



**System Impact Study for
Transfer Applications on the
AESO × BCTC Path
1 November 2006 – 1 May 2010**

Report No: SPA2006-7
August 2006

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Executive Summary

The following applications for Long Term Firm Point-to-Point (LTFPtP) transmission service on the AESO x BCTC Path were submitted to British Columbia Transmission Corporation (BCTC):

OASIS #	Time Stamp	Customer	Amount	Term
70604537	16 Dec. 2005	BCPS	100 MW	1 year (1 May 2006 – 1 May 2007)
70610287	20 Dec. 2005	BCPS	50 MW	1 year (1 Nov 2006 – 1 Nov 2007)
70610289	20 Dec. 2005	BCPS	50 MW	1 year (1 May 2007 – 1 May 2008)
70610293	20 Dec. 2005	BCPS	50 MW	1 year (1 Nov 2007 – 1 Nov 2008)
70610309	20 Dec. 2005	BCPS	50 MW	1 year (1 May 2008 – 1 May 2009)
70610313	20 Dec. 2005	BCPS	50 MW	1 year (1 Nov 2008 – 1 Nov 2009)
70610317	20 Dec. 2005	BCPS	50 MW	1 year (1 May 2009 – 1 May 2010)

These applications are based on the assumption that in BC the Network Resources in Seven Mile Generating Station (SEV) will be reduced and will be substituted by the requested import to serve the Network Load.

In response to the first application, BCTC released “System Impact Study for One-Year Transfer Application on the AESO x BCTC Path 1 May 2006 – 1 May 2007 (Report No. SPA2006-05)”. The current System Impact Study (SIS) is in response to the aggregate of the above applications in accordance with the Open Access Transmission Tariff (OATT). This SIS reviews importing 150 MW to 400 MW on AESO x BCTC path from 1 November 2006 to 1 May 2010. It only addresses the capability of the BCTC’s transmission grid and does not consider capabilities of adjacent systems.

The starting conditions for this SIS are: BCTC’s studies of the 2004 Network Integrated Transmission Services request (NITS2004), BC Hydro’s native load requirements, existing “General Wheeling Agreement” (GWA) transfer rights, and prior firm Point-to-Point commitments on the AESO x BCTC Path.

In this SIS, it is concluded that:

- 1- With 24290 MJ minimum on-line rotational energy of BC Hydro and Fortis BC, OASIS #70604537 can be accommodated between 1 September 2006 and 31 March 2010¹.
- 2- OASIS # 70604537 and 70610287 can be accommodated if the minimum on-line rotational energy of BC Hydro and Fortis BC is increased to approximately 25000 MJ.
- 3- OASIS # 70604537 and 70610287 and 70610289 can be accommodated if the minimum on-line rotational energy of BC Hydro and Fortis BC is increased to approximately 30000 MJ.
- 4- OASIS # 70604537 and 70610287 and 70610289 and 70610293 can be accommodated if the minimum on-line rotational energy of BC Hydro and Fortis BC is increased to approximately 30000 MJ.
- 5- OASIS # 70604537 and 70610287 and 70610289 and 70610293 and 70610309 can be accommodated if the minimum on-line rotational energy of BC Hydro and Fortis BC is increased to approximately 30000 MJ.
- 6- OASIS # 70604537 and 70610287 and 70610289 and 70610293 and 70610309 and 70610313 can be accommodated if the minimum on-line rotational energy of BC Hydro and Fortis BC is increased to approximately 35000 MJ.
- 7- OASIS # 70604537 and 70610287 and 70610289 and 70610293 and 70610309 and 70610313 and 70610317 can be accommodated if the minimum on-line rotational energy of BC Hydro and Fortis BC is increased to approximately 45000 MJ.
- 8- To accommodate these requests during peak flow hours, reduction of generation in SEV should leave at least 1220 MW pre-contingency generation in the South Interior East (SIE) region. The required minimum generation is within the nameplate capacity of the remaining SIE generators.
- 9- The requested flows on the AESO x BCTC path will not exceed the capacity of the Alberta – BC inter-ties.

¹ Between 1 May 2006 and 31 August 2006 only 15 MW of OASIS # 70604537 can be accommodated.

