# Renewable Energy

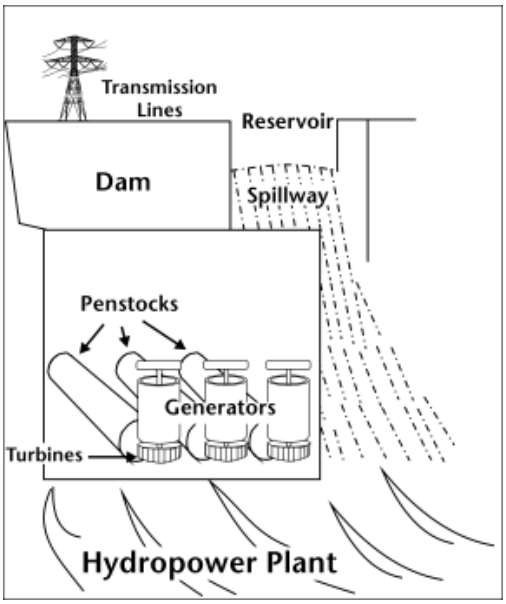
## Hydropower and Ocean Energy

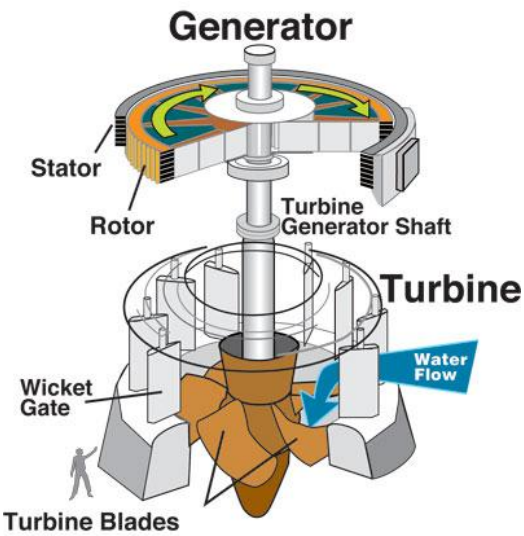
For centuries, people have been using gravitational force of falling water to do work. The movement of the water turns a mill, which is used to grind grain, machine tools, or even to convey water over distances. Today, we use this ancient technology to generate electricity. This is referred to as hydroelectricity.

Hydroelectricity occurs in modern dams, where the falling water is used to generate enough force to turn a turbine that is connected to an electricity generator. With this action, potential energy of water is transformed into mechanical energy and then into electrical energy. This is both an efficient and green way of generating electricity. It is not as hard as the geothermal electricity because people do not have to find a perfect are to generate it; and it is also not as polluting as the nuclear and coal fired power plants. Therefore, hydroelectricity is much greener than most other energy sources.

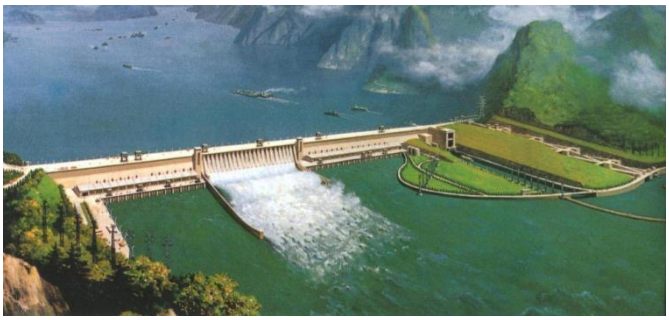
## Water Dams

A dam is built where there is a natural source of water in a valley and it is used to hold the water and create pressure so that the water can produce more electrical power. The gravitational potential energy stored in the water is used to turn generators and create electricity. Electrical generators are turned by massive turbines, which are within tunnels in the dam wall – water flows through the tunnels with great pressure due to the great height, at which is kept in the dam. If there is a greater volume of water or there is a very large difference between the water level and where it flows out, then more power comes out of the water as it has greater potential energy. For example, Hydro power generation works well in mountainous countries as the water can be stored at very high pressures. The dam wall increases with width as you go down toward the base because the water pressure gets greater as depth increases. This difference in height of the water is called the head.






