# Hydroelectric and Tidal Power

# What is Hydroelectric Power?

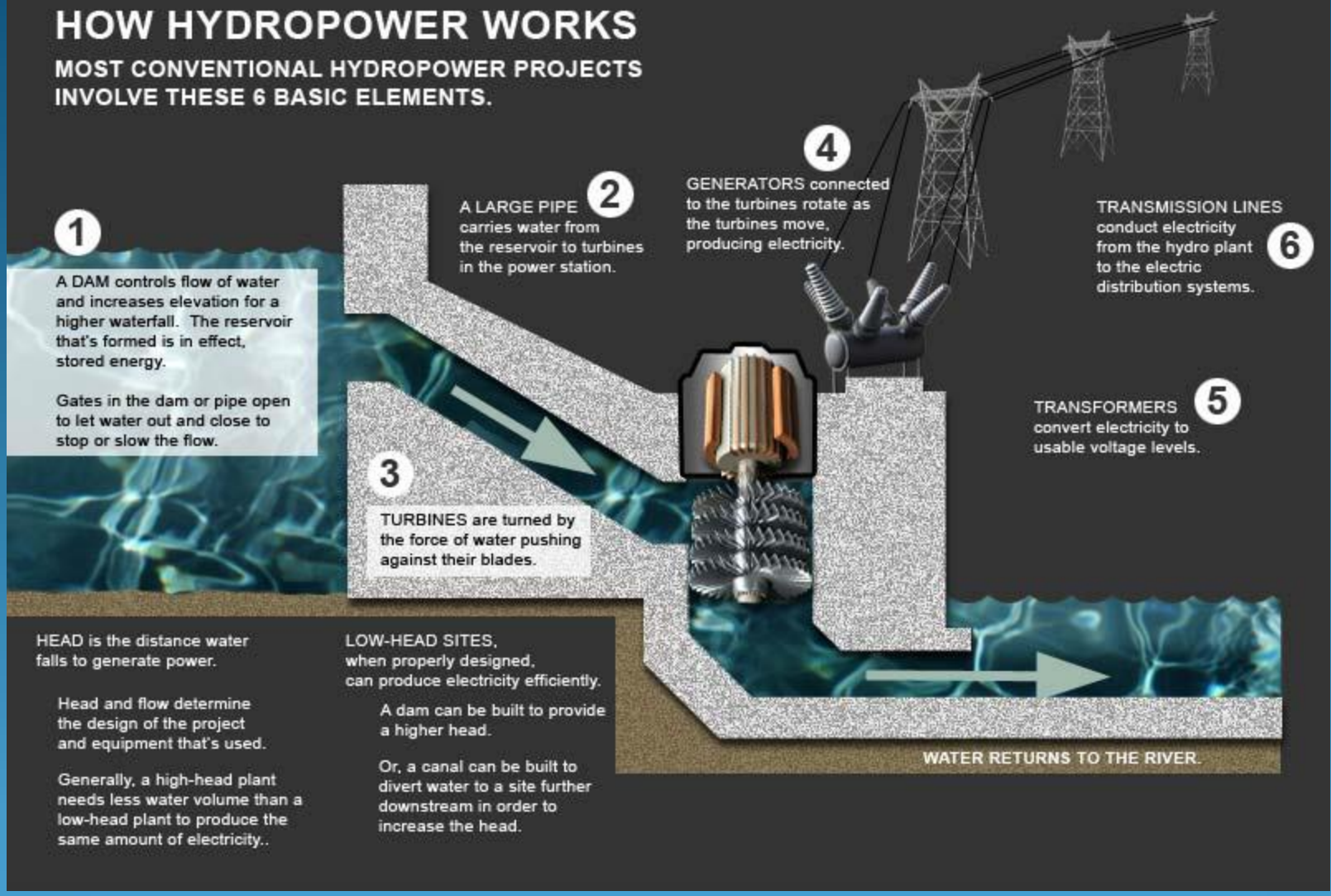
Harvesting the energy of moving water to produce electricity for our own needs.

