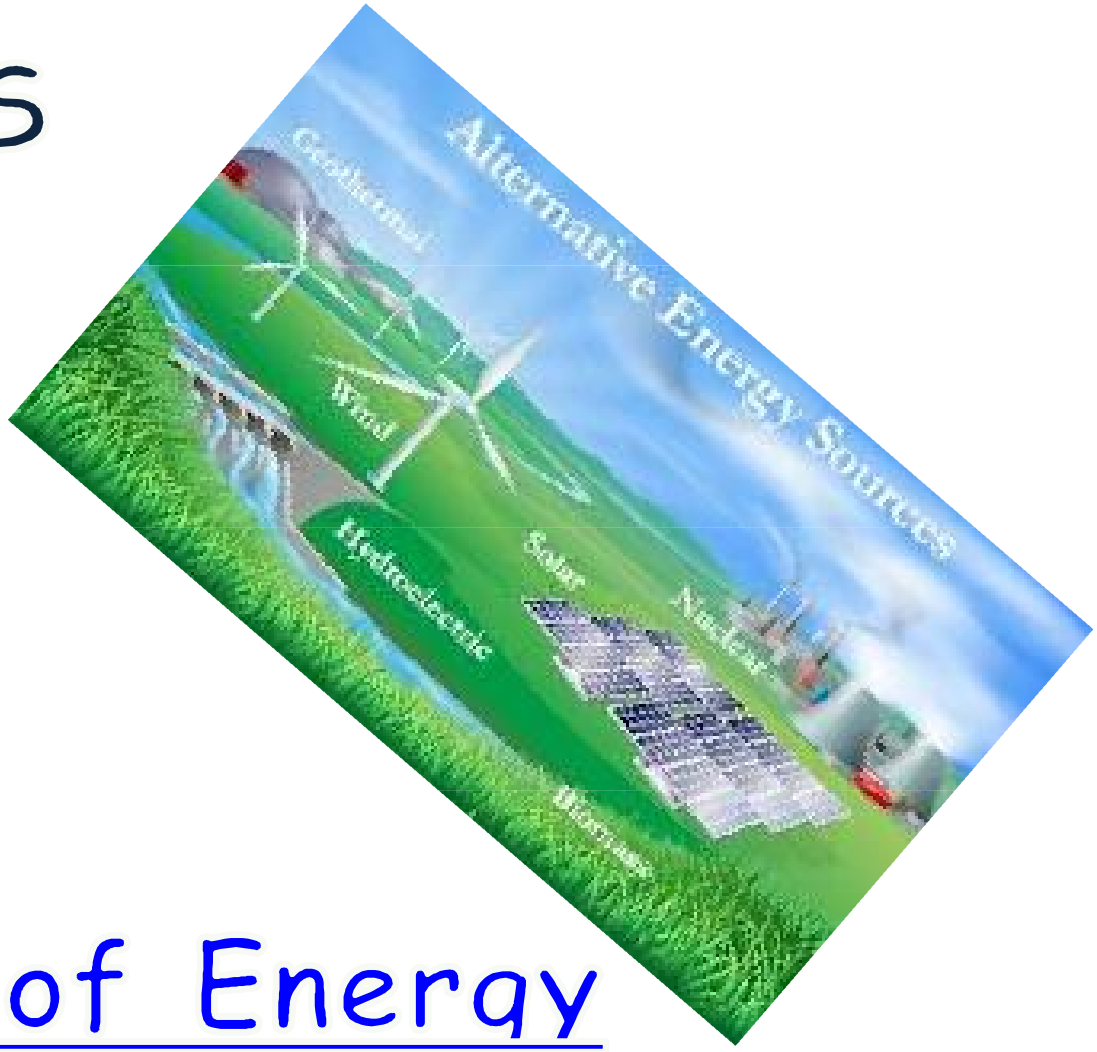
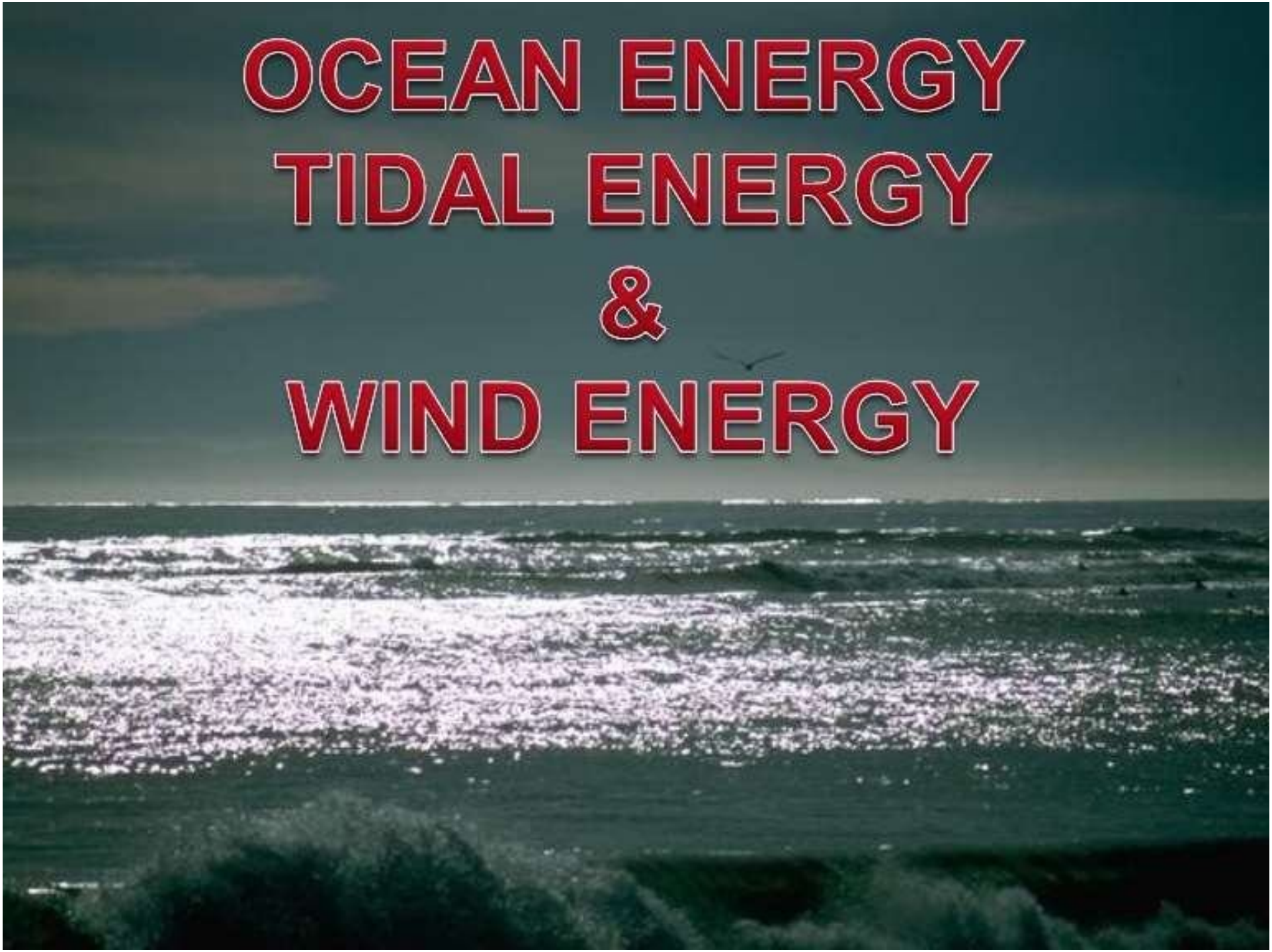
PHYSICS

