

# HYDROELECTRIC PLANT

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# WHAT IS HYDROELECTRICITY?

Hydroelectricity is a kind of electricity produced by hydropower. Hydropower or water power uses fast running water to produce electricity. This is a sustainable energy production. This energy is produced by converting gravitational potential or kinetic energy.



# WHAT IS AN HYDROELECTRIC PLANT?

An hydroelectric plant uses hydroelectricity to produce energy, they are a great alternative to fossil fuel plant that produce a lot of greenhouse gases.

The 3 Gorges Dam in China is the biggest hydroelectric plant, it contains 39,3 km<sup>3</sup> of water that produces 22500 megawatts (MW).



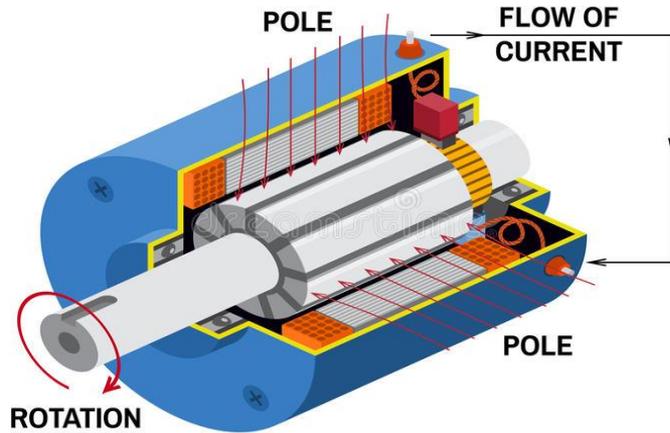
# HOW DOES THE HYDROELECTRIC STATION WORK?

The operating principle of a hydroelectric plant exploits the movement of large masses of water through the jump that is generated by a difference in height: a certain quantity is withdrawn at a certain altitude to be returned, without any chemical-physical alteration, to a lower .



The potential energy of the water is thus transformed into kinetic energy which, in making its jump, sets the turbine connected to a current generator, also called alternator, in rotational motion, which in turn produces electricity.

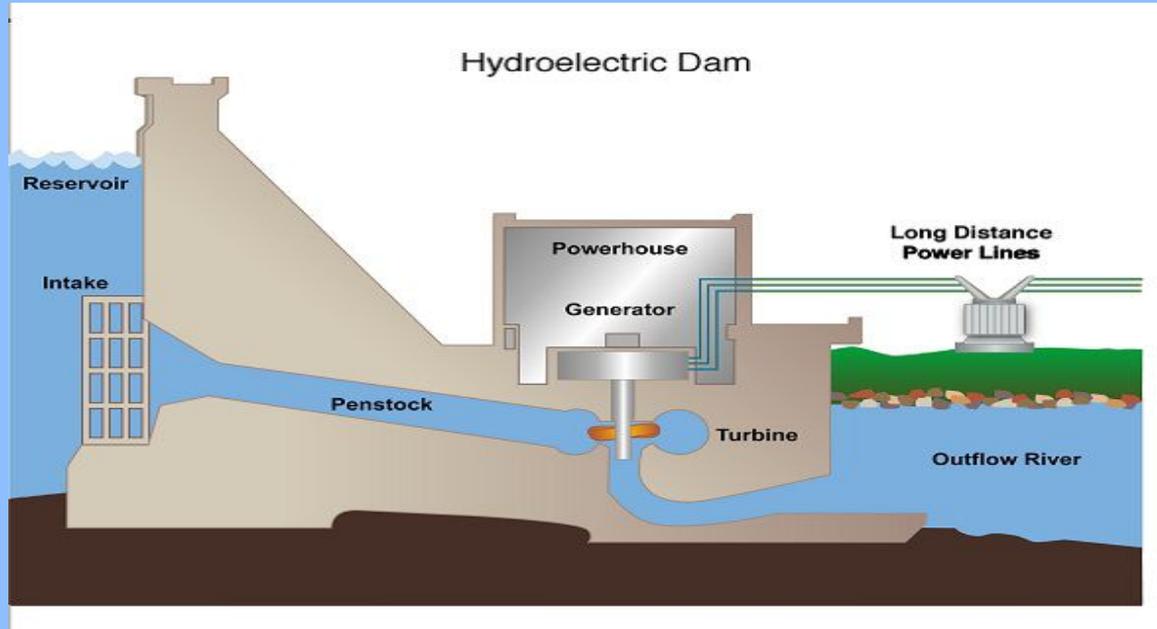
## ELECTROMAGNETIC INDUCTION



This happens in two steps: first through a distributor and then through an impeller. If both are adjustable, the turbine is called bi-regulating, while if only one part is regulating and the other is fixed, it is defined as single-regulating or propeller.

