System Impact Study
For
BC Hydro Distribution
NITS 2004 – Stage 1 – Preliminary Results

Report # SP2005 – 04

February, 2005

System Planning and Performance Assessment

DISCLAIMER OF WARRANTY, LIMITATION OF LIABILITY

Executive Summary

This report summarizes preliminary results of the System Impact Study (SIS), pursuant to the SIS Agreement between "BC Hydro Distribution" (BCHD) and "BC Transmission Corporation" (BCTC). In response to BCHD's Application for 10 year Network Integration Transmission Service (NITS 2004), BCTC resolved that a SIS was needed to determine the transmission requirements for meeting BCHD's 10 year load and resource forecasts between September 2004 and September 2014. On 24 January 2005, in accordance with BC Hydro's Wholesale Transmission Services (WTS) Tariff Supplement # 30, BCHD and BCTC signed a System Impact Study Agreement outlining the terms of reference for the study.

According to the agreement, the SIS will consist of three separate stages. BCTC reviewed all of the BCHD's submitted resource portfolios and load forecasts in conjunction with firm import/export commitments. Eight study scenarios were developed to represent all possible resource patterns and flows. A preliminary technical analysis of the bulk transmission requirements was conducted for each one of the study scenarios. The analysis, which was conducted in accordance with the BCTC and WECC planning standards, identified the following for each scenario:

- *Transmission constraints in the Interior to Lower Mainland (ILM), Lower Mainland to Vancouver Island (LM-VI), South Interior (SI), and North Interior (NI) regions of the grid.*
- *The required Network Upgrades (NU) and/or Direct Assignment Facilities (DAF) to remove the ILM, LM-VI, SI, and NI constraints.*
- *Start date and earliest in-service date for reinforcements in the ILM, LM-VI, SI, and NI regions.*
- *Reliability Must Run (RMR) coastal generation, that is the generation in the LM and VI, required for reliable operation of the integrated network prior to the earliest in-service date of the ILM reinforcements*
- *Generation required for the reliable operation of the system to defer reinforcements where applicable.*

Eight load/resource scenarios were studied. Transmission constraints in different regions of the bulk transmission grid were identified. In each scenario the schedule for the transmission upgrades, that will remove the constraints, were specified. The suggested upgrades and RMR will secure reliable operation of the transmission network under both normal and stressed conditions for the duration of NITS 2004 application.

It was concluded that with the nominated 147 MW minimum coastal generation, the forecasted load in the Lower Mainland and Vancouver Island could not be served. In order to maintain the load / resource balance additional Interior resources must be dispatched and coastal RMR tables must be observed. This additional transfer of power from the Interior to Lower Mainland makes the NITS 2004 a competing application for the 500 MW transfer capability on the Interior to Lower Mainland network secured for BCHA x BPAT point-to-point transfer under OASIS # 254221. Details of technical scenario analysis are appended at the end of the report.

The specified conclusions may change when more detailed studies are performed. This report outlines the result of the studies and should not be considered as the planned upgrades for the BCTC transmission network.

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1. Introduction

The NITS 2004 SIS, is based on the information submitted in the "BC Hydro's 2004 Application to the BCTC for Network Integration Transmission Services (NITS)". This information covers a broad range of resource, load, and committed export/import possibilities. Utilizing the submitted information, BCTC developed eight study scenarios for evaluating transmission system requirements. This section summarizes the submitted alternatives for resources, load, export, and import. The next section documents both the load/resource/export/import assumptions and the bulk transmission requirements for each one of the studied scenarios.

1.1 Resource Alternatives

A) Base Case: Resource additions in MW are specified in Table 1.1

Table 1.1

Year	**Name**	Peace	Columbia	LM	VI
2003/2004	Market reserves		86	314	
2004/2005	DSBs		107	393	
By 2007/2008	IPP_EPA	140	140	300	160
2007/2008	VICFT				293
By 2009/2010	GMS Resource smart	246			
2009/2010	Alcan	-147			
2009/2010	KIT_SCGT	180			
2010/2011	System Generic	59	117	121	
By 2011/2012	Mica Resource smart		130		
2012/2013	System Generic	60	60	60	
2013/2014	System Generic	117	59	60	
2013/2014	Burrard retired			-960	
2014/2015	System Generic	469	410	423	
By 2018/19	GMS Resource smart	77			
2018/19	NWE retirement	-68			
2018/19	Mica 5		450		
2023/24	Rev 5		500		
By 2023/2024	System Generic	645	645	664	
	Totals	**1778**	**2618**	**1061**	**453**

B) Alternative 01: Resource additions in MW are specified in Table 1.2

Table 1.2

Year	**Name**	Peace	Columbia	LM	VI
2003/2004	Market reserves		86	314	
2004/2005	DSBs		107	393	
By 2007/2008	IPP_EPA	140	140	300	160
2007/2008	VICFT				293
By 2009/2010	GMS Resource smart	246			
2009/2010	Alcan	147			
By 2011/2012	Mica Resource smart		130		
2011/2012	Rev 5		500		
2013/2014	Burrard retired			-960	
2014/2015	Site-C	900			
By 2014/2015	Kelly Generic	427			
2015/2016	North West Wind	700			
By 2018/19	GMS Resource smart	77			
2017/2018	Mica 5		450		
2018/2019	NWE retirement	-68			
2022/2023	Rev 6		500		
By 2023/2024	Kelly Generic	973			
	Totals	**3542**	**1827**	**-267**	**453**

C) Alternative 02: Resource additions in MW are specified in Table 1.3

Table 1.3

Year	**Name**	Peace	Columbia	LM	VI
2003/2004	Market reserves		86	314	
2004/2005	DSBs		107	393	
By 2007/2008	IPP_EPA	140	140	300	160
2007/2008	VICFT				293
By 2009/2010	GMS Resource smart	246			
2009/2010	Alcan	147			
2009/2010	Rev 5		500		
By 2011/2012	Mica Resource smart		130		
2011/2012	Mica_5		450		
2013/2014	Rev 6		500		
2013/2014	Mica 6		450		
2013/2014	Burrard retired			-960	
By 2014/2015	Nicola Generic		736		
By 2018/19	GMS Resource smart	77			
2018/19	NWE retirement	-68			
By 2023/2024	Nicola Generic		1012		
	Totals	**542**	**4025**	**-267**	**453**

D) Alternative 03: Resource additions in MW are specified in Table 1.4

Table 1.4

Year	**Name**	Peace	Columbia	LM	VI
2003/2004	Market reserves		86	314	
2004/2005	DSBs		107	393	
By 2007/2008	IPP_EPA	140	140	300	160
2007/2008	VICFT				293
By2009/ 2010	GMS Resource smart	246			
2009/2010	Alcan	147			
By 2011/ 2012	Mica Resource smart		130		
2011/2012	Rev 5		500		
By 2012/2013	Nicola generic		184		
2013/2014	Burrard retired			-960	
2014/2015	EKT Coal		600		
2014/2015	Alberta imports		500		
2015/2016	Alberta imports		500		
By 2018/19	GMS Resource smart	77			
2018/19	NWE retirement	-68			
2019/2020	Mica 5		450		
2022/2023	Rev 6		500		
By 2023/2024	Nicola Generic		552		
	Totals	**542**	**4163**	**-267**	**453**

1.2 Load Forecast Alternatives

A) BC Hydro's October 2004 normal load forecast with the probability of the actual load exceeding the forecast once every two years.

B) BC Hydro's October 2004 high load forecast with the probability of the actual load exceeding the forecast once every ten years.

1.3 BC-US Export Alternatives

A) 230 MW long-term firm point-to-point export on BCHA x BPAT path, based on the OASIS # 72623 application for long-term firm point-to-point service.

B) 730 MW firm export on BCHA x BPAT path, based on OASIS # 72623 and OASIS # 254221 application for long-term firm point-to-point service.

1.4 BC-Alberta Import and Export

A) 101 MW long-term firm point-to-point import on EAL x BCHA path OASIS # 1360519.

B) 210 MW long-term firm point-to-point export on BCHA x EAL path OASIS # 311564 and 311565.

1.5 Interchange with Alcan

A) Alcan is designated as a network resource with 147 MW dependable capacity until the end of fiscal year 2009.

B) Alcan is designated as a 175 MW network load from the beginning of fiscal year 2010.

1.6 Interchange with Fortis BC

A) Import designations from Fortis BC (FBC) into BC Hydro across Kootenay Interconnection are listed in Table 1.6.1 :

Table 1.6.1

	F2005	F2006	F2007	F2008	F2009	F2010	F2011	F2012	F2013	F2014	F2015
FBC (Winter)											
Max	730	730	730	730	730	730	730	730	730	730	730
FBC (Summer)											
Max	744	744	744	744	744	744	744	744	744	744	744

B) Export designations to FBC are listed in Table 1.6.2:

Table 1.6.2

		F2005	**F2006**	**F2007**	**F2008**	**F2009**	**F2010**	**F2011**	**F2012**	**F2013**	**F2014**	**F2015**
Winter												
Fortis	Coincident	181.0	181.0	181.0	181.0	181.0	185.0	189.0	192.0	196.0	196.0	196.0
Fortis	Non-Coincident	184.7	184.7	184.7	184.7	184.7	188.8	192.9	195.9	200.0	200.0	200.0
Summer												
Fortis	Coincident	181.0	181.0	181.0	181.0	181.0	185.0	189.0	192.0	196.0	196.0	196.0
Fortis	Non-Coincident	184.7	184.7	184.7	184.7	184.7	188.8	192.9	195.9	200.0	200.0	200.0

1.7 Return of Down Stream Benefits (DSBr)

Designated MW levels of import for DSBr are listed in Table 1.7.1

Table 1.7.1

	F2005	**F2006**	**F2007**	**F2008**	**F2009**	**F2010**	**F2011**	**F2012**	**F2013**	**F2014**	**F2015**
DSBr (Winter & Summer)											
Max	1176.4	1218	1244.3	1240.9	1245.2	1400	1400	1400	1400	1400	1400

2. Methodology and Assumptions

- The preliminary results of the study were determined by the existing BCTC knowledge of the system and limited steady state analysis.

- A -200/+300 MVAr SVC is suggested at ING as a generic reinforcement for evaluation of static and dynamic VAr requirements in the LM. Scope and timing of the actual VAr reinforcements in the LM will be studied further in the NITS2004 SIS.
- The Total Transfer Capability (TTC) of the ILM transmission network is determined by using thermal nomograms. These nomograms identify the overloading boundaries of the network during N-1 (forced outage of one transmission element) and N-1-1 (forced outage of one transmission element when another transmission element is scheduled out for maintenance) conditions.
- In the thermal nomograms for the ILM network, maximum available transfer of power from NIC 500 kV and KLY 500 kV buses are respectively referred to as “Maximum Columbia Generation” and “Maximum Peace Generation”.
- Where the designated resource plan causes the maximum transfer from NIC (or KLY) 500 kV bus to exceed the thermal limit of the existing ILM network a note is inserted to highlight that “Maximum Columbia (or Peace) generation cannot be achieved with any amount of coastal RMR”.
- The SI transmission grid between SEL and NIC is stressed for 3/14th of the DSBr on the BDY-NLY tie. Transfer of this power on the ILM network is offset by a one-to-one reduction of power from MCA generation plants.
- Many of the reinforcement projects proposed in this report are conceptual in nature and their incremental TTC, feasibility, and project duration are based on today’s knowledge of the BCTC’s network. Alternative reinforcements could be discovered in future studies.
- The regulating margin and impact of the designated wind farm resources to keep the Interties at schedule have not been included in this study.

3. Study Scenario Results

Table 2.1 summarizes study scenarios for the NITS 2004 System Impact Study. Each study scenario identifies the load forecast, the resource plan, and the BCHA x BPAT firm export level for that study. Other factors such as FBC import/export, Alberta import/export, DSBr designation and load variation between winter and summer seasons are reviewed within each scenario. Where required, the review includes sensitivity analysis of the above factors to identify specific network upgrades on different transmission cut-planes.

Table 2.1

STUDY SCENARIO	RESOURCE PLAN	OCTOBER 2004 LOAD FORECAST	FIRM EXPORT TO THE USA (MW)
Scenario 1	Base Case	Probable 1 in 2 year	230
Scenario 2	Alternative 1	Probable 1 in 10 year	230
Scenario 3	Alternative 2	Probable 1 in 10 year	230
Scenario 4	Alternative 3	Probable 1 in 10 year	230
Scenario 5	Base Case	Probable 1 in 2 year	730
Scenario 6	Alternative 1	Probable 1 in 10 year	730
Scenario 7	Alternative 2	Probable 1 in 10 year	730
Scenario 8	Alternative 3	Probable 1 in 10 year	730

3.1 Study Scenario 1

Main Assumptions
Resource Designation: Base Case
Load Forecast: 1 in 2 year forecast
BC-US export on 5L51 and 5L52: 230 MW

Bulk Transmission Requirements for Scenario 1:

Table 2.1.1

PROJECT DESCRIPTION	START DATE	IN-SERVICE DATE	REGION	COMMENTS
NIC-MDN 500 kV Line (5L83), 50% series compensation, 3000 A.	April 2004	Earliest: October 2013	Interior to Lower Mainland	For maximum interior dispatch flexibility the ILM will be short of TTC by 2007.
KLY-CKY 500 kV Line (5L46), CRK 50% series compensation , 3000 A	October 2005	Earliest October 2014	Interior to Lower Mainland	For maximum interior dispatch flexibility 5L46 will be required by 2015.
ING SVC, -200/+300 MVAr	October 2005	October 2010	Lower Mainland	Provisions for VAr reinforcement in the Lower Mainland.
ARN-VIT 230 kV AC Cable Circuits (2L124 & 2L129) each with a 600 MVA Phase Shifting Transformer at VIT	April 2004	Earliest: October 2008	Lower Mainland to Vancouver Island	The second circuit can be delayed by dispatching VI dependable RMR generation.
ING-ARN 230 kV circuits (2L10 & 2L57) Upgrading		October 2008	Lower Mainland	Both circuits can be delayed by dispatching VI dependable RMR generation.
SAT 230 kV, 66.1 MVAr shunt reactors, two units.	April 2004	October 2008	Vancouver Island	
Generic third tie to Vancouver Island		Oct 2014	Vancouver Island	This circuit can be delayed by dispatching dependable RMR generation.
Series Compensation of 5L91(50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	Increase transfer capability on 5L91-5L96/5L98 cut-plane to transmit the surplus generation in Selkirk area plus import from FortisBC, and US through the 230 kV Nelway – Boundary connection to LM load centre.
Series Compensation of 5L98 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	
Series Compensation of 5L96 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	
SEL Transformer Bank Addition T4 (1200 MVA)	April 2005	November 2006	South Interior	Transfer the surplus generation in Selkirk area plus import from

				FortisBC, and US on 2L112 out of the area to the BCTC 500 kV system
SEL 500 kV, 123 MVAr shunt Reactor	April 2005	July 2006	South Interior	Regulate high voltage at SEL and reduce losses resulted by running SEV generators as synchronous condensers for voltage control.
Series Compensation of 5L71 and 5L72 (each line 40% compensation and 3200 A)	October 2005	October 2009	South Interior	MCA Resource Smart (130 MW) and voltage stability around NIC.
NIC 500 kV Station Reconfiguration	Fall 2005	Fall 2009	South Interior	Improve station reliability in time for the next significant station loading increase.
The interconnection from KIT_SCGT(180 MW) to KIT station	Fall 2006	Fall 2009	North Interior	
Ashton Creak 250 MVAr Shunt Capacitor	Fall 2016	Fall 2018	South Interior	Voltage support required for REV G5
Applying new RAS	Fall 2005	Fall 2024	All regions	

Coastal RMR Requirements for Scenario 1:

The following table identifies the amount of coastal RMR that allows reliable operation of the ILM network with and without any network upgrades.

Table 2.1.2

YEAR	COASTAL RMR MAXIMUM COLUMBIA GENERATION (MW)		COASTAL RMR MAXIMUM PEACE GENERATION (MW)	
	With NU	Without NU	With NU	Without NU
2005/06	1072	1072	1078	1078
2006/07	1207	1207	1195	1195
2007/08	1282	1282	1285	1285
2008/09	1427	1427	1395	1395
2009/10	1530	1530	1497	1497
2010/11	1811	1811	1641	1641
2011/12	1924	1924	1712	1712
2012/13	2069	2069	1829	1829
2013/14	1022	2213	1022	1968
2014/15	329	See Note 1	329	2345
2015/16	278	See Note 1	278	2561
2016/17	331	See Note 1	331	2738
2017/18	362	See Note 1	362	2939
2018/19	147	See Note 1	147	3105
2019/20	147	See Note 1	147	3294
2020/21	206	See Note 1	206	3488
2021/22	189	See Note 1	189	3734
2022/23	261	See Note 1	261	3939
2023/24	147	See Note 1	147	4147

Note1: Maximum Columbia generation cannot be achieved with any amount of coastal RMR

Note 2: The designated minimum LM/VI generation is 147 MW. At this level of generation, the following apply:

- The LM/VI generation of 147 MW is not adequate to provide the load/resource balance between 2005/2006 and 2022/2023
- For simultaneous dispatch of maximum Columbia, and maximum Peace resources there will not be enough TTC on the ILM network. To remove the constraint by network upgrades, 5L83 will be required as early as 2007 and 5L46 will be required in 2014. However, this is not feasible because the earliest in-service date of 5L83 is 2013. To remove the constraint without the new network upgrades, coastal RMRs must be adequate (subject to Note 1). Table 2.1.2 shows the required RMR both with network upgrades and without them.
- 5L83 AND 5L46 together will provide adequate TTC on the ILM network for simultaneous dispatch of Peace and Columbia resources.

3.2 Study Scenario 2

Main Assumptions
Resource Designation: Alternative 1
Load Forecast: 1 in 10 year forecast
BC-US export on 5L51 and 5L52: 230 MW

Bulk Transmission Requirements for Scenario 2:

Table 2.2.1

PROJECT DESCRIPTION	START DATE	IN-SERVICE DATE	REGION	COMMENTS
NIC-MDN 500 kV Line (5L83), 50% series compensation, 3000 A.	April 2004	Earliest: October 2013	Interior to Lower Mainland	For maximum interior dispatch flexibility the ILM will be short of TTC by 2007.
KLY-CKY 500 kV Line (5L46), CRK 50% series compensation , 3000 A	October 2005	Earliest October 2014	Interior to Lower Mainland	For maximum interior dispatch flexibility 5L46 will be required by 2015
ING SVC, -200/+300 MVAr	October 2005	October 2010	Lower Mainland	Provisions for VAr reinforcement in the Lower Mainland.
ARN-VIT 230 kV AC Cable Circuits (2L124 & 2L129) each with a 600 MVA Phase Shifting Transformer at VIT	April 2004	Earliest: October 2008	Lower Mainland to Vancouver Island	The second circuit can be delayed by dispatching VI dependable RMR generation.
ING-ARN 230 kV circuits (2L10 & 2L57) Upgrading		October 2008	Lower Mainland	Both circuits can be delayed by dispatching VI dependable RMR generation.
SAT 230 kV, 66.1 MVAr shunt reactors, two units.	April 2004	October 2008	Vancouver Island	
Generic third tie to Vancouver Island		Oct 2014	Vancouver Island	This circuit can be delayed by dispatching dependable RMR generation.
Series Compensation of 5L91(50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	Increase transfer capability on 5L91-5L96/5L98 cut-plane to transmit the surplus generation in Selkirk area plus import from FortisBC, and US through the 230 kV Nelway – Boundary connection to LM load centre. These series compensations should be put into service ASAP to increase TTC
Series Compensation of 5L98 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	
Series Compensation of 5L96 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	

				and reduce generation shedding.
SEL Transformer Bank Addition T4 (1200 MVA)	April 2005	November 2006	South Interior	Transfer the surplus generation in Selkirk area plus import from FortisBC, and US on 2L112 out of the area to the BCTC 500 kV system
SEL 500 kV, 123 MVAr shunt Reactor	April 2005	July 2006	South Interior	Regulate high voltage at SEL and reduce losses resulted by running SEV generators as synchronous condensers for voltage control.
ACK 500 kV, 250 MVAr Shunt Capacitor	October 2009	October 2011	South Interior	Support additional flow from REV G5 and from SEL.
NIC 500 kV Station Reconfiguration	Fall 2007	Fall 2011	South Interior	Improve station reliability in time for the next significant station loading increase.
Series Compensation of 5L71 and 5L72 (each line 40% compensation and 3200 A)	October 2005	October 2009	South Interior	MCA Resource Smart (130 MW) and voltage stability around NIC.
Upgrade KDY series capacitor station: 1) Increase the series compensation from 50% to 65% 2) Increase the rated current from 2310 A to the minimum of 2500 A	Fall 2011	Fall 2014	North Interior	The transmission reinforcement requirements to move MW from site C (900) and NW_Wind (700) to KLY were only based on the power flow studies. The degree of series compensation at KDY and MLS and auto VAR shunt compensation at WSN and KLY may change after further transient stability, sub-synchronous resonance and system reactive power compensation studies.
Upgrade MLS series capacitor station: 1) Increase the degree of series compensation from 50% to 65% 2) Increase the rated current from 1950 A to the minimum of 2500 A	Fall 2011	Fall 2014	North Interior	
Upgrade the overload capabilities of 5L1, 5L2 and 5L3 from 2500 A to the minimum of 2750 A	Fall 2011	Fall 2014	North Interior	

Upgrade the overload capabilities of 5L11and 5L12 from 2500 A to the minimum of 2750 A	Fall 2011	Fall 2014	North Interior	
WSN 500 kV, 500 MVAr Auto or SVC shunt Capacitor compensation	Fall 2011	Fall 2024	North Interior	
KLY 500 kV, 500 MVAr Auto or SVC shunt Capacitor compensation	Fall 2011	Fall 2014	North Interior	
Two 500 kV circuits from Site C (900 MW) to PCN switch yard	Fall 2006	Fall 2014	North Interior	Site C (900MW) interconnection.
The interconnection from NW_Wind (700 MW) to SKA station	Fall 2006	Fall 2014	North Interior	
Applying new RAS	Fall 2005	Fall 2024	All regions	

RMR Requirements for Scenario 2:

Table 2.2.2

YEAR	COASTAL RMR MAXIMUM COLUMBIA GENERATION (MW)		COASTAL RMR MAXIMUM PEACE GENERATION (MW)	
	With NU	Without NU	With NU	Without NU
2005/06	1360	1360	1360	1360
2006/07	1470	1470	1478	1478
2007/08	1552	1552	1578	1578
2008/09	1702	1702	1693	1693
2009/10	1812	1812	1865	1865
2010/11	2017	2017	2006	2006
2011/12	2517	2517	2123	2123
2012/13	2627	2627	2287	2287
2013/14	947	2732	947	2402
2014/15	147	2845	147	3291
2015/16	147	2981	147	See note 2
2016/17	147	3118	147	See note 2
2017/18	147	See note 1	147	See note 2
2018/19	147	See note 1	147	See note 2
2019/20	147	See note 1	401	See note 2
2020/21	147	See note 1	730	See note 2
2021/22	285	See note 1	1070	See note 2
2022/23	252	See note 1	1211	See note 2
2023/24	411	See note 1	1356	See note 2

Note1: Maximum Columbia generation cannot be achieved with any amount of coastal RMR

Note2: Maximum Peace generation cannot be achieved with any amount of coastal RMR

Note 3: The designated minimum LM/VI generation is 147 MW. At this level of generation, the following apply:

- The LM/VI generation of 147 MW is not adequate to provide the load/resource balance between 2005/2006 and 2022/2023
- For simultaneous dispatch of maximum Columbia, and maximum Peace resources there will not be enough TTC on the ILM network. To remove the constraint by network upgrades, 5L83 will be required as early as 2007 and 5L46 will be required in 2014. However, this is not feasible because the earliest in-service date of 5L83 is 2013. To remove the constraint without the new network upgrades, coastal RMRs must be adequate (subject to Notes 1 and 2). Table 2.2.2 shows the required RMR both with network upgrades and without them.
- 5L83 AND 5L46 together will provide adequate TTC on the ILM network for simultaneous dispatch of Peace and Columbia resources until 2019.

