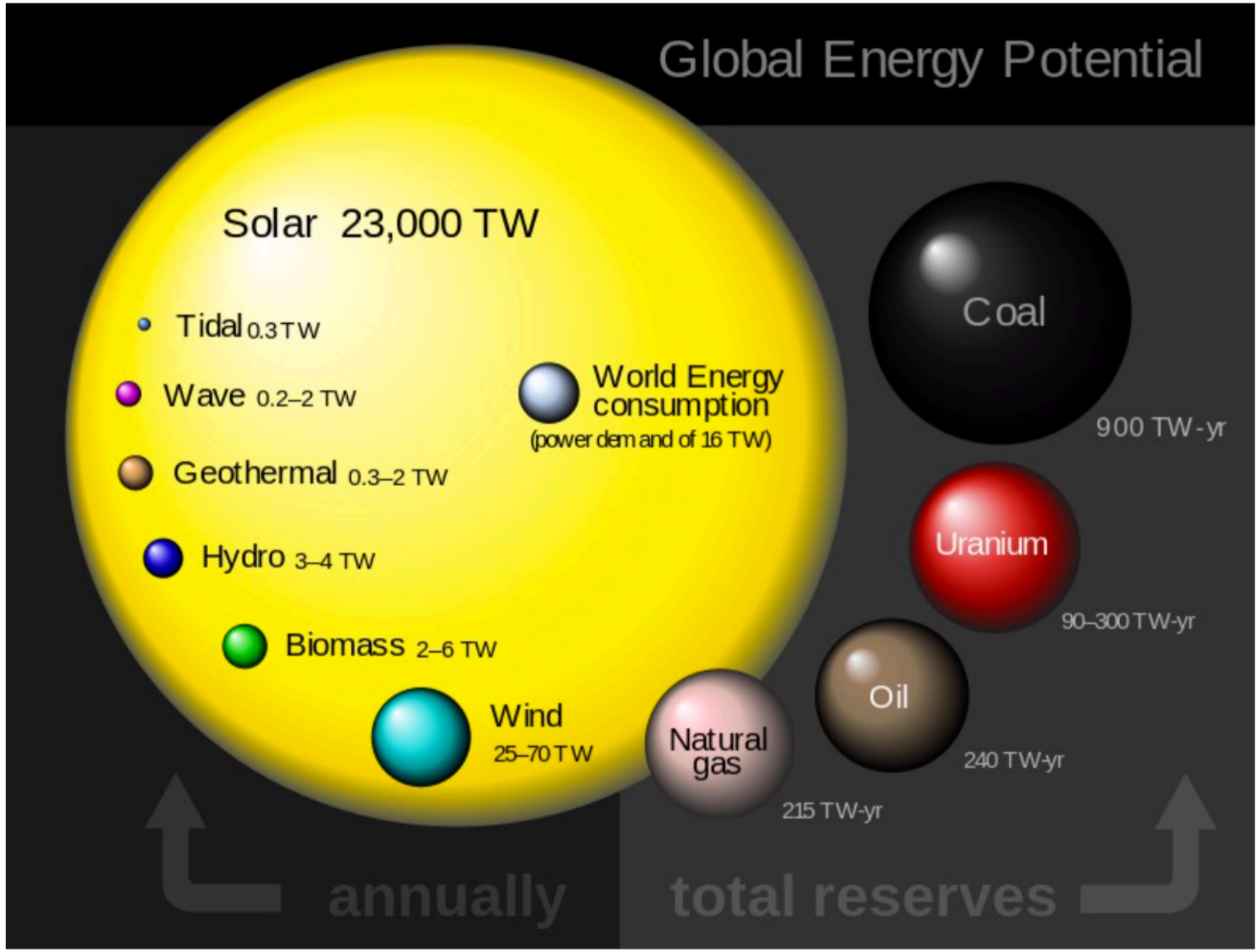
ENERGIA ONDAS, MARES, LAMINAS DE AGUA, OTEC, EOLICA OFFSHORE

PEA3560

AQUILES

Panorama Mundial e Nacional



Tipos

- Marés
- Ondas
- Correntes Marinhas
- Eólica Offshore
- Térmica
- Diferença de Salinidade
- VIV – Vibração induzida por Vortice

