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# Electricity



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# Electricity





Electricity (from New Latin *ēlectricus*, "amber-like") is a general term that **encompasses** Electricity (from New Latin *ēlectricus*, "amber-like") is a general term that encompasses a variety of phenomena resulting from the presence and flow of electric charge. These **include** Electricity (from New Latin *ēlectricus*, "amber-like") is a general term that encompasses a



term that encompasses a

In general usage, the word 'electricity' is adequate to refer to a number of physical effects.

**However**In general usage, the word 'electricity' is adequate to refer to a number of physical effects. However, in scientific usage, the term is **vague**In general usage, the word 'electricity' is adequate to refer to a number of physical effects. However, in scientific usage, the term is vague, and these related, but **distinct**In general usage, the word 'electricity' is adequate to refer to a number of physical effects. However,





**Electric charge** – a property – a property of some subatomic – a property of some subatomic particles, which determines their electromagnetic interactions. Electrically charged matter is influenced by, and produces, electromagnetic fields

**Electric field** – an influence – an influence produced by an electric charge on other charges in its vicinity.

**Electric potential** – the capacity of an electric field to do work, typically measured in volts.



**Electric current** – a movement or flow of electrically charged particles, typically measured in amperes.

**Electromagnetism** – a fundamental interaction between the electric field and motion of electric charge.





Electricity has been studied since antiquity,  
though scientific advances Electricity has  
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Electricity has  
been respected, street and lighting though  
scientific applications. The invention of the





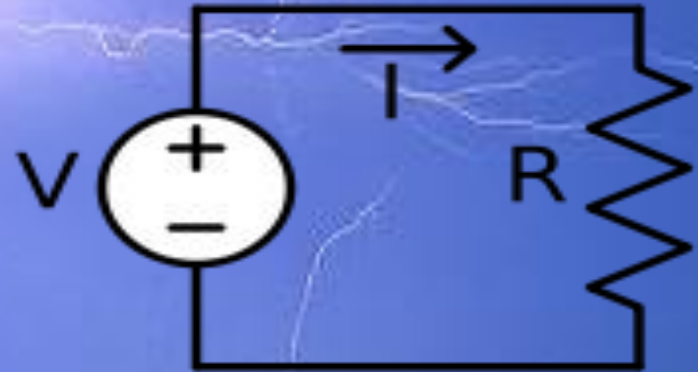
Benjamin Franklin conducted extensive research on electricity in the 18th century





# Electric circuits

An electric circuit is an interconnection of electric components, usually to perform some useful task, with a return path to enable the charge to return to its source. The components in an electric circuit can take many forms, which can include elements such as resistors, capacitors, switches, transformers and electronics. Electronic circuits contain active components, usually semiconductors, and typically exhibit non-linear behaviour, requiring complex analysis. The simplest electric components are those that are termed passive and linear: while they may temporarily store energy, they contain no sources of it, and exhibit linear responses to stimuli.



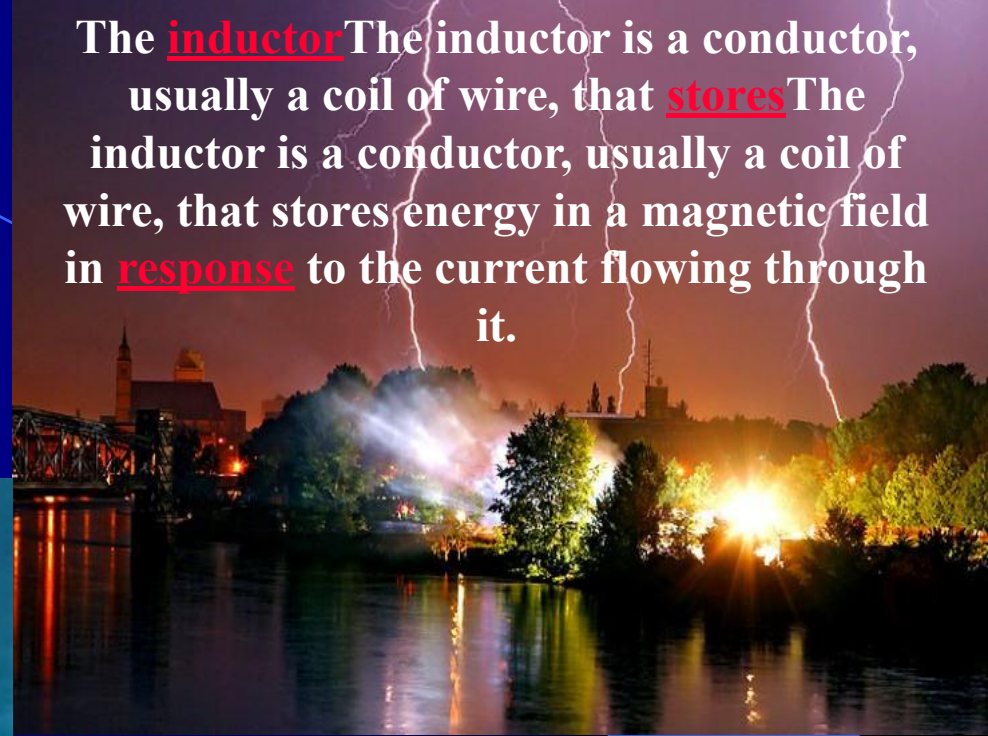
A basic electric circuit. The voltage source  $V$  on the left drives a current  $I$  around the circuit, delivering electrical energy into the resistance  $R$ . From the resistor, the current returns to the source, completing the circuit.

