Report on Industrial Visit

To

SATHANUR HYDRO POWER PLANT, SATHANUR (15/09/2017)

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ACKNOWLEDGEMENT:

On behalf of the entire Electrical and Electronics branch, we take this opportunity to offer our sincere thanks to Sathanur hydro Power Plant for allowing us to visit the hydro Power Plant & guiding us at every step. We would also like to thank Dr. A. Devaraju, Principal of ACET & Mr. K. B. Bhasker, HOD of EEE Department of ACET.

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INTRODUCTION TO THE COMPANY:

Sathanur Hydroelectric Power Plant India is located at Sathanur, Near Thiruvannamalai, Tamil Nadu, India. Location coordinates are: Latitude= 12.1833, Longitude= 78.8505. This infrastructure is of TYPE Hydro Power Plant with a design capacity of 7.5 MW. It has 1 unit(s). The first unit was commissioned in 1999. It is operated by Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO).

INTRODUCTION TO SATHANUR HYDRO POWER PLANT:

Sathanur Dam is formed by **Sathanur reservoir**, one of the major dams in Tamil Nadu. It is constructed across the Thenpennai River also called as Pennaiyar River in Thandarampet taluk among Chennakesava Hills. The dam can be reached by road 30 km from Thiruvannamalai City. It was constructed in 1958. There is also a large crocodile farm and a fish grotto. Parks are maintained inside the dam for tourists to visit and the gardens have been used by the film industry.

MAJOR MILESTONES & ACHIEVEMENTS:

- The land development commenced in the year 1994.
- The power station commercially commenced its operation in 1999.
- The Sathanur Dam Project was started in the year 1953.
- Dam works are operational from 1958.

OVERVIEW OF THE PLANT:

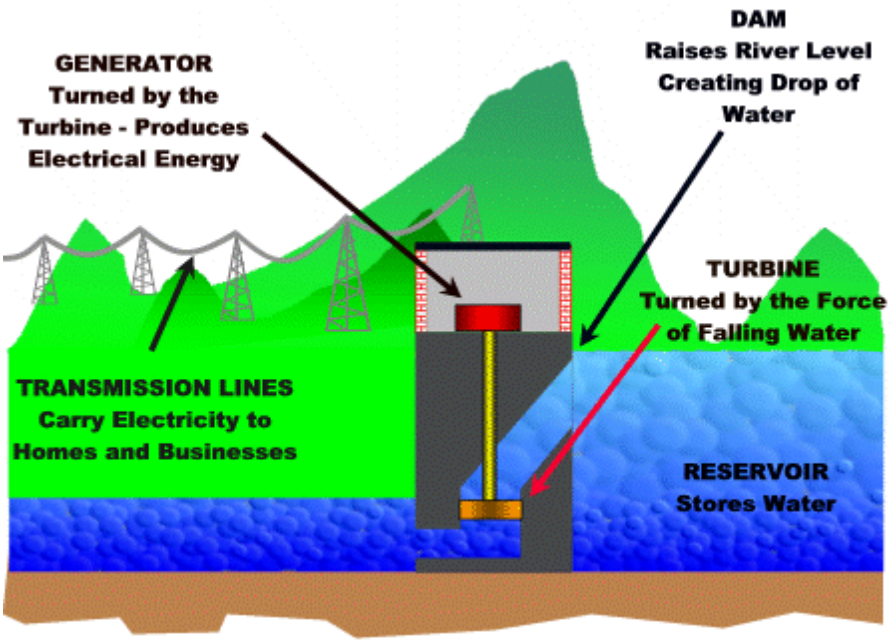
Hydropower plants capture the energy of falling water to generate electricity. A turbine converts the kinetic energy of falling water into mechanical energy. Then a generator converts the mechanical energy from the turbine into electrical energy.

Hydroplanes range in size from "micro-hydro" that power only a few homes to giant dams like Hoover Dam that provide electricity for millions of people.

Parts of a Hydroelectric Plant

Most conventional hydroelectric plants include four major components (see graphic below):

1. **Dam.** Raises the water level of the river to create falling water. Also controls the flow of water. The reservoir that is formed is, in effect, stored energy.
2. **Turbine.** The force of falling water pushing against the turbine's blades causes the turbine to spin. A water turbine is much like a windmill, except the energy is provided by falling water instead of wind. The turbine converts the kinetic energy of falling water into mechanical energy.
3. **Generator.** Connected to the turbine by shafts and possibly gears so when the turbine spins it causes the generator to spin also. Converts the mechanical energy from the turbine into electric energy. Generators in hydropower plants work just like the generators in other types of power plants.
4. **Transmission lines**. Conduct electricity from the hydropower plant to homes and business.



PLANT FEATURES:

- PlantCapacity : 1230MW
- Land for Plant : 17,750 acres
- Type of plant : Vertical kaplan
- Length of penstock : 40m
- Penstock(internal diameter) : 2.60m
- Height of dam : 36.28m

MAJOR COMPONENTS SPECIFICATIONS:

1. TURBINE:

The Kaplan turbine is an inward flow reaction turbine, which means that the working fluid changes pressure as it moves through the turbine and gives up its energy. Power is recovered from both the hydrostatic head and from the kinetic energy of the flowing water. The design combines features of radial and axial turbines.

The inlet is a scroll-shaped tube that wraps around the turbine's wicket gate. Water is directed tangentially through the wicket gate and spirals on to a propeller shaped runner, causing it to spin.