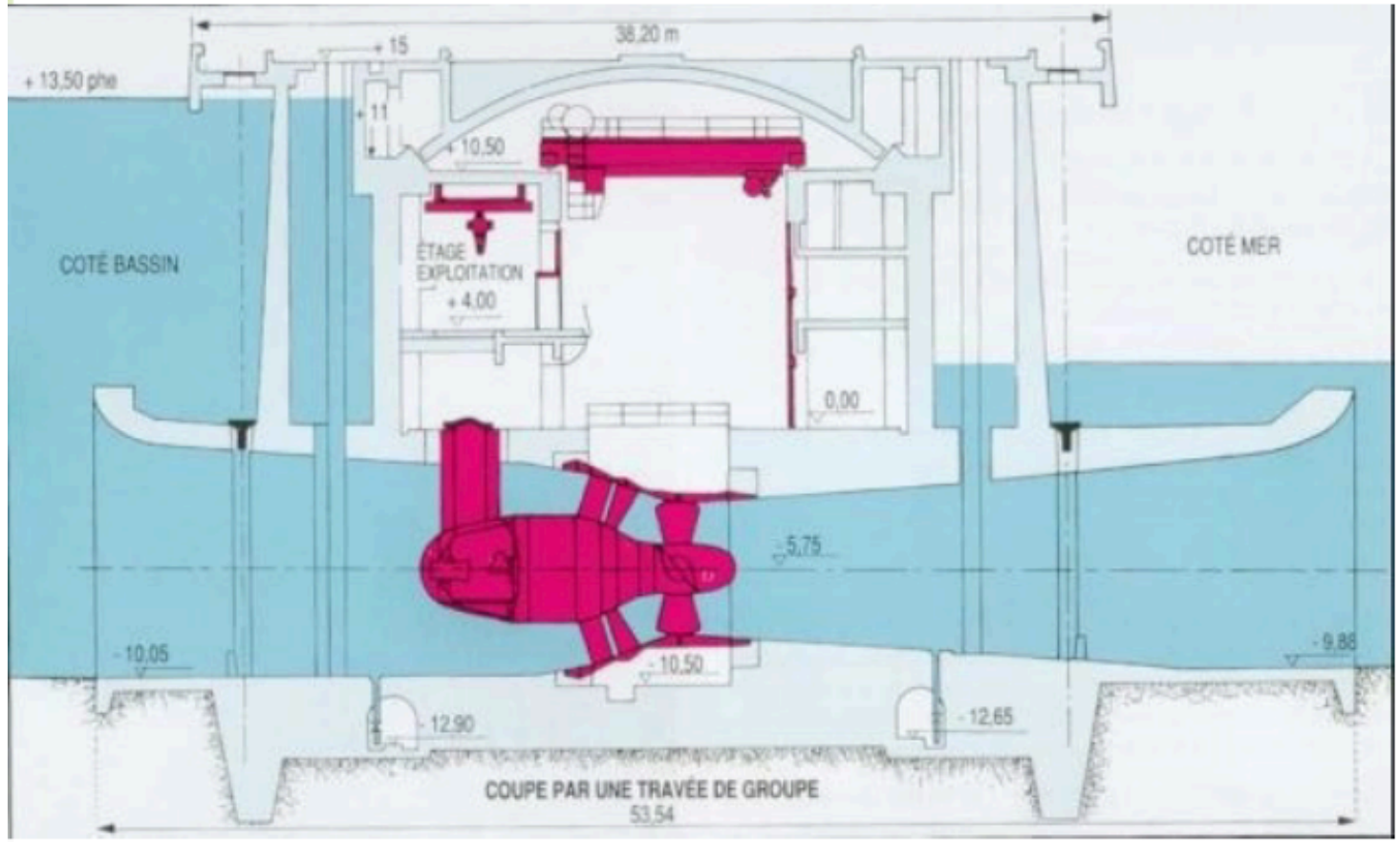
- Térmica – Havaí

Energia Oceânica

- Maré com barragem – La Rance 240MW

Energia Oceânica

- Maré com barragem – La Rance

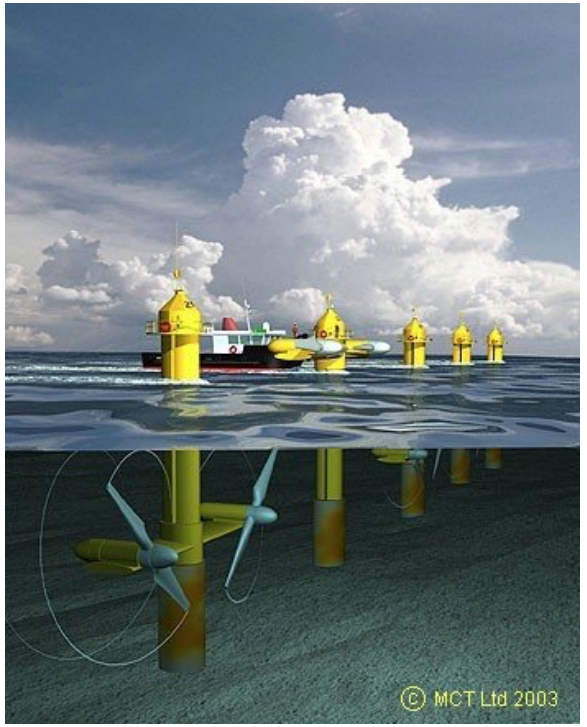


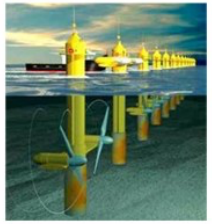
Energia Oceânica

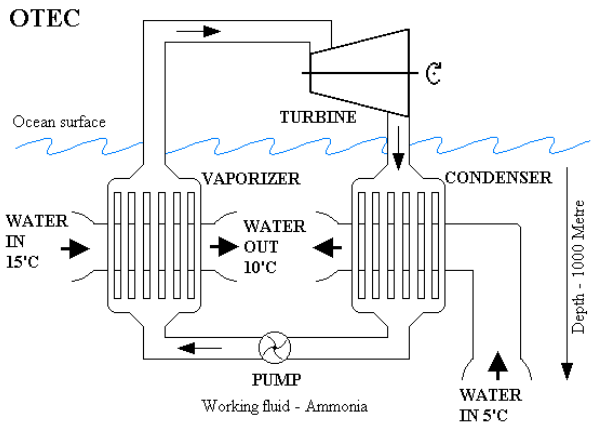
- Maré com barragem – Sihwa-Lake 254MW

Energia Oceânica

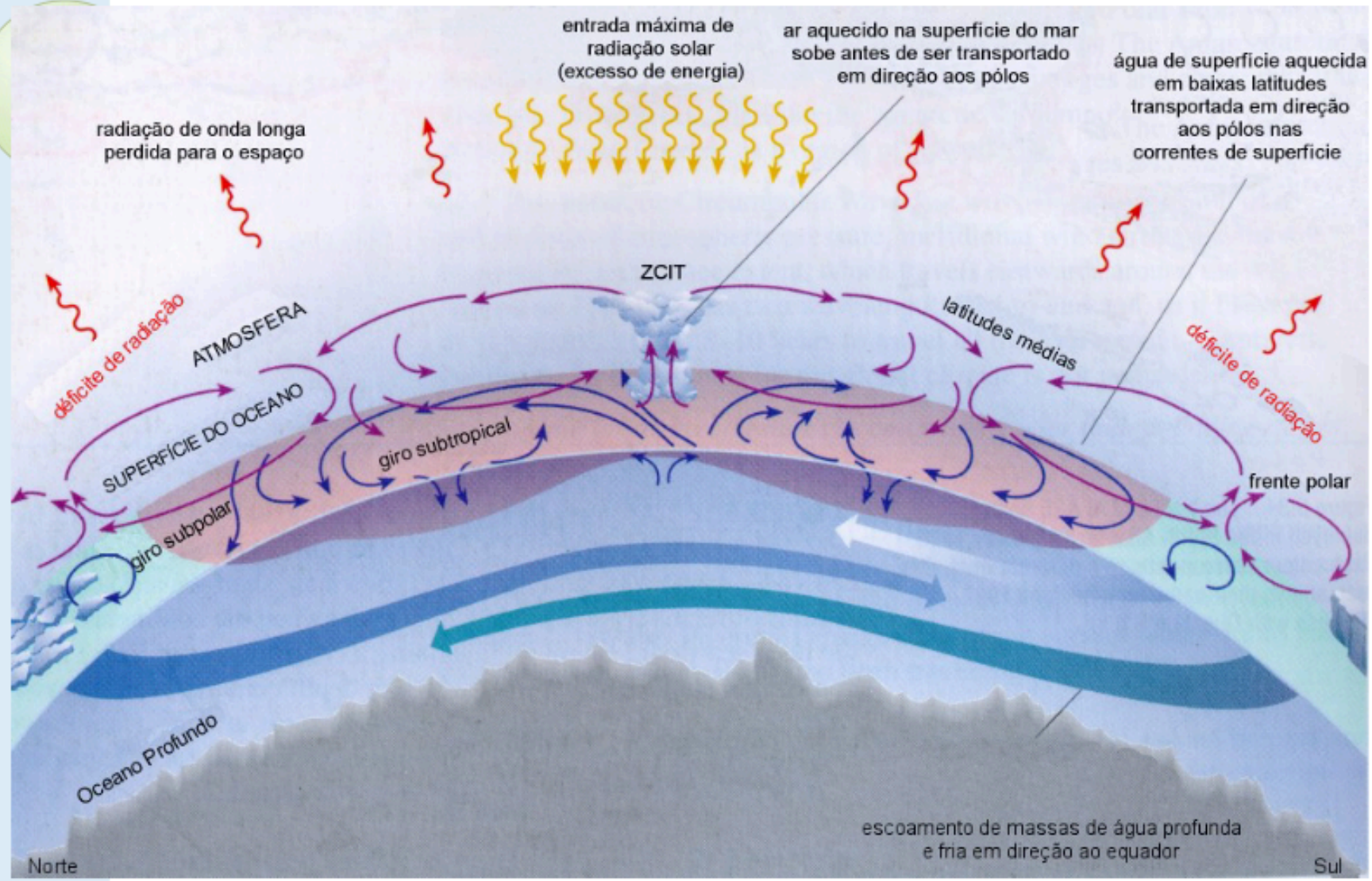
- Estuário do rio Bacanga - MA



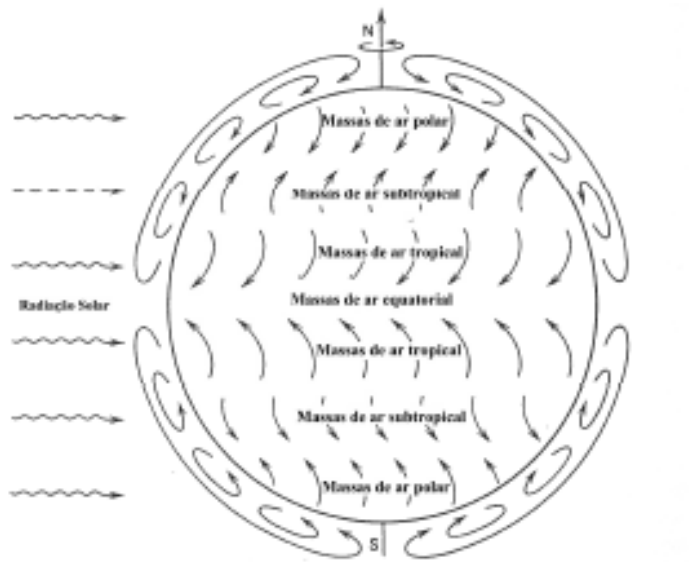
Sistemas que «calvagam» as ondas	Sistemas que aproveitam as correntes marítimas
	
Sistemas que usam o princípio de Arquimedes	**Sistemas baseados em turbinas de baixa queda**
	



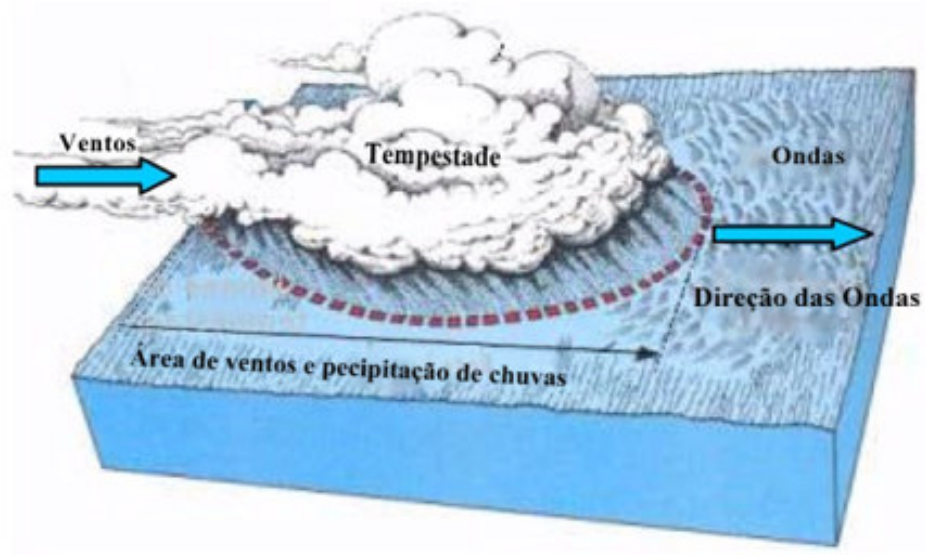
Vento


entrada máxima de
radiação solar
(excesso de energia)
ar aquecido na superfície do mar
sobe antes de ser transportado
em direção aos pólos
água de superfície aquecida
em baixas latitudes
transportada em direção
aos pólos nas
correntes de superfície
radiação de onda longa
perdida para o espaço
ZCIT
déficite de radiação
ATMOSFERA
SUPERFÍCIE DO OCEANO
giro subtropical
giro subpolar
latitudes médias
déficite de radiação
frente polar
Oceano Profundo
escoamento de massas de água profunda
e fria em direção ao equador
Norte
Sul

Origens das ondas marítimas

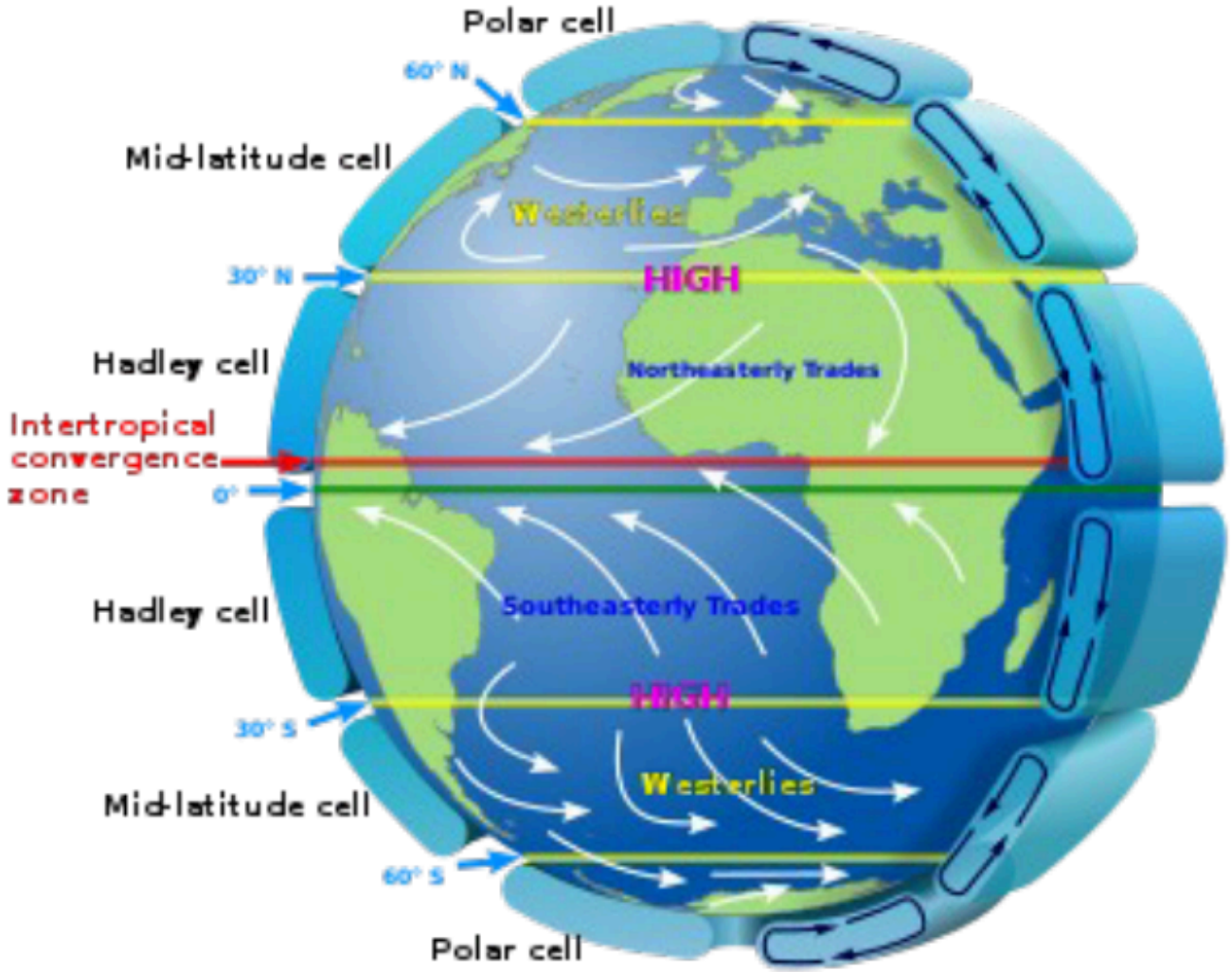


Movimento das Massas de ar.

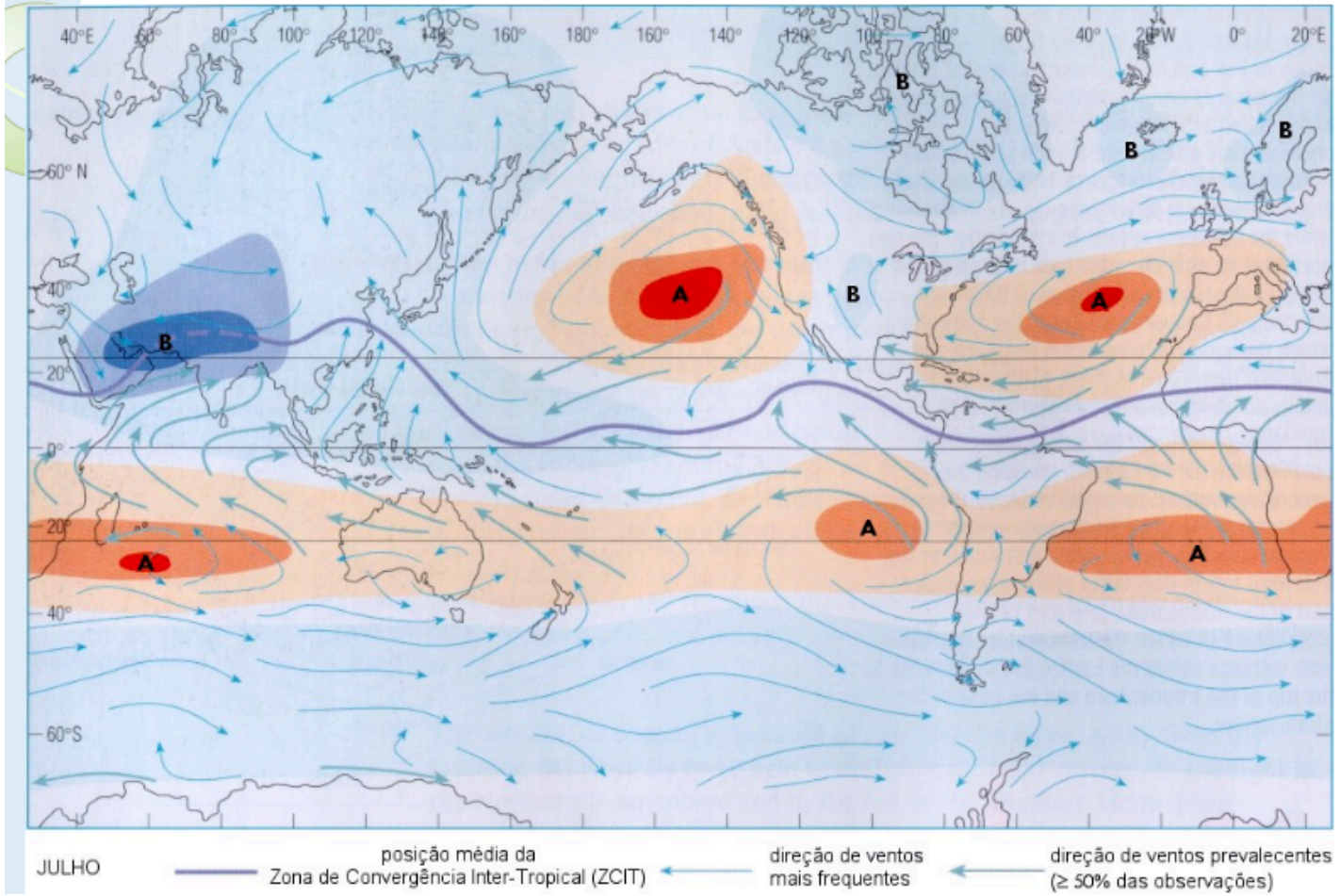


Formação de ondas causadas pela ação do vento e tempestade.

