GLOSSARY:

Acoustic Doppler Current Profiler: A sonar that attempts to produce a record of water current velocities for a range of depths.
Biomimicry: The copying or imitation of a natural phenomenon's or environment's efficiency and survival mechanisms in manufacturing.

Doppler Shifts: The change in frequency of a wave for an observer moving relative to the source of the wave.

Gulf Stream Current: The Gulf Stream is a strong, fast moving, western boundary warm ocean current originating in the Gulf of Mexico and flowing into the Atlantic Ocean.

Hydrofoil: A surface form creating a thrust against water in a direction perpendicular to the plane approximated by the surface.
Kinetic Energy: The energy possessed by a system or object as a result of its motion.

Run-of-the-river: Hydropower that involves placing small, mini, or micro hydro turbines into waterways without large dams.

Stator: A portion of a machine that remains fixed with respect to rotating parts.

Subtropical Gyre: A large system of ocean currents. The center of a subtropical gyre is a high pressure zone. Circulation around the high pressure is clockwise in the northern hemisphere and counterclockwise in the southern hemisphere due to the Coriolis effect. The high pressure in the center is due to the westerly winds on the northern side of the gyre and easterly trade winds on the southern side of the gyre.

Western-Boundary Current: Warm, deep, narrow and fast flowing currents that form on the west side of ocean basins due to western intensification.

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Teachers Guide

SYNOPSIS:

Water evaporates from lakes and oceans all over the world, condenses to form clouds, precipitates as rain and snow and then flows back to the oceans. This is the global water cycle. Hydroelectric power takes advantage of this cycle to generate electricity by using moving water as its energy source. Because the water cycle is a constantly recharging system, it is an excellent source of renewable energy.

Traditional hydroelectric power uses the energy of moving water to turn hydraulic turbine blades. These spinning blades turn a generator shaft that produces electricity. The generator converts this energy into electricity. Engineers have developed innovative technologies that take advantage of other sources of energy from water including ocean currents, tides and waves. In this program, traditional systems are explained, as well as new technologies that take advantage of currents and waves.

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CURRICULUM UNITS:

- Ecology
- Engineering
- Environmental Science
- Physics
- Physical Science

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CAREER OPPORTUNITIES:

- Electrician
- Engineer
- Physicist
- Plant Technician or Manager

PROGRAM OVERVIEW:

There are several unique devices that have been developed, some of them using biomimicry, to harness the power of ocean waves and currents. One promising system is mounted on the seafloor and moves back and forth with wave motion. The device is strategically placed where there are constant wave patterns. It contains a hydraulic system that converts the mechanical energy of the wave motion into fluid pressure, which is used to spin a generator.

ISSUES & CRITICAL THINKING:

1. Scientists and engineers have learned to efficiently use moving water to generate power in lakes and rivers using dams. Why are scientists now exploring other moving water options?

2. How will the newly designed ocean turbine systems differ from the technology currently used in dams?

3. Detail the environmentally negative aspects of hydroelectric power generation on the surrounding ecosystems. Do the newly designed ocean systems off a less invasive option compared to dams?

4. Discuss the potential energy contained in the Gulf Stream current.