# Potential?

- Streams/ rivers (most common)
- Tides/ waves
- Underwater turbines

# HOW HYDROPOWER WORKS

## MOST CONVENTIONAL HYDROPOWER PROJECTS INVOLVE THESE 6 BASIC ELEMENTS.



**1**

A DAM controls flow of water and increases elevation for a higher waterfall. The reservoir that's formed is in effect, stored energy.

Gates in the dam or pipe open to let water out and close to stop or slow the flow.

**2** A LARGE PIPE carries water from the reservoir to turbines in the power station.

**3** TURBINES are turned by the force of water pushing against their blades.

**4** GENERATORS connected to the turbines rotate as the turbines move, producing electricity.

**5** TRANSFORMERS convert electricity to usable voltage levels.

**6** TRANSMISSION LINES conduct electricity from the hydro plant to the electric distribution systems.

HEAD is the distance water falls to generate power.

Head and flow determine the design of the project and equipment that's used.

Generally, a high-head plant needs less water volume than a low-head plant to produce the same amount of electricity..

LOW-HEAD SITES, when properly designed, can produce electricity efficiently.

A dam can be built to provide a higher head.

Or, a canal can be built to divert water to a site further downstream in order to increase the head.

WATER RETURNS TO THE RIVER.

# Historical Uses

Greeks and Romans used hydropower to power mills to grind corn

Domesday Book (1086): listed 5,624 water-wheel driven mills in England south of the Trent River (about 1 mill for every 400 people)

# Present Day

- Same concept as historical mills, but more complex.
- Now produce about 24% of the world's electricity
- Supplies more than 1 billion people with power
- Produces 675,000 megawatts (= 3.6 billion barrels of oil)

# The Hoover Dam

- Located about an hour from Las Vegas
- A total of 19 turbines  create 2,998,000 horsepower which translates into 4 billion kilowatt hours a year
- 17 turbines give energy to the nearby cities, while 2 give energy to the power plant
- Serves 1.3 million people

# Enhancing Developed Areas

- Can be done in countries that use hydropower, currently worldwide 24% of the electricity is made by hydro-power supplying over 1 billion people
- Produces a good amount of energy with very low environment damaging effects
- It’s already producing 10% of USA's energy, it could be used to produce more if more effort and funds were invested in the programm

# Potential of Hydropower

- That impact is nonetheless considerable
- Hydro-power has many advantages , it is clean and safe energy source, self sustaining, possible flood control, and very efficient ranging from 90-95%
- They can efficiently improve the environment
- Hydroelectric power is a renewable energy source and contributes no greenhouse gases or other pollutants

# Environmental Problems

- Emissions of greenhouse gases
- Dams/ turbines diminish aquatic populations
- Impacts quality of water
- Flooding

# Social Problems

- Significant start-up cost
- Visually unattractive
- Relocation
- Water rights issues

# Is Hydropower really sustainable?

- Siltation reduces a dam's water storage so water stored in the wet season cannot be stored for use in the dry season