Class - X



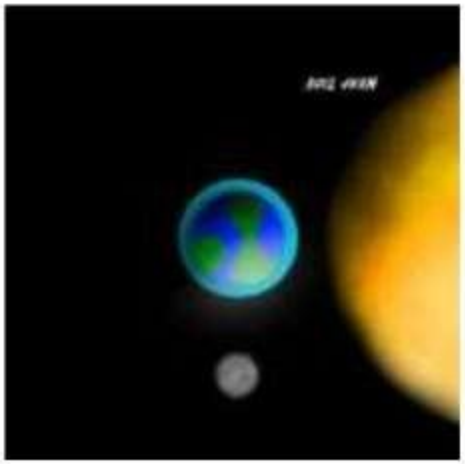
Sources of Energy

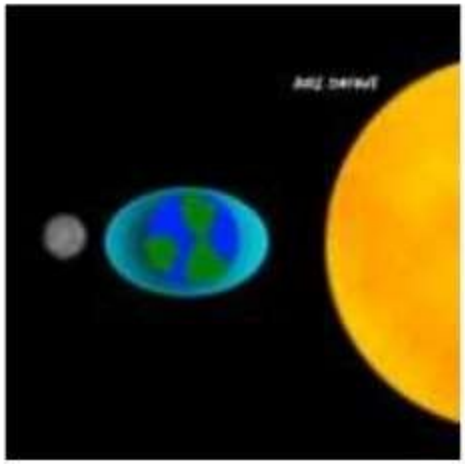
પુના International School
Shree Swaminarayan Gurukul, Zundal


OCEAN ENERGY
TIDAL ENERGY
&
WIND ENERGY

WHAT IS A TIDE ?

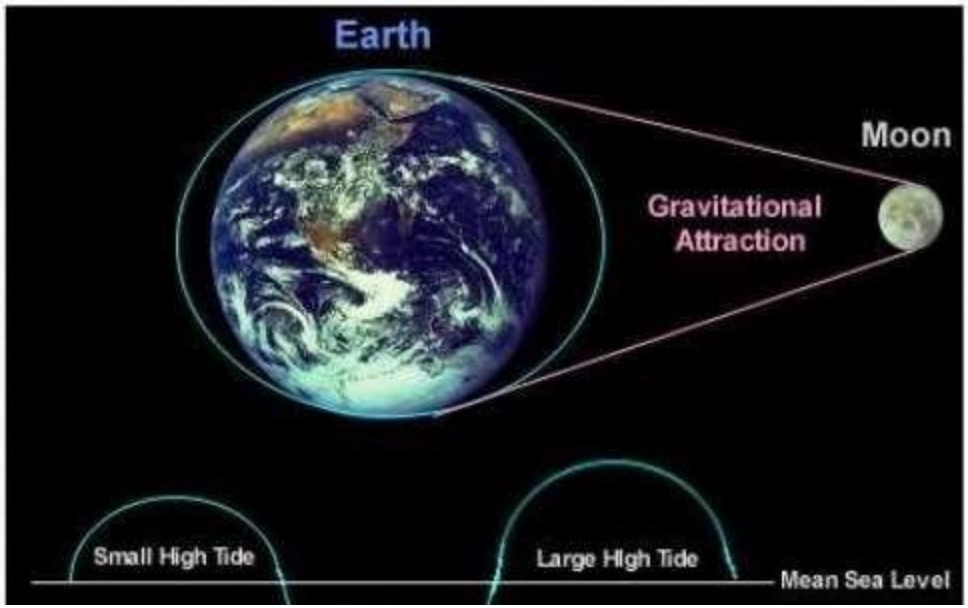
- **Tides** are the rising and falling of Earth's ocean surface caused by the tidal forces of the Moon and the Sun acting on the oceans.





