ELECTRIC GENERAL RATE APPLICATION 2015

Manitoba Hydro Undertaking #21

Manitoba Hydro to provide the intended typical average year operation for the Bipoles which achieve equal losses.

Response:

Any year of operation will result in losses being shared equally among the Bipoles.

The typical operation of the HVDC system is such that the generation from the lower Nelson plants is provided to the Northern Collector System (NCS). The Northern Collector System is then used to distribute the generation between the HVDC convertor stations. The HVDC losses consider the transmission loss on the NCS system, DC converter station losses and DC line losses.

Manitoba Hydro generally operates the HVDC system in such a manner that losses are minimized. This is reasonably well estimated by equalizing the current on each of the Bipoles. Losses on each Bipole depends on the equipment characteristics, and will vary with the DC current. NCS losses were considered to be equally shared between Bipoles. Variations in Bipole loading will occur when parts of the converter station are unavailable or when parts of the Northern Collector System is unavailable, thereby reducing the ability to share the load equally among the Convertor Stations.

If current is assumed to be equal in each of the Bipoles, and generation patterns of the lower Nelson plants are assumed to reflect historic generation patterns (hourly loads increased on a pro rata basis to reflect increases in generation capacity connected to the HVDC system) then the average losses on Bipole I are calculated to be 537 GW.h, Bipole II are 542 GW.h and Bipole III are 571 GW.h in 2022 with Keeyask. Bipole III has higher DC line losses due to longer line length. However, this loss is partly offset by the reduced DC station losses due to the advanced HVDC technology. Recognizing that Bipole loading will vary from that assumed for a variety of reasons including outage conditions, losses were assumed to be shared equally among the Bipoles.