The outlet is a specially shaped draft tube that helps decelerate the water and recover kinetic energy.

The turbine does not need to be at the lowest point of water flow as long as the draft tube remains full of water. A higher turbine location, however, increases the suction that is imparted on the turbine blades by the draft tube. The resulting pressure drop may lead to cavitation.

Variable geometry of the wicket gate and turbine blades allow efficient operation for a range of flow conditions. Kaplan turbine efficiencies are typically over 90%, but may be lower in very low head applications.[3]

Current areas of research include CFD driven efficiency improvements and new designs that raise survival rates of fish passing through.

Because the propeller blades are rotated on high-pressure hydraulic oil bearings, a critical element of Kaplan design is to maintain a positive seal to prevent emission of oil into the waterway. Discharge of oil into rivers is not desirable because of the waste of resources and resulting ecological damage.

1. **GENERATOR:**

In electricity generation, a **generator** is a device that converts motive power into electrical power for use in an external circuit. Sources of mechanical energy include steam turbines, gas turbines, water turbines, internal combustion engines and even hand cranks.

Generator is a machine that converts mechanical energy into electrical energy. It works based on principle of faraday law of electromagnetic induction. The faradays law states that whenever a conductor is placed in a varying magnetic field, EMF is induced and this induced EMF is equal to the rate of change of flux linkages. This EMF can be generated when there is either relative space or relative time variation between the conductor and magnetic field. So the important elements of a generator are:

- Magnetic field
- Motion of conductor in magnetic field

Generators are basically coils of electric conductors, normally copper wire, that are tightly wound onto a metal core and are mounted to turn around inside an exhibit of large magnets. An electric conductor moves through a magnetic field, the magnetism will interface with the electrons in the conductor to induce a flow of electrical current inside it. The conductor coil and its core are called the armature, connecting the armature to the shaft of a mechanical power source, for example an motor, the copper conductor can turn at exceptionally increased speed over the magnetic field. The point when the generator armature first starts to turn, then there is a weak magnetic field in the iron pole shoes. As the armature turns, it starts to raise voltage. Some of this voltage is making on the field windings through the generator regulator. This impressed voltage builds up stronger winding current, raises the strength of the magnetic field. The expanded field produces more voltage in the armature. This, in turn, make more current in the field windings, with a resultant higher armature voltage. At this time the signs of the shoes depended on the direction of flow of current in the field winding. The opposite signs will give current to flow in wrong direction.

The generators are classified into types.

- AC generators
- DC generators

The specification of generator in the plant:

Type	: HV732530/18
Design	: IP 31
Capacity	: 7500kw /8333kVA
Speed	: 333.33rpm
Voltage/Current	: 11000V/437A
Excitation voltage	: 64-132V/152-269A

2. **TRANSFORMER:**

A **transformer** is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. A varying current in one coil of the transformer produces a varying magnetic field, which in turn induces a voltagein a second coil. Power can be transferred between the two coils through the magnetic field, without a metallic connection between the two circuits. Faraday's law of induction discovered in 1831 described this effect. Transformers are used to increase or decrease the alternating voltages in electric power applications. Since the invention of the first constant-potential transformer in 1885, transformers have become essential for the transmission, distribution, and utilization of alternating current electrical energy.[3] A wide range of transformer designs is encountered in electronic and electric power applications. Transformers range in size from RF transformers less than a cubic centimeter in volume to units interconnecting the power grid weighing hundreds of ton

The specification of the transformer in power plant:

Type	: step down
Capacity	: 8/10 MVA
Voltage	: 33/11 kV
Cooling	: ONAN / ONAF

The purpose excitation of generator the excitation transformer is used. It is a special type of transformer. It is resin based core type transformer and it not any breather and conservator.

3. **CIRCUIT BRAKEER:**

A **circuit breaker** is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by excess current, typically resulting from an overload or short circuit. Its basic function is to interrupt current flow after a fault is detected. Unlike a fuse, which operates once and then must be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation. Circuit breakers are made in varying sizes, from small devices that protect low-current circuits or individual household appliance, up to large switchgear designed to protect high voltage circuits feeding an entire city. The generic function of a circuit breaker, RCD or a fuse, as an automatic means of removing power from a faulty system is often abbreviated as ADS (Automatic Disconnection of Supply).

Types:

According to their arc quenching media the circuit breaker can be divided as-

1. Oil circuit breaker.
2. Air circuit breaker.
3. SF_6 circuit breaker.
4. Vacuum circuit breaker.

According to their services the circuit breaker can be divided as-

1. Outdoor circuit breaker
2. Indoor breaker.

According to the operating mechanism of circuit breaker they can be divided as-

1. Spring operated circuit breaker.
2. Pneumatic circuit breaker.
3. Hydraulic circuit breaker.

According to the voltage level of installation types of circuit breaker are referred as-

1. High voltage circuit breaker.
2. Medium voltage circuit breaker.
3. Low voltage circuit breaker.

CONCLUSION:

The Industrial Visit to the Sathanur Hydro Power Plant, Sathanur was highly successful. We received insight of the whole plant right from the raw material (water) procurement, processing, generation & transmission of electricity. The whole process was explained in-detail by their representative with detailed description about each equipment with their specifications. A doubt solving session with the Control Room Incharge cleared all our queries. This kind of industrial exposure helped us to absorb the theoretical aspects of Power Plant and Power Electronics Engineering more efficiently.

PHOTO GALLERY