

Appendix A: Portfolio Transmission Modelling Process

A.1. Overview of the Transmission System

BC Hydro delivers electric power through an interconnected system consisting of 5,675 km of 500 kV transmission lines plus additional transmission circuits at the 360 kV to 60 kV level, for a total of about 18,000 km of transmission circuit. Figure A.1 “BC Hydro System - Main Generating Plants and Transmission System” shows the 500 kV transmission system and the major generating stations, substations and series capacitor stations.

The 500 kV bulk transmission system delivers the electric power output from the remote hydroelectric generating stations in the north and east to the load centre in southwestern B.C. It also links B.C.’s other load regions such as north coast and Vancouver Island to the main grid, and interconnects the B.C. system to the Alberta and western U.S. systems.

A.2. General Approach

British Columbia Transmission Corporation (BCTC) models the transmission system to determine the 500 kV bulk transmission system additions and reinforcements associated with each portfolio under consideration in the IEP. This modelling is done to:

- Determine the expected power transfers on the 500 kV transmission system at the time of winter peak load in the BC Hydro system for each of the portfolios with their individual forecasted load levels and generation resources over the 20-year period 2003/04 to 2022/23;
- Compare the expected power transfers with the total power transfer capability in various parts of the existing 500 kV transmission system;
- Select the appropriate transmission system reinforcements and their timing as required for each portfolio; and
- Provide cost estimates for the reinforcement projects.

The Power System Simulator for Engineering (PSSE) program is the primary modelling tool used to evaluate the transmission system’s expected steady state and dynamic performance.

For the IEP portfolios, the load forecast (winter peak load in MW) and generation resource additions (winter dependable capacity in MW) were summarized by regions: North Interior, South Interior, Lower Mainland and Vancouver Island. Transmission system losses (capacity in MW) for the Lower Mainland and Vancouver Island were also estimated. Committed uses (firm power transfer obligations) for various transmission service clients and for BC Hydro’s firm exports are included as part of the estimate for the winter peak load hour Interior-to-Lower Mainland power transfer.

For each portfolio, the 500 kV transmission system reinforcements (Interior-to-Lower Mainland and Mainland-to-Vancouver Island transmission) are required when the expected power transfer in the winter peak hour exceeds the transmission path’s capability. Where necessary, future transmission reinforcements are modelled so that their timing coincides with the future major generation additions.

A.3. Reliability Must-Run Generation

BC Hydro's existing bulk transmission system requires that a minimum amount of dependable generation be maintained in the coastal generation region, which includes the Lower Mainland, Bridge River and Vancouver Island areas. For this reason, BC Hydro identifies supply units in the coastal region that are available as reliability must-run (RMR) generation. BCTC considers this information critical to plan for reliable transmission. In other words, an increase in coastal RMR generation defers the need for Interior-to-Lower Mainland transmission upgrades. However, for the reasons discussed below, neither Burrard nor the DSBs are nominated by BC Hydro as RMR generation:

- In order to rely on RMR-nominated generation to defer transmission upgrades, it must be available over the long-term. However, given the uncertainties over the future of Burrard, it is not prudent to count on it for RMR to defer incremental transmission capacity;
- A facility nominated to provide RMR must be made available to the transmission provider to dispatch as it requires. Burrard has a relatively high heat rate and therefore significant operating costs could be incurred if BCTC is forced to dispatch it during periods of high gas prices; and
- The DSBs are a premium heavy load hour product so, as with Burrard, they are a relatively expensive resource to use for RMR generation. Furthermore, the quantity of energy associated with the DSBs is only known with certainty for 5 years and therefore it is not relied upon for planning purposes.

A.4 Assumptions in the Transmission Analysis

The BC Hydro bulk transmission system reinforcements used in the portfolio analysis includes only the changes to the 500 kV transmission system and their estimated costs. With the exception of the Vancouver Island cable link, the reinforcements at lower voltages (230 kV to 63 kV) do not include BCTC's evaluation or transmission cost estimates. Interconnection costs for the generation projects scheduled in the portfolios are included in the project cost estimates.

The firm exports from Lower Mainland to the U.S. system are at 230 MW (per the Seattle City Light agreement) plus a transmission reliability margin (TRM) of 50 MW. BC Hydro has 500 MW of point-to-point transmission capability from B.C. to the U.S. The IEP assumes that this capacity is available for domestic use, which results in the deferment of transmission additions.

The Interior-to-Lower Mainland transmission requirement, when required, was satisfied by the fifth Interior-to-Lower Mainland 500 kV transmission line (Nicola-to-Meridian 5L83). This transmission line would run from Merritt to Coquitlam; its earliest feasible in-service date is F2014. The generation resources in the Lower Mainland and Vancouver Island were assumed to operate at their winter dependable capacity. However, the generation at Burrard was kept at zero for the reasons discussed in section A.3. In the Mainland-to-Vancouver Island transmission system, the firm capability of the HVDC system was assumed to reduce to zero as of F2008. The earliest feasible in-service date for the new 230 kV circuit to Vancouver Island is F2009.

For the Vancouver Island call for tenders, 63 per cent of the new generation was assumed to be located south of Dunsmuir station (near Qualicum), the

supply point for the existing Mainland-to-Vancouver Island 500 kV circuits. This “location” assumption for the Vancouver Island call for tenders affects the amount of shortfall in the Vancouver Island transmission system from Dunsmuir to the south.

For the portfolio where the Downstream Benefit Entitlement (DSB) is scheduled as a resource, 11/14ths of the DSB capacity was designated as an import on the U.S.-to-Lower Mainland ties and the balance as imports at the Nelway intertie in the Southern Interior, near Trail, B.C.

Estimated costs for each reinforcement project in 2003 dollars, were based on BCTC’s 2003/2004 Transmission System Capital Plan. Costs for all expected future 500 kV reinforcements are used in the portfolio analysis, including the projects common to all portfolios. An example of the project, which is common to all the portfolios, is new series compensation on 5L91 planned for F2008. The costs for 500 kV transmission system replacement projects (due to aging system components) and for ongoing operating and maintenance of the existing transmission system are not included in the cost information.

Figure A.1. BC Hydro– Main Generating Plants & Transmission System

