203: Electrical installations technology  
**Handout 26: Electricity supply**

**Learning outcome**

The learner will:

1. know how electricity is supplied.

**Assessment criteria**

The learner can:

5.2 identify **transmission voltages**

5.3 identify **distribution voltages**

5.4 state the **component parts** of the electrical distribution network.

**Range**

**Transmission voltages**: 400kV, 275kV, 132kV.

**Distribution voltages**: 33KV, 11KV, 400/230V.

**Component parts**: Sub-stations, pylons, power stations, cables, insulators, transformers.

**Electricity supply**

The electricity supply industry comprises:

* generation
* transmission
* distribution.

**Generation**

In the UK, power stations are often sited close to the fuel source and other important resources required for generation, eg a large source of cooling water. Most base‑load power stations produce electricity at around 25,000 volts (25kV).

**Transmission**

This electricity needs to be transmitted around the country to the load centres. These transmission lines form the basis of the National Grid. The National Grid is the high-voltage electric power transmission network in Great Britain, connecting power stations and major sub-stations, and ensuring that electricity generated anywhere in England, Scotland and Wales can be used to satisfy demand elsewhere.

By connecting the power stations and load centres in the form of a grid, greater security of supplies can be ensured. Additionally, during periods of light loading, eg in the summer, individual power stations can be shut down to enable maintenance operations to be carried out, whilst maintaining supply to consumers.

Using a step‑up transformer, the output from the power station is then stepped up to the transmission voltage. The reason why transmission is carried out at high voltages is to reduce the I2R losses across the system.

Three transmission voltages are used:

* 400kV
* 275kV
* 132kV.

The original Grid that came into operation in 1933 operated at 132kV. In 1949, the British Electricity Authority decided to upgrade the grid by adding 275kV links. From 1965, the Grid was partly upgraded to 400kV to become the supergrid, defined as referring to those parts of the British electricity transmission system that are connected at voltages in excess of 200kV.

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| Most of the grid is formed by overhead power lines, with cables suspended from insulators mounted on metal pylons or – to give them their proper name – transmission towers.  Normally, there are two off three phase circuits on each pylon. One or two earth wires, also called ‘guard’ wires, are placed on top to intercept lightning and harmlessly divert it to ground.  The conductors are generally made of a steel inner core for strength, surrounded by aluminium conductors around the outside; the cable has no insulation applied. | 01 Pylon.jpg |

**Distribution**

When these transmission lines are in the vicinity of the load centres, using a step‑down transformer, the voltage is stepped down for secondary transmission (132kV; 66kV). When the load centre is reached, it is stepped down again for local distribution at 33kV and 11kV. Supplies to individual users will see a further step-down to 400V for commercial and industrial users (heavy industry will be supplied at 33kV or 11kV, depending on demand) and 230V for domestic users.

Three distribution voltages are used:

* 33kV
* 11kV
* 400/230V

**Component parts** of the electrical distribution network include:

* sub-stations
* pylons
* power stations
* cables
* insulators
* transformers.

See the diagram on the following page for the transmission and distribution supply system.

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| 02 Transmission - portrait.png |