

Wave of the Future

Exploring Renewable Energy Sources and the Power of the Ocean



OBJECTIVE:

Students will examine why we need energy, where energy comes from, and how natural resources are used. They will understand that nonrenewable energy sources exist in limited amounts, and once they are used, gone forever. Students will learn that renewable resources can be replenished through natural processes or resource management practices. Students will understand how every energy source has certain advantages and disadvantages connected to its use. They will be oriented to the struggle that when using any energy source, many factors must be considered, such as its cost, long term supply, and various environmental and social impacts of its use. They will examine how ocean waves hold impressive energy potential. They will research active wave power stations around the world, and examine current challenges they face, such as cost of equipment, and the corrosive effect seawater can have on technological equipment. They will learn how powerful ocean energy is and brainstorm ways of harnessing wave energy as a promising source for renewable energy for the future.

PURPOSE:

Students will learn how they share in the responsibility of conserving resources and why helping to create alternatives to nonrenewable energy is such a pressing global issue. Students will learn how humans depend on energy. They will understand how to empower through visual imagery, encourage action, and provoke new ways of thinking. Students will work collaboratively on a renewable

energy art project. They will be oriented to the concept of environmental stewardship, and understand why it is important to have passion for causes and a commitment to helping and educating others. Students will brainstorm and imagine creative ways to harness the renewable energy of the ocean. Students will be oriented to the belief that through their artwork, it is possible to make a global difference and contribute to positive change. Students will experiment with printmaking and create artwork and an artist statement that links potential wave energy alternatives, and honors Hokusai's Japanese woodcut of "The Great Wave".

VOCABULARY:

Energy, Fossil Fuel, Kinetic Energy, Renewable, Nonrenewable, Hydroelectric Power, Generate, Sustainability, Environmental Stewardship, Energy Conservation, Collaboration, Turbine, Contour Line, Form, Printmaking

TIME NEEDED: 3 Classes, 60 minutes each

GRADE LEVEL: 2nd- 8th Grade. "Wave of the Future" is a comprehensive lesson plan, that teachers should adapt to best accommodate their classroom needs.

MATERIALS:

- Pencils/Erasers
- Brayers (ink roller)
- Ink (any color)
- White scratch paper
- Styrofoam Plates
- Flat tray or Cookie Sheet

DISCUSSION:

- What is the difference between renewable and nonrenewable energy?
- What is energy, and why do we need it?
- What are ways that students can make a difference in their homes and schools that reflect energy awareness?
- What is environmental stewardship, and why do all students share the responsibility of educating others?
- How can students educate their friends and family on sustainable energy?
- What is an artist statement, and how does it collaborate with the art image to communicate a deeper message?
- Would ocean energy be considered renewable or nonrenewable?

- What are the existing models to harness wave energy and where are experimental wave generator plants, or wave energy buoy sites located globally?
- What are some potential pros and cons to the capture of wave energy?
- Would students be comfortable with the idea of an energy company that could potentially control parts of the ocean? How would this concept differ from other ways of harnessing renewable energy?
- What is a contour line and how does it simplify form?
- What is printmaking, and what emotions are felt when observing Hokusai's woodblock print of "The Great Wave"?

PROCEDURE:

- Students will be introduced to various renewable energy sources, such as biomass energy, solar energy, wind energy, geothermal energy and hydrogen. The teacher will highlight, and focus the students specifically on ocean energy, and will explain that a great amount of solar energy is held in the ocean as scientists and engineers are presently working to utilize that energy. Students will also learn about an ocean thermal energy conversion system, which uses differences in water temperature to turn a turbine that produces energy. They will also discuss hydropower, currents and changing tides, and harnessing the energy from waves, by channeling the moving water through turbines that then produce electricity.
- Teachers will introduce and lead a class discussion on the advantages and disadvantages of wave energy:

http://www.conserve-energy-future.com/Advantages_Disadvantages_WaveEnergy.php

- Teachers will list out **advantages** of wave energy, including:
 - Wave energy doesn't require any fuels to create
 - It does not produce green house gasses or harmful waste products
 - Widely available and easily predictable (tides are consistent)
 - Variety of ways to harness (present methods include power plants with hydro turbines to large ocean vessels which float in the ocean, gathering the wave energy)
- Teachers will list out **disadvantages** of wave energy, including:
 - Current high cost to build wave devices
 - Marine life potentially harmed

- Physical presence of equipment could impact shorelines visually and practically
- There are presently only a handful of functioning wave energy projects
- Effects of unpredictable ocean weather on equipment

http://greenthefuture.com/wavepower_proscons.html

- Students will be introduced to Pelamis Wave Power, the world's first commercial wave energy project. They will research why the operation closed only after a few months:



- Students will be introduced to the technology and design of wave power buoys:



<http://scitechdaily.com/floating-power-buoy-creates-electricity-from-ocean-waves/>

- Teachers will remind students that throughout history, individuals have harnessed the energy of waves:



- Teachers will elaborate on the notion that humanity has long been fascinated by the power of the ocean, and introduce the Japanese artist Hokusai, and show his famous masterpiece “The Great Wave”:



- Teachers will show students a simplified line rendition of Hokusai’s “The Great Wave”. Teacher will explain contour line and simplicity in form.

Students will draw on scratch paper, their contour version of the “The Great Wave”:



- Teachers will introduce Styrofoam printing and show demonstration. Students will use Hokusai’s “The Great Wave” as inspiration, then create a sketch for the reductive print, honoring the power of a wave. When the student’s contour line sketch is completed, they will prepare the image to transfer the drawing to the Styrofoam plates.



- Students will tape their wave image to the foam board. Using a pencil, students will trace over their drawn image, pressing lightly through to the Styrofoam. They will lift the paper off, and then strengthen the depth of the Styrofoam lines by retracing the image using pencil.



- Students will discard (recycle) the drawn contour paper plan, and take their styrofoam plate to the printing station, established by the teacher. Students will roll the brayers, spreading the ink on the tray, and then rolling the ink on their plates.



- Students will move their plates away from inking station and carefully set their plates, face down, on clean construction paper, careful to lie it down only once, in the center of the paper. They will press with a clean roller applying pressure to transfer their image.
- Students can print various editions of their prints, experimenting with color, and adding texture to their plates. The monoprints will be left to dry, and the inking station cleaned.
- Teachers will introduce the concept of an artist statement. Students will write an imaginative paragraph linking their individual wave monoprint, to creative new alternatives to harness wave energy. Their paragraph will reflect an understanding of the current models used to harness wave energy, and will elaborate and imagine inventive original alternatives. The student artist statements will be displayed next to their artwork within the school. The statements will display their creative thinking, and link the connection of renewable energy potential, and the power of their individual wave.

ART ELEMENTS:

- Color
- Space
- Shape
- Form

ART SKILLS:

- Drawing
- Collaboration
- Printmaking

INTERDISCIPLINARY CONTENT

- Connection to science while addressing environmental water and climate issues
- Social studies connection regarding global responsibility to environmental efforts.

NATIONAL STANDARDS:

- Visual Art Standard 1: Understanding and applying media, techniques, and processes
- Visual Art Standard 3: Choosing and evaluating a range of subject matter, symbols, and ideas
- Visual Art Standard 5: Reflecting upon and assessing the characteristics and merits of their work and the work of others