The purpose of the **Distribution** system is to deliver power to the customers after the voltage has been stepped-down to a “distribution” voltage. As the power gets closer to the customers, it is generally more economical to move the power at these lower voltages.
Distribution

Typical Primary distribution voltages include:

- 19.9 kV
- 12.7 kV
- 7.6 kV
- 7.2 kV
- 2.4 kV

Note: Phase to Ground voltages
Distribution

Before the power gets to the customer, a transformer may lower the “primary” voltage to a “secondary” voltage of 120/240 volts.

Primary: 19,900 volts

Secondary: 120/240 volt service
Distribution

The distribution circuits may be **overhead** or **underground**. This will depend on the load density and the physical conditions of the particular area to be served.
**Distribution**

Typical distribution equipment are listed below:

- Capacitors
- Fuses
- Circuit Reclosers
- Regulators
- Poles
- Switches & sectionalizers
- Transformers - Overhead
- Underground Equipment
A *riser* or *riser pole* is used to connect underground cables to an overhead primary line.
Padmount transformers perform the same function as overhead transformers. Padmounts step down the “primary” voltage to “secondary” voltage - usually 120/240 volts.
Distribution - Underground Equipment

Single Phase Pad Mounted Transformer

Primary Cable

Secondary Cable
Three phase underground distribution systems provide underground service to large customers.
Distribution - Underground Equipment

Outdoor metal clad switchgear provides a weather proof housing for circuit breakers, protective relays, meters, current transformers, potential transformers, bus conductors, and other items necessary to provide electric system requirements.
Sectionalizers

A sectionalizer is designed to isolate faults on circuits in conjunction with reclosers. A sectionalizer does not interrupt fault current. It waits until the recloser de-energizes the line. After a pre-determined number of operations by the recloser, the sectionalizer opens to isolate the section of faulty line. This allows the recloser to re-energize the line up to the open sectionalizer.
Voltage regulators are devices that maintain distribution voltage within a specified range of values. They are used by power companies to minimize voltage drop and to ensure that the proper voltage is supplied to customers.
Distribution Regulators/Autoboosters

Most **Voltage Regulators** are capable of raising or lowering the voltage by 10%.
Most Voltage Regulators have 16 taps or steps in the raise and lower position.

The position indicator shown here has 16 “steps” in the lower position, 16 steps in the raise position, and a Neutral position.

Each step can raise or lower the voltage by 5/8%. At Step 16-Raise, the voltage is raised by 10%. Likewise, in Step 16-Lower, the voltage is lowered by 10%.
Distribution Regulators/Autoboosters

If a voltage regulator needs to be **bypassed**, it is important to have the regulator in the **Neutral** position.
Autoboosters are very similar to voltage regulators. The difference is that autoboosters can only increase voltage.
Distribution - Switches

Switches are used to disconnect or close circuits that may be energized.

Gang Operated Switch

Switch Control Handle
Distribution - Switches
Some switches are equipped with motor controls and supervisory control so that switches may be operated remotely.

Gang Operated Switch with Motor Controls
Solid Blade Disconnect Switch

Distribution - Switches

The picture below shows a Solid Blade “In-Line” Disconnect switch that is operating using a switch stick.
Distribution Transformers - Overhead

Transformers are designed to reduce the voltage of the primary circuit to the voltage required to supply the customer.
Transformer banks are used to provide customers with 3-phase power.
Depending on the customer’s needs, transformer banks are connected in different configurations.
**Distribution Operation Center**

A distribution system is divided into several regions or divisions within each operating company. These regions or divisions have distribution control centers sometimes referred to as **Distribution Operation Centers or DOC’s**.
Distribution Control Center

The Distribution Operation Centers are responsible for all distribution lines and equipment within their area of control.
Distribution Control Center

Whenever switching is performed on their system, it is coordinated through the DOC.
Distribution Control Center

Operators track the status of lines and equipment using various tags.
An automated control system called SCADA allows operators to monitor and control substation and line equipment remotely.

SCADA stands for Supervisory Control and Data Acquisition.
Distribution Control Center

Customer Service Representatives deal directly with the customers. They relay information about system outages to the control center operators.