Introduction

Oceanography

It’s a branch of science that deals with all the aspect of sea and ocean.

Braches of Oceanography

- Physical Oceanography
- Chemical Oceanography
- Biological Oceanography
- Geological Oceanography

Importance of ocean studies

The ocean influences our lives in many ways

- **Climate system**
- **Oceanic processes.**
- **Resources of the ocean are important.**
- **Energy from ocean**
- **Transportation**

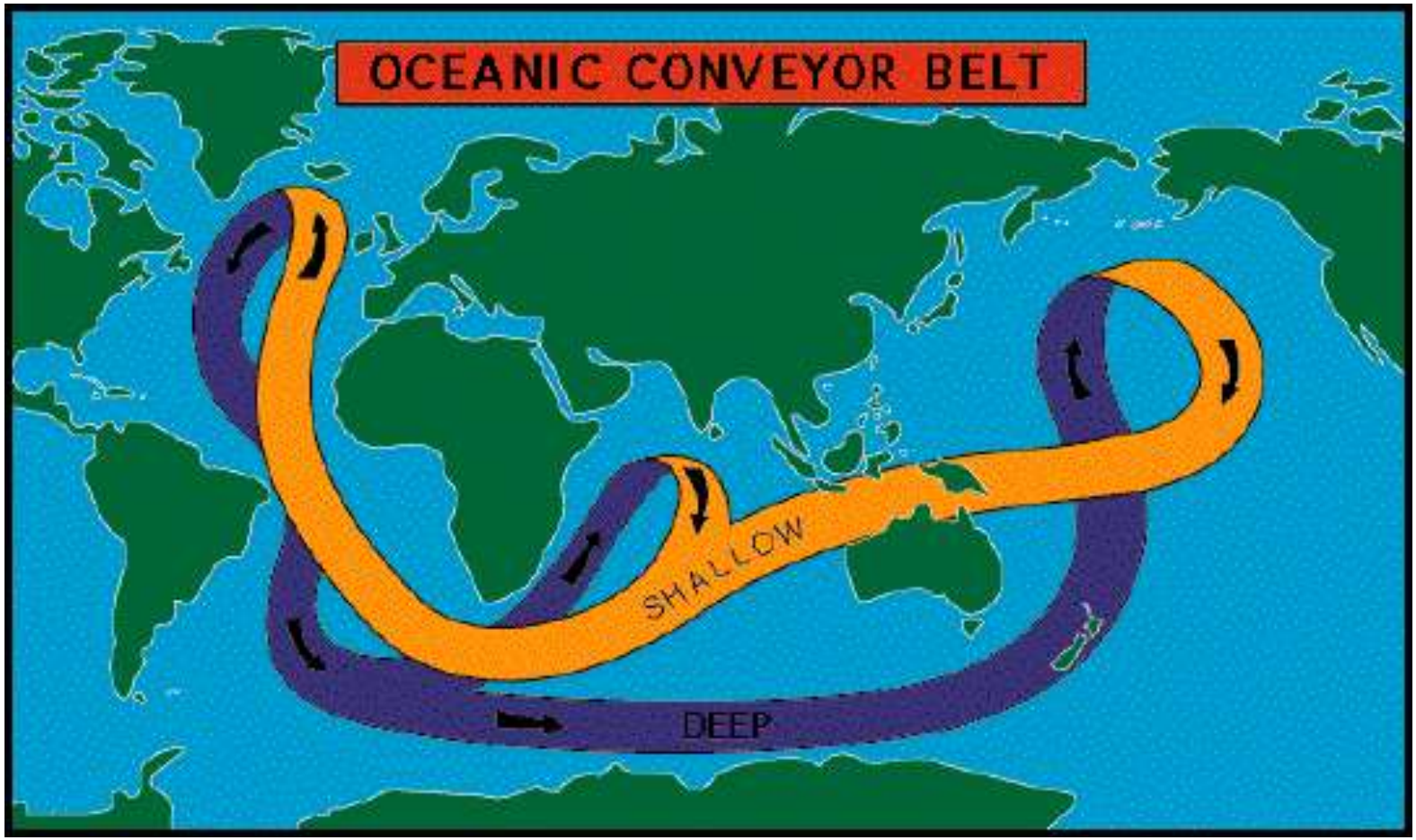
Climate system

- The ocean strongly influences climate including earth's surface temperature, by influencing:
  - The amount of CO_2 in the atmosphere,
  - The transport of heat from the tropics to polar regions.
  - The operation of the hydrological cycle.(Monsoon)
  - Earth's carbon cycles.

- Most of the oxygen in the atmosphere comes from the oceans.