3.3 Study Scenario 3

Main Assumptions
Resource Designation: Alternative 2
Load Forecast: 1 in 10 year forecast
BC-US export on 5L51 and 5L52: 230 MW

Bulk Transmission Requirements for Scenario 3:

Table 2.3.1

PROJECT DESCRIPTION	START DATE	IN-SERVICE DATE	REGION	COMMENTS
NIC-MDN 500 kV Line (5L83), 50% series compensation, 3000 A.	April 2004	Earliest: October 2013	Interior to Lower Mainland	For maximum interior dispatch flexibility the ILM will be short of TTC by 2007.
KLY-CKY 500 kV Line (5L46), CRK 50% series compensation , 3000 A	October 2005	Earliest October 2014	Interior to Lower Mainland	For maximum interior dispatch flexibility 5L46 will be required by 2015
ING SVC, -200/+300 MVAr	October 2005	October 2010	Lower Mainland	Provisions for VAr reinforcement in the Lower Mainland.
ARN-VIT 230 kV AC Cable Circuits (2L124 & 2L129) each with a 600 MVA Phase Shifting Transformer at VIT	April 2004	Earliest: October 2008	Lower Mainland to Vancouver Island	The second circuit can be delayed by dispatching VI dependable RMR generation.
ING-ARN 230 kV circuits (2L10 & 2L57) Upgrading		October 2008	Lower Mainland	Both circuits can be delayed by dispatching VI dependable RMR generation.
SAT 230 kV, 66.1 MVAr shunt reactors, two units.	April 2004	October 2008	Vancouver Island	
Generic third tie to Vancouver Island		Oct 2014	Vancouver Island	This circuit can be delayed by dispatching dependable RMR generation.
Series Compensation of 5L91(50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	Increase transfer capability on 5L91-5L96/5L98 cut-plane to transmit the surplus generation in Selkirk area plus import from FortisBC, and US through the 230 kV Nelway – Boundary connection to LM load centre. compensations should be put into service ASAP to
Series Compensation of 5L98 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	
Series Compensation of 5L96 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	

				increase TTC and reduce generation shedding.
SEL Transformer Bank Addition T4 (1200 MVA)	April 2005	November 2006	South Interior	Transfer the surplus generation in Selkirk area plus import from FortisBC, and US on 2L112 out of the area to the BCTC 500 kV system
SEL 500 kV, 123 MVAr shunt Reactor	April 2005	July 2006	South Interior	Regulate high voltage at SEL and reduce losses resulted by running SEV generators as synchronous condensers for voltage control.
ACK 500 kV, 250 MVAr Shunt Capacitor	October 2009	October 2011	South Interior	Support additional flow from REV G5 and from SEL.
NIC 500 kV Station Reconfiguration	Fall 2005	Fall 2009	South Interior	Improve station reliability in time for the next significant station loading increase.
Series Compensation of 5L71 and 5L72 (each line 40% compensation and 3200 A)	October 2005	October 2009	South Interior	MCA Resource Smart (130 MW) and voltage stability around NIC.
NIC 500 kV 300 MVAr Shunt Capacitor (#1)	October 2008	October 2011	South Interior	MCA Resource Smart and MCA G5.
DOW (Downie) Switching Station		Fall 2014	South Interior	MCA G6 & REV G6.
DOW – REV line (5L78)		Fall 2014	South Interior	MCA G6 & REV G6.
NIC 500 kV 300 MVAr Shunt Capacitor (#2)	October 2011	October 2014	South Interior	MCA G6 & REV G6.
NIC 500 kV SVC, -200/+300 MVAr	October 2009	October 2014	South Interior	Provisions for VAr reinforcement in SI.
Applying new RAS	Fall 2005	Fall 2024	All regions	

RMR Requirements for Scenario 3:

Table 2.3.2

YEAR	COASTAL RMR MAXIMUM COLUMBIA GENERATION (MW)		COASTAL RMR MAXIMUM PEACE GENERATION (MW)	
	With NU	**Without NU**	**With NU**	**Without NU**
2005/06	1360	1360	1360	1360
2006/07	1470	1470	1478	1478
2007/08	1552	1552	1577	1577
2008/09	1702	1702	1695	1695
2009/10	2187	2187	1865	1865
2010/11	2467	2467	2006	2006
2011/12	See note 1	See note 1	2083	2083
2012/13	See note 1	See note 1	2195	2195
2013/14	147	See note 1	378	2317
2014/15	147	See note 1	147	2436
2015/16	147	See note 1	147	2580
2016/17	147	See note 1	147	2728
2017/18	147	See note 1	147	2884
2018/19	147	See note 1	147	3032
2019/20	319	See note 1	147	3190
2020/21	540	See note 1	208	3354
2021/22	847	See note 1	369	3523
2022/23	1076	See note 1	528	3695
2023/24	1308	See note 1	691	3870

Note1: Maximum Columbia generation cannot be achieved with any amount of coastal RMR

Note 2: The designated minimum LM/VI generation is 147 MW. At this level of generation, the following apply:

- The LM/VI generation of 147 MW is not adequate to provide the load/resource balance between 2005/2006 and 2022/2023
- For simultaneous dispatch of maximum Columbia, and maximum Peace resources there will not be enough TTC on the ILM network. To remove the constraint by network upgrades, 5L83 will be required as early as 2007 and 5L46 will be required in 2014. However, this is not feasible because the earliest in-service date of 5L83 is 2013. To remove the constraint without the new network upgrades, coastal RMRs must be adequate (subject to Note 1). Table 2.3.2 shows the required RMR both with network upgrades and without them.
- 5L83 AND 5L46 together will provide adequate TTC on the ILM network for simultaneous dispatch of Peace and Columbia resources until 2019.

3.4 Study Scenario 4

Main Assumptions
Resource Designation: Alternative 3
Load Forecast: 1 in 10 year forecast
BC-US export on 5L51 and 5L52: 230 MW

Bulk Transmission Requirements for Scenario 4:

Table 2.4.1

PROJECT DESCRIPTION	START DATE	IN-SERVICE DATE	REGION	COMMENTS
NIC-MDN 500 kV Line (5L83), 50% series compensation, 3000 A.	April 2004	Earliest: October 2013	Interior to Lower Mainland	For maximum interior dispatch flexibility the ILM will be short of TTC by 2007.
KLY-CKY 500 kV Line (5L46), CRK 50% series compensation , 3000 A	October 2005	Earliest October 2014	Interior to Lower Mainland	For maximum interior dispatch flexibility 5L46 will be required by 2015
ING SVC, -200/+300 MVAr	October 2005	October 2010	Lower Mainland	Provisions for VAr reinforcement in the Lower Mainland.
ARN-VIT 230 kV AC Cable Circuits (2L124 & 2L129) each with a 600 MVA Phase Shifting Transformer at VIT	April 2004	Earliest: October 2008	Lower Mainland to Vancouver Island	The second circuit can be delayed by dispatching VI dependable RMR generation.
ING-ARN 230 kV circuits (2L10 & 2L57) Upgrading		October 2008	Lower Mainland	Both circuits can be delayed by dispatching VI dependable RMR generation.
SAT 230 kV, 66.1 MVAr shunt reactors, two units.	April 2004	October 2008	Vancouver Island	
Generic third tie to Vancouver Island		Oct 2014	Vancouver Island	This circuit can be delayed by dispatching dependable RMR generation.
Series Compensation of 5L91(50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	Increase transfer capability on 5L91-5L96/5L98 cut-plane to transmit the surplus generation in Selkirk area plus import from FortisBC, and US through the 230 kV Nelway – Boundary connection to LM load centre. These series compensations should be put into service
Series Compensation of 5L98 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	
Series Compensation of 5L96 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	

				ASAP to increase TTC and reduce generation shedding.
SEL Transformer Bank Addition T4 (1200 MVA)	April 2005	November 2006	South Interior	Transfer the surplus generation in Selkirk area plus import from FortisBC, and US on 2L112 out of the area to the BCTC 500 kV system
SEL 500 kV, 123 MVAr shunt Reactor	April 2005	July 2006	South Interior	Regulate high voltage at SEL and reduce losses resulted by running SEV generators as synchronous condensers for voltage control.
Series Compensation of 5L92 (50% compensation , 2750 A)	Fall 2009	Fall 2014	South Interior	To transfer EKT 600 MW and 1000 MW import from Alberta to NIC.
Series Compensation of 5L94 (50% compensation , 2750 A)	Fall 2009	Fall 2014	South Interior	
New 500 kV SEL-VAS-NIC line (5L97, 5L99)	Fall 2005	Fall 2014	South Interior	
Series Compensation of the new SEL-VAS-NIC 500 kV line (50% compensation, 2750 A)	Fall 2005	Fall 2014	South Interior	
The interconnection from EKT (600 MW) to CBK station	Fall 2006	Fall 2014	South Interior	
ack 500 kV, 250 MVAr Shunt Capacitor	October 2009	October 2011	South Interior	Support additional flow from REV G5 and from SEL.
NIC 500 kV Station Reconfiguration	Fall 2007	Fall 2011	South Interior	Improve station reliability in time for the next significant station loading increase.
Series Compensation of 5L71 and 5L72 (each line 40% compensation and 3200 A)	October 2005	October 2009	South Interior	MCA Resource Smart (130 MW) and voltage stability around NIC.
Applying new RAS	Fall 2005	Fall 2024	All regions	

RMR Requirements for Scenario 4:

Table 2.4.2

YEAR	COASTAL RMR MAXIMUM COLUMBIA GENERATION (MW)		COASTAL RMR MAXIMUM PEACE GENERATION (MW)	
	With NU	Without NU	With NU	Without NU
2005/06	1360	1360	1360	1360
2006/07	1470	1470	1478	1478
2007/08	1552	1552	1577	1577
2008/09	1703	1703	1695	1695
2009/10	1814	1814	1865	1865
2010/11	2017	2017	2006	2006
2011/12	See note 1	See note 1	2083	2083
2012/13	See note 1	See note 1	2195	2195
2013/14	959	See note 1	959	2317
2014/15	147	See note 1	147	2436
2015/16	147	See note 1	147	2581
2016/17	147	See note 1	147	2728
2017/18	194	See note 1	194	2884
2018/19	384	See note 1	384	3033
2019/20	147	See note 1	147	3191
2020/21	226	See note 1	226	3355
2021/22	373	See note 1	356	3524
2022/23	1226	See note 1	532	3696
2023/24	1460	See note 1	695	3870

Note1: Maximum Columbia generation cannot be achieved with any amount of coastal RMR

Note 2: The designated minimum LM/VI generation is 147 MW. At this level of generation, the following apply:

- The LM/VI generation of 147 MW is not adequate to provide the load/resource balance between 2005/2006 - 2014/2015 and 2017/2018 – 2021/2022
- For simultaneous dispatch of maximum Columbia, and maximum Peace resources there will not be enough TTC on the ILM network. To remove the constraint by network upgrades, 5L83 will be required as early as 2007 and 5L46 will be required in 2014. However, this is not feasible because the earliest in-service date of 5L83 is 2013. To remove the constraint without the new network upgrades, coastal RMRs must be adequate (subject to Note 1). Table 2.4.2 shows the required RMR both with network upgrades and without them.
- 5L83 AND 5L46 together will provide adequate TTC on the ILM network for simultaneous dispatch of Peace and Columbia resources until 2022.

3.5 Study Scenario 5

Main Assumptions
Resource Designation: Base Case
Load Forecast: 1 in 2 year forecast
BC-US export on 5L51 and 5L52: 730 MW

Bulk Transmission Requirements for Scenario 5:

Table 2.5.1

PROJECT DESCRIPTION	START DATE	IN-SERVICE DATE	REGION	COMMENTS
NIC-MDN 500 kV Line (5L83), 50% series compensation, 3000 A.	April 2004	Earliest: October 2013	Interior to Lower Mainland	For maximum interior dispatch flexibility the ILM will be short of TTC by 2007.
KLY-CKY 500 kV Line (5L46), CRK 50% series compensation , 3000 A	October 2005	Earliest October 2014	Interior to Lower Mainland	For maximum interior dispatch flexibility 5L46 will be required by 2015
ING SVC, -200/+300 MVAr	October 2005	October 2010	Lower Mainland	Provisions for VAr reinforcement in the Lower Mainland.
ARN-VIT 230 kV AC Cable Circuits (2L124 & 2L129) each with a 600 MVA Phase Shifting Transformer at VIT	April 2004	Earliest: October 2008	Lower Mainland to Vancouver Island	The second circuit can be delayed by dispatching VI dependable RMR generation.
ING-ARN 230 kV circuits (2L10 & 2L57) Upgrading		October 2008	Lower Mainland	Both circuits can be delayed by dispatching VI dependable RMR generation.
SAT 230 kV, 66.1 MVAr shunt reactors, two units.	April 2004	October 2008	Vancouver Island	
Generic third tie to Vancouver Island		Oct 2014	Vancouver Island	This circuit can be delayed by dispatching dependable RMR generation.
Series Compensation of 5L91(50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	Increase transfer capability on 5L91-5L96/5L98 cut-plane to transmit the surplus generation in Selkirk area plus import from FortisBC, and US through the 230 kV Nelway – Boundary connection to LM load centre. These series compensations should be put into service
Series Compensation of 5L98 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	
Series Compensation of 5L96 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	

				ASAP to increase TTC and reduce generation shedding.
SEL Transformer Bank Addition T4 (1200 MVA)	April 2005	November 2006	South Interior	Transfer the surplus generation in Selkirk area plus import from FortisBC, and US on 2L112 out of the area to the BCTC 500 kV system
SEL 500 kV, 123 MVAr shunt Reactor	April 2005	July 2006	South Interior	Regulate high voltage at SEL and reduce losses resulted by running SEV generators as synchronous condensers for voltage control.
Series Compensation of 5L71 and 5L72 (each line 40% compensation and 3200 A)	October 2005	October 2009	South Interior	MCA Resource Smart (130 MW) and voltage stability around NIC.
NIC 500 kV Station Reconfiguration	Fall 2005	Fall 2009	South Interior	Improve station reliability in time for the next significant station loading increase.
The interconnection from KIT_SCGT(180 MW) to KIT station	Fall 2006	Fall 2009	North Interior	
ACK 500 kV, 250 MVAr Shunt Capacitor	Fall 2016	Fall 2018	South Interior	Voltage support required for REV G5
Applying new RAS	Fall 2005	Fall 2024	All regions	

RMR Requirements for Scenario 5:

Table 2.5.2

YEAR	COASTAL RMR MAXIMUM COLUMBIA GENERATION (MW)		COASTAL RMR MAXIMUM PEACE GENERATION (MW)	
	With NU	Without NU	With NU	Without NU
2005/06	1580	1580	1586	1586
2006/07	1718	1718	1705	1705
2007/08	1796	1796	1799	1799
2008/09	1945	1945	1911	1911
2009/10	2050	2050	2016	2016
2010/11	2339	2339	2163	2163
2011/12	2455	2455	2236	2236
2012/13	2604	2604	2357	2357
2013/14	1526	2752	1526	2499
2014/15	814	See note 1	814	2888
2015/16	760	See note 1	760	3111
2016/17	814	See note 1	814	3293
2017/18	845	See note 1	845	3500
2018/19	550	See note 1	550	3671
2019/20	614	See note 1	614	3866
2020/21	683	See note 1	683	4066
2021/22	666	See note 1	666	4321
2022/23	739	See note 1	739	4533
2023/24	405	See note 1	405	4749

Note1: Maximum Columbia generation cannot be achieved with any amount of coastal RMR

Note 2: The designated minimum LM/VI generation is 147 MW. At this level of generation, the following apply:

- The LM/VI generation of 147 MW is not adequate to provide the load/resource balance between 2005/2006 - 2023/2024.
- For simultaneous dispatch of maximum Columbia, and maximum Peace resources there will not be enough TTC on the ILM network. To remove the constraint by network upgrades, 5L83 will be required as early as 2007 and 5L46 will be required in 2014. However, this is not feasible because the earliest in-service date of 5L83 is 2013. To remove the constraint without the new network upgrades, coastal RMRs must be adequate (subject to Note 1). Table 2.5.2 shows the required RMR both with network upgrades and without them.
- 5L83 AND 5L46 together will provide adequate TTC on the ILM network for simultaneous dispatch of Peace and Columbia resources.

3.6 Study Scenario 6

Main Assumptions
Resource Designation: Alternative 1
Load Forecast: 1 in 10 year forecast
BC-US export on 5L51 and 5L52: 730 MW

Bulk Transmission Requirements for Scenario 6:

Table 2.6.1

PROJECT DESCRIPTION	START DATE	IN-SERVICE DATE	REGION	COMMENTS
NIC-MDN 500 kV Line (5L83), 50% series compensation, 3000 A.	April 2004	Earliest: October 2013	Interior to Lower Mainland	For maximum interior dispatch flexibility the ILM will be short of TTC by 2007.
KLY-CKY 500 kV Line (5L46), CRK 50% series compensation , 3000 A	October 2005	Earliest October 2014	Interior to Lower Mainland	For maximum interior dispatch flexibility 5L46 will be required by 2015
ING SVC, -200/+300 MVAr	October 2005	October 2010	Lower Mainland	Provisions for VAr reinforcement in the Lower Mainland.
ARN-VIT 230 kV AC Cable Circuits (2L124 & 2L129) each with a 600 MVA Phase Shifting Transformer at VIT	April 2004	Earliest: October 2008	Lower Mainland to Vancouver Island	The second circuit can be delayed by dispatching VI dependable RMR generation.
ING-ARN 230 kV circuits (2L10 & 2L57) Upgrading		October 2008	Lower Mainland	Both circuits can be delayed by dispatching VI dependable RMR generation.
SAT 230 kV, 66.1 MVAr shunt reactors, two units.	April 2004	October 2008	Vancouver Island	
Generic third tie to Vancouver Island		Oct 2014	Vancouver Island	This circuit can be delayed by dispatching dependable RMR generation.
Series Compensation of 5L91(50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	Increase transfer capability on 5L91-5L96/5L98 cut-plane to transmit the surplus generation in Selkirk area plus import from FortisBC, and US through the 230 kV Nelway – Boundary connection to LM load centre. These series compensations should be put into service
Series Compensation of 5L98 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	
Series Compensation of 5L96 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	

				ASAP to increase TTC and reduce generation shedding.
SEL Transformer Bank Addition T4 (1200 MVA)	April 2005	November 2006	South Interior	Transfer the surplus generation in Selkirk area plus import from FortisBC, and US on 2L112 out of the area to the BCTC 500 kV system
SEL 500 kV, 123 MVAr shunt Reactor	April 2005	July 2006	South Interior	Regulate high voltage at SEL and reduce losses resulted by running SEV generators as synchronous condensers for voltage control.
ACK 500 kV, 250 MVAr Shunt Capacitor	October 2009	October 2011	South Interior	Support additional flow from REV G5 and from SEL. Project dates are subject to change.
NIC 500 kV Station Reconfiguration	Fall 2007	Fall 2011	South Interior	Improve station reliability in time for the next significant station loading increase.
Series Compensation of 5L71 and 5L72 (each line 40% compensation and 3200 A)	October 2005	October 2009	South Interior	MCA Resource Smart (130 MW) and voltage stability around NIC.
Upgrade KDY series capacitor station: * Increase the series compensation from 50% to 65% * Increase the rated current from 2310 A to the minimum of 2500 A	Fall 2011	Fall 2014	North Interior	The transmission reinforcement requirements to move MW from site C (900) and NW_Wind (700) to KLY were only based on the power flow studies. The degree of series compensation at KDY and MLS and auto VAR shunt compensation at WSN and KLY may change after further transient stability, sub-synchronous resonance and system reactive power compensation studies.
Upgrade MLS series capacitor station: * Increase the degree of series compensation from 50% to 65% * Increase the rated current from 1950 A to the minimum of 2500 A	Fall 2011	Fall 2014	North Interior	
Upgrade the overload capabilities of 5L1, 5L2 and 5L3 from 2500 A to the minimum of 2750 A	Fall 2011	Fall 2014	North Interior	

Upgrade the overload capabilities of 5L11and 5L12 from 2500 A to the minimum of 2750 A	Fall 2011	Fall 2014	North Interior	
WSN 500 kV, 500 MVAr Auto or SVC shunt Capacitor compensation	Fall 2011	Fall 2014	North Interior	
KLY 500 kV, 500 MVAr Auto or SVC shunt Capacitor compensation	Fall 2011	Fall 2014	North Interior	
Two 500 kV circuits from Site C (900 MW) to PCN switch yard	Fall 2006	Fall 2014	North Interior	Site C (900MW) interconnection.
The interconnection from NW_Wind (700 MW) to SKA station	Fall 2006	Fall 2014	North Interior	
Applying new RAS	Fall 2005	Fall 2024	All regions	

RMR Requirements for Scenario 6:

Table 2.6.2

YEAR	COASTAL RMR MAXIMUM COLUMBIA GENERATION (MW)		COASTAL RMR MAXIMUM PEACE GENERATION (MW)	
	With NU	Without NU	With NU	Without NU
2005/06	1875	1875	1875	1875
2006/07	1987	1987	1996	1996
2007/08	2071	2071	2098	2098
2008/09	2228	2228	2219	2219
2009/10	2341	2341	2394	2394
2010/11	2550	2550	2538	2538
2011/12	3065	3065	2659	2659
2012/13	3176	3176	2828	2828
2013/14	1446	3287	1446	2946
2014/15	562	3403	562	3866
2015/16	147	3543	147	See note 2
2016/17	175	3685	301	See note 2
2017/18	147	See note 1	448	See note 2
2018/19	292	See note 1	555	See note 2
2019/20	442	See note 1	882	See note 2
2020/21	597	See note 1	1220	See note 2
2021/22	762	See note 1	1568	See note 2
2022/23	728	See note 1	1713	See note 2
2023/24	891	See note 1	1861	See note 2

Note1: Maximum Columbia generation cannot be achieved with any amount of coastal RMR

Note2: Maximum Peace generation cannot be achieved with any amount of coastal RMR

Note 3: The designated minimum LM/VI generation is 147 MW. At this level of generation, the following apply:

- The LM/VI generation of 147 MW is not adequate to provide the load/resource balance between 2005/2006 and 2015/2016
- For simultaneous dispatch of maximum Columbia, and maximum Peace resources there will not be enough TTC on the ILM network. To remove the constraint by network upgrades, 5L83 will be required as early as 2007 and 5L46 will be required in 2014. However, this is not feasible because the earliest in-service date of 5L83 is 2013. To remove the constraint without the new network upgrades, coastal RMRs must be adequate (subject to Notes 1 & 2). Table 2.6.2 shows the required RMR both with network upgrades and without them.
- 5L83 AND 5L46 together will provide adequate TTC on the ILM network for simultaneous dispatch of Peace and Columbia resources until 2016.

3.7 Study Scenario 7

Main Assumptions
Resource Designation: Alternative 2
Load Forecast: 1 in 10 year forecast
BC-US export on 5L51 and 5L52: 730 MW

Bulk Transmission Requirements for Scenario 7:

Table 2.7.1

PROJECT DESCRIPTION	START DATE	IN-SERVICE DATE	REGION	COMMENTS
NIC-MDN 500 kV Line (5L83), 50% series compensation, 3000 A.	April 2004	Earliest: October 2013	Interior to Lower Mainland	For maximum interior dispatch flexibility the ILM will be short of TTC by 2007.
KLY-CKY 500 kV Line (5L46), CRK 50% series compensation , 3000 A	October 2005	Earliest October 2014	Interior to Lower Mainland	For maximum interior dispatch flexibility 5L46 will be required by 2015
ING SVC, -200/+300 MVAr	October 2005	October 2010	Lower Mainland	Provisions for VAr reinforcement in the Lower Mainland.
ARN-VIT 230 kV AC Cable Circuits (2L124 & 2L129) each with a 600 MVA Phase Shifting Transformer at VIT	April 2004	Earliest: October 2008	Lower Mainland to Vancouver Island	The second circuit can be delayed by dispatching VI dependable RMR generation.
ING-ARN 230 kV circuits (2L10 & 2L57) Upgrading		October 2008	Lower Mainland	Both circuits can be delayed by dispatching VI dependable RMR generation.
SAT 230 kV, 66.1 MVAr shunt reactors, two units.	April 2004	October 2008	Vancouver Island	
Generic third tie to Vancouver Island		Oct 2014	Vancouver Island	This circuit can be delayed by dispatching dependable RMR generation.
Series Compensation of 5L91(50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	Increase transfer capability on 5L91-5L96/5L98 cut-plane to transmit the surplus generation in Selkirk area plus import from FortisBC, and US through the 230 kV Nelway – Boundary connection to LM load centre. These series compensations should be put into service
Series Compensation of 5L98 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	
Series Compensation of 5L96 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	

				ASAP to increase TTC and reduce generation shedding.
SEL Transformer Bank Addition T4 (1200 MVA)	April 2005	November 2006	South Interior	Transfer the surplus generation in Selkirk area plus import from FortisBC, and US on 2L112 out of the area to the BCTC 500 kV system
SEL 500 kV, 123 MVAr shunt Reactor	April 2005	July 2006	South Interior	Regulate high voltage at SEL and reduce losses resulted by running SEV generators as synchronous condensers for voltage control.
ACK 500 kV, 250 MVAr Shunt Capacitor	October 2009	October 2011	South Interior	Support additional flow from REV G5 and from SEL.
NIC 500 kV Station Reconfiguration	Fall 2005	Fall 2009	South Interior	Improve station reliability in time for the next significant station loading increase.
Series Compensation of 5L71 and 5L72 (each line 40% compensation and 3200 A)	October 2005	October 2009	South Interior	MCA Resource Smart (130 MW) and voltage stability around NIC.
NIC 500 kV 300 MVAr Shunt Capacitor (#1)	October 2008	October 2011	South Interior	MCA Resource Smart and MCA G5.
DOW (Downie) Switching Station		Fall 2014	South Interior	MCA G6 & REV G6.
DOW – REV line (5L78)		Fall 2014	South Interior	MCA G6 & REV G6.
NIC 500 kV 300 MVAr Shunt Capacitor (#2)	October 2011	October 2014	South Interior	MCA G6 & REV G6.
NIC 500 kV SVC, -200/+300 MVAr	October 2009	October 2014	South Interior	Provisions for VAr reinforcement in SI.
Applying new RAS	Fall 2005	Fall 2024	All regions	

RMR Requirements for Scenario 7:

Table 2.7.2

YEAR	COASTAL RMR MAXIMUM COLUMBIA GENERATION (MW)		COASTAL RMR MAXIMUM PEACE GENERATION (MW)	
	With NU	Without NU	With NU	Without NU
2005/06	1875	1875	1875	1875
2006/07	1987	1987	1997	1997
2007/08	2071	2071	2098	2098
2008/09	2228	2228	2219	2219
2009/10	2727	2727	2394	2394
2010/11	3014	3014	2538	2538
2011/12	3510	See note 1	2617	2617
2012/13	3702	See note 1	2732	2732
2013/14	533	See note 1	862	2858
2014/15	147	See note 1	147	2981
2015/16	147	See note 1	147	3130
2016/17	147	See note 1	147	3280
2017/18	270	See note 1	213	3441
2018/19	580	See note 1	376	3594
2019/20	799	See note 1	527	3758
2020/21	1025	See note 1	684	3927
2021/22	1339	See note 1	849	4100
2022/23	1574	See note 1	1011	4277
2023/24	1812	See note 1	1178	4459

Note1: Maximum Columbia generation cannot be achieved with any amount of coastal RMR

Note 2: The designated minimum LM/VI generation is 147 MW. At this level of generation, the following apply:

- The LM/VI generation of 147 MW is not adequate to provide the load/resource balance between 2005/2006 - 2013/2014 and 2017/2018 – 2023/2024
- For simultaneous dispatch of maximum Columbia, and maximum Peace resources there will not be enough TTC on the ILM network. To remove the constraint by network upgrades, 5L83 will be required as early as 2007 and 5L46 will be required in 2014. However, this is not feasible because the earliest in-service date of 5L83 is 2013. To remove the constraint without the new network upgrades, coastal RMRs must be adequate (subject to Note 1). Table 2.1.2 shows the required RMR both with network upgrades and without them.
- 5L83 AND 5L46 together will provide adequate TTC on the ILM network for simultaneous dispatch of Peace and Columbia resources until 2018.

