar projects can be designed to benefit businesses and individual households.

5. Community solar projects allow people to benefit from solar energy without having solar panels on their property.

   **True.** Community solar lets people share the energy produced by a central solar facility.

6. You must own a home to participate in a community solar project.

   **False.** Renters and those who don't own homes can participate in community solar projects.

7. Solar panels are silent and don't produce any noise pollution.

   **True.** Solar panels generate electricity quietly, making them an excellent option for urban and residential areas.

8. Solar power contributes to air and water pollution.

   **False.** Solar power does not produce air or water pollution.

9. Solar energy can be stored in batteries for use when the sun isn't shining.

   **True.** Solar energy can be stored in batteries for later use, such as at night or on cloudy days.

10. The cost of solar energy has decreased significantly in the last decade.

    **True.** The cost of solar energy has dropped significantly due to technological advances and increased production.

**Present the agenda**

Students should become familiar with the format: After the opening activity, students will learn new information. The main activity requires students to work in groups to create a persuasive pitch for a community solar project in a fictional town. The closing activity asks individual students to answer one of two questions about the potential impacts of community solar.

**Present the Big Question and the lesson objectives** (see top of page 1):

- Review two examples of successful community solar projects in Massachusetts: Brewster Community Solar Garden and the Harvard Solar Garden.
- Today, students will explore community solar strategies and how these projects can benefit diverse populations.

**Key points to emphasize:**

- Highlight that Massachusetts is a leader in community solar, with over 1,500 megawatts (MW) installed as of 2023.
- These and other community solar projects save customers money and contribute significantly to Massachusetts's clean energy goals!

**Possible discussion questions:**

- Where might a community solar project be located in your community?
- What could you say to persuade your neighbors to support a community solar project?

## 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 when possible.
- Highlight careers related to the technologies.
- Help the students to relate the material to themselves and their communities.

**Show the video *What Is Community Solar?*** (3–5 mins), and follow it with a brief check-in to hear what students took away.

**Video debrief:**

- What stood out to you?
- What part of the video inspired you the most?
- Is there anything you want to learn more about?

**Introduction to Solar**

**Discussion guidance:**

- Call on one or two students to share what they already know about solar energy.
- Discuss how solar panels and solar electricity work.

**How solar panels work (basic):**

- Solar panels are made of solar cells, which are typically made from silicon.
- When sunlight hits the cells, particles of light called photons knock electrons loose.
- These free electrons flow through the cells, creating an electric current.
- The current is collected by wires and used as electricity to power homes, devices, and anything else that runs on electricity.
- Solar panels have no moving parts, making them durable and long-lasting.

**Community Solar Technology**

Review the main components of these community solar systems using the labeled illustration shown on the screen:

1. Solar panels convert sunlight into electricity, harnessing renewable energy to power homes and businesses.
2. Solar batteries store energy generated by solar panels, providing power during nighttime or cloudy days and enhancing energy independence.
3. Inverters convert direct current (DC) from solar panels into alternating current (AC), making the energy usable for homes and businesses.
4. Transformers adjust electrical voltage levels, stepping them up or down as needed for safe transmission and efficient power distribution.
5. Metering and switchgear keep electrical systems safe and allow technicians to monitor

the operation of community solar systems.

6. Utility grids are networks that distribute electricity from producers to consumers, ensuring a consistent power supply across various locations.

**The benefits of using solar electricity:**

- Clean and renewable energy
- Reduction of pollution and carbon emissions
- Potential savings over time
- Ability to store power in a battery for later use
- Flexible arrangements and designs

**Possible check-in questions:**

- True or false: Solar panels generate more power in colder temperatures. (True)
- True or false: Solar panels generate more power when positioned perpendicular to direct sunlight. (True)

**Energy Equity**

**Discussion guidance:**

- A MassCEC map shows the uneven distribution of community solar projects within Massachusetts as of 2022.
- Invite one or two students to respond to this question: *Why do some communities have more access to solar energy than others?* Answers: Pollution, site access, resources to build a solar farm, and community support

**Key points to emphasize:**

- Community solar projects can benefit areas and individuals that cannot install their own solar panels, including renters and those without suitable space for solar installations.
- Community solar projects can help make solar energy more accessible for everyone, contributing to energy equity.
- Energy equity is a form of environmental justice that describes equal access to resources such as clean energy.