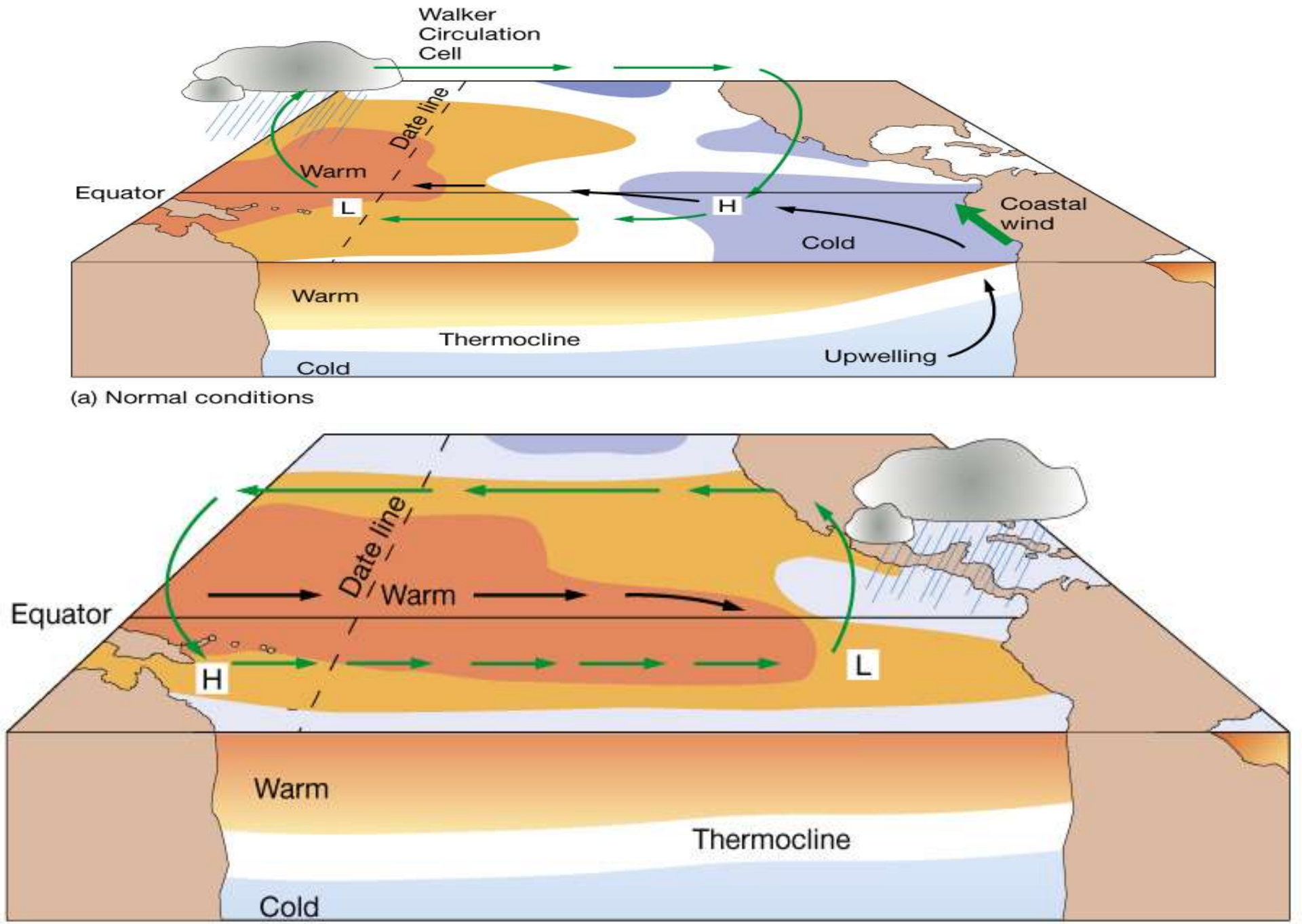
- The oceans may be responsible for abrupt climate change.

- Will global warming plunge the world into the next ice age?


OCEANIC CONVEYOR BELT
SHALLOW
DEEP

El Niño and other oceanic processes change weather patterns.

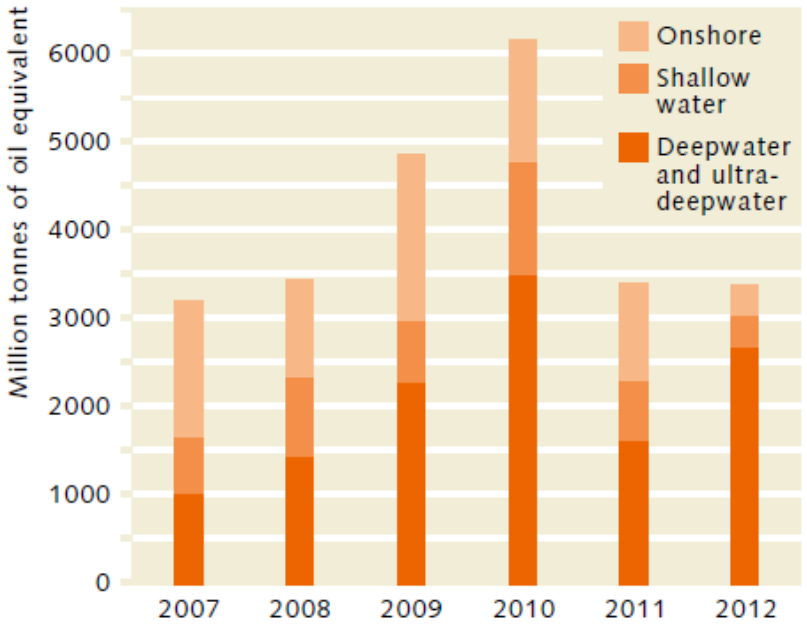
- The ocean strongly influences weather patterns.
- The largest source of year-to-year change in the weather is El Niño, which is a disruption of the interaction of the atmosphere and ocean in the Pacific.
- A change of temperature of surface water in the western north Pacific and in the tropical Atlantic can cause drought in Texas, the great plains, and the and west.


Walker
Circulation
Cell
Date line
Warm
Equator
L
H
Coastal
wind
Cold
Warm
Thermocline
Cold
Upwelling
(a) Normal conditions
Date line
Warm
Equator
H
L
Warm
Thermocline
Cold
(b) El Niño conditions