The capacitor is a device **capable** of storing charge, and thereby storing electrical energy in the resulting field. It consists of two conducting **plates** separated by a thin insulating layer, in practice, thin metal foils are coiled together, increasing the surface area per unit volume and therefore

The capacitor is a device capable of storing charge, and named after Michael Faraday, and given the symbol F; one farad is the capacitance that develops a potential difference of one volt when it stores a charge of one **coulomb**.

The **inductor** is a conductor, usually a coil of wire, that **stores** energy in a magnetic field in **response** to the current flowing through it.

When the current changes, the magnetic field does too, inducing a voltage between the **ends** of the conductor. The magnetic field does too, inducing a voltage between the ends of the conductor. The **induced** voltage is proportional to the time rate of change of the current. The constant of proportionality is termed the inductance. The unit of inductance is the henry, named



## Production and uses



## Generation



Electrical energy is usually generated by electro-mechanical generators driven by steam produced from **fossil** Electrical energy is usually generated by electro-mechanical generators driven by steam produced from fossil fuel **combustion** Electrical energy is usually generated by electro-mechanical generators driven by steam produced from fossil fuel combustion, or the heat released from nuclear **reactions** Electrical energy is usually generated by electro-mechanical generators driven by steam produced from fossil fuel combustion, or the heat released from nuclear reactions; or from other sources such as kinetic energy extracted from wind or flowing water. Such generators bear no **resemblance** Electrical energy is usually generated by electro-mechanical generators driven by steam produced from fossil fuel combustion, or the heat released from nuclear reactions; or from other sources such as kinetic energy extracted from wind or flowing water. Such generators bear no resemblance to Faraday's homopolar disc generator of 1831, but they still rely on his electromagnetic

