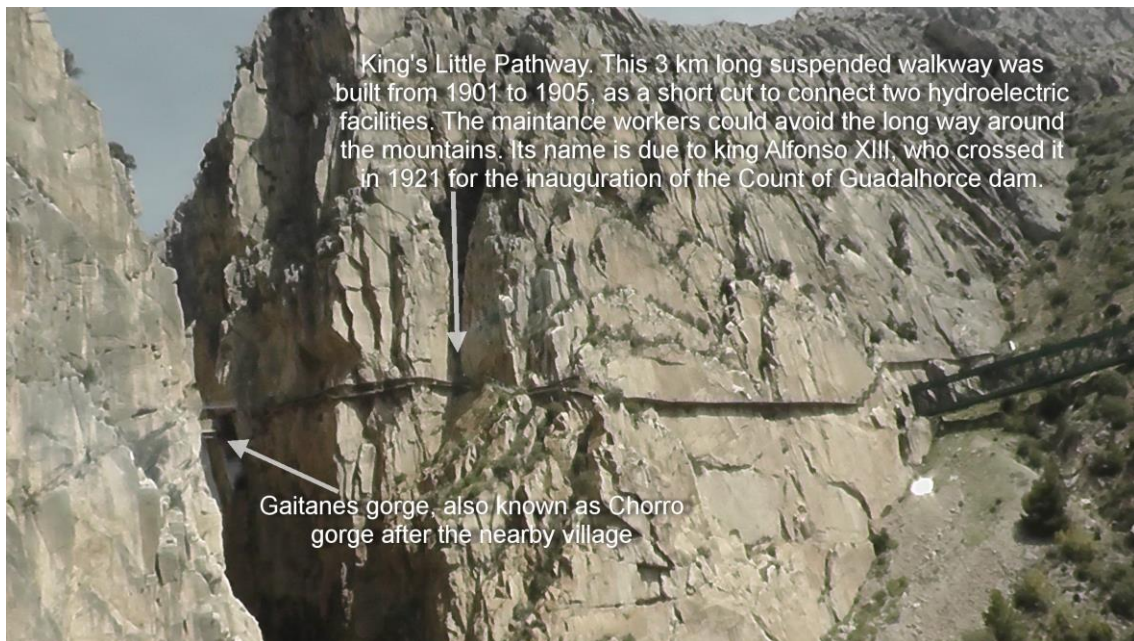


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“Tajo de la Encantada” Hydroelectric Power Station

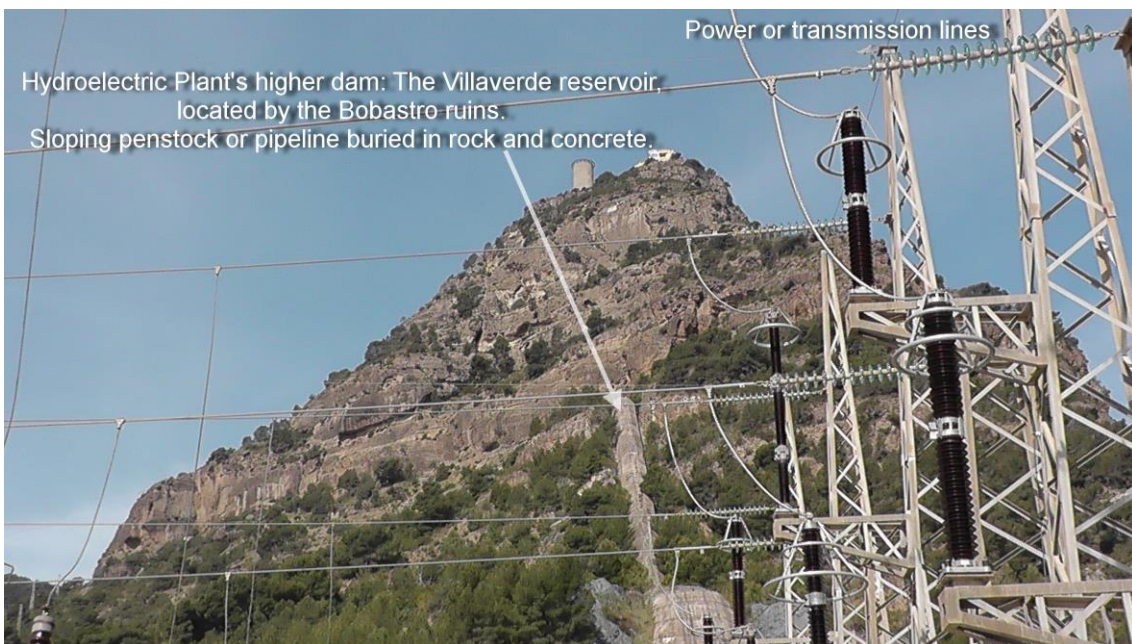
The “Tajo de la Encantada” or “Chorro” Hydroelectric Power Station is a pure pumped storage plant, which transfers from the lower reservoir, which has a capacity of 3,3 cubic hectometres, to the higher reservoir having 3 hm³ (3 thousand million litres). The water fall or difference in height is of approximately 400 metres. The turbines operate both in pump and turbine modes. The power station is equipped with four reversible pump-turbine/motor-generator assemblies. Each turbine generates a power output of 90 MW in generator operating mode, and a power input of 100 MW in pump operating mode.





