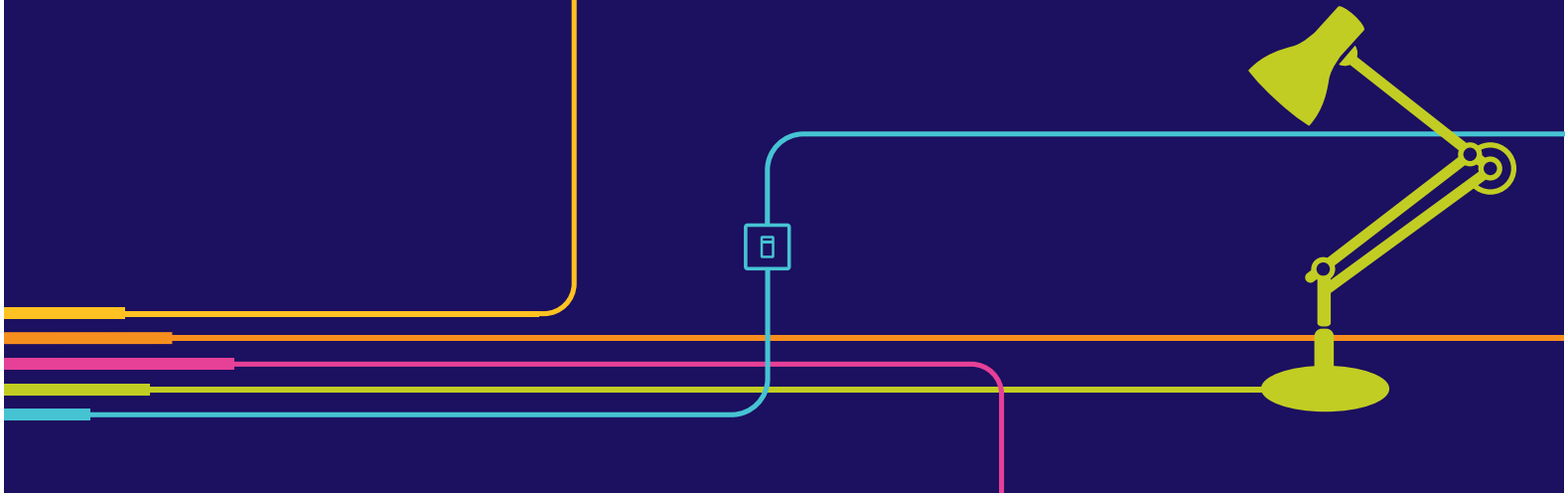
Be the source

nationalgrid

How electricity is made and transmitted

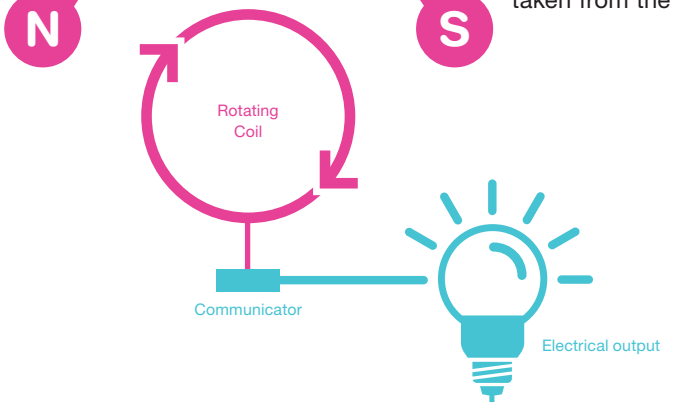


How it works

It was in 1831 that Michael Faraday plunged a bar magnet into a coil of wire and first recognised that he had generated, in his own words, “a wave of electricity”. He later rotated a copper plate between the poles of a magnet and found that power could be taken from the axis to the rim of the disc.

These fundamental experiments provided the basis for the production of electrical power by mechanical means.

Faraday is often referred to as the “Father of Electricity” because of the importance of his scientific discoveries, the principles of which are still used today in the production and supply of electricity.



Generation

Coal, uranium, oil, gas, hydro, wind and solar are the main sources of energy used in the generation of electricity in England and Wales. Much of the electricity is produced in thermal power stations which comprise:-

Boiler

Heat produced by burning fuel is used to convert water (circulating in tunes) into steam. The steam, at a very high temperature and pressure, is then directed onto the turbine.

Turbine

The turbine is a rotating shaft to which is attached a series of blades. As the high pressure steam passes through the turbine, the blades are forced to turn at high speed, rotating the shaft – similar to the action of a windmill.

From the turbine the steam enters a condenser, passing over tubes containing cool water. This cools the steam which condenses back into water and also creates a vacuum to help improve the flow of steam through the turbine. A series of pumps then return the water under pressure to the boiler to be recirculated in the boiler tubes.

