Study some practical applications of tidal energy
Pioneers in this type of energy: Salter's Duck

"BLUE DEAL FOR THE FUTURE" CONTEST

IES JOAN FUSTER SUECA

Unió Europea

Erasmus+

CEEI VALENCIA
CENTROS EUROPEOS DE EMPRESAS INNOVADORAS

Interreg
EUROPEAN UNION
Mediterranean
BLUE DEAL

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Group: 2nd FPBasic Vehicles

Subject: Applied Science (II)

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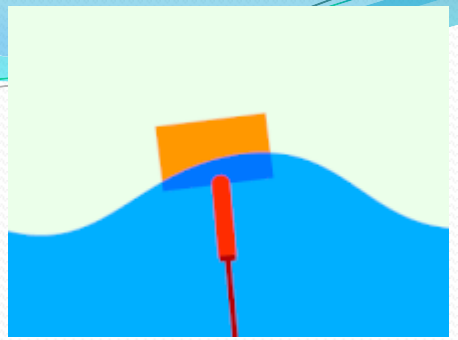


PROJECT INDEX

1. INTRODUCTION

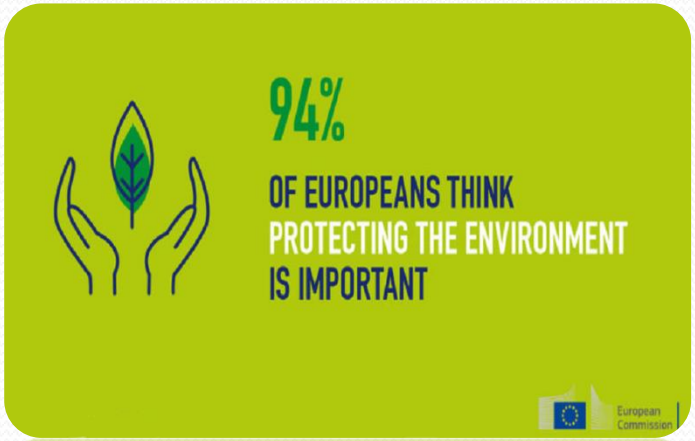
Objectives of our project

- The work presented has tired to study in a practical and simple way some basic concepts for the training of our students, related to sustainability, respect for the natural environment or the responsible use of the planet's resources.
- We have captured these concepts by focusing on emerging renewables energies and specifically on tidal energy, which is a clean, efficient and modern way of obtaining energy, which is also widely accepted and invested in the Mediterranean area in which we live.
- Our students have carried out research and reading work in the centre's library, the preparation of the material in electronic format in the computer room and finally the subsequent design of the model in their automotive mechanics workshop.
- By participating in the contest with this work, we hope to help in the best way possible to make visible and spread the objectives pursued by these energies in the rice-growing region where we live, such as Ribera Baja of Sueca.

1. INTRODUCTION

1.1. UE Schedule 2030

- Schedule 2030 together with the Paris and Madrid deals about the climate change, it is the route to a better world and a global framework for international cooperation on sustainable development with its economic, environment and governance dimensions.



1. INTRODUCTION

1.2. Sustainable Development Goals

- The 17 Sustainable Development Goals of the United Nations seek as primary purpose to strengthen the means of implementation and rehabilitation the world association for the development of human societies in a sustainable way.

- They stand out from them:

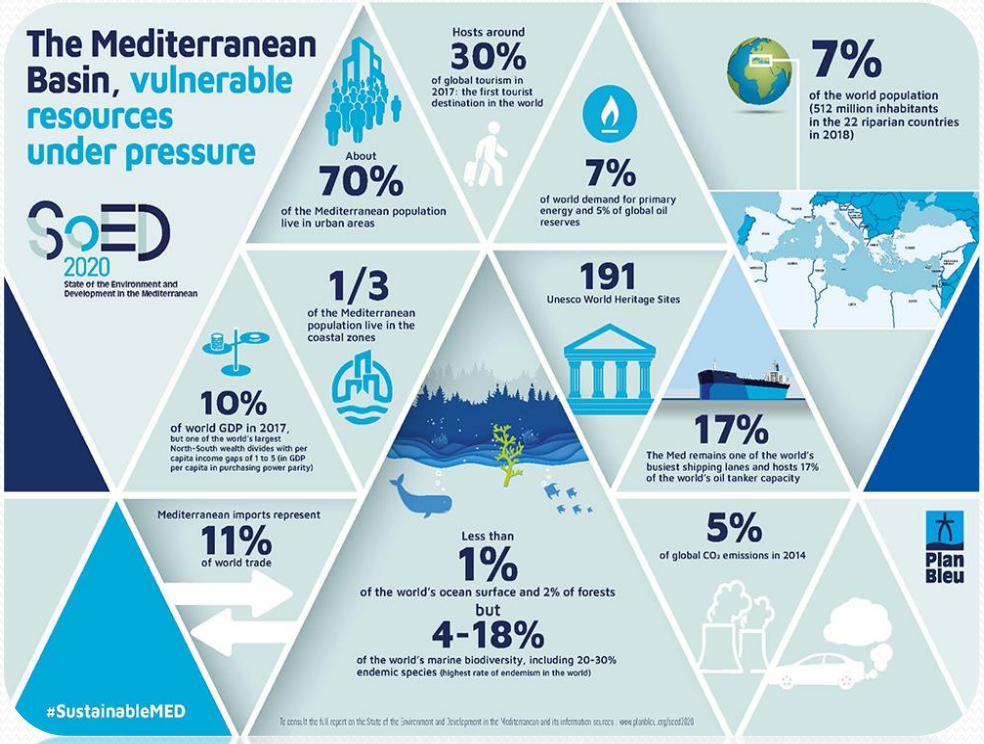
1. Zero hunger
2. Health and Wellness
3. Quality education
4. Gender equality

1. INTRODUCTION

1.3. Importance of renewable energies

- Directly combat climate change by having zero Greenhouse gas emissions.
- Reduce air pollution (Photochemical smog at big cities) and the improve air quality.
- Help keep the planet's non-renewable natural resources intact.
- Improve the quality of life and stabilize the economy.