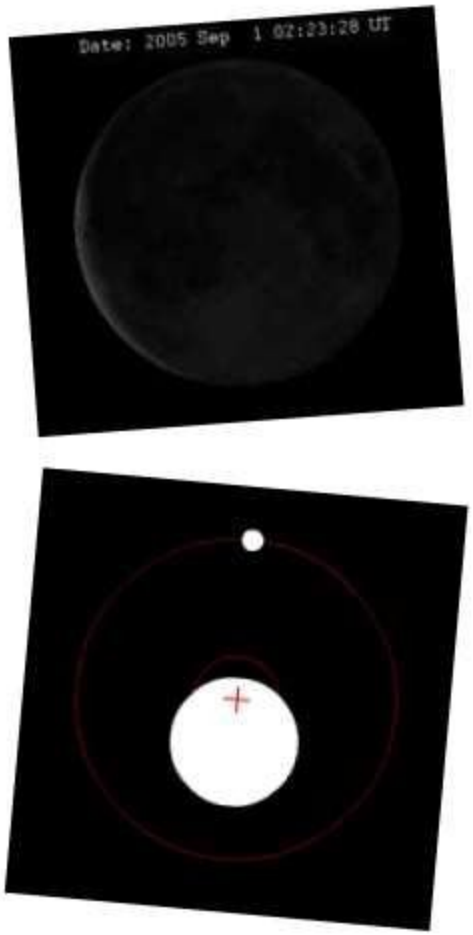
TIDES & TIDAL POWER:-

- Rise and fall in sea levels
- Caused by the combined effect of moon and sun.
- Tides are quite predictable.



WHAT IS THE TIDAL FORCE ?

- The **tidal force** is the vectorial difference between the gravitational force of the Earth and the gravitational force of the Moon.

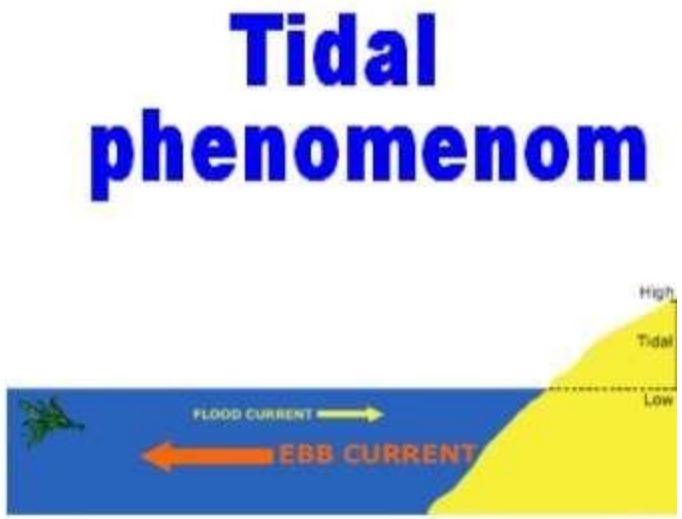


INTRODUCTION

Tidal power, also called tidal energy, is a form of hydropower that converts the energy of tides into useful forms of power - mainly electricity. This is the only form of energy whose source is the moon.

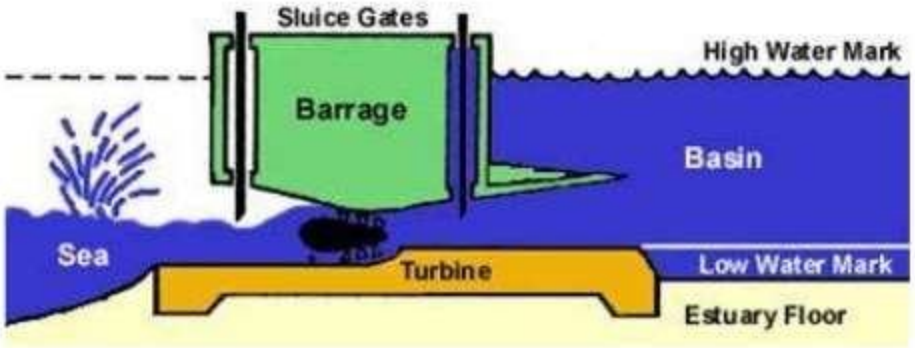
ABOUT TIDAL POWER

- **Tidal power**, sometimes called **tidal energy**, is a form of hydropower that exploits the movement of water caused by tidal currents or the rise and fall in sea levels due to the tides.
- Although not yet widely used, tidal power has potential for future electricity generation and is more predictable than wind energy and solar power.



PRINCIPLE OF TIDAL POWER STATIONS

- 1. Barrages make use of the **potential energy** from the difference in height (or *head*) between high and low tides. . Barrages suffer from th problems of very high civil infrastructure costs, few viable sites globall and environmental issues.



- 2. Tidal stream systems make use of the **kintetic energy** from the moving water currents to power turbines, in a similar way to wind mills use moving air. This method is gaining in popularity because of the lower cost and lower ecological impact.

COMPONENTS OF TIDAL POWER PLANT

- ## Gates & Locks:-

Tidal power basins have to be filled and emptied gates are open regularly and frequently, but heads are vary in highest and on the sides where they occurs which is not the case with the conventional river projects.The gates must be opened and closed rapidly and this operation should use a power.

- ## Power House:-

Because small heads only available large size turbine are hence power house is also large structure. Both the French and soviet operating use the bulb type of turbine the propeller type with the reversible blades.

CONT.....