Vento

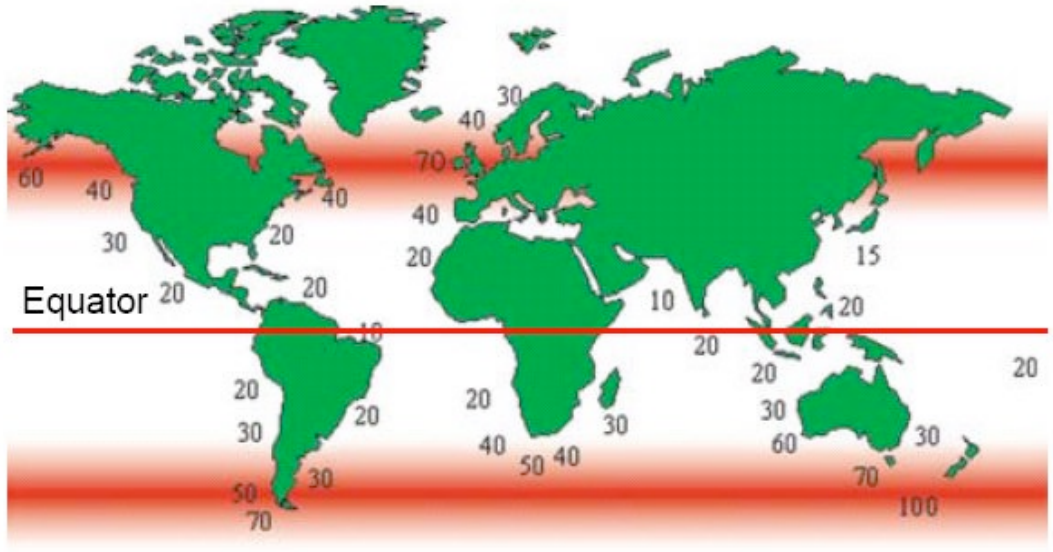

Polar cell
60° N
Mid-latitude cell
Westerlies
30° N
HIGH
Hadley cell
Northeasterly Trades
Intertropical convergence zone
0°
Hadley cell
Southeasterly Trades
HIGH
30° S
Mid-latitude cell
Westerlies
60° S
Polar cell

Circulação Básica

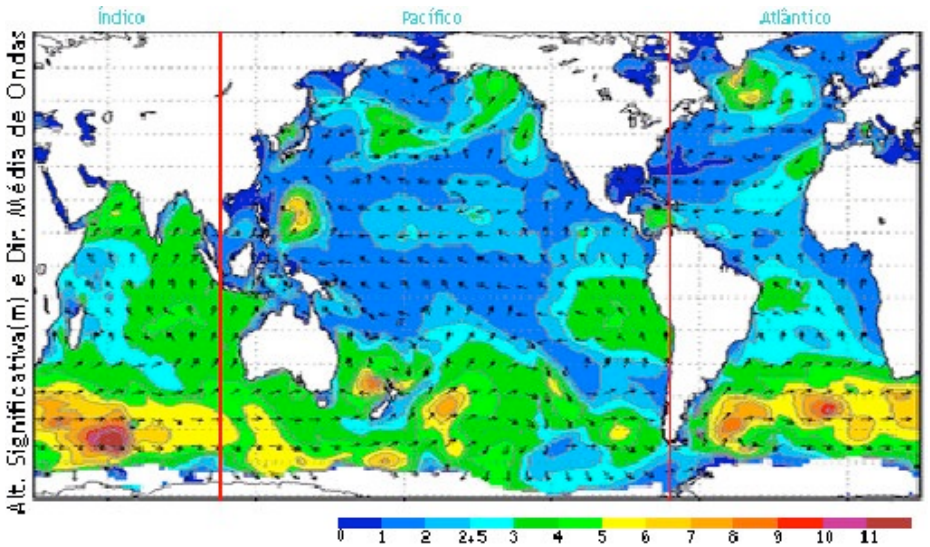


Earth Null School
https://earth.nullschool.net/pt/

Distribuição Global da energia contida nas ondas do mar em kW



Distribuição da energia contida nas ondas do mar em kW nas costas brasileiras



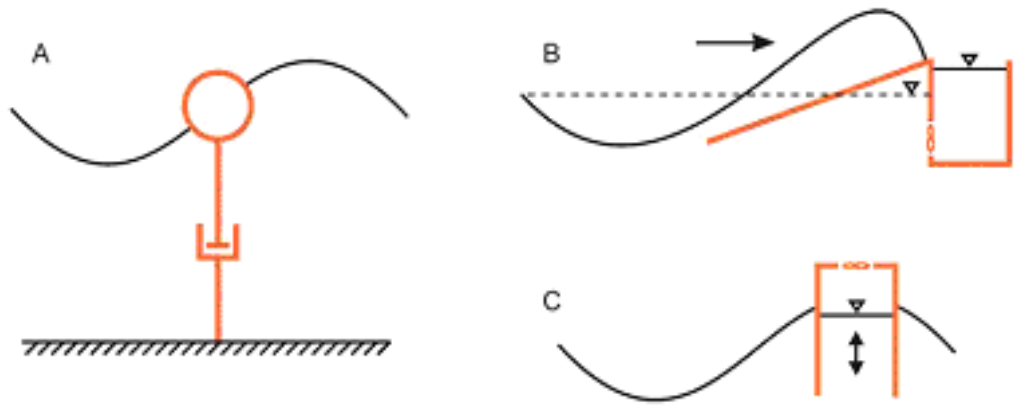
Mapa das alturas significativas das alturas e direções de Ondas Marítimas Global

Modelos Numericos

- Wavewatch III (WW3)
- WAM
- SWAM
- UMWM
- .....

Resultado de Modelos

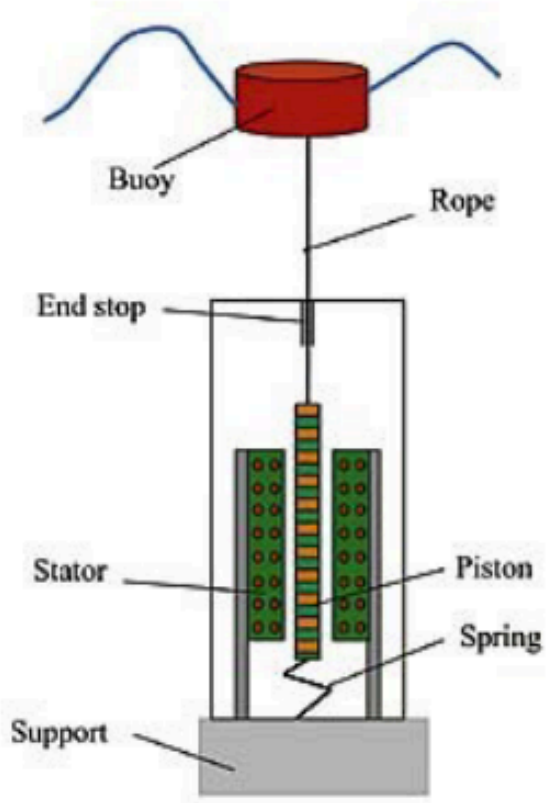
- CPTEC (https://www.cptec.inpe.br)
- NOAA (https://polar.ncep.noaa.gov/waves/)

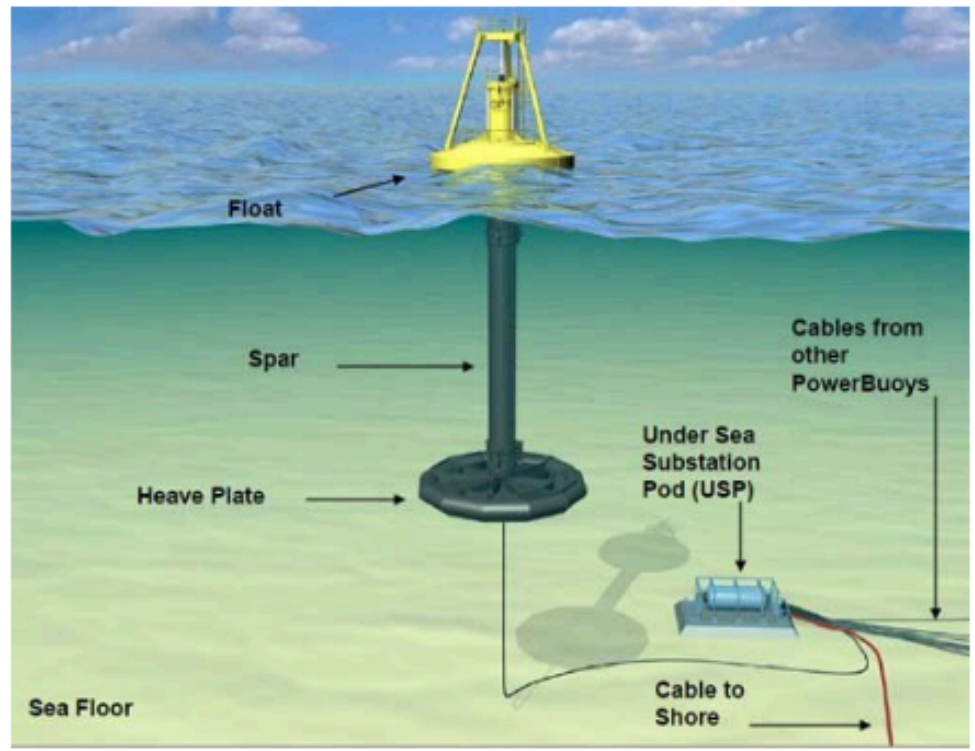


Tipos de conversores de energia de ondas do mar; a) Conversores por coluna oscilante; b) conversor por transbordamento (Overtopping device); c) Dispositivo por pressão de coluna de água e ar.

