

MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute, Affiliated To R.G.P.V. Bhopal)



Electrical Engineering Department

Educational Visit to Guna Substation (10-September-2022)

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INFORMATION

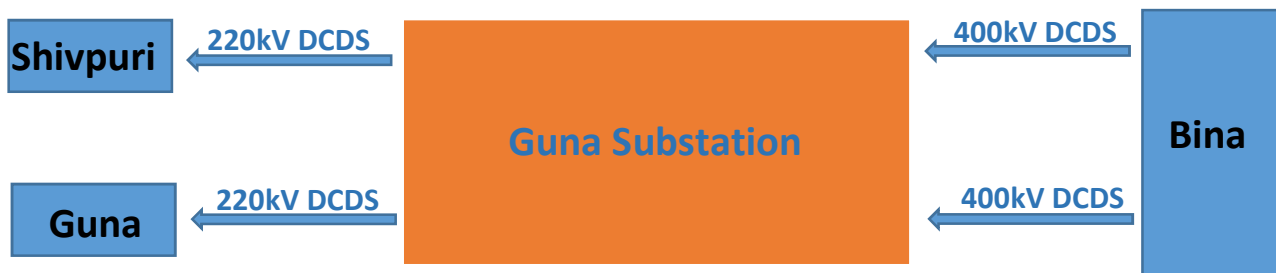
Guna Substation is a 400kV substation located in Guna, M. P. India.

The Guna Substation project's construction has begun in 2020. The works are commissioned recently in 2022. Guna Substation project, which is a new substation, will be operated by **Power Grid Corporation of India**.

The designed voltage level of the substation is **400/220kV** and the operating voltage level is 400/220kV. The step-in voltage of the project is 400kV and the step-out voltage is 220kV.

Here 400kV Double-Circuit, Double Stringing (DCDS Quad Moose) transmission lines are supplied by **Bina (MPPTCL)** to Guna with 2 x 80 MVAR Switchable line reactor at Guna end.

After stepping down the voltages, 220kV DCDS lines are delivered to Guna (MPPTCL) with Zebra Conductor & Shivpuri (MPPTCL) with Zebra Conductor each.



PURPOSE OF VISIT

❖ Industrial visits are important for the following reasons:

- ✓ To gain a practical knowledge of the actual working of the transmission system.
- ✓ To get the practical knowledge of the equipments used in system like Transformers, Reactors, Circuit Breakers, etc.
- ✓ To study co-ordination between different power generation stations.
- ✓ To know about the Controlling system to protect Faults.

The main purpose for this is visit to be familiar with industrial environment and to get practical knowledge of electrical power transmission and distribution.

Students of 5th semester Electrical Engineering have get the idea of electrical power transmission and distribution.

Students also get familiar with Transformer maintenance, Circuit breaker, Transformer Isolator, Bus Bar, Protective relays, Lightning Arresters, Towers Load break switches, Line Reactors & Filters used in Substation.

WHAT WE LEARNT?

Substaion:

A **substation** is a part of an electrical generation, transmission, and distribution system. Substations transform voltage from high to low, or the reverse, or perform any of several other important functions. A substation include transformers to change voltage levels between high transmission voltages and lower distribution voltages, or at the interconnection of two different transmission voltages.

Guna Substation is a transmission substations. This switching station have 2 bus and some circuit breakers. This substation covers a large area (several acres/hectares) with multiple voltage levels, many circuit breakers, and a large amount of protection and control equipment (voltage and current transformers, relays and SCADA systems).

Elements of the Substation:

As the 3-phase line conductors comes to substation from the generating station, then following equipments are connected for their operations as below:

1. **Lightning Arrester:** Lightening arrestors are the instruments that are used in the incoming feeders so that to prevent the high voltage entering the main station. This high voltage is very dangerous to the instruments used in the substation. Even the instruments are very costly, so to prevent any damage lightening arrestors are used. The lightening arrestors do not let the lightening to fall on the station. If some lightening occurs the arrestors pull the lightening and ground it to the earth.
2. **Capacitor Voltage Transformer (CVT):** A capacitor voltage transformer (CVT) is a transformer used in power systems to step-down extra high voltage signals and provide low voltage signals either for measurement or to operate a protective relay. These are high pass Filters (carrier frequency 50 KHz to 500 KHz) pass carrier frequency to carrier panels and power frequency parameters to switch yard. In its most basic form the device consists of three parts: two capacitors across which the voltage signal is split, an inductive element used to tune the device and a transformer used to isolate and further step-down the voltage.
3. **Current Transformer:** Current transformer is a current measuring device used to measure the currents in high voltage lines directly by stepping down the currents to measurable values by means of electromagnetic circuit.

4. Step-down Transformer: Power Transformers are the heart of substation. They step down the voltage from H.V.(400kV) to L.V.(220kV). Then this power is supplies to consumers as per requirements.

5. Shunt Reactors: A reactor, also known as a line reactor, is a coil wired in series between two points in a power system to minimize inrush current, voltage notching effects, and voltage spikes. Shunt reactors and series reactors are used widely in AC networks to limit overvoltage or shortcut current in power transmission. With a growing number of high-voltage overhead lines in a fast-changing energy environment, both shunt and series reactors play a key role in stabilizing network systems and increasing grid efficiency. They are available as series reactors, variable and fixed shunt reactors with a rated power 80MVAR.

6. Grounding/Earthing (Grid grounding): The primary purpose of a grounding grid is to equalize the potential gradients above the grid, protecting people and equipment. Under ground-fault conditions, the portion of the fault current flowing from the earth to the grid or vice versa triggers a rise of the ground potential above the grid-with respect to remote earth. This event is the ground potential rise. Numerically, the ground potential rise is equal to the product of the grid resistance times the maximum grid current. If the people inside and around the substation can tolerate the ground potential rise, the grounding grid is safe.

A plate made up of galvanized copper or iron is buried vertically at a depth of not less than 3m from ground level. The plate here connects all the conductors to the earth.

SCADA (supervisory control and data acquisition) is a category of software applications for controlling industrial processes, which is the gathering of data in real time from remote locations in order to control equipment and conditions. SCADA provides organizations with the tools needed to make and deploy data-driven decisions regarding their industrial processes.

CONCLUSION

The experience of this tour was really fantastic and unforgettable. It was a reverberating experience which we all cherished.

Students got valuable information from this Substation visit and our Alumni Engineer guided us on how to stand in the corporate world in the era of competition & described to us about the complete working of that transmission system.

We got to learn a lot many more things from this tour.

Thank You