



**System Impact Study for
Designation of Powell River (38 MW) as Network Resource
under Network Integration Transmission Service**

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Prepared by: **Bruce Chen** May 17, 2012
Senior Engineer, Growth Capital Planning, BC Hydro Date

Reviewed by: **Kevin Zhang** May 17, 2012
Senior Engineer, Growth Capital Planning, BC Hydro Date

Approved by: **Wah Shum** May 23, 2012
Manager, Growth Capital Planning, BC Hydro Date

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Executive Summary

This System Impact Study (SIS) identifies the required system reinforcement associated with Transmission Service Request (TSR) 75651301 that designated the 38 MW Power River (POW) G12 generator as a Network Resource.

Unlike other Network Resources, there will be no net power injection from this resource into the BC Hydro Transmission System under normal operating conditions due to the large load at the Powell River paper mill, the generator owner. Occasional energy injection from this Network Resource may occur when BC Hydro transmission capacity from Powell River to Malaspina is available. This System Impact Study identifies the generation restrictions/shedding/run-back remedial action schemes (RAS) that are needed to avoid any transmission line upgrades associated with the Network Integration Transmission Service (NITS). For the purposes of assessing the NITS requirements, there is no power flow out of the POW mill into the BC Hydro transmission system when modeling normal system conditions.

To accommodate the Designation of the POW 38 MW generator G12 as a Network Resource, this System Impact Study has identified the following requirements:

- A generation restriction/run-back scheme is required to curtail the total Powell River generation output in case of an overload on circuit 2L48 (SAY-MSA). An overload up to 110% initiates the generation run-back scheme and should be mitigated within 30 minutes.
- A generation shedding remedial action scheme (RAS) is required to mitigate an overload of 110% or more on circuit 2L48 (SAY-MSA) for over 20 seconds. The Powell River G12 generator was tripped in this study, which could be replaced by other generating units. If so, a further operational study would be needed. Also, the RAS initiation time requirement of 20 seconds will also be verified in the operational study.
- In case of the 132 kV line 1L48 open ended at SAY, a Direct Transfer Trip (DTT) to Powell River circuit breakers (BCH CB No. 1 and BCH CB No. 2) is required if this DTT has not been implemented as part of an earlier project.
- In case of the 230 kV line 2L48 open ended at SAY or MSA, a Direct Transfer Trip (DTT) to Powell River circuit breakers (BCH CB No. 1 and BCH CB No. 2) is required if this DTT has not been implemented as part of an earlier project.
- There is a Lower Mainland Under-Voltage Load Shedding RAS (LM UVLS) that needs to be reviewed and updated to accommodate the POW 38 MW NITS designation. BCH P&C Engineering will conduct an area system review study and BCH will create a project to incorporate the study recommendations.

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1.0 Introduction

This System Impact Study (SIS) identifies the generation restrictions/shedding/run-back remedial action schemes (RAS) that are needed to avoid any transmission line upgrades associated with Transmission Service Request (TSR) 75651301 that designated the 38 MW Power River (POW) G12 generator as a Network Resource. The POW 38 MW Network Resource has been included in the BC Hydro 2011 NITS data updates via BRP and CRP1/CRP2.

The designation of the 38 MW of generating capacity from POW G12 as a Network Resource is the result of BC Hydro executing an Electricity Purchase Agreement (EPA) with the generator owner through BC Hydro’s Integrated Power Offer (IPO) program. The 38 MW of generating capacity is associated with upgrade work done on the POW G12 generating unit. The capacity deemed to be delivered to BC Hydro under the EPA is net of the hourly generator baseline (GBL) that varies by season. Normally, there will not be any net flow of power from the pulp mill (POW) into the BC Hydro system under normal operating conditions due to the large mill load.

Figure 1 shows the interconnection of the customer owned POW substation into the BCH Transmission System.