Hydroelectric Plant's lower dam: The Enchanted's Ravine reservoir.

The plant is also used to provide water for consumption or irrigation, from the dam of its reservoir, to Malaga city and the town and villages of the Guadalhorce valley.



Power or transmission lines

Hydroelectric Plant's higher dam: The Villaverde reservoir, located by the Bobastro ruins. Sloping penstock or pipeline buried in rock and concrete.

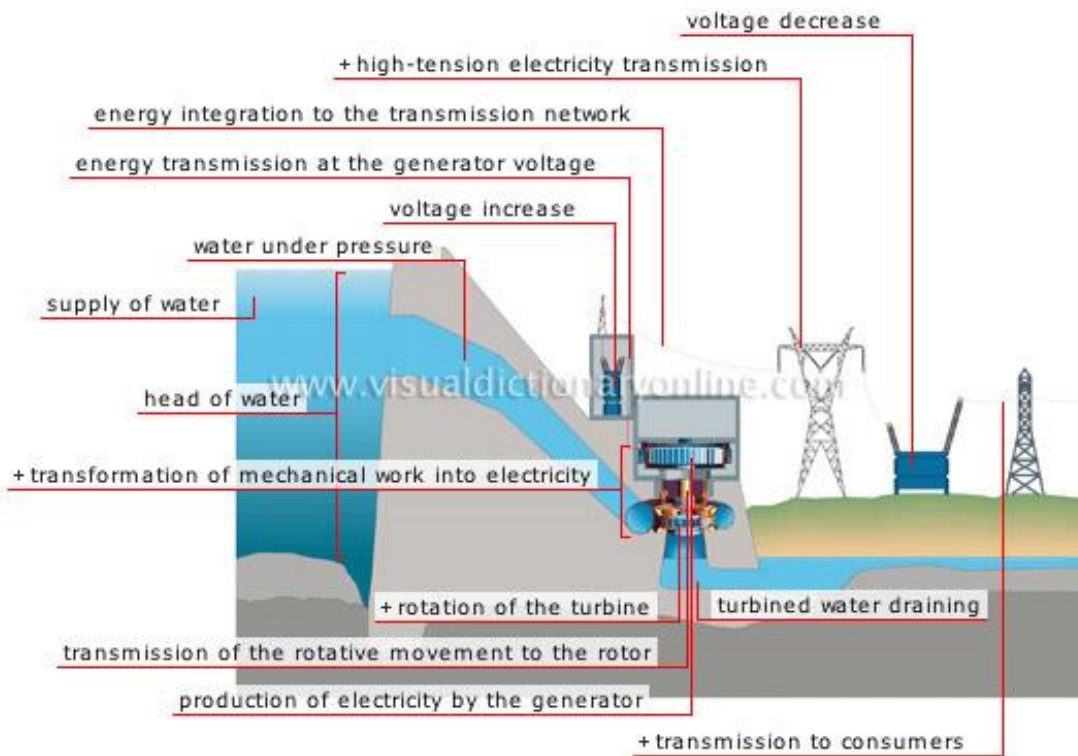


The Bobastro ruins is of Roman origin. The first transformation in the Bobastro castle took place in 880 by Omar, an Islamised Goth who took refuge in the Roman ruins when he came back from his exile in Africa after revolting against the Moors.

