



**British Columbia Transmission
CORPORATION™**

**Facilities Study for
Columbia Power Corporation's
Twenty-Year Transfer Applications on
the
BCHA × BPAT Path**

**Report No: SPA2004-06
21 May 2004**

System Performance Assessment Department

Executive Summary

Columbia Power Corporation (CPC) submitted the following Completed Applications for Long Term Firm Point-to-Point (LTFPtP) transmission service on the BCHA x BPAT Path:

OASIS #	Time Stamp	Amount	Term (revised on 26 November 2003)
620107	12 Mar 02	75 MW	20 year (1 Aug 2006 – 1 Aug 2026)
620109	13 Mar 02	50 MW	20 year (1 Aug 2006 – 1 Aug 2026)
620115	14 Mar 02	25 MW	20 year (1 Aug 2006 – 1 Aug 2026)

On 06 February 2004, British Columbia Transmission Corporation (BCTC) posted the “System Impact Study for Columbia Power Corporation’s Twenty Year Transfer Applications on the BCHA x BPAT Path, Report No. SPA2003-10”

https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/suppliers/transmission-system/engineering_studies_data/studies/interregional/CPC150MW_620107_109_115_SIS_final.pdf.

The System Impact Study (SIS) concluded that:

1. The existing long-term firm Available Transfer Capability (ATC) on the BCHA x BPAT Path is 0 MW.
2. OASIS # 620107, 620109, and 620115 can be accommodated by upgrading BC Hydro’s transmission network.
3. These Network Upgrades will be necessary whether one or all of the above OASIS applications are approved:

ATC	Incremental Reinforcements
> 0 MW ≤ 170 MW	<ul style="list-style-type: none"> • Series capacitor bank on 5L82 upgraded for 3.3 kA operation • Series capacitor bank on 5L41 & 5L42 upgraded for 3 kA operation • Summer ratings of 5L42 upgraded to 3 kA • Summer rating of 2L1 upgraded to 0.98 kA • Replace 5L44 2.0 kA circuit breaker (5CB11 at Ingledow Station) with a 3.0 kA circuit breaker • Addition of 1 × 250 MVAR and 1 × 250 MVAR mechanically switched shunt capacitors at Ingledow 500 kV Station and

ATC	Incremental Reinforcements
	Meridian 500 kV Station <ul style="list-style-type: none"> • Replace two 672 MVA 230/500 kV transformers at Selkirk Station with two 1200 MVA 230/500 kV transformers (T3 earliest in-service date, T2 needed in 2014) • 50% series compensation of 5L91 for 3.0 kA operation (needed in 2010 for up to 28 MW ATC, in 2009 for up to 50 MW ATC, and earliest in-service date for more than 50 MW ATC) • 50% series compensation of 5L98 for 3.0 kA operation (needed in 2010 for up to 28 MW ATC, in 2009 for up to 50 MW ATC, and earliest in-service date for more than 50 MW ATC)

4. Various Remedial Action Schemes (RAS) are required for Undervoltage-Load-Shedding, Direct Load Shedding, and Transfer Trip for multi-contingency events.

At the request of the applicant, BCTC conducted this Facilities Study to estimate the cost and schedule of the Network Upgrades and to determine CPC's share of the costs. During the Facilities Study, an improved plan for providing the required transformer capacity at Selkirk Station was developed. Based on the new plan, the existing Selkirk transformers T2 and T3 will be paralleled and a new 1200 MVA transformer will be added at the earliest in-service date. There will be no further transformer additions in Selkirk Station. This option will cost \$16.3 M less than the Selkirk transformer replacement option identified in the System Impact Study report. In addition, this plan will minimize transformer outage time.

It is concluded that the requested transmission service can be granted by 31 October 2007 provided that the upgrade projects commence no later than 01 September 2004. The estimated cost of the Network Upgrades, including the new Selkirk Transformer replacement plan, is \$134.0 M. CPC is responsible for the total cost. All costs are capital direct inflated, include overhead and interest during construction, and are accurate within +/- 35%.