**Possible discussion questions:**

- Is access to information a barrier to energy equity? If so, how?
- Would you be willing to live next door to a community solar facility? Why or why not?
- Would you be willing to live next door to a nuclear power facility? Why or why not?

**Show the Nexamp video *Community Solar: What It Is and How It Works*** (3–5 mins), and follow it with a brief check-in to hear what students took away.

**Video debrief:**

- What stood out to you?
- What part of the video inspired you the most?
- Is there anything you want to learn more about or try here at your school?

**Solar Site Surveys**

**Discussion guidance:**

- Only some locations are cost-effective, productive sites for installing solar electric panels.
- Professionals know how to "survey" any location—whether rooftop, yard, or open space—to determine whether it's a viable site, capable of producing plenty of solar electricity for use by homes, buildings, and vehicles.

Key points to emphasize:

- If the site is suitable, workers design and install a system that provides some or all of the site's required electricity, which lowers emissions and energy bills.
- Suppose a solar project site is located far from its intended use. In that case, solar electricity can travel along the same electric power transmission lines used by any electricity produced by other means.

**Possible student questions:**

- Wherever the site, what kind of maintenance do solar panels require? Answer: Periodic washing and inspection for damage and the surrounding foliage should be cut back to prevent shading.
- How can solar site surveys be performed remotely? Answer: It's common for solar site surveyors to use tools such as Google Earth or drone-based cameras to gather the information they need.

---

## Primary Learning Activity (20 mins)

**Materials:**

- Slide deck and slides
- Student worksheets

**Activity objective**: To allow students to apply what they've learned about community solar and think critically about how solar energy projects can be tailored to various communities with unique needs.

**Instructions:**

- Divide students into four groups. Depending on the class size, you may decide to assign more than one group to each of the four communities for the activity.
- Assign each group to one of the four communities on their worksheets: City Center, Historic District, Suburban Town, and Rural Community.
- Working together, each group will do the following:
    - Analyze the details of their community provided on the worksheets. Students will focus on the unique needs and opportunities of their community, including any challenges that must be overcome.
    - Create a persuasive pitch for a community solar project in their assigned community. Each group will need to consider the characteristics of their community when creating their pitch. Students will use the pitch structure provided in their worksheets: Introduction, Benefits, Challenges, and a Call to Action.
    - Prepare to present their pitch to the class.

**Guiding questions for closing the discussion:**

- Which pitch did you find the most compelling, and why?
    - Encourage students to share what made a particular pitch stand out. Was it how they addressed the community's needs? Creativity? Clarity?
- What challenges do you think are most common across different communities when implementing new community solar projects?
    - If necessary, help students identify common barriers such as funding, infrastructure, or community buy-in.
- How could projects like these help address energy equity issues in underserved communities?

**Summarize key takeaways:**

1. Community solar projects allow multiple participants to share the benefits of a single solar installation, increasing access to renewable energy.
2. Successful community solar programs prioritize collaboration, location suitability, and community involvement.
3. Environmental justice ensures that disadvantaged communities access clean energy and its benefits.

**Differentiations and Adaptations: Learning Activity** (if available)

**For students who benefit from more interaction, use visual aids or models.**
**Adaptation**: Allow groups to create a visual aid or model to accompany their pitch, such as a poster, diagram, or 3D model of their solar project. Provide materials such as markers, chart paper, and building blocks.
**Goal**: To engage students who do better with hands-on activities by allowing them to express their ideas in a tangible way that complements their verbal presentation.

