

The Pothencode Substation is a major 220 kV grid substation under KSEB Limited, playing a vital role in receiving bulk power and distributing it reliably to the Thiruvananthapuram region. The substation is designed with a robust busbar system, including a bus coupler, which interconnects two bus sections and enhances operational flexibility by allowing load transfer during maintenance or fault conditions without interrupting supply. Adapter panels are provided in the control and relay panels to facilitate proper interfacing of protection, metering, and control circuits.

From the 220 kV bus, power is transmitted outward through several 220 kV transmission lines connecting Pothencode to important substations such as Attingal, Kazhakuttam, New Kattakkada, Paruthippara, and Technocity, along with other grid points in the regional network. These outgoing lines strengthen grid interconnection and improve power flow flexibility in the Thiruvananthapuram region. The EHV lines are supported using insulator string units, which provide the required electrical insulation and mechanical strength under high voltage and environmental stresses.

At downstream levels, particularly in urban and distribution interfaces, RMUs (Ring Main Units) are used to ensure compact, safe, and reliable 11 kV distribution with minimum outage duration. Voltage regulation at the transformer level is achieved through OLTC (On Load Tap Changer), which automatically adjusts transformer tap positions to maintain steady secondary voltage under varying load conditions.

The power transformers and autotransformers (ATR – Auto Transformer) are protected using multiple protection schemes. Buchholz relay and MARIAN Buchholz relay (oil and gas-operated

protection devices) are provided to detect internal faults such as winding insulation failure or oil decomposition. Transformer breathers are fitted with silica gel (blue), which absorbs moisture from incoming air and changes colour to indicate saturation, ensuring the insulating oil remains dry. Cooling is managed through auto fan operation, where transformer cooling fans start automatically up to 65 °C and additional stages operate above this temperature to prevent overheating.

For reactive power compensation and voltage profile improvement, capacitor banks are installed at appropriate voltage levels to reduce reactive power flow and improve system power factor. The transmission lines connected to the substation use insulator string units, which provide mechanical support and electrical insulation for EHV conductors under high tension and environmental stress.

In auxiliary and modern grid-support systems, power electronic equipment such as inverters using IGBT (Insulated Gate Bipolar Transistor) technology are employed, especially in battery energy storage systems, control power supplies, and renewable energy integration interfaces. These IGBT-based inverters offer fast switching, high efficiency, and precise control, supporting stable and reliable substation operation.

From a planning and development perspective, Pothencode is identified as a 220 kV substation with provision for future expansion. Government and state energy planning documents indicate availability of space for additional grid infrastructure, including potential installation of Battery Energy Storage Systems (BESS).