Renewable Energy

Sustainability

Teacher's Guide

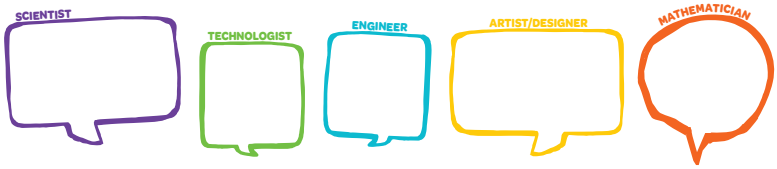
This guide provides teachers with information on using the student Renewable Energy Thinking Sheet as a rich multidisciplinary exploration of sustainability, inquiry, and visualization using STEAM teams' approach to problem solving.

There are sustainable alternative energy options that can replace non-renewable sources such as fossil fuels. The one that most classrooms start to explore is the sun's energy, captured by solar panels. Depending on your students' age and interests they might also explore energy from:

- wind, using wind turbines to convert air movement into electricity
- oceans, converting wave movement into energy people can use on land
- the Earth, using geothermal energy for heating and cooling
- plant and animal waste decomposition, using biogas recycling and anaerobic bacteria digestion.

- Have students form STEAM teams to research natural and renewable energy sources.
- The RESPOND section of their Thinking Sheet is focused on observations of what energy is used for and their research on the energy sources that power those uses. Challenge students to think of actions they can take and what changes they can advocate for when thinking of ways to make each energy use more sustainable. There is room for students to sketch and write their ideas on the towers.
- For young children who are not yet able to complete the written Thinking Sheet, plan creative movement and pantomime activities so they can show how the power of the sun, wind, and a waterfall feel and move.
- For older students, their research could include exploring the equipment and processes for capturing geothermal energy from the Earth's core and biogas energy from decomposing waste, especially animal digestive byproducts.

Curiosity fuels their inquiry. Students can connect their curiosity to STEAM careers by asking questions from the point of view of Scientists, Technologists, Engineers, Artists/designers, and Mathematicians. Examples of what each discipline might ask about solar energy include:



- **Scientist**: How can the sun's energy be captured and used in ways that replace fossil fuels? Why is solar energy renewable while the fossil fuels it replaces are finite?
- **Technology Expert**: What is the role of technology in communicating information about solar energy from the collection site to the distribution and storage facilities? What sorts of technological security protections are needed to prevent any misuse or compromise during the collection or distribution of solar energy?
- **Engineer:** How does specially designed equipment convert the sun's energy into electricity? What materials are needed? How can solar power be stored to use during times when the sun isn't shining? How can engineering enable energy to be collected, transmitted, stored, shared, reallocated and delivered to areas where it is needed?
- **Artist/Designer**: How can small solar devices be designed for various use-case needs such as solar-powered signs, solar cars, etc.? How can aesthetically pleasing solar farms be designed so neighbors won't view the landscape as an eyesore? Are there different solar panel designs that might increase the effectiveness for various types of terrain or geo-positioning locations?
- **Mathematician**: How much solar energy is there and how much of it can be collected and used? How is solar energy measured? How much energy does one solar panel collect? How many solar panels are needed to meet the community's needs?

Crayola's Easton, Pennsylvania solar farm

Crayola and Renewable Energy

Crayola has a longstanding commitment to caring for the environment. In fact, the first Crayola crayons were made in 1903 in a facility that ran on hydropower from the Bushkill Creek in Easton, Pennsylvania. Crayola is proud to host a 20-acre solar field next to the Pennsylvania plant. Crayola invests in 100% renewable energy from solar power for U.S. manufacturing—enough to make more than 3 billion crayons, 700 million markers, and 120 million jars of paint a year. These 33,000 solar panels also enable Crayola to redirect any excess electricity back to the grid to help offset community needs.

Crayola Education

TEACHER'S GUIDE to Student Thinking Sheet

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When students make their thinking visible, the creative experience becomes an authentic assessment tool that educators can use to discern what they know and wonder about. Encourage students to:

- focus on an energy source and the equipment needed to capture and distribute that energy
- show what natural elements are needed (sun, water, waves, underground cave or cavity, etc.) to use that renewable energy source
- sketch their ideas and collaborate with others to generate more innovative designs.

Water Dam Hydropower


Solar Panels


Wind Turbines

Encourage students to present their work in progress. Even when students work independently, urge them to pause periodically and share ideas with a classmate or their STEAM team members. Collaboration often leads to more innovative thinking. Culminating presentations and work-in-progress conversations help students wonder more, build deep understandings, and engage in collegial relationships that resemble real-world STEAM teams.

At the end of the activity, ask students to help you assess how the project went, what they enjoyed, and what changes they recommend for next time the class does a similar activity. Ask students to help you set goals for the next activity. Regardless of the subject matter, how could they improve their inquiry, collaboration, artistic, and presentation skills?

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