CENTRE FOR RENEWABLE &
SUSTAINABLE ENERGY STUDIES

Geothermal & Ocean Energy

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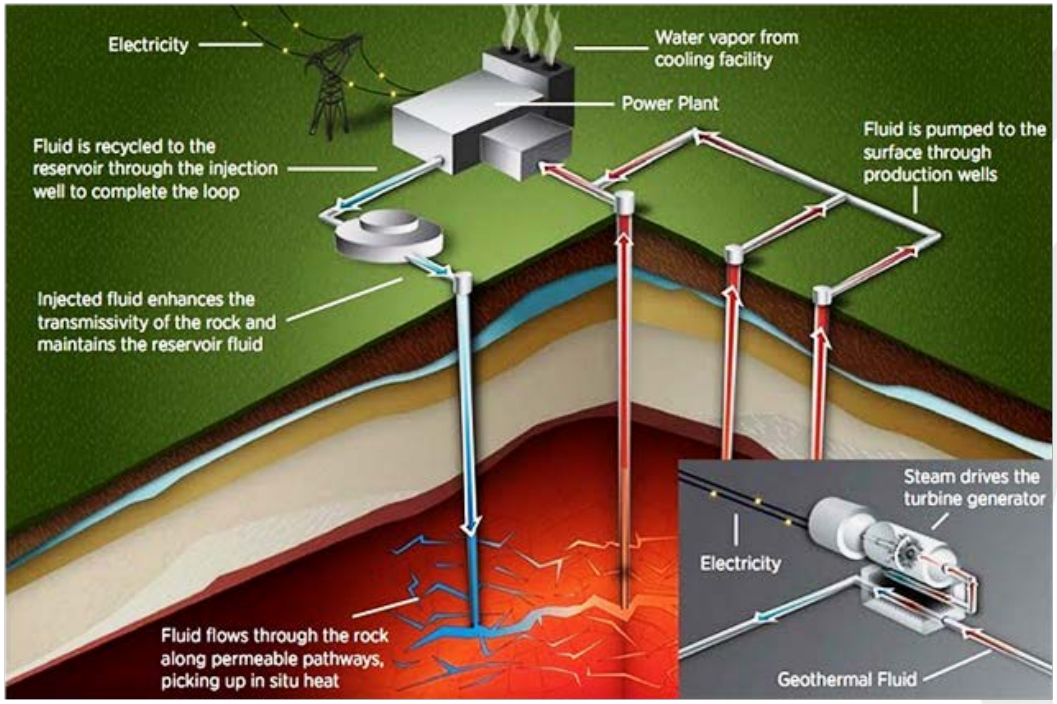
Geothermal Energy: Uses



Source:photonicswiki.org

- Beneath the earth's crust lies **hot magma**. The energy it contains is called **geothermal** or **earth** energy.
- Geothermal energy is used in many ways, e.g. for heat pumps and heating of living spaces.
- Geothermal power plants use the earth's natural heat to vaporise **water** or an **organic** medium.
- This creates **steam** which drives a **turbine** that generates electricity.

Geothermal Energy: Heating Plants

- Geothermal heat plants require lower temperatures and the **heated water** is used directly.
- If near the source, the heat can be used directly to heat **homes, buildings** and **hot-water supplies.**
- These are common in very cold countries like Iceland.
- **Natural warm water springs** are examples of geothermal energy.

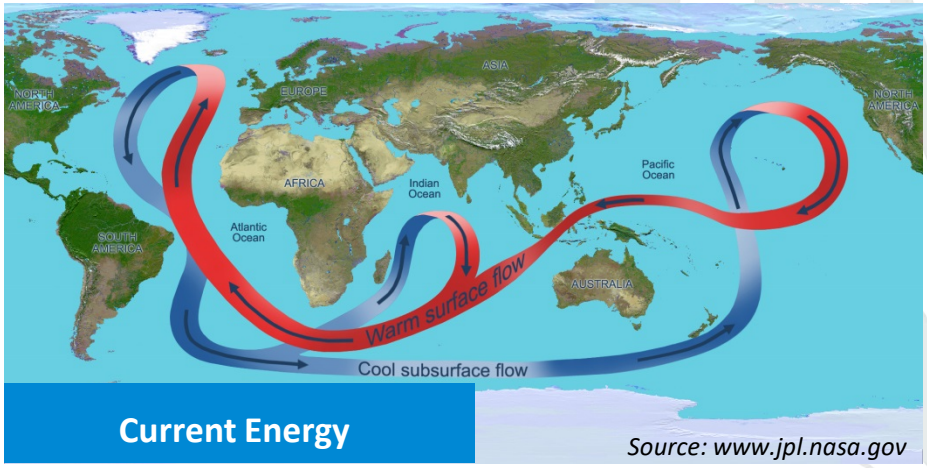
Ocean Energy: Wave, Tidal and Current Energy