# HYDROELECTRIC ENERGY

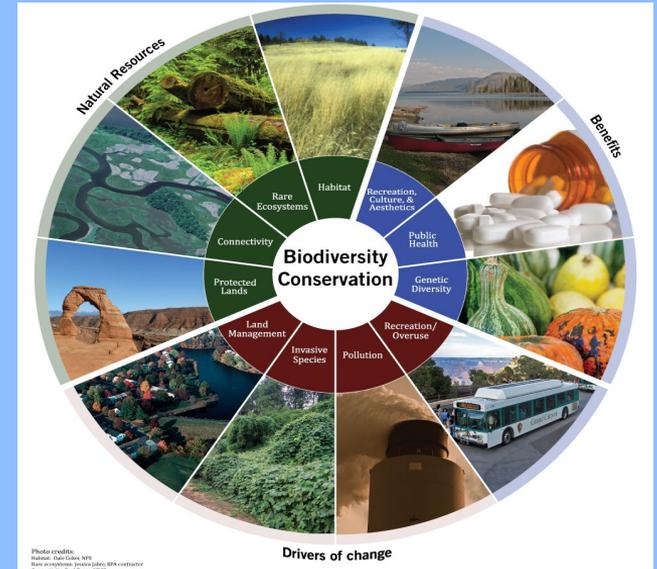
The fundamental parts of a hydroelectric power plant are the dam, for the creation of the necessary head, the turbine, for the transformation of kinetic energy into mechanics, and the alternator, for the transformation of mechanical energy into electrical energy.



A hydroelectric plant consists of the following components:

-water intake, filtering and conveyance works. The intake works are used to capture the river water which is subsequently filtered and finally conveyed to the turbines with pipes.

-ancillary works for the protection of biodiversity and the environment, are interventions to reduce the environmental impact.



-central for the transformation of water energy into electrical energy, here we find the alternator that transform the mechanical energy of rotation into continuous electrical energy.

-drainage works, consist of channels through which water can return to its watercourse.

-transformation and transport of the electricity produced, used to vary the output voltage from the alternator up to that of the electricity line.





# HYDROELECTRIC

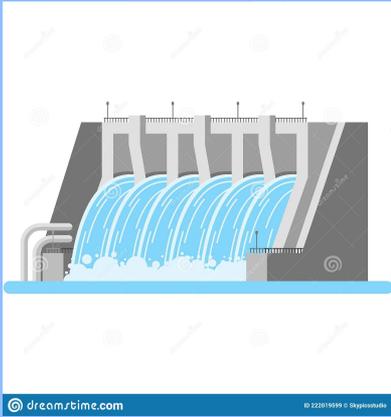


- Hydroelectric energy is now considered a form of clean and renewable energy as it is not responsible for harmful emissions into the atmosphere and is not subject to exhaustion, which is why it is one of the most advantageous energy sources.
  - However, although its environmental impact is quite small, hydroelectric power plants can also generate countless disadvantages for the environment as well as a hydrogeological risk of built-up areas.
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# Main advantages

- Hydroelectric energy is one of the main forms of renewable energy capable of replacing the exploitation of fossil fuels and significantly reducing air pollution.
- **Reclamation of marshy areas** (Hydroelectric power plants make it possible to protect swampy areas and remove the danger of flooding thanks to the containment of waterways by means of dams.)
- **Cleaning and cooling of rivers** (The rake of the hydroelectric power plant ensures adequate cleaning and navigability of the waterways by retaining branches and trees.)





## Main advantages



- **Irrigation** (Thanks to hydroelectric plants, it is possible to have water reserves even in periods of drought, ensuring a continuous source of electricity.)
- **Cost containment** (The production of energy through hydroelectric plants has rather low costs, dictated by particularly advantageous and economical maintenance and operating costs, especially when compared to those of nuclear or coal plants.)