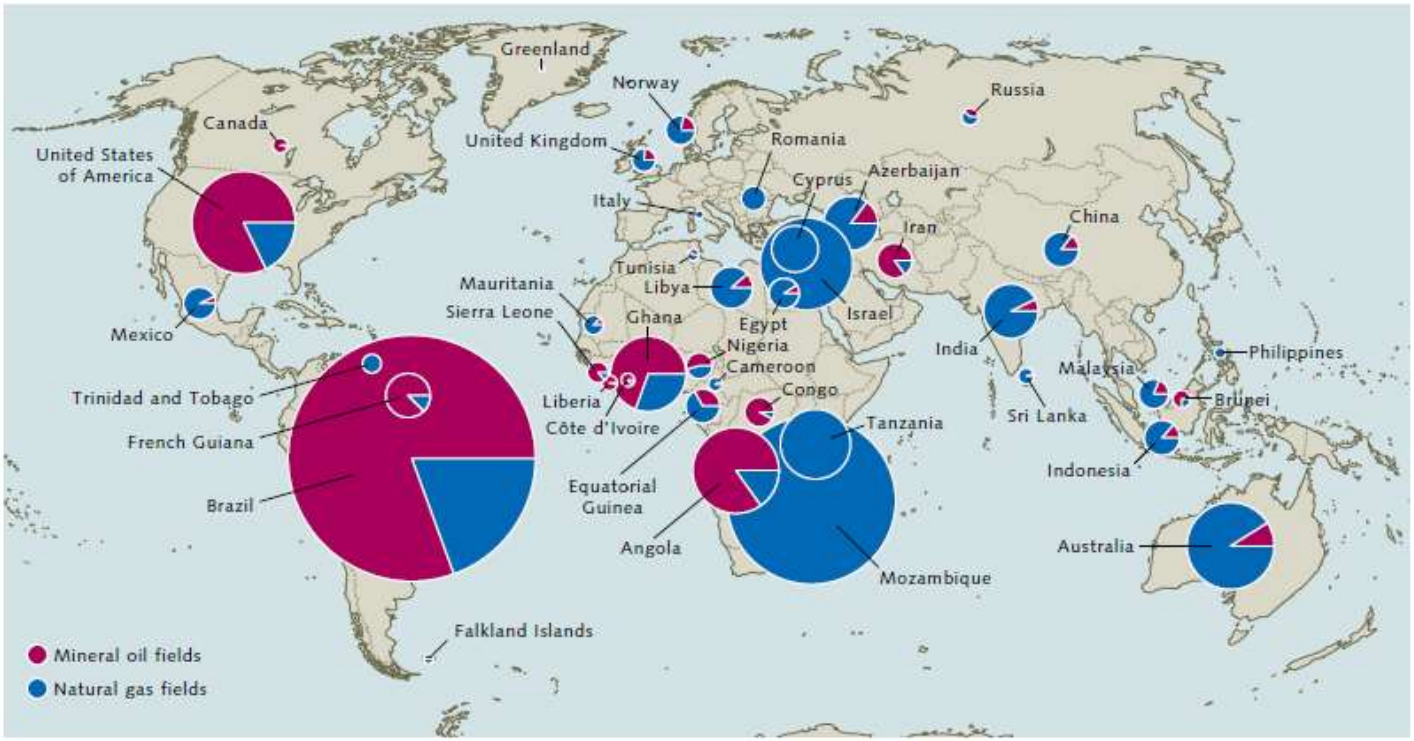
Resources of the ocean

- Roughly 25% of the protein used by people comes from fish.
- Sea food have rich in good protein
- Seaweed rich in vitamins, minerals
- Medicine