2. ECONOMIC ACTIVITIES RELATED TO THE SEA



2. ECONOMIC ACTIVITIES RELATED TO THE SEA

- The economic importance of coastal waters and marine resources depends on and is conditioned by the capacity of the environment to withstand new pressures or to guarantee current ones in a sustainable manner.
- Spain is a maritime country par excellence, with a coastline of some 10.000 km which, together with other factors, such as its beauty and biological wealth, have created and inseparable bond between the goods and services provided by the seas and our economic and social development.
- Traditionally, the main uses of the sea can be considered fishing, maritime transport and uses derived from tourism. But along with them, there are more and more uses and activities that have a place in such valuable space, such as aquaculture, the extraction of aggregates, the energy use of waves, scientific research, the protection of species,…

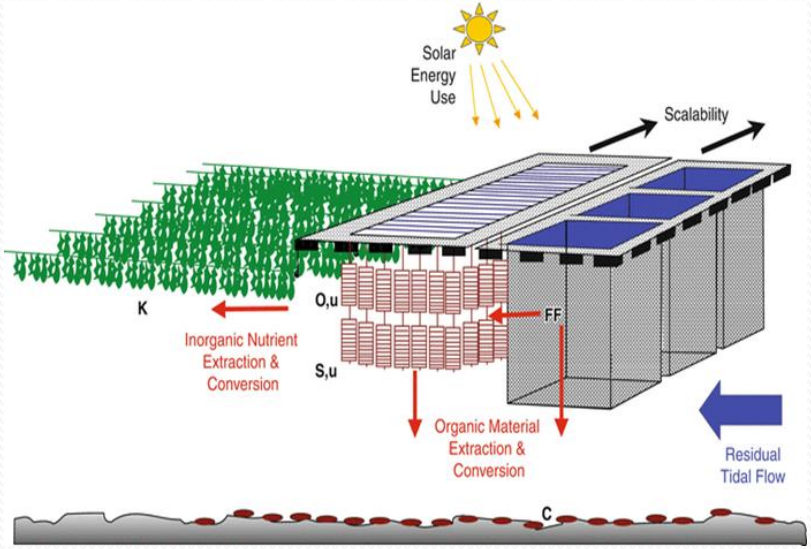
2. ECONOMIC ACTIVITIES RELATED TO THE SEA

2.1. Aquaculture

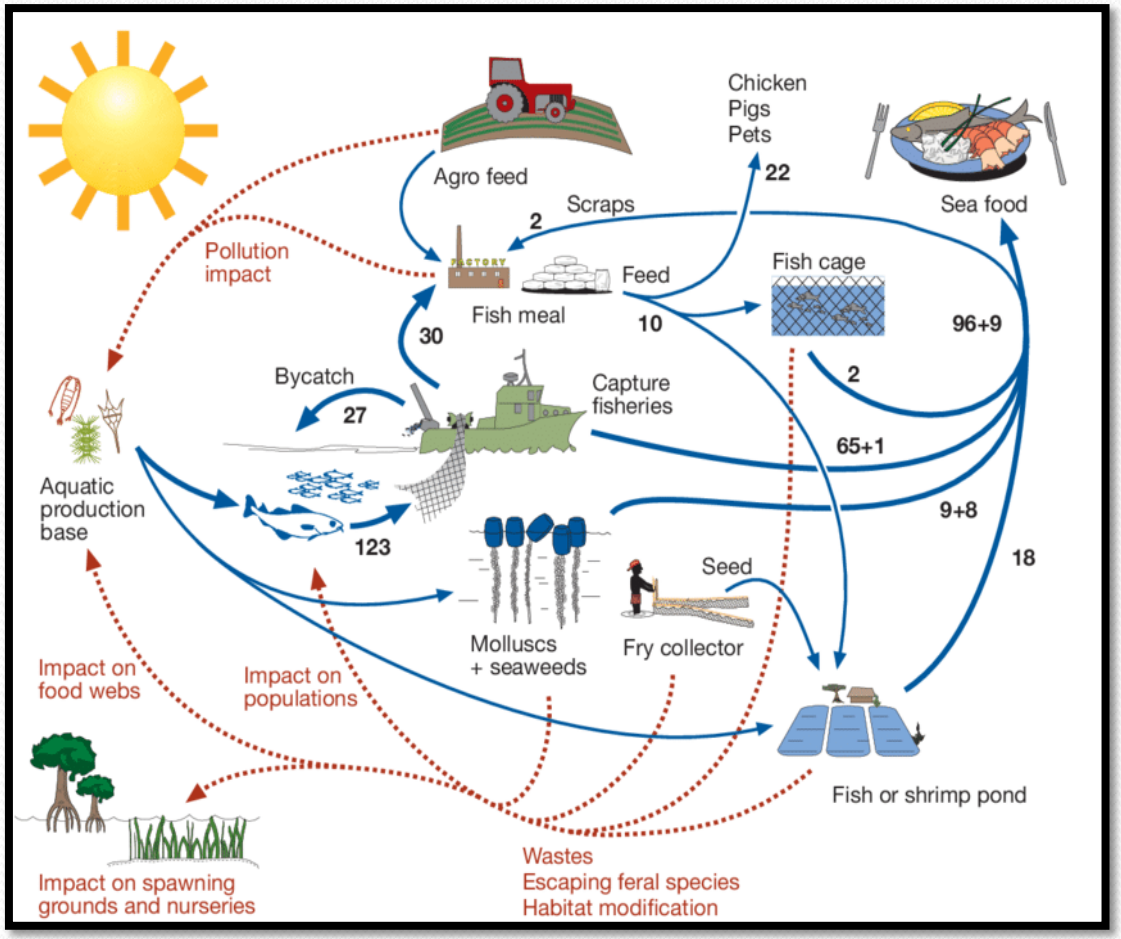
- It is the set of activities, techniques and knowledge of raising aquatic plant and animal species. It is an important economic activity for the production of food, raw materials for industrial and pharmaceutical use, and living organisms for repopulation or ornamentation.

