

# AC and DC Technology

*Direct current (DC) technology allows a large amount of power to flow through a smaller transmission line corridor in comparison to alternating current (AC) technology. Benefits include increased operating efficiency and flexibility, decreased land impacts and enhanced reliability.*

## History of DC technology

In the late 1880s, a battle emerged between electricity pioneers George Westinghouse and Thomas Edison. The reason: Edison promoted DC for electric power distribution while Westinghouse was a proponent of AC distribution. More than 125 years later, Westinghouse's legacy is firmly established in the AC system that predominantly powers most North American (including Albertan) homes, farms and businesses.

But Edison's ideas also remain in the DC systems that today increasingly help move power over long distances in many parts of the world. Examples in Canada include:

- Alberta–Saskatchewan Interconnection installed in 1989
- Quebec–New England Interconnection installed in the early 1990s
- Vancouver Island Interconnection installed in the late 1970s
- Nelson River, Manitoba bipoles installed in the 1970s

DC systems include the high voltage direct current (HVDC) transmission lines used in Manitoba and Quebec, and also within the Pacific Northwest and California–Nevada areas of the U.S. HVDC lines can carry a large amount of power over even longer distances.

## Benefits of DC transmission lines

DC is used for long distance transmission because it has some major advantages over AC.

**Improved efficiency:** All power lines experience line losses—power that is lost in the form of heat when a line is operating. DC transmission lines typically experience reduced line losses compared to AC lines meaning less power wasted and, as a result, better efficiency.

**Smaller physical footprint:** Two 500 kilovolt (kV) DC lines can transport a similar amount of power as 10 single circuit 240 kV AC lines. Additionally, DC towers usually require less space than AC towers of similar capacity.

**Scalability:** With DC lines, the amount of power the line can transmit can be increased by adding equipment at each end of the line. This decreases the need to build more power lines and lessens the impact on landowners if demand for power increases in the future.

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## The future of DC technology in Alberta

Demand for electricity in southern and central Alberta is stressing our transmission system. Despite the recent economic downturn, the Alberta Electric System Operator (AESO) forecasts long-term growth in electricity demand of 3.2 per cent annually for the next 20 years. As part of its mandate, the AESO must ensure Albertans have a reliable system that meets North American Electric Reliability Corporation (NERC) reliability standards. If we do not reinforce our existing transmission infrastructure, the system will be operating below NERC reliability standards.

Alberta currently has no DC lines. However, the Government of Alberta has identified use of DC technology as a significant strategy to help strengthen the province's transmission system and achieve the following policies set out in the 2008 *Provincial Energy Strategy*:

- "...build transmission...to zones of renewable or low-emission electricity
- ...use, where possible, technology such as high-voltage direct current to maximize efficiency of rights of way and minimize impacts
- ...implement policy...for the development and deployment of 'smart grid' technology"

The Edmonton–Calgary Transmission System Reinforcement project will be the first in the province to use DC technology. Identified by the AESO in the *2009 Long-term Transmission System Plan*, it is one of four Critical Transmission Infrastructure projects the Government of Alberta approved under the *Electric Utilities Act*.

The reinforcement project will build two 2,000 megawatt (MW) HVDC lines between Edmonton and Calgary. Each line will operate at 1,000 MW during the first stage of the project with potential to add more capacity as it is needed. While the estimated costs for installing the DC lines will be approximately 25 per cent higher than AC lines, the long-term benefits to Albertans are significant. By investing in DC technology, the AESO will be better able to ensure a robust transmission system that provides reliable service to all Albertans, attracts new generation, encourages investment in Alberta and facilitates a competitive energy marketplace.