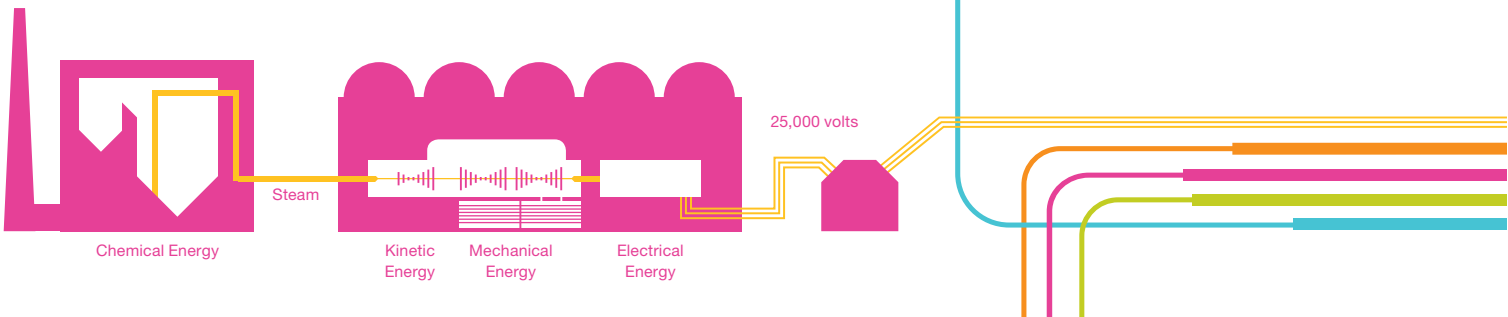
Generator

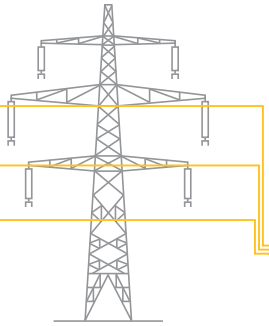
Attached to the turbine shaft is a generator which is basically a powerful electro-magnet surrounded by a series of windings – the modern day equivalent of Faraday’s bar magnet and coil of wire.

The rotation of the turbine causes the windings to be cut by the magnetic field of the electro-magnet and thus electricity is generated in the windings.

Renewables

A small proportion of the UK’s electricity is already generated from the renewable sources, but this is expected to grow significantly in the next few years. The Government is targeting a 34% reduction in carbon emissions by 2020, and 80% by 2050. There are alternative solutions to this problem, but a substantial increase in renewable sources such as wind, wave and solar generation is likely.





400kV Transmission Tower

275,000 or 400,000 volts

Transmission

Generator Transformer

Electricity is usually generated in power stations at about 22,000 volts, then increased by substation transformers to 275,000 and 400,000 volts, and fed into the National Grid system to be transmitted, efficiently, over long distances.

The reason we do this is to reduce the amount of energy lost in the conductors as it is transmitted. Raising the voltage reduces the electric current flowing and it is current that causes heat losses.

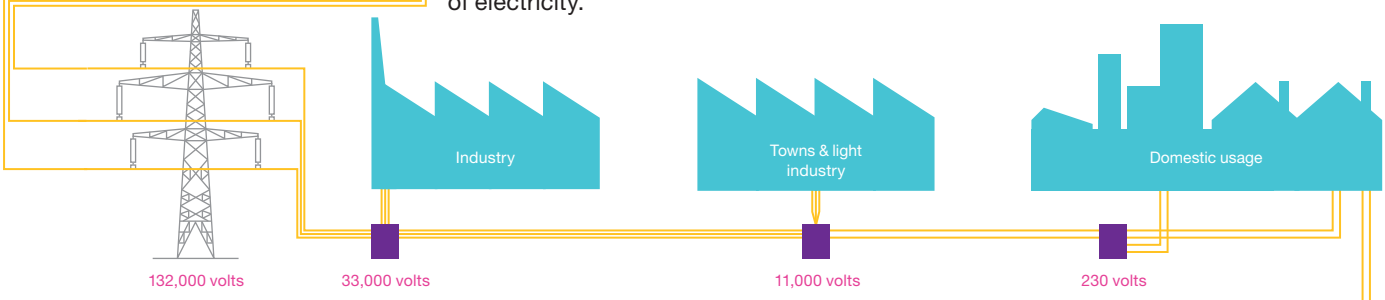
National Grid

National Grid circuits are the motorways of the electricity system in England and Wales. A network of overhead lines, underground conductors and substations link the power stations and allow large amounts of electricity to be transmitted around the country to meet the demand at any time.

Substations

Substations control the voltage and direction of electricity. Transformers are used to increase the voltage of electricity into the National Grid system for transmission, and to reduce the voltage to lower levels for distribution by the networks of the local electricity companies.

Increasingly, we are investing in new technologies that will enable us to transport electricity more efficiently. We are also investing in additional connections to Europe and in the networks needed to connect in new, renewable sources of electricity.



Distribution Network companies then distribute the energy in their licence areas throughout England and Wales.

Supply to Areas

Electricity is taken from the National Grid transmission system and reduced to 132,000 volts and lower voltages for distribution by the local electricity companies. Some large industrial customers requiring large amounts of electricity may be supplied direct from substations at 33,000 volts.

Supply to Towns

The supply is further reduced to 11,000 volts for distribution to towns, villages and direct to small industrial customers.

Supply to the Home

The voltage is finally reduced by transformers to 230 volts for use in homes, schools, shops and businesses.

Distribution

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Securing our energy supply for future generations