2.1.1. Ecological aquaculture

- Ecologically, sustainable and environmentally responsible aquaculture, which does not increase the pressure on the marine environment, the estuaries, or fresh water.



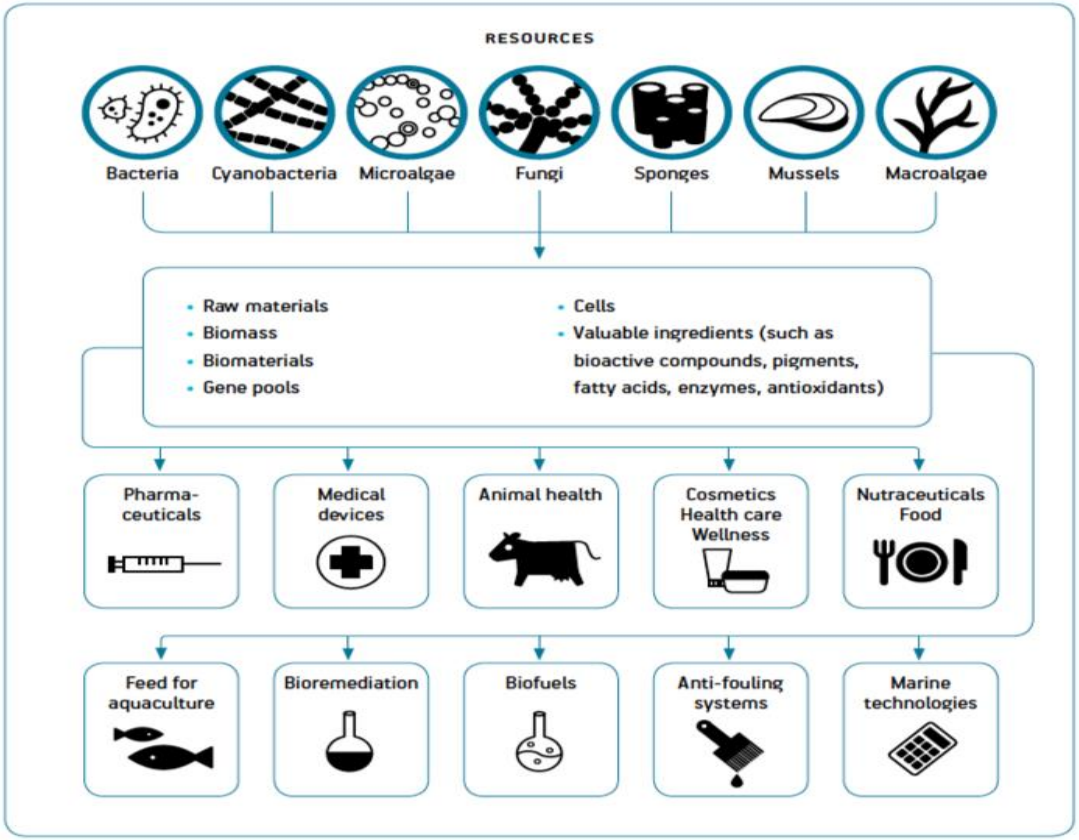
2. ECONOMIC ACTIVITIES RELATED TO THE SEA



2. ECONOMIC ACTIVITIES RELATED TO THE SEA

2.2. Blue or Marine Biotechnology

- Applications of biotechnology in marine and aquatic environments. It is still in early stage of development but very promising in the field of aquaculture, health care, cosmetics and food products.



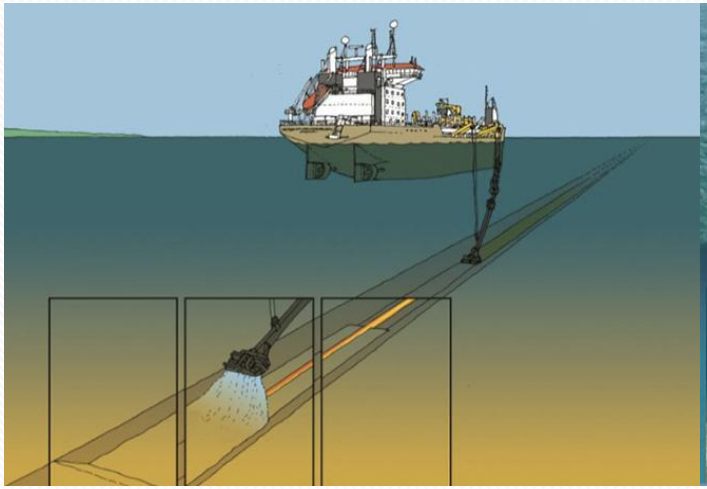
2. ECONOMIC ACTIVITIES RELATED TO THE SEA

2.3. Seabed mining

Seabed mining is a process of mineral extraction, which take place about 1.400 to 3.700 meters below the ocean surface.