World recent finding of oil source

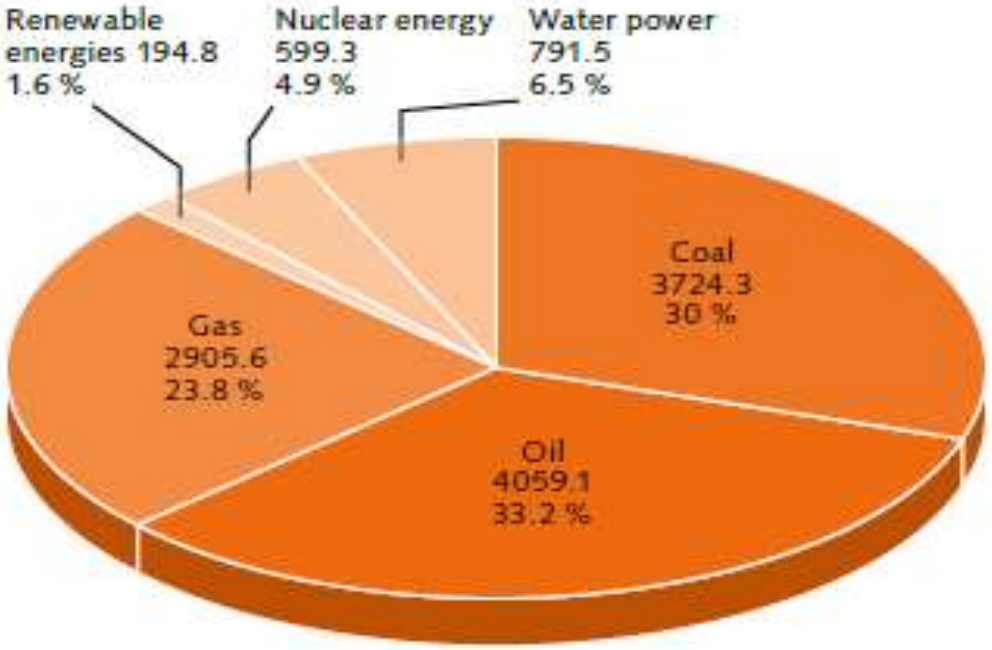


Major new deposits



Oceanic Energy

World primary energy consumption

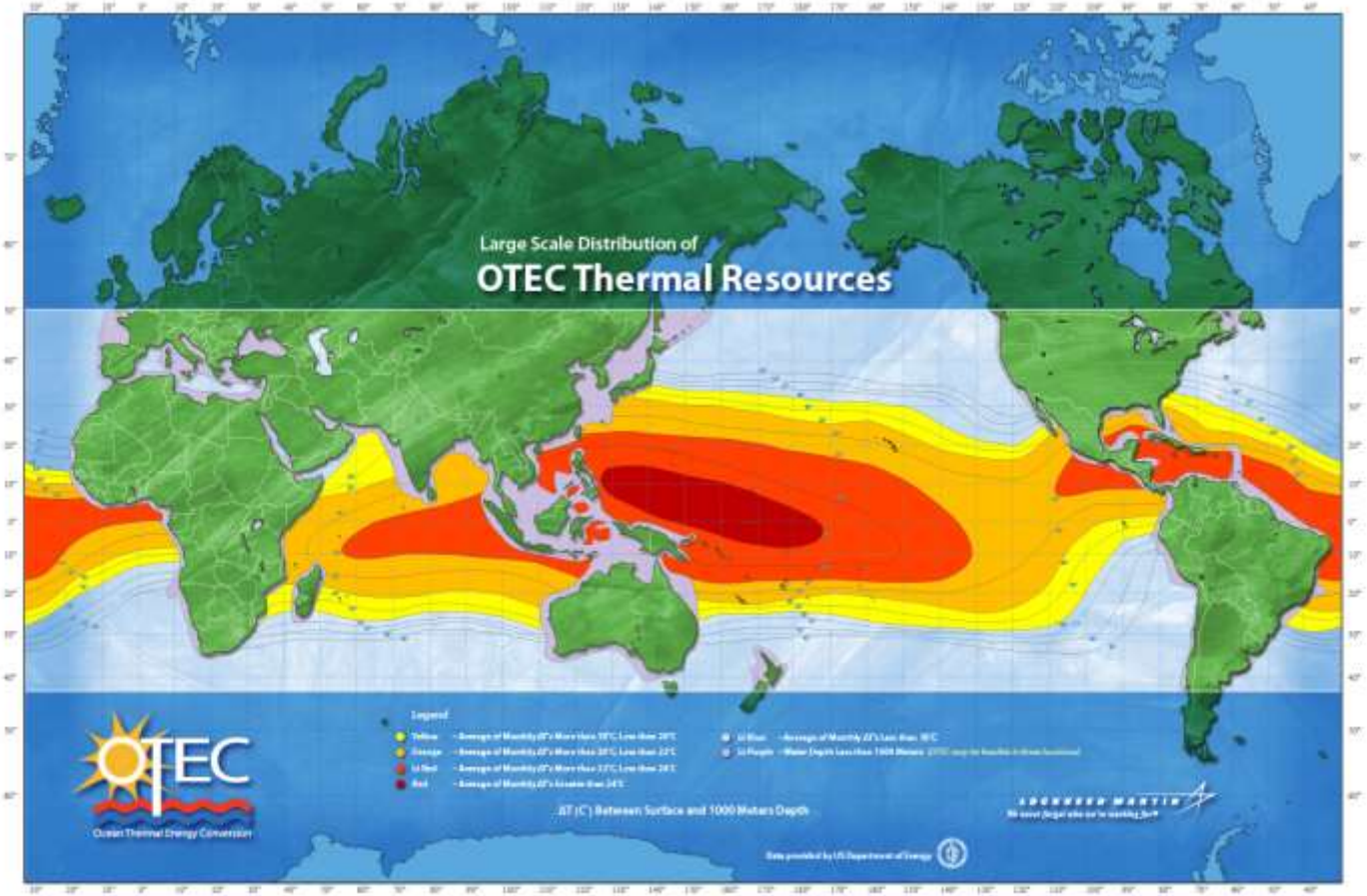


Renewable Energy

- Hydro Power
- Wind Energy
- **Oceanic Energy**
- Solar Power
- Geothermal
- Biomass

Sources of Energy from Ocean

- OTEC
- Water currents
- Waves
- Tide


Large Scale Distribution of
OTEC Thermal Resources
OTEC
Ocean Thermal Energy Conversion
Legend
ΔT (C°) Between Surface and 1000 Meters Depth

OTEC

Ocean Thermal Energy Conversion

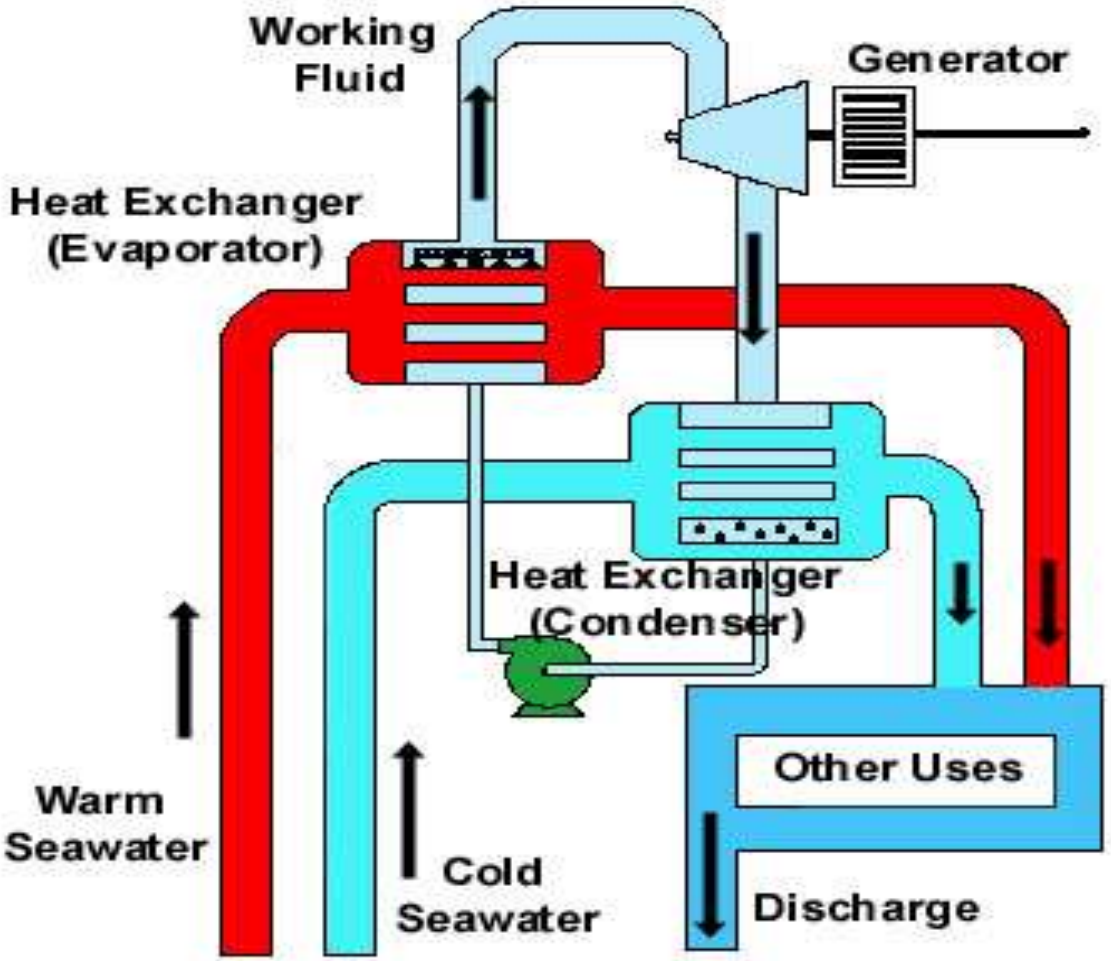
- Depends on the difference in temperature between surface and water at 600 - 1000m depth