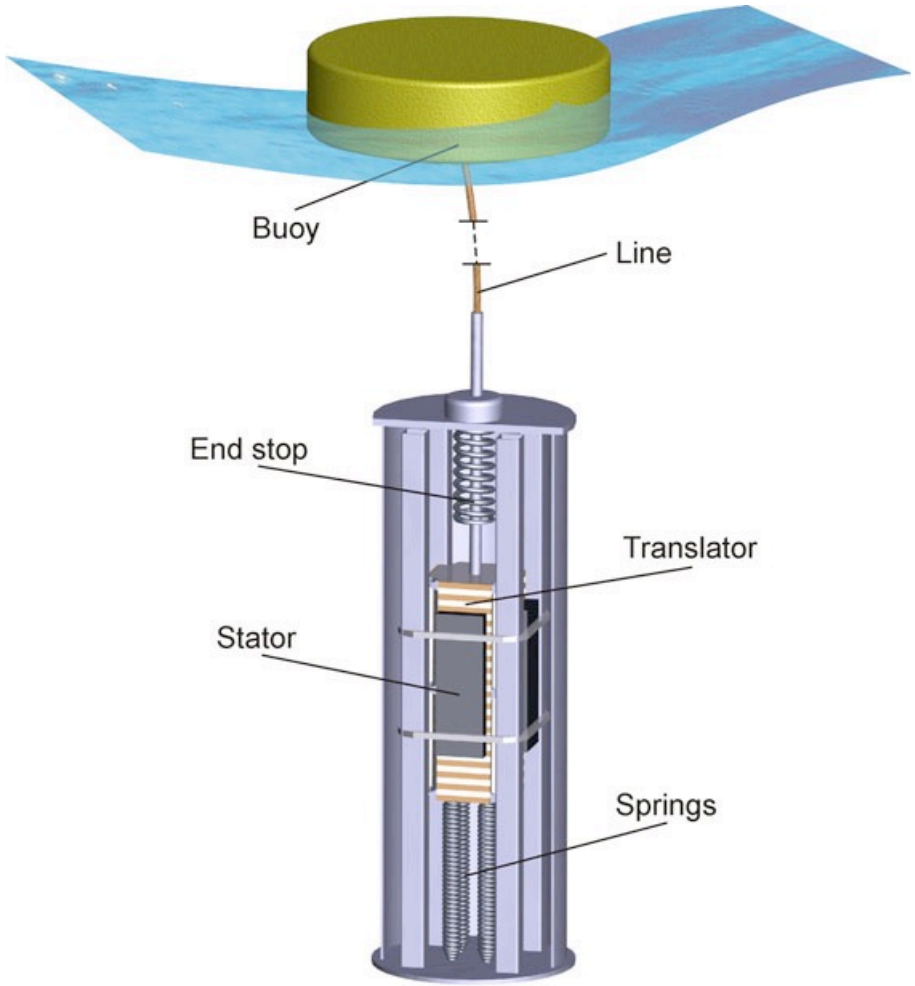
Conversores Ondas

Point Absorber Buoy

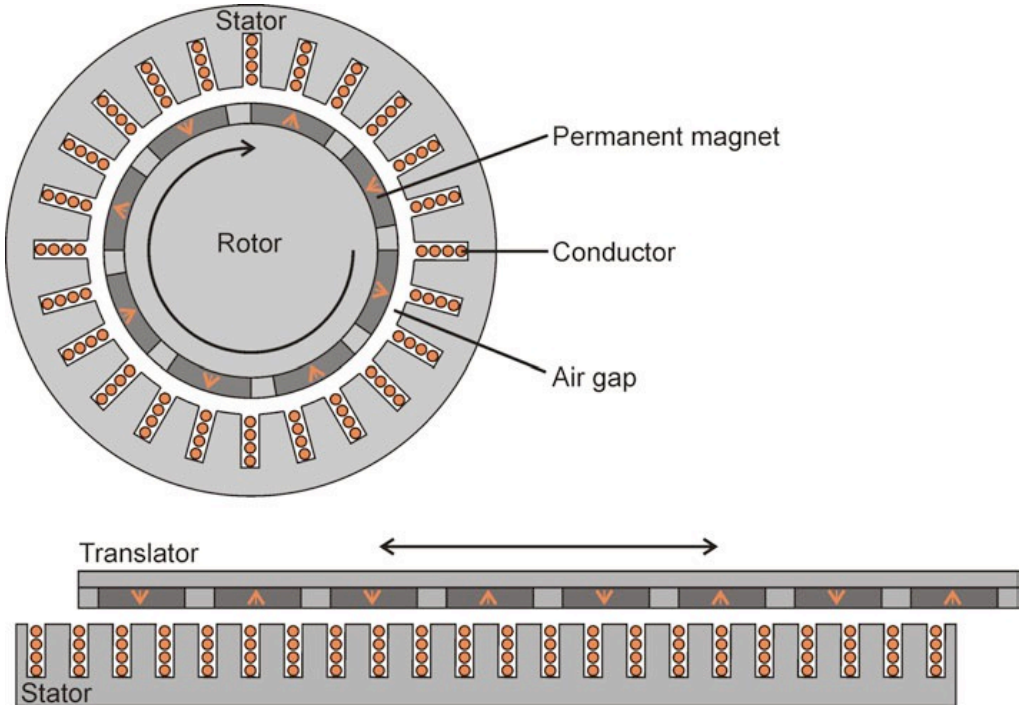




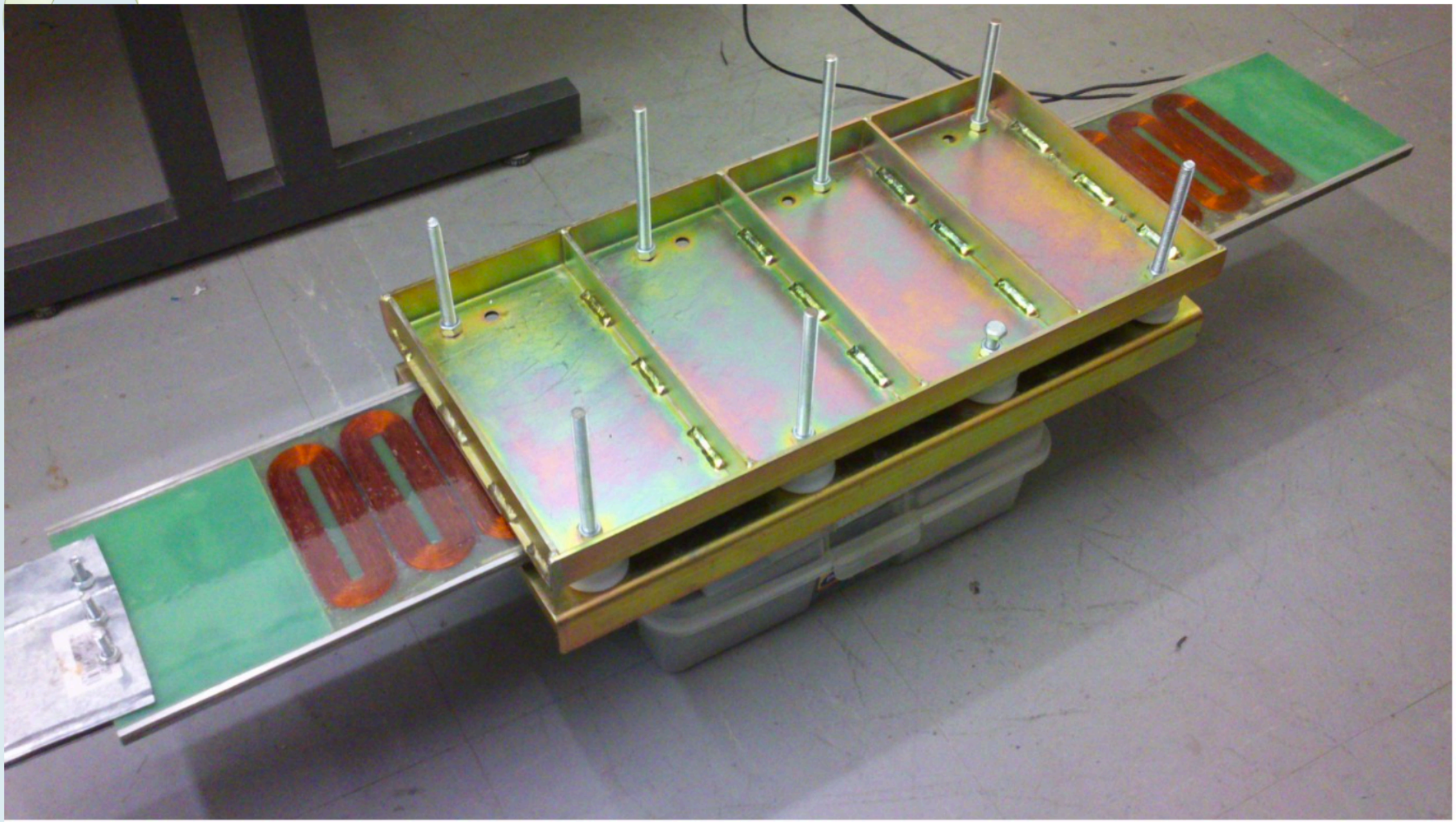
Conceptual drawing of the wave energy converter.



The basic components of a round and a linear permanent magnet generator.
Permanent magnets are mounted on the moving rotor/translator.
The stator holds
cables in which voltages are induced from the movement of the rotor/translator. The
air gap separates the static and moving parts.