The Bobastro ruins are one of the most unusual archaeological sites in Spain. Most of the site remains relatively untouched and undiscovered. What is visible today are 3 large structures: the ruins of the Alcazar, a Muslim necropolis and, most importantly, a Mozarabic (relating to the Christian inhabitants of Spain under the Muslim Moorish kings) church, the only one of its kind in the world.



The output voltage or electric tension is 220 kilovolts (1 kilovolt=1000 volts) which is directly transferred to the “Tajo de la Encantada” substation, owned by Red Eléctrica Española (Spanish Electrical Network). Voltage is the electromotive force/work or electrical potential difference between two points in a circuit, which pushes or moves the electrons creating a current. There are two types of voltage: DC, direct current voltage always having the same polarity, positive or negative such as in a battery; and AC, alternating-current voltage, alternating between positive or negative, such as in a wall socket. (The DC is typically used for electronics and the AC for motors.)

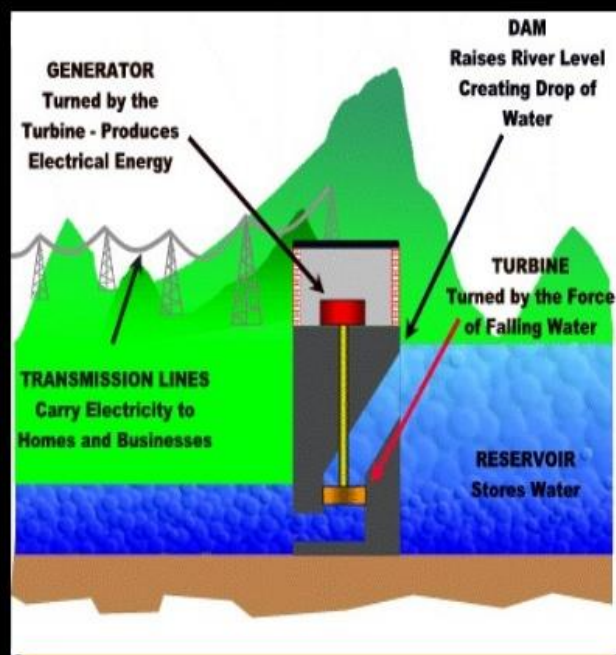


Inside Hydro Power Plant

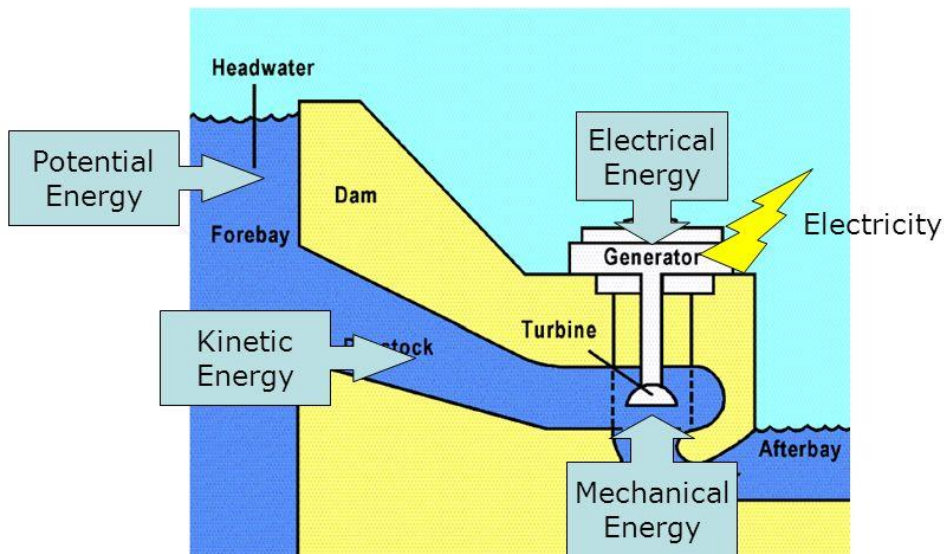
1. DAM
2. Intake
3. Turbine
4. Generators
5. Transformer
6. Power Lines
7. Outflow
8. Pumped Storage