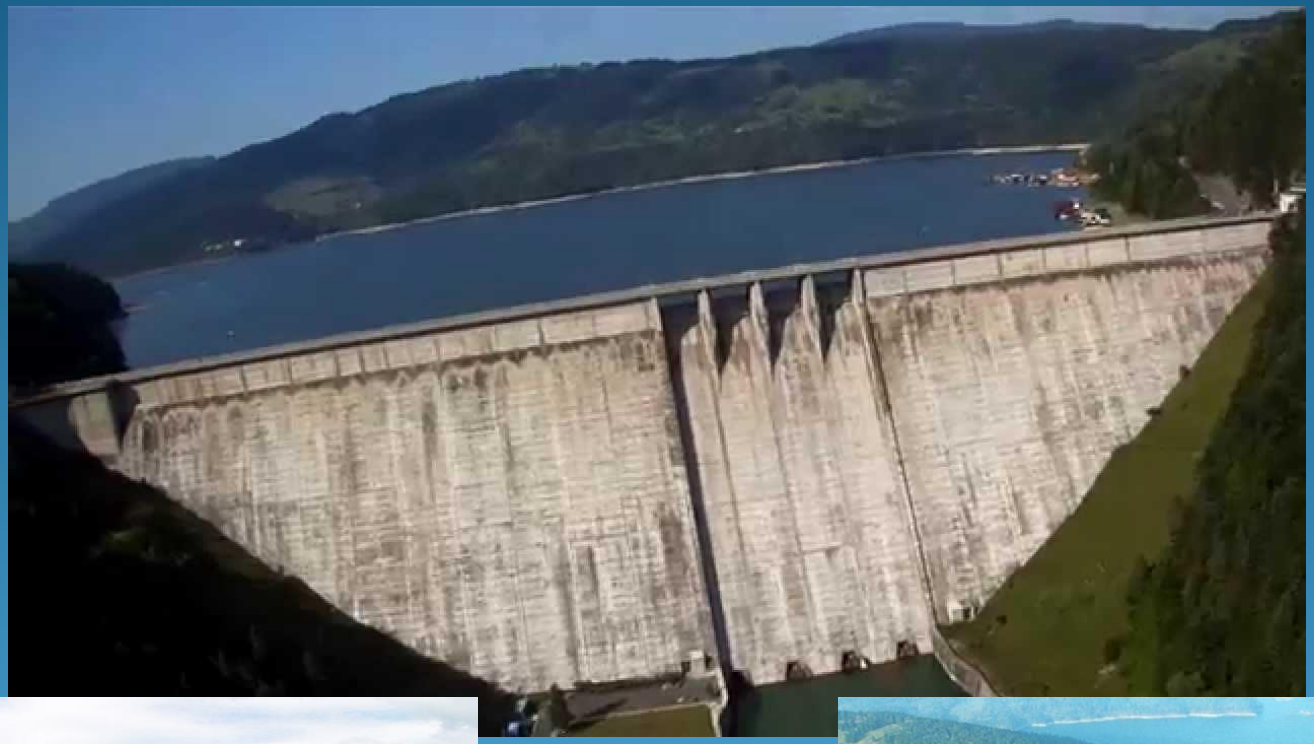
- The life of dams can be extended by sediment bypassing, special weirs, and forestation project to reduce silt production. At some point, it becomes uneconomic to operate in most cases.

- Water flow can decrease in areas due to environmental problems such as global warming
- the North Cascades glaciers  have lost a third of their volume since 1950, resulting in stream flows that have decreased by as much as 34%
- no burning of fossil fuels
- Even though water sources can eventually be reduced, other water resources will always be available due to the water cycle