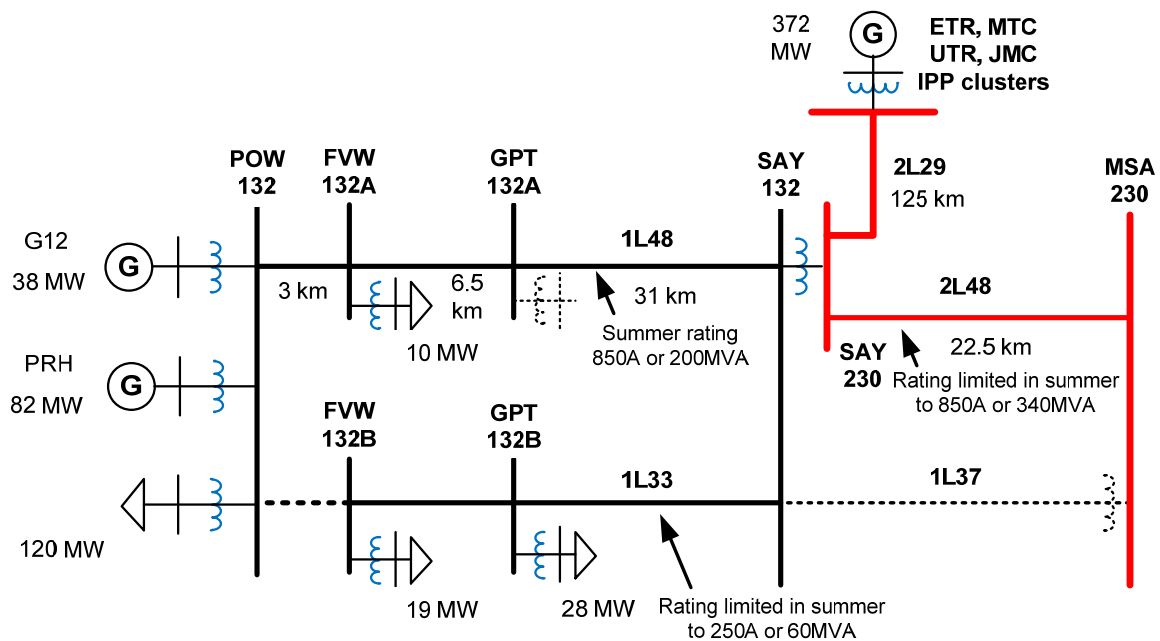


Figure 1 – MSA to POW transmission diagram under system normal operating condition.

2.0 Purpose of Study

The purpose of this System Impact Study is to assess the impact of the 38 MW power injection from POW G12 generating unit on the BCH Transmission System including the substation facilities. This SIS is to identify the generation restrictions/shedding/run-back RAS required to

avoid any transmission line upgrades associated with the Designation as a Network Resource of the POW 38 MW generation.

3.0 Terms of Reference

The study investigates and addresses the voltage and overloading issues of the BCH transmission network in the vicinity of Powell River and Malaspina area as a result of the POW 38 MW power injection. Topics studied include equipment thermal loading and rating requirements, system transient stability and voltage stability, transient over-voltage and high level remedial action scheme requirements. BCH planning methodology will be applied to this study.

4.0 Assumptions

The powerflow conditions studied are represented by base cases that include generation, transmission facilities, and load forecast applicable to this project. Applicable seasonal conditions and appropriate study years for the study horizon are to be incorporated. The 2012 heavy winter, heavy summer and light summer load flow cases have been selected for this study.

Powell River generating station is an existing facility. In 2002, BCH conducted an Interconnection Impact Study to assess POW's export of 80 MW to BCH system and the results are outlined in BCH Report No. RSP2002-01. There have been no material changes to POW generators since then; therefore the transient stability study results from the 2002 Interconnection Impact Study were used in this POW 38 MW NITS designation study.

5.0 System Studies

Power flow and transient stability studies were carried out to evaluate the impact of the proposed POW G12 38 MW NITS designation.

5.1 Steady State Pre-outage Power Flows

Pre-outage power flows were prepared to assess the impact of the POW 38 MW NITS designation using three basic system load conditions: 2012 winter peak load, summer light load and summer peak load.

Powell River is a paper mill with a mix of generation and load facilities. The existing operation of these facilities results in the power on 1L48 normally flowing from the Saltery Bay station (SAY) to Grief Point (GPT), to Forestview (FVW) and on to the Powell River (POW) mill. This NITS designation is for export of 38 MW from Powell River to BCH, but the agreement with the generator owner is that normally power will not flow out of POW towards GPT/FVW/SAY. The gross load at POW normally exceeds the total POW generating capacity of 121.4 MW. The Designation of 38 MW of POW generator G12 as a Network Resource for supplying BC Hydro's aggregate Network

Load will not normally reverse the direction of power flow on 1L48 between Powell River and Grief Point.