3.8 Study Scenario 8

Main Assumptions
Resource Designation: Alternative 3
Load Forecast: 1 in 10 year forecast
BC-US export on 5L51 and 5L52: 730 MW

Bulk Transmission Requirements for Scenario 8:

Table 2.8.1

PROJECT DESCRIPTION	START DATE	IN-SERVICE DATE	REGION	COMMENTS
NIC-MDN 500 kV Line (5L83), 50% series compensation, 3000 A.	April 2004	Earliest: October 2013	Interior to Lower Mainland	For maximum interior dispatch flexibility the ILM will be short of TTC by 2007.
KLY-CKY 500 kV Line (5L46), CRK 50% series compensation , 3000 A	October 2005	Earliest October 2014	Interior to Lower Mainland	For maximum interior dispatch flexibility 5L46 will be required by 2015
ING SVC, -200/+300 MVAr	October 2005	October 2010	Lower Mainland	Provisions for VAr reinforcement in the Lower Mainland.
ARN-VIT 230 kV AC Cable Circuits (2L124 & 2L129) each with a 600 MVA Phase Shifting Transformer at VIT	April 2004	Earliest: October 2008	Lower Mainland to Vancouver Island	The second circuit can be delayed by dispatching VI dependable RMR generation.
ING-ARN 230 kV circuits (2L10 & 2L57) Upgrading		October 2008	Lower Mainland	Both circuits can be delayed by dispatching VI dependable RMR generation.
SAT 230 kV, 66.1 MVAr shunt reactors, two units.	April 2004	October 2008	Vancouver Island	
Generic third tie to Vancouver Island		Oct 2014	Vancouver Island	This circuit can be delayed by dispatching dependable RMR generation.
Series Compensation of 5L91(50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	Increase transfer capability on 5L91-5L96/5L98 cut-plane to transmit the surplus generation in Selkirk area plus import from FortisBC, and US through the 230 kV Nelway – Boundary connection to LM load centre. These series compensations should be put into service
Series Compensation of 5L98 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	
Series Compensation of 5L96 (50% compensation ,2750 A)	Fall 2005	Earliest: Fall 2009	South Interior	

				ASAP to increase TTC and reduce generation shedding.
SEL Transformer Bank Addition T4 (1200 MVA)	April 2005	November 2006	South Interior	Transfer the surplus generation in Selkirk area plus import from FortisBC, and US on 2L112 out of the area to the BCTC 500 kV system
SEL 500 kV, 123 MVAr shunt Reactor	April 2005	July 2006	South Interior	Regulate high voltage at SEL and reduce losses resulted by running SEV generators as synchronous condensers for voltage control.
Series Compensation of 5L92 (50% compensation , 2750 A)	Fall 2009	Fall 2014	South Interior	
Series Compensation of 5L94 (50% compensation ,2750 A)	Fall 2009	Fall 2014	South Interior	
500 SEL-VAS-NIC line (5L97,5L99)	Fall 2005	Fall 2014	South Interior	To transfer EKT 600 MW and 1000 MW import from Alberta to NIC.
Series Compensation of 500 kV SEL-VAS-NIC line (50% compensation, 2750 A)	Fall 2005	Fall 2014	South Interior	
The interconnection from EKT (600 MW) to CBK station	Fall 2006	Fall 2014	South Interior	
ACK 500 kV, 250 MVAr Shunt Capacitor	October 2009	October 2011	South Interior	Support additional flow from REV G5 and from SEL.
NIC 500 kV Station Reconfiguration	Fall 2007	Fall 2011	South Interior	Improve station reliability in time for the next significant station loading increase.
Series Compensation of 5L71 and 5L72 (each line 40% compensation and 3200 A)	October 2005	October 2009	South Interior	MCA Resource Smart (130 MW) and voltage stability around NIC.
Applying new RAS	Fall 2005	Fall 2024	All regions	

RMR Requirements for Scenario 8:

Table 2.8.2

YEAR	COASTAL RMR MAXIMUM COLUMBIA GENERATION (MW)		COASTAL RMR MAXIMUM PEACE GENERATION (MW)	
	With NU	Without NU	With NU	Without NU
2005/06	1875	1875	1875	1875
2006/07	1987	1987	1997	1997
2007/08	2071	2071	2098	2098
2008/09	2228	2228	2218	2218
2009/10	2341	2341	2394	2394
2010/11	2550	2550	2538	2538
2011/12	See note 1	See note 1	2617	2617
2012/13	See note 1	See note 1	2731	2731
2013/14	1459	See note 1	1458	2857
2014/15	616	See note 1	615	2981
2015/16	367	See note 1	367	3129
2016/17	530	See note 1	530	3280
2017/18	671	See note 1	671	3442
2018/19	866	See note 1	866	3593
2019/20	597	See note 1	597	3756
2020/21	702	See note 1	702	3926
2021/22	852	See note 1	828	4101
2022/23	1728	See note 1	989	4277
2023/24	1968	See note 1	1153	4459

Note1: Maximum Columbia generation cannot be achieved with any amount of coastal RMR

Note 2: The designated minimum LM/VI generation is 147 MW. At this level of generation, the following apply:

- The LM/VI generation of 147 MW is not adequate to provide the load/resource balance
- For simultaneous dispatch of maximum Columbia, and maximum Peace resources there will not be enough TTC on the ILM network. To remove the constraint by network upgrades, 5L83 will be required as early as 2007 and 5L46 will be required in 2014. However, this is not feasible because the earliest in-service date of 5L83 is 2013. To remove the constraint without the new network upgrades, coastal RMRs must be adequate (subject to Note 1). Table 2.8.2 shows the required RMR both with network upgrades and without them.
- 5L83 AND 5L46 together will provide adequate TTC on the ILM network for simultaneous dispatch of Peace and Columbia resources until 2014.

4. Conclusions

Eight load/resource scenarios were studied. Transmission constraints in different regions of the bulk transmission grid were identified. In each scenario the schedule for the transmission upgrades, that will remove the constraints, were specified. The suggested upgrades and RMR will secure reliable operation of the transmission network under both normal and stressed conditions for the duration of NITS 2004 application.

It was concluded that with the nominated 147 MW minimum coastal generation, the forecasted load in the Lower Mainland and Vancouver Island could not be served. In order to maintain the load / resource balance additional Interior resources must be dispatched and coastal RMR tables must be observed. This additional transfer of power from the Interior to Lower Mainland makes the NITS 2004 a competing application for the 500 MW transfer capability on the Interior to Lower Mainland network secured for BCHA x BPAT point-to-point transfer under OASIS # 254221.

This report outlines the result of the studies and should not be considered as the planned upgrades for the BCTC transmission network.

Appendix 1: Thermal Nomogram of the ILM Network

Figure 1.1 shows thermal boundaries of the Interior to Lower Mainland network for N-1 contingencies.

Figure 1.1

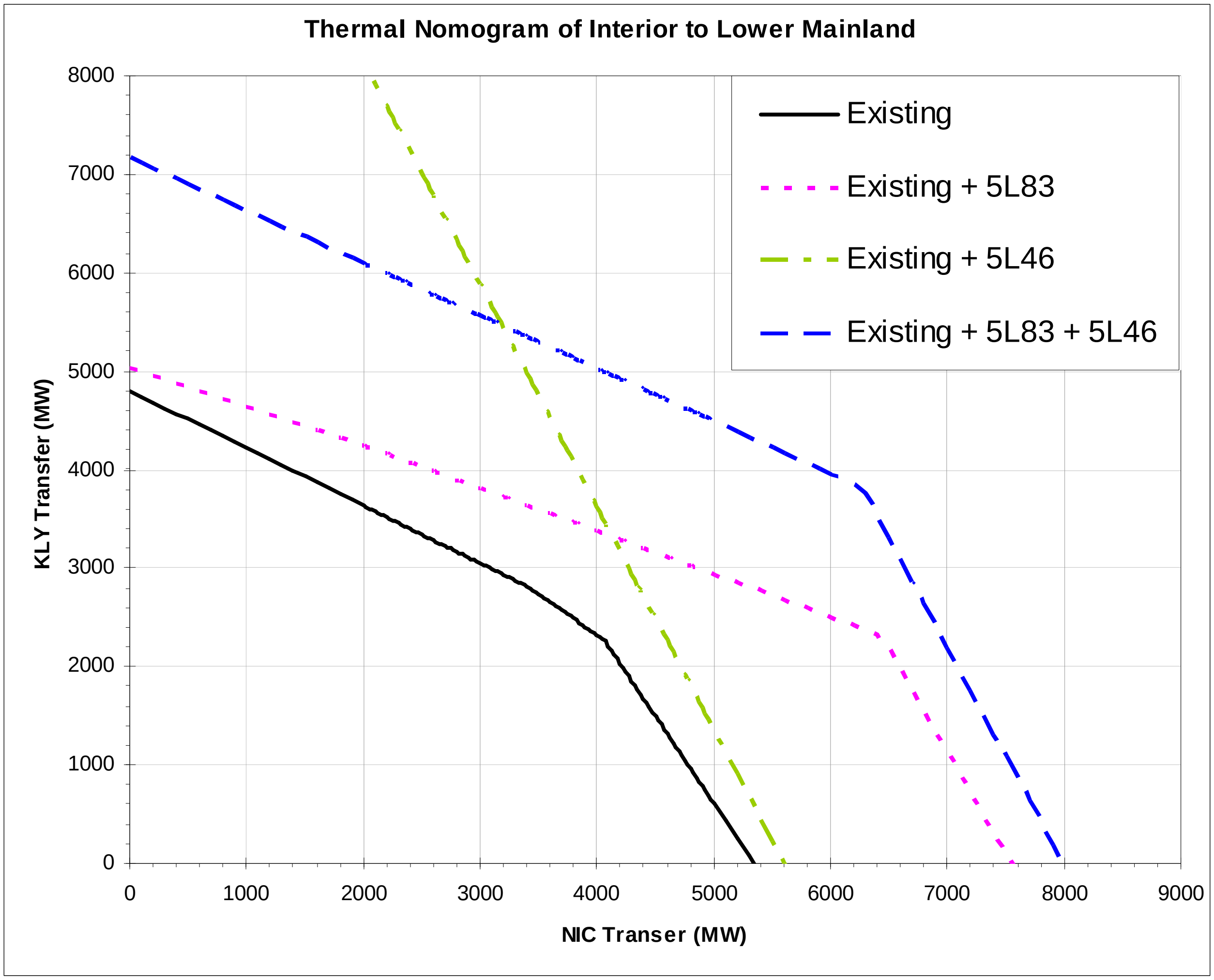
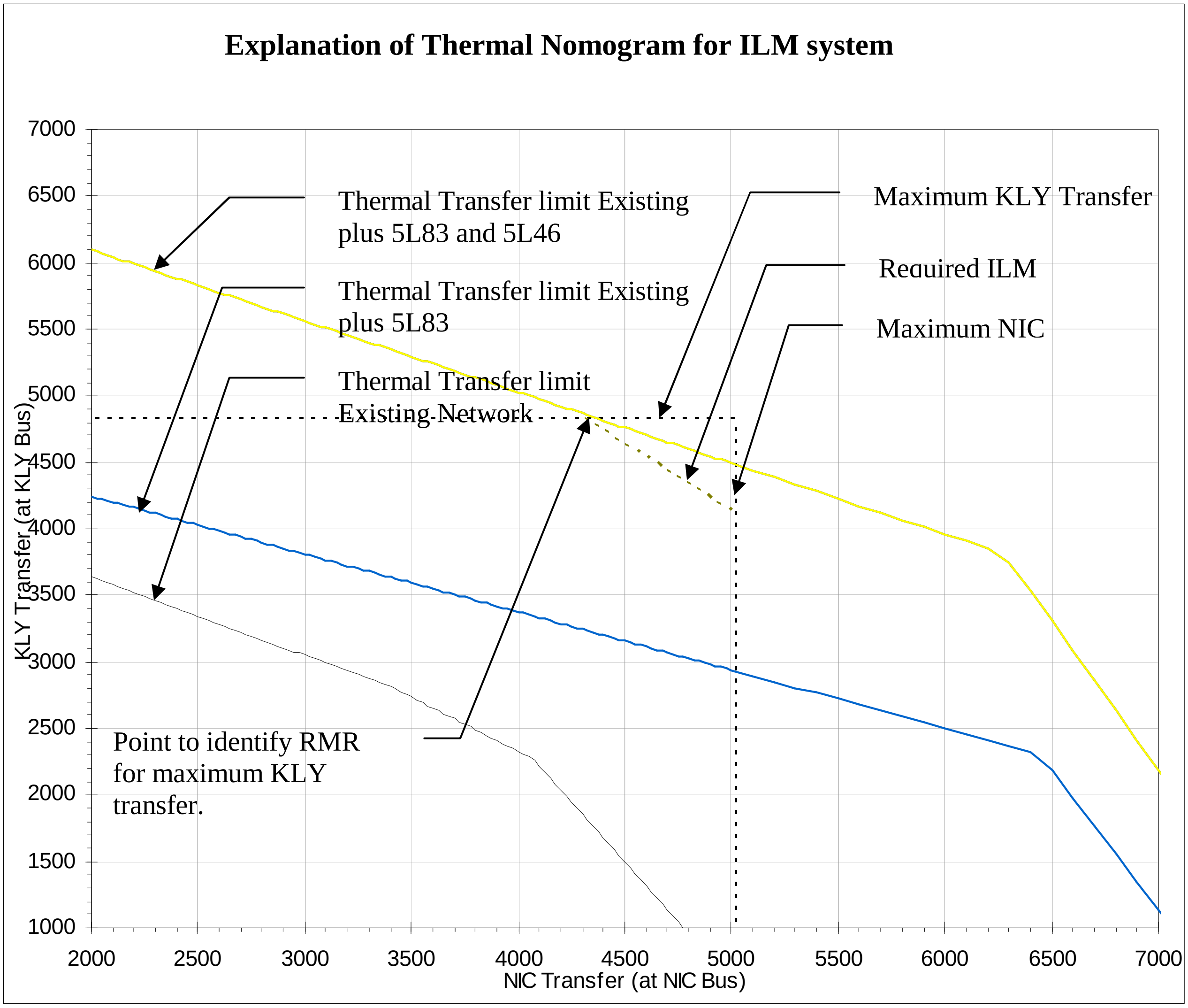


Figure 1.2 illustrates terminologies applicable to the thermal nomograms of the ILM network.

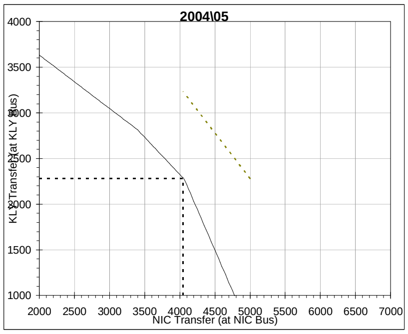
Figure 1.2

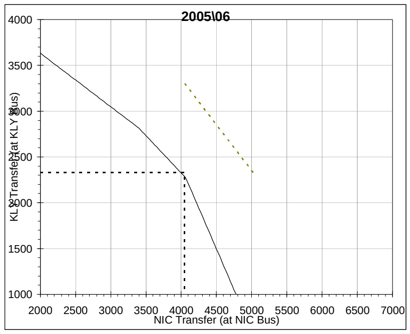


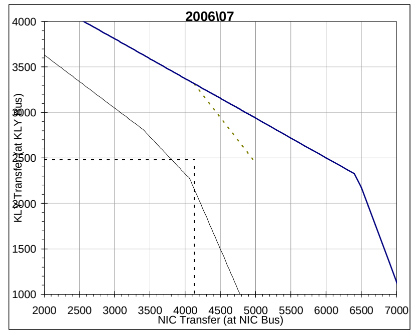
Appendix 2: Nomogram Analysis for Scenario 1

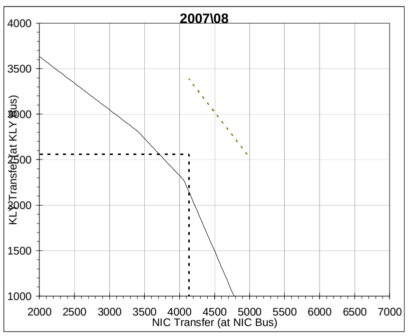
This appendix summarizes details of the N-1 nomogram analysis for scenario 1.

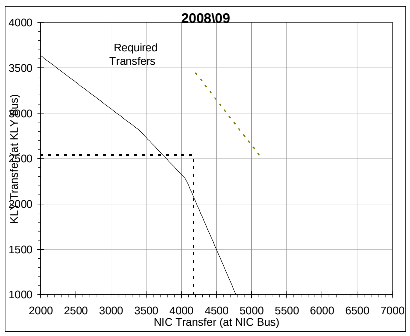
Minimum Coastal Generation:147MW

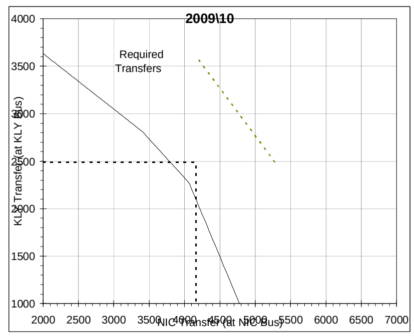


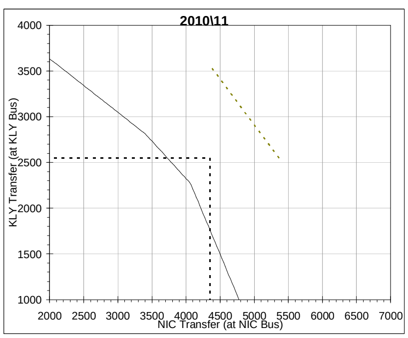


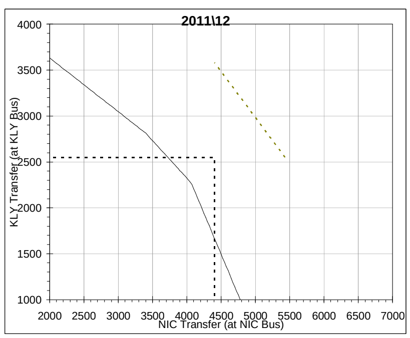


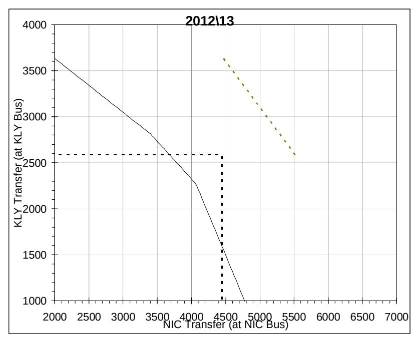


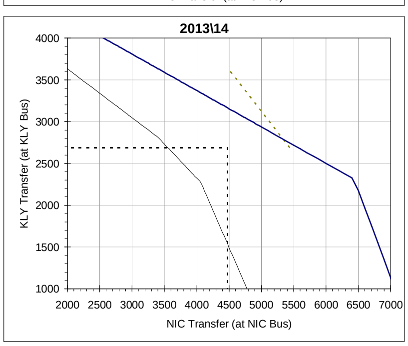








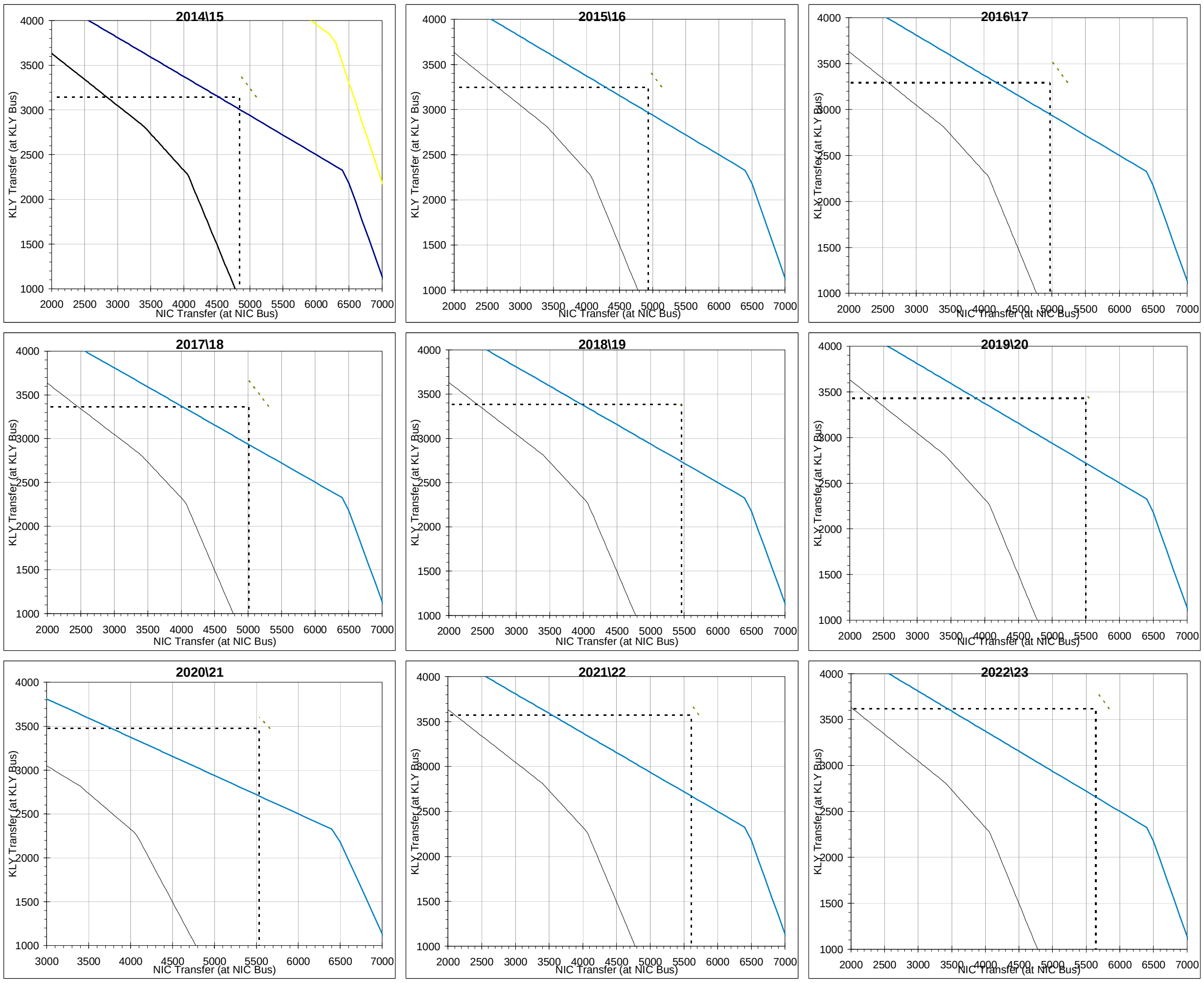


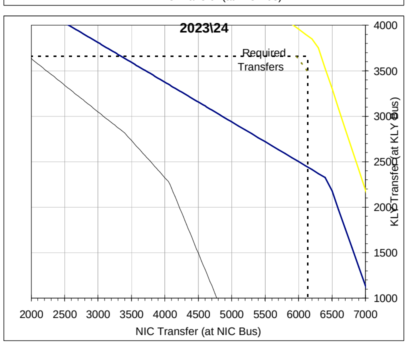


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: System Generic
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjuste	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4005	4109	4109	4168	4285
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4005	4109	4109	4168	4285
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5883	5948	6007	6054
Installed Cap (Adjuste	5599	5599	5695	5695	5701	5701	5883	5948	6007	6054
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2279	2331	2480	2558	2537	2488	2547	2552	2586	2689
Max NIC Transfer	4045	4047	4133	4133	4173	4162	4351	4404	4446	4476
Req Trans @ KLY/NIC	7280	7351	7443	7525	7649	7770	7911	7986	8104	8125
Req Trans @ LM	6991	7057	7142	7218	7332	7443	7572	7641	7749	7863
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	-387	-340	87	383	277	124	353	334	353	530

Minimum Coastal Generation:147MW (Continued)

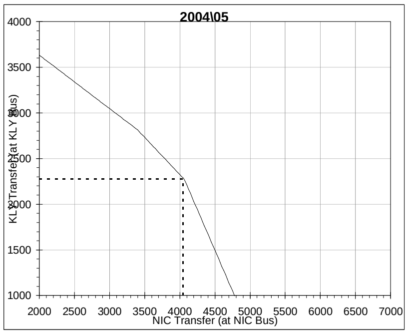


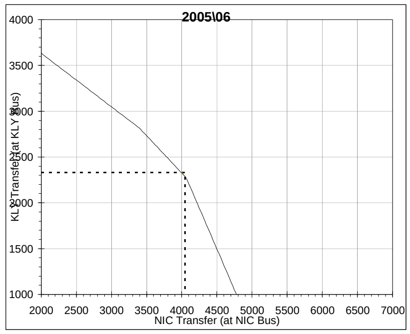


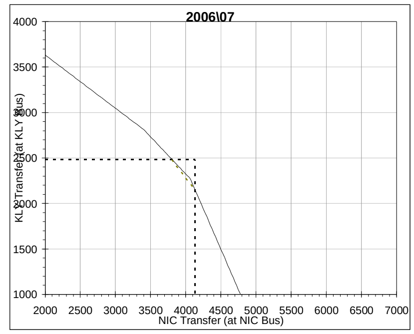
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: System Generic
Load Forecast: October 2004 Forecast - Heavy Winter