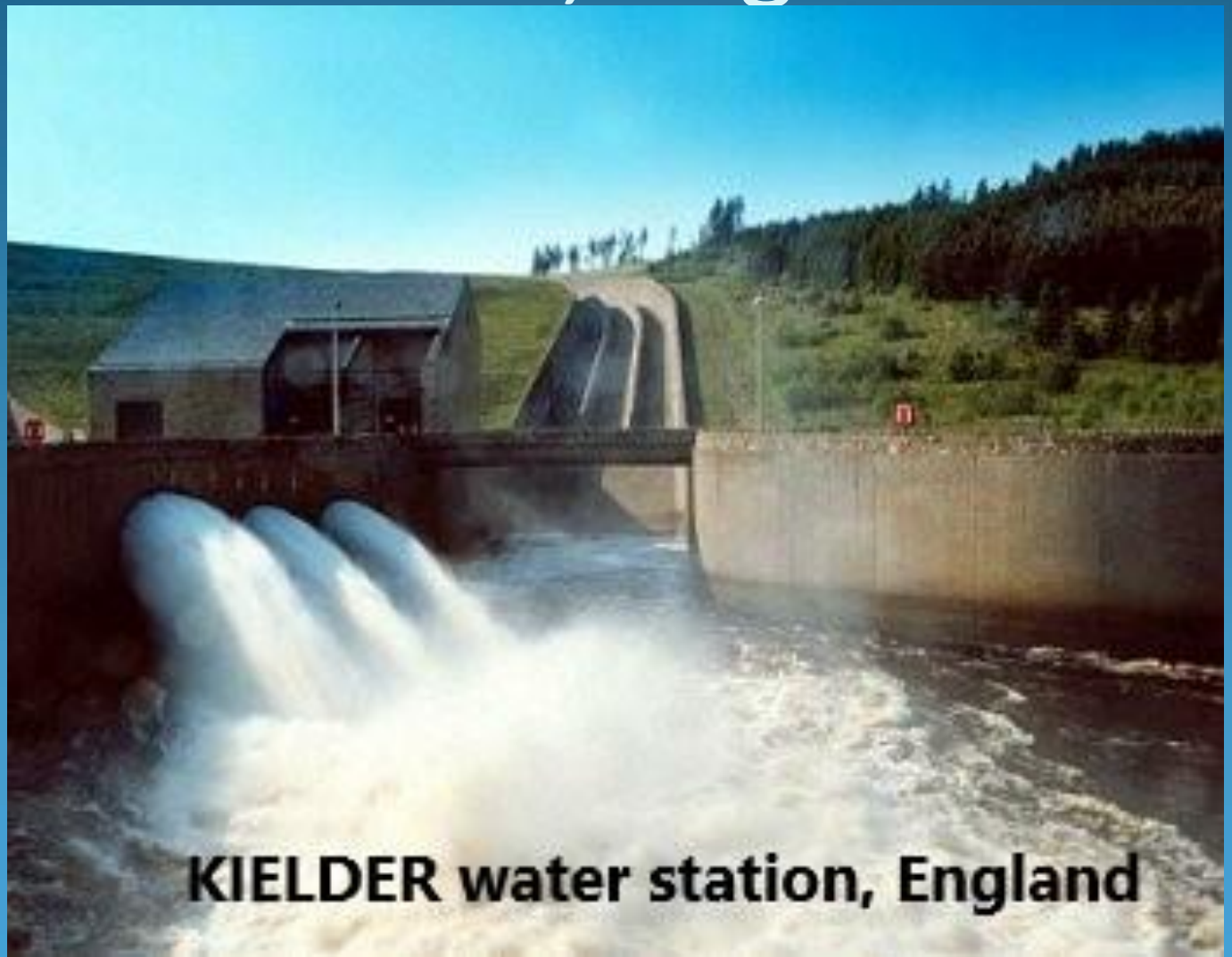
# Hydroelectric Power Station

