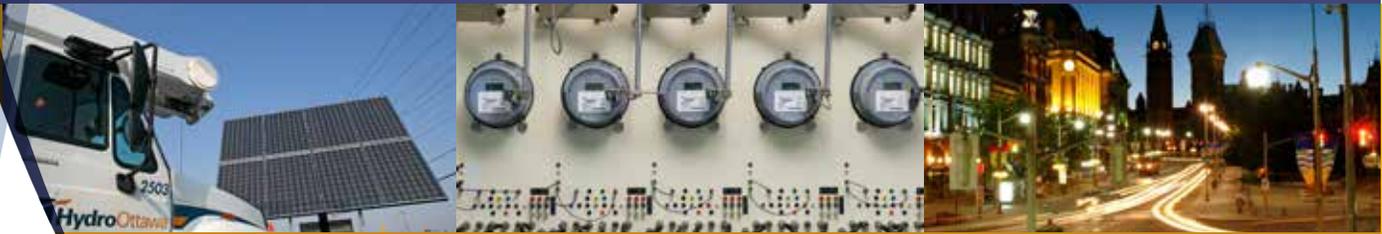




# Hydro Ottawa BASIC FACTS ABOUT ELECTRICITY



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Electricity is a form of energy. It is used to run machines in the home such as computers, appliances and air conditioners, or massive industrial machines. Electricity can also be transformed into other types of energy such as light and heat.

Electricity begins with atoms, the smallest of all particles. The centre of the atom contains protons and neutrons; electrons are contained around the protons and neutrons and move quickly around them. The quick movement of electrons is what makes the energy in electricity.

## HOW ELECTRICITY IS MADE

Electricity companies make electricity in generating stations, using “fuels” such as rapidly-moving water, uranium, fossil fuels, wind, solar collectors, biomass or biogas. Some generating stations can make enough electricity for a city; others make much smaller amounts. Homeowners can also generate electricity at their home using a technology such as photovoltaic solar cells on the roof.

An electricity generator is typically a machine that moves a magnet near a wire to create a steady flow of electrons. Fast-flowing water, steam, nuclear fission, and wind are typical fuels that cause the magnet to move near the wire.

Rapidly-moving water, for example, flowing through a turbine causes the turbine (imagine a boat’s propeller) to rotate quickly. The shaft from the turbine is connected