- Upper Reservoir
- Lower Reservoir

Reversible Turbine

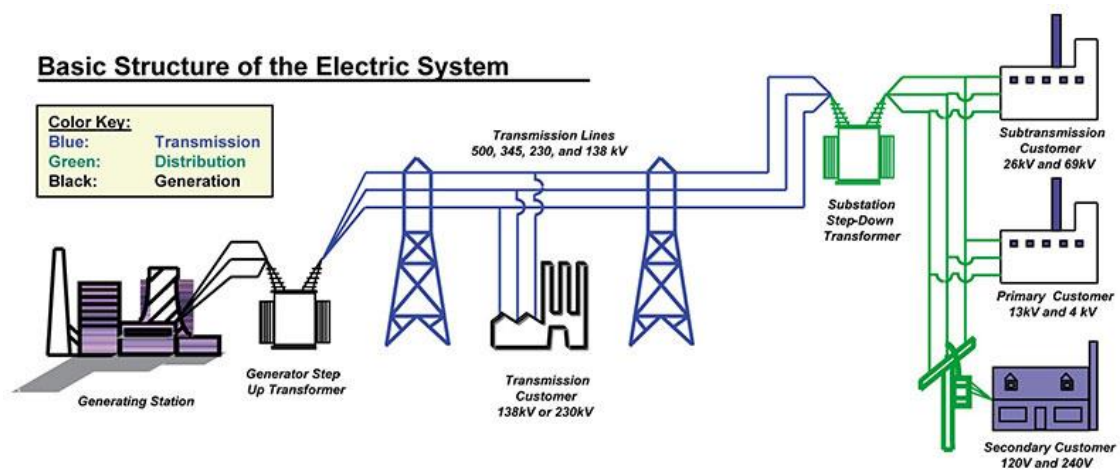


Hydropower to Electric Power

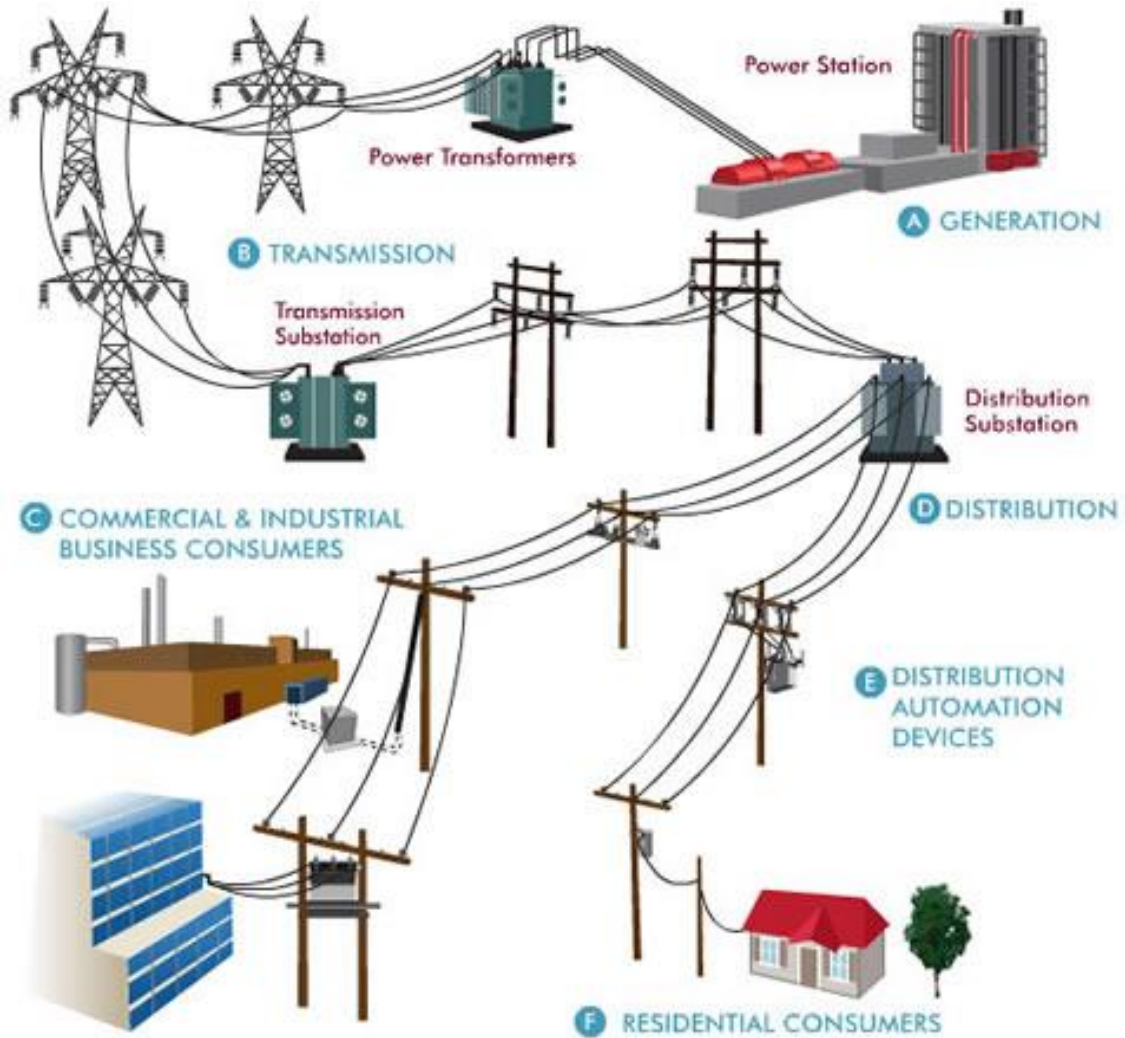


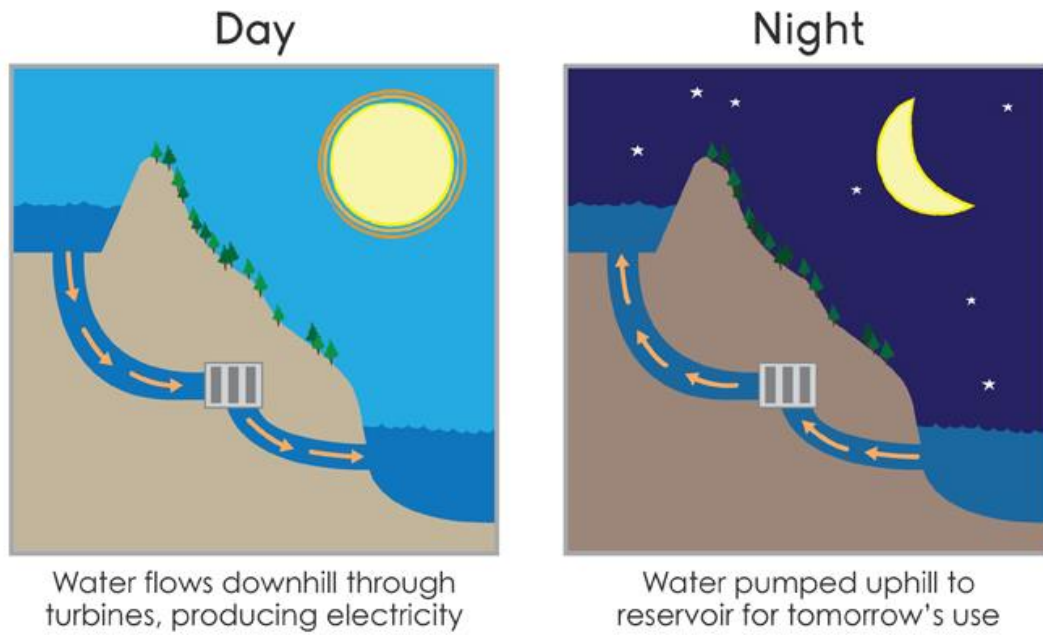
The power station generates an annual energy power of between 250 and 300 GWh. (Gigawatt hour. Electrical potential or potential energy is the result of multiplying the electrical potential difference between the two ends of a charge by the current circulating through it), although it may vary according to meteorological, economic or strategic conditions.