The Bulb Group:-

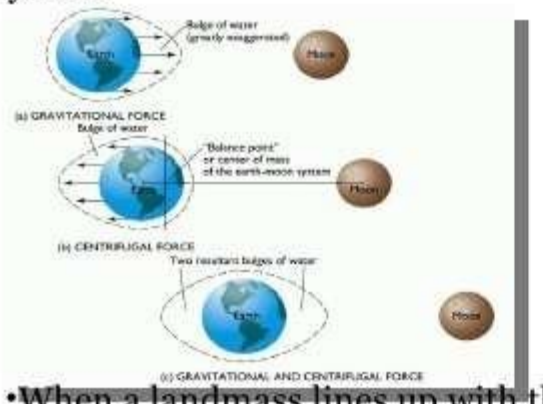
A bulb type turbine is example of flow turbine. The bulb set resembling in appearance a small submarine is made up of an ague shape steel contains a horizontal duct in which alternator and a Kaplan turbine is placed and entirely surrounding by water.

Rim Type Turbine:-

Different types of turbine are under study usually mention are include shaft turbine rim type turbine or straight flow turbine where the gear is attached on the turbine blade arrangement that couples two turbine of conventional type to one generator and a hydraulic system in which six turbine are to hydrostatic pumps. The main problems in rim type turbine in which the rotor surrounded the turbine the runner and rim.

Basic physics of tides

•Gravitational pull of the sun and moon and the pull of the centrifugal force of rotation of the earth-moon system.



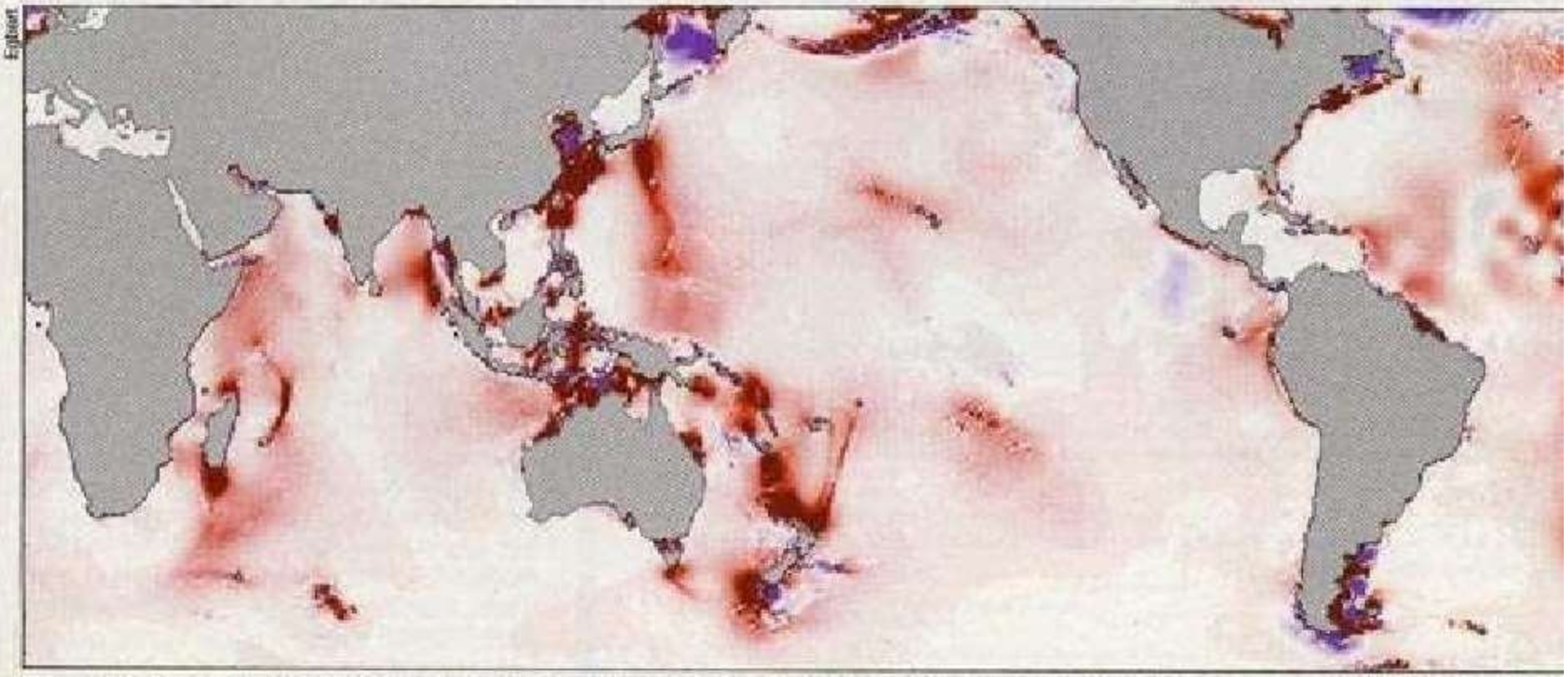
•When a landmass lines up with the earth-moon system, the water around it is at high tide.

•When a landmass is at 90 to the earth-moon system, the water around it is at low tide.

- There are two high tides and two low tides during each period of rotation of the earth.
- **Spring and Neap tides** depend on the orientation of the sun, moon, and the earth.

- High spring tides occur when the sun and moon line up with the earth. This occurs whether they are either on same or opposite side.
- Low neap tides occur when the sun and moon line up at 90 a to each other.
- Flood Currents: currents moving in the direction of the coast.
- Ebb Currents: the current receding from the coast

World Map of the Distribution of Tida Energy



Based on TOPEX/Poseidon satellite data, a color map estimates tidal energy dissipation in the ocean between 66°S and 66° Red areas show tides losing energy. Blue areas reflect noise in the data.