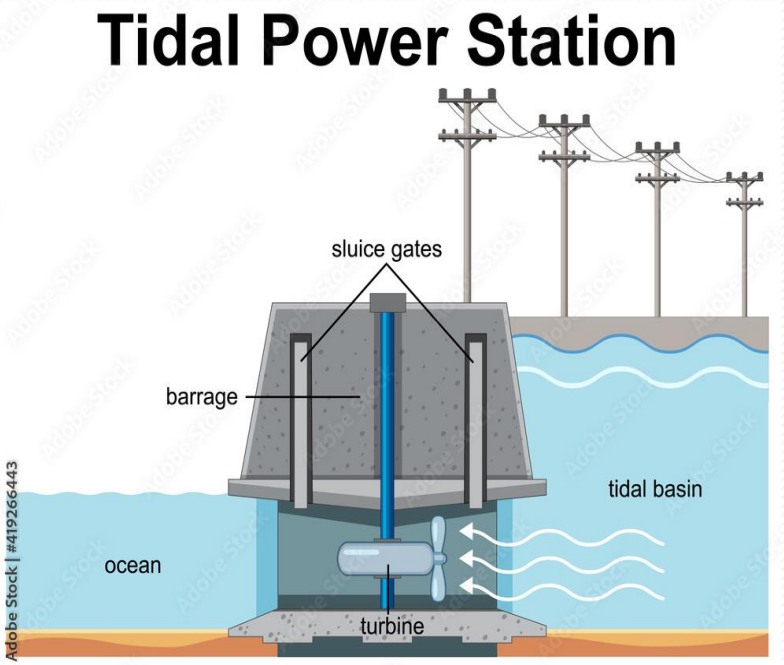
Hydrothermal vents create deposits containing precious metals such as silver, gold, copper, manganese, cobalt and zinc.

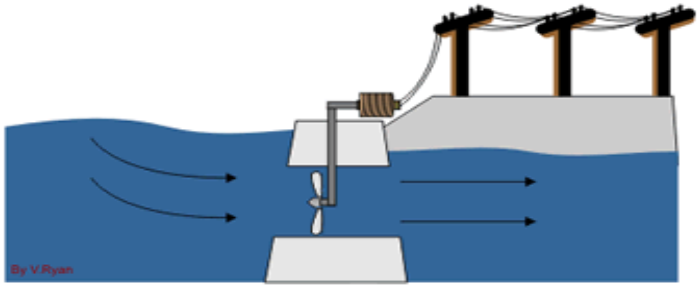
The deposits are extracted using hydraulic pumps to the surface to be processed. This deep sea mining raises questions about the environmental damage to the surrounding areas, it could cause damage to zooplankton and therefore to the food chain of the ecosystem.



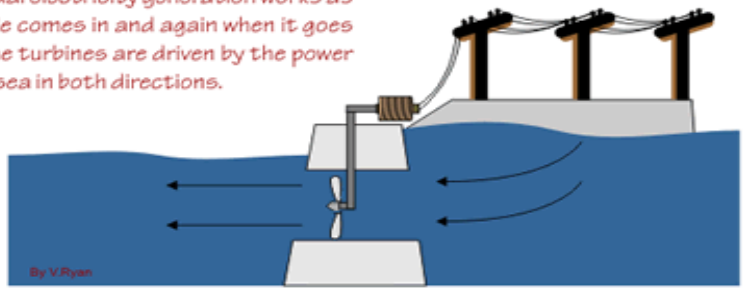
3. TIDAL POWER PLANTS

- Tidal energy is that which is generated by the rise and fall of the tides, taking advantage of the force of maritime movement to transform it into electricity.
- The basic system of tidal power plants is based on the storage of water in a dam system, with doors that open and close in order to allow the exit and entry of sea water.





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.



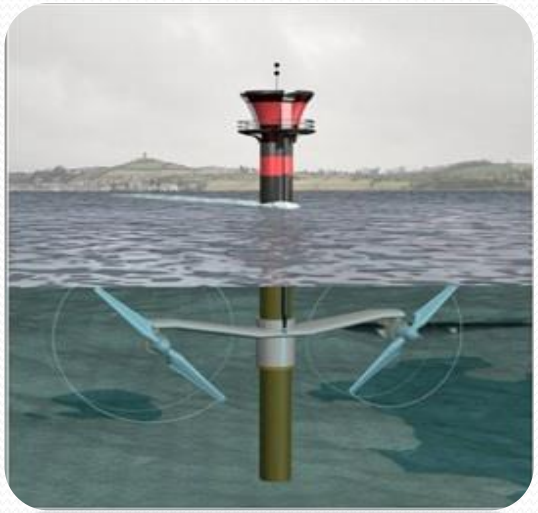
3. TIDAL POWER PLANTS

- When the tides is at its highest point, the gates of the dam open to let the water in. Finally the doors close and wait for the tide to go down, to a minimum difference of about five meters high. This difference in height is used to pass stored water through turbines that allow the transformation of kinetic energy into electricity.
- TYPES OF TIDAL POWER PLANTS

1.Tidal dam: it is the basic model based on dikes.

2.Tidal current generator: works with a system of propellers to take adavntage of movement of water.

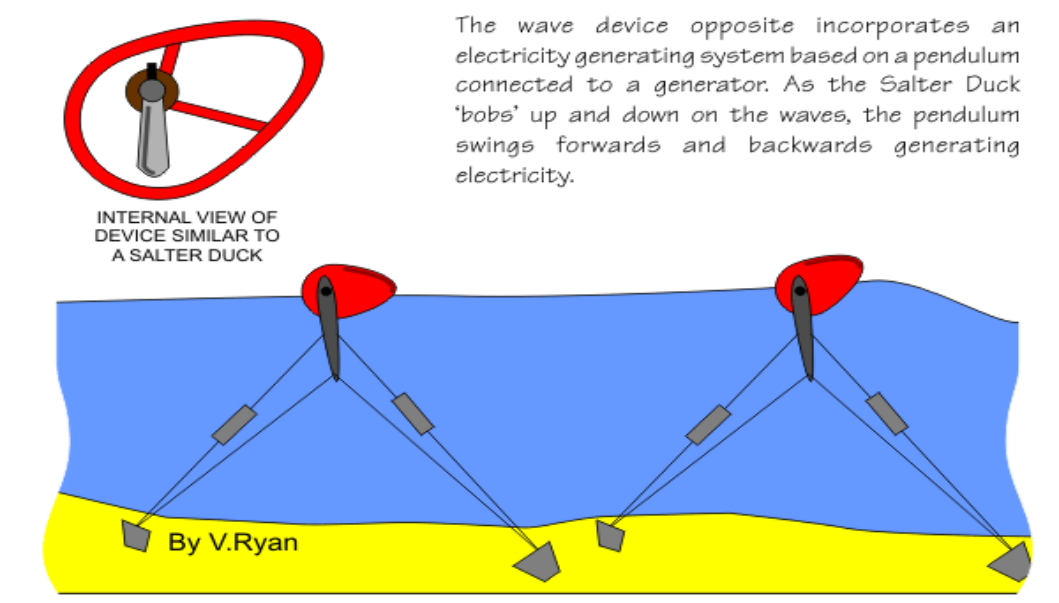
3.Dynamic tidal energy: combines the two previous models.