The generator contains two main parts: the rotor and the stator. The rotor is the part which rotates and the wire has a huge magnet inside of it. The stator is the part which is covered in copper. The electrical current is created when the rotor spins around the copper wire on the stator. This is the charge which is then used as electricity.



China is the largest producer of hydroelectricity, followed by Canada, Brazil, and the United States. Egypt also uses hydropower along the Nile River. One of the greatest advantages of hydroelectric power is the ability to store potential energy. When energy consumption is low, the dam can fill the reservoir and use less water. When the demand is high, the dam can allow more water through, thus generating more electricity. The operation of electricity systems depends on rapid and flexible generation sources to meet peak demands, maintain the system voltage levels, and quickly re-establish supply after blackouts. Energy generated by hydroelectric installations can be injected into the electricity system faster than that of any other energy source.

Hydroelectricity helps fight climate changes also. The hydroelectric life cycle produces very small amounts of greenhouse gases (GHG). In emitting less GHG than power plants driven by gas, coal or oil, hydroelectricity can help retard global warming. Although, only 33% of the available hydroelectric potential has been developed, today it hydroelectric generation prevents the equivalent to burning 4.4 million barrels of petroleum per day, worldwide.

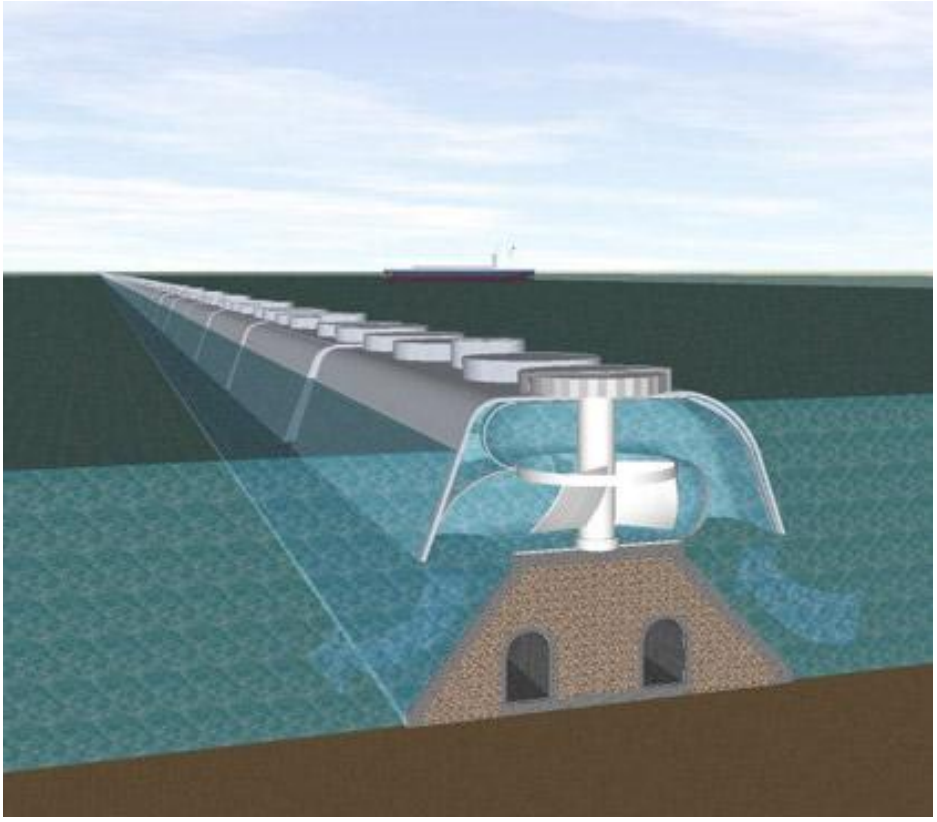
The challenges that face this technology is that it is dependent on the hydrology (precipitation) in the area. The building of dams is expensive and in some cases flooding the land poses a threat to the wildlife of the area. The building of dams also restricts the natural migration of fish. Management of a dam must also consider the flow of water below the dam, and the water quality.

Balancing the pros and cons of hydropower is a challenge for scientists and engineers. The many benefits must be weighed against the potential costs and impacts that building a dam would create.