Ocean energy refers to the renewable energy source where energy from moving waves or ocean currents is captured using wave energy converters to generate electricity. There are three types of these sources: **wave**, **tidal** & **current energy sources**

Wave Energy

Source: pexels.com

Tidal Energy



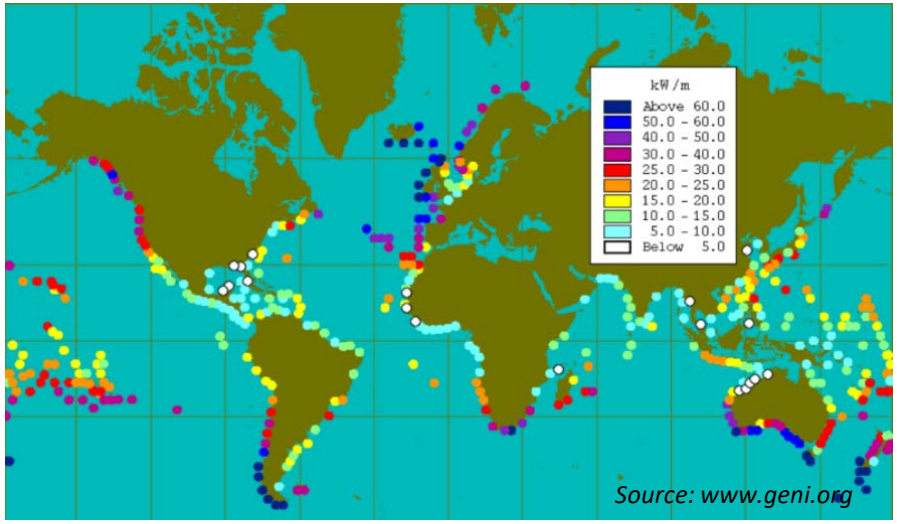
Current Energy

Source: www.jpl.nasa.gov

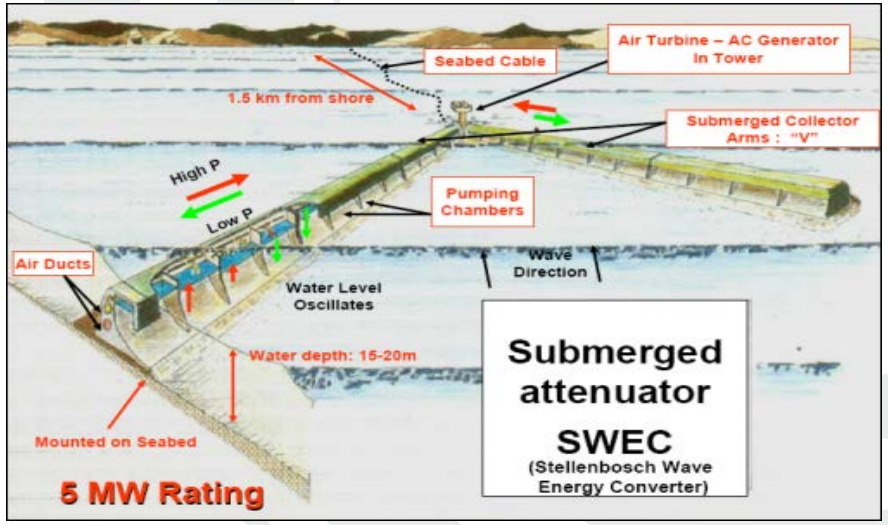
Ocean Energy: Wave Energy

Wave energy has enough potential to serve the energy demand of the world. This is how it works:

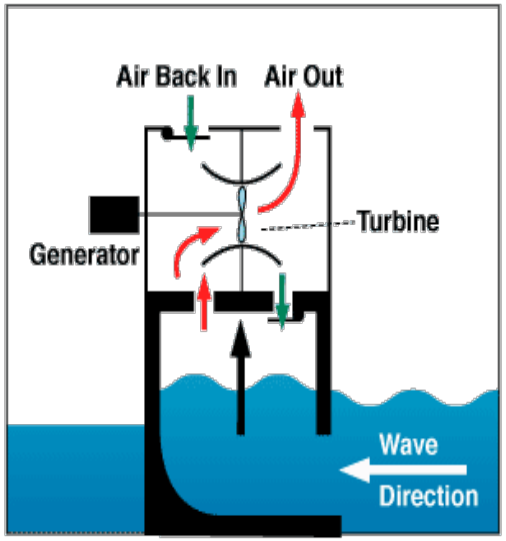
1. The **ocean's waves** are formed when offshore winds **transfer kinetic energy** onto the ocean surface.
2. Surfers use **wave energy** (kinetic energy) to lift them upwards and drive them forwards.
3. The **kinetic** and **potential** energy in waves can be used to generate **electricity.** The image below shows the potential of wave energy that can be generated throughout the world.
4. Wave Energy Converters (**WECs**) use the vertical displacement of the waves to generate electricity.

