



ACTIVITY

TIDAL POWER: HARNESSING THE ENERGY OF SEA CURRENTS

Time: 1 hour per STEAM subject

Days of Implementation: 5 days

Grade Level: Upper Secondary

Designed by: Elena Martelli

Alignment with STEAM subjects

Science: Understanding concepts such as tidal formation, gravitational forces, and sea currents.

Technology: Using equipment to monitor tides and software to create simulations.

Engineering: Designing sustainable energy solutions, such as tidal power plants or other coastal infrastructure.

Arts: Representation of tidal movements and energy concepts through visual arts and creative storytelling.

Mathematics: Tidal energy calculations, power generation efficiency, and wave height analysis.

Related or achieved SDGs

- SDG 14: Life Below Water: Supports awareness and reflection on the importance of protecting marine ecosystems, as well as oceans, as a source of clean energy
- SDG 7: Affordable and Clean Energy: Encourages exploration of tidal energy as a key renewable energy source.
- SDG 13 Climate Action: Explores how renewable energy is a key solution to climate change.

Objectives

By the end of the class, students will be able to:

- Explain how tides are formed and how they behave.
- Analyze the relationship between the moon, sun, and earth's gravitational forces in tidal cycles.
- Explore the impact of tides on coastal environments and human activities.
- Understand how tidal energy can be harnessed as a renewable energy source.
- Use mathematical calculations to measure tidal range and energy potential.
- Design a model demonstrating tidal energy conversion or coastal protection structures.

Materials Needed

- Water tanks or clear containers for tidal demonstrations
- Small fans or water pumps to simulate tidal currents
- Rulers, stopwatches, and measuring tools
- Computers with tidal simulation software, like [Open Tidal Farm](#) or [Beltoforion](#)
- Sand, pebbles, and clay for coastal models
- Art supplies
- Equipment for tidal energy experiments, such as small motors or generators

Lesson Plan

Introduction

Tides can be a powerful renewable energy source. In this activity, students will explore tides and tidal power. They will consider how tides impact coastal environments and can be used as a source of renewable energy. By using innovation and design skills, they will explore how tidal power can harness the ocean's energy to produce electricity.

1. Inquiry & Exploration

Students explore tides and tidal power through videos, real-world observations (if they live by the coast), and discussions. Some ideas include:

- [Ocean Tides](#)
- [Team Lab. Memory of Waves](#)

Discussion Questions:

- What causes tides to form?
- How do the moon and sun affect tides?
- What are the differences between high tide and low tide?
- How do tides impact coastal environments?
- How can tides be used as a source of renewable energy?

2. Investigation & Research (30 min)

- Have the students research different tidal cycles, their effects on marine ecosystems, and how tides can be harnessed for energy. Students can examine local, regional, or national tidal patterns and their impact on coastal areas. Some ideas for investigation include:
 - [Tidal Power 101](#)

3. Implementation & Design

Create an opportunity for students to explore tidal energy through hands-on experiments. Some ideas for engaging activities:

- **Option 1: Creating a model of a tidal system.** Students can create a simple model of a tidal system using a transparent container filled with water. By manually adding and removing water (or using a small pump), they simulate the natural rise and fall of a tide. Students can place a small water wheel or turbine in the tank to visualize how moving water can generate energy. The activity shows how tidal energy works: when water flows in and out due to tides, it can spin turbines and produce electricity.
- **Option 2: Measuring tidal range, frequency, and flow rate.** Students can measure the change in water level (tidal range), the frequency of rise and fall, and the rate of movement (flow rate) in their tidal tank model. Using a ruler and a timer, they can track these changes during simulated tidal cycles. This helps them understand key physical concepts behind tidal energy: the greater the tidal range and flow rate, the more potential energy is available for generating electricity.
- **Option 3: Designing small-scale models of tidal turbines.** Students can create small models of tidal turbines. Models demonstrate how tidal energy is generated from the movement of water and how spinning blades generate electricity when water flows through them. Kits are available for schools to create turbine models and simulate how electricity is generated by the movement of water.
- **Option 4: Working with tidal energy.** Have students work together to build a simple tidal energy generator. Students should design a raft with an attached motor. Then, using a tank or similar body of water, they should propel the raft. Students should observe how the motor generates electricity from water, converting tidal energy into power.

4. Testing & Reflection

Have students test their tidal models in groups to observe how tides interact, based upon the options selected above. They should aim to look for improvements that they can make in their prototypes.

Reflection Questions:

- How does your renewable energy model convert tidal energy into power?
- What is working well? What is a challenge?
- Is tidal energy more efficient than other forms of energy? Are there any limitations?
- How can you improve your prototype?

5. Presentation & Action

Organize a session where students have the opportunity to present their prototypes to the class. They should explain their designs and how they embraced tidal energy. If possible, have the students carry out specific demonstrations of their tidal energy models.

Criteria

- Scientific Understanding (25%)
- Technical Implementation (25%)
- Creativity and Innovation (25%)
- Presentation Clarity (25%)

Reflection

- Did students fully understand?
- What should I improve for next time?
- Was the lesson interesting enough for the students?