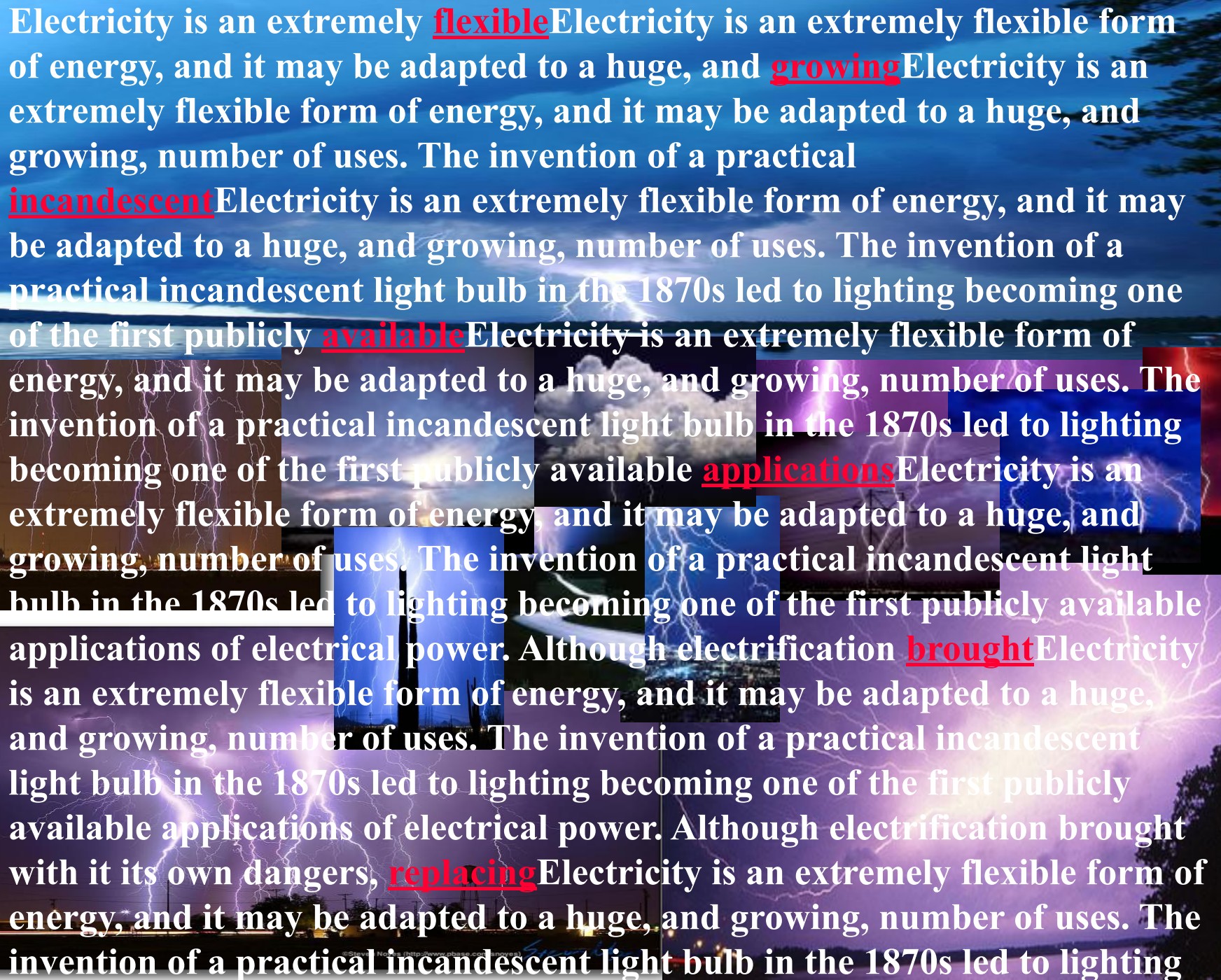


**Demand** Demand for electricity grows with great rapidity. Demand for electricity grows with great rapidity as a nation modernizes and its economy develops. The United States showed a 12% increase Demand for electricity grows with great rapidity as a nation modernizes and its economy develops. The United States showed a 12% increase in demand during each year of the first three decades of the twentieth century, a rate of growth that is now being