- Two types of OTEC System

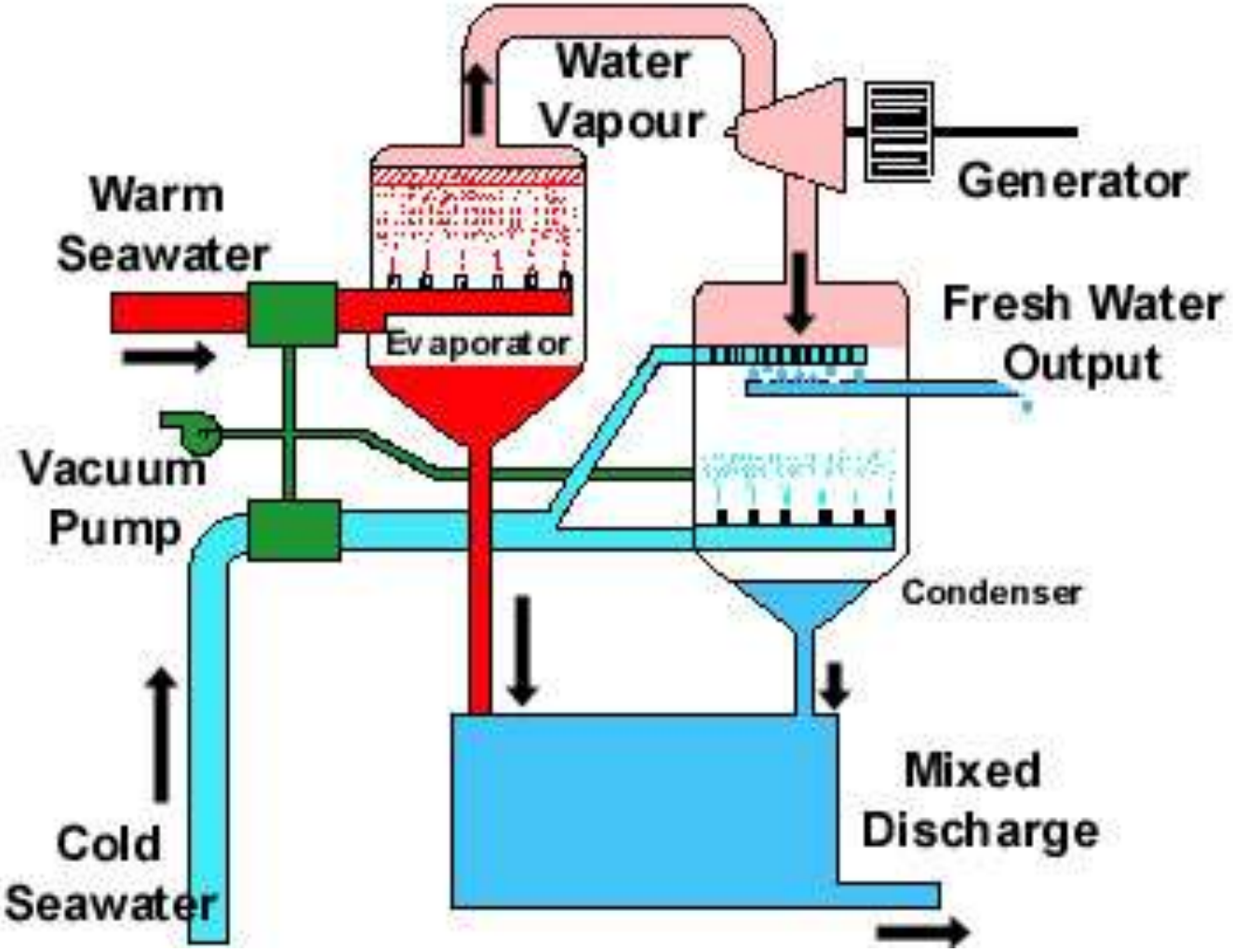
  Closed Cycle – low boiling point liquid(Ammonia)

