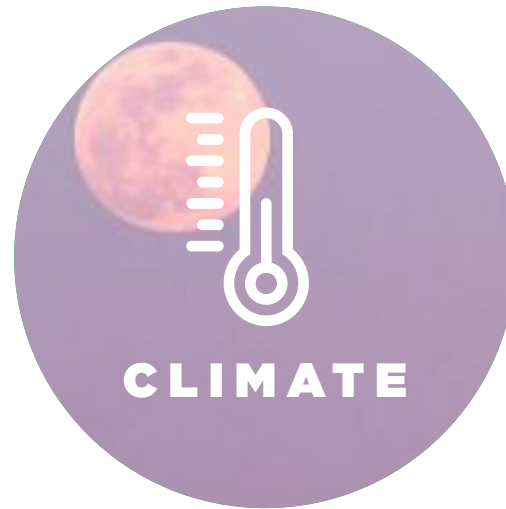




8TH GRADE
STEM & SOCIAL STUDIES





LUNAR ENERGY

Driving Question:

How can tidal movement be captured and harnessed as a form of energy?

Materials Needed:

Images of the solar system, bucket on a rope with water, toy propeller, science notebook, sketchpad, writing utensil, device for research, water, prototyping materials such as plastic jugs, mini propellers and clay

In this lesson, students will:

- recognize that the alignment of our planet, moon and sun, as well as convection currents in the ocean, cause the movement of the tides. They will understand how that movement can be captured as energy.

National Learning Standards:

Science: MS-ESS2-4; MS-ETS1-1; MS-ETS1-3
 Social Studies: VI,g
 Art: Cr1.1.8a; Cr2.1.8a; Cr2.3.8a; Pr4.1.8a; Pr6.1.8a; Cn10.1.8a



SPINNING THE COCOON

Show students an image of the solar system focusing on the Earth, our moon and the Sun. Ask students to identify what forces keep our solar system in a relatively predictable state of motion. Discuss how the gravitational pull of the Earth, moon and sun are all unique, but play a vital role in maintaining planetary alignment and distances.

Put water in a small bucket with a rope attached and ask students what will happen if you swing it very quickly over your head, and then demonstrate. Ideally, if you swing the bucket fast enough, gravity acts on the water to keep it in the bucket, regardless of it going upside down over your head. Tell students it is this force, as well as the oceans' movement as result of thermal energy, that cause changes in daily tidal heights.

Next, pour water through a toy propeller and watch as it spins. Ask students of what the propeller movement reminds them. Discuss how water movement past the propeller is similar to wind blowing past a turbine. Explain that energy can be captured in a similar fashion.

KERNEL OF KNOWLEDGE

The first tidal project in Canada was built in Annapolis Nova Scotia where the highest tides in the world are harnessed to produce electricity. With a capacity of 20 megawatts, the plant can provide electricity to approximately 4,500 homes.



METAMORPHOSIS

Students will design and prototype a device built to capture the energy of the changing tides. Students might develop a way to capture the ebb and flow via tanks, underwater turbines or any other method. Students should use flowing water to test the movement of their system and its efficiency. They should include materials that might be used in a full-scale device, decide how the device will be anchored, and how it will transmit energy to a power plant. Students will then research their design to determine how it might be detrimental to underwater ecosystems and create an environmental impact statement. Finally, students will present their prototype and environmental impact statement to classmates.



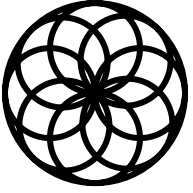
THROUGH THE LENS

Students can create a video on Flipgrid or a poster that explains the types of energy that were used during the 1800s. Have them explain why industry is beginning to return to wind power and looking at more renewable energy sources. The following questions may help get students started:

- How did the Lowell Mills in Massachusetts power their machines in the early 1800s?
- Where in the world was wind power more readily available than water power?
- When and why was wind power more efficient than water power?
- Why is there a push to go back to wind power?

UPCYCLE

A lot of wind energy is produced via offshore turbines, so why not combine wind and tidal energy? Have the students design a concept that incorporates the tidal energy system they just created and a wind turbine system to make double use of oceanic infrastructure. Students should build prototypes and test them to see if the two systems can work independently, while still being attached to each other.



KALEIDOSCOPE

Discuss with students how wind energy has been used since ancient times and was even used to help pump water for steam engines during the American Industrial Revolution. Have students conduct research to explain why our society has gone away from wind power in favor of other types of power sources.



eARTh

For years, artists have used their work to bring awareness to social, political and environmental issues around the world. This type of art can be seen in neighborhoods, museums and everywhere in between. Land Art Generator is an organization that asks artists and designers to take these passions to the next level. They host annual design competitions focusing on creating models of renewable energy that add value to public spaces, inspire, educate and provide power to people around the world. Visit their [website](#) with your students and explore the different competitions and artistic designs that have been submitted.

As you look at the examples with your students, ask them to talk about what they see in the different designs, focusing their responses to include the principles of design. Look at the specifics for competitions that combine art, technology and science. Break the students into pairs or small groups, and have them create a design for one of the competitions. You can choose the competition or let the groups choose from the list on the site.

The focus of each of the projects is to create an aesthetically pleasing design that functions as a work of art as well as a source of renewable energy. Each group should create a variety of potential design sketches and then choose one to prototype. Have them present their design to the class in a 30-60 second video that makes the case for their design and states why their product is better for the environment. They must discuss both the design principles that were used to create a visually pleasing structure, as well as how it functions as a source of renewable energy. If the students meet the guidelines for the actual contest, have them send in an official entry.

Community Garden

- While it is essential to be friendly to our environment, it is equally as important to show others that they are important and beautiful. Start a “kindness campaign” in your class. Tell students to leave a post-it or other type of note on one person’s desk/locker/book, etc., each day.
- The note should point out something positive about that person, or include an inspirational quote or image. Start in your classroom and see if it will catch on throughout the entire school – and maybe into the community!



CAREER CONNECTION

Renewable Energy Engineer - Engineers working in renewable energy are part of a growing sector of green jobs that involve environmentally conscious production. These individuals maximize the potential of clean energy sources such as wind, solar, geothermal and hydropower. Renewable energy engineers monitor and develop alternative energy outputs. For this career, you need a bachelor's degree and various licenses.

Oceanographer - Oceanographers study the formations, composition and history of the seafloor to provide vital information about the past and future. They use advanced technology to confirm and develop theories about land masses and other underwater features. Oceanography requires a bachelor's degree, although most have a master's or doctorate degree.



CAREER HIGHLIGHT

Brian Polagye is an associate professor and co-director of the Northwest National Marine Renewable Energy Center. There, he focuses on the environmental impact of renewable marine energy, including energy that can be created by rivers, tides and ocean currents.



