Water Works

If you've ever been to the beach, then you've felt the force of the ocean. Waves knock you over and toss you around. The tide drags at your feet. If only we could only put some of that energy to work . . .

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People have used the power of moving water in rivers and waterfalls for thousands of years. And now, scientists are dipping into the ocean to provide electricity to people around the world.

Waves and tides keep the ocean in constant motion. Why not tap into some of that energy?

Water works hard at Niagara Falls

Height of falls: *190 feet*
Width of falls: *3,300 feet*
Speed of falling water: *20 mph*
Water falling per minute: *379,000 tons*
Power of falling water: *enough to light 44 million light bulbs*
Here's one more stat: *since 1901, 18 daredevils have plunged over the falls in barrels, balls, and boats. But don't plan on it yourself; it's illegal.*

Water Power

In a water wheel, moving water falls onto a paddle, pushing it down—and causing the wheel to turn.

Hydroelectricity—electricity generated by water power—provides 20 percent of the electricity in the world. In hydroelectric dams, a simple technology operates: water falling over the dam spins a water wheel called a turbine. A turbine is a kind of generator—a machine that makes electrical power. It does this by moving two magnets against each other, causing electrons to jump. The result is an electric current.

For hundreds of years, most river dams were small and operated with the seasonal flow of the water, which is heavier at some times than at others. Then, in the 1930s, huge dams sprouted around the country. Their builders dammed up rivers and flooded massive amounts of land to create lakes. These human-made lakes provide a constant flow of water for a constant flow of electricity.

Even though dams provide clean and renewable energy, critics of dams say that they harm the environment by changing the natural flow of rivers and by flooding miles of dry land.

Like a waterfall, water rushing over a dam contains a lot of power.

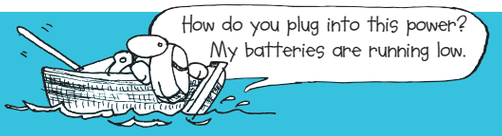
Rocking, Rolling Waves

Wave power is the new wave in water power research. As wind blows across open ocean, it causes swells that rhythmically rise and fall. The height of each wave, its length, and how fast it travels determine how much power it carries. Strong and abundant waves, such as those off the coast of Oregon, work best to provide the most power.

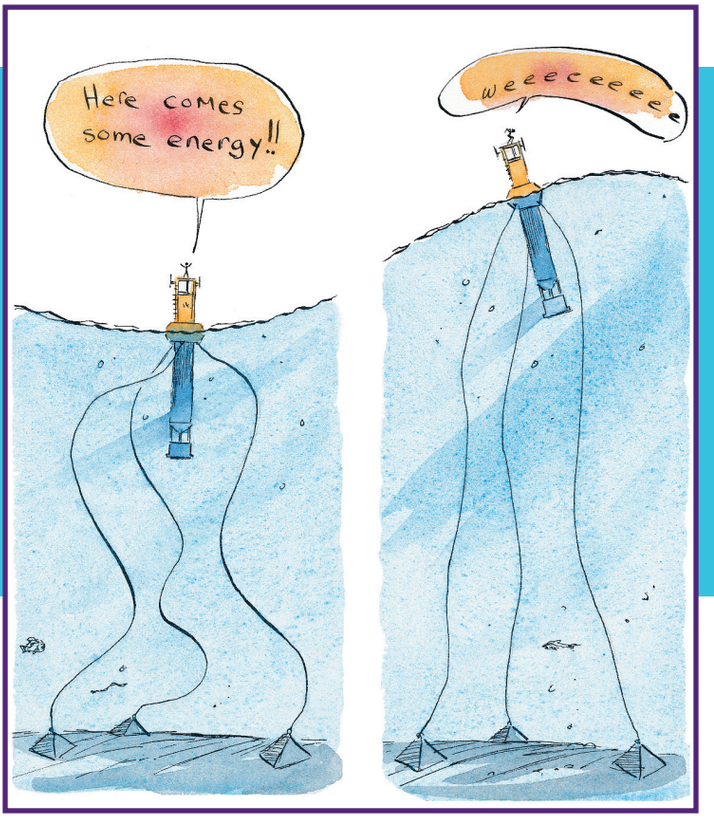
For some time now, engineers have been inventing and designing devices called wave power generators that transform the energy of ocean waves into electricity. The generators bob offshore, where the wave motion is active, but close enough to send the electricity back to land.

Wave power generators create electricity, and power cables transfer the electricity along the ocean's floor, under the beach, and then to what's called a transmission grid. From the grid, the power can reach nearby homes or businesses.