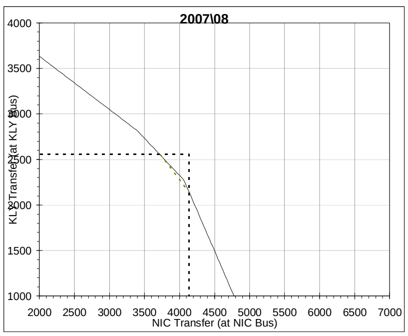
Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjust	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4754	4871	4930	5019	5056	5114	5173	5290	5349	5407
Installed Cap (Adjust	4754	4871	4930	5019	5056	5114	5173	5290	5349	5407
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	6464	6581	6640	6699	7207	7266	7324	7428	7486	8045
Installed Cap (Adjust	6464	6581	6640	6699	7207	7266	7324	7428	7486	8045
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	3143	3248	3293	3366	3385	3429	3472	3574	3618	3661
Max NIC Transfer	4842	4935	4972	5010	5461	5497	5532	5608	5643	6134
Req Trans @ KLY/NIC	8244	8387	8531	8677	8828	8980	9137	9300	9462	9628
Req Trans @ LM	7976	8110	8244	8381	8522	8664	8810	8961	9112	9266
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	1212	1172	1015	852	1314	1551	1791	2138	2316	2745

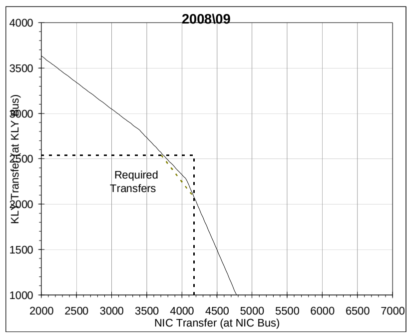
Maximum Columbia Generation

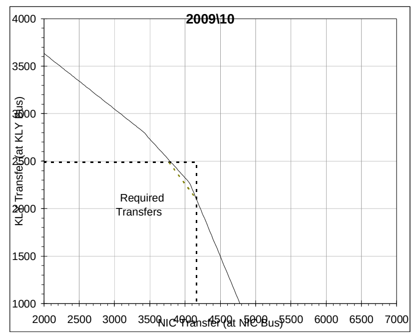


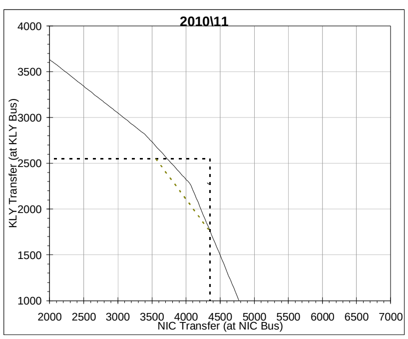


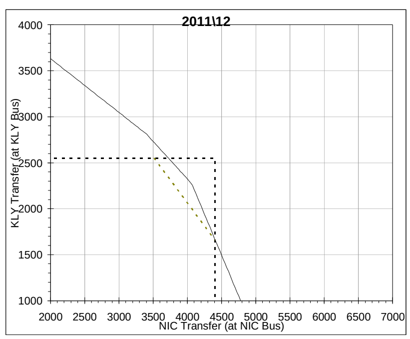


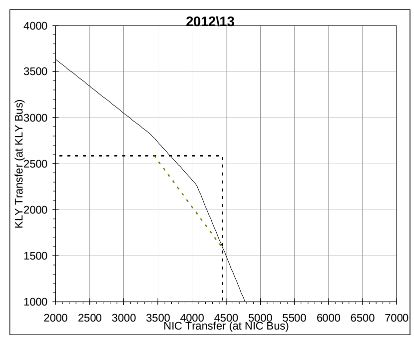


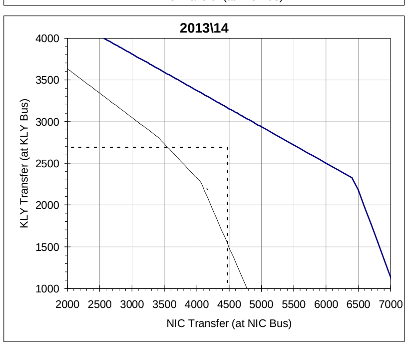








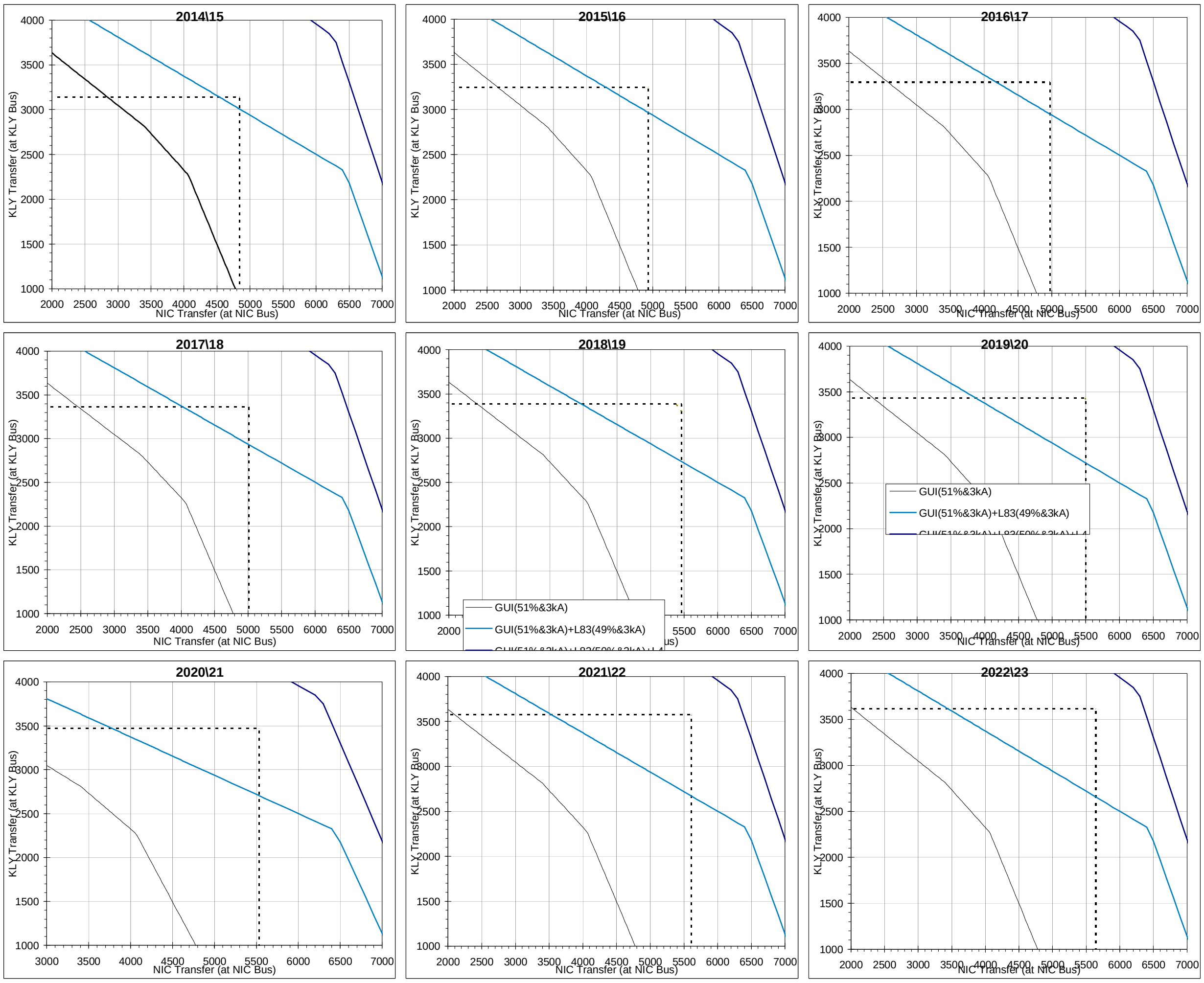


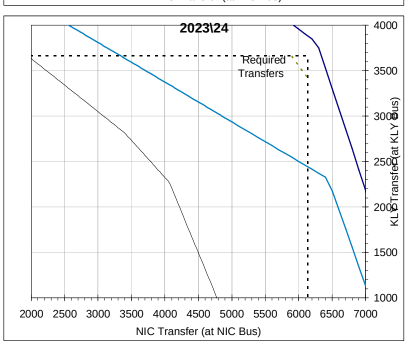


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: System Generic
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1016	1072	1207	1282	1427	1530	1811	1924	2069	1022
Installed Cap (Adjuste	1016	1072	1207	1282	1427	1530	1811	1924	2069	1022
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4005	4109	4109	4168	4285
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4005	4109	4109	4168	4285
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5883	5948	6007	6054
Installed Cap (Adjuste	5599	5599	5695	5695	5701	5701	5883	5948	6007	6054
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2279	2331	2480	2558	2537	2488	2547	2552	2586	2689
Max NIC Transfer	4045	4047	4133	4133	4173	4162	4351	4404	4446	4476
Req Trans @ KLY/NIC	6322	6331	6280	6280	6247	6257	6105	6063	6030	7164
Req Trans @ LM	6101	6110	6061	6061	6031	6040	5896	5856	5824	6960
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	-295	-271	190	478	398	255	492	477	501	616

Maximum Columbia Generation (Continued)

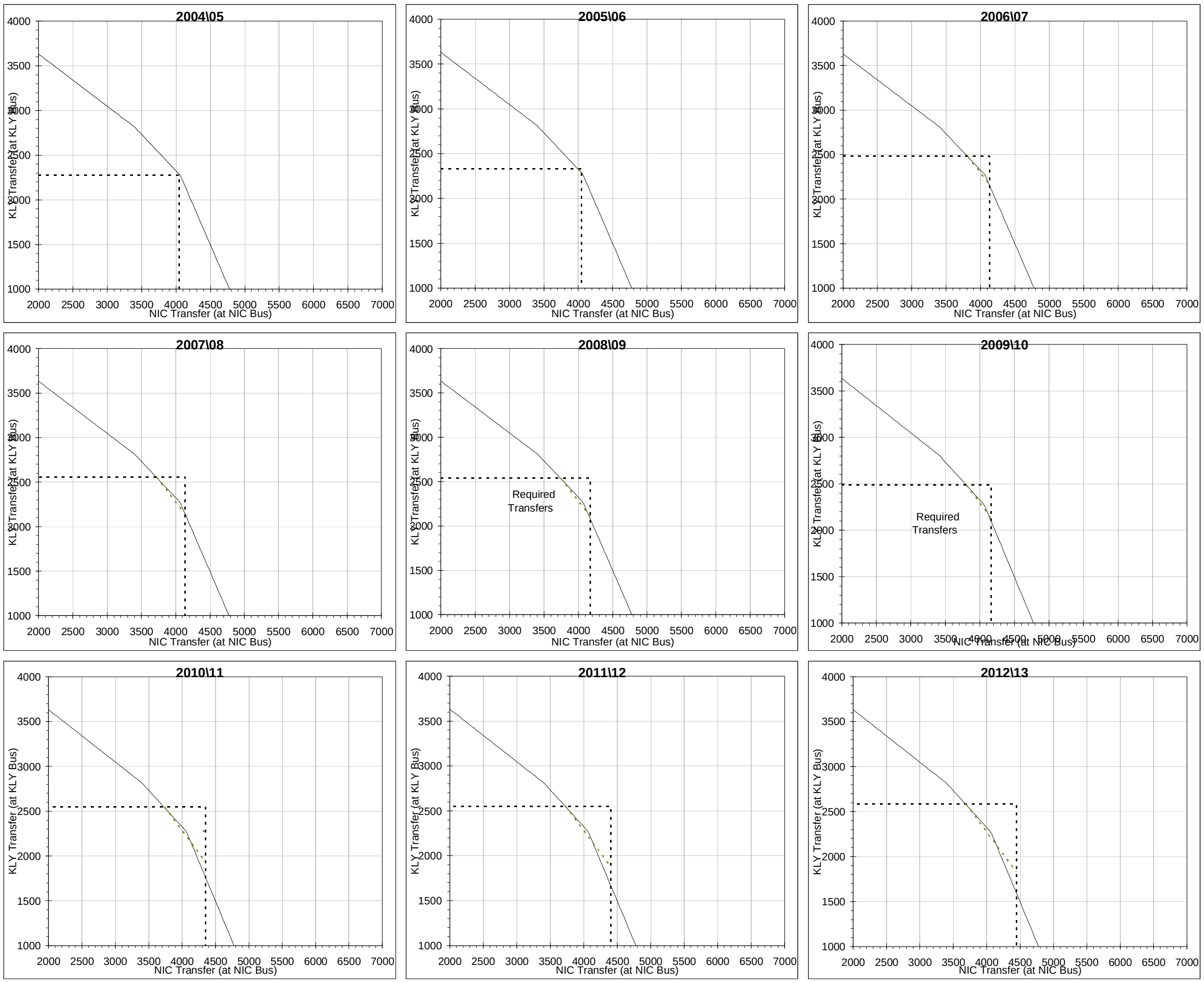


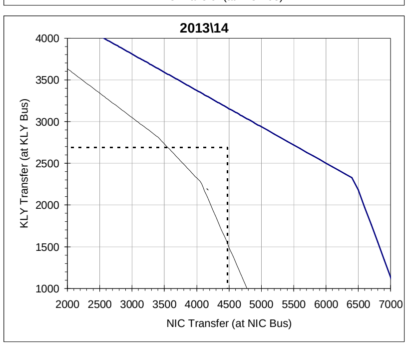


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: System Generic
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	329	278	331	362	147	147	206	189	261	147
Installed Cap (Adjust	329	278	331	362	147	147	206	189	261	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4754	4871	4930	5019	5056	5114	5173	5290	5349	5407
Installed Cap (Adjust	4754	4871	4930	5019	5056	5114	5173	5290	5349	5407
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	6464	6581	6640	6699	7207	7266	7324	7428	7486	8045
Installed Cap (Adjust	6464	6581	6640	6699	7207	7266	7324	7428	7486	8045
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	3143	3248	3293	3366	3385	3429	3472	3574	3618	3661
Max NIC Transfer	4842	4935	4972	5010	5461	5497	5532	5608	5643	6134
Req Trans @ KLY/NIC	7985	8182	8264	8375	8763	8914	9003	9180	9259	9553
Req Trans @ LM	7784	7972	8050	8155	8521	8664	8748	8917	8991	9265
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	1732	1904	1911	1941	2296	2287	2277	2415	2404	2814

Maximum Peace Generation

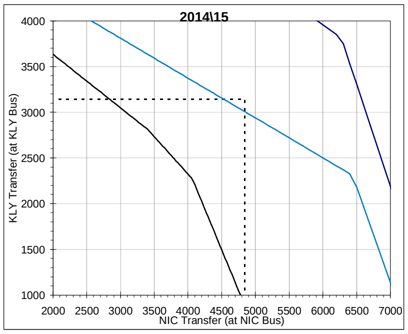


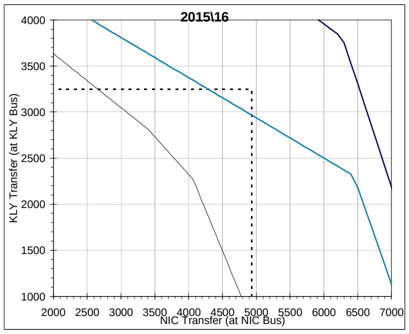


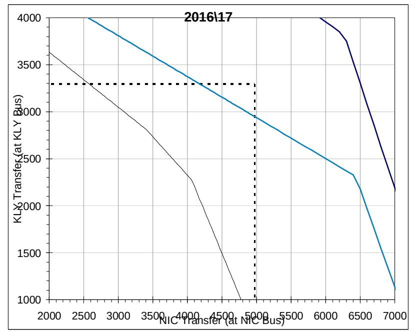
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: System Generic
Load Forecast: October 2004 Forecast - Heavy Winter

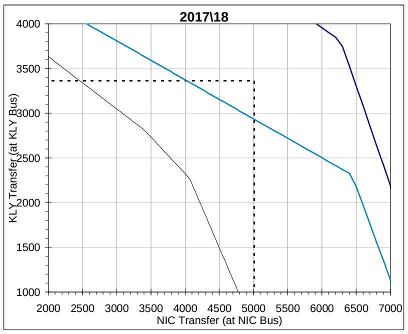
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1016	1078	1195	1285	1395	1497	1641	1712	1829	1022
Installed Cap (Adjuste	1016	1078	1195	1285	1395	1497	1641	1712	1829	1022
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4005	4109	4109	4168	4285
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4005	4109	4109	4168	4285
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5883	5948	6007	6054
Installed Cap (Adjuste	5599	5599	5695	5695	5701	5701	5883	5948	6007	6054
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2279	2331	2480	2558	2537	2488	2547	2552	2586	2689
Max NIC Transfer	4045	4047	4133	4133	4173	4162	4351	4404	4446	4476
Req Trans @ KLY/NIC	6322	6325	6293	6276	6282	6291	6281	6281	6274	7164
Req Trans @ LM	6101	6104	6073	6058	6063	6072	6061	6060	6053	6960
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	-295	-241	173	492	352	211	262	196	189	616

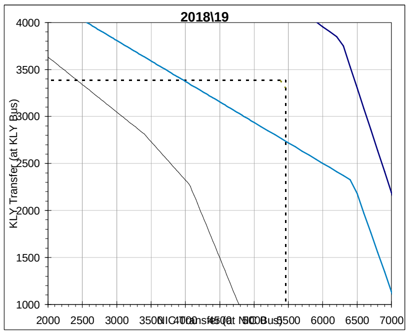
Maximum Peace Generation (Continued)

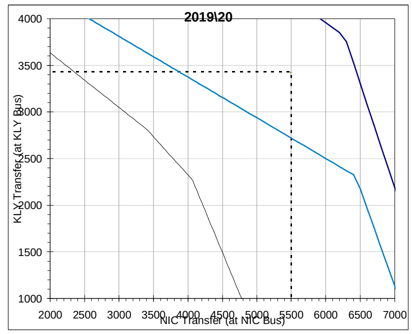


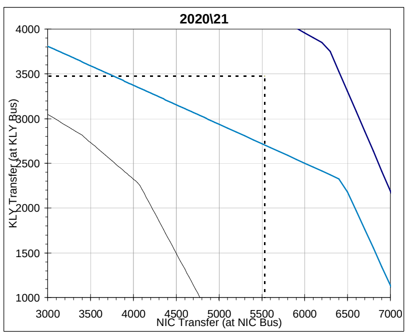


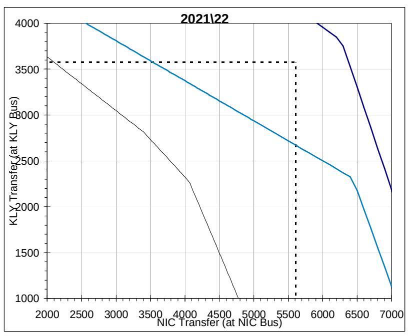


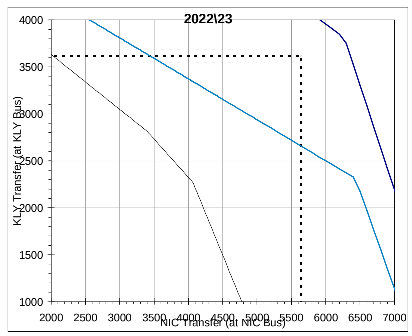


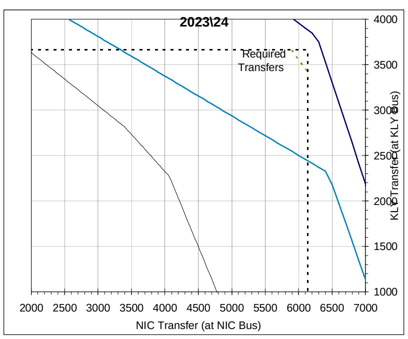












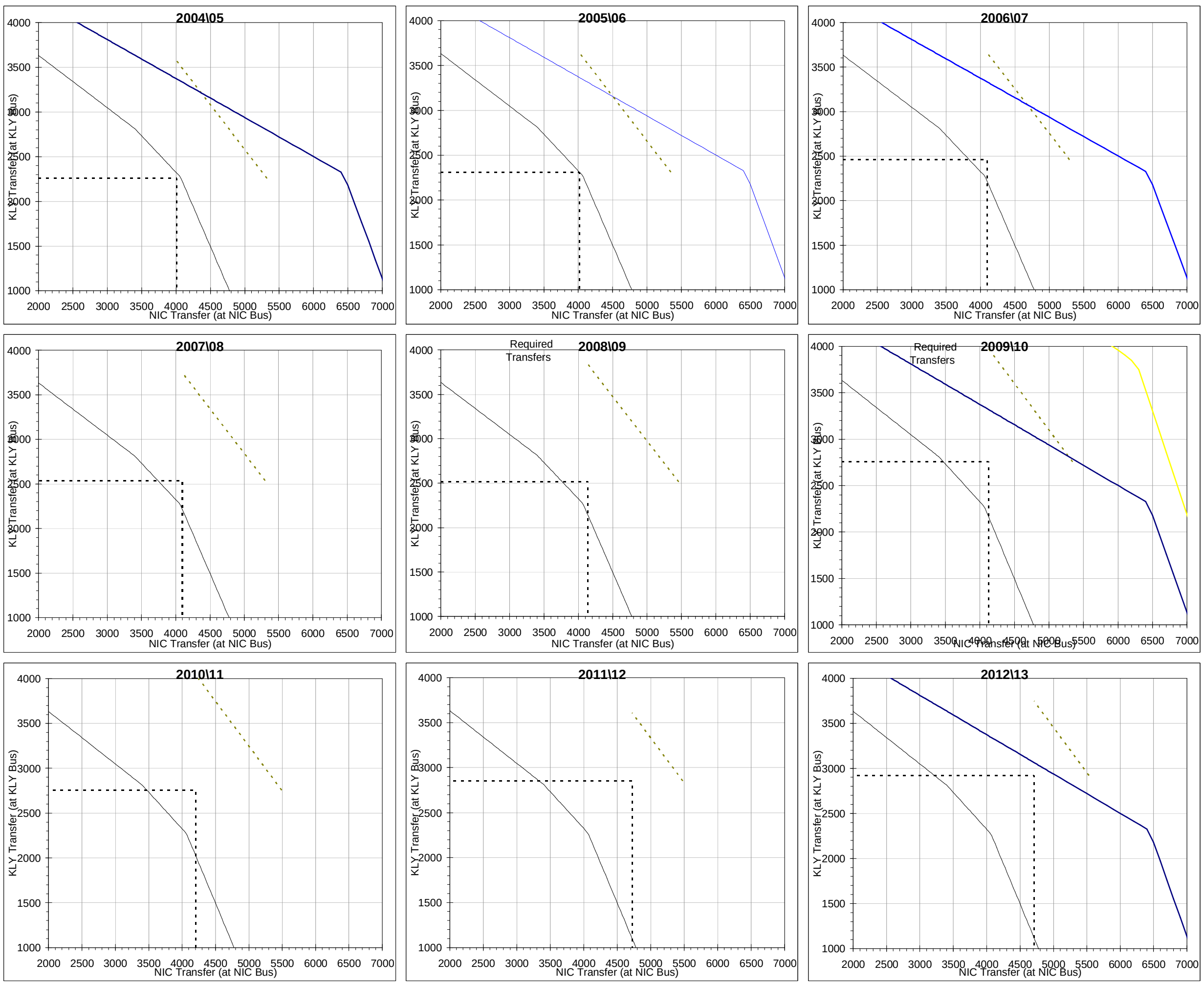
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: System Generic
Load Forecast: October 2004 Forecast - Heavy Winter

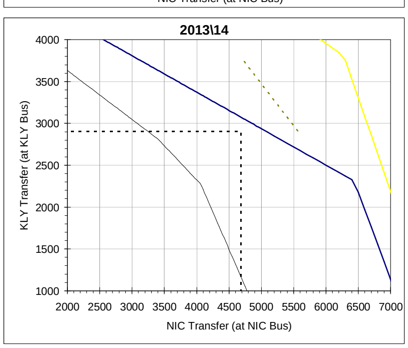
Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	329	278	331	362	147	147	206	189	261	147
Installed Cap (Adjust	329	278	331	362	147	147	206	189	261	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4754	4871	4930	5019	5056	5114	5173	5290	5349	5407
Installed Cap (Adjust	4754	4871	4930	5019	5056	5114	5173	5290	5349	5407
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	6464	6581	6640	6699	7207	7266	7324	7428	7486	8045
Installed Cap (Adjust	6464	6581	6640	6699	7207	7266	7324	7428	7486	8045
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	3143	3248	3293	3366	3385	3429	3472	3574	3618	3661
Max NIC Transfer	4842	4935	4972	5010	5461	5497	5532	5608	5643	6134
Req Trans @ KLY/NIC	7985	8182	8264	8375	8763	8914	9003	9180	9259	9553
Req Trans @ LM	7784	7972	8050	8155	8521	8664	8748	8917	8991	9265
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	1732	1904	1911	1941	2296	2287	2277	2415	2404	2814

Appendix 3: Nomogram Analysis for Scenario 2

This appendix summarizes details of the N-1 nomogram analysis for scenario 2.