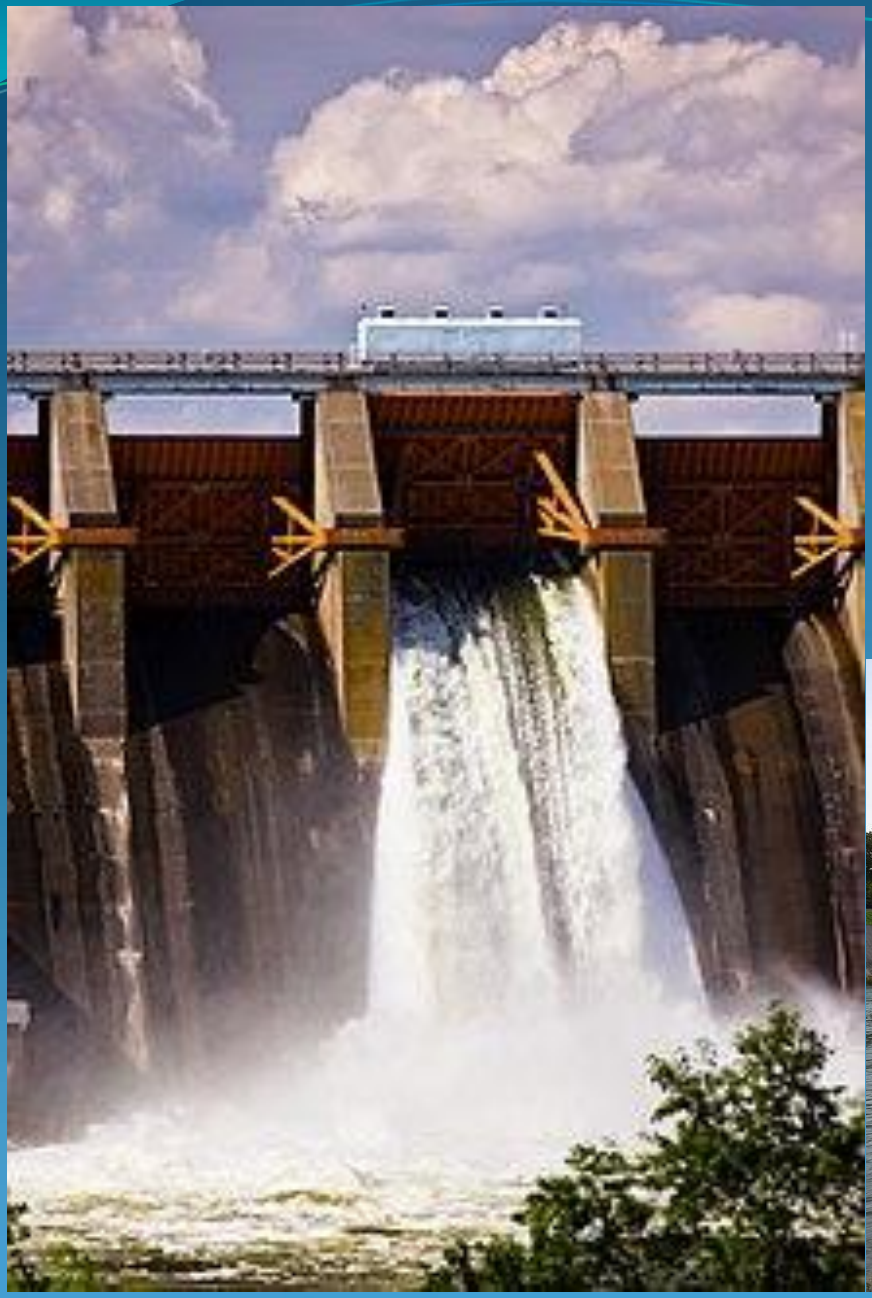
# Slapy Hydroelectric Power Station, Czech Republic