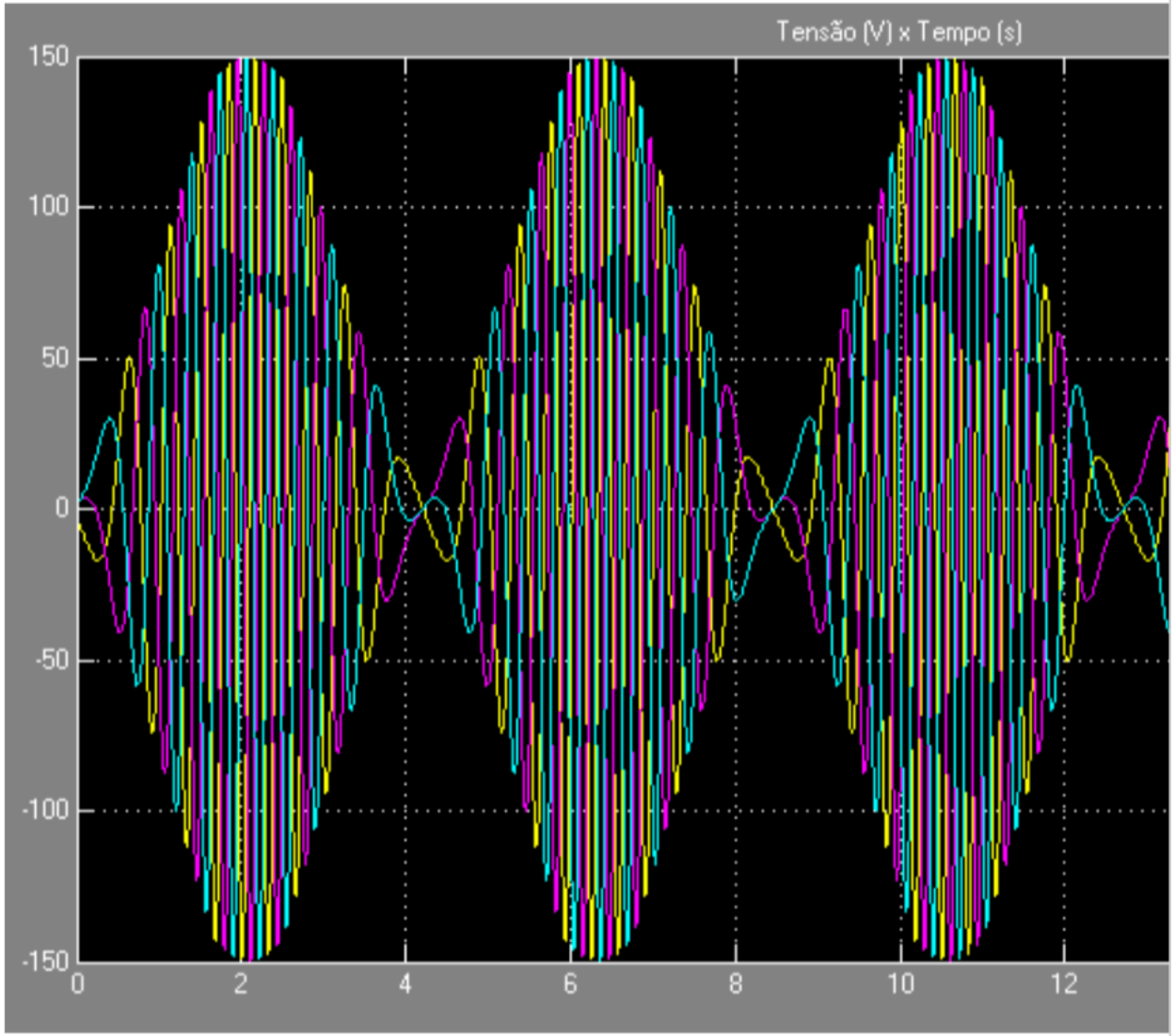


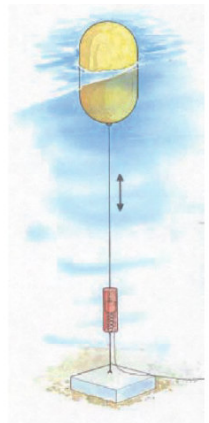
Geradores Lineares

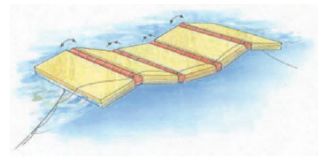


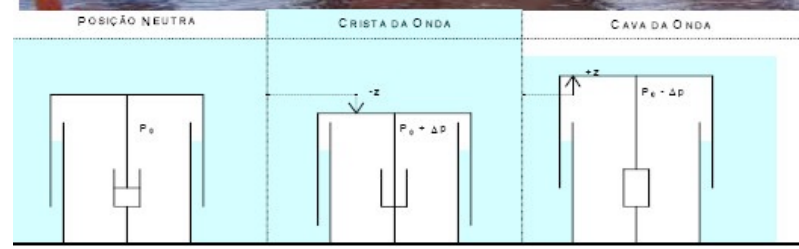
Geradores Lineares

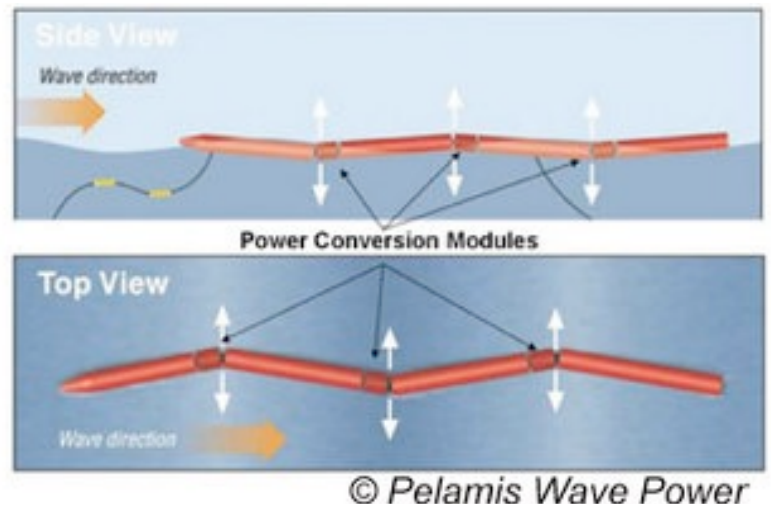
- E = B.l.v
- Baixa velocidade
- Forma de onda pulsada
- Requer acondicionamento



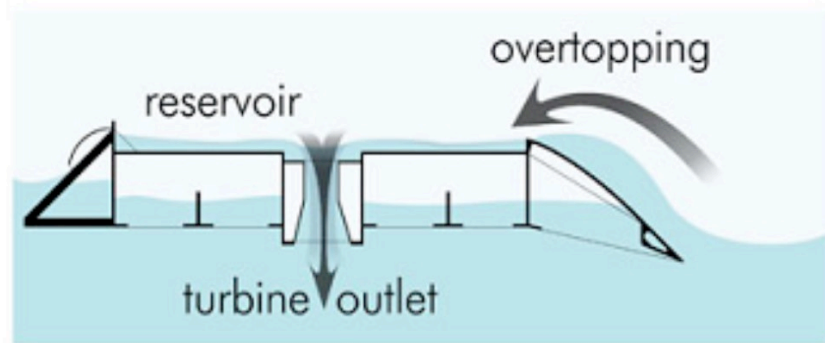








Alguns exemplos de conversores por coluna oscilante; a) ;b) AWS; c) Pelami

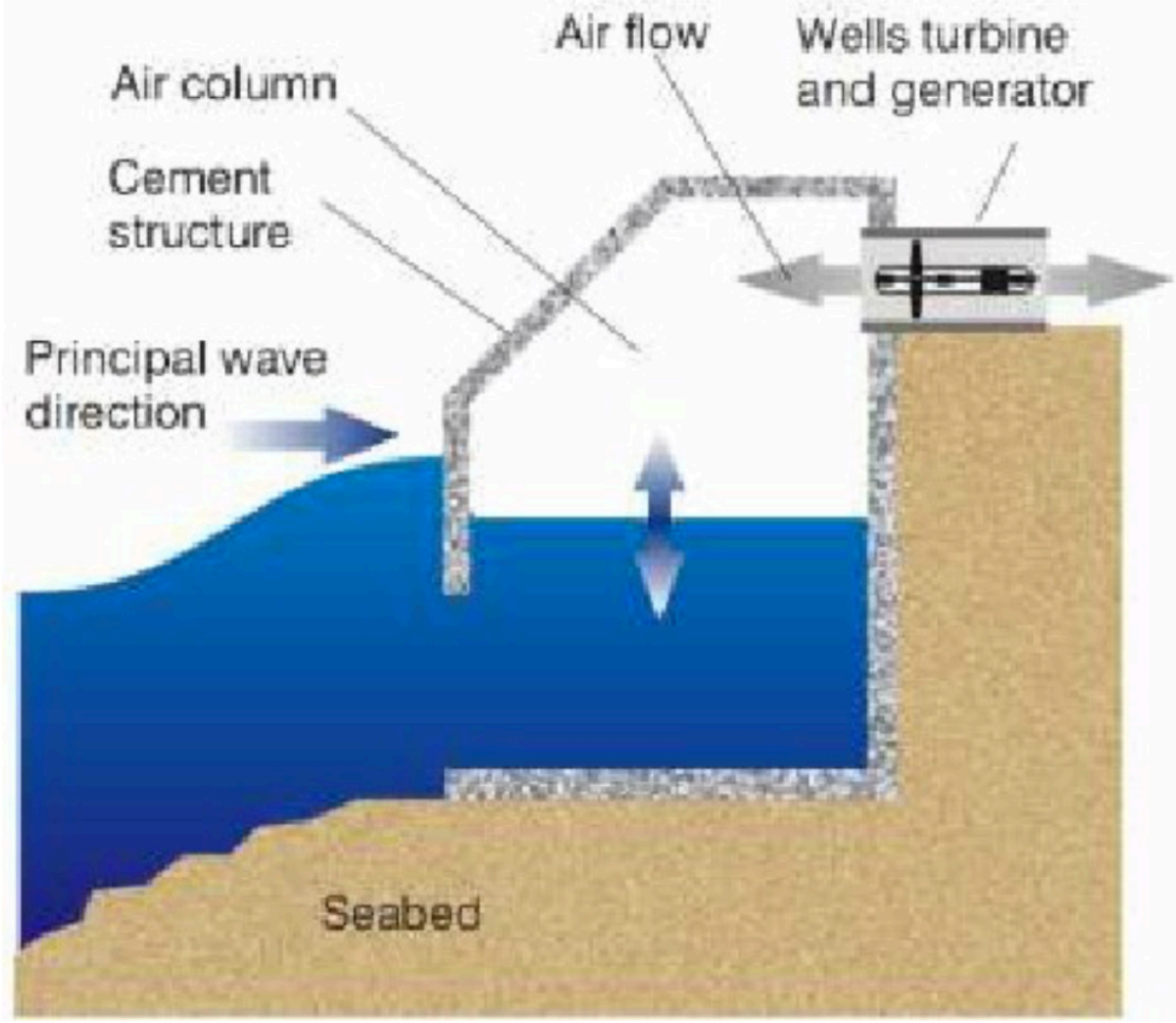


Exemplo de conversor por transbordamento.