Minimum Coastal Generation:147MW

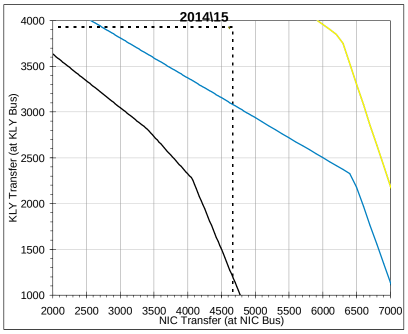


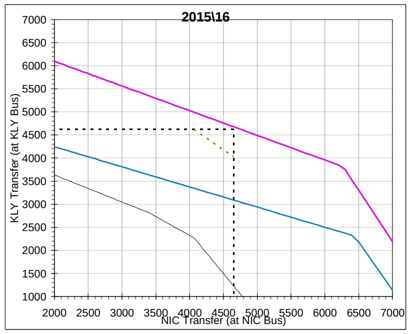


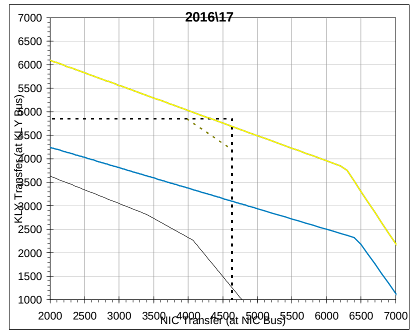
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: Site-C
Load Forecast: October 2004 Forecast - Heavy Winter

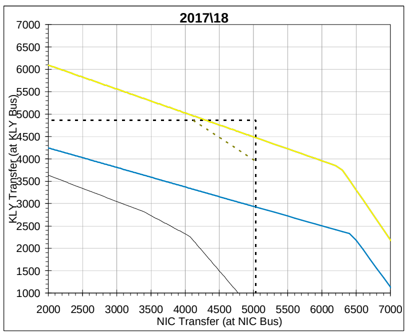
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjuste	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4465	4557	4557
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4327	4373	4465	4557	4557
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5766	6331	6331	6320
Installed Cap (Adjuste	5599	5599	5695	5695	5701	5701	5766	6331	6331	6320
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2854	2921	2907
Max NIC Transfer	4011	4013	4099	4098	4137	4125	4205	4723	4710	4685
Req Trans @ KLY/NIC	7581	7657	7755	7844	7975	8101	8250	8332	8455	8475
Req Trans @ LM	7267	7338	7429	7511	7631	7748	7885	7959	8071	8191
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	-744	-701	-280	7	-108	27	-43	492	422	-19

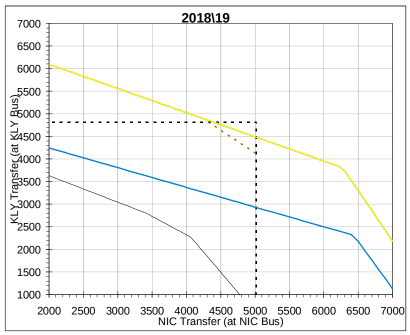
Minimum Coastal Generation: 147 MW (Continued)

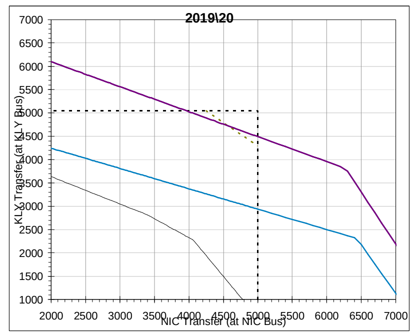


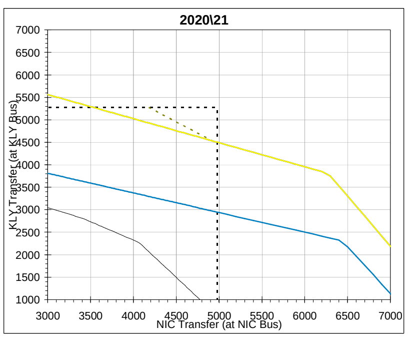


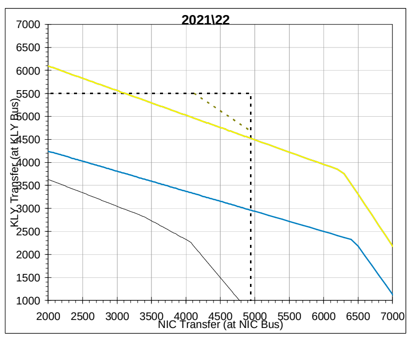


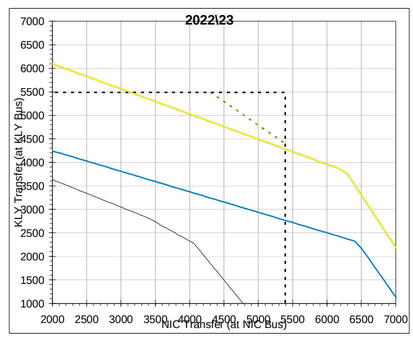


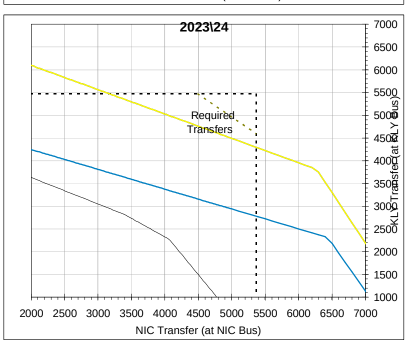








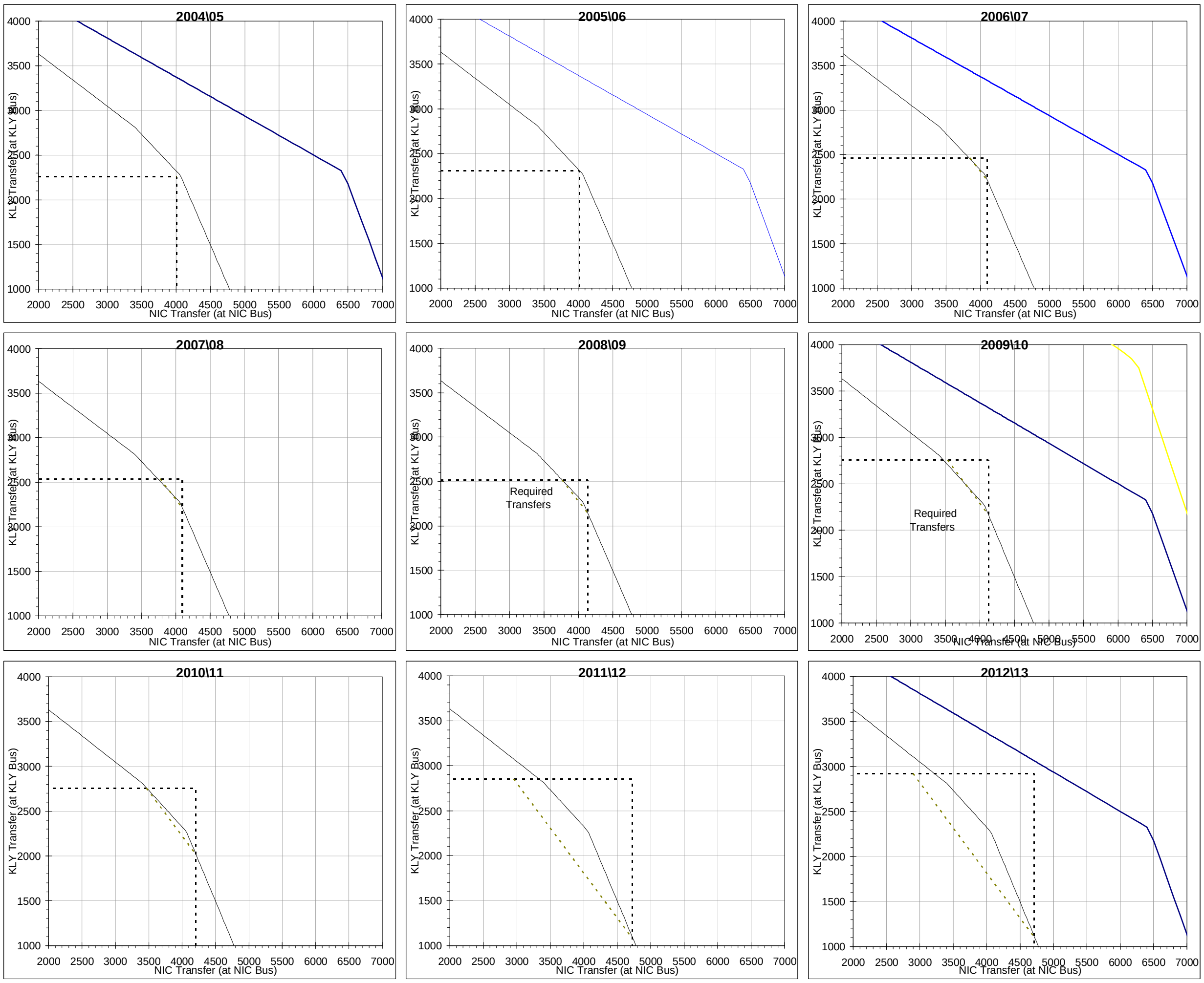


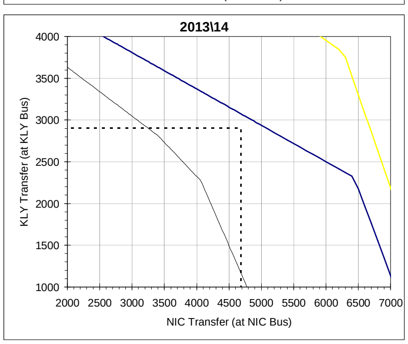


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: Site-C
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjust	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	5700	6400	6643	6674	6652	6895	7138	7382	7382	7382
Installed Cap (Adjust	5700	6400	6643	6674	6652	6895	7138	7382	7382	7382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	6320	6320	6320	6770	6770	6770	6770	6756	7256	7256
Installed Cap (Adjust	6320	6320	6320	6770	6770	6770	6770	6756	7256	7256
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	3931	4618	4848	4861	4820	5049	5276	5503	5488	5472
Max NIC Transfer	4670	4652	4635	5035	5016	4998	4980	4947	5388	5369
Req Trans @ KLY/NIC	8532	8678	8827	8980	9134	9291	9454	9620	9789	9959
Req Trans @ LM	8309	8448	8589	8733	8879	9028	9183	9339	9497	9658
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	1318	1841	1905	2164	1951	1679	1309	918	998	613

Maximum Columbia Generation

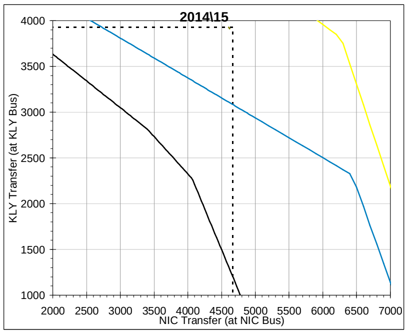


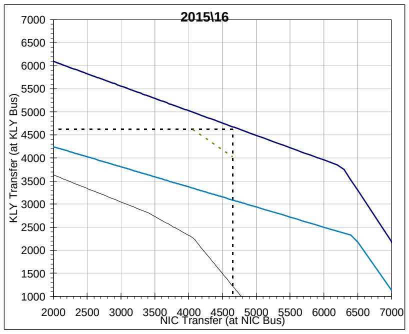


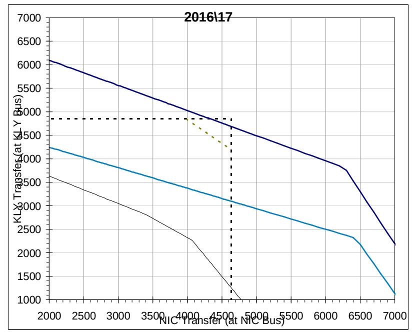
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: Site-C
Load Forecast: October 2004 Forecast - Heavy Winter

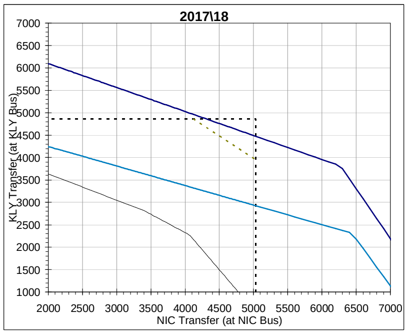
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1342	1360	1470	1552	1702	1812	2017	2517	2627	947
Installed Cap (Adjuste	1342	1360	1470	1552	1702	1812	2017	2517	2627	947
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4465	4557	4557
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4327	4373	4465	4557	4557
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5766	6331	6331	6320
Installed Cap (Adjuste	5599	5599	5695	5695	5701	5701	5766	6331	6331	6320
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2854	2921	2907
Max NIC Transfer	4011	4013	4099	4098	4137	4125	4205	4723	4710	4685
Req Trans @ KLY/NIC	6269	6324	6306	6307	6277	6286	6221	5806	5815	7591
Req Trans @ LM	6051	6103	6086	6087	6059	6068	6007	5610	5618	7362
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	-622	-575	-191	23	37	-68	116	636	571	451

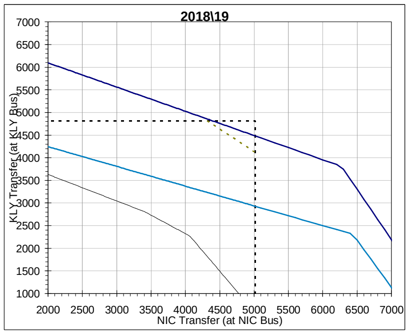
Maximum Columbia Generation (Continued)

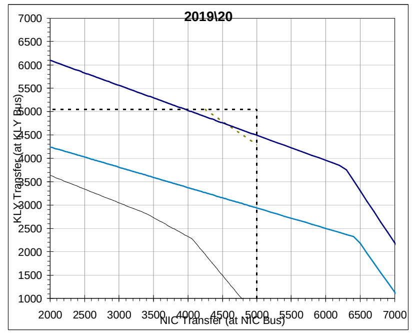


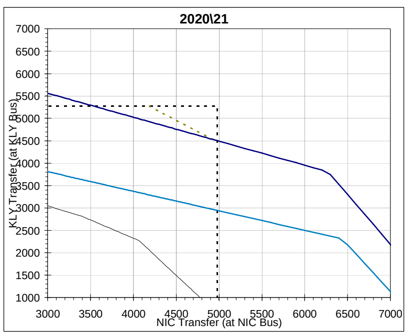


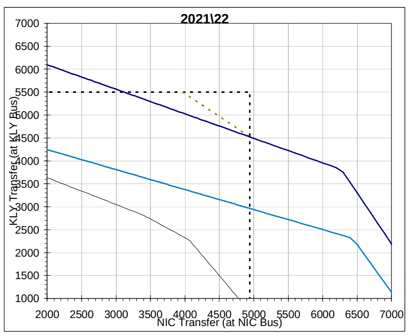


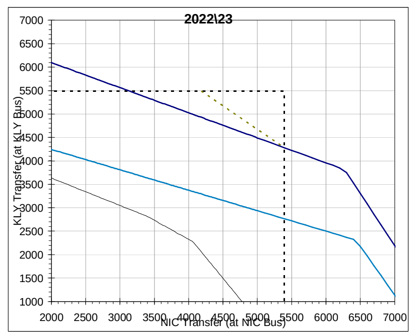


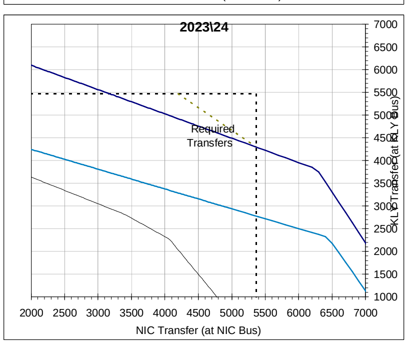








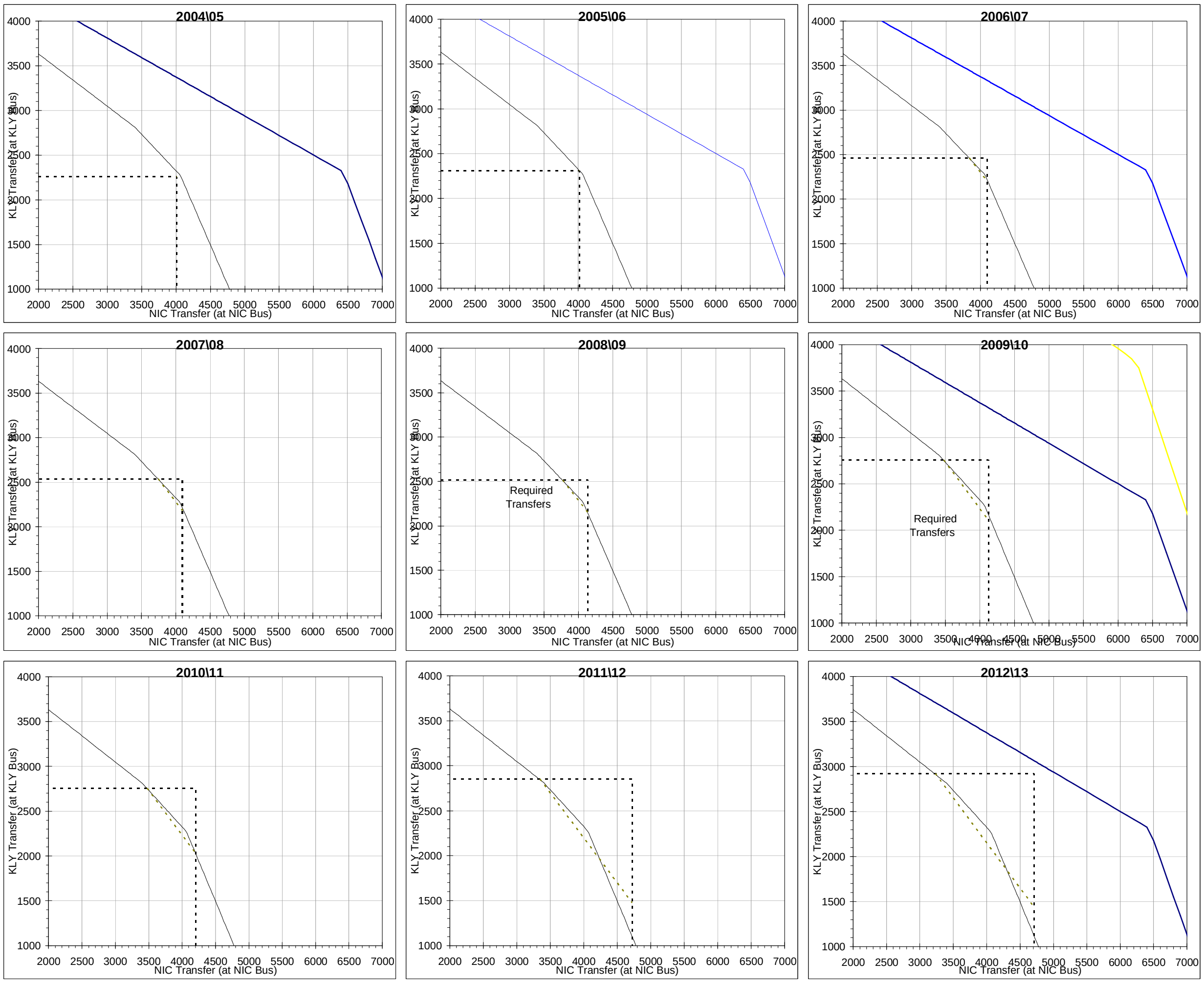


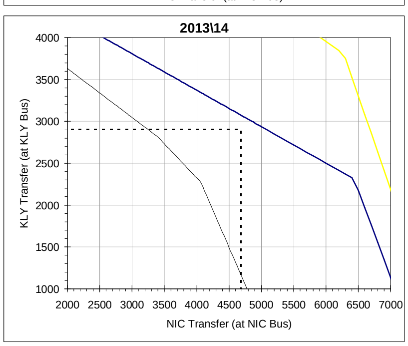


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: Site-C
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	147	147	147	147	285	252	411
Installed Cap (Adjust	147	147	147	147	147	147	147	285	252	411
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	5700	6400	6643	6674	6652	6895	7138	7382	7382	7382
Installed Cap (Adjust	5700	6400	6643	6674	6652	6895	7138	7382	7382	7382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	6320	6320	6320	6770	6770	6770	6770	6756	7256	7256
Installed Cap (Adjust	6320	6320	6320	6770	6770	6770	6770	6756	7256	7256
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	3931	4618	4848	4861	4820	5049	5276	5503	5488	5472
Max NIC Transfer	4670	4652	4635	5035	5016	4998	4980	4947	5388	5369
Req Trans @ KLY/NIC	8532	8678	8827	8980	9134	9291	9454	9466	9671	9662
Req Trans @ LM	8309	8448	8589	8733	8879	9028	9183	9193	9385	9377
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	1318	1841	1905	2164	1951	1679	1309	1112	1148	988

Maximum Peace Generation

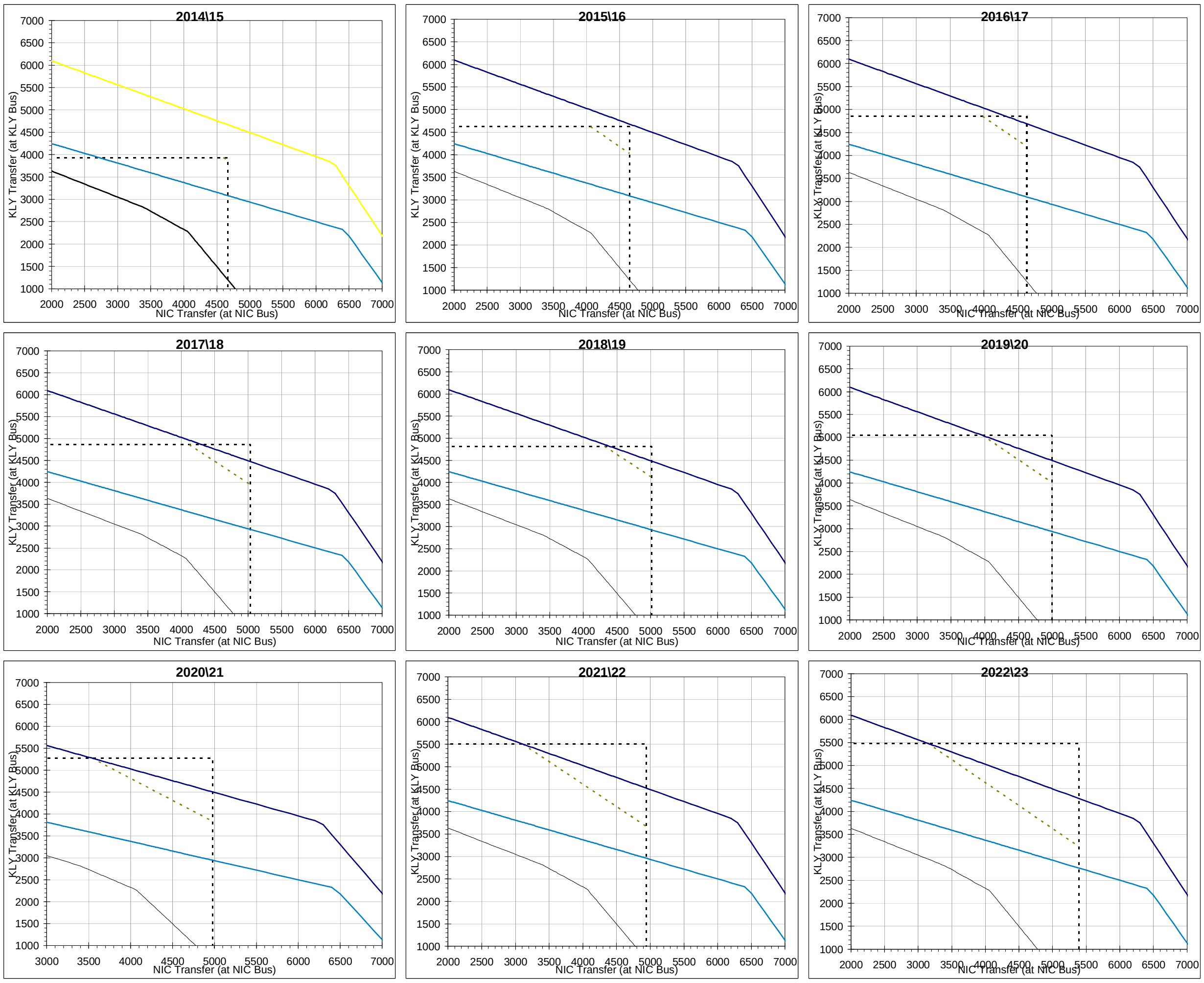


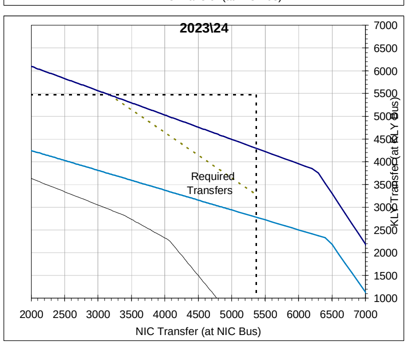


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: Site-C
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1342	1360	1478	1578	1693	1865	2006	2123	2287	947
Installed Cap (Adjust	1342	1360	1478	1578	1693	1865	2006	2123	2287	947
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4465	4557	4557
Installed Cap (Adjust	3820	3828	3978	4055	4101	4327	4373	4465	4557	4557
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5766	6331	6331	6320
Installed Cap (Adjust	5599	5599	5695	5695	5701	5701	5766	6331	6331	6320
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2854	2921	2907
Max NIC Transfer	4011	4013	4099	4098	4137	4125	4205	4723	4710	4685
Req Trans @ KLY/NIC	6269	6324	6297	6279	6287	6232	6233	6197	6150	7591
Req Trans @ LM	6051	6103	6078	6061	6068	6017	6018	5979	5934	7362
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	-622	-575	-152	143	17	178	101	146	156	451

Maximum Peace Generation (Continued)





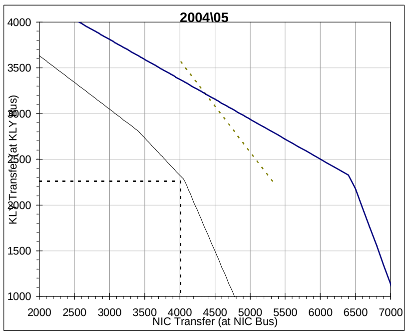
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: Site-C
Load Forecast: October 2004 Forecast - Heavy Winter

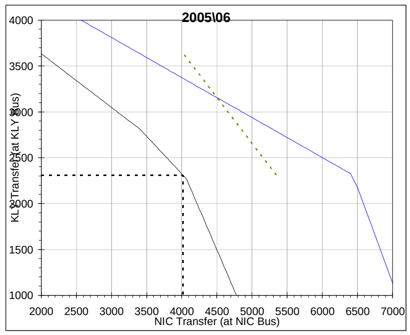
Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	147	147	401	730	1070	1211	1356
Installed Cap (Adjust	147	147	147	147	147	401	730	1070	1211	1356
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	5700	6400	6643	6674	6652	6895	7138	7382	7382	7382
Installed Cap (Adjust	5700	6400	6643	6674	6652	6895	7138	7382	7382	7382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	6320	6320	6320	6770	6770	6770	6770	6756	7256	7256
Installed Cap (Adjust	6320	6320	6320	6770	6770	6770	6770	6756	7256	7256
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	3931	4618	4848	4861	4820	5049	5276	5503	5488	5472
Max NIC Transfer	4670	4652	4635	5035	5016	4998	4980	4947	5388	5369
Req Trans @ KLY/NIC	8532	8678	8827	8980	9134	9009	8810	8610	8627	8640
Req Trans @ LM	8309	8448	8589	8733	8879	8760	8571	8378	8391	8404
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	1318	1841	1905	2164	1951	2032	2111	2166	2434	2240

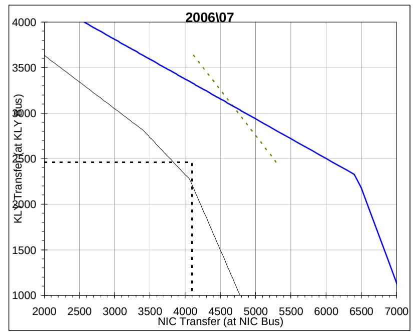
Appendix 4: Nomogram Analysis for Scenario 3

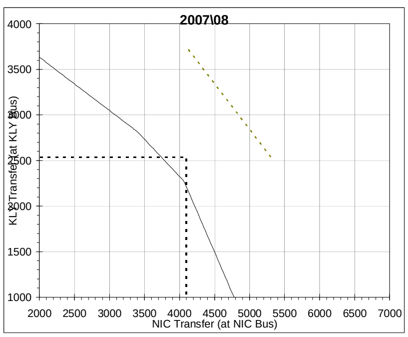
This appendix summarizes details of the N-1 nomogram analysis for scenario 3.