4. PRACTICAL APPLICATIONS. DESIGNS AND COUNTRIES THAT BET ON THIS ENERGY

4.1. Pioneers in this type of energy. Salter's Duck.

- Also known as "Edinburgh's Duck", it is a device that converts wave energy into electricity. The impact of the wave induces the rotation of the gyroscopes located inside the pear-shaped "duck" and an electric generator converts this rotation into electricity with an overall efficiency of up to 90%.



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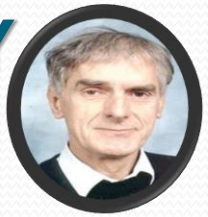
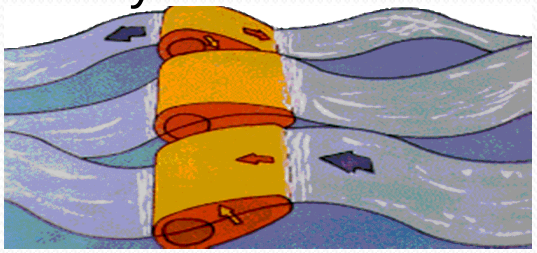


4.1. Salter's Duck.

- Its development and original idea was in charge of the engineer Stephen Salter, in response to oil shortages in the 1970s.
- Funding for the project was cut off during the 1980s as oil prices normalized and the UK government moved away from alternative energy sources.

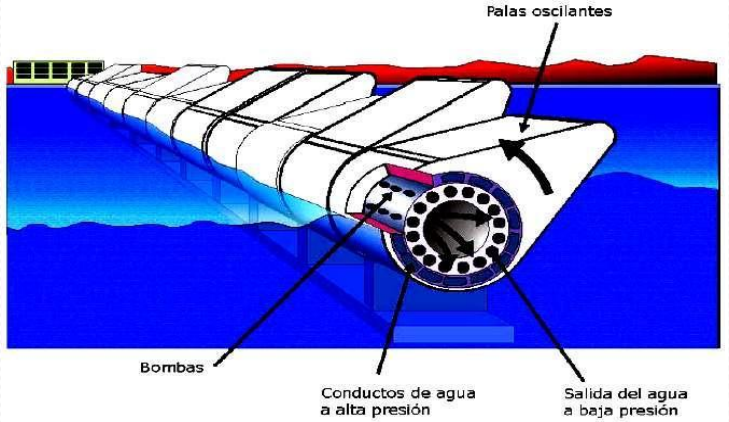


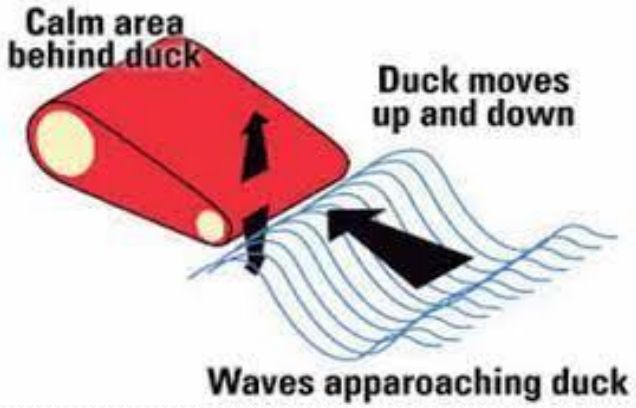
- As of May 2018, no other wave energy device ever entered large-scale production again.
- The idea of creating this device came to him by analogy with a "toilet tank" while he was a student at the University of Edinburgh.

4. PRACTICAL APPLICATIONS. DESIGNS AND COUNTRIES THAT BET ON THIS ENERGY

4.1. Salter's Duck.

- The original prototype was made of a chain of floating paddles of rudimentary cross-sections linked by a central spine.
- The final design worked with 20 or 23 ducks connected to each other by an articulated spine.





- Each of the ducks in motion with the waves that hit it and transfer the energy of the impact.

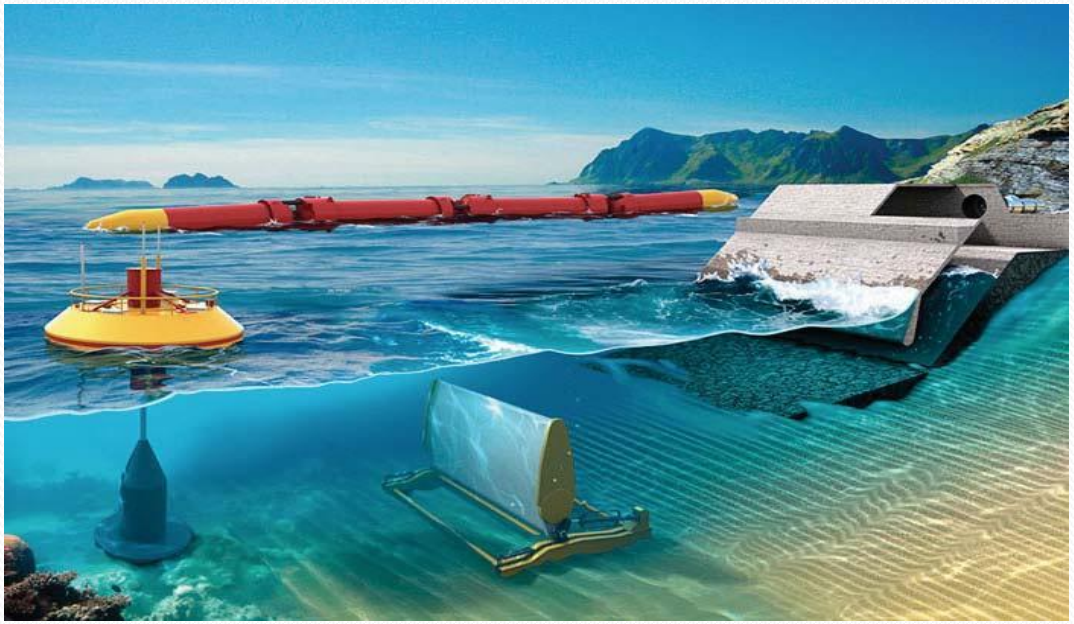
Their pear-shaped shape means that when they face the ocean current, due to their orientation and rocking, they turn when hit and that causes four gyroscopes inside to move back and fourth, creating hydraulic energy that is transferred to a turbine or generator.

