

Electric Grid

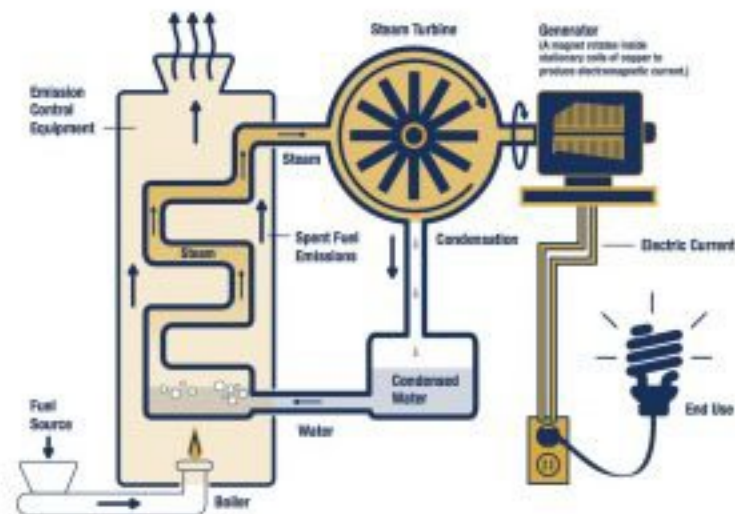
What is Electricity?

Electricity is a form of energy, which occurs when electrons move from one place to another. Electricity travels at nearly the speed of light. Though we all use cellphones and other things with batteries, electricity cannot be easily stored on a large (utility) scale. It must be generated and delivered at almost the precise moment it is needed.

How is Electricity Generated?

Electricity is generated by causing electrons to move through a wire. Utilities make or generate electricity by spinning huge magnets inside wire loops. (If you've ever used a magnet to pull or push an object, you are forcing electrons to move. The principle is the same.)

A large turbine connected to these magnets creates the spinning or rotation.



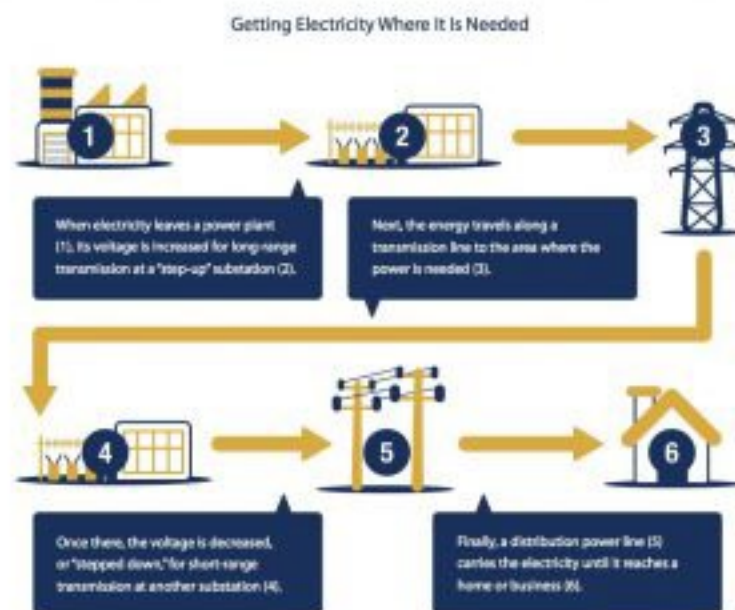
The turbine is turned by pressurized steam (in most cases) created by boiling water heated by coal, natural gas or other fossil fuels or by nuclear power in large boilers. Or, the turbines are pushed by wind in a wind turbine (windmill) or by water in hydroelectric generation.

Solar electric generation works differently. Electricity is produced when sunlight strikes a solar cell (objects made of semiconductors), knocking electrons loose. A solar panel comprised of many solar cells is wired to capture these flowing electrons, or electric current.

How is electricity transmitted?

Simply put, electricity is transmitted from the power plant, which produces or “makes” the electricity, through wires to your house or business. It is not dissimilar in principle to the way water from a reservoir is piped to your home.