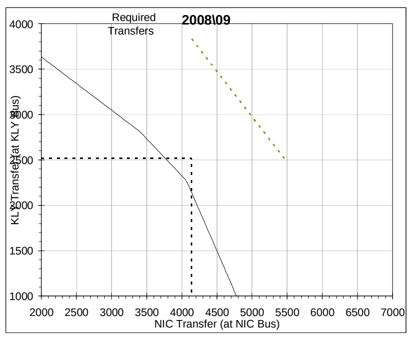
Minimum Coastal Generation:147MW

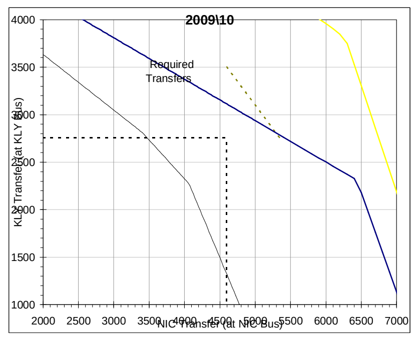


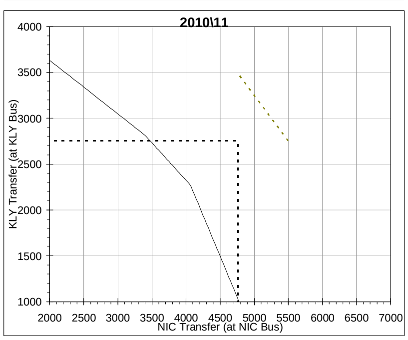


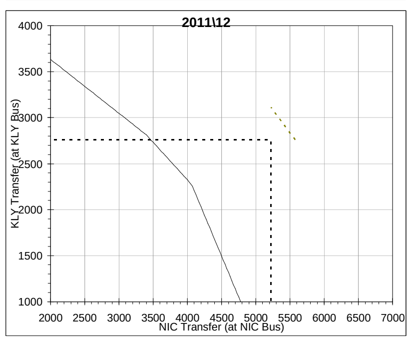


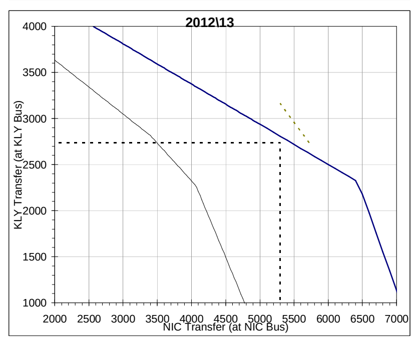


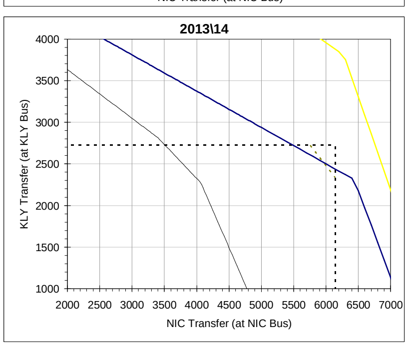








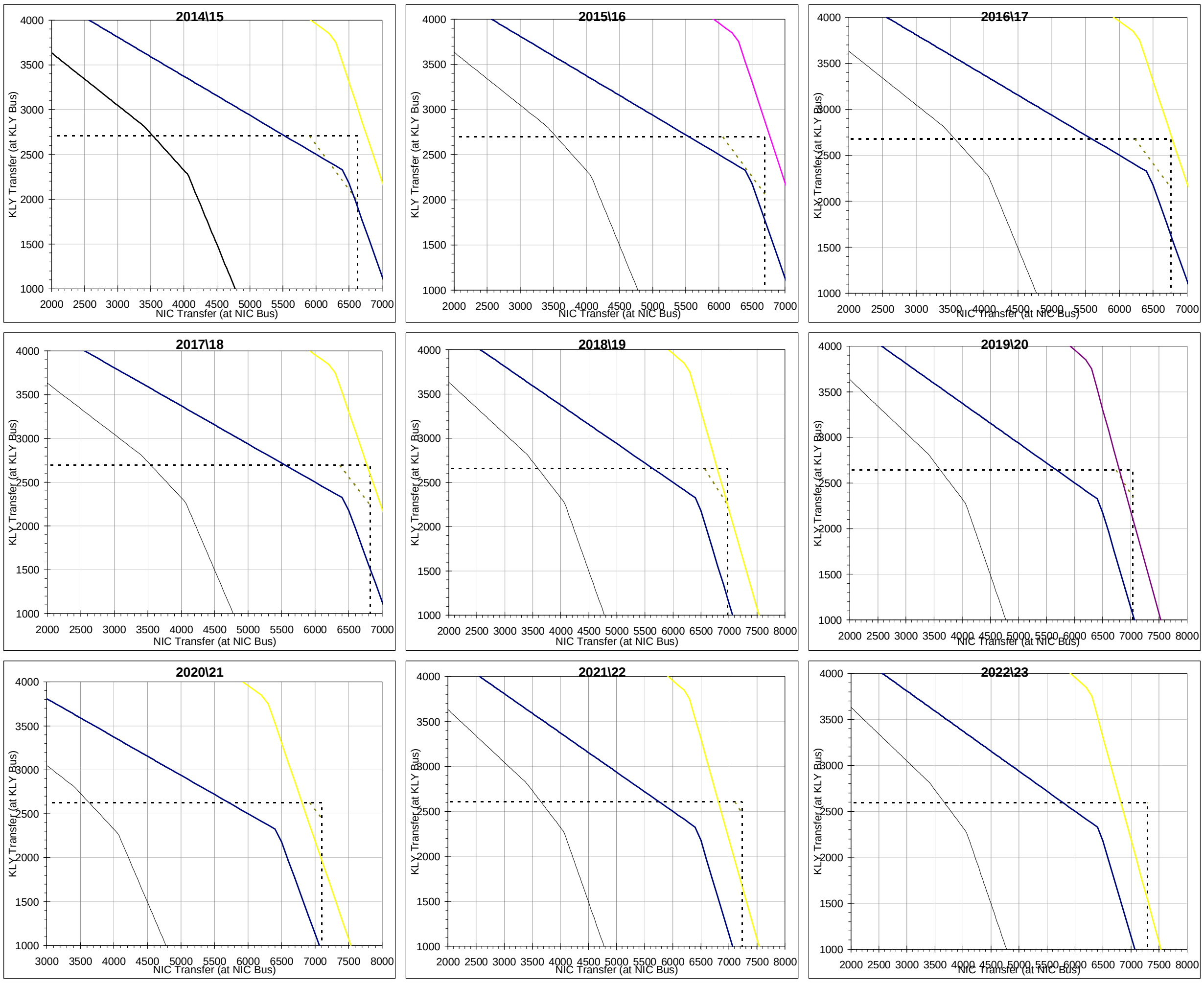


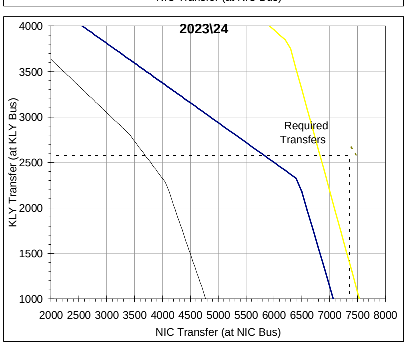


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: MCA-REV
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjuste	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	6201	6358	6873	6965	7904
Installed Cap (Adjuste	5599	5599	5695	5695	5701	6201	6358	6873	6965	7904
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2762	2737	2723
Max NIC Transfer	4011	4013	4099	4098	4137	4592	4757	5225	5297	6142
Req Trans @ KLY/NIC	7581	7657	7755	7844	7975	8103	8252	8337	8461	8478
Req Trans @ LM	7267	7338	7429	7511	7631	7748	7885	7959	8071	8191
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	-744	-701	-280	7	-108	494	509	899	822	1433

Minimum Coastal Generation: 147 MW (Continued)

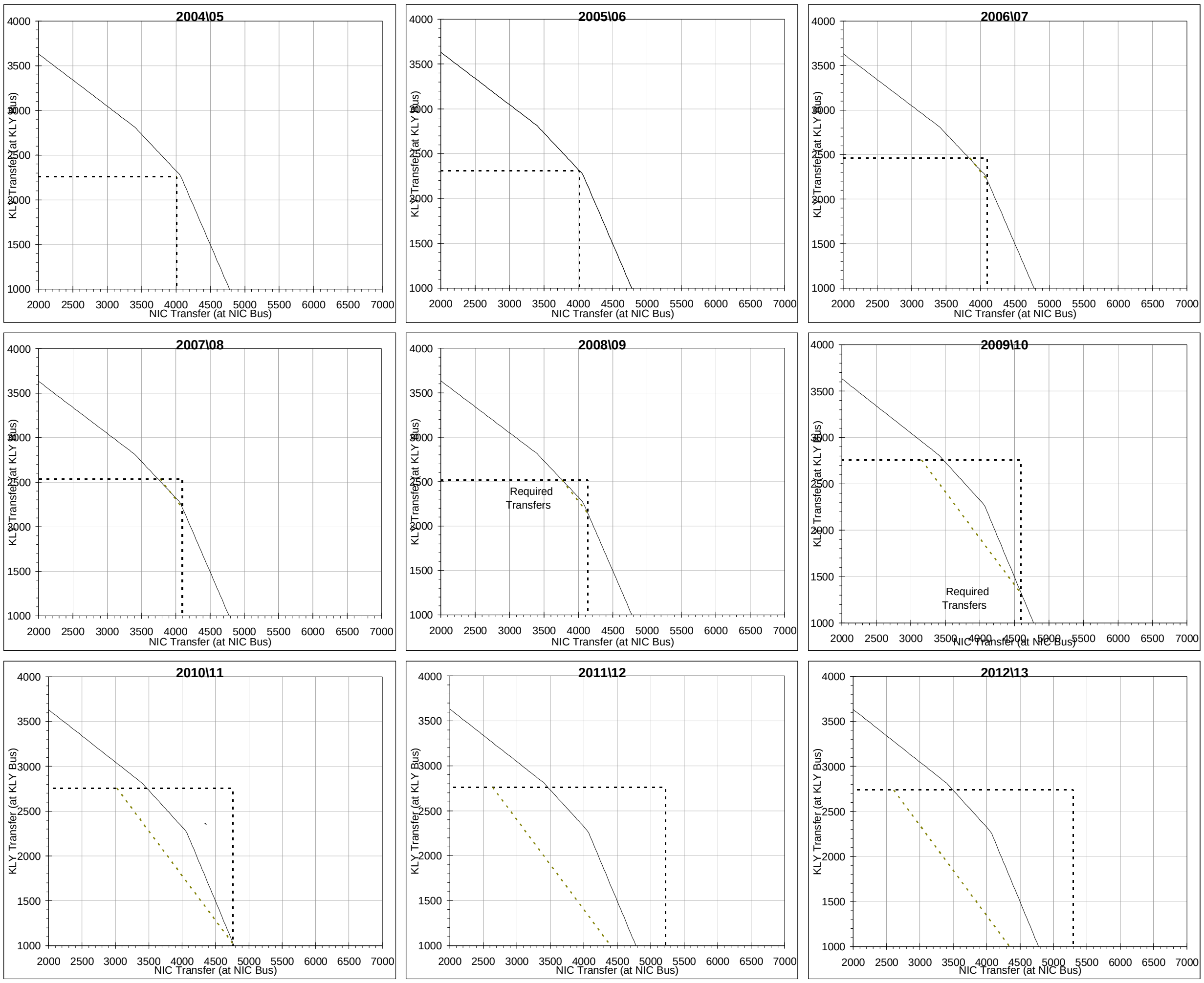


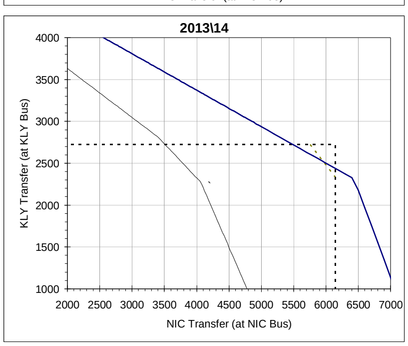


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: MCA-REV
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjust	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Installed Cap (Adjust	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	8455	8547	8639	8731	8915	9007	9099	9269	9361	9453
Installed Cap (Adjust	8455	8547	8639	8731	8915	9007	9099	9269	9361	9453
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2708	2695	2682	2696	2656	2641	2625	2608	2594	2578
Max NIC Transfer	6627	6694	6759	6824	6973	7036	7101	7233	7297	7358
Req Trans @ KLY/NIC	8607	8756	8907	9061	9220	9380	9546	9715	9886	10061
Req Trans @ LM	8309	8448	8589	8733	8879	9028	9183	9339	9497	9658
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	1622	1266	1674	1704	1654	1543	1426	1372	1251	1124

Maximum Columbia Generation

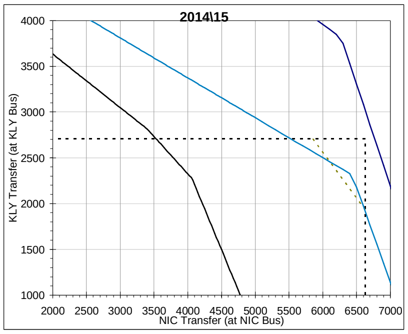


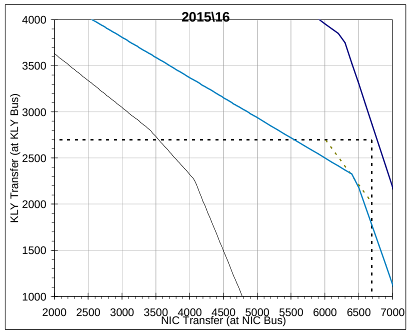


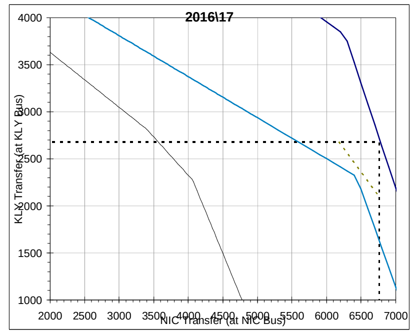
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: MCA-REV
Load Forecast: October 2004 Forecast - Heavy Winter

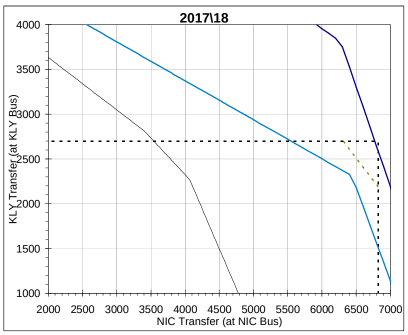
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1342	1360	1470	1552	1702	2187	2467	2947	3133	147
Installed Cap (Adjuste	1342	1360	1470	1552	1702	2187	2467	2947	3133	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	6201	6358	6873	6965	7904
Installed Cap (Adjuste	5599	5599	5695	5695	5701	6201	6358	6873	6965	7904
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2762	2737	2723
Max NIC Transfer	4011	4013	4099	4098	4137	4592	4757	5225	5297	6142
Req Trans @ KLY/NIC	6269	6324	6306	6307	6277	5912	5779	5401	5342	8478
Req Trans @ LM	6051	6103	6086	6087	6059	5711	5584	5217	5159	8191
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	-622	-575	-191	23	37	635	650	1009	927	1433

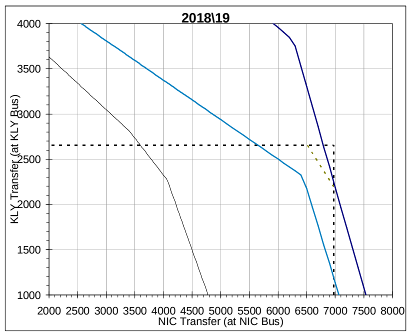
Maximum Columbia Generation (Continued)

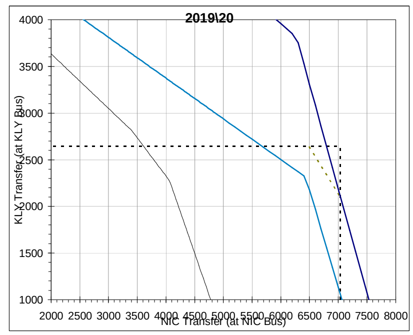


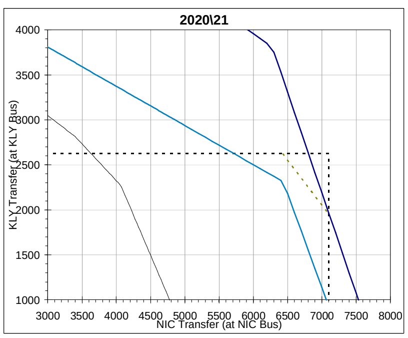


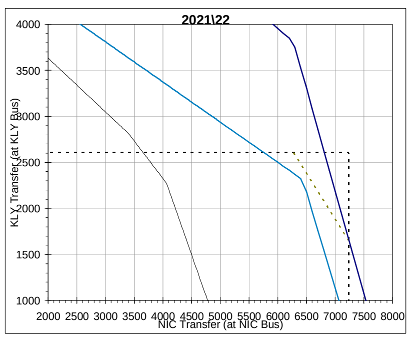


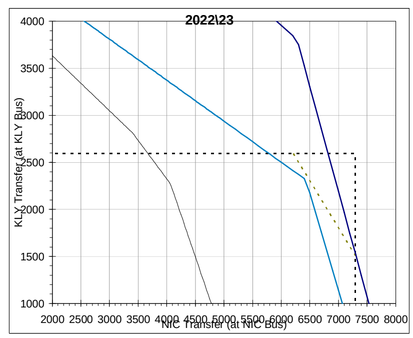


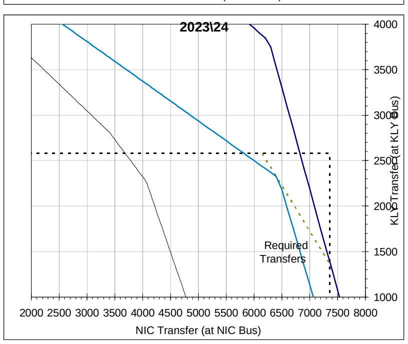








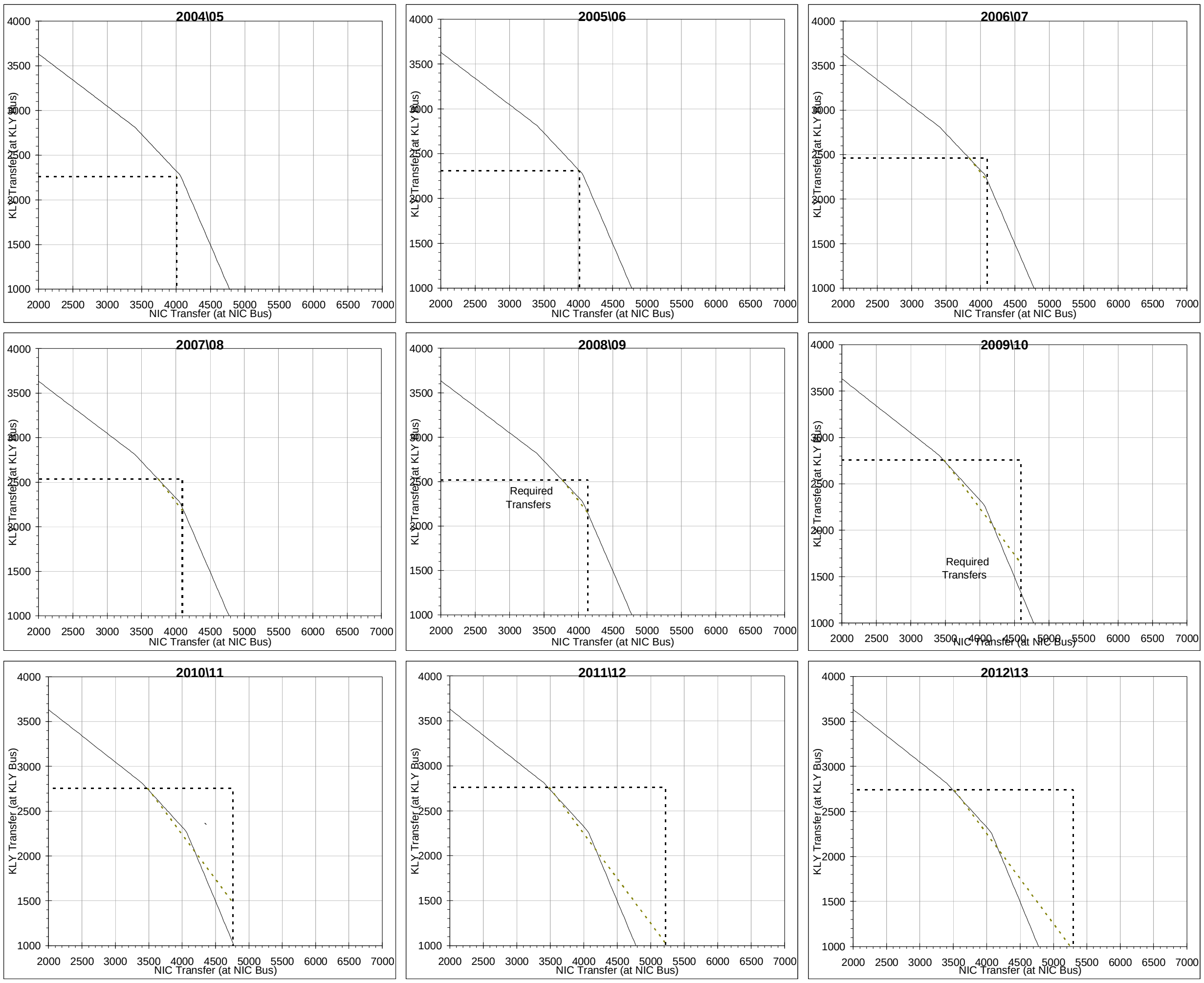


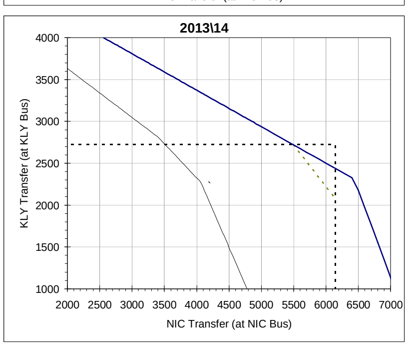


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: MCA-REV
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	147	147	319	540	847	1076	1308
Installed Cap (Adjust	147	147	147	147	147	319	540	847	1076	1308
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Installed Cap (Adjust	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	8455	8547	8639	8731	8915	9007	9099	9269	9361	9453
Installed Cap (Adjust	8455	8547	8639	8731	8915	9007	9099	9269	9361	9453
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2708	2695	2682	2696	2656	2641	2625	2608	2594	2578
Max NIC Transfer	6627	6694	6759	6824	6973	7036	7101	7233	7297	7358
Req Trans @ KLY/NIC	8560	8708	8857	9010	9167	9133	9052	8885	8804	8726
Req Trans @ LM	8309	8448	8589	8733	8879	8846	8768	8606	8528	8452
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	2012	1918	1822	1750	1701	1610	1517	1488	1386	1277