4.2. COCKEREL'S RAFT

- This device consists of an articulated raft that bends with the passage of the waves, thus taking advantage of the movement to drive a hydraulic pump.
- Ocean waves are waves of energy, generated by winds and solar heat, which are transmitted through the surface of oceans, it is a vertical and horizontal movement of water molecules.
- This waves of energy on the surface of the sea can travel millions of kilometers can and in places, such as the North Atlantic, the energy can reach 10 KW for each square meter of ocean.

4.2. COCKEREL'S RAFT

- The areas of ocean with the greatest amount of energy accumulated in the waves are those regions beyond 30º South latitude with strong latitudes.
- Later we will see its application in the "Pelamis Project".



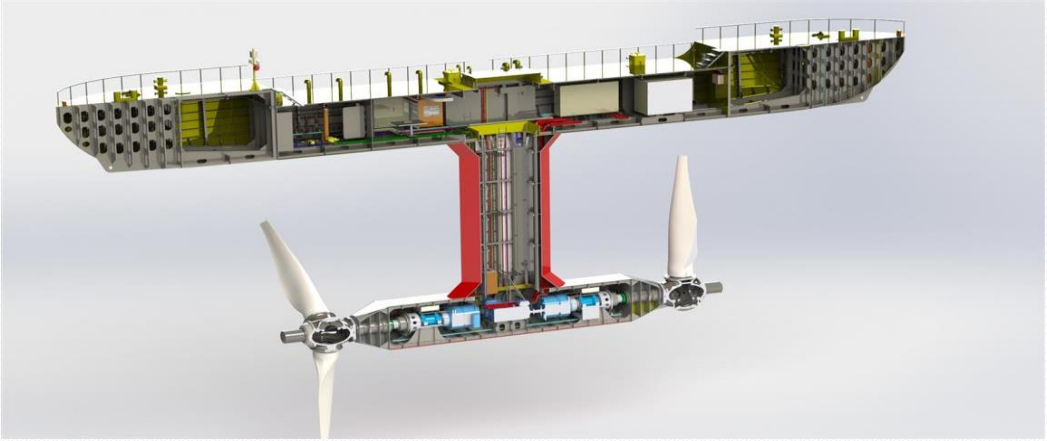
5. MEDITERRANEAN AREA RESEARCH PROJECT

1. **Magallanes Project**

- The Spanish project in an advanced stage of development that investigates electricity that investigates electricity generation through tidal energy.

- Platform operation:

It is fixed to the bottom of the sea by two anchor points, one at the bow and the other at the stern. Once moored, the tidal currents turn the blades of the two rotors.



5. MEDITERRANEAN AREA RESEARCH PROJECT

- The movement of its propellers produce the rotation of an axis and later, through a generator, said mechanical energy is converted into electric current.

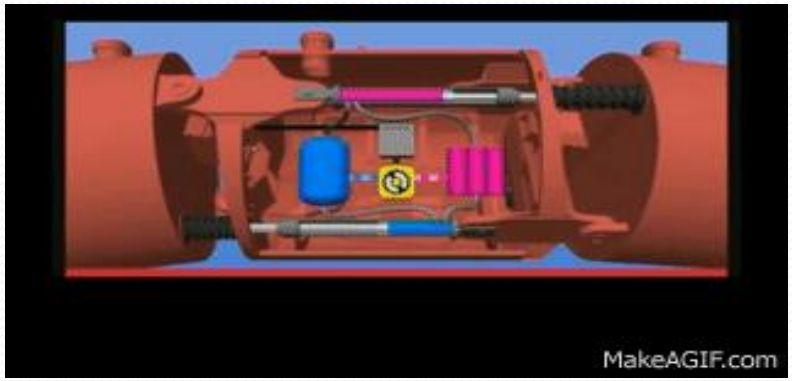
- The generation capacity of the platform is up to 2MW of power and a 5.200 MWh/year, a single of these platforms can cover the consumption of about 500 homes.