# Bicaz-Stejaru,Romania



# Kielder Hydroelectric power station, England





# Garsten-St-Ulrich, Austria

# Keguns Hydroelectric ,Latvia

# KREMASTA Hydroelectric Power Station

**Kremasta Aeolia-Akarnania (Central Greece / N 38o 53’ 10,68” - E 21o 29’ 43,44”)**

**(437 MWatt)**

# THISSAVROS Hydroelectric Power Station

**Paranesti Dramas (Macedonia / N 41o 21’ 31” - E 24o 22’ 15”)**

**(384 MWatt)**

# POLYFYTOS Hydroelectric Power Station

**Servia Kozanis (Macedonia / N 40o 19’ 50” - E 22o 07’ 31”)**

**(375 MWatt)**

# SFIKIAS Hydroelectric Power Station

**Sfikias Verias (Macedonia / N 40o 23’ 50” - E 22o 11’ 32”)**

**(315 MWatt)**

# *Plastira Lake Hydroelectric Power Station*

**Nevropoli Karditsas (Thessalia / N 39o 19’ 38” - E 21o 48’ 43”)**

**(130 MWatt)**

# Benefits of Hydroelectric Stations (HES)

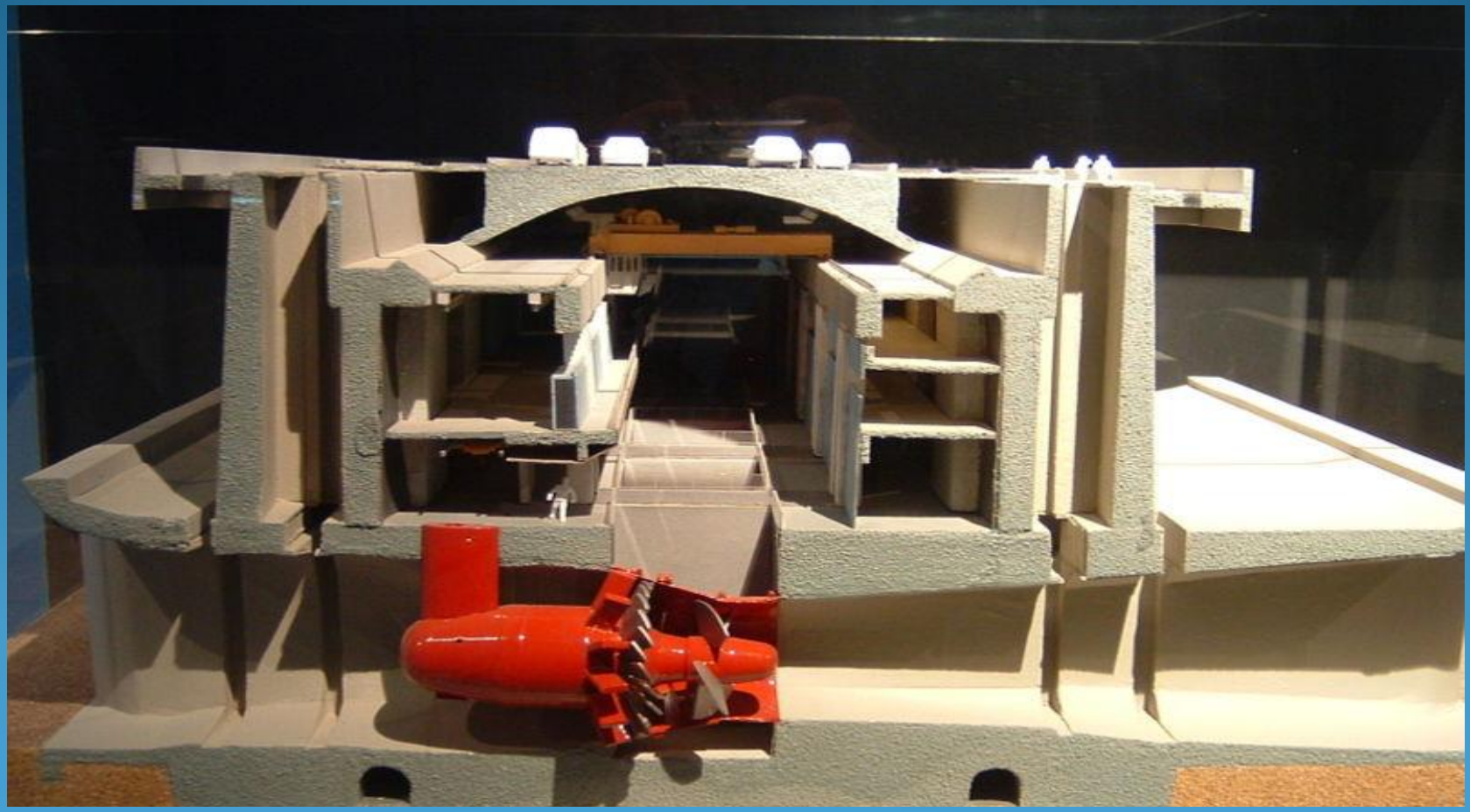
- The HES function producing "clean" renewable electric energy.
- The units of HES provide more services and uses of water to others (flood protection, irrigation, water supply, recreation etc).
- The HES are very important especially for GREECE, a Mediterranean Country, where the lack of water is intense, especially in summer.
- Their role becomes more and more important nowadays because their reservoirs help to collect rainwater so that the climate changes will not affect the country significantly.
- Moreover, in case of heavy rainfalls and extreme weather phenomena, they help to avoid floods and environmental disasters.