Being a hydro accumulation power plant, one of its functions is to stabilise fluctuations in the grid, due mainly to the instability in the condition of the wind turbines. The wind power transfer into the grid is intermittent and unstable.



This hydroelectric power plant has been designated as strategic, because it can autonomously provide a black start and feed power into the grid within 5 minutes, in the case of blackouts in the Spanish electric system.





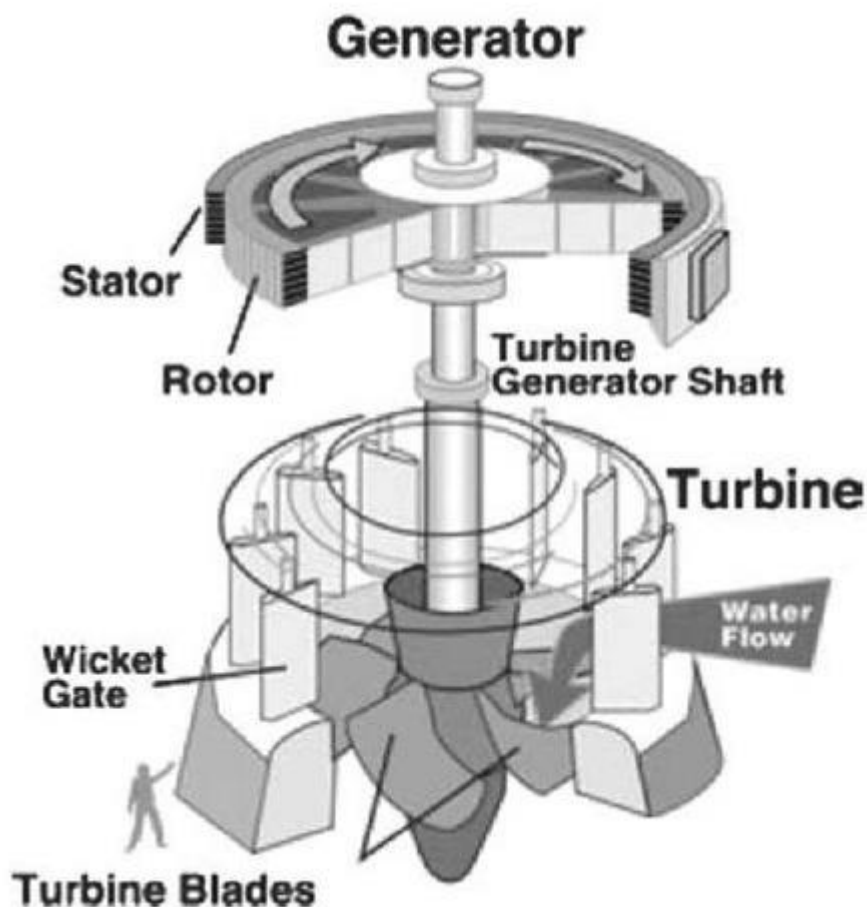
According to electricity demand, the control centre of the Spanish Electricity Network can remotely start up the different assemblies, either to generate power in the turbine mode during the day, when electricity prices and demand are highest; or to pump water in the pumping mode to the higher reservoir at night, when electricity prices and demand are lowest.