For electricity to get to where it is needed, though, it must go through several intermediate steps.



1. Electricity leaves the power plant.
2. A “Step up” substation near the plant increases the voltage so the electricity can efficiently travel longer distances – similar to increasing the pressure on water in a water pipe. The voltage is increased to anywhere between 69,000 and 800,000 volts, depending on the distance the power will travel and the amount of electricity to be moved.
3. Electricity then enters the transmission system, traveling at nearly the speed of light over heavy cables strung between tall towers.

4. A “step-down” substation near its final destination reduces the voltage so it can be transmitted using smaller cables.
5. Distribution lines carry the electricity from the step down substation.
6. Electricity is further reduced by small transformers on the utility poles (or located underground) to reduce the voltage again to around 120-140 volts and is then delivered to residential customers.

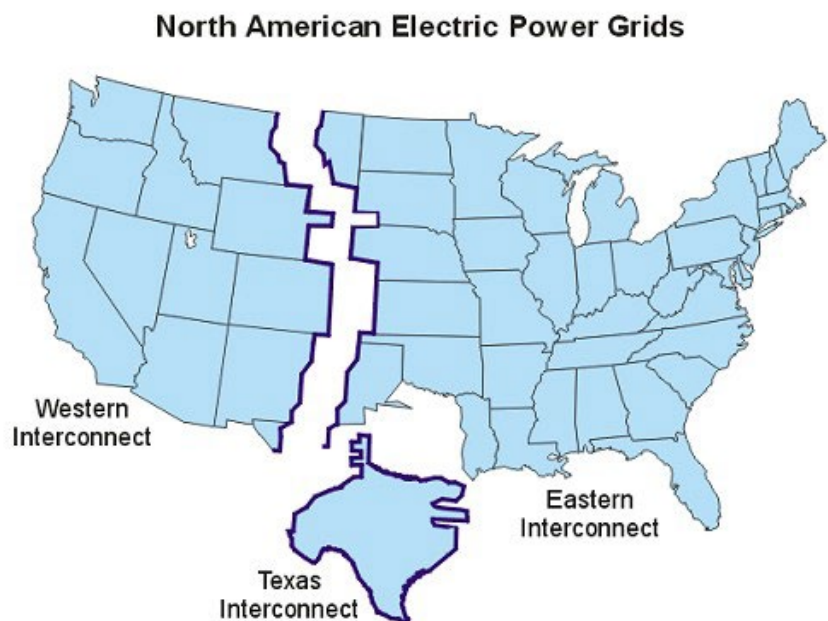
The Electric Grid System

The North American Electric Grid system is a complex, interconnected network of generating plants, transmission lines and distribution facilities. Electric companies have interconnected their transmission systems so that they may buy and sell power from each other and from other power suppliers to ensure the most economic power is used to serve customers and to provide reliability of service. The grid provides redundancy in the event of an emergency.

Electric Companies Invest Heavily in the Grid

The grid is one of the reasons the electric power industry is the most capital-intensive industry. IEA members invest over \$2 billion annually on capital investments in Indiana, which includes generation, transmission, distribution, and smart grid system upgrades; new, cleaner generation capacity; and environmental and energy-efficiency improvements.

According to the U.S. Department of Energy, there are more than 450,000 miles of high voltage transmission lines in the U.S. Transmission lines in the U.S. are divided into three integrated regional grids:



- one in the East which connects the Eastern seaboard and the Plains states;
- another in the West which connects the Pacific coast and the Mountain states; and
- another that operates in Texas.

Regional Transmission Organizations

There are two regional transmission organizations that operate in Indiana.

1. MISO (Midcontinent Independent System Operator) is an independent, not-for-profit, member-based organization that manages the generation and transmission of high-voltage electricity across 15 U.S. states and the Canadian province of Manitoba.
2. PJM is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia.



For more information, visit:

- <https://www.misoenergy.org/>
- <https://www.pjm.com/>