# Tidal and Wave Energy

# How it Works - Tidal Barrages

- Tidal Barrages
- Dam an estuary
- As water flows out or in, a turbine is spun
- Electricity is generated by the turbine

# How it Works -Tidal Barrages



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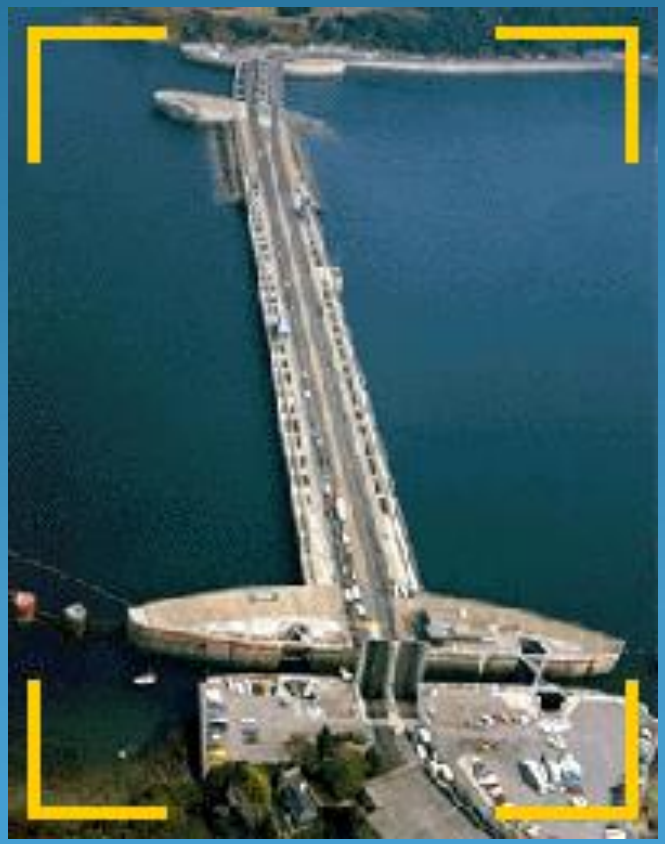
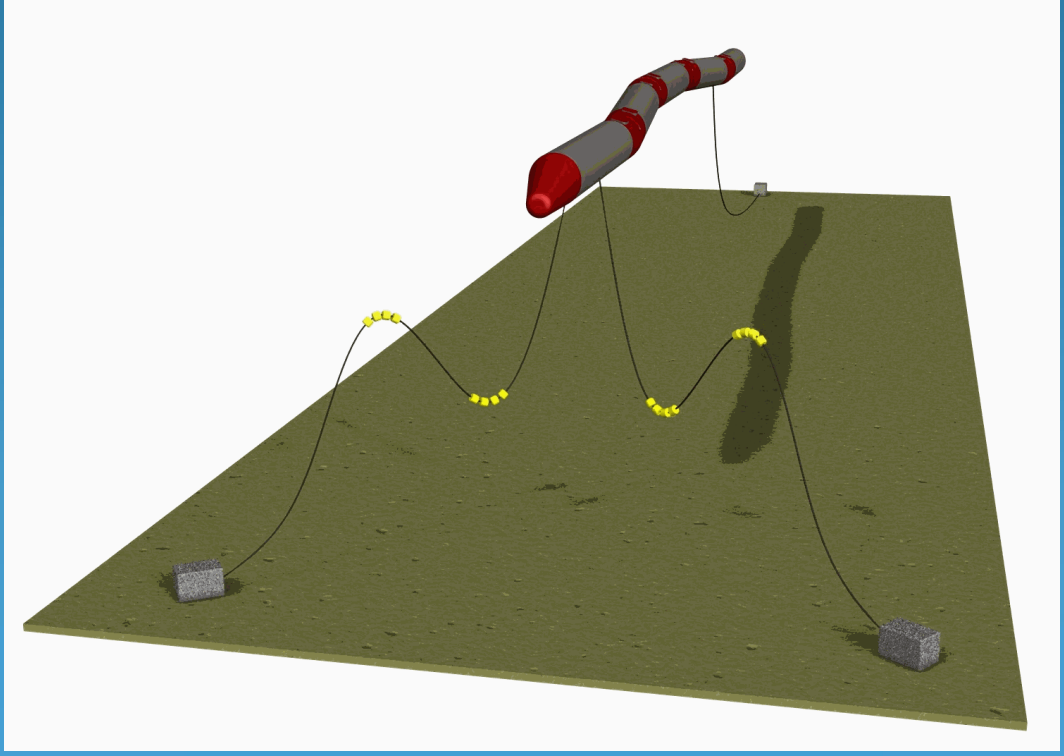