If, on the one hand, the initial investment for the construction of a hydroelectric plant may apparently be high, hydroelectric power plants ensure a continuous availability of raw material over time for free and allow it to be supplied very quickly.

# What are the disadvantages

- **Environmental changes** (The total dependence on atmospheric agents makes the operation of hydroelectric plants rather sensitive to climate changes and to changes in meteorological conditions, exposing them to high risks in a period of prolonged drought.)
- The construction of dams and penstocks, in addition to causing disfigurement of the environment, also triggers possible environmental changes that have a particular impact on flora and fauna.
- Especially near rivers, the construction of the plants generates the disappearance of some species of fish, in particular salmon, which are unable to deposit their eggs during migration.





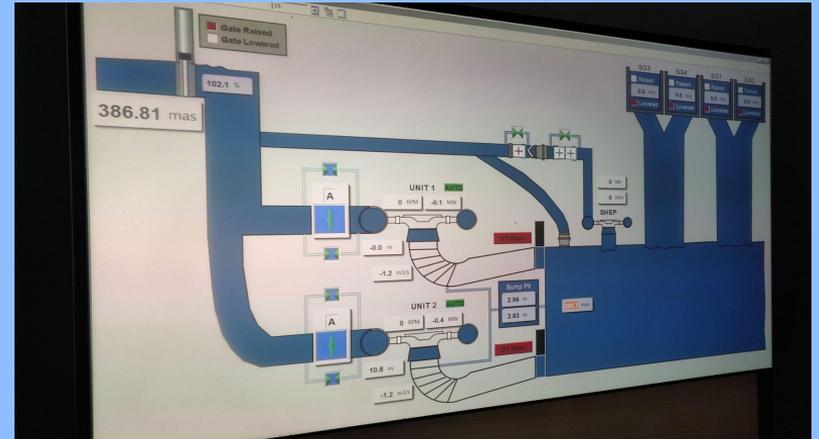
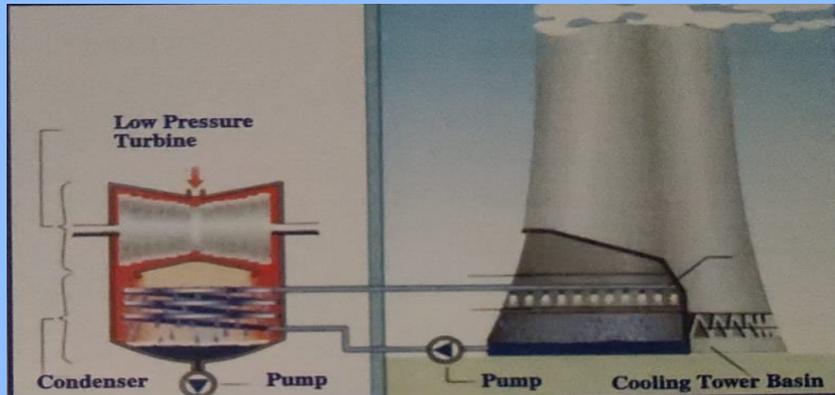
## What are the disadvantages



- The noise of the system also generates the transfer of local inhabitants and native species, which tend to move away, contributing to the alteration of ecosystems and the landscape.
  - **Presence of chemicals** (In addition to representing a danger to natural habitats, hydroelectric plants can also damage those of river beds due to the low levels of oxygen dissolved in the water.)
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# Water Supplying System

We are in Greece and the Power Plant's feeding with raw water is ensured from Polvfytos lake via three pump rooms with a total capacity of 8,500 m<sup>3</sup>/h which are installed in series serving the Power Plants of KOZANI-PTOLEMAIDA basin. The industrial water is used to replace the losses of the cooling water systems of thermal cycle and for the needs of the Power Plant's fire fighting system. The maximum quantity of industrial water consumption is about 4.200 m<sup>3</sup>/h.



The largest quantity of this water is used for replacing the losses of the cooling water systems after being partially softened by removing its transient hardness with the use of hydrated lime. The softening of the cooling water is necessary in order to avoid the formation of scale layers inside the cooling water system piping. A quantity of softened water feeds the system of desalination which operates with the use of ion exchanging resins for the production of disalinated water which is required by the thermal cycle of the Power Plant's Units.





THANK YOU