**ALASKA BC INTER-TIE STUDY**

March 3, 2006

In July 2005, BCTC completed the planning report SPA 2005-24, which described a potential extension of the BC Hydro transmission system into the area northwest of Terrace. That report made a preliminary observation that a 287 kV line would be required to serve the predicted area loads.

Were such a line in place, it would create opportunities for interties to be developed between British Columbia and the Alaska panhandle. This report builds on the recommendation of the earlier study and assumes that an intertie would be constructed as a 287 kV tap from the Bob Quinn station to the BC border. The additional costs for the BC portion of this added scope have not been costed in detail, but would be expected to fall between $30M and $120M.

BCTC reiterates that both the planning report SPA 2005-24 and the work done in this study are very preliminary. Before initiating any project to serve loads or undertake an intertie in this area, more robust planning and consultation would need to be completed.

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# Alaska-BC Inter-tie Study

## Project 16239-21-00
## Report # 16239-21-00-3

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# 1 Introduction

There are potential benefits for parties in both South-East Alaska and British Columbia of interconnecting various Alaskan loads and generators to the BC grid. These benefits may include:

- Improved continuity of service to customers due to redistribution of power flows following a contingency or during a planned maintenance outage;
- Improved frequency stability as a result of the increased inertia of the combined power system;
- Improved voltage stability as a result of combined short circuit capability; and
- Trade opportunities.

In order to determine the feasibility of a likely Inter-tie route, and to focus the effort of future more detailed planning efforts, a limited study is carried out in this project to determine the likely transfer capabilities for a range of net area loads and generation. The studied route is from Terrace, BC to Tyee Lake in SE Alaska. This route generally follows Highway 37 to the Iskut River, then west to the Craig River, and then southwest to the Bradfield Canal.

# 2 The Studied Case

The studied case is based on a BCTC's 2009 heavy winter condition modified as follows:

- A 287 kV line added from Skeena to Bob Quinn with 40% series compensation.
- A 287 kV line tap added from Bob Quinn to the BC-Alaska border (approximately the same length as that between Meziadin to Bob Quinn).
- Potential hydro generation connected to Meziadin 138 kV bus.
- Zero to 250 MW load added at Bob Quinn 287 kV bus, in steps of 50 MW, to represent the demand by likely mining developments in northern BC.
- A ±40 MVAR Static Synchronous Compensator (STATCOM) assumed at Bob Quinn 287 kV bus for voltage support.
- Alaska system modeled as a variable source at the BC-Alaska border to be used for determination of the maximum aggregate transfer into BC at this point.
- A variable load (i.e., sink) added at Skeena 500 kV bus to offset the injection by Alaska source.

The study is based on static analysis using the Voltage Security Assessment Tool (VSAT) only. It considers voltage stability limits, bus voltage violations of ±5% change between pre- and post-contingency situations, and branch thermal overloads against rating A (i.e., 750 MVA for the 287 kV line from Bob Quinn to Meziadin and 584 MVA from Meziadin to Skeena) for the region between the inter-tie and the nearest point on the BC 500 kV network (i.e., Skeena). It does not consider the ability of the BC system to transmit this power to loads or impacts on power flow beyond the nearest point.

The following single contingencies are applied:

1. Outage of the line from SKA287 to MIN287.
2. Outage of the line from SKA287 to RUP287.
3. Outage of one of the two transformers from SKA287 to SKA138.
4. Outage of one of the two transformers from SKA287 to SKA 66.
5. Outage of the transformer from AYH287 to AYH138.
6. Outage of the transformer from MEZ138 to MEZ25VRS.
7. Outage of the line from MEZ138 to STW138.

A single line diagram of the region of study is shown in Figure 1, representing the maximum expected generation at BC-Alaska border (bus 90000), which is 200 MW.

# 3 Transfer Limits

Transfer limits are computed for various Bob Quinn loads, with and without potential hydro generation, as shown in Table 1. Voltage stability limits indicate the system collapse for the worst contingency. Voltage decline limits correspond to larger than 5% voltage reduction after the worst contingency. In all cases the worst contingency is the first applied contingency, and the largest voltage change occurs at RUP287 bus. Note that there is no voltage rise problem. Furthermore, the 138:287 kV transformer at Meziadin is the only branch that shows significant overload when potential hydro generation is at 112 MW output, i.e., up to 113% in various cases. However, this overload exists even without any injection at the BC-Alaska border (the transformer rating of 110.4 MVA needs to be re-examined).