**For students who struggle with public speaking, provide options for presentation styles.**
**Adaptation**: Allow groups to present their pitch in alternative formats, such as recording a video, creating a digital presentation (e.g., using Google Slides or PowerPoint), or writing a script that another group member can read aloud.
**Goal**: To reduce anxiety for students uncomfortable with public speaking while still allowing them to share their ideas and contribute meaningfully to the activity.

## Closing Activity (5 mins)

**Materials:**

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

**Activity objective:** To enable students to demonstrate their understanding of the lesson objectives by answering one of the following two questions:

- How can community solar projects positively impact Massachusetts's climate goals?
- How can community solar address energy equity in your community?

**Discussion notes:**

- Give students 30–60 seconds to consider their reflections.
- Call on students individually, and invite them to respond to one of these reflection questions. They may respond to both if they wish, but they only need to respond to one.

**Instructional steps:**

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

---

**Extension: If learners are loving this topic and want more . . .**

**Design your community solar plan.**
**Prompt**: Choose a community in your area that interests you. Research its energy needs and characteristics, such as population size, typical weather, and energy costs. Then, design a community solar plan tailored to that community. Include details such as location, estimated costs, and benefits. Present your plan as a short report, poster, or slide presentation.
**Goal**: To deepen understanding by applying concepts to a real-world scenario while fostering research and critical thinking skills.

**Explore careers in community solar development.**
**Prompt**: Research a career related to community solar projects, such as a renewable energy project manager, solar installation technician, or environmental policy advocate. Create a summary or presentation about the role, including the skills and qualifications needed, typical responsibilities, and how the career supports renewable energy and sustainability goals.
**Goal**: To help students connect their interest in community solar to potential future career paths, encouraging exploration of real-world opportunities not necessarily covered by this course.

**Handouts: Group Activity (below)**

# Pitching Community Solar

## Instructions

Read the profile of your assigned town area below. Then, complete the worksheet on the next page to create your Community Solar Project pitch.

## Community Profiles

### City Center

**Population:** 200,000
**Building types:** High-rise apartments, office buildings, small businesses, and public transportation hubs
**High energy usage:** Electricity needed for lighting, air conditioning, and public transit
**Challenges:** Limited roof space, high electricity demand, noise pollution, and shading from tall buildings
**Opportunities:** Large rooftops on office buildings and public transportation hubs, interest in reducing energy costs for businesses, and the involvement of local businesses and public services in the project

### Historic District

**Population:** 100,000
**Building types:** Older buildings, historic homes, museums, schools, and government buildings
**Moderate energy usage:** Many energy-inefficient older buildings
**Challenges:** Historic preservation rules that limit building changes, shading from tall trees, and limited space for solar panel installations
**Opportunities:** Many flat roofs on public buildings (schools and museums), strong community support for environmental projects, and the possibility of energy efficiency upgrades paired with solar

### Suburban Town

**Population:** 50,000
**Building types:** Single-family homes, schools, shopping centers, and parks
**Moderate energy usage:** Peak usage during summer for air conditioning and winter for heating
**Challenges:** Homeowner reluctance to install solar panels due to upfront costs and some homes being unsuitable for rooftop solar panels due to shading and roof conditions
**Opportunities:** Large parking lots at shopping centers and schools are ideal for solar panel installations, and the potential for neighborhood collaboration on community solar

### Rural Community

**Population:** 5,000
**Building types:** Farms, single-family homes, and small businesses
**Low to moderate energy usage:** Higher energy use on farms for machinery and irrigation
**Challenges:** Long distances between homes, less infrastructure, and limited internet access
**Opportunities:** Large open spaces for ground-mounted solar installations, interest from farmers in reducing energy costs, and the potential for solar to support farming operations

## Discussion Prompts

Complete the worksheet below to craft a pitch for your community solar project.

**What is your assigned community?**

**Introduction: Introduce your town and explain why solar energy is vital.**

**Benefits: Explain the benefits of community solar for your community.**

**Challenges: Identify two or three key challenges to the project and propose ideas to overcome them.**

**Call to action: Give a persuasive argument for why this project should happen now.**