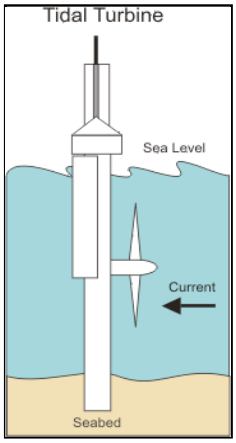
Ocean Energy

Tidal Energy

Tides are caused by the gravitational pull of the moon and sun, and the rotation of the earth. Near shore, water levels can vary up to 40 feet. Only about 20 locations have good inlets and a large enough tidal range- about 10 feet- to produce energy economically. The simplest generation system for tidal plants involves a dam, known as a barrage, across an inlet. Sluice gates on the barrage allow the tidal basin to fill on the incoming high tides and to empty through the turbine system on the outgoing tide, also known as the ebb tide. There are two-way systems that generate electricity on both the incoming and outgoing tides.

Tidal barrages can change the tidal level in the basin and increase turbidity in the water. They can also affect navigation and recreation. Potentially the largest disadvantage of tidal power is the effect a tidal station can have on plants and animals in the estuaries.

There are currently two commercial sized barrages in operations. One is located in La Rance, France; the other is in Annapolis Royal, Nova Scotia, Canada. The US has no tidal plants and only a few sites where tidal energy could be produced economically. France, England, Canada, and Russia have much more potential.

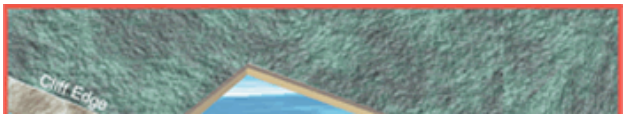


Tidal fences can also harness the energy of tides. A tidal fence has vertical axis turbines mounted in a fence. All the water that passes is forced through the turbines. They can be used in areas such as channels between two landmasses. Tidal fences have less impact on the environment than tidal barrages although they can disrupt the movement of large marine animals. They are cheaper to install than tidal barrages too. A tidal fence is planned for the San Bernardino Strait in the Philippines.

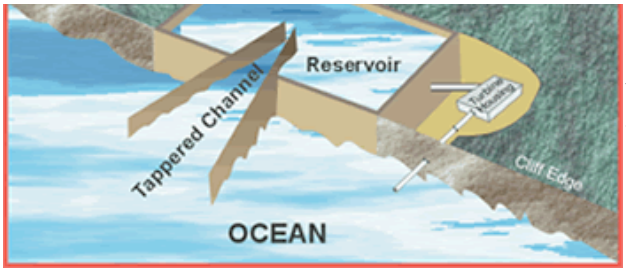
Tidal turbines are a new technology that can be used in many tidal areas. They are basically wind turbines that can be located anywhere there is strong tidal flow. Because water is about 800 times denser than air, tidal turbines will have to be much sturdier than wind turbines. They will be heavier and more expensive to build but will be able to capture more energy.

Wave Energy

Waves are caused by the wind blowing over the surface of the ocean. There is tremendous energy in the ocean waves. The total power of waves breaking around the world's coastlines is estimated at 2-3 million megawatts. The west coasts of the US and Europe and the coasts of Japan and New Zealand are good sites for harnessing wave energy.

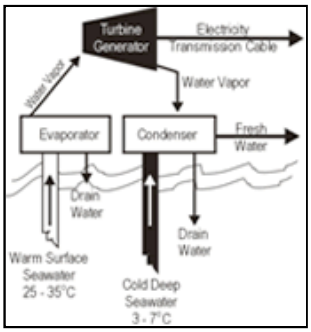


One way to harness wave energy is to bend or focus the waves into a narrow channel, increasing their power and size. The waves



can then be channeled into a catch basin or used directly to spin turbines. There are no big commercial wave energy plants, but there are a few small ones. Small, on-shore sites have the best potential for the immediate future; they could produce enough energy to power local communities. Japan, which imports almost all of its fuel, has an active wave-energy program.

Ocean Thermal Energy Conversion (OTEC)



The energy from the sun heats the surface water of the ocean. In tropical regions, the surface water can be 40 or more degrees warmer than the deep water. This temperature difference can be used to produce electricity. The OTEC system must have a temperature difference of at least 25 degrees Celsius to operate, limiting use to tropical regions. Hawaii has experimented with OTEC since the 1970's. There is no large-scale operation of OTEC today. There are many challenges. First, the OTEC systems are not very energy efficient. Pumping water is a giant engineering challenge. Electricity must also be transported to land. It will probably be 10 to 20 years before the technology is available to produce and transmit electricity economically from OTEC systems.

Solar

Research is being done to place solar farms over the ocean. With oceans making up 70 percent of the earth's surface, some people believe near the coasts would be a perfect place for solar farms. Currently, solar energy is used on offshore platforms and to operate remotely located equipment at sea. Solar energy is a renewable energy source, is free and does not pollute. Visit the solar section of the site for more on solar.

Wind

Wind energy, like solar energy is already used on land. Wind turbines, and wind farms can only be placed where the wind constantly blows. Along the coast of much of the US , conditions are well suited to use wind energy. There are people who are opposed to putting turbines just offshore. People think the turbines will spoil the view of the ocean. Right now, there is a plan to build an offshore wind plant off the coast of Cape Cod , MA. Wind is a renewable energy source that does not pollute so

some people see it as a good alternative to fossil fuels. To learn more about wind, visit the wind section of the site.