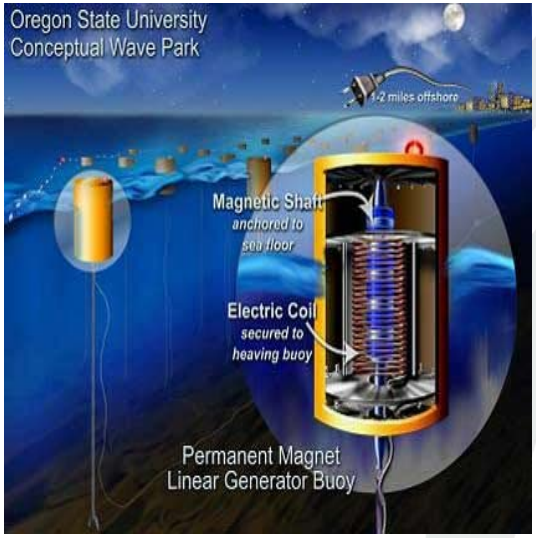


Source: www.geni.org



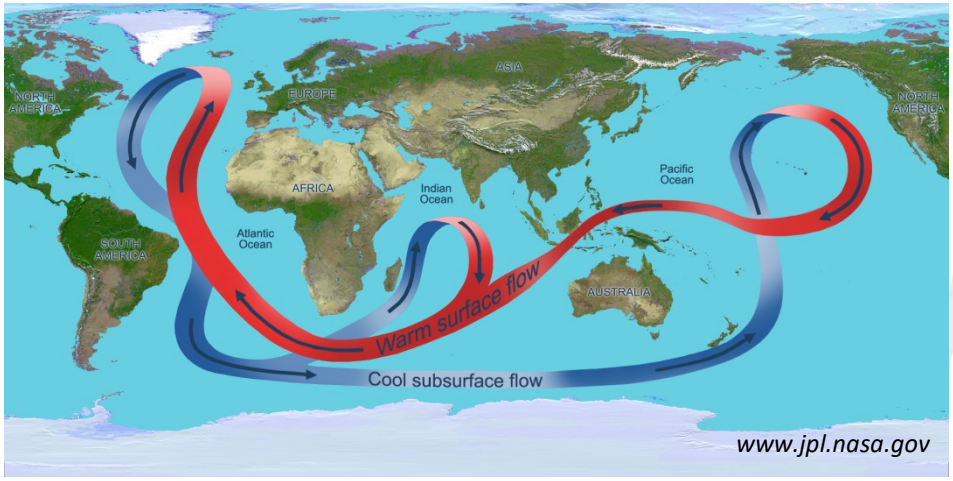
Ocean Energy: Wave Energy

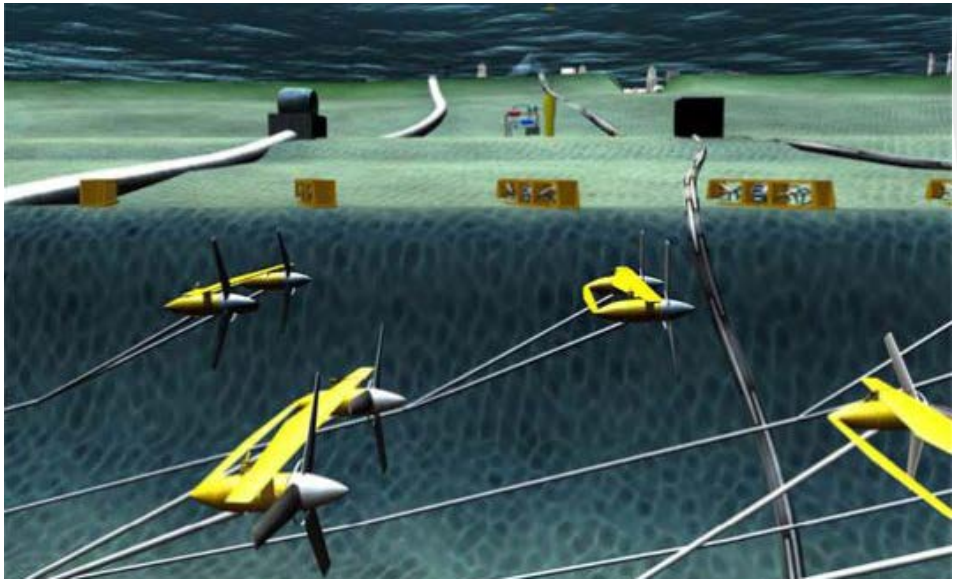




- Wave Energy Converters (WECs) are structures which interact with incoming waves, converting this energy into electricity through a **hydraulic, mechanical** or **pneumatic** power take-off system.
- WECs are kept in position by a **mooring system** or placed **directly** on the seabed or seashore.
- **Power** is transmitted to the shore by a sub-sea electrical cable or a high-pressure hydraulic pipe system.