JULY 15, 2000 SCIENCE NEWS, VOL. 158

Developing Nations that could receive significant benefits from Tidal Energy

Indian Ocean: Comoros, Madagascar, Maldives, Seychelles

Asia: China, India, Indonesia, Korea, Philippines, Vietnam

Pacific Ocean: Fiji, Kiribati, Micronesia, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor, Tuvalu, Vanuatu

Central and South America: Argentina, Brazil, Ecuador, Guyana, Panama, Surinam.

Atlantic Ocean: Cape Verde.

All coastal nations with tidal passes between coral reefs or offshore islands

History

- The first tidal power station was the Rance tidal power plant built over a period of 6 years from 1960 to 1966 at La Rance, France. It has 240 MW installed capacity.
- also the world's second biggest tidal power station.

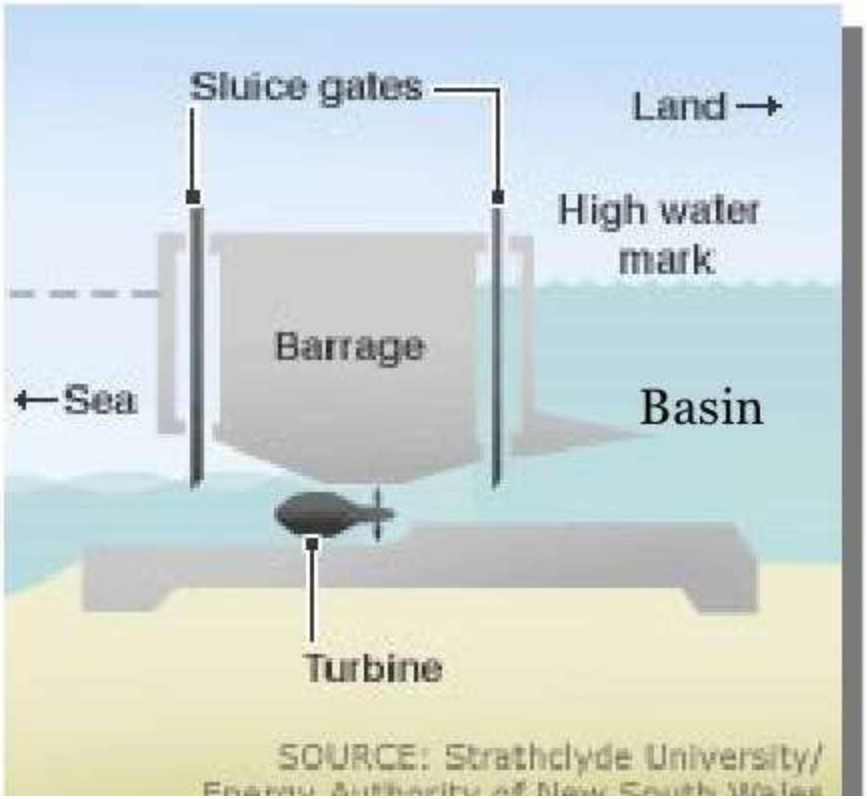
- With a peak rating of 240 Megawatts, generated by its 24 turbines, it supplies 0.012% of the power demand of France. With a capacity factor of approximately 40%, it supplies an average 96 Megawatts, giving an annual output of approximately 600GWh. The barrage is 750 m (2,461 ft) long, from Brebis point in the west to Briantais point in the east. The power plant portion of the dam is 332.5 m (1,091 ft) long. The tidal basin measures 22.5 km^2 (9 sq mi).

Two types of tidal plant facilities.

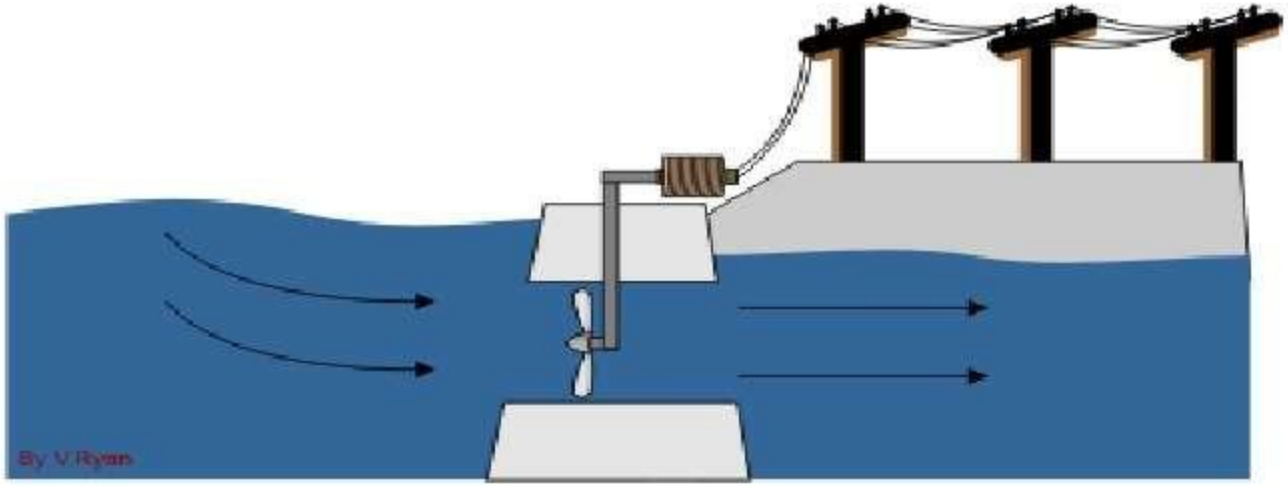
- Tidal barrages
- Tidal current turbines
- Dynamic tidal power plants

1.) Tidal Barrage

- Utilize potential energy
- Tidal barrages are typically dams built across an estuary or bay.
- consist of turbines, sluice gates, embankments, and ship locks.

