Renewable Energy

Sustainability

Project Plan

Introduction

Humans have always used energy to make life easier. Many traditional energy sources are not renewable, meaning the supply of fossil fuels is being depleted. We can capture energy from sustainable resources, such as the sun, wind, and water.

LEARNING OBJECTIVES

Students will:

- look at energy sources through a multidisciplinary STEAM lens
- form teams to select and explore a sustainable energy source
- create a prototype of their team's sustainable energy source
- present their prototypes to demonstrate the STEAM team's understanding
- connect insights from all the teams' prototypes to develop a fuller understanding of several renewable energy sources.

Pine Arts Collaborative

Vocabulary

energy
renewable
finite
design thinking
prototype
fossil fuel
solar panel
hydroelectric power
biogas
wind turbine
geothermal

SUPPLIES

- recycled items including cardboard, string, and small boxes
- natural items such as pebbles and twigs
- recycled paper including aluminum foil
- crayons and markers
- scissors, glue, and tape

PREPARE

Solar panels are an example of renewable energy that is found in many communities. Students may find it helpful to visit a solar farm or interview someone who is using solar energy in their home, factory, school, or other facility. Additionally, students' online research will provide them with facts and insights helpful to designing their prototypes and understanding their selected source of renewable energy.

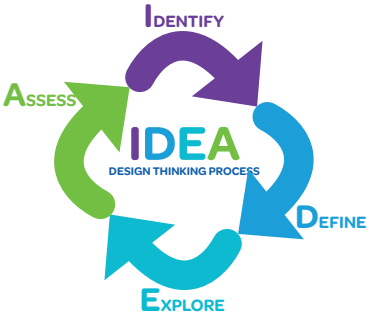
Essential Questions

- What are some similarities and differences between finite and renewable energy resources?
- Why is it important to replace finite energy sources with renewable energy?
- What are some innovative ideas for how to make renewable energy more accessible?

Guiding Questions

- How does location determine which renewable energy sources are available?
- What features should be designed into an alternative energy prototype?
- How can the prototype be presented in an informative and convincing format?
- Why is working with a collaborative team important for generating innovative prototypes?

Applying the Design Thinking process to this project:



- **IDENTIFY** and research sustainable energy sources that could be alternatives to fossil fuels.
- **DEFINE** possible solutions to an energy problem your team decides to explore.
- **EXPLORE** ways to create a prototype of a sustainable energy source.
- **ASSESS** how the prototype your team created demonstrates your team's understanding of renewable energy.

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

PROJECT PLAN

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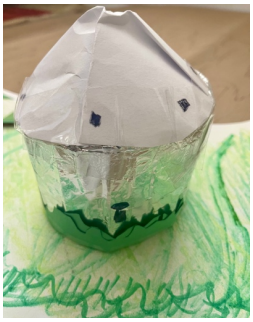
- Have students research where the energy that powers your school comes from. Are both finite and renewable energy resources being used?
- Next have students individually identify examples of renewable energy that interest them as they consider solar, wind, geothermal, biogas, and hydropower. Then help the class divide into STEAM teams based on which classmates share similar interests so they can collaboratively create an alternative energy prototype.

- Have each team choose one renewable energy source and continue with deeper research to learn about its benefits and challenges as well as innovative features that their STEAM team might incorporate into their prototypes.
- Ask teams to use the STEAM lenses of Science, Technology, Engineering, Arts, and Mathematics to explore energy problems and solutions. Encourage them to employ a design thinking approach which could help them Identify, Define, Explore, and Assess their innovative thinking, creative problem-solving, data analysis, collaboration, and willingness to learn from mistakes.
- Have each group use recycled materials and art supplies to create a three-dimensional prototype of their imagined equipment model that generates energy from that source. Ask them to put their prototype in an environmental context—perhaps on a cardboard roof, next to a painted river or waterfall, or on a drawing of an underground cross-section.

