# *IEEE Honours Historical Achievement in Electrical Engineering*

*by Lindsay Ingram, LSIEEE and Public Affairs Manitoba Hydro*

Following on the three previous Canadian dedications at DeCew Falls in Ontario (2004) and Signal Hill and Heart's Content in Newfoundland (both in 1985), The Institute of Electrical and Electronics Engineers (IEEE) History Center recently recognized **The Nelson River High Voltage Direct Current (HVDC) Transmission System** as a pioneering engineering project in the long distance transmission of electrical power and energy. The Manitoba Electrical Museum, located in Winnipeg, Manitoba, was the site of the Milestone Dedication Ceremony on June 3rd 2005. Members of the IEEE Winnipeg Section together with Manitoba Hydro staff and retirees as well as other organizations that played a part in the project were in attendance. Mr. Bill Kennedy, President of IEEE Canada, unveiled a commemorative plaque that reads:

**IEEE MILESTONE IN ELECTRICAL ENGINEERING AND COMPUTING**

**HIGH VOLTAGE DIRECT CURRENT, 1972**

**On 17 June 1972, the Nelson River High Voltage Direct Current (HVDC) transmission system began delivery of electric power. It used the highest operating voltage to deliver the largest amount of power from a remote site to a city. The bipolar scheme gave superior line reliability and the innovative use of the controls added significantly to the overall system capabilities. Finally, the scheme used the largest mercury arc valves ever developed for such an application.**

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In the 1960s, the key to developing Northern Manitoba's rich hydroelectric resources was finally discovered in the form of long distance high voltage direct current (HVDC) technology. Lower line losses than conventional AC transmission gave HVDC the edge and the system has gone on to prove itself a highly reliable system that is now the backbone of the supply of power and energy, delivering over 75% of the province's electricity output to Manitobans and export customers. Manitoba Hydro has gone on to become world renowned for its expertise and research and development in this field.

Manitoba Hydro's HVDC system consists of two transmission lines carried by two rows of identical steel towers running 895 kilometers from Gillam in northern Manitoba south to the Dorsey converter station close to Winnipeg. One line has its northern terminus at the Radisson converter station close to Gillam and the other extends another 42 kilometers to the Henday converter station. Manitoba Hydro's three largest hydroelectric generating stations are located on the Nelson River at Kettle, Long Spruce, and Limestone, representing a total capacity of 3570 Mw for transmission.

The Government of Canada assisted with a financing agreement to make the project possible. Atomic Energy Canada Ltd. on behalf of the government was responsible for the construction of the project and the primary consultant was Teshmont Consultants LP.

**For Manitoba Hydro: Len Bateman, Bob Brennan**
**For IEEE: Bill Kennedy, Lindsay Ingram, Dr. Ani Gole**

**Nelson River HVDC Mercury Arc Valves**

Construction of the transmission lines began in January 1968 and the first transmission of power took place in June 1972. The two transmission lines, known as Bipole 1 and Bipole 2, consisting of some 4000 guyed steel towers, took about three years to build. Having to traverse large tracts of muskeg country meant that much of the work had to be done during the winter when the ground was frozen.

The three converter stations, comprised of switchyards and converter buildings containing the valves, are extremely large facilities and are the heart of the conversion process. The original Bipole 1 mercury arc valves have now been replaced with solid state thyristor valves.

HVDC transmission of electricity, particularly over such a long distance was relatively new in the late 1960s and '70s. Manitoba Hydro and local engineering consultants specializing in the new technology gained an international reputation for expertise in this technology and visitors from around the world have come to Manitoba to witness the Nelson River system in action. Manitoba consultants and manufacturers have worked on HVDC systems in many parts of the world.

With its high reliability, flexibility of operation, and inherent stability, the Nelson River HVDC Transmission System has proven its worth.

The IEEE Winnipeg Life Members Chapter submitted this Milestone proposal and nomination with the support of Manitoba Hydro staff and retired personnel.

## *About the Author*

**Lindsay Ingram** is a retired Director of the System Planning Division with Manitoba Hydro where he spent 33 years. In retirement, he became Interim Director of the Manitoba HVDC Research Centre located in Winnipeg, followed by consulting assignments. He is currently a volunteer board member of the Manitoba Electrical Museum and is also a Life Member of the IEEE, the Association of Professional Engineers and Geoscientists of the Province of Manitoba, and the Canadian Society for Senior Engineers (CSSE/EIC).