Ocean Energy: Ocean Currents

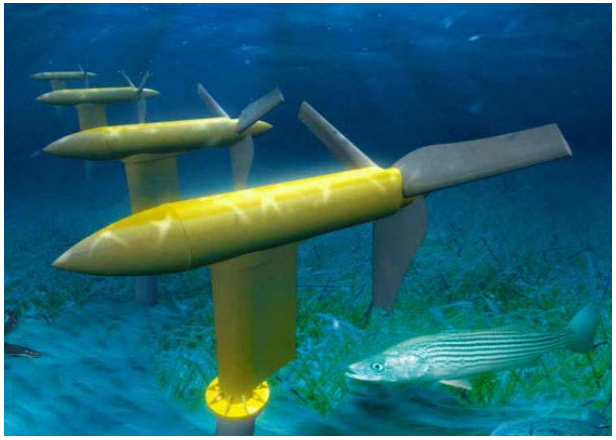


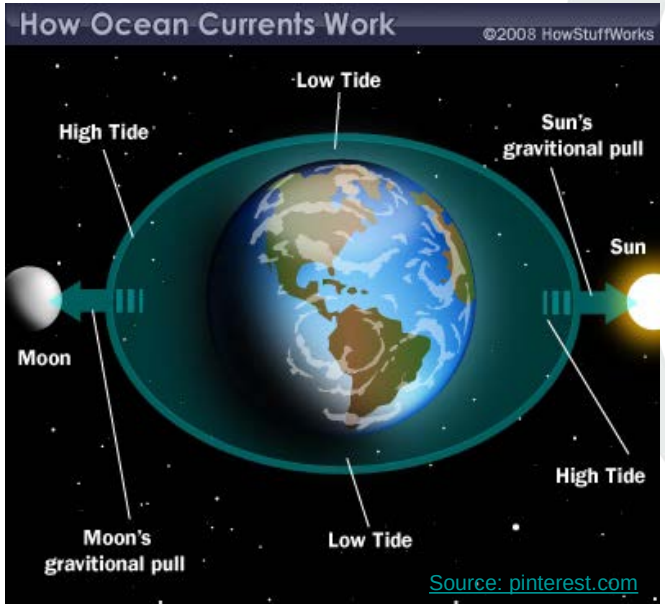


Ocean currents refer to moving bodies of water.

- These are caused mainly due to the **rise** and **fall** of tides because of the gravitational interactions between the earth, moon and sun.
- Other effects such as regional differences in **temperature, salinity** and the **Coriolis Effect** due to the rotation of the earth are also major influences.
- These types of currents are similar to tidal currents but aren't exactly the same.