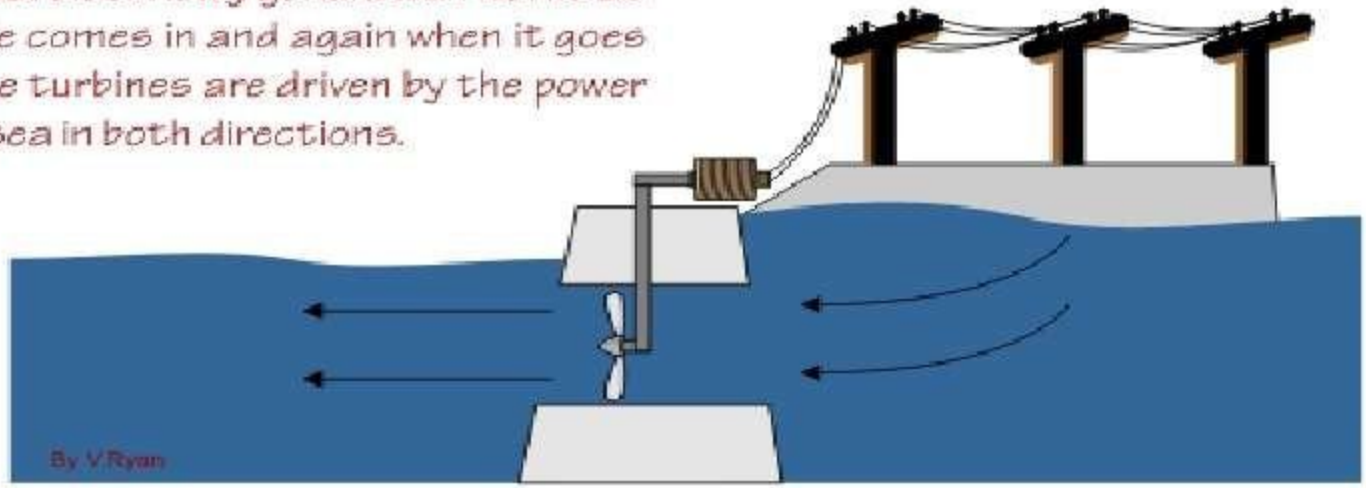


- **Two types:**
  - **Single basin system**
  - **Double-basin systen**



TIDE COMING IN

This tidal electricity generation works as the tide comes in and again when it goes out. The turbines are driven by the power of the sea in both directions.



TIDE GOING OUT

Single basin system-

Ebb generation: During flood tide basin is filled and sluice gates are closed , trapping water. Gates are kept closed until the tide has ebbed sufficiently and thus turbines start spinning and generating electricity.

Flood generation: The basin is filled through the turbine which generate at flood tide.

Two way generation: Sluice gates and turbines are closed until near the end of the flood tide when water is allowed to flow through the turbines into the basin creating electricity. At the point where the hydrostatic head is insufficient for power generation the sluice gates are opened and kept open until high tide when they are closed. When the tide outside the barrage has dropped sufficiently water is allowed to flow out of the basin through the turbines again creating electricity.

I. SINGLE BASIN SYSTEM

- In this system there is only one interaction with the sequence. The two are separated by dam and flow between through sluice valves. The generation of power is by……..
  - ➔Single ebb cycle system
  - ➔Single tide cycle system
  - ➔Double cycle system

➔SINGLE EBB CYCLE SYSTEM:-

When the flood tide comes in the sluice gates are open to permit sea water to enter the basin or reservoir, while turbine seas are shut. At the start of ebb tide and the sluice gates are closed. The generation of power takes place when the sea is ebbing and the water from basin flows over there sufficient difference between reservoir and falling tide.

➔SINGLE TIDE SYSTEM

Here generation is affected when sea is at flood tide. The water of sea is admitted into the basin over turbine. As the flood period is over and the sea level is slopping, the basin is drained into the sea through side ways. The main disadvantage is in the both the ebb and tide cycle system is intermittent occurs at regular interval. There is possibility of connection another system such possibility can regulate operation of the system for both ebb and flood tides with single basin..

cont……

➔DOUBLE CYCLE SYSTEM:-

The power generation is affected when sea is at flood tide. The direction through turbine during the ebb and the flood tides alternate but the machine acts as a turbine for either direction of flow.

