Alternating Current and Direct Current – What's the Difference?

Overview of Electrical Currents

Alternating current (AC) and direct current (DC) both play a pivotal role in the delivery and use of electricity–both types of current are used for the transmission of electrical energy. The difference between the two is how their electrons flow during transmission.

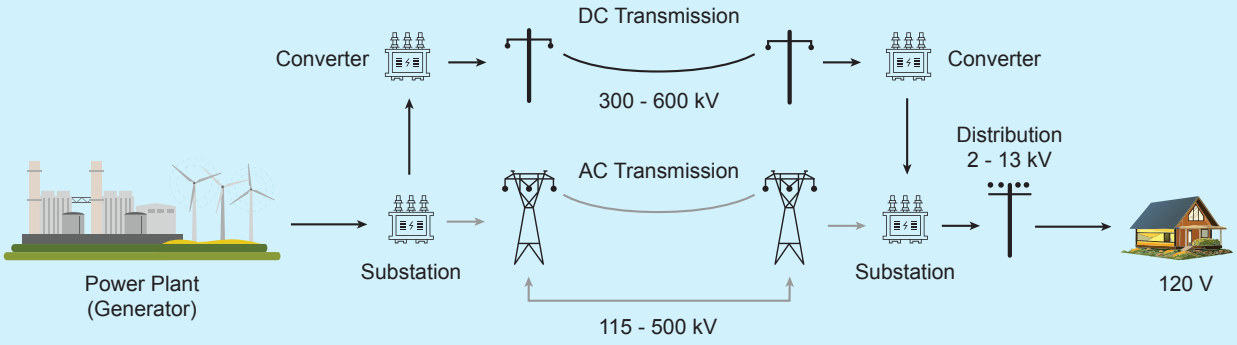
- Alternating current electricity changes direction each second in an oscillating repetition or wave-like pattern. In North America, this change in direction occurs in a continuous cycle that repeats 60 times per second (60 Hertz [Hz]).
- Direct current electricity does not change direction as it is transmitted, but instead flows in one direction.

Role of AC Power

Electricity delivered by AC transmission lines is stepped down to lower voltages for local distribution, and the voltage is stepped down again to 120 volts (V) for use in homes and other buildings. The voltages of AC and DC transmission lines are higher and therefore reported in kilovolts (kV) where 1 kV = 1,000 V.

How do DC Transmission Lines Connect to the AC Power Grid?

Where a DC transmission line becomes part of the system, AC electricity is converted to DC electricity at one end of the DC transmission line and that DC electricity is converted back to AC electricity at the other end. If power is needed to flow in the opposite direction, say in response to a large demand for electricity in the West, the process shown can be easily reversed.



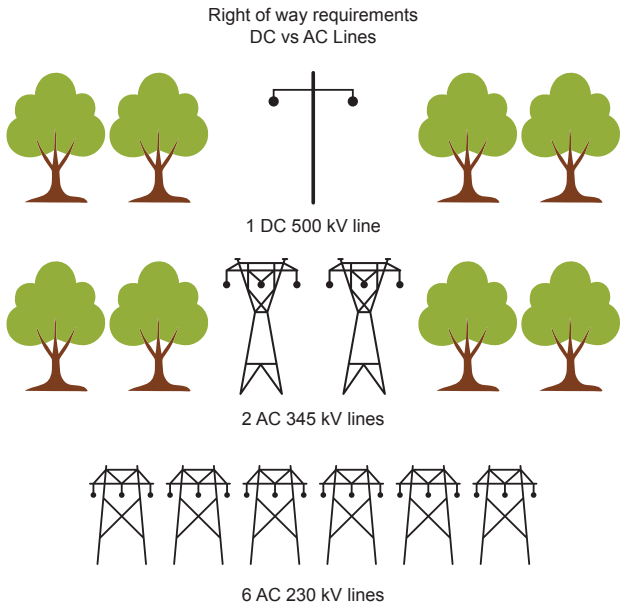
What are the Advantages of DC Power Transmission?

Over the past 50+ years, DC transmission lines have been found to offer significant electrical and land use advantages over AC transmission lines for moving large amounts of power over long distances:

Over long distances, DC transmission can move more power with lower electrical losses (i.e., more efficiently) than AC transmission.

DC transmission allows the grid operator greater control over the power flow, which enhances system stability, and it facilitates the integration of energy from different resource areas to avoid outages.

A single DC transmission line can move as much power as multiple AC transmission lines while requiring a smaller land use footprint to move the same amount of power.



This information was prepared by scientists and engineers at Exponent, Inc., an international scientific and engineering firm, to describe the differences between AC and DC electricity for transmission systems.

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