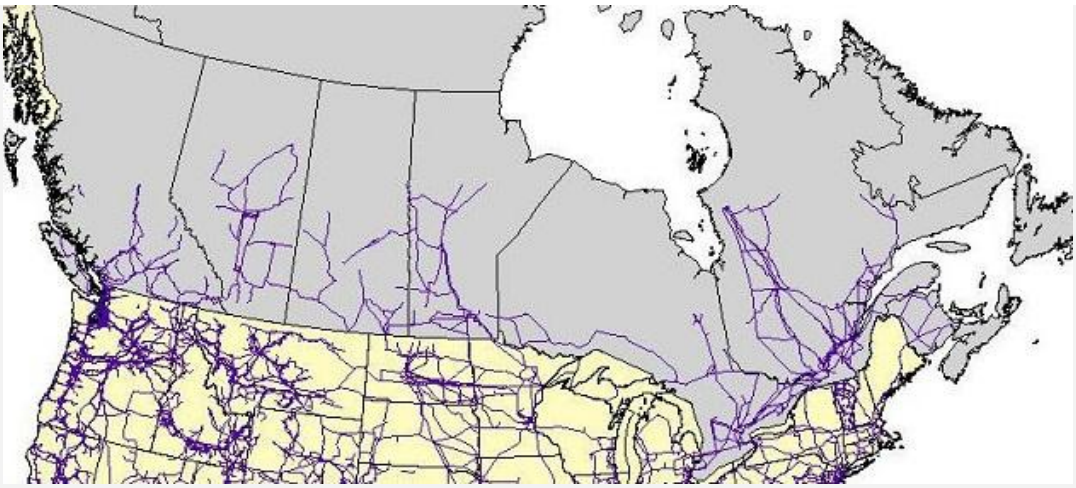
POWER TO THE PEOPLE



Map of Canadian Energy Grid - Global Energy Network Institute

The Nitty Griddy Details of Energy Transmission

by Yang Lei and Chris Hilbrecht

How does electricity get from where it is generated to consumers? In Canada, more than 160 000 kilometres of high voltage wires carry electricity across the country and to export markets in the United States. Three main networks of electric wiring, referred to as “grids” make electricity available across the country: the Western grid, which includes British Columbia and Alberta; the Eastern Grid, which connects Saskatchewan, Manitoba and Ontario; and the Quebec grid, which, surprisingly enough, serves Quebec, along with Atlantic Canada.

Most of the basic technology for electric transmission developed in the late 19th century. Initially, the generation and transmission of electricity occurred at a local level, with small generators used to power electric lighting systems. In electric technology's infancy, there was little consistency in the voltages and currents used, but as demand for electricity grew, so did the need for a consistent method of transmitting it.

Full standardization was actually finally fed by militarism: when the First World War broke out munitions factories had to be quickly constructed and militaries demanded standardized electrical equipment, but a particularly interesting moment in the history of electricity happened when early Alternating Current (AC) and Direct Current (DC) systems competed for dominance in the electric grid. Legendary inventors like Thomas Edison, who favoured DC, and Nikola Tesla, who backed AC, engaged in bitter feuds over the future of electrical technology which were not always limited to sensible debates over which technology was better. Edison, for example, was not above using smear tactics to advance his technology, and promoted the use of AC in electric chairs hoping that a gruesome association with executions would rub off on his competitors.

Despite Edison's . . . er . . . *creative* attempts to undermine AC, Tesla's technology ultimately took over as the dominant technique for transmitting electricity.

Alternating Current is better for sending electricity over long distances, because the higher voltages at which it operates allows thinner wires to carry the same amount of power. This long distance capability became important as the scale of generation projects grew, and helped to foster the centralization which continues to dominate the grid today.

At present, electric grids in Canada tend to run in a north-south direction, since often electricity is generated in northern areas, such as in hydroelectric projects in northern Quebec, and then delivered to urban markets in the south. Because of the challenges for electricity transmission brought by Canada's vast distances, severe climate, and difficult terrain, Canada has been a pioneer in high-voltage transmission technologies.

So with this grid in place, how do electricity producers make sure the supply of electricity they produce matches consumer demand? Here in Ontario, where this website is based, the Independent Electricity System Operator (IESO), a non-profit corporation linked to the provincial government, monitors the electric system, estimates demand, and collects price bids from different generators to supply the needed electricity. This competitive system has the same net result as a centrally planned public system, which keeps generators running based on which ones are most efficient, since the most efficient methods of generation can run at the lowest cost and are consequently the most competitive.

Some plants, such as coal-fired generating stations, are more cost-effective if run constantly at full power since they can take up to eight hours to reach their most efficient level of operation; others, like small natural gas turbines, may only be run for a few hundred hours each year — they can reach full power minutes after starting up, but are quite inefficient, so are only used to meet peaks in demand.

The grid in North America is divided into 3 (by some counts 4) sections: West Coast, East Coast (sometimes excluding Québec), and Texas. There are interchanges at the boundary of each network, and transformers ensure that voltage is compatible from one grid to another. The electricity market has two pricing systems: wholesale and retail. In wholesale electricity markets, all producers sells at a fixed price to a central distribution authority, who then creates price packages for the consumers. In retail electricity markets, producers sell to a variety of retailers, who then compete amongst each other for consumers.

Source: http://www.sassweb.ca/3bb3/volume1-0/distribution-and-transmission/power-to-the-people