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1. Introduction

The following Wholesale Transmission Service (WTS) applications for importing LTFPtP power from Alberta to BC Hydro's network on the AESO × BCTC path is processed in accordance with BCTC's OATT:

OASIS #	Time Stamp	Customer	Amount	Term
70604537	16 Dec. 2005	BCPS	100 MW	1 year (1 May 2006 – 1 May 2007)
70610287	20 Dec. 2005	BCPS	50 MW	1 year (1 Nov 2006 – 1 Nov 2007)
70610289	20 Dec. 2005	BCPS	50 MW	1 year (1 May 2007 – 1 May 2008)
70610293	20 Dec. 2005	BCPS	50 MW	1 year (1 Nov 2007 – 1 Nov 2008)
70610309	20 Dec. 2005	BCPS	50 MW	1 year (1 May 2008 – 1 May 2009)
70610313	20 Dec. 2005	BCPS	50 MW	1 year (1 Nov 2008 – 1 Nov 2009)
70610317	20 Dec. 2005	BCPS	50 MW	1 year (1 May 2009 – 1 May 2010)

These applications are based on the assumption that in BC the Network Resources in SEV will be reduced and will be substituted by the requested import to serve the Network Load.

The first request was studied in the SIS report SPA2006-5. It concluded that OASIS # 70604537 can be accommodated after 31 August 2006 providing that the pre-contingency SIE generation remains above 1220 MW. This SIS assumes automatic rollover of OASIS # 70604537 and reviews the system conditions that are required for importing 50 – 300 MW increments on the AESO x BCTC path between 1 November 2006 and 1 May 2010.

2. Terms of Reference

Review of the submitted OASIS requests is conducted with reference to the following five BCTC documents:

1- "Facilities Study For BC Hydro Distribution NITS 2004, Report # SP2005-26, September 2005" (NITS2004-FS).

<http://www.bctc.com/NR/rdonlyres/86705D4D-0560-4A56-AAB1-5F9FA32ADDF9/0/SP200526Final2.pdf>

2- "System Impact Study For BC Hydro Distribution NITS 2004 - Stage 3 (Final) Revision-1, Report # SP2005-06, May 2005" (NITS2004-SIS-Stage3).

http://www.bctc.com/NR/rdonlyres/7242916C-A344-434E-8C4E-5B27108ADB9B/0/SIS_Stage3Revision1.pdf

3- "System Impact Study For BC Hydro Distribution NITS 2004 - Stage 1 - Preliminary Results, Report # SP2005-04, February 2005".

http://www.bctc.com/NR/rdonlyres/F2EABDC9-2A4D-4FA6-8C3F-9D8692B1ADA0/0/BCH_NITS2004_SIS_Stg1.pdf

4- Real Time Operations SOO 7T-17 on BC – Alberta Interconnection, Revision date: 26 April 2006.

<http://www.bctc.com/NR/rdonlyres/4F9D4A14-9835-41C6-BD89-C62FF5CCBA4B/0/7t17.pdf>

5- Real Time Operations System Operating Order (SOO) 7T-34 on South Interior Generation Shedding and Outage Requirements, Effective date: 3 May 2006.

6- Real Time Operations System Operating Order (SOO) 7T-64 on BCTC Transfer Limits, Revision date: 9 September 2005.

7- System Impact Study for One-Year Transfer Application on the AESO × BCTC Path, 1 May 2006 – 1 May 2007, Report No: SPA2006-5, June 2006

3. Resources for Transmission Request

The Point-of-Receipt (POR) will be BC - Alberta border on the AESO x BCTC Path. Point-of-Delivery (POD) will be BC Hydro's Network Load. Alberta generators are the resources for this request.