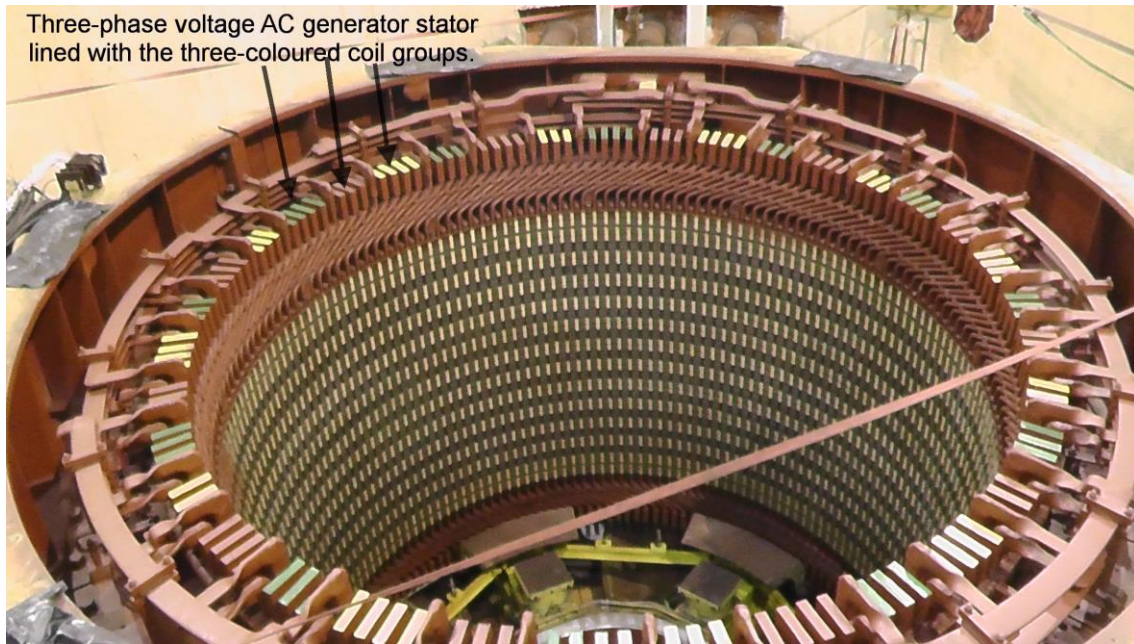


This is a safety guard or spherical valve through which the water enters into each turbine. It is used as gate and emergency mechanism, situated either in the turbine inlet or where the water is taken in. It is a control device of fluid pipe and its basic function is to connect or cut off the water circulation inside the pipeline, to change the circulation and flow direction of medium, and to adjust the pressure and flow of medium.



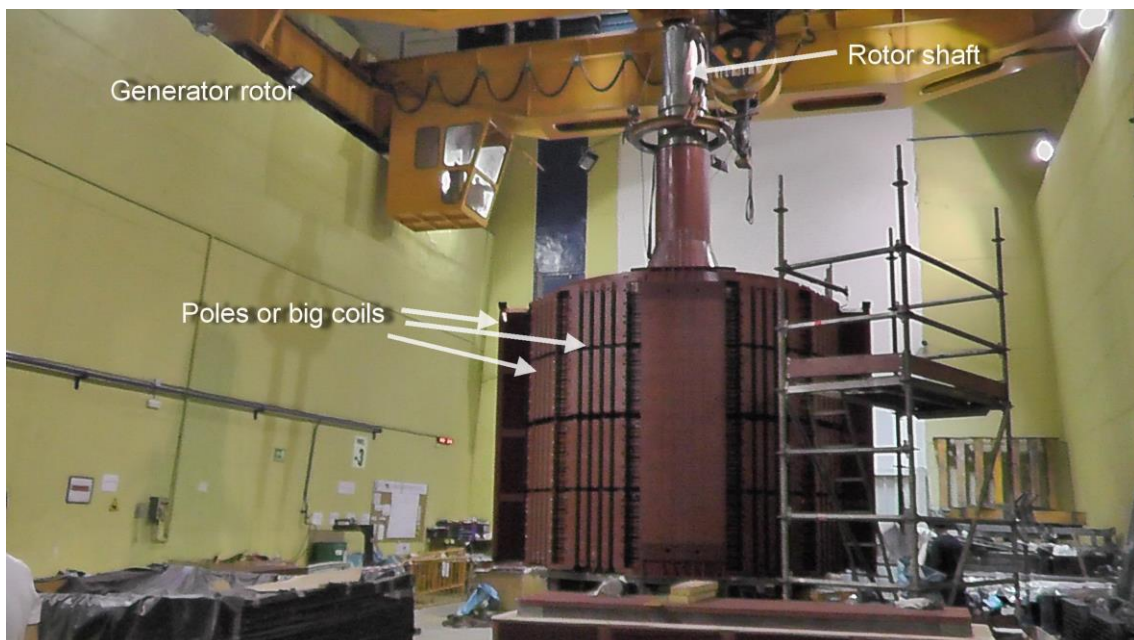
An electric generator is a device that converts mechanical energy obtained from an external source into electrical energy as the output. A generator does not actually 'create' electrical energy. Instead, it uses the mechanical energy supplied to it to force the movement of electric charges present in the wire of its windings through an external electric circuit. This flow of electric charges constitutes the output electric current supplied by the generator.