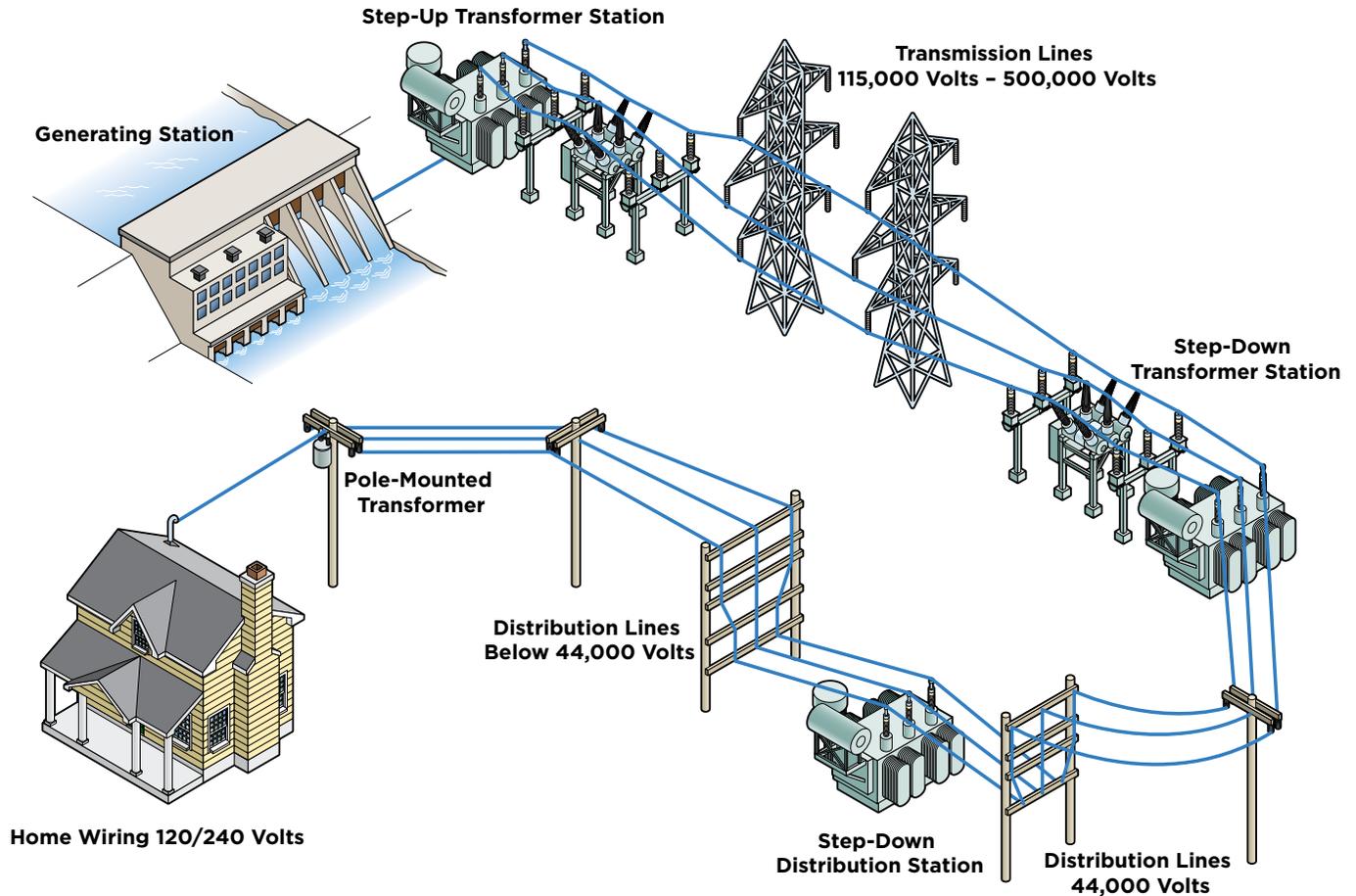


to the generator. The spinning turbine rotates this shaft connected to the generator, which in turn rotates the copper coils of the generator. As the copper coils spin within the magnets, electricity is produced.

Electricity can also be made in generating stations that use nuclear fission to boil water and create the steam that spins the turbine-generators; or by burning natural gas, coal, oil, landfill gas, or biomass to create the steam; or by harnessing the wind or ocean waves to spin the turbines. Electricity generation from solar uses a different process — photovoltaic solar cells convert energy from the sun directly into a flow of electrons.

In most of the world today, the most-used ways of making electricity are by burning fossil fuels; using water power; and using nuclear power. Videos on each of these technologies are available at [www.opg.com/news/videos.asp](http://www.opg.com/news/videos.asp).

## FROM ELECTRICITY GENERATION TO THE HOME



### MOVING ELECTRICITY ALONG TRANSMISSION CORRIDORS

Once electricity is created in a turbine-generator, it needs to be transmitted to where it will be used.

A simple way to think about this movement of electrons is to imagine a pump pushing water through a pipe. Only instead of pushing water, electricity generators act like a pump to push electrons along, and to apply a certain amount of pressure to the electrons. In an electrical circuit, the **number** of electrons in motion is called the amperage or current, and this is measured in amps. The **pressure** pushing the electrons along is called the voltage and is measured in volts.

As the electricity leaves the generator, it enters a transmission substation just outside the generating building. This substation uses large transformers to convert the generator's voltage (which is at the thousands-of-volts level) up to extremely high voltages for long-distance transmission on the transmission grid.

Typical voltages for long distance transmission are in the range of 115,000 to 765,000 volts. Ontario's transmission lines — the large towers we see in rural areas or urban corridors — operate at 500,000 volts, 230,000 volts and 115,000 volts. A typical maximum transmission distance is roughly 500 kilometres.



## GETTING ELECTRICITY TO HOMES AND BUSINESSES

For power to be useful in a home or business, it must be converted to lower voltages and moved to electricity customers along a distribution grid. All cities and towns have distribution grids; there are also distribution grids serving rural areas.

The electricity which was transmitted at high voltage enters the distribution grid and is converted to a lower voltage in a power substation. This substation has transformers that “step down” transmission voltages from the high transmission voltages to distribution voltages that are typically less than 10,000 volts.

The substation also has a “bus” that can split the distribution power off in multiple directions; and it often has circuit breakers and switches so that the substation can be disconnected from the transmission grid if necessary, or so that separate distribution lines can be disconnected from the substation when necessary.

In order to “transform” from higher distribution voltages to the lower 120 and 240 volt supplies used in normal household electrical services, a transformer steps down the voltage. These can either be mounted on a pole for overhead distribution networks or on a concrete pad for underground distribution networks. Each transformer typically serves ten or more homes.

Once the electricity is at 120 or 240 volts, it enters the house through the wire connecting the house to the distribution transformer. The electricity goes through a meter, which

measures the amount of electricity the house uses, and then through the electrical panel which uses breakers or fuses to protect the wires in the walls from being overloaded. The electricity is now ready at the wall outlets and switches to meet the homeowner’s power needs.

Until recently, the meter on the house or business had to be “read” by an electricity distribution company worker to see how much electricity was consumed. Customers would pay based on their level of consumption.

Now, many electricity customers (including almost all in Ontario) have smart meters, which use wireless technology to send electricity consumption data, as well as data on when the electricity was used, back to the electricity distribution company. This data is used to prepare the electricity bill and is available to customers to better understand their consumption patterns to conserve energy and reduce cost.

Customers with smart meters pay more for electricity used during peak-usage times, somewhat less for electricity used for mid-peak periods, and considerably less for electricity used during low peak periods (evenings and weekends).

Sources: HowStuffWorks  
Canadian Nuclear Association

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