Conversores Ondas

Conversores Ondas

- Oscillating Water Column

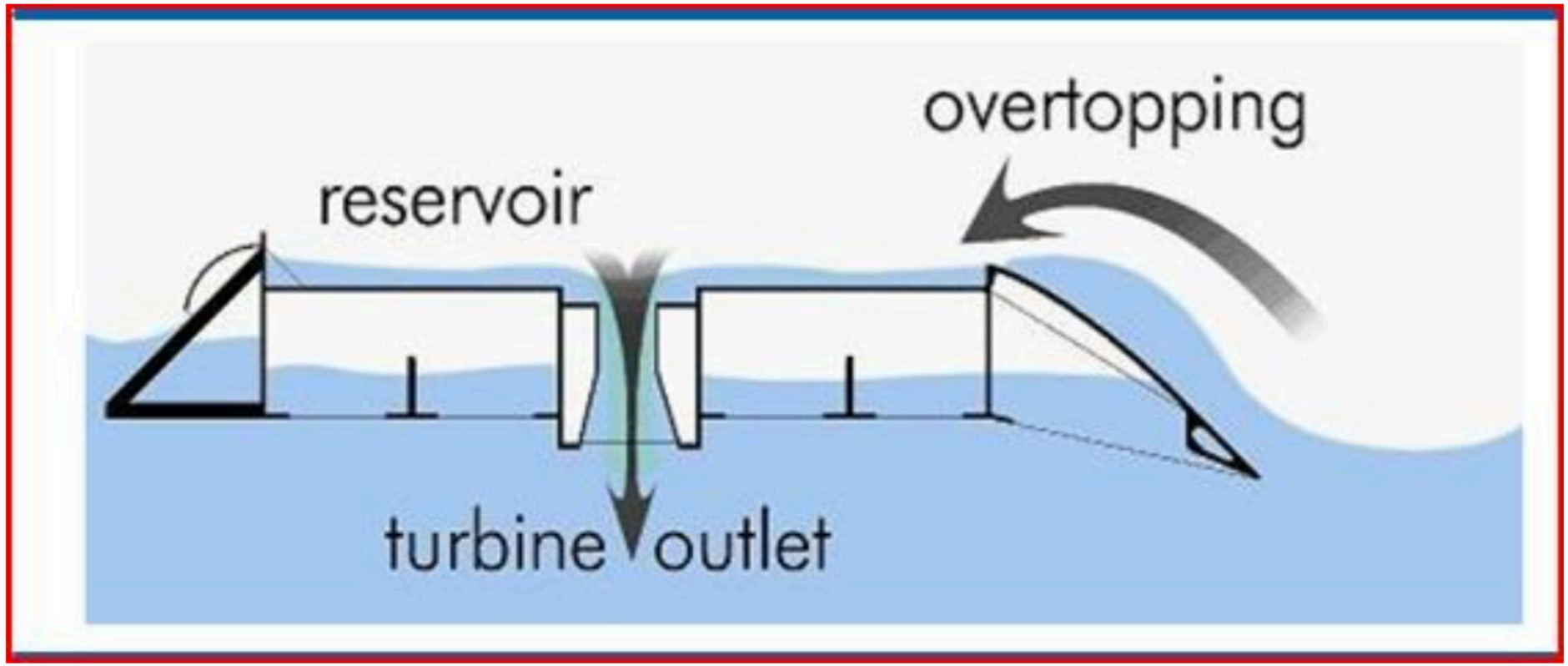


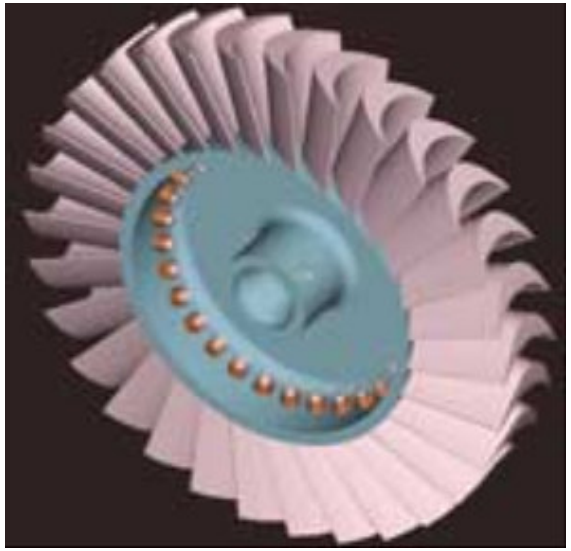
Conversores Ondas

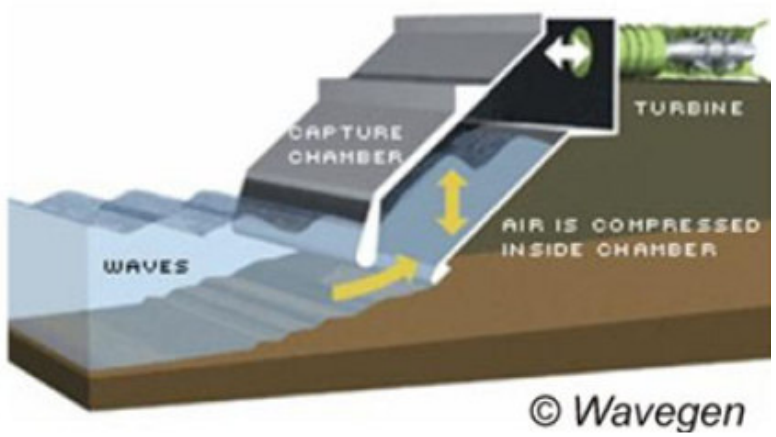
- OWC – Usina de Pico, Açores

Conversores Ondas

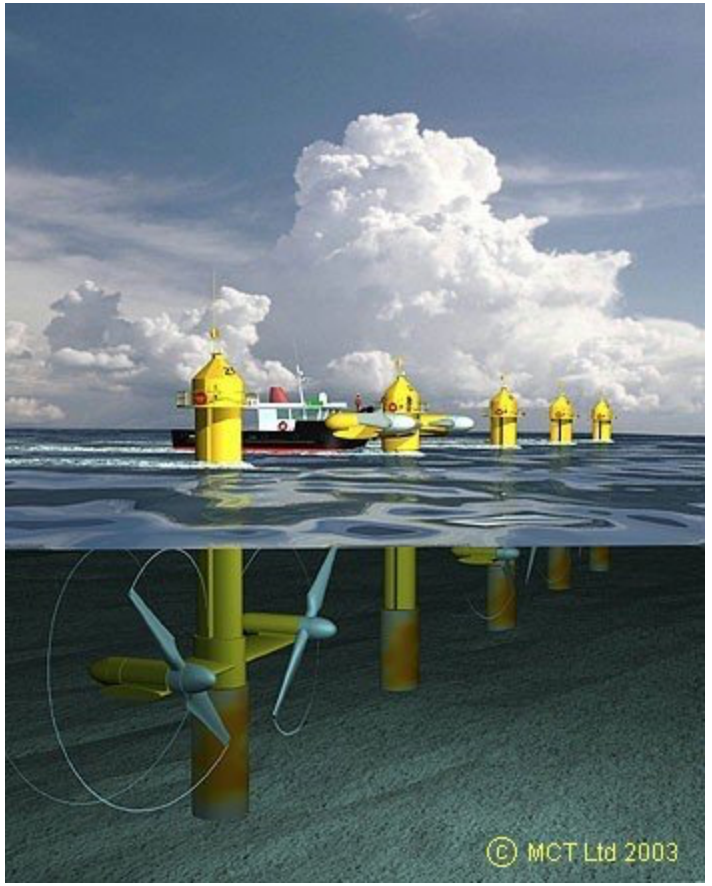
- Overtopping Device







a) Exemplo de conversor acionado por coluna de água e ar;
b) Turbina Wells;
c) LIMPET conversor instalado na ilha Isle, Escócia.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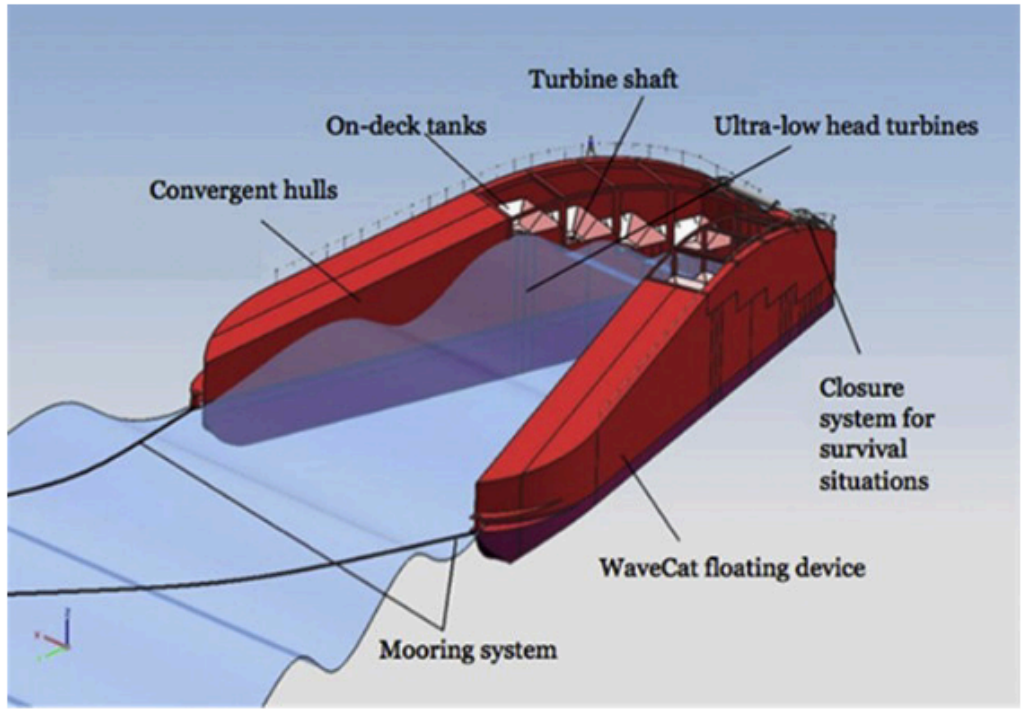
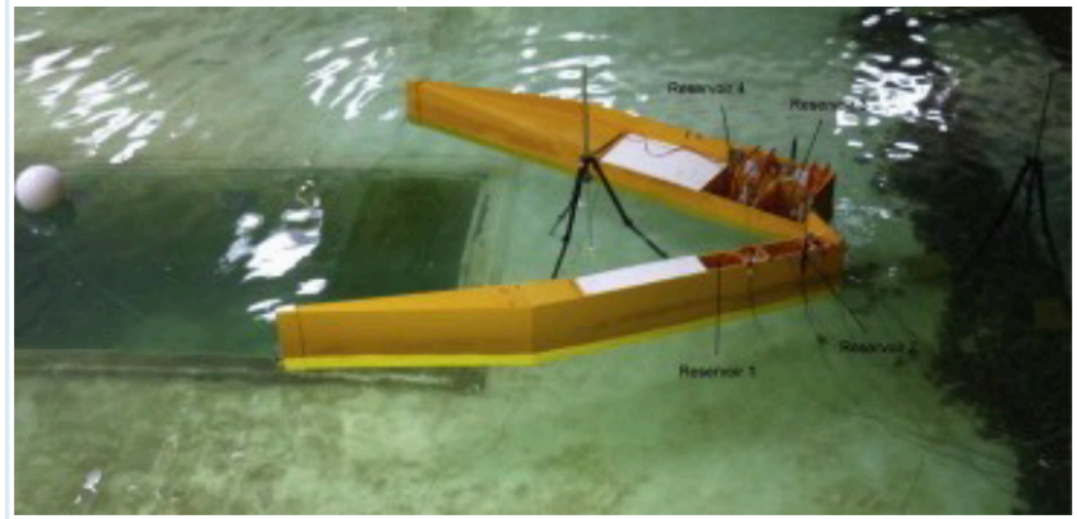
Conversores Ondas

- Overtopping Device – WaveCat



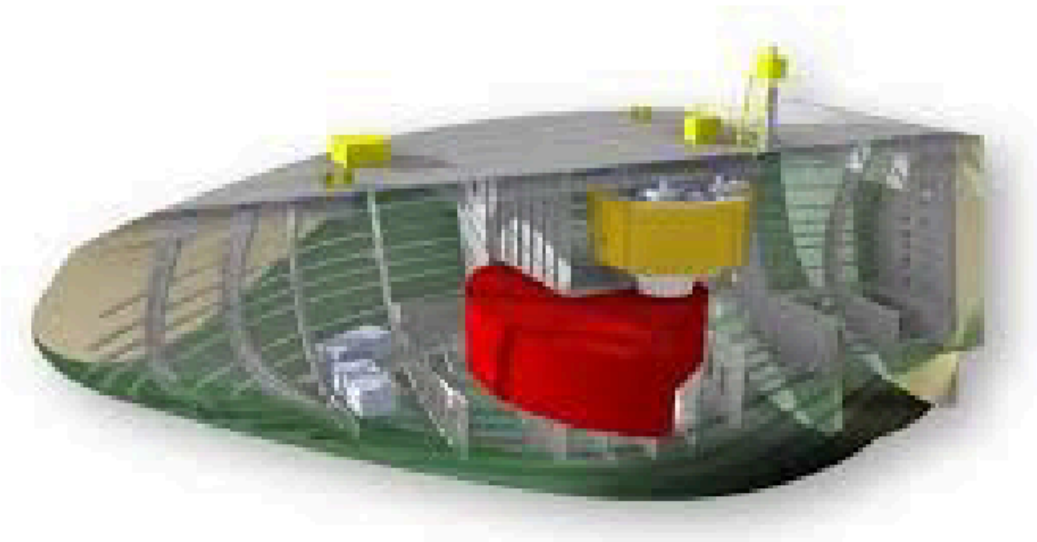
Conversores Ondas

- Overtopping Device – WaveCat



Conversores Ondas

- Eccentric Mass



Conversores Ondas

- Eccentric Mass - Wello

Energia a partir das ondas do mar será gerada por bóias submarinas

Catherine Brahic
NewScientist - 19/06/2007

Elas se parecem um pouco com minas submarinas, mas têm um objetivo bem menos sinistro - os primeiros desses equipamentos geradores de energia a partir das ondas do mar deverá emergir das profundezas do oceano na costa do Reino Unido em 2008.

Energia das ondas

A empresa AWS Ocean Energy desenvolveu a bóia submarina que retira energia das ondas a 50 metros abaixo da superfície. Segundo a empresa, como o equipamento é inteiramente subaquático, ele não sofre danos causados pelas tempestades como acontece com outros equipamentos que geram energia a partir das ondas, além de não interferir com a navegação.

As primeiras cinco bóias de teste serão ancoradas no fundo do mar no próximo ano, na costa da Escócia. A energia é gerada pela alteração na pressão que as ondas causam ao fazer subir e descer a coluna de água no interior das bóias.

Bóias submarinas

As bóias são ocas e cheias de um gás de alta compressão, que permite que a metade superior da bóia se mova para cima e para baixo. Quando uma onda passa sobre ela, na superfície, a água adicional armazenada no topo da bóia aumenta a pressão da água e a metade superior da bóia é pressionada para baixo.

Quando a onda se vai, a coluna de água é menor, baixando a pressão e fazendo com que a metade superior suba. É esse balanço de sobe-desce que movimenta o gerador no interior da bóia.

Segunda a empresa, a energia elétrica para abastecer uma cidade de 55.000 habitantes precisará de meio quilômetro quadrado de área do fundo do mar, coberta por 100 bóias submarinas.