Table of Contents

1. INTRODUCTION	5
2. TERMS OF REFERENCE	6
3. SYSTEM STUDY CONDITIONS	6
4. RESOURCES FOR TRANSMISSION REQUEST	6
5. PROJECT AND TRANSMISSION SERVICE RISKS	7
6. COSTS AND SCHEDULES	7
7. CONCLUSIONS	8
APPENDIX 1	9

1. Introduction

In March 2002, CPC submitted three Wholesale Transmission Service Applications (WTSA) for LTFPtP Transmission Service on the BCHA × BPAT Path between 1 August 2006 and 1 August 2026. In response to these applications, on 06 February 2004, BCTC posted the “System Impact Study for Columbia Power Corporation’s Twenty Year Transfer Applications on the BCHA x BPAT Path, Report No. SPA2003-10”

https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/suppliers/transmission-system/engineering_studies_data/studies/interregional/CPC150MW_620107_109_115_SIS_final.pdf.

The SIS was based on the previous planning reports and drew the following conclusions:

- 1) The existing long-term firm Available Transfer Capability (ATC) on the BCHA x BPAT Path is 0 MW.
- 2) OASIS # 620107, 620109, and 620115 can be accommodated by upgrading BC Hydro’s transmission network.
- 3) These Network Upgrades will be necessary whether one or all of the above OASIS applications are approved:

ATC	Incremental Reinforcements
<p>> 0 MW ≤ 170 MW</p>	<ul style="list-style-type: none"> • Series capacitor bank on 5L82 upgraded for 3.3 kA operation • Series capacitor bank on 5L41 & 5L42 upgraded for 3 kA operation • Summer ratings of 5L42 upgraded to 3 kA • Summer rating of 2L1 upgraded to 0.98 kA • Replace 5L44 2.0 kA circuit breaker (5CB11 at Ingledow Station) with a 3.0 kA circuit breaker • Addition of 1 × 250 MVAR and 1 × 250 MVAR mechanically switched shunt capacitors at Ingledow 500 kV Station and Meridian 500 kV Station • Replace two 672 MVA 230/500 kV transformers at Selkirk Station with two 1200 MVA 230/500 kV transformers (T3 earliest in-service date, T2 needed in 2014) • 50% series compensation of 5L91 for 3.0 kA operation (needed in 2010 for up to 28 MW ATC, in 2009 for up to 50 MW ATC, and earliest in-service date for more than 50 MW ATC) • 50% series compensation of 5L98 for 3.0 kA operation (needed in 2010 for up to 28 MW ATC, in 2009 for up to 50 MW ATC, and earliest in-service date for more than 50 MW ATC)

- 4) Various RASs are required for Undervoltage-Load-Shedding, Direct Load Shedding, and Transfer Trip for multi-contingency events.

On 05 March 2004, CPC signed a Facilities Study Agreement with BCTC. At the request of the applicant, BCTC conducted this Facilities Study to estimate the cost and schedule of the Network Upgrades and to determine CPC's share of the costs.

2. Terms of Reference

This Facilities Study is based on the "System Impact Study for Columbia Power Corporation's Twenty Year Transfer Applications on the BCHA x BPAT Path, Report No. SPA2003-10"

3. System Study Conditions

The base study conditions for OASIS requests # 620107, 620109, and 620115 were published in the "System Impact Study for Columbia Power Corporation's Twenty Year Transfer Applications on the BCHA x BPAT Path, Report No. SPA2003-10".

Among the Network Upgrades identified in the SIS report are replacement of two 672 MVA 230/500 kV transformers T3 and T2 with two 1200 MVA transformers at Selkirk Station (T3 earliest in-service date, T2 needed in 2014). Total cost of transformer replacement was estimated at \$32.8 M and it would require approximately five months outage time for T2 replacement in 2014.

During the Facilities Study, Selkirk transformer replacement project was revisited to examine feasibility of a more cost-efficient alternative for providing transformer capacity. It was concluded that CPC's request would be met with paralleling T2 and T3 and adding one new 1200 MVA transformer at the earliest in-service date. This plan eliminates the need for another 1200 MVA transformer in 2014. Total cost of this preferred alternative solution is estimated at \$16.5 M and it will not require lengthy outages.

4. Resources for Transmission Request

The Point-of-Receipt (POR) and Point-of-delivery (POD) for OASIS requests # 620107, 620109, and 620115 were identified in the "System Impact Study for Columbia Power Corporation's Twenty Year Transfer Applications on the BCHA x BPAT Path, Report No. SPA2003-10".

5. Project and Transmission Service Risks

The estimated capital costs of the specified Network Upgrades have feasibility level of accuracy (+/- 35%). Consequently, some uncertainty in the customer share of the costs should be expected.