Student prototypes:


solar panel field


wind turbine


biogas digester


hydroelectirc power

- Have each group present their prototype and describe the collaborative process used in their design thinking. How did assuming roles as scientists, technology experts, engineers, artists, and mathematicians help them be innovative and come up with solutions?
- Following each presentation ask the audience to question the team members about their design and what they learned about renewable energy and design thinking.

- Help students connect the research they conducted for their prototypes to what they have observed or experienced. How could they advocate for increased use of solar, wind, geothermal, biogas, or hydropower, and with which decision makers might they share their renewable energy presentations?
- Help students connect the design thinking process to other problem-solving and collaborative projects they work on. Did every team member contribute to the Idea, Define, Explore, and Assess stages? Did everyone feel they were heard? Did they spend adequate time identifying the options before diving into the exciting part of making a prototype?
- Did conducting a self-assessment of their project deepen their collaboration? Did their assessment include how their prototype demonstrates their knowledge?
- Did students connect the project they worked on with the fuller picture of how renewable energy sources impact global sustainability goals?

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For Younger Students

Use your school as an energy research site. Walk around with young children and have them identify where and how power is used. For example, look in the cafeteria and observe the cooking and refrigeration needs. Look in classrooms, hallways, and the library for lighting needs, heat and air conditioning, and technology. Discuss the sources of energy for the school. Build their curiosity about fossil fuels and alternate energy sources. Have students design a remodeled school entrance that could help retain heat in the winter and air conditioning in the summer. What structural designs, such as windows that tilt out and ceiling fans, could help draw fresh air into the building during autumn and spring?

For Older Students

Encourage older students to do more research on local energy providers and innovative examples of renewable energy. They could explore the amount of electricity drawn from and added back to the grid. They could calculate the contributions from renewable sources that supplement fossil fuels. They could interview a local energy company's community liaison to learn more about energy distribution and sources and how renewable sources fit into future plans.

Student Reflections

- Why is renewable energy important?
- Where in the community can students advocate for renewable energy use? (examples: at school, with an energy provider, and/or during county or city leaders' meetings)
- What challenges did the teams encounter and what innovations could help solve those problems?
- Why is it important for energy issues to be explored by collaborative teams?

Teacher Reflections

- Which renewable energy sources were most interesting to students and what might pique their interest in exploring other sources?
- What impact did this project have on students' desire to learn about real-world energy challenges in the community and across the world?
- How could the Design Thinking process be used to address other curriculum areas where teams need to generate ideas that solve problems?
- What levels of team collaboration and shared decision making were observed? How can students help set collaboration goals to focus on making sure each team member's voice is heard and the decision-making process is inclusive?

Standards and Skill Development

Standards provide a guide to what students should know and be able to do. They help connect everyday learning experiences to the curriculum. This **sustainability** project addresses the following educational standards:

SCIENCE (NGSS)

- Communicate solutions that will reduce the negative impact of humans on the land, water, air, and/or other living things in the local environment.
- Construct explanations and design solutions.
- Identify situations that people want to change and problems that can be solved.

LANGUAGE ARTS

- Conduct short and sustained research projects based on focused questions to demonstrate understanding of the subject under investigation.
- Speak and listen to develop comprehension and presentation skills.
- Present information and supporting evidence such that others can follow the line of reasoning and use a style that is appropriate to the purpose and audience.

VISUAL ARTS

- Use observation and investigation to prepare for making art.
- Repurpose objects to make something new.
- Identify how art is used to inform or change beliefs, values, or behaviors of an individual or society.

MATHEMATICS

- Look for and create constructed structures and models.
- Use three-dimensional forms, two-dimensional shapes, and math operations to solve real-world problems.

SOCIAL AND EMOTIONAL COMPETENCIES

Help children understand how emotions, behaviors, and attitudes impact achievement in school, career, and life by building skills in:

- Self-awareness–setting and achieving goals to better understand oneself.
- Social Awareness–understanding others' points of view and respecting diversity.
- Responsible Decision Making—identifying decisions that are consistent with goals and considering the well-being of oneself and others.