

Role in Energy Generation and Transmission

Waves and optics form the core of how electrical and electromagnetic energy is generated, transmitted, and converted. Light is fundamentally an electromagnetic wave made of oscillating electric and magnetic fields, linking optical principles directly to electrical energy systems.

Changing magnetic fields create electric fields (Faraday's Law) and moving charges or changing electric fields create magnetic fields.

An example is the how Induction Generates Electricity

Moving magnets: A turning turbine spins a magnet inside a coil of wire.

Changing fields: This rotation creates a changing magnetic field inside the wire loop.

Voltage creation: Faraday's law shows that this changing magnetic field induces an electric voltage and current in the wire.

Solar Power: Photovoltaic cells convert light wave energy into electrical current via the photoelectric effect.

Fiber Optics: Electrical data signals convert into light pulses, traveling through glass fibers via total internal reflection for high-speed grid communication.

Smart Grid Sensors: Optical sensors measure high-voltage electrical current and temperature safely using light phase shifts and the Faraday effect.