Normal mode of operation in this part of the network is Powell River connecting to the grid via 1L48, with a section of 1L33 between Powell River and Forestview normally open. This study assumes that 1L33 between Powell River and Forestview will remain open. Should there be an outage on 1L48, the POW G12 38 MW capacity could be delivered via circuit 1L33 without overloading that circuit. The 1L48 thermal rating is about 3.5 times greater than that of 1L33.

In the Toba Valley area, 125 km north of Saltery Bay (SAY) substation, two IPPs were added in July 2010, East Toba (ETR) 147 MW and Montrose (MTC) 88 MW. In addition, there will be two new IPPs entering service in January 2014, Upper Toba (UTR) 64 MW and Jimmie Creek (JMC) 73 MW. Therefore, there is a total generation addition of 372 MW that is interconnected to the BCH transmission system and transferred through 2L48. Circuit 2L48 has a summer (30 deg C ambient temperature) thermal rating of 848 Amp (about 340 MW). This means that, under some system conditions, circuit 2L48 could become overloaded.

As a result, the power transfer must be curtailed under some operation scenarios. A generation restriction/run-back scheme will be required to curtail the total Powell River generation output to quickly eliminate any overloading of circuit 2L48.

5.2 Power Flow Based First Contingency Study

Power flow-based single-contingency (N - 1) studies have been conducted to confirm that the post-disturbance system performance including bus voltage deviation and facility loading meets the planning criteria under different system load conditions including 2012 heavy winter, heavy summer and light summer.

The study indicates that contingencies within POW substation that result in a decrease in net load, may overload circuit 2L48. The mill owner advised that the largest net load loss could be as high as 40 MW.

A generation shedding RAS will be required to mitigate an overload of 110% or more on circuit 2L48 (SAY-MSA). The generation shedding RAS is to shed 40 MW of Powell River generation. This study identifies the generation shedding RAS to trip Powell River G12 generator, which could be replaced by other generating units if so requested by the customer.

5.3 Transient Stability Study

In 2002, BCH conducted an Interconnection Impact Study to assess POW's export of 80 MW to the BCH system and the results are included in BCH Report No. RSP2002-01. There have been no material changes to POW generators since then; therefore, the POW

transient stability study results from the 2002 interconnection impact study are used in this POW 38 MW NITS designation study.

The 2002 interconnection impact study identified a need for a transfer trip from MSA to POW circuit breakers (BCH CB No. 1 and BCH CB No. 2), to remove POW generation when the 132 kV line at MSA is open ended.

Later BC Hydro conducted a study in 2006 for building a new Sallery Substation (SAY) between POW and MSA. SAY went into service in 2010. To accommodate the new SAY, the transfer trip RAS to Powell River circuit breakers (BCH CB No. 1 and BCH CB No. 2) should be modified to shed POW generation under the following contingencies:

- a. When the 132 kV line 1L48 is open ended at SAY.
- b. When the 230 kV line 2L48 is open ended at SAY or MSA.

In addition, there is an existing Lower Mainland Under-Voltage Load Shedding RAS (LM UVLS), which needs to be reviewed and updated to accommodate the POW 38 MW NITS designation.

BCH P&C Engineering will conduct an area system review study and BCH will create a project to incorporate the study recommendations after the study is completed.

5.4 Upgrade Requirements

In order to accommodate the Designation of POW 38 MW generation as Network Resource, the generation restrictions/shedding/run-back RAS are proposed in lieu of transmission line upgrades.

6.0 **Conclusions**

To accommodate the Designation of POW 38 MW generation as Network Resource, this System Impact Study has identified the following requirements:

- A generation restriction/run-back scheme is required to curtail the total Powell River generation output in case of an overload on circuit 2L48 (SAY-MSA). An overload up to 110% initiates the generation run-back scheme and should be mitigated within 30 minutes.
- A generation shedding remedial action scheme (RAS) is required to mitigate an overload of 110% or more on circuit 2L48 (SAY-MSA) for over 20 seconds. The Powell River G12 generator was tripped in this study, which could be replaced by other generating units. If so, a further operational study would be needed. Also, the RAS initiation time requirement of 20 seconds will also be verified in the operational study.
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