  Open Cycle – Sea water to Stream

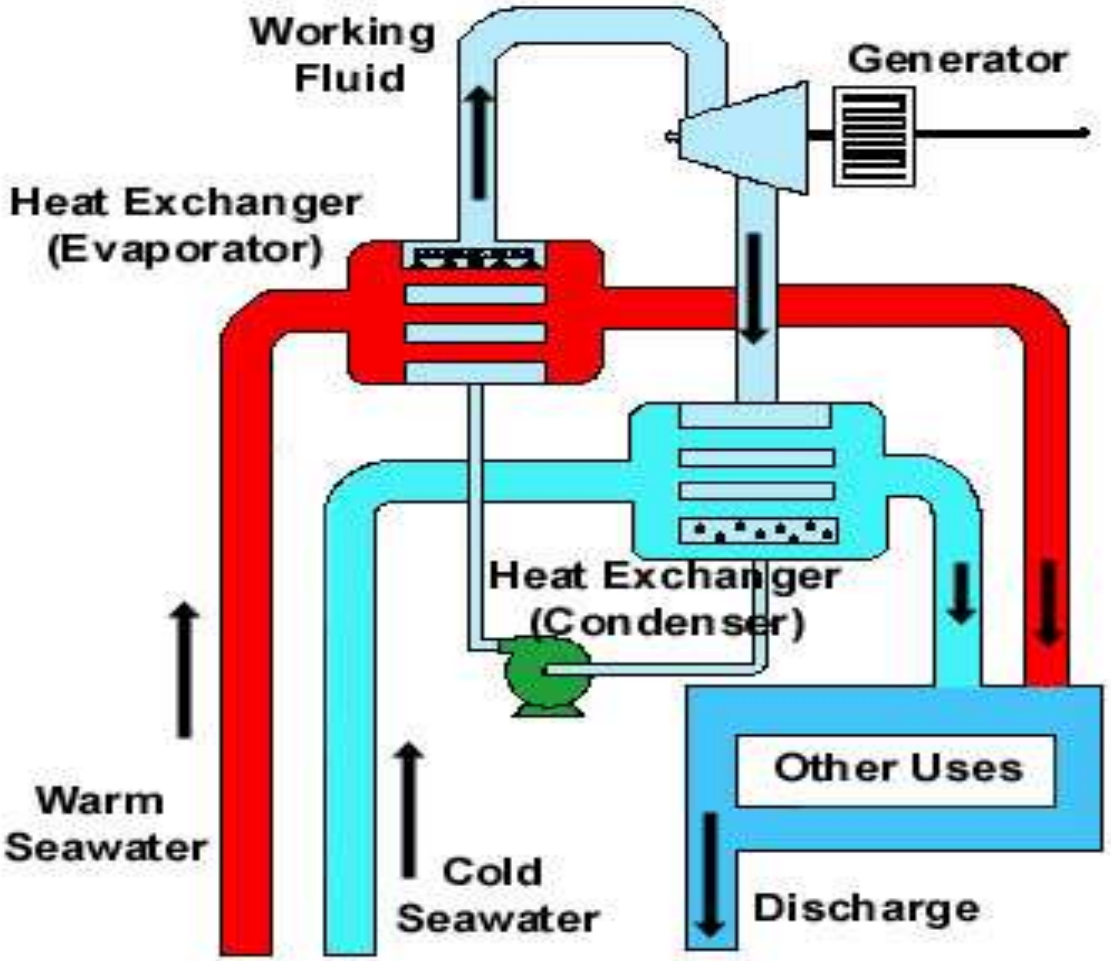
Closed Cycle - OTEC



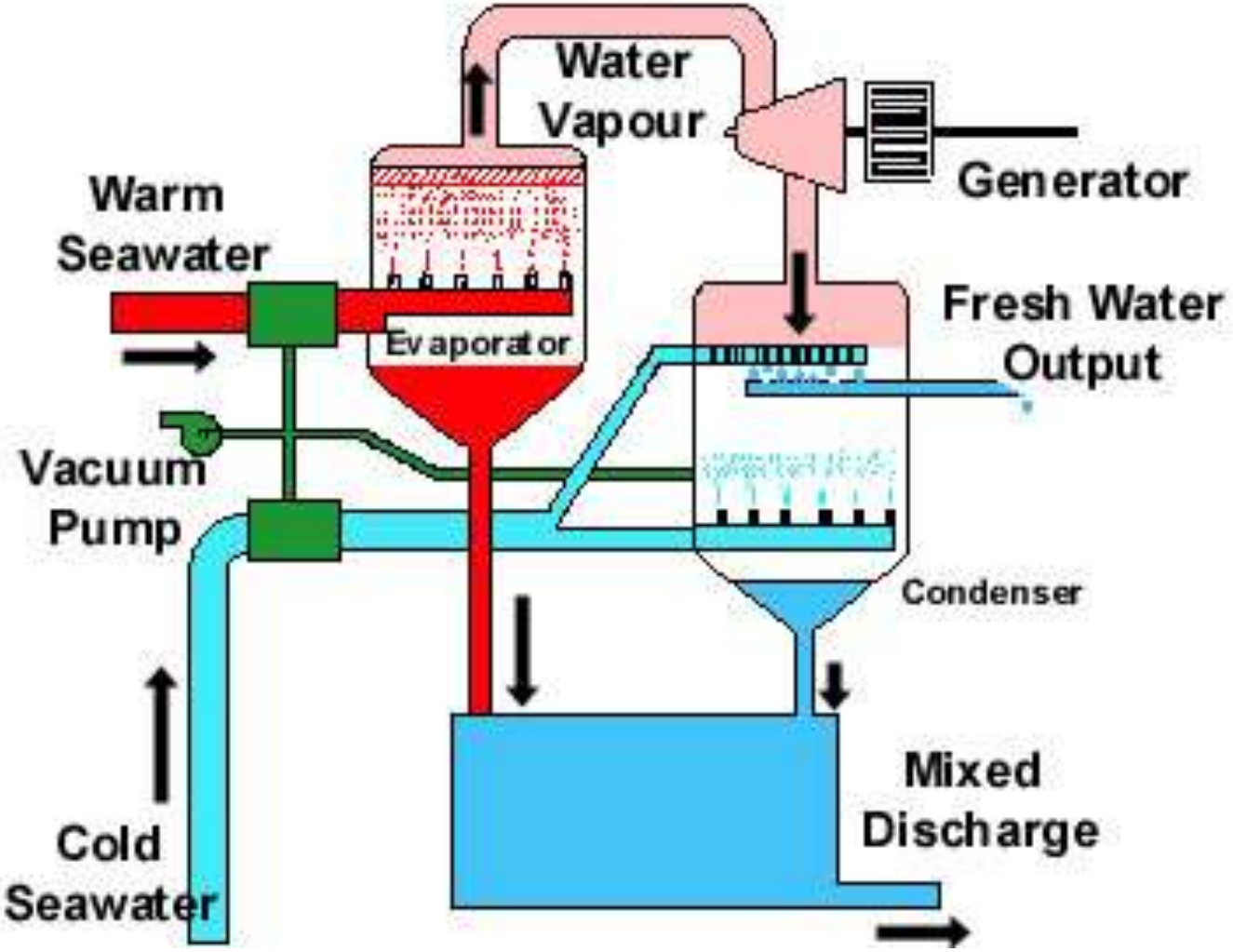
Open Cycle – OTEC



Closed Cycle - OTEC



Open Cycle – OTEC



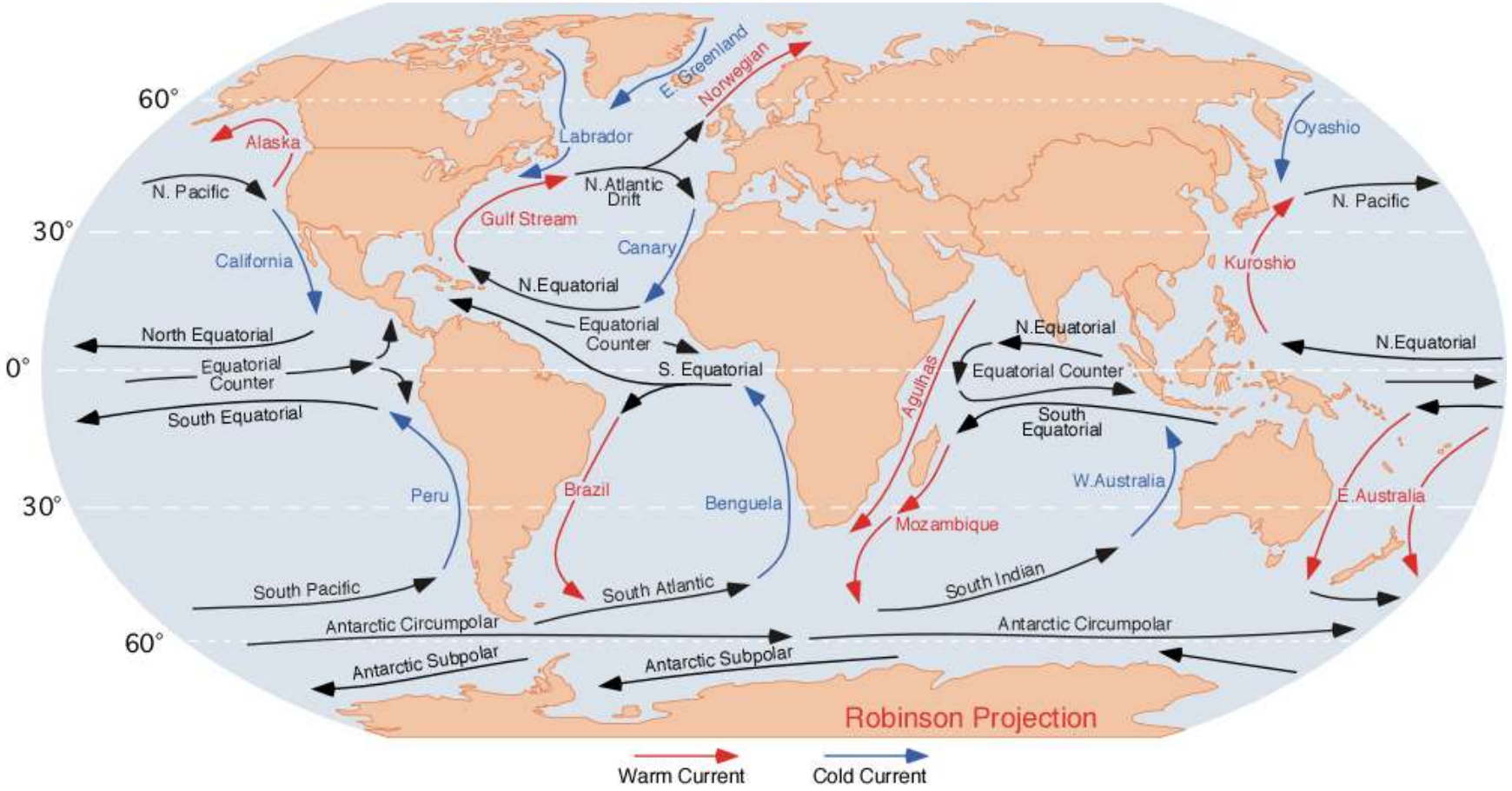
Water currents

Ocean currents

An ocean current is a continuous, directed movement of seawater generated by following forces Breaking waves, Wind, the Coriolis effect, cabbeling, temperature and salinity differences

Tidal currents

Tides are caused by the gravitational pull of the Sun and Moon

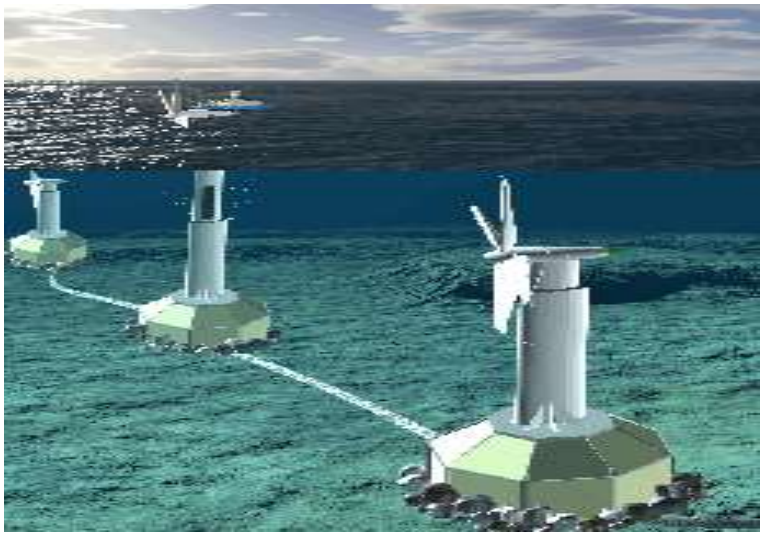

60°
30°
0°
30°
60°
Alaska
N. Pacific
California
Labrador
E. Greenland
Norwegian
N.Atlantic Drift
Gulf Stream