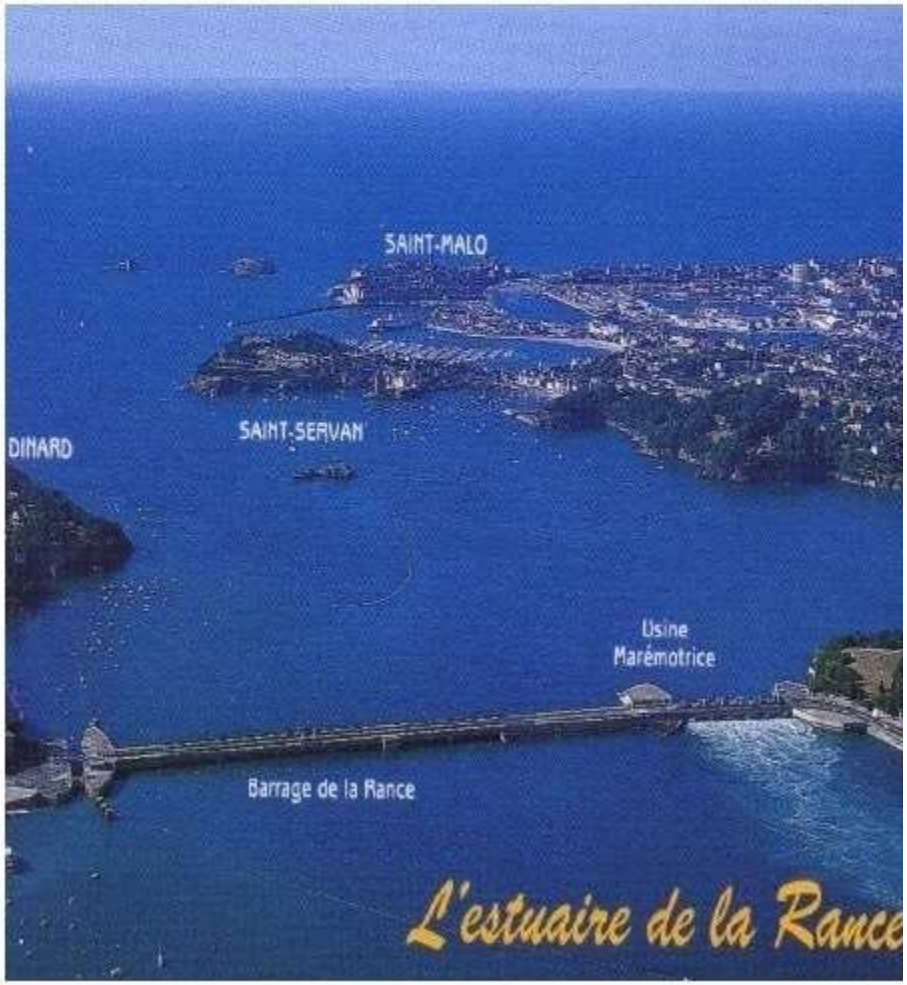
In this system the power is accomplished during both emptying process takes place during short period of time. The filling of ocean is high while at low tide emptying occurs. The flow of water in both directions is used to drive a no of water turbine each driving an electric generator. Electric power is generated once in every six hours 12.5 min.

Double-basin system

- There are two basins, but it operates similar to e
  ebb generation, single-basin system. The only
  difference is a proportion of the electricity is use
  to pump water into the second basin allowing
  storage.

Current sites of tidal barrages

- **La Rance**, Brittany, France
  - The first and 2nd largest tidal barrage power plant
  - Constructed between 1961 and 1967.
  - Situated on the Rance River.
  - Contains 24 reversible 10 MW bulb turbines generating a capacity of 240 MW and a net power output of 480 GWh per year.
  - Two- way generation system and pumped storage.



Annapolis Tidal Generation Facility on the **Bay of Fundy**, Canada

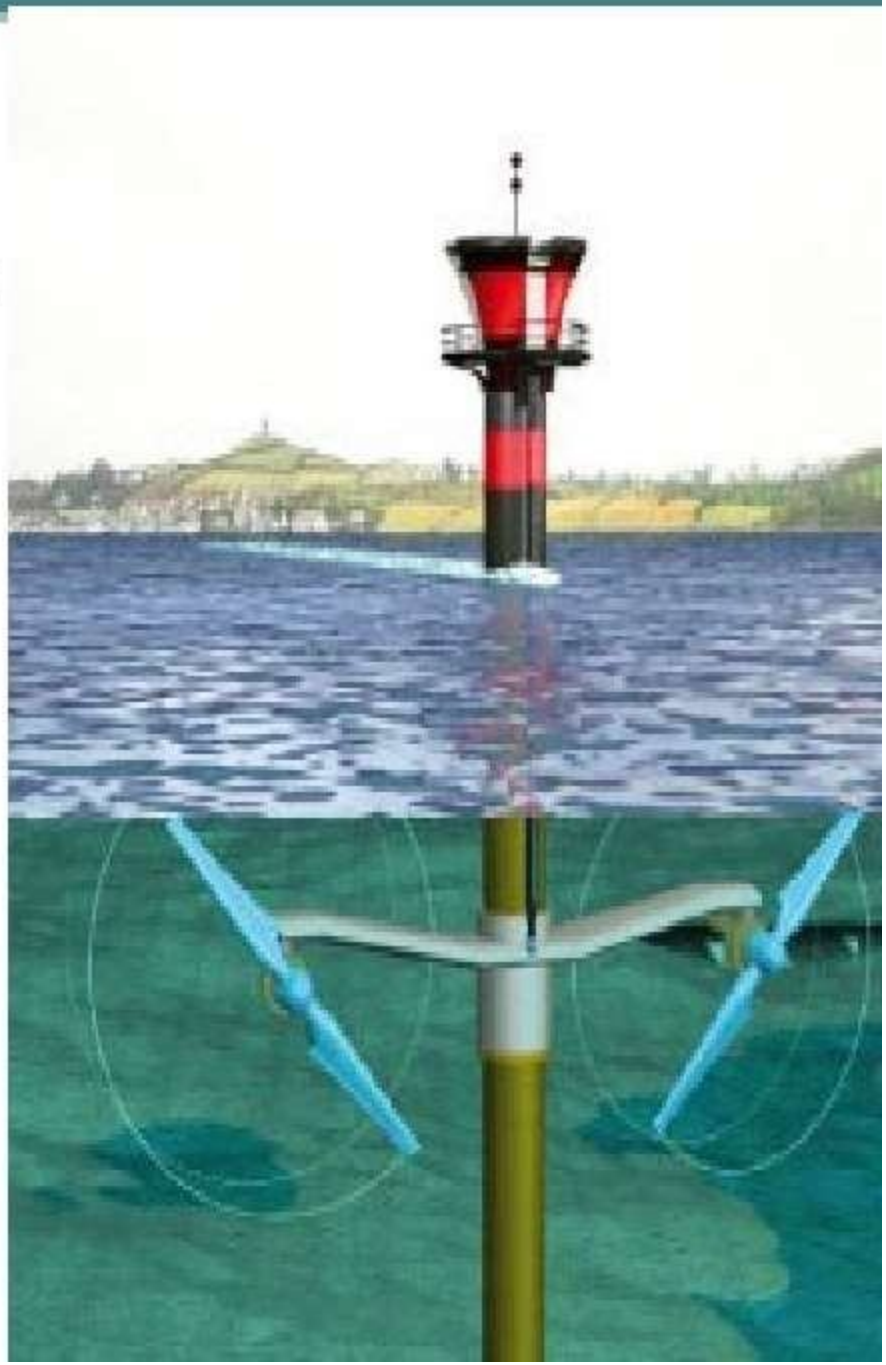
Constructed between 1981 and 1984.