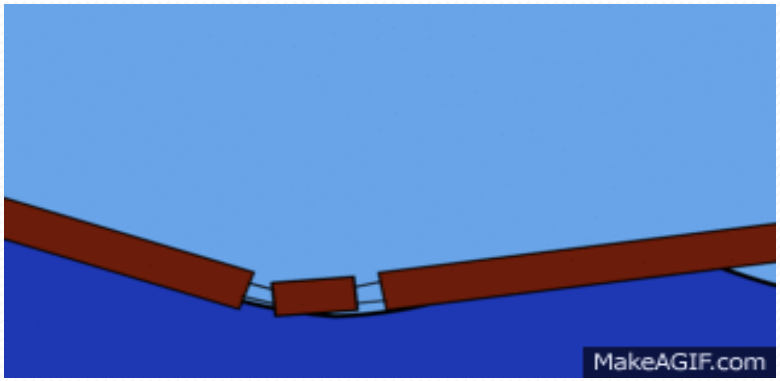
https://youtu.be/qKpeLeTUAfM

5. MEDITERRANEAN AREA RESEARCH PROJECT

2. Wave energy converter Pelamis

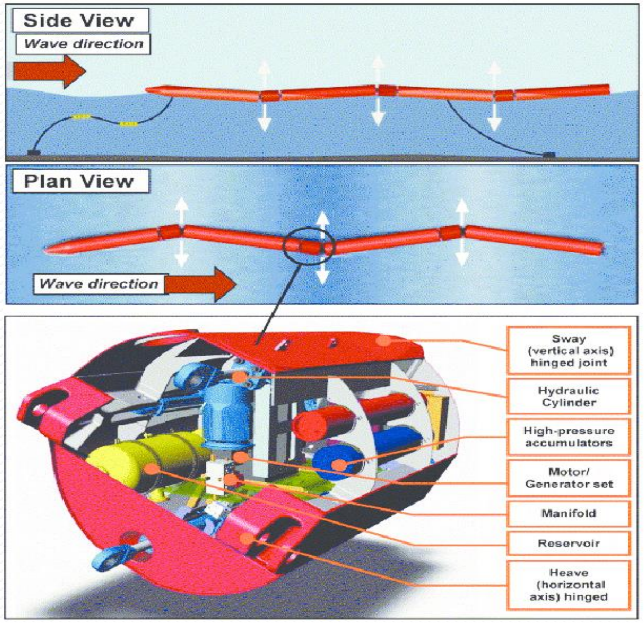
- It is an example of emerging technology that uses the movement of ocean waves to generate electricity.
- This snake-shaped machine is made up of connected sections that flex and bend when the waves pass, with a movement that generates electric current.
- The system can survive almost without maintenance in very adverse marine weather conditions (storms and cyclones).

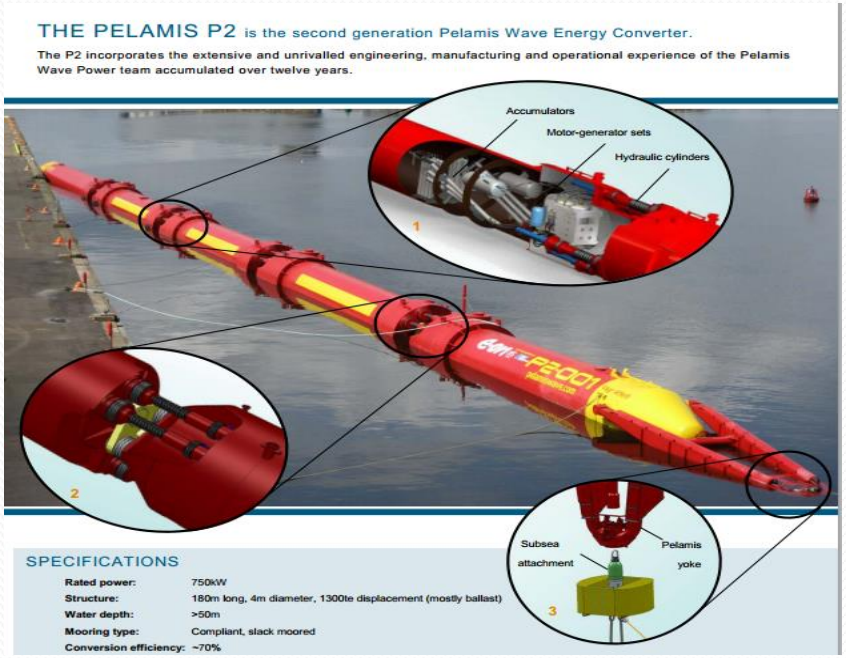




5. MEDITERRANEAN AREA RESEARCH PROJECT

- The first farm or wave park, called “Okeanós”, it is planned for the Portuguese coast near the city “Póvoa de Varzim”.
- This experimental park will prevent the emission of more than 6.000 tons of carbon dioxide that would otherwise be produced by the production of electricity using fossil sources.





5. MEDITERRANEAN AREA RESEARCH PROJECT

3. **Tramuntana Park**

- Floating offshore wind energy project designed for the Empordà in the face of the challenge of climate change. It is conceived as an unprecedented energy, environmental and economic opportunity for the territory, its population and fishing, tourist, nautical, economic, social and business activities.

https://youtu.be/_iwX-iBFMmE

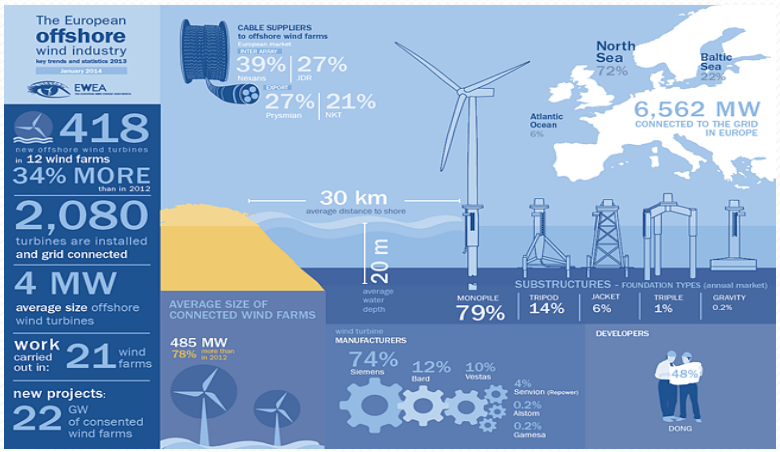
Located 24 km from the Bay of Roses

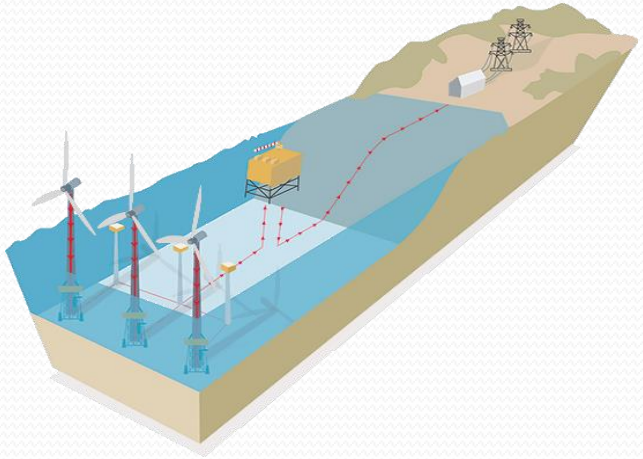
It will generate 45% electricity demand Girona