6. Costs and Schedules

Table 6.1 shows the estimated cost of Network Upgrades and the expected in-service date (ISD) for the CPC's requests. All cost items are capital direct inflated Dollars and include overhead and interest during construction expenses. The ISDs are based on the earliest achievable project completion date assuming that all projects will start on 1 September 2004.

Description	Proj ShortName	ISD	Cost
Series Capacitors			
AMC (5L82) upgraded to 3.0 kA nominal	N3AMCCX2	31-Oct-06	\$ 15,281,591
CHP (5L41) upgraded to 2.73 kA nominal	N3CHPCX	31-Oct-06	\$ 8,299,737
CRK (5L42) upgraded to 2.73 kA nominal	N3CRKCX	31-Oct-06	\$ 3,249,516
5L91 Series Compensation to 50%	N3L91CX3	31-Oct-07	\$ 28,212,272
5L98 Series Compensation to 50%	N3L98CX3	31-Oct-07	\$ 49,460,701
Line Upgrades			
2L1 upgraded to 0.98 kA Summer	N32L01U	Jan 31/06	\$ 549,945
5L42 upgraded to 3.0 kA Summer	N35L42U	Jan 26/06	\$ 1,183,239
Circuit Breaker Upgrades			
ING 1 x 3 kA CB (5L44, 5CB11)	N3INGCBB	30-Nov-06	\$ 2,000,435
Switched Shunt Capacitors			
ING 1 x 250 MVAR 500 kV CX	N3INGSC1	30-Nov-06	\$ 4,572,516
MDN 1 x 250 MVAR 500 kV CX	N3MDNCX1	30-Nov-06	\$ 4,760,481
Transformer Upgrades			
1200 MVA SEL T4 addition, T2&T3 Paralleling	N3SELT4	31-Oct-06	\$ 16,458,209
Total			\$134,028,642

Table 6.1

Appendix 1 shows the cash flow for the above transmission upgrades.

7. Conclusions

It is concluded that the requested transmission service can be granted by 31 October 2007 provided that the Network Upgrade work commences no later than 01 September 2004. The estimated cost of the specified Network Upgrades is \$134.0 M. CPC is responsible for the total cost. The cost estimate is accurate within +/- 35%.

Appendix 1

The following table shows the cash flow of the Network Upgrade projects.

Description	Total Cost	Overhead	IDC	Year 1 2004/05	Year 2 2005/06	Year 3 2006/07	Year 4 2007/08	Year 5 2008/09
Series Capacitors								
AMC (5L82) upgraded to 3.0 kA nominal	\$15,281,591	\$853,797	\$197,094	\$162,600	\$2,454,800	\$11,613,300	\$0	\$0
CHP (5L41) upgraded to 2.73 kA nominal	\$8,299,737	\$463,450	\$110,987	\$129,700	\$1,334,800	\$6,260,800	\$0	\$0
CRK (5L42) upgraded to 2.73 kA nominal	\$3,249,516	\$179,925	\$71,291	\$107,200	\$873,500	\$2,017,600	\$0	\$0
5L91 Series Compensation to 50%	\$28,212,272	\$1,514,599	\$1,454,073	\$716,100	\$4,028,200	\$10,511,300	\$9,988,000	\$0
5L98 Series Compensation to 50%	\$49,460,701	\$2,639,955	\$2,822,046	\$1,313,600	\$8,859,100	\$18,940,100	\$14,885,900	\$0
Line Upgrades								
2L1 upgraded to 0.98 kA Summer	\$549,945	\$30,540	\$9,805	\$69,700	\$439,900	\$0	\$0	\$0
5L42 upgraded to 3.0 kA Summer	\$1,183,239	\$65,741	\$21,798	\$157,100	\$938,600	\$0	\$0	\$0
Circuit Breaker Upgrades								
ING 1 x 3 kA CB (5L44, 5CB11)	\$2,000,435	\$110,550	\$47,185	\$95,600	\$468,300	\$1,278,800	\$0	\$0
Switched Shunt Capacitors								
ING 1 x 250 MVAR 500 kV CX	\$4,572,516	\$254,442	\$77,174	\$22,600	\$922,000	\$3,296,300	\$0	\$0
MDN 1 x 250 MVAR 500 kV CX	\$4,760,481	\$287,163	\$128,918	\$110,000	\$709,700	\$3,524,700	\$0	\$0
Transformer Upgrades								
1200 MVA SEL T4 addition, T2&T3 Parallel	\$16,458,209	\$900,422	\$551,287	\$740,800	\$3,442,000	\$10,823,700	\$0	\$0