Maximum Peace Generation

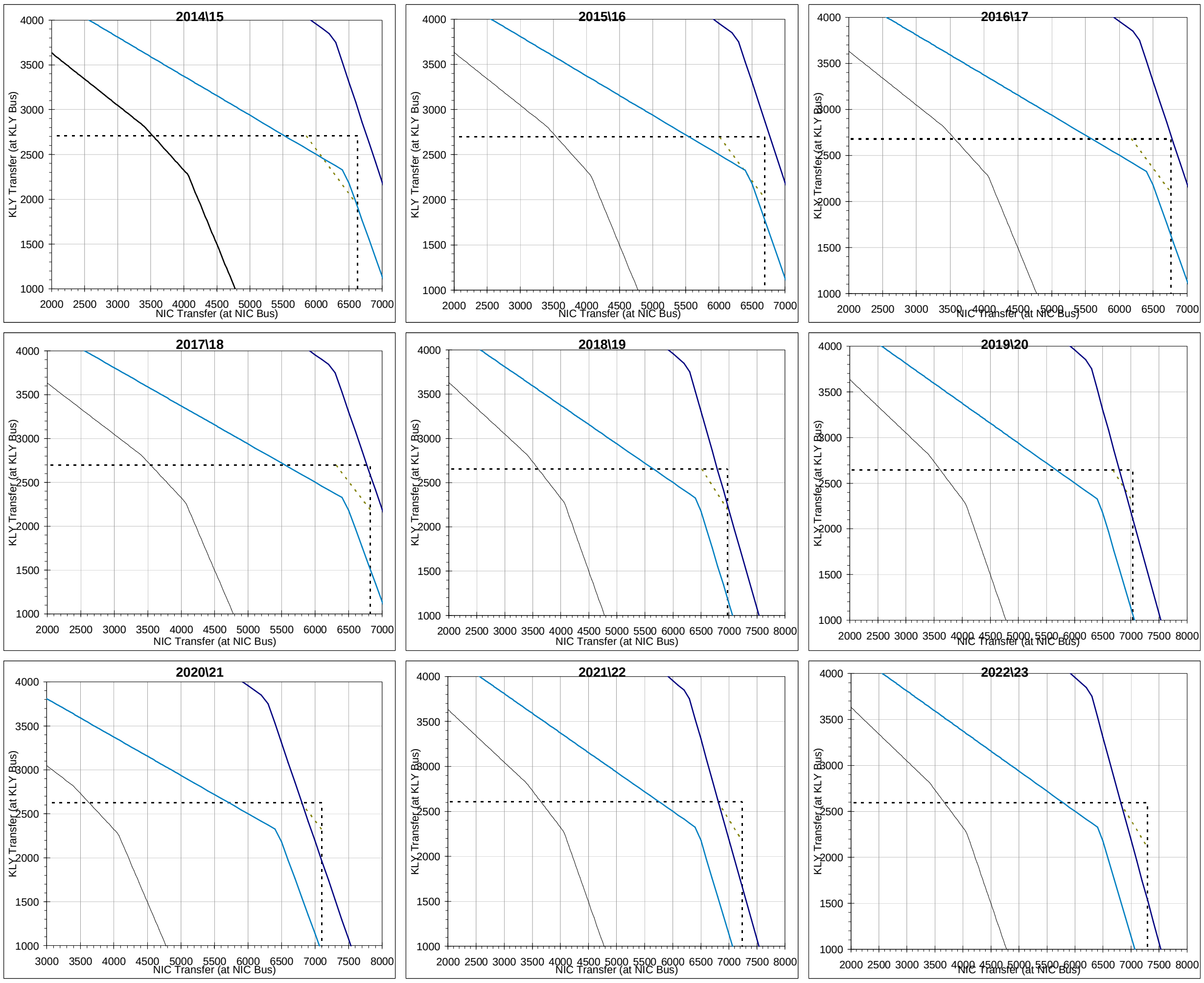


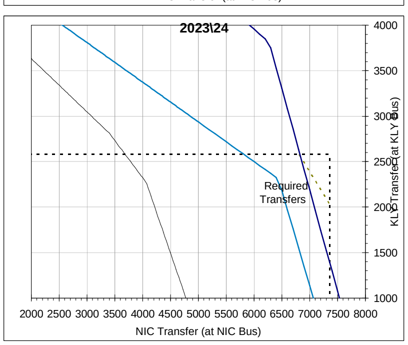


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: MCA-REV
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1342	1360	1478	1577	1695	1865	2006	2083	2195	378
Installed Cap (Adjuste	1342	1360	1478	1577	1695	1865	2006	2083	2195	378
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	6201	6358	6873	6965	7904
Installed Cap (Adjuste	5599	5599	5695	5695	5701	6201	6358	6873	6965	7904
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2762	2737	2723
Max NIC Transfer	4011	4013	4099	4098	4137	4592	4757	5225	5297	6142
Req Trans @ KLY/NIC	6269	6324	6297	6280	6285	6237	6239	6246	6252	8219
Req Trans @ LM	6051	6103	6078	6062	6066	6017	6018	6017	6021	7948
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	-622	-575	-152	143	27	222	71	-33	-187	1660

Maximum Peace Generation (Continued)





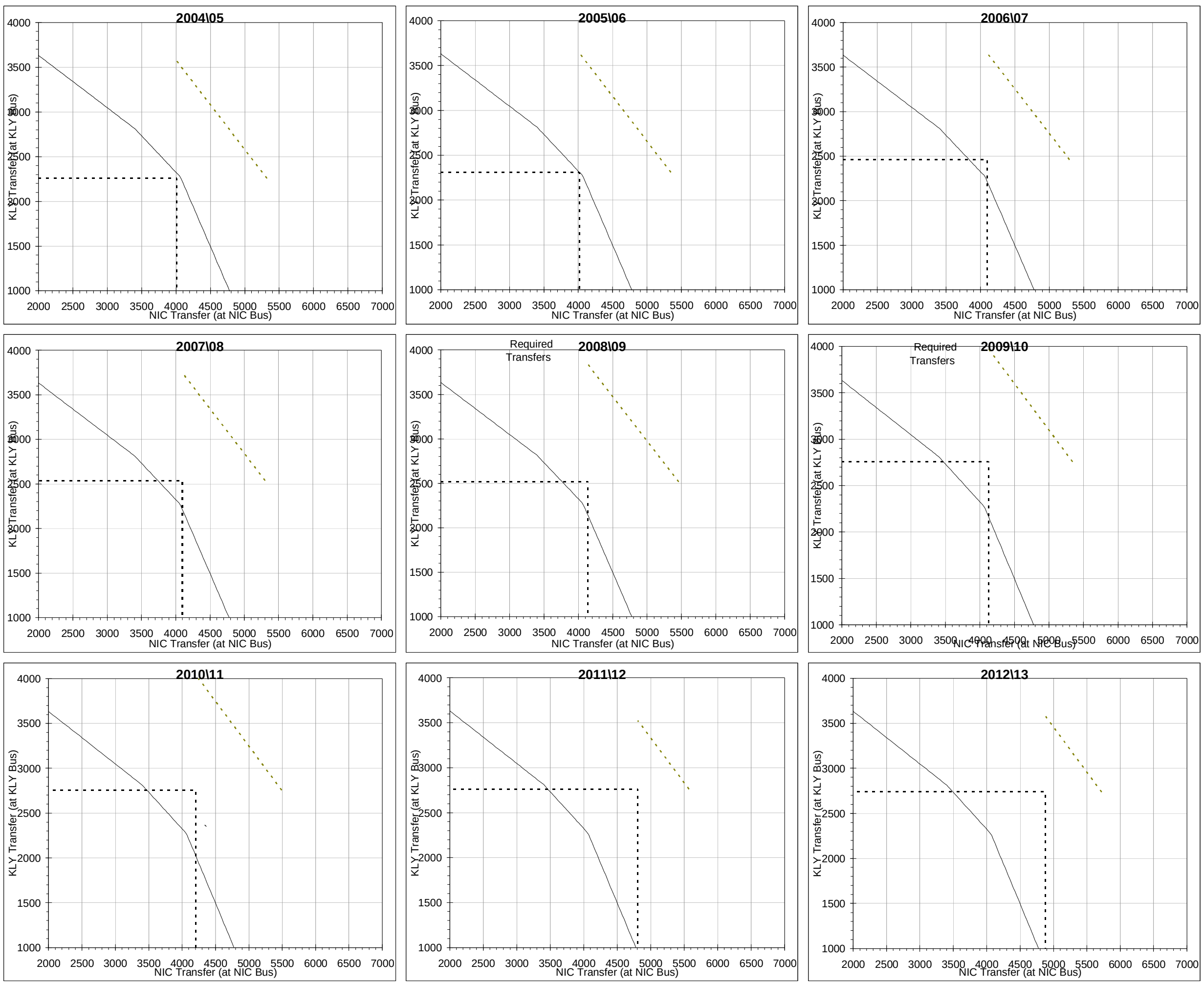
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: MCA-REV
Load Forecast: October 2004 Forecast - Heavy Winter

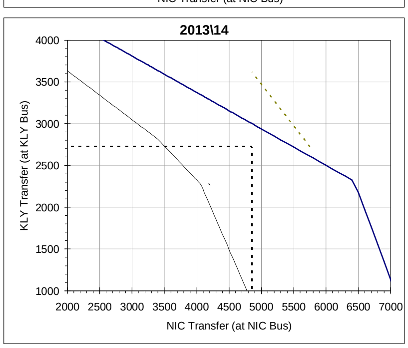
Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	147	147	147	208	369	528	691
Installed Cap (Adjust	147	147	147	147	147	147	208	369	528	691
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Installed Cap (Adjust	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	8455	8547	8639	8731	8915	9007	9099	9269	9361	9453
Installed Cap (Adjust	8455	8547	8639	8731	8915	9007	9099	9269	9361	9453
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2708	2695	2682	2696	2656	2641	2625	2608	2594	2578
Max NIC Transfer	6627	6694	6759	6824	6973	7036	7101	7233	7297	7358
Req Trans @ KLY/NIC	8560	8708	8857	9010	9167	9325	9421	9409	9400	9391
Req Trans @ LM	8309	8448	8589	8733	8879	9028	9117	9104	9094	9084
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	2012	1918	1822	1750	1701	1438	1189	1028	869	705

Appendix 5: Nomogram Analysis for Scenario 4

This appendix summarizes details of the N-1 nomogram analysis for scenario 4.

Minimum Coastal Generation:147MW

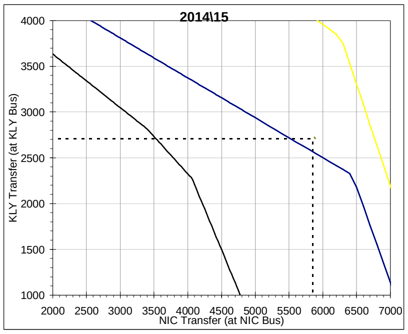


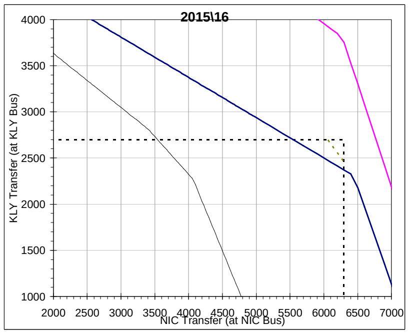


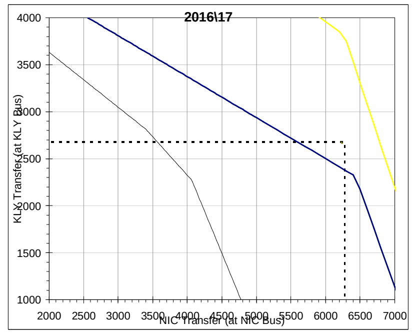
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: ALB-EKT coal
Load Forecast: October 2004 Forecast - Heavy Winter

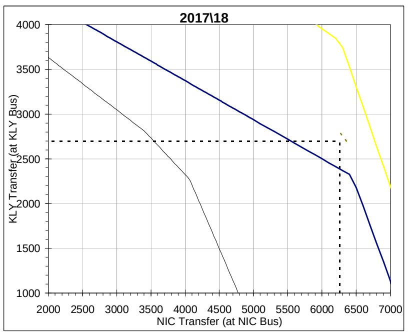
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjust	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Installed Cap (Adjust	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5766	6423	6515	6504
Installed Cap (Adjust	5599	5599	5695	5695	5701	5701	5766	6423	6515	6504
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2762	2737	2723
Max NIC Transfer	4011	4013	4099	4098	4137	4125	4205	4808	4881	4856
Req Trans @ KLY/NIC	7581	7657	7755	7844	7975	8101	8250	8334	8458	8475
Req Trans @ LM	7267	7338	7429	7511	7631	7748	7885	7959	8071	8191
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	-744	-701	-280	7	-108	27	-43	483	406	153

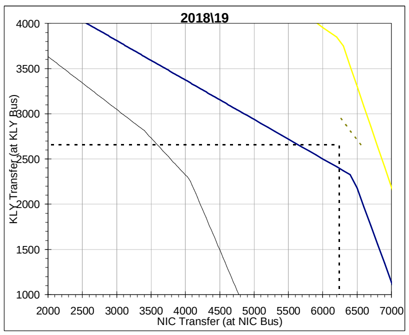
Minimum Coastal Generation: 147 MW (Continued)

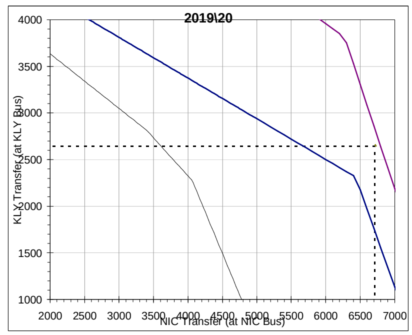


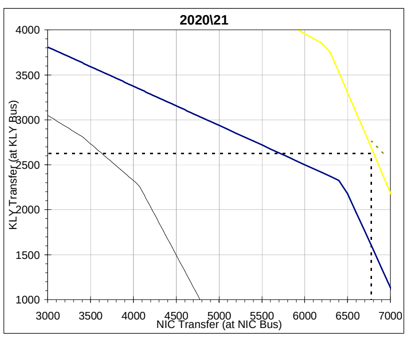


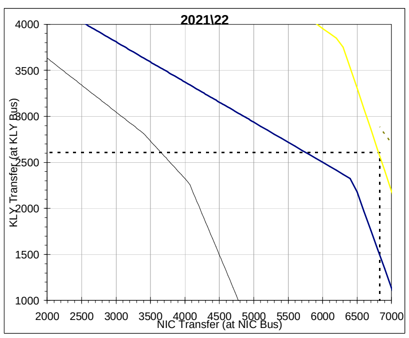


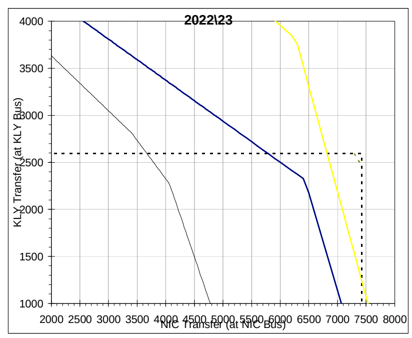


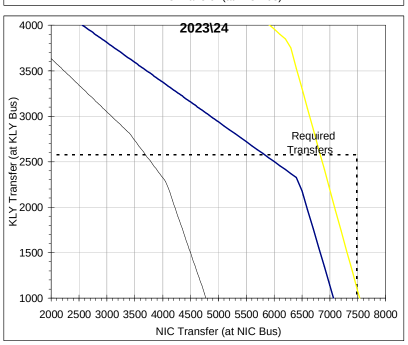








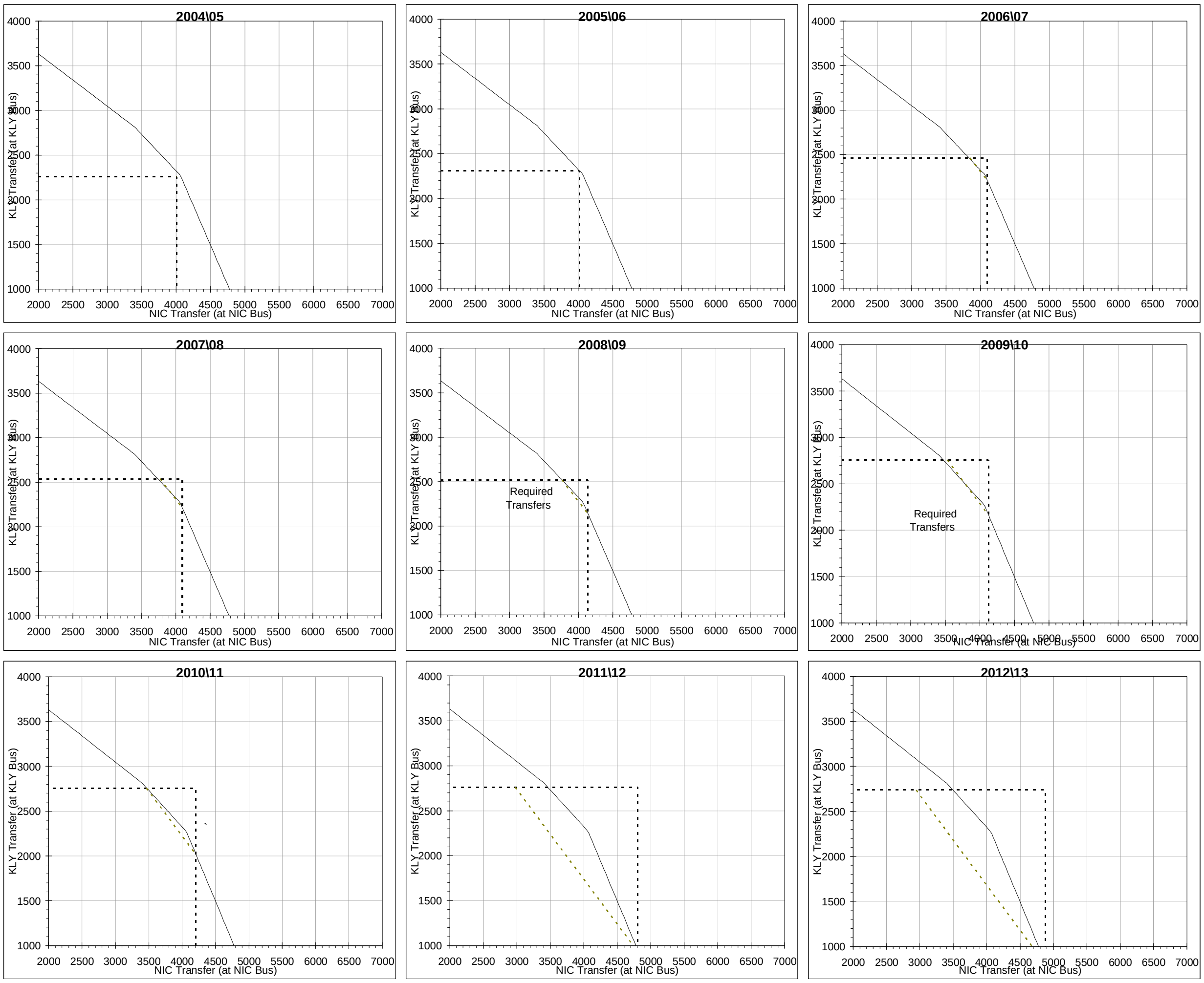


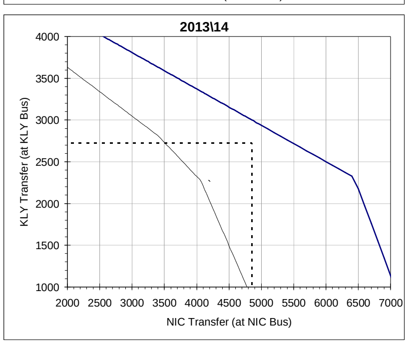


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: ALB-EKT coal
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjust	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Installed Cap (Adjust	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	7604	8104	8104	8104	8104	8645	8737	8815	9499	9591
Installed Cap (Adjust	7604	8104	8104	8104	8104	8645	8737	8815	9499	9591
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2708	2695	2682	2696	2656	2641	2625	2608	2594	2578
Max NIC Transfer	5854	6292	6275	6257	6238	6712	6775	6827	7420	7482
Req Trans @ KLY/NIC	8601	8753	8903	9057	9214	9377	9543	9712	9888	10062
Req Trans @ LM	8309	8448	8589	8733	8879	9028	9183	9339	9497	9658
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	926	1102	1226	1144	930	1224	1106	972	1372	1245

Maximum Columbia Generation

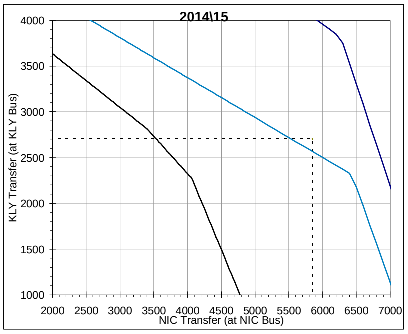


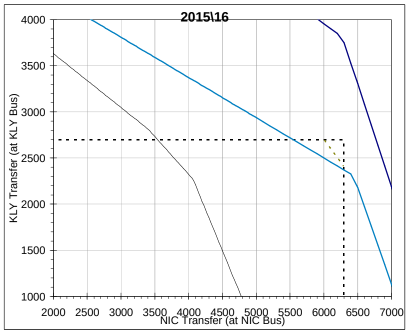


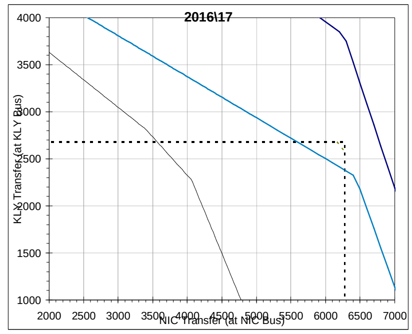
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: ALB-EKT coal
Load Forecast: October 2004 Forecast - Heavy Winter

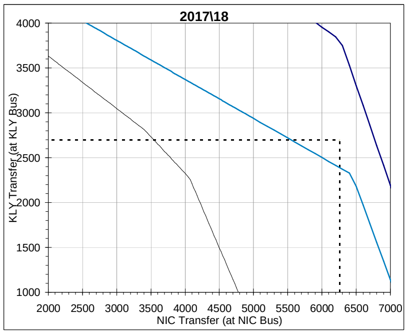
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1342	1360	1470	1552	1703	1814	2017	2588	2770	959
Installed Cap (Adjuste	1342	1360	1470	1552	1703	1814	2017	2588	2770	959
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5766	6423	6515	6504
Installed Cap (Adjuste	5599	5599	5695	5695	5701	5701	5766	6423	6515	6504
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2762	2737	2723
Max NIC Transfer	4011	4013	4099	4098	4137	4125	4205	4808	4881	4856
Req Trans @ KLY/NIC	6269	6324	6306	6307	6276	6285	6221	5738	5680	7578
Req Trans @ LM	6051	6103	6086	6087	6058	6067	6007	5544	5487	7350
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	-622	-575	-191	23	38	-63	116	624	547	438

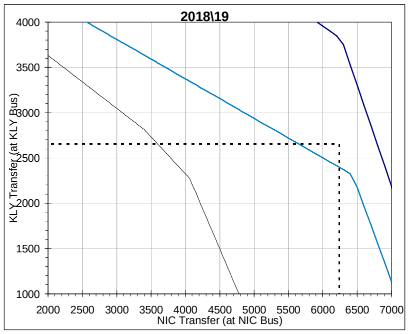
Maximum Columbia Generation (Continued)