## Ocean Energy

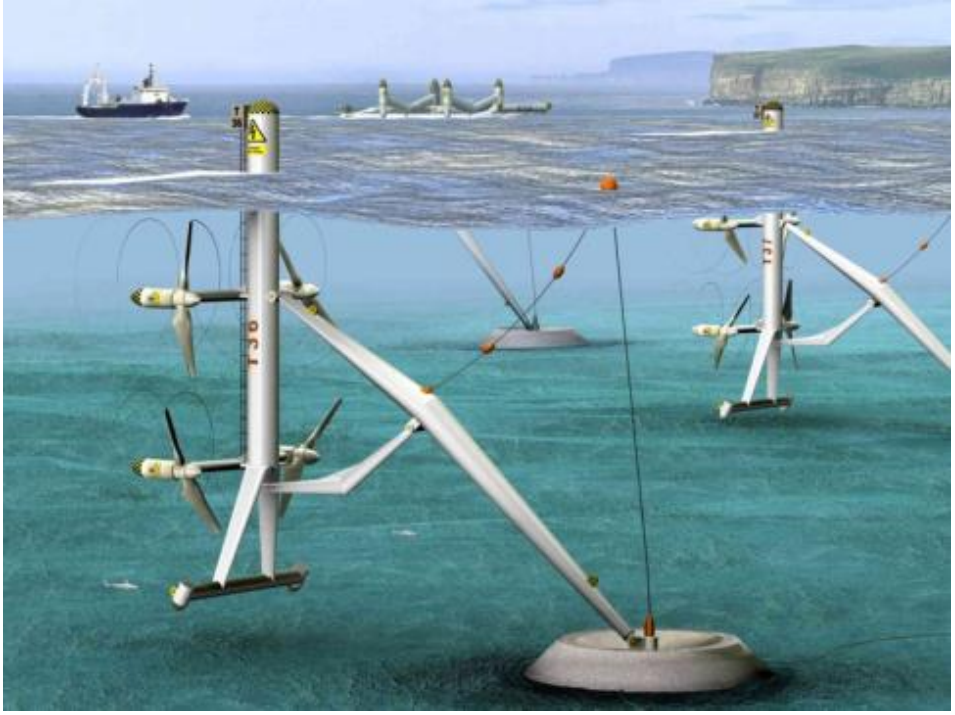
As the world begins to develop and create new technology, there is a constant demand to find new and improved energy sources. Society is making strides to lean away from the use of fossil fuels to clean and renewable energy sources. On eof these energy sources being used and tested is Ocean Energy, or energy generated by the change in ocean tides. Ocean energy, or tidal energy is a reliable source due to the predictable cycle of tides which has the flow of sea water transfer from the middle of the ocean to the shores and vice versa. The tidal energy used through variations of sea levels caused by the gravitational effects of the moon along with the rotation of the Earth.

As of now there have been three different types of tidal plants produced, tidal fences, barrage plants, and turbines. Each is intended to harness the energy possessed from the change in water levels and the flow of water.



There are three main parts to barrage tidal plants, the most common type of tidal plant. The barrage, which acts like a dam, holds back water to be released later. Sluice gates allow the water through the turbine. The turbine spins due to water flowing through it, which also rotates an electrical generator. The generator converts kinetic energy into electric energy, while water is stored in the barrage, building up potential energy for when the tide is falling. The generator works by the movement of a solenoid, mechanically by tides, inside of a magnetic field, which induces a current in the solenoid. Tidal turbines function similarly to the barrage tidal plant, but it is placed in the ocean, which provides a constant tide and kinetic energy source. The greater the momentum, mass and velocity of the water, the greater the energy produced.

With any relatively new idea that has the potential to replace traditional methods of energy generation, there are pros and cons that arise. Tidal energy allows for the production of energy by using the predictable environmental changes as opposed to the harmful fumes emitted from burning fossil fuels. As such, the production is easy to predict, track, and incorporate into the national electric grid. Other advantages include: no harmful emissions into the environment, abundant, renewable, and relatively inexpensive fuel source, and it has the potential to contribute an ever increasing percent of the energy demand in the world.



There are however, some concerns about the impact that these systems have on the natural sea-life. Salt-water is highly corrosive to most man-made materials. Tidal energy is only convenient to those communities living close enough to the ocean.

Despite the many disadvantages, there are many great advantages. Scientists and engineers who can design systems which account for the few concerns associated with ocean energy technology will be able to further advance our use of this renewable energy source.