Canary
N.Equatorial
Equatorial Counter
S. Equatorial
North Equatorial
Equatorial Counter
South Equatorial
Peru
Brazil
Benguela
South Pacific
South Atlantic
Antarctic Circumpolar
Antarctic Subpolar
Oyashio
N. Pacific
Kuroshio
N.Equatorial
Equatorial Counter
South Equatorial
Agulhas
Mozambique
W.Australia
E.Australia
South Indian
Antarctic Circumpolar
Antarctic Subpolar
Robinson Projection
Warm Current
Cold Current

Tides

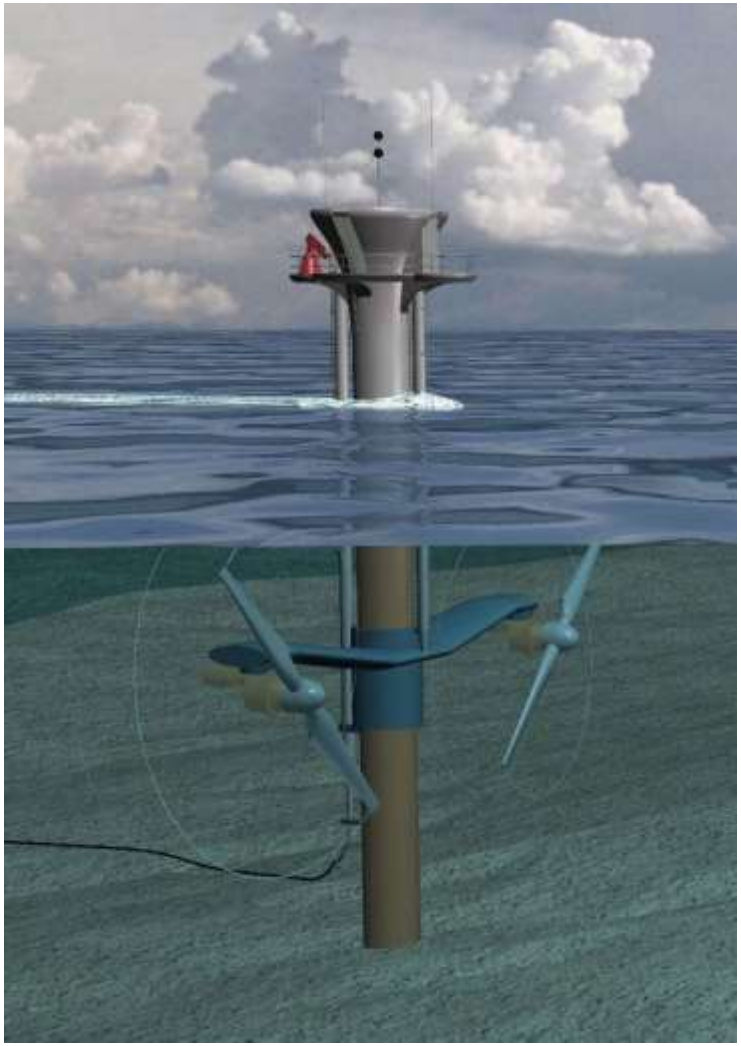
- The rise and fall in sea level is called a tide.
- Caused by a **giant wave**.
- One low-tide/high-tide cycle takes about 12 hrs and 25 min.
- Tidal range is the difference in ocean level between high-tide and low-tide