# How it Works - Wave Energy

Many experimental technologies
Example: Pelamis Project



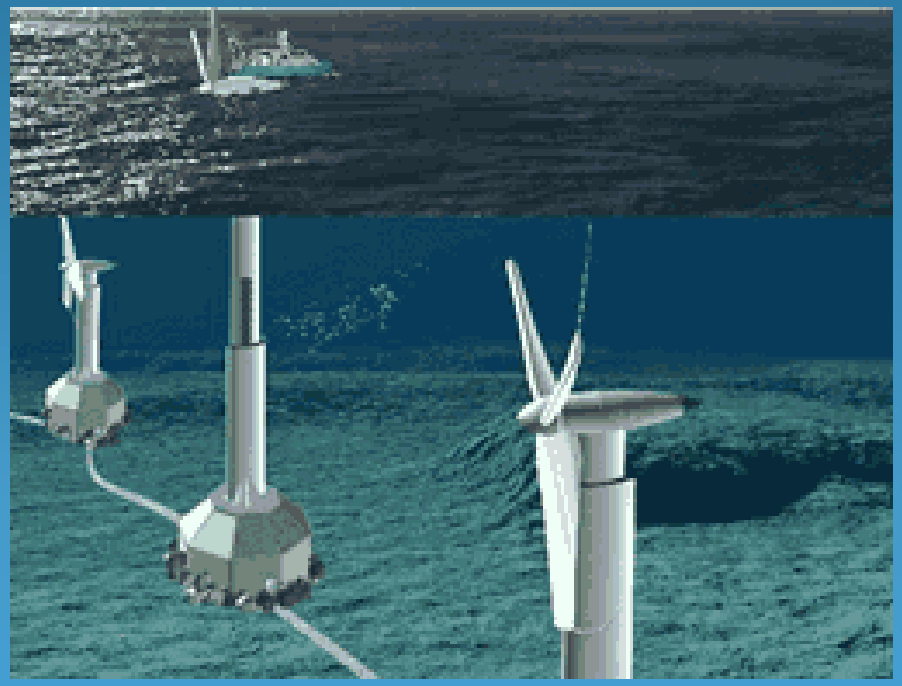
# How it Works - Wave Energy

- Offshore Turbines
- Have gearboxes, anchored by a monopile

# Tidal and Wave Power Station

# How it Works – Wave Energy

- Swanturbines
- No gearboxes, anchored by concrete



# Tildal: Motrico

# Tildal: Sihwa Lake

# Tildal: Rance

# Tildal: MeyGen

# Kislaya Guba Tidal Power Station

# Stranford Lough SeaGen

# Eastern Scheldt

# Tidal Lagoon Swansea Bay

# Rance Tidal Power Station