4. System Study Conditions

Review of the OASIS request # 70604537, 70610287, 70610289, 70610293, 70610309, 70610313, and 70610317 is based on the following network conditions:

- BC Hydro's December 2005 load forecast.
- Total Transfer Capability (TTC) of the 5L91-5L96-5L98 cut-plane without using any generation shedding Remedial Action Scheme (RAS): 1850 MW.
- The existing General Wheeling Agreement (GWA) with Fortis BC on transfer rights.
- The minimum on-line rotational energy to serve light hour loads in BCTC and Fortis BC: 24290 MJ
- Automatic rollover of OASIS # 311567 LTFPtP transfer on the AESO x BCTC path: 101 MW
- OASIS # 1457456 Short Term FPtP transfer on the AESO x BCTC path between 01 October 2005 and 31 August 2006: 134 MW
- Teck Cominco Scheduling rights: 370 MW
- Designated Return of Down Stream Benefits (DSBr) as per Table 1:

Table 1

F2007	F2008	F2009	F2010	F2011 and after
1244.3 MW	1240.9 MW	1245.2 MW	1400.0 MW	1400.0 MW

- Transmission Reliability Margin (TRM) on the AESO x BCTC path: 65 MW
- Transfer limit from Alberta to BC for system normal: 1000 MW

5. Project and Transmission Service Risks

Content of this document contains some uncertainty in terms of the load forecast, cut-plane limits, and the amount of available on-line rotational energy.

6. Analysis

The import capability into the BCTC's transmission grid on the AESO x BCTC path can be restricted by the following factors:

A) Transfer limit on the Alberta – BC transmission inter-ties: The limits are defined in BCTC SOO 7T-17. In this SOO, for system normal conditions the transfer limit is 1000 MW. In real time, the actual limit may be less than 1000 MW due to generation shedding restrictions in Alberta. The analysis shows that total import of 101 MW to 501 MW from Alberta will not impose any restrictions on the Alberta – BC transmission inter-ties.

B) The amount of on-line rotational energy in BC: When importing power from the US and Alberta, a simultaneous outage of 5L51 and 5L52 will trigger a RAS that separates BC transmission from the US and Alberta grids. After separation, the generation deficit in BC will cause a frequency dip. BC's domestic load will have to be shed to restore the system frequency. The lesser the amount of on-line rotational energy, the more severe the frequency dip and the higher the amount of load shedding required for recovery.

The frequency dip and the load shedding can be controlled in part by having more rotational energy on-line. The frequency dip on the BC system can not be lower than 57.9 Hz. BCTC's system operating order 7T-64 identifies the total simultaneous import capability from both the US and Alberta during light load periods using the 57.9Hz criteria.

In this study, Between May 2006 and May 2010 the forecasted light summer load in BCTC and Fortis BC areas are approximately 4500 MW to 4900 MW. At these load levels, total import into the BC transmission network is restricted to avoid frequency excursion, below 57.9 Hz, for simultaneous outage of 5L51 and 5L52. Table 2 shows the total allowable import into the BC transmission grid for the minimum on-line rotational energy. The table also lists BCTC's existing import obligations and determines the remaining import capability from Alberta.

Table 2

Duration	Aprx. Import Capability @ 24,290 MJ	Existing Import Obligations MW					Remaining Import Capability from Alberta @ 24,290 MJ
		TRM (AB)	Alcan	Cominco	DSBs	OtherAB-BC	
1Apr2006 to 31Aug2006	2050	65	147	370	1218	235	15
1Sep2006 to 31Mar2007	2050	65	147	370	1218	101	149
1Apr2007 to 31Mar2008	2076	65	147	370	1244	101	148
1Apr2008 to 31Mar2009	2105	65	147	370	1241	101	181
1Apr2009 to 31Mar2010	2119	65	147	370	1245	101	191
1Apr2010 to 31Mar2011	2138	65	147	370	1400	101	55
1Apr2011 to 31Mar2012	2149	65	0	370	1400	101	213
1Apr2012 to 31Mar2013	2162	65	0	370	1400	101	226
1Apr2013 to 31Mar2014	2194	65	0	370	1400	101	258
1Apr2014 to 31Mar2015	2203	65	0	370	1400	101	267
1Apr2015 to 31Mar2016	2217	65	0	370	1400	101	281
1Apr2016 to 31Mar2017	2237	65	0	370	1400	101	301
1Apr2017 to 31Mar2018	2269	65	0	370	1400	101	333
1Apr2018 to 31Mar2019	2305	65	0	370	1400	101	369
1Apr2019 to 31Mar2020	2353	65	0	370	1400	101	417
1Apr2020 to 31Mar2021	2404	65	0	370	1400	101	468
1Apr2021 to 31Mar2022	2460	65	0	370	1400	101	524
1Apr2022 to 31Mar2023	2509	65	0	370	1400	101	573
1Apr2023 to 31Mar2024	2558	65	0	370	1400	101	622

Table 2 indicates that, with the minimum on-line rotational energy², there is only enough import capability to rollover OASIS # 70604537 until 31 March 2010.