The modern-day generators work on the principle of electromagnetic induction discovered by Michael Faraday in 1831-32. Faraday discovered that the above flow of electric charges could be induced by moving an electrical conductor, such as a wire that contains electric charges, in a magnetic field. This movement creates a voltage difference between the two ends of the wire or electrical conductor, which in turn causes the electric charges to flow, thus generating electric current.



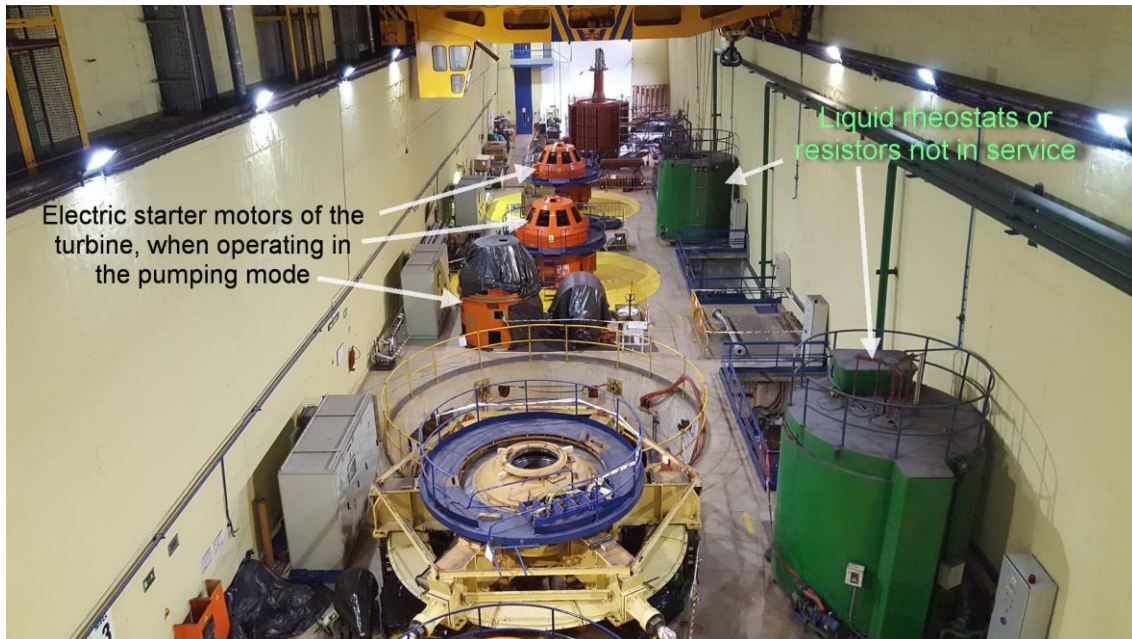
This photo shows the alternator stator, the fixed part. Both the rotor and stator make up the turbine alternator.

The coloured pieces identify which phase each coil group that makes up the alternator stator belongs to.



This photo shows the alternator rotor, which is the movable part, and is the element which was being substituted at the time.

The generator rotor has got 12 poles around it, which are big coils, and turns at 500 rpm.



The orange equipment is the electric starter motor of the turbine when operating in the pumping mode.

The green equipment is the liquid rheostat or resistor, which is not in service.

The whole turbine structure takes up several floors of the power plant.

There is another piece of equipment called **excitation equipment**, with which a direct current is created, which causes the rotor turning the poles into electromagnets. Through this, the current is induced in the stator, producing electricity.



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