One wave power generator, called the Pelamis, will soon snake over the ocean's surface off the coast of Portugal. This is the first wave power site in the world to actually sell electricity from waves to people nearby. Eventually, the Portuguese government plans to install enough Pelamis models

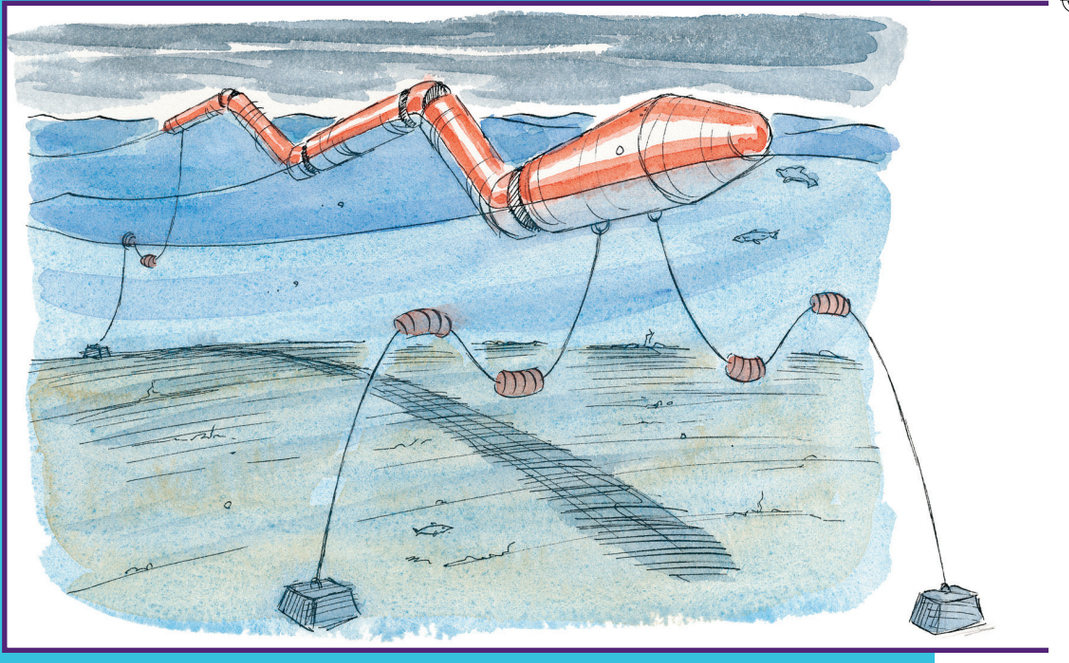


In one wave power generator, a buoy floats on the ocean's surface. It's connected to the ocean floor by long cables. As the wave lifts the buoy up and drops it down, its motion turns a pump. The pump pushes fluid through a high-pressure container. The fluid then turns a wheel, which activates the generator. One of these buoys bobs off the coast of Hawaii, and more may soon be installed along the coast of Washington State.



to cover about half a mile of ocean and create electricity for 20,000 homes.

Another design looks like a sea serpent floating on the water. Called the Pelamis, it's even named for a sea snake. The Pelamis may look small when it floats in the immense ocean, but it's made up of huge red cylinders, each one as tall as three people, and it stretches out almost 400 feet over the water. The Pelamis works because a number of different pieces are linked to one another. The pieces push and pull against each other, up and down and side to side. This action operates a pump that pushes fluid to turn a wheel and power a generator.



Rocketship? No, Pelamis!

To see the Pelamis at work, visit: http://www.oceanpd.com/Anims/pelamis_V4.html.