In this report, total import capabilities associated with higher amounts of on-line rotational energy are investigated. Table 3 is an indication of the total import capability into BCTC and Available Transfer Capability (ATC) from Alberta based on different levels of the on-line rotational energy in the BCTC's control area.

Table 3

Duration	BCH & FBC	Total / ATC MW	Total / ATC MW	Total / ATC MW	Total / ATC MW	Total / ATC MW	Total / ATC MW
	SL Load	25000 MJ	30000 MJ	35000 MJ	40000 MJ	45000 MJ	50000 MJ
1Sep2006 to 31Mar2007	4581	2065 / 164	2172 / 271	2278 / 377	2384 / 483	Note 1	Note 1
1Apr2007 to 31Mar2008	4668	2090 / 163	2193 / 265	2295 / 368	2398 / 471	2501 / 573	Note 1
1Apr2008 to 31Mar2009	4733	2120 / 196	2223 / 299	2327 / 403	2432 / 508	2536 / 612	Note 1
1Apr2009 to 31Mar2010	4796	2133 / 205	2233 / 305	2334 / 406	2434 / 506	2534 / 606	Note 1
1Apr2010 to 31Mar2011	4838	2152 / 69	2253 / 170	2355 / 272	2455 / 372	2556 / 473	Note 1
1Apr2011 to 31Mar2012	4895	2163 / 227	2261 / 325	2357 / 421	2455 / 519	2552 / 616	Note 1
1Apr2012 to 31Mar2013	4954	2176 / 240	2270 / 334	2364 / 428	2457 / 521	2551 / 615	Note 1
1Apr2013 to 31Mar2014	5025	2207 / 271	2303 / 367	2398 / 462	2493 / 557	2588 / 652	Note 1
1Apr2014 to 31Mar2015	5048	2217 / 281	2313 / 377	2409 / 473	2504 / 568	2600 / 664	Note 1
1Apr2015 to 31Mar2016	5106	2230 / 294	2322 / 386	2414 / 478	2507 / 571	2599 / 663	2691 / 755
1Apr2016 to 31Mar2017	5184	2250 / 314	2340 / 404	2429 / 493	2519 / 583	2609 / 673	2700 / 764
1Apr2017 to 31Mar2018	5263	2281 / 345	2370 / 434	2458 / 522	2545 / 609	2634 / 698	2722 / 786
1Apr2018 to 31Mar2019	5347	2317 / 381	2407 / 471	2497 / 561	2586 / 650	2675 / 739	2765 / 829
1Apr2019 to 31Mar2020	5431	2366 / 430	2454 / 518	2544 / 608	2632 / 696	2721 / 785	2809 / 873
1Apr2020 to 31Mar2021	5523	2417 / 481	2505 / 569	2594 / 658	2681 / 745	2769 / 833	2858 / 922 Note 2
1Apr2021 to 31Mar2022	5624	2473 / 537	2560 / 624	2648 / 712	2736 / 800	2823 / 887	2912 / 976 Note 2
1Apr2022 to 31Mar2023	5709	2521 / 585	2608 / 672	2695 / 759	2782 / 846	2868 / 932	2956 / 1020 Note 2
1Apr2023 to 31Mar2024	5795	2570 / 634	2656 / 720	2743 / 807	2829 / 893	2916 / 980	3001 / 1065 Note 2

Note 1: At the specified load level, there is adequate on-line rotational energy to avoid frequency excursion.

Note 2: The ATC is limited by the 1000 MW restriction on the Alberta – BC inter-ties.

² 24290 MJ for both BC Hydro and Fortis BC rotating machines.