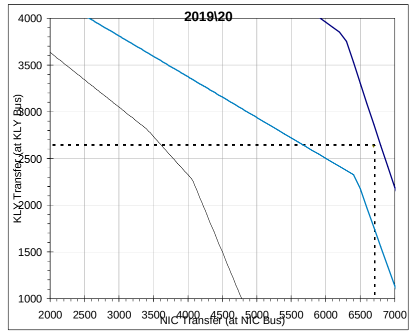


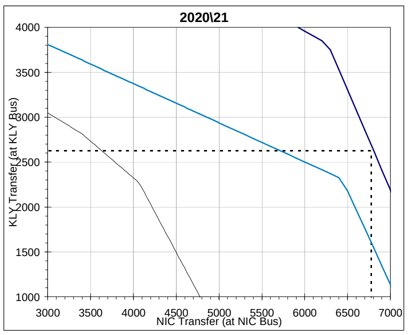


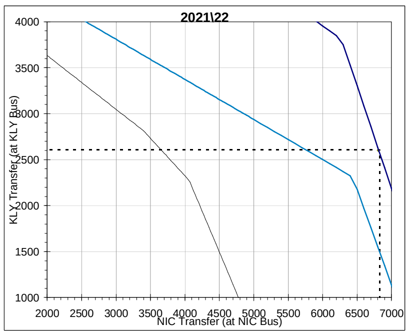


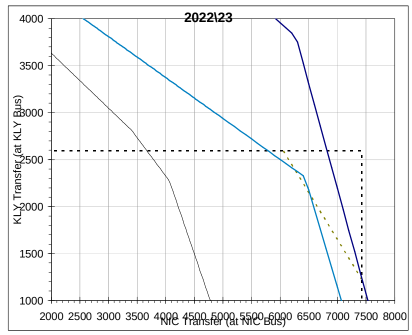


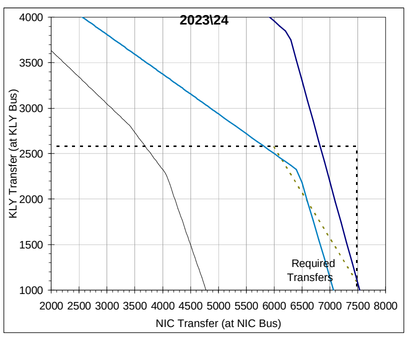








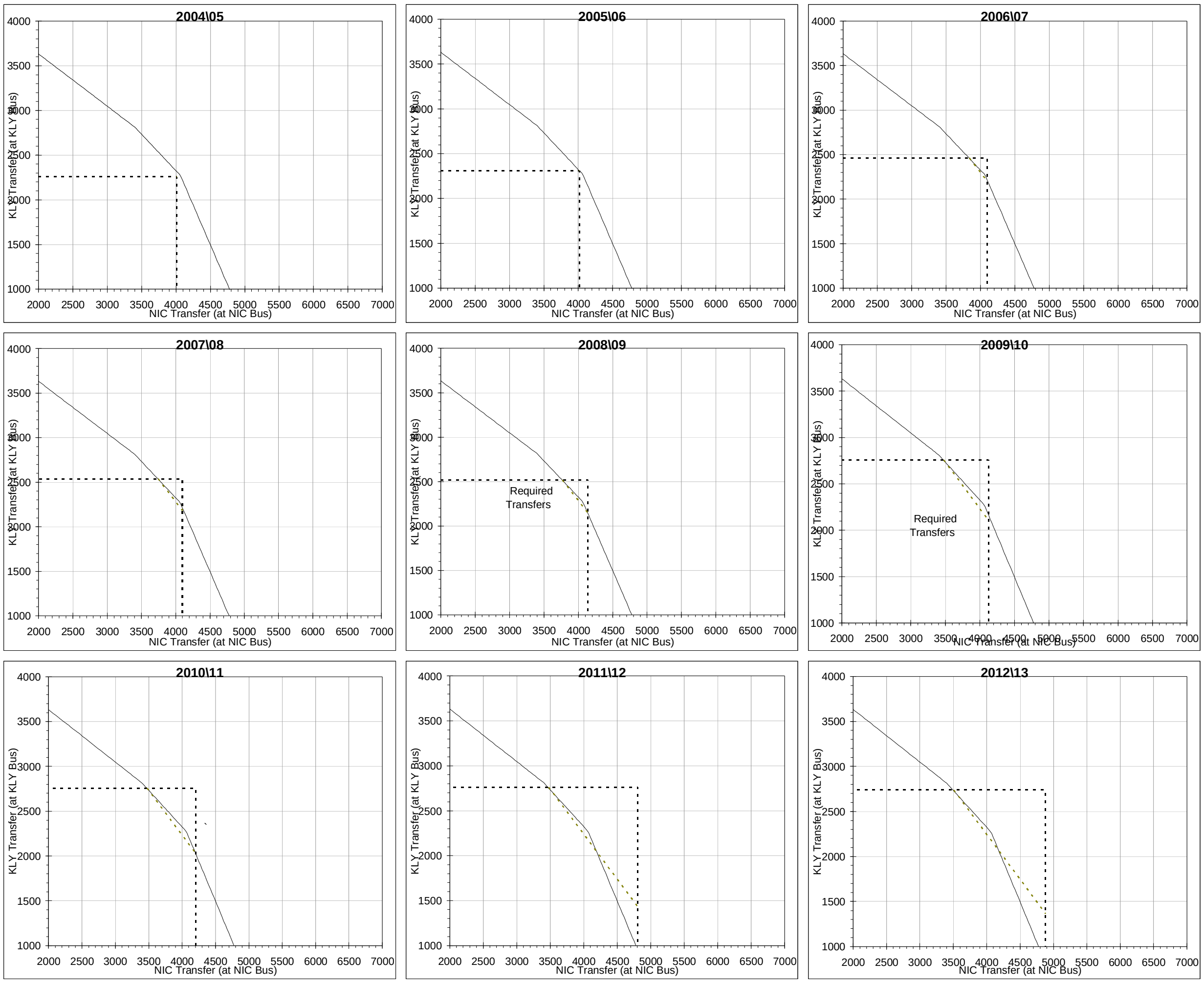


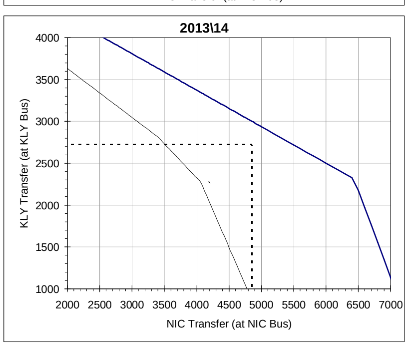


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: ALB-EKT coal
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	194	384	147	226	373	1226	1460
Installed Cap (Adjust	147	147	147	194	384	147	226	373	1226	1460
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Installed Cap (Adjust	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	7604	8104	8104	8104	8104	8645	8737	8815	9499	9591
Installed Cap (Adjust	7604	8104	8104	8104	8104	8645	8737	8815	9499	9591
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2708	2695	2682	2696	2656	2641	2625	2608	2594	2578
Max NIC Transfer	5854	6292	6275	6257	6238	6712	6775	6827	7420	7482
Req Trans @ KLY/NIC	8549	8702	8850	8950	8891	9320	9396	9399	8647	8569
Req Trans @ LM	8309	8448	8589	8684	8628	9028	9099	9100	8376	8300
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	1259	1529	1352	1203	1013	1278	1171	1056	1512	1400

Maximum Peace Generation

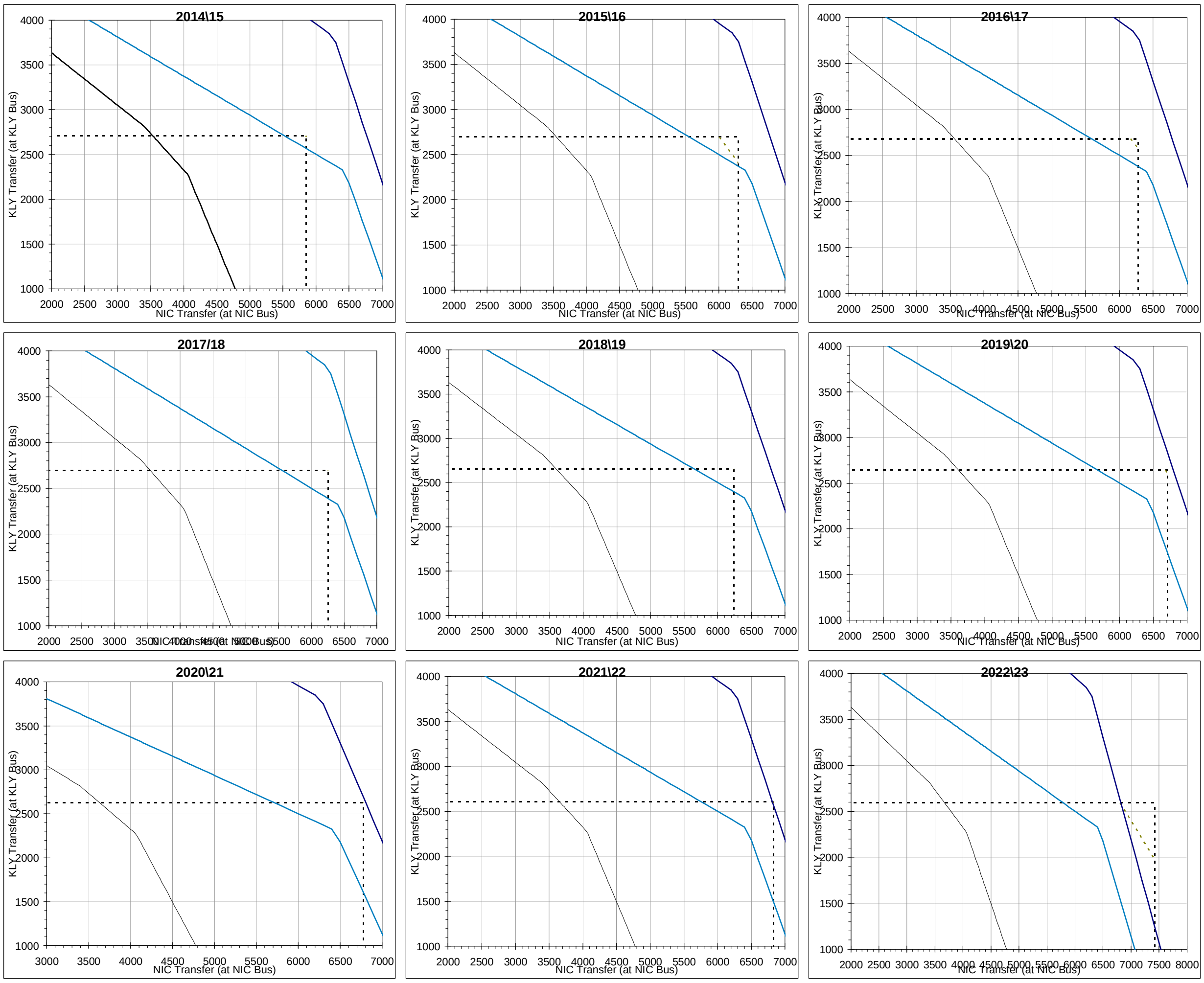


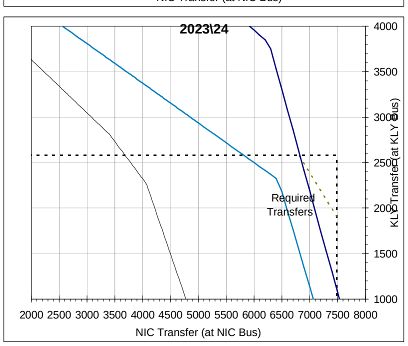


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: ALB-EKT coal
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1342	1360	1478	1577	1695	1865	2006	2083	2195	959
Installed Cap (Adjust	1342	1360	1478	1577	1695	1865	2006	2083	2195	959
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Installed Cap (Adjust	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5766	6423	6515	6504
Installed Cap (Adjust	5599	5599	5695	5695	5701	5701	5766	6423	6515	6504
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2762	2737	2723
Max NIC Transfer	4011	4013	4099	4098	4137	4125	4205	4808	4881	4856
Req Trans @ KLY/NIC	6269	6324	6297	6280	6285	6232	6233	6239	6245	7578
Req Trans @ LM	6051	6103	6078	6062	6066	6017	6018	6017	6021	7350
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	-622	-575	-152	143	27	178	101	-3	-156	438

Maximum Peace Generation (Continued)





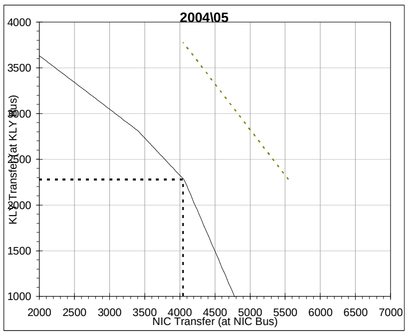
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: ALB-EKT coal
Load Forecast: October 2004 Forecast - Heavy Winter

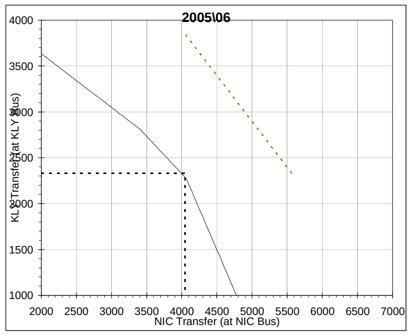
Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	194	384	147	226	356	532	695
Installed Cap (Adjuste	147	147	147	194	384	147	226	356	532	695
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Installed Cap (Adjuste	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	7604	8104	8104	8104	8104	8645	8737	8815	9499	9591
Installed Cap (Adjuste	7604	8104	8104	8104	8104	8645	8737	8815	9499	9591
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2708	2695	2682	2696	2656	2641	2625	2608	2594	2578
Max NIC Transfer	5854	6292	6275	6257	6238	6712	6775	6827	7420	7482
Req Trans @ KLY/NIC	8549	8702	8850	8950	8891	9320	9396	9416	9398	9389
Req Trans @ LM	8309	8448	8589	8684	8628	9028	9099	9117	9090	9079
Export @ ING	280	280	280	280	280	280	280	280	280	280
Generation Reserves	1259	1529	1352	1203	1013	1278	1171	1041	864	702

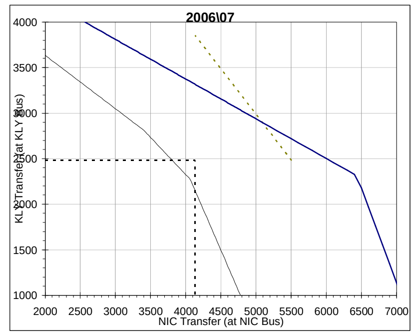
Appendix 6: Nomogram Analysis for Scenario 5

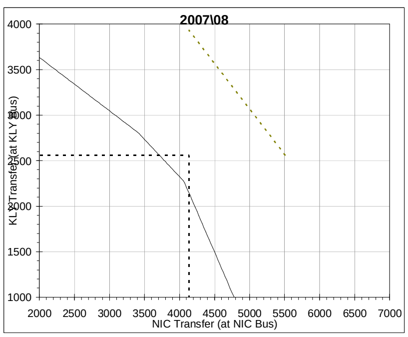
This appendix summarizes details of the N-1 nomogram analysis for scenario 5.

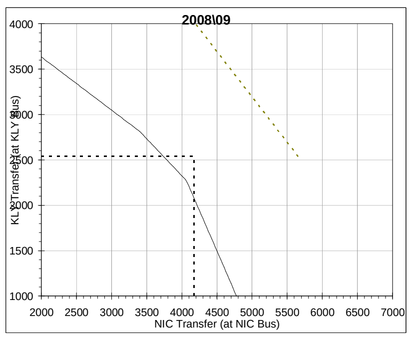
Minimum Coastal Generation:147MW

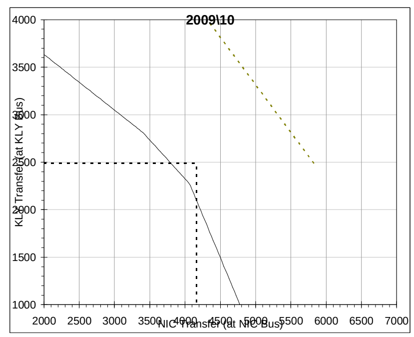


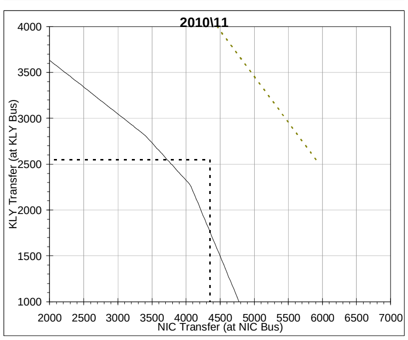


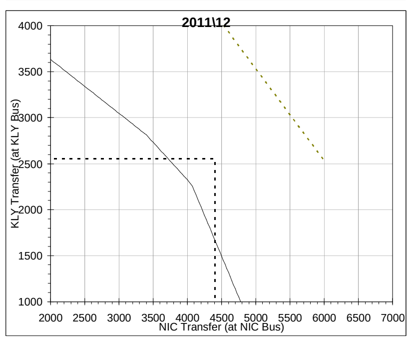


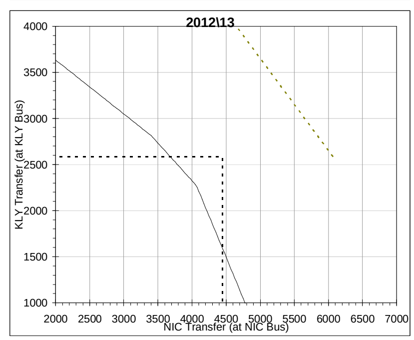


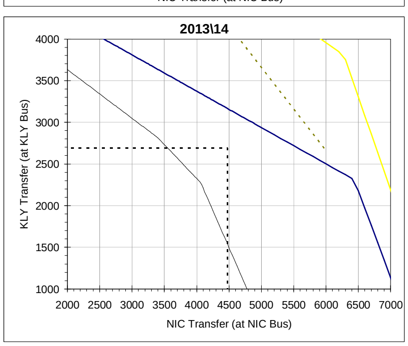








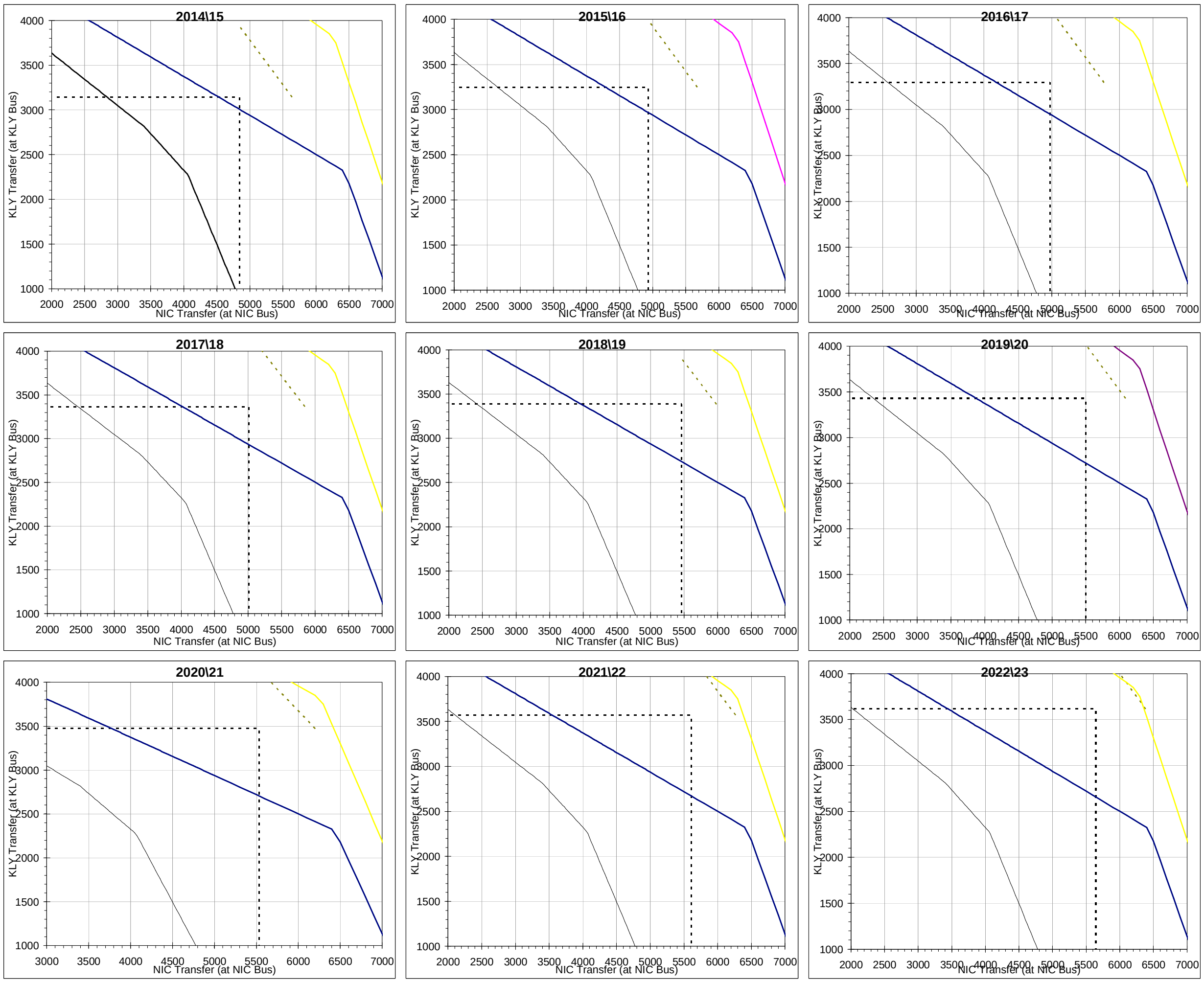


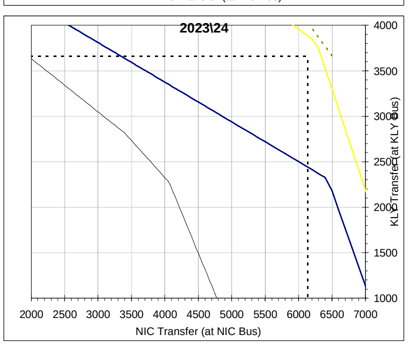


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: System Generic
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjuste	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4005	4109	4109	4168	4285
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4005	4109	4109	4168	4285
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5883	5948	6007	6054
Installed Cap (Adjuste	5599	5599	5695	5695	5701	5701	5883	5948	6007	6054
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2279	2331	2480	2558	2537	2488	2547	2552	2586	2689
Max NIC Transfer	4045	4047	4133	4133	4173	4162	4351	4404	4446	4476
Req Trans @ KLY/NIC	7824	7895	7988	8070	8194	8317	8458	8534	8652	8661
Req Trans @ LM	7491	7557	7642	7718	7832	7943	8072	8141	8249	8363
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	-934	-887	-461	-165	-272	-426	-198	-217	-199	-317

Minimum Coastal Generation: 147 MW (Continued)

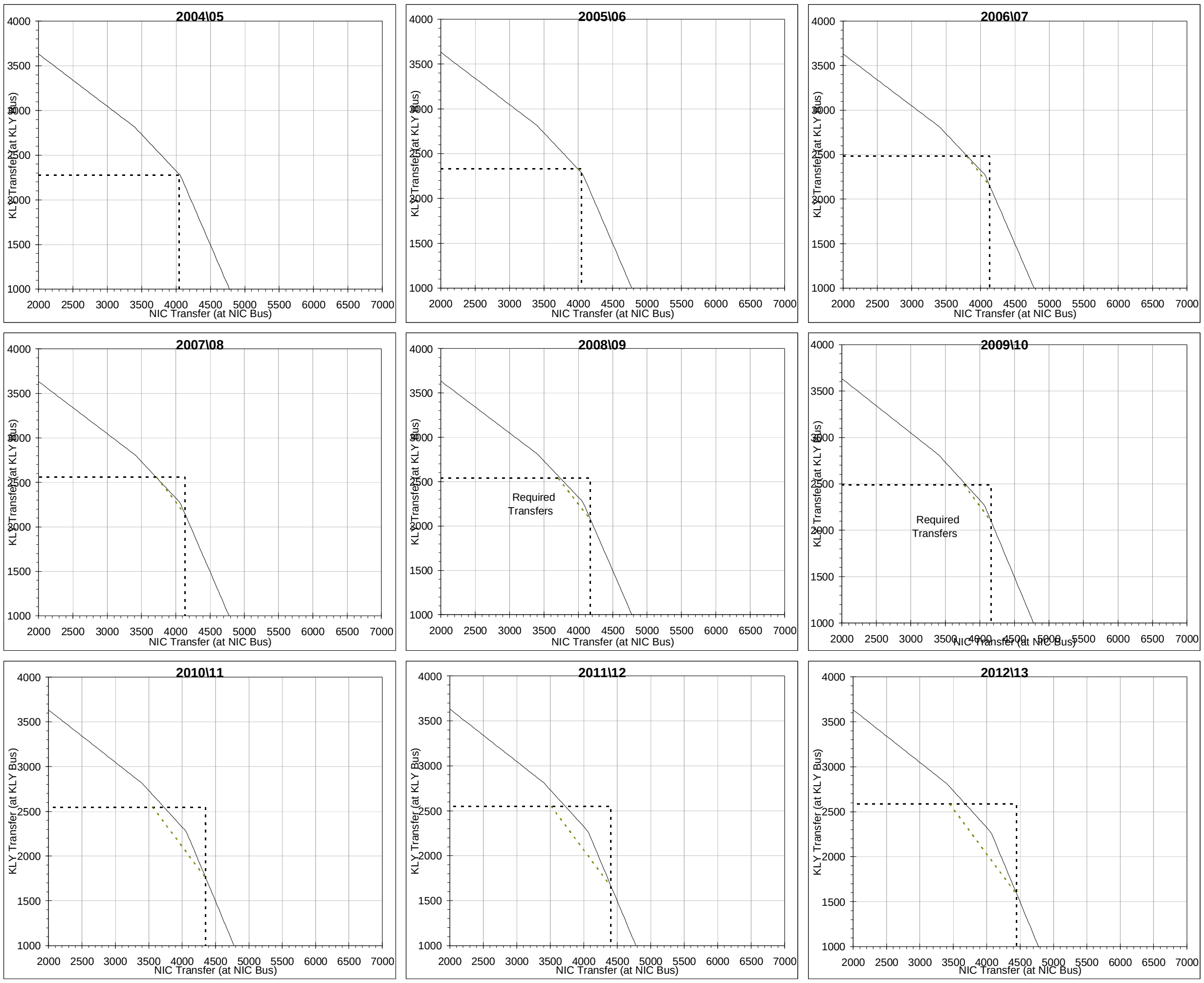


