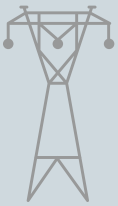
Transmission Line Electricity — Q & A

When a new transmission line is proposed, landowners may have questions about the electricity carried, and environmental effects. This brochure is aimed at answering some of the questions we have heard.

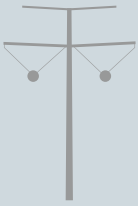
What is the purpose and role of transmission lines?

The purpose of a transmission line is to transport electricity from one area to another. To do this efficiently, the voltage needs to be raised far higher than the 120 volts at which we use electricity in our homes, schools, and businesses.

Historically, most transmission lines have carried alternating current (AC) electricity that changes direction and intensity 60 times per second (i.e., 60-Hertz [Hz]) that is then stepped down in voltage at substations for local use. Newer technology allows transporting electricity by converting AC electricity at a converter station to direct current (DC) electricity for transport to a distant converter station where the DC electricity is then converted back to AC electricity for local use.



AC — current field direction changes 60 times per second

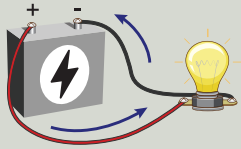


DC — current flows in one direction (as from a battery)

Electricity carried by AC and DC transmission lines creates electric and magnetic fields (EMF). Are the fields the same for AC and DC lines?

No, they differ in an important way - the frequency of the electricity and therefore the frequency of the fields are different.

DC — current flows in one direction (as from a battery)



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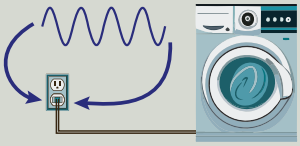


Why is the frequency important?

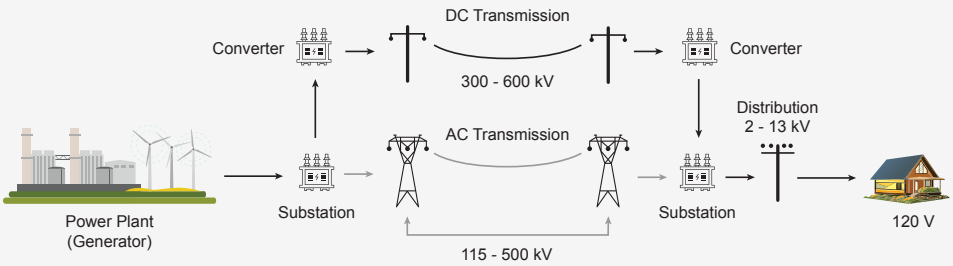
Because the frequency of the EMF determines how EMF interacts with the environment including people.

What are the sources of electric and magnetic fields from AC and DC transmission lines?

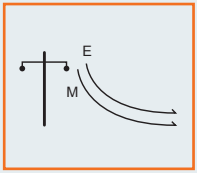
The **electric fields** are produced by the voltage (measured in volts, V or kilovolts [kV]: 1 kV = 1000 V) applied to the conductors of the transmission lines. The higher the voltage, the greater the electric field. The figure below shows how electricity flows on AC transmission lines and lower voltage AC lines and how stations at each end of a DC line convert DC to AC electricity or DC electricity to AC distribution electricity. Ranges of voltages at which electricity is transmitted are shown for the AC and DC lines.

Magnetic fields are produced by the flow of electrical currents (measured in Amperes, A). The greater the current flow, the higher the magnetic field.

Current flows are not listed in this figure. While for a constant power, higher voltage lines will have lower current (i.e., power = voltage x current), higher voltage lines can carry more power and are often constructed with larger (and sometimes more conductors) which allows them to carry higher currents (and hence may also produce higher magnetic fields).

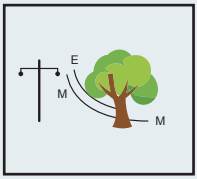


How are electric and magnetic fields similar or different?



SIMILARITIES

- The frequency of the electric field and the magnetic field is the same as the electricity carried by the line.
- The strength of both fields diminishes quickly with distance from conductors or other sources.



DIFFERENCES

- Electric fields are blocked by common objects such as trees, shrubs, fences and buildings.
- Magnetic fields of DC or AC transmission lines (or other sources) are not blocked by most materials.

Do the EMF from DC and AC lines cause dangerous shocks to persons?

Transmission lines are required to meet requirements of the National Electric Safety Code. Adherence to the Code protects persons from hazardous shocks under transmission lines and from contact with grounded objects. The low levels of the electric fields from transmission lines are difficult for most persons to even perceive and the magnetic fields are not perceptible.

Do AC or DC fields adversely affect the health of people, farm animals or crops?

We encounter AC and DC fields from many sources in our daily lives, including from transmission lines. Research shows that DC and AC fields do not couple well with smaller objects including people, livestock, and plants. Electric fields are greatly attenuated by the body (AC) or totally blocked from the body interior (DC) so that at levels under transmission lines only surface effects may be perceived.

Multiple authoritative reviews of scientific research on AC and DC fields have not concluded that the fields we typically encounter in our communities and under transmission lines are harmful to human or animal health or crops [e.g., IARC, 2002; NRPB 2004; WHO, 2006, 2007; SCENIHR, 2015; SSM, 2022]. Exposures to AC and DC fields under transmission lines and elsewhere in communities also are below biologically-based limits set by scientific agencies to avoid known effects of fields (ICES, 2020; ICNIRP, 2009, 2010, 2020; WHO 2016).

Does the release of energy at points on conductors of transmission lines affect the performance of electrical appliances in homes, cars, or tractors or reception of GPS or mobile phone signals?

At points on the conductor surface where the electric field is concentrated on nicks, insects, debris or raindrops, small amounts of energy can be released (called corona activity) as weak, radio frequency noise. The frequencies of these corona-generated fields are too low to interfere with the vast majority of today's electrical devices and appliances such as cell phones and GPS that operate at higher frequencies than transmission lines and corona. The reception of AM radio stations is an exception and when driving directly under or very close to a transmission line, static can sometimes be heard.

Do DC or AC lines produce audible noise?

When corona activity on the conductors occurs, the release of small amounts of energy also may also produce audible humming and crackling noises. This audible noise from a transmission line is generally low to moderate at right-of-way edges and would meet Environmental Protection Agency's noise guidelines (USEPA 1974) for acceptable levels that provide an adequate margin of safety.

NOTICE

This information was prepared by scientists and engineers at Exponent, Inc., an international scientific and engineering firm, to present a current summary of the status of EMF research as reflected in reviews by science and health organizations. This brochure is limited to the scientific literature reviewed and may not include all information in the public domain.

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