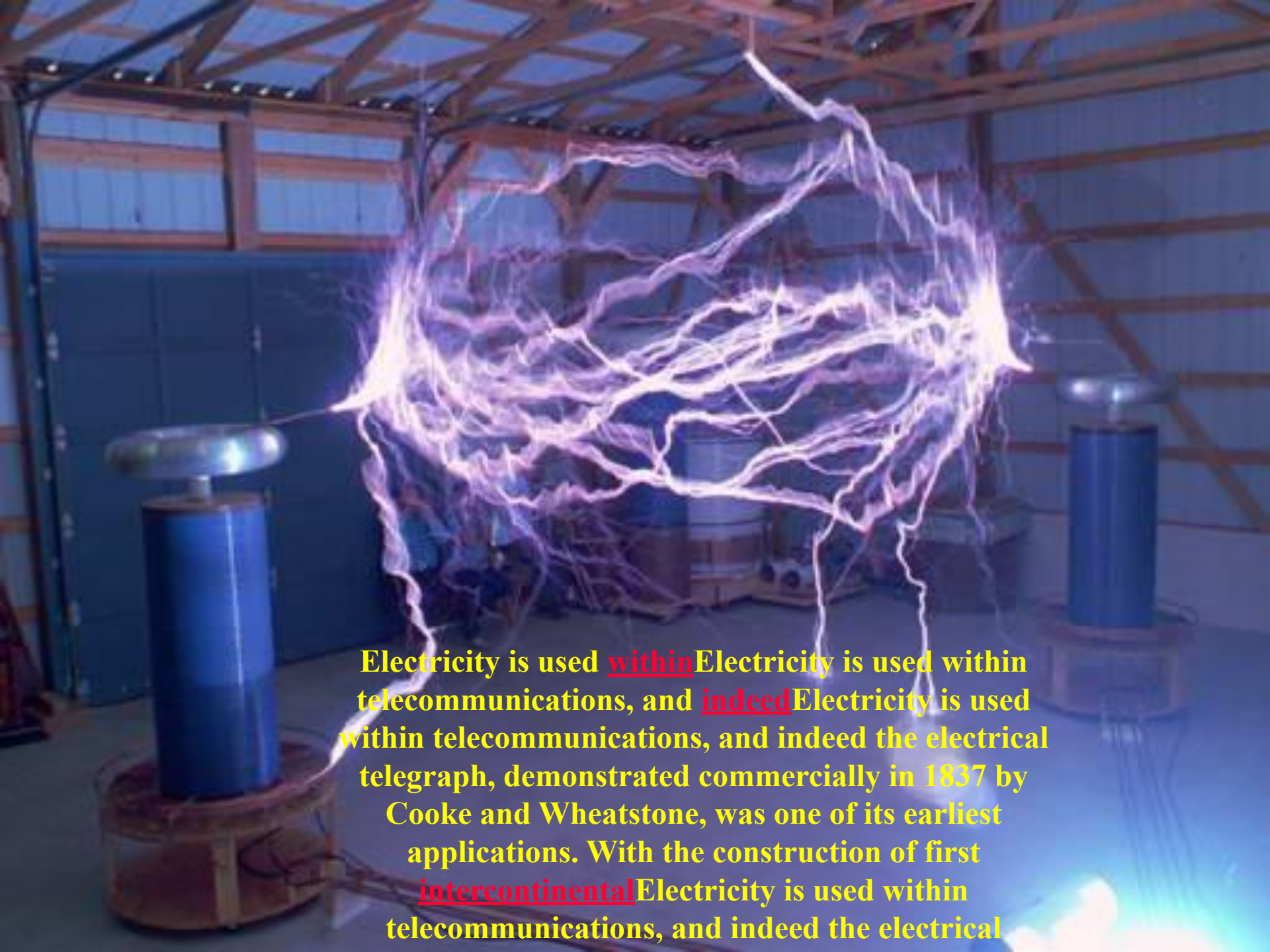
# Uses







Electricity is an extremely **flexible** Electricity is an extremely flexible form of energy, and it may be adapted to a huge, and **growing** Electricity is an extremely flexible form of energy, and it may be adapted to a huge, and growing, number of uses. The invention of a practical **incandescent** Electricity is an extremely flexible form of energy, and it may be adapted to a huge, and growing, number of uses. The invention of a practical incandescent light bulb in the 1870s led to lighting becoming one of the first publicly **available** Electricity is an extremely flexible form of energy, and it may be adapted to a huge, and growing, number of uses. The invention of a practical incandescent light bulb in the 1870s led to lighting becoming one of the first publicly available **applications** Electricity is an extremely flexible form of energy, and it may be adapted to a huge, and growing, number of uses. The invention of a practical incandescent light bulb in the 1870s led to lighting becoming one of the first publicly available applications of electrical power. Although electrification **brought** Electricity is an extremely flexible form of energy, and it may be adapted to a huge, and growing, number of uses. The invention of a practical incandescent light bulb in the 1870s led to lighting becoming one of the first publicly available applications of electrical power. Although electrification brought with it its own dangers, **replacing** Electricity is an extremely flexible form of energy, and it may be adapted to a huge, and growing, number of uses. The invention of a practical incandescent light bulb in the 1870s led to lighting