*Table 1: Various Limits of Alaska Generation Transfer to BC.*

| Bob Quinn Load (MW) | Without potential hydro Generation | | Potential hydro Generation @ 112 MW | |
|---|---|---|---|---|
| | Voltage Stability Limit (MW) | Voltage Decline Limit (MW) | Voltage Stability Limit (MW) | Voltage Decline Limit (MW) |
| 0 | 430 | 410 | 360 | 340 |
| 50 | 450 | 440 | 380 | 370 |
| 100 | 460 | – | 390 | 380 |
| 150 | 470 | – | 400 | – |
| 200 | 470 | – | 410 | – |
| 250 | 460 | – | 400 | – |

# 4 Conclusion

Table 1 indicates that the lowest transfer limit is 340 MW before applying any security margin, which corresponds to having 112 MW potential hydro generation connected to Meziadin 138 kV bus and minimum load at Bob Quinn. Considering the 200 MW maximum expected generation from Alaska, it appears that sufficient voltage security margin exists for the studied configuration.

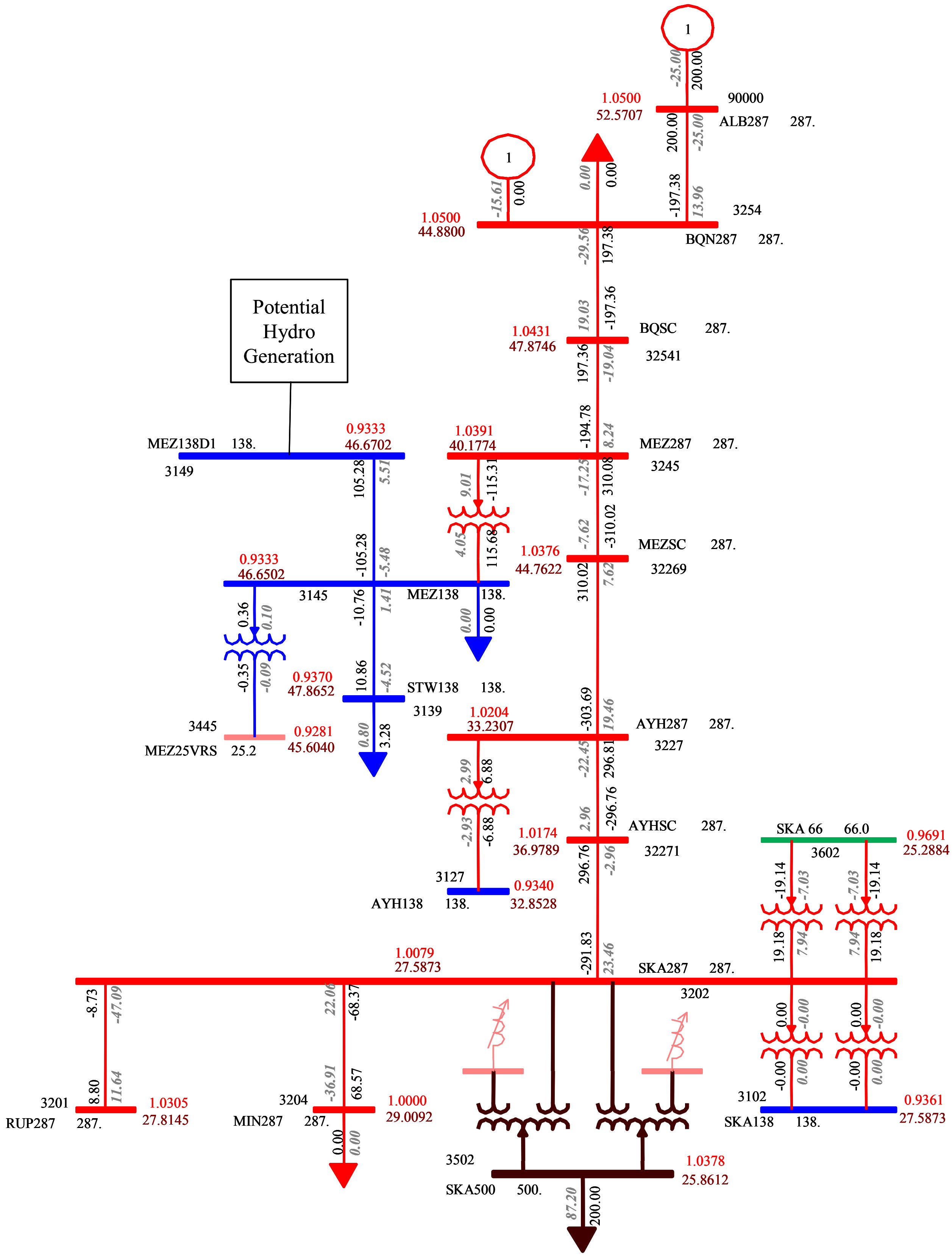


*Figure 1: Single line Diagram of the Studied Region – No Load at Bob Quinn, 112 MW Potential Hydro Generation Connected to Meziadin 138 kV Bus, and 200 MW Alaska Generation Offset by 200 MW Load at Skeena.*