Generating capacity of 20 MW and a net output of GW h per year.

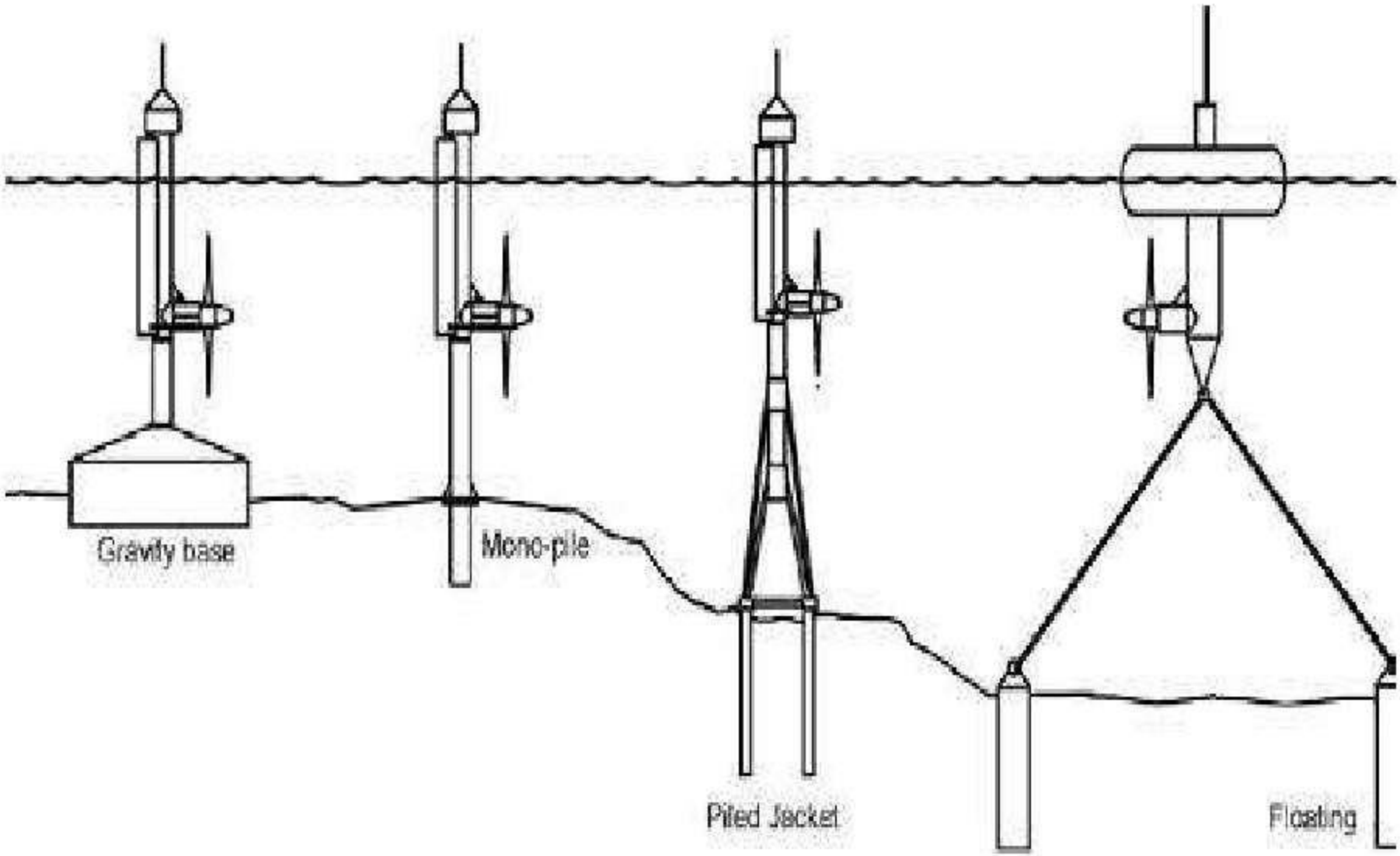
Further development is bei considered in the Bay of Fundy.

2.)Tidal current turbines

- Make use of the kinetic energy of moving water to power turbines, in a similar way to wind turbines that use wind to power turbines.
- Operate during flood and ebb tides.
- Consists of a rotor, gearbox, and a generator. These three parts are mounted onto a support structure. There are three main types:
  - Gravity structure
  - Piled structure
  - Floating structure



- **Gravity Structures** are massive steel or concrete structures attached to the base of the units to achieve stability by their own inertia.
- **Piled Structures** are pinned to the seabed by one or more steel or concrete piles. The piles are fixed to the seabed by hammering if the ground conditions are sufficiently soft or by pre-drilling, positioning and grouting if the rock is harder.
- **Floating Structures** provide a potentially more convincing solution for deep water locations.



Support structure concepts

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JUST A NOTE TO SAY
THANK YOU!