Ocean Energy: Tidal Currents

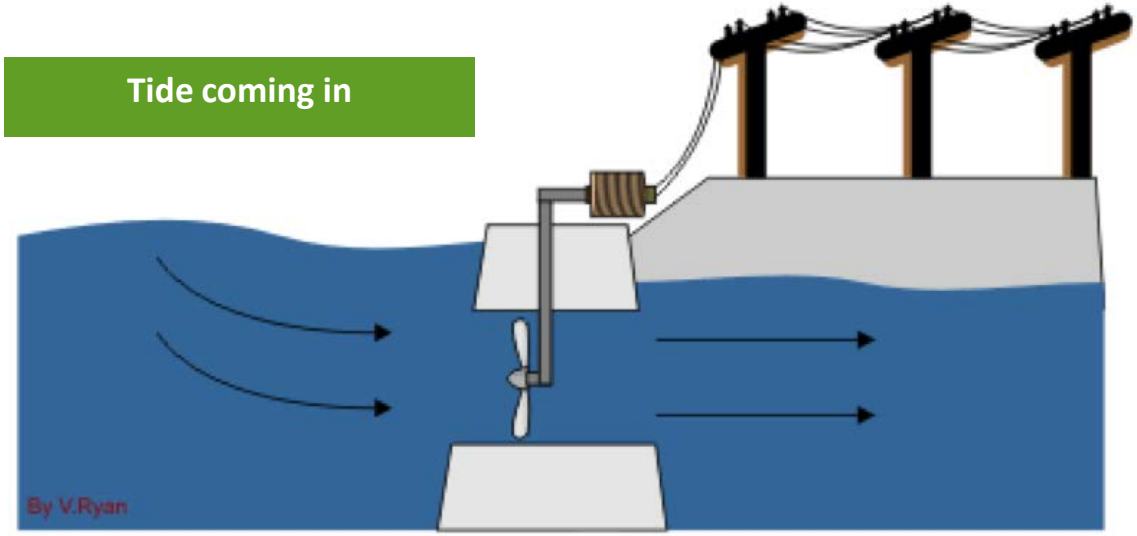




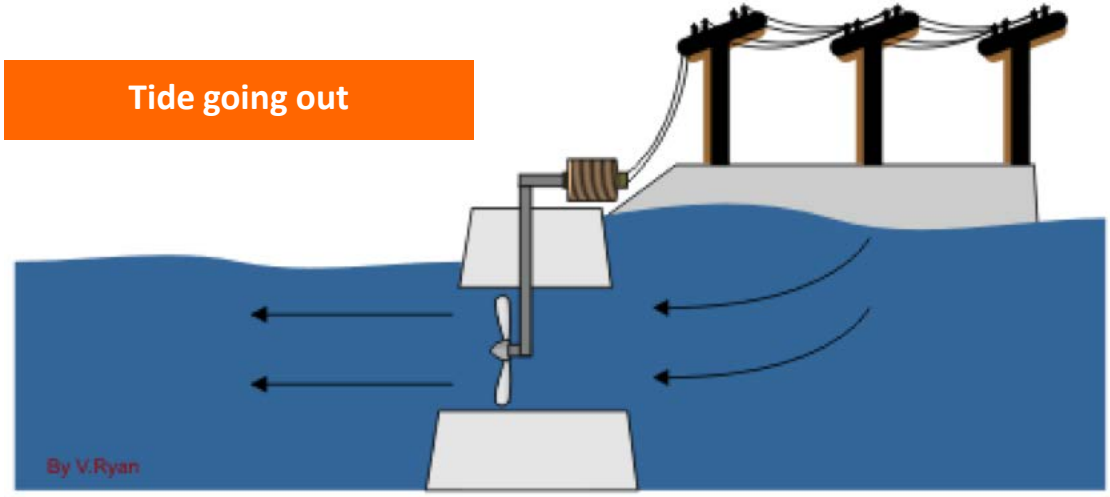
- Tidal energy is the energy present in massive bodies of water which **move** through the ocean due to **gravitational** interactions between the earth, moon and sun, causing **tidal currents.**
- Tidal currents are caused mainly by the rise and fall of the tides, causing the whole sea to flow.
- Tidal currents occur close to the **shoreline.**
- The kinetic energy of tidal currents can be converted in much the same way that a wind turbine extracts energy from the wind, using various types of **open-flow rotors.**
- There is a huge potential for generating electric power from **ocean tidal currents**.

Tidal Energy: Generating Electricity

Tide coming in



Tide going out



- Tidal energy can also be harnessed by constructing a dam or a barrage across an estuary or bay with a **suitable tidal range**.
- Water is **channelled through turbines** to generate electricity.
- **Bi-directional turbines** are used to generate electricity when the tide comes in and when it goes out.

Tidal Energy: Tidal Barrages

- Tidal barrages have been built across estuaries in **France**, **Canada** and **China.**
- **High costs** and **environmental** objections have limited further expansion of this technology.

Reference

- Slide 2 image: www.photonicswiki.org
- Slide 3 image: https://www.flickr.com
- Slide 4 image: www.jpl.nasa.gov (Current), www.pexels.com/photo/ocean-water-wave-photo-1295138 (Wave)
- Slide 5 image: www.geni.org/globalenergy/library/renewable-energy-resources/ocean.shtm (Wave energy potential), www.GEOTHERMAL_ENERGY_tapping.png
- Slide 8 image: www.pinterest.com
- Slide 10 image: https://upload.wikimedia.org/wikipedia/commons/9/95/Sihwa_Lake_Tidal_Power_Station_01.png