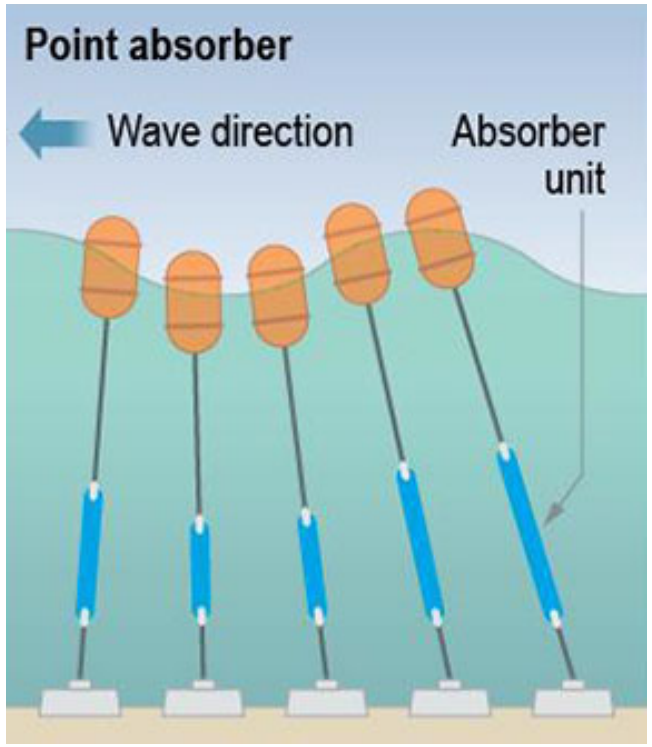
COPPE/UFRJ - Porto Pecém - Ceara

http://www.youtube.com/watch?v=o70SrMJpkIo

Marine and Hydrokinetic Technology Glossary NREL

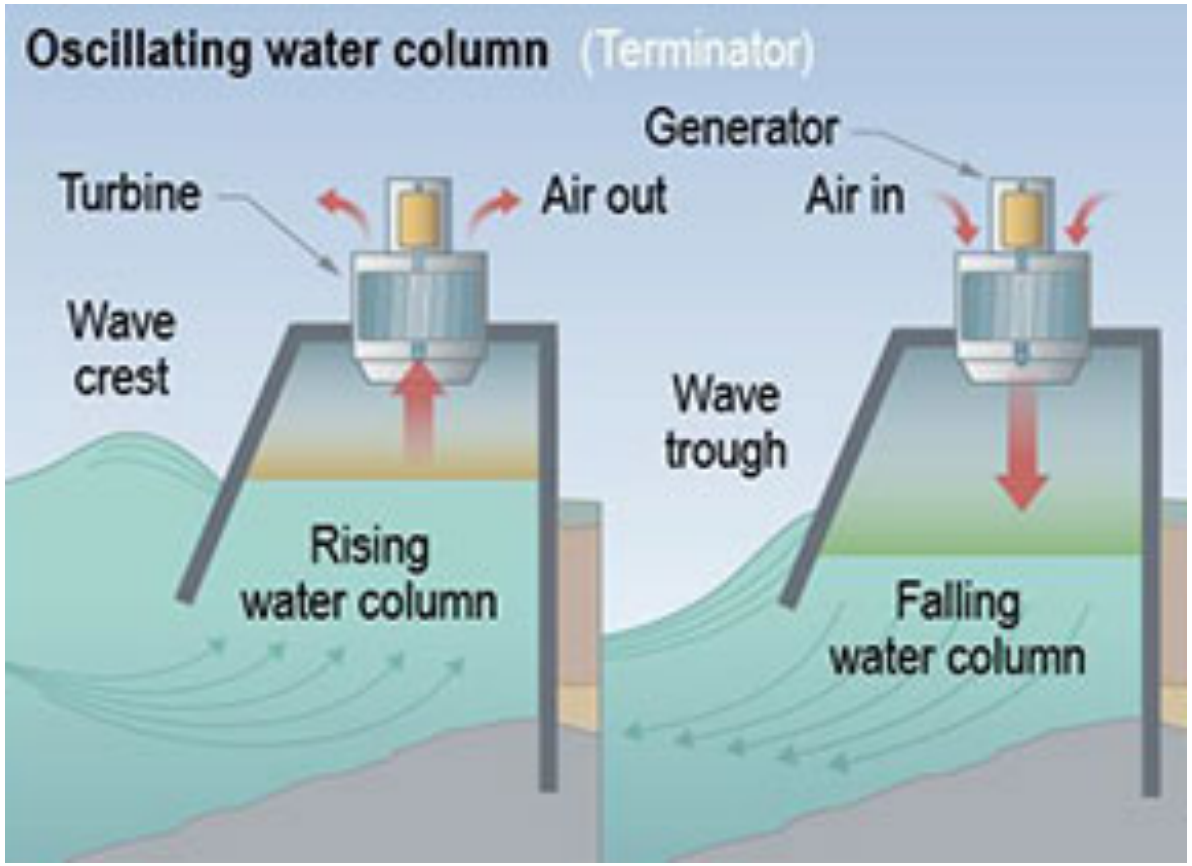
PEA3560

AQUILES

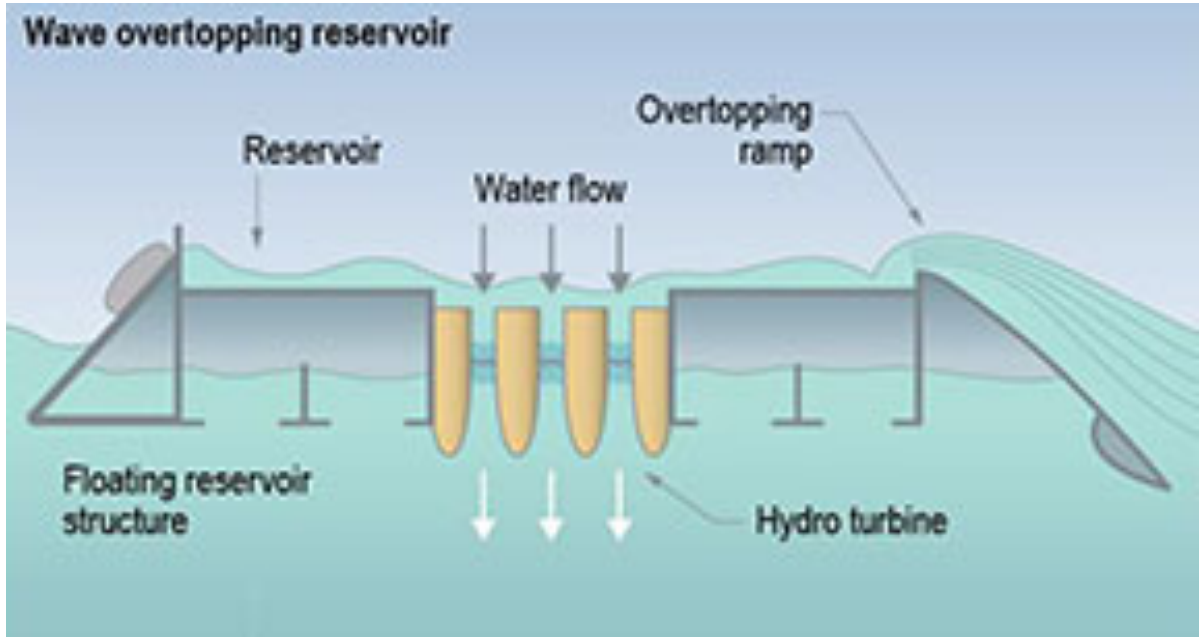


Point Absorber
Wave energy capture device, with principal dimension relatively small compared to the wavelength, and is able to capture energy from a wave front greater than the physical dimension of the device. **There are floating and submerged models.**

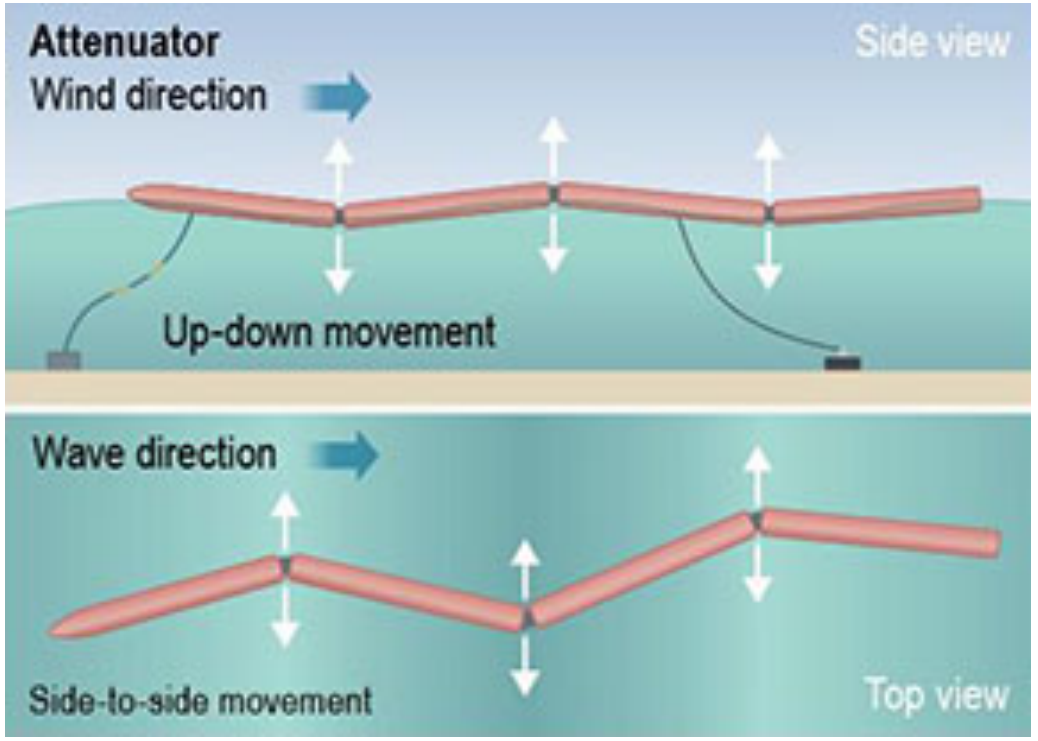
Submerged Pressure Differential
Wave energy capture device, which can be considered a fully submerged point absorber; a pressure differential is induced within the device as the wave passes driving a fluid pump to create mechanical energy.



Oscillating Water Column
Partially submerged structure that encloses a column of air above a column of water; a collector funnels waves into the structure below the waterline, causing the water column to rise and fall; this alternately pressurizes and depressurizes the air column, pushing or pulling it through a turbine. **There are shore-based and floating models.**

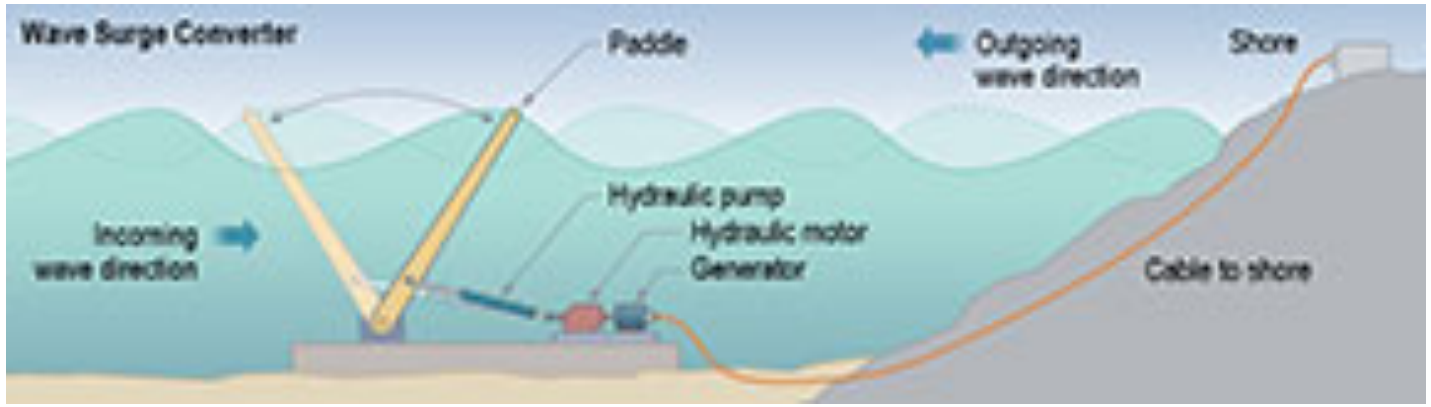


Overtopping Device
Partially submerged structure; a collector funnels waves over the top of the structure into a reservoir; water runs back out to the sea from this reservoir through a turbine. **There are shore-based and floating models.**



Attenuator

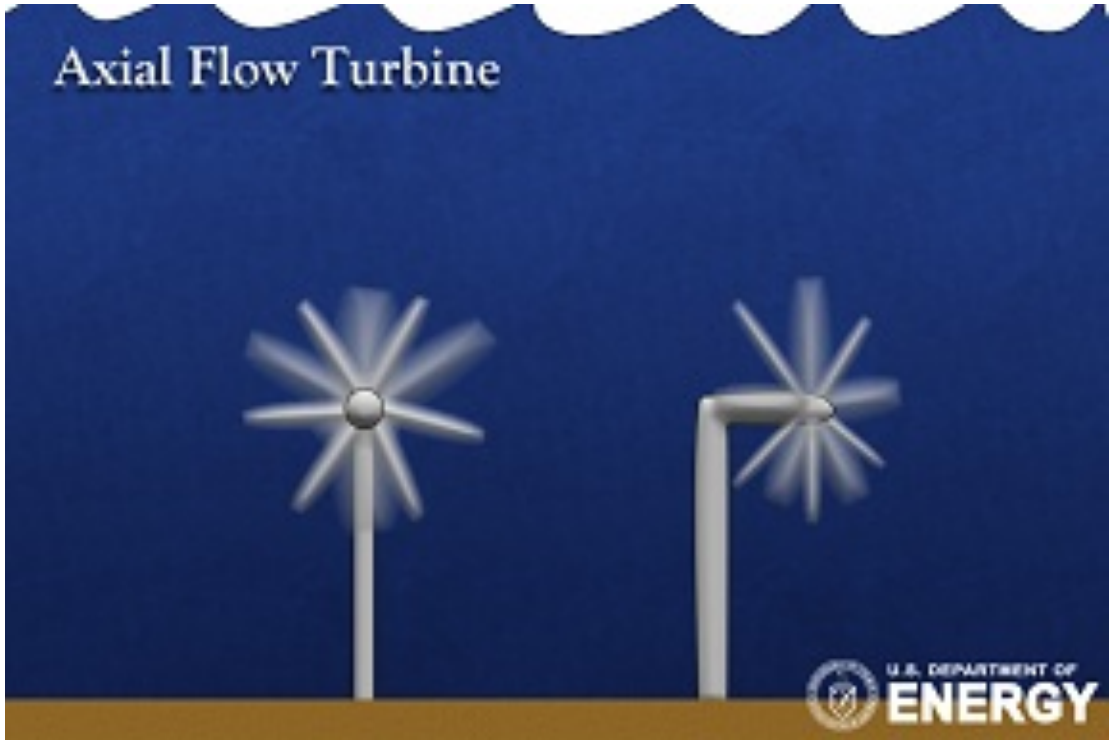
Wave energy capture device with principal axis oriented parallel to the direction of the incoming wave that converts the energy due to the relative motion of the parts of the device as the wave passes along it.