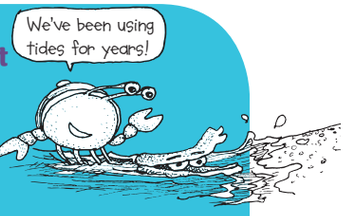
Turning, Churning Tides

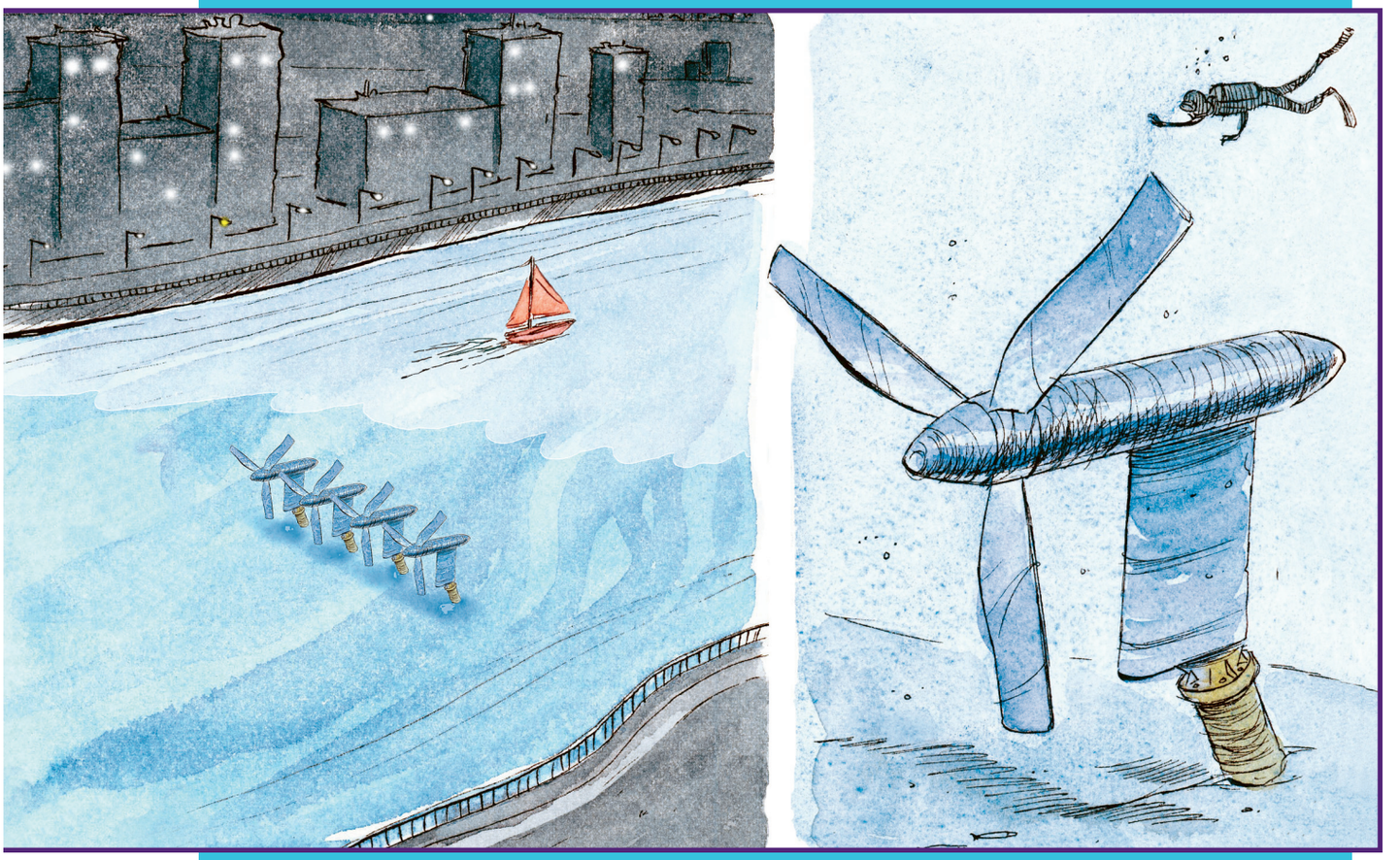
The gravitational pull of the moon tugs bulges of water back and forth, every day, around the world. We call this movement tidal flow. The tide rushes in and out, day after day, in a regular, predictable pattern, which makes it an ideal source of renewable energy.

Oceans and rivers meet at the river's mouth. The funnel shape of many river mouths increases the rush of the tides. This makes river mouths ideal sites for tidal power generators.

Small tidal power generators were installed last year in the mouth of New York City's East River. They're powering a nearby supermarket and parking garage. If everything works as expected, the company will install 300 generators—enough to power 8,000 homes. The city of San Francisco also plans to place tidal generators in the rushing waters of San Francisco Bay.

The most popular tidal power generators are like underwater windmills. They sit along the floor of the bay and spin with the incoming and outgoing water. The turning blades power a generator. These turbines offer the latest spin on tidal water wheels that were installed in rivers in Europe as far back as the 1500s.





Waves of the Future

Of course, working in an ocean comes with challenges. Power generators need to float where waves swell with the most force and tides pull the strongest, without blocking shipping routes and fishing areas or harming the local environment. Plus, the technology is so new that the electricity produced is still expensive. Storms can be damaging, and some waves, called rogue waves, are freakishly high and strong. So wave power generators have to be built tough. Plus, salt water eats away at metal and can destroy all this expensive equipment. Wave power companies have learned from the builders of offshore oil rigs about special coatings to protect metals from salt water.

Researchers are testing these new technologies around the world. Ocean power projects exist in the United States, Portugal, England, and Australia. How well do the designs survive in the ocean? How efficiently do they create electricity? Can they be built without costing too much money? Are there any challenges in transporting the energy to shore? Do the blades on tidal generators kill sea life?

Energy engineers are hopeful about the future. Waves and tides contain a tremendous amount of energy, enough to supply about 10 percent of the world's energy needs.

Stand on the beach with your feet in the water, and you'll feel the same way the scientists do. There's a lot of power out there—and we're starting to bring it home.