Tidal energy

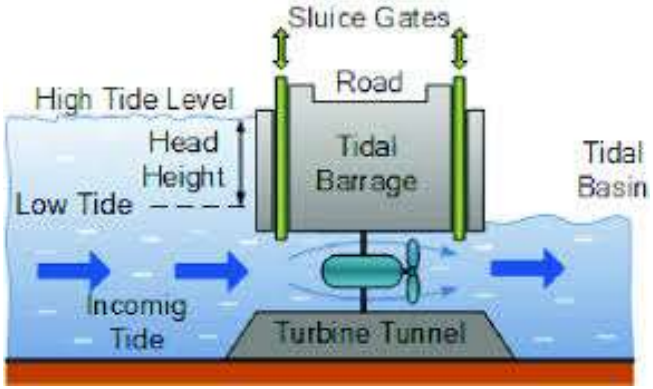
1. Tidal Turbine Farms
2. Tidal Barrages (dams)



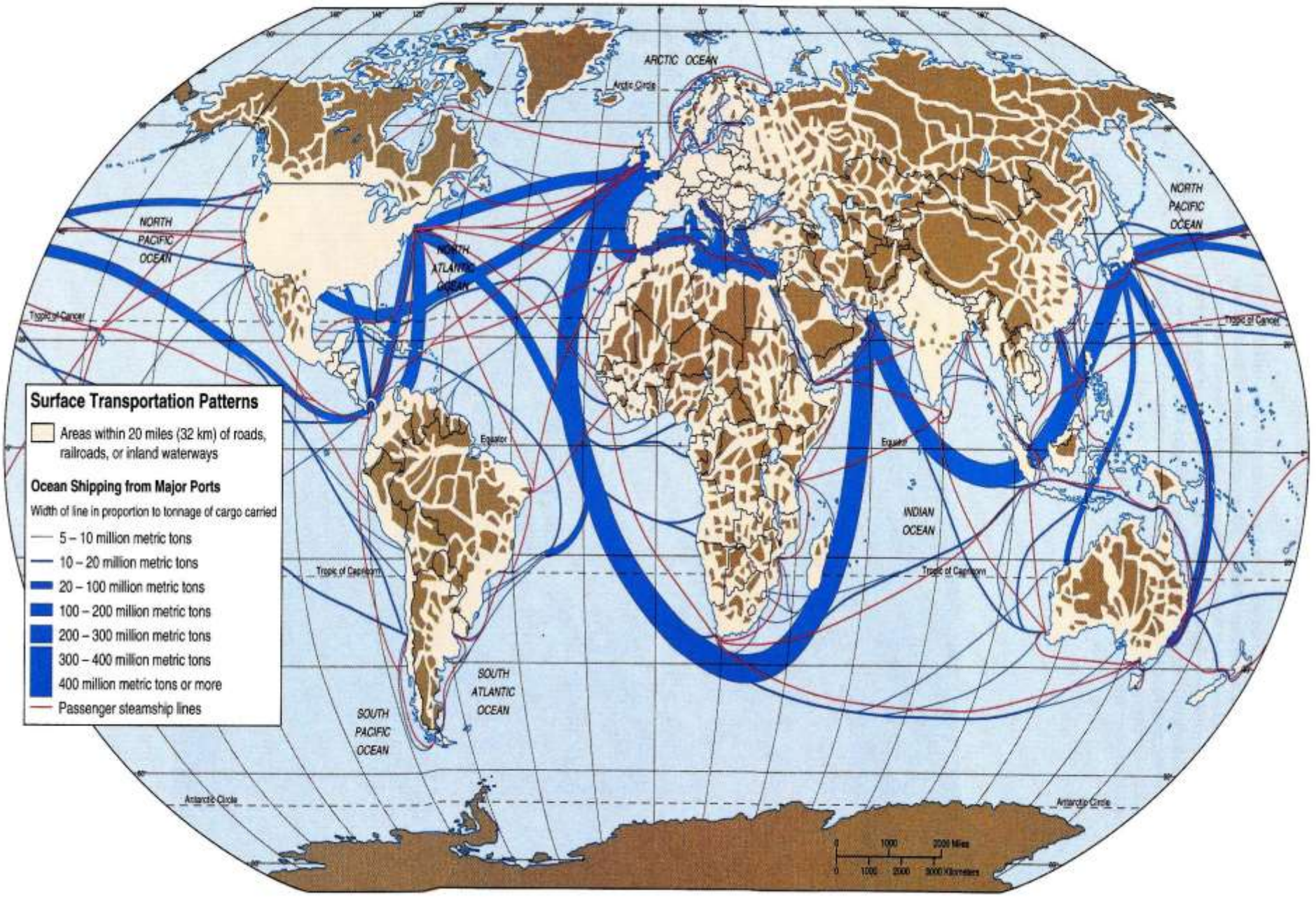
Swan turbines



MCT Seagen
Marine current Turbines


Sluice Gates
Road
High Tide Level
Head
Height
Tidal
Barrage
Tidal
Basin
Low Tide
Incomig
Tide
Turbine Tunnel

World Transportation Patterns



Advantages of Container Shipping

While aeroplanes are faster, container ships can carry more goods in one go. It would take hundreds of aeroplanes to carry all the goods that can fit on just one large container ship.

Transporting goods in large volumes makes it cheaper

It is estimated that on average a container ship emits around 40 times less CO2 than a large freight aircraft and three times less than a heavy truck.

Container shipping is also estimated to be two and a half times more energy efficient than rail and 7 times more so than road.