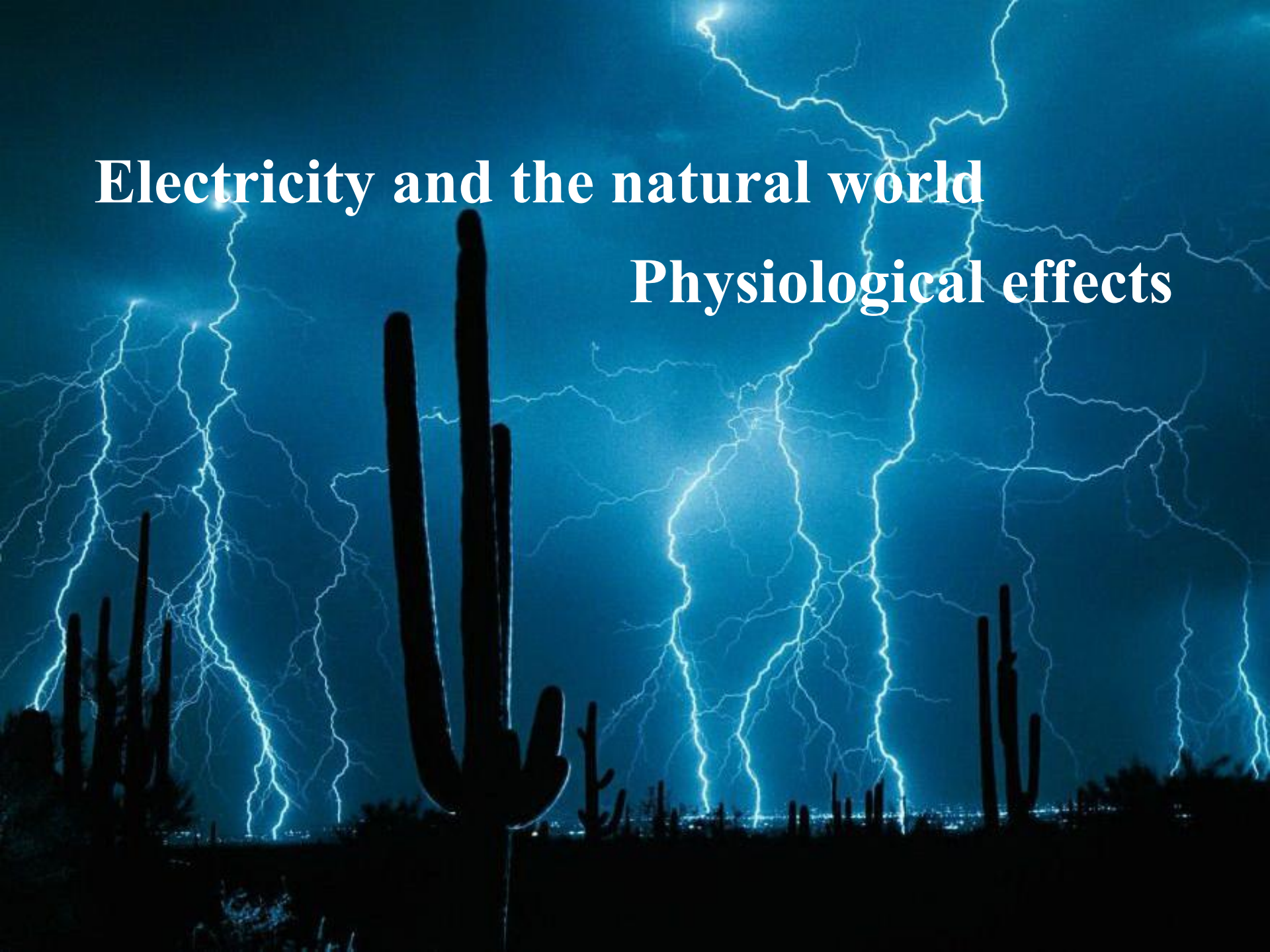
Electricity is used within Electricity is used within telecommunications, and indeed Electricity is used within telecommunications, and indeed the electrical telegraph, demonstrated commercially in 1837 by Cooke and Wheatstone, was one of its earliest applications. With the construction of first intercontinental Electricity is used within telecommunications, and indeed the electrical



Optical fibre and satellite Optical fibre and satellite communication technology have taken Optical fibre and satellite communication technology have taken a share of the market for communications systems, but electricity can be expected to remain an essential part of the process.

# Electricity and the natural world

## Physiological effects



A voltage applied to a human body causes an electric current to flow through the tissues. A voltage applied to a human body causes an electric current to flow through the tissues, and although the relationship is non-linear, the greater the voltage, the greater the current. The threshold for perception varies with the supply frequency and with the path of the current, but is about 1 mA for mains-frequency electricity.

If the current is sufficiently high, it will cause muscles contraction, fibrillation of the heart, and tissue burns. The lack of any visible sign that a conductor is electrified makes electricity a particular hazard.

The pain The pain caused by an electric shock The pain caused by an electric shock can be intense, leading electricity at times to be employed as a method of torture. Death caused by an electric shock is referred to as electrocution.



Electrocution is still Electrocutation is still the means of judicial execution Electrocution is still the means of judicial execution in some

END