5. MEDITERRANEAN AREA RESEARCH PROJECT

- **Objectives of Tramuntana Park:**

1) Guarantee the supply of clean and zero kilometre energy throughout the province of Girona.
2) It will reduce the carbon footprint, the use of fossil fuels and the heating and pollution of water.
3) It generates direct and indirect jobs in the territory.
4) It recovers the marine systems and their biodiversity in the context of a blue economy and sustainable tourism.



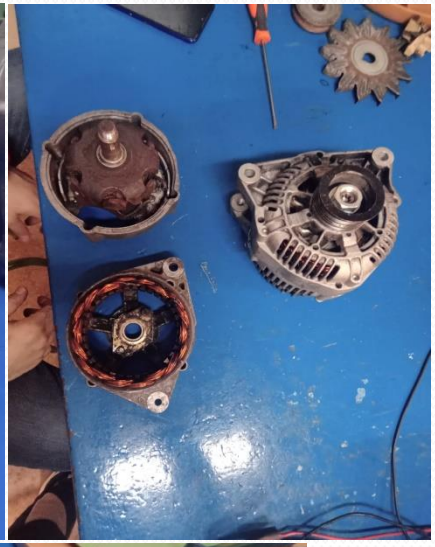


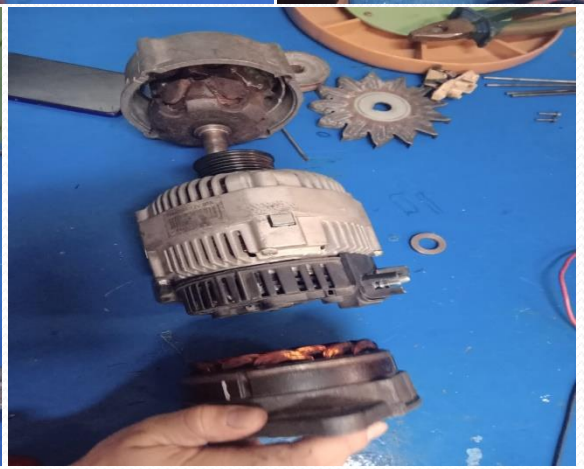
6. PRACTICAL APPLICATION OF THE PROJECT: MARINE WIND TURBINE ROTOR

- **MATERIALS**

a) Turbine
b) Rotor
c) Stator
d) Cable
e) Coil
f) Diode bridge
g) Generator
h) Rectifier
i) Multimeter







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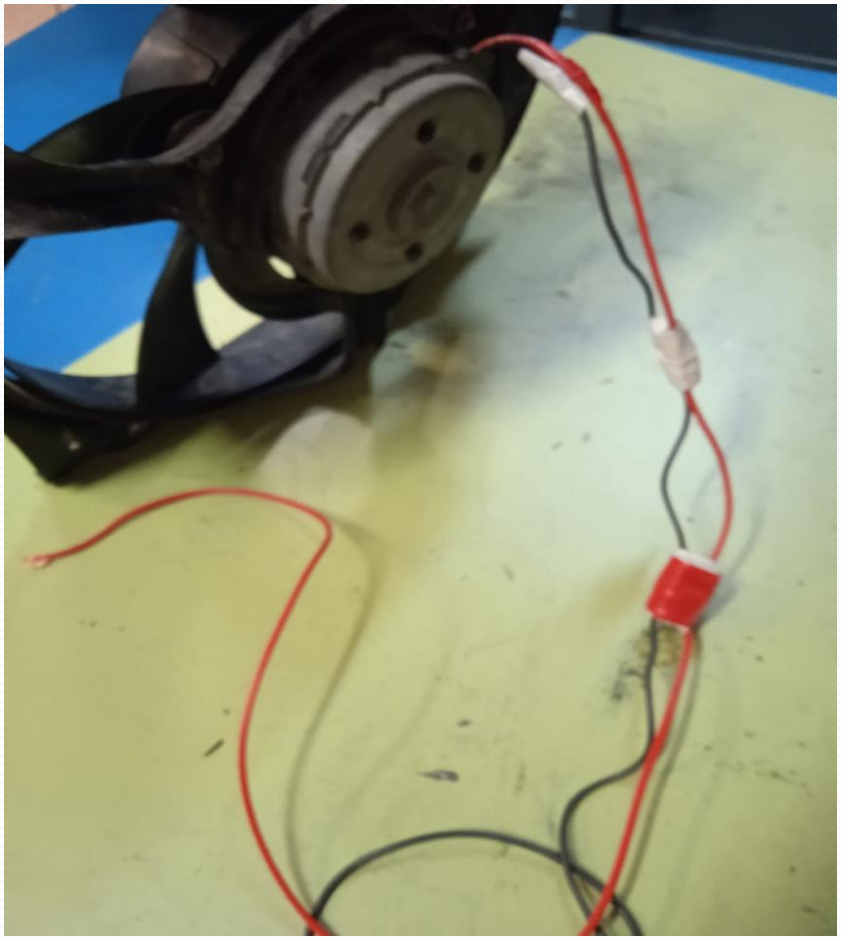

THANK YOU VERY MUCH FOR THE ATTENTION GIVEN