Oscillating Wave Surge Converter

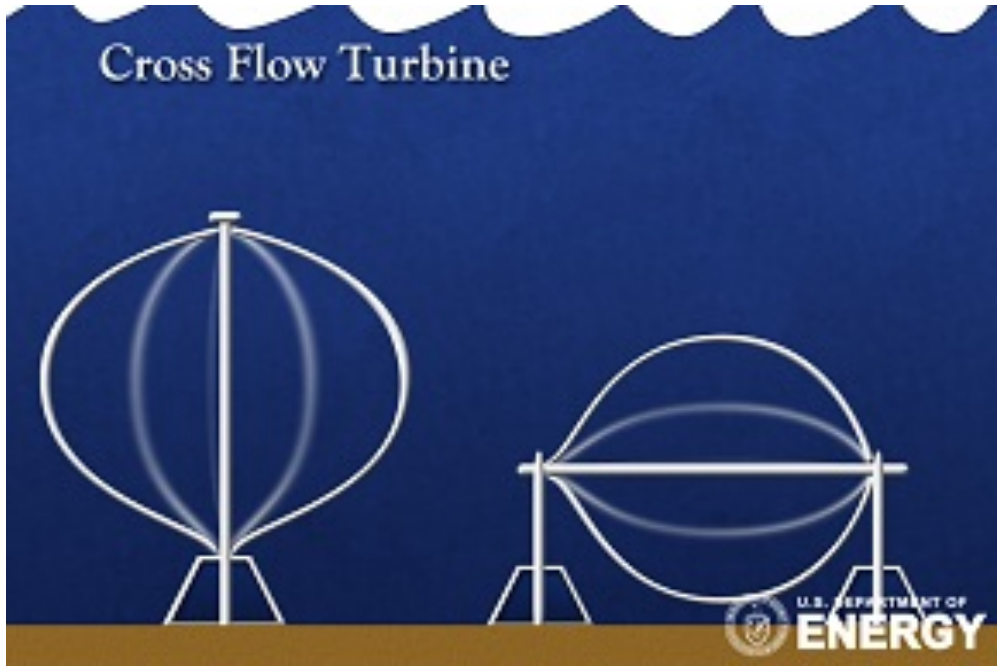
Any of several devices that capture wave energy directly without a collector by using relative motion between a float/flap/membrane and a fixed reaction point; the float/flap/membrane oscillates along a given axis dependent on the device; mechanical energy is extracted from the relative motion of the body part relative to its fixed reference.

CURRENT

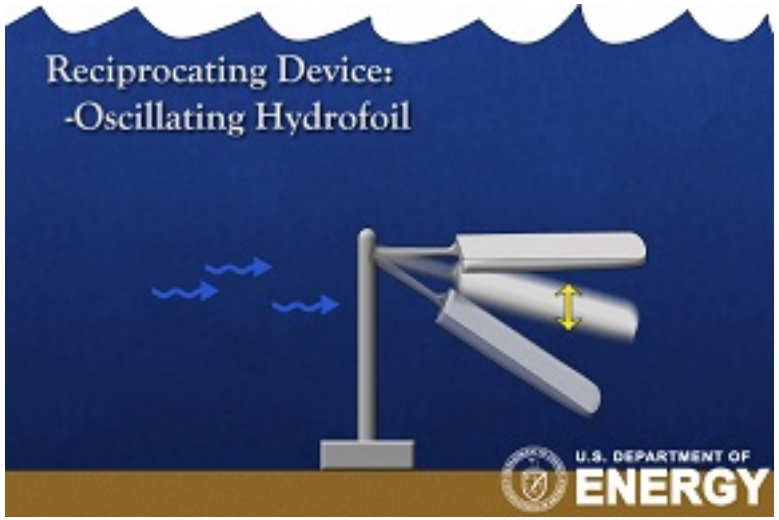


Axial Flow Turbine

Typically has two or three blades mounted on a horizontal shaft to form a rotor; the kinetic motion of the water current creates lift on the blades causing the rotor to turn driving a mechanical generator. These turbines must be oriented in the direction of flow. **There are shrouded and open rotor models.**



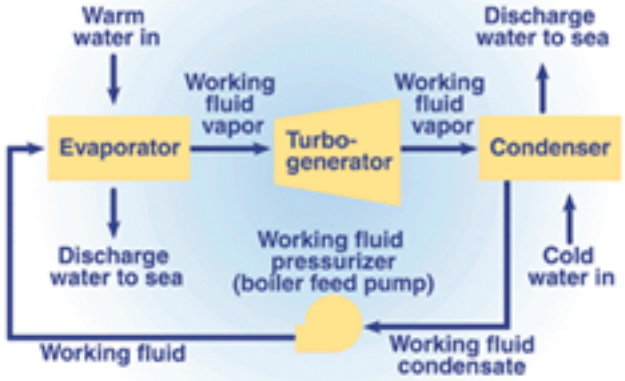
Cross Flow Turbine
Typically has two or three blades mounted along a vertical shaft to form a rotor; the kinetic motion of the water current creates lift on the blades causing the rotor to turn driving a mechanical generator. These turbines can operate with flow from multiple directions without reorientation. **There are shrouded and open rotor models.**



Reciprocating Device
Uses the flow of water to produce the lift or drag of an oscillating part transverse to the flow direction. This behavior can be induced by a vortex, the Magnus effect, or by flow flutter.

Oscillating Hydrofoil: (Example of a Reciprocating Device)
Similar to an airplane wing but in water; yaw control systems adjusts their angle relative to the water stream, creating lift and drag forces that cause device oscillation; mechanical energy from this oscillation feeds into a power conversion system.

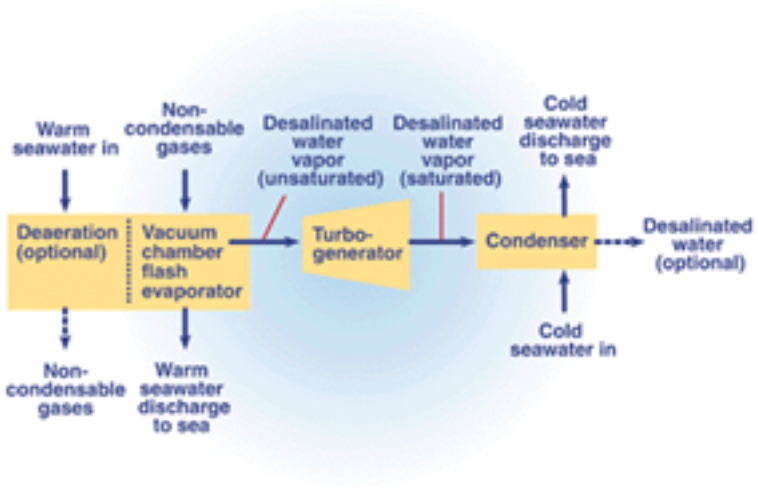
OCEAN THERMAL ENERGY CONVERSION (OTEC)



Closed-cycle

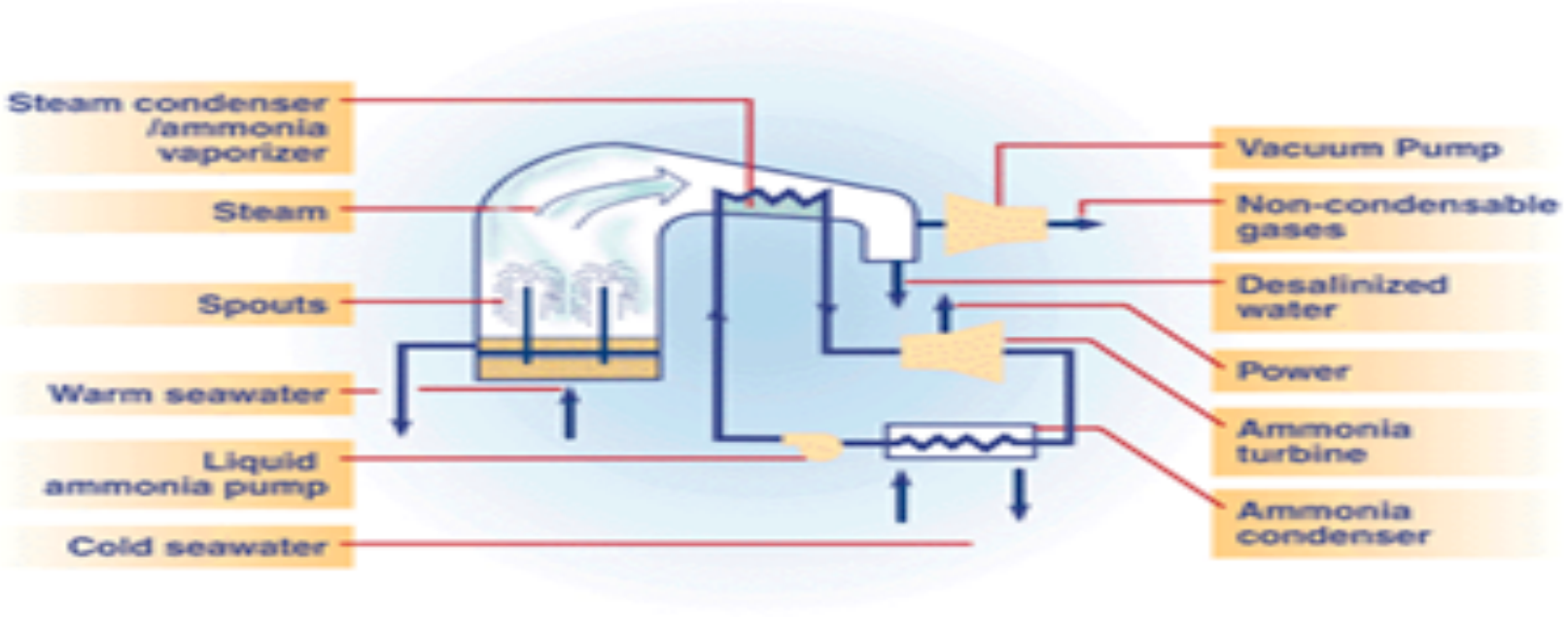
These systems use fluid with a low-boiling point, such as ammonia, to rotate a turbine to generate electricity. Warm surface seawater is pumped through a heat exchanger where the low-boiling-point fluid is vaporized. The expanding vapor turns the turbo-generator. Cold deep-seawater—pumped through a second heat exchanger—condenses the vapor back into a liquid, which is then recycled through the system.

OCEAN THERMAL ENERGY CONVERSION (OTEC)



Open-cycle

These systems use the tropical oceans' warm surface water to make electricity. When warm seawater is placed in a low-pressure container, it boils. The expanding steam drives a low-pressure turbine attached to an electrical generator. The steam, which has left its salt behind in the low-pressure container, is almost pure fresh water. It is condensed back into a liquid by exposure to cold temperatures from deep-ocean water.



Hybrid

These systems combine the features of both the closed-cycle and open-cycle systems. In a hybrid system, warm seawater enters a vacuum chamber where it is flash-evaporated into steam, similar to the open-cycle evaporation process. The steam vaporizes a low-boiling-point fluid (in a closed-cycle loop) that drives a turbine to produce electricity.

REFERENCIAS

- https://www.energy.gov/eere/water/marine-and-hydrokinetic-technology-glossary