Other restrictions:

C) Transfer capability of the west of Selkirk cut-plane: As stated in the NITS2004 Facilities Study: “After commissioning of Vaseux Lake (VAS) 500 kV substation in November 2005, the total transfer capability on the 5L91 - 5L96 - 5L98 cut-plane will be limited to about 1850 MW. The limit is imposed to prevent voltage instability for loss of 5L96.”

Between 2007 and 2010, the approximate range of load requirements on the cut-plane will be between 1900 MW and 2150 MW during peak load hours and between 2300 MW and 2470 MW during light load hours. This level of demand will exceed the firm TTC of the transmission cut-plane. To avoid voltage instability, generation dispatch in the SIE region has to be restricted such that the flow on the 500 kV cut-plane west of Selkirk remain below 1850 MW. Cut-plane flows higher than the firm TTC can be accommodated by arming a SIE generation shedding RAS.

Increasing the import from Alberta and reducing the corresponding generation in SEV will limit the amount of SIE generation available for shedding. During light load hours the demand on the west of Selkirk cut-plane can exceed its TTC by up to 620 MW. This corresponds to the highest amount of SIE generation that has to be shed following a 5L96 outage. BCTC’s SOO 7T-34 defines the minimum post contingency generation requirements in the south interior region. Based on this SOO, after the outage of 5L96, there has to be 2 SEV units + 1 equivalent SEV unit on-line as a minimum. To accommodate this import request, the minimum pre-contingency on-line SIE generation during peak flow hours has to be 1220 MW³.

The existing nameplate capacity of the generating plants in SEV and Kootenay Chanel (KCL) is near 1400 MW. Total nameplate capacity of the generating plants in the SIE region, including Arrow Lake Hydro (ALH) and Brilliant Expansion (BRX), is approximately 1800 MW. After reducing the SEV by up to 400 MW, the remaining SIE generation capacity can be as high as 1400 MW which is higher than the required 1220 MW. The applicant will be able to reduce SEV generation and maintain the minimum generation requirements. SEV generation can be reduced by restricting the output of the on-line units or by taking up to two units off-line.

³ Breakdown of the 1220 MW generation: 620 MW to be shed for excess light hour flow + 400 MW for the minimum 2 SEV units requirement + 200 MW for the minimum one equivalent SEV unit requirement.

7. Conclusions

In this SIS it is concluded that:

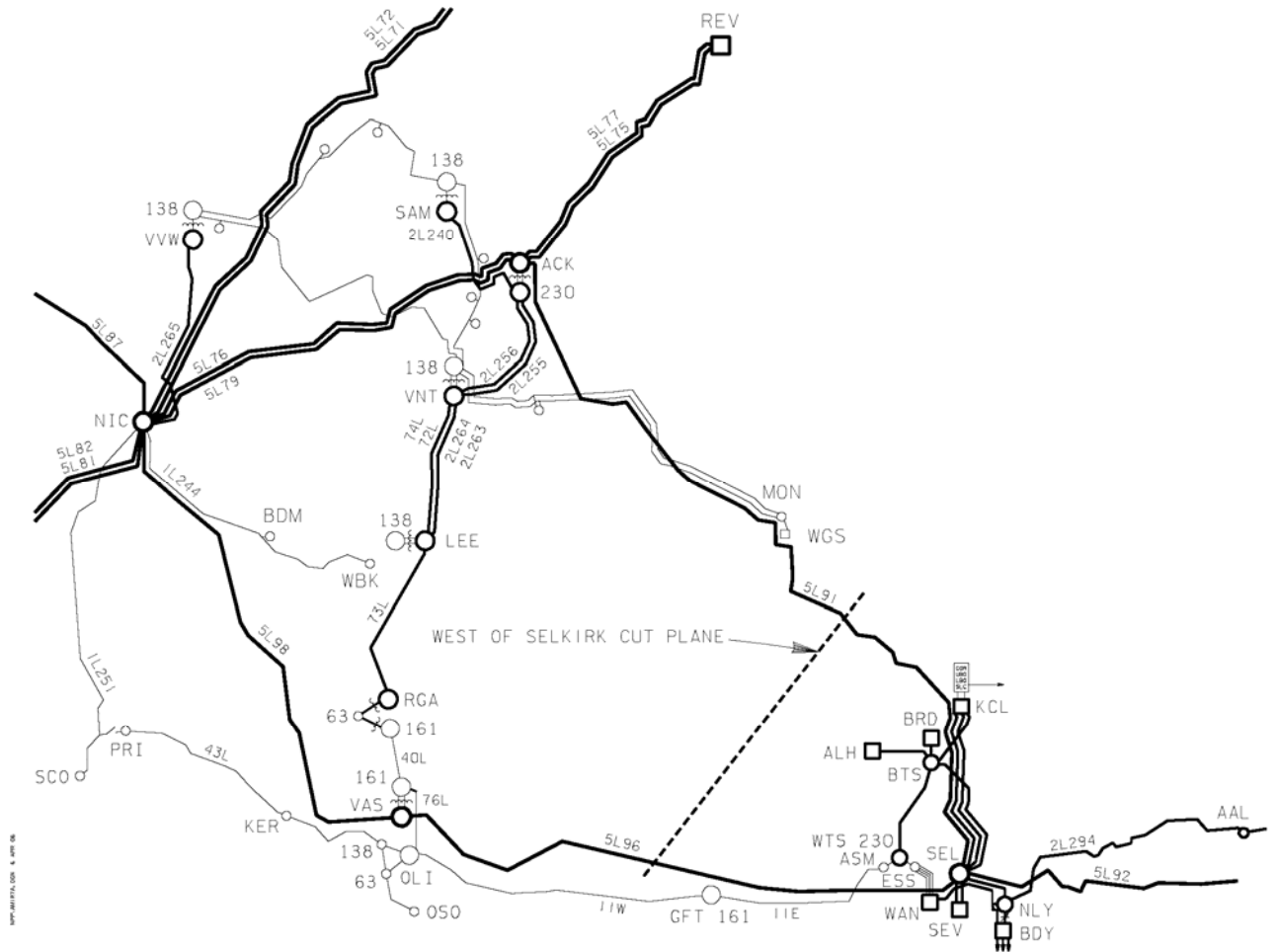
- 1- With 24290 MJ minimum on-line rotational energy of BC Hydro and Fortis BC, OASIS #70604537 can be accommodated between 1 September 2006 and 31 March 2010.
- 2- OASIS # 70604537 and 70610287 can be accommodated if the minimum on-line rotational energy of BC Hydro and Fortis BC is increased to approximately 25000 MJ.
- 3- OASIS # 70604537 and 70610287 and 70610289 can be accommodated if the minimum on-line rotational energy of BC Hydro and Fortis BC is increased to approximately 30000 MJ.
- 4- OASIS # 70604537 and 70610287 and 70610289 and 70610293 can be accommodated if the minimum on-line rotational energy of BC Hydro and Fortis BC is increased to approximately 30000 MJ.
- 5- OASIS # 70604537 and 70610287 and 70610289 and 70610293 and 70610309 can be accommodated if the minimum on-line rotational energy of BC Hydro and Fortis BC is increased to approximately 30000 MJ.
- 6- OASIS # 70604537 and 70610287 and 70610289 and 70610293 and 70610309 and 70610313 can be accommodated if the minimum on-line rotational energy of BC Hydro and Fortis BC is increased to approximately 35000 MJ.
- 7- OASIS # 70604537 and 70610287 and 70610289 and 70610293 and 70610309 and 70610313 and 70610317 can be accommodated if the minimum on-line rotational energy of BC Hydro and Fortis BC is increased to approximately 45000 MJ.
- 8- To accommodate these requests during peak flow hours, reduction of generation in SEV should leave at least 1220 MW pre-contingency generation in the SIE region. The required minimum generation is within the nameplate capacity of the remaining SIE generators.
- 9- The requested flows on the AESO x BCTC path will not exceed the capacity of the Alberta – BC inter-ties.

Appendix 1 Transmission Cut-Planes

Figure 1: The West of Selkirk Cut Plane

TTC: 1850 MW

Expected cut plane flow: 1900 – 2130 MW in 2007
1900 – 2150 MW in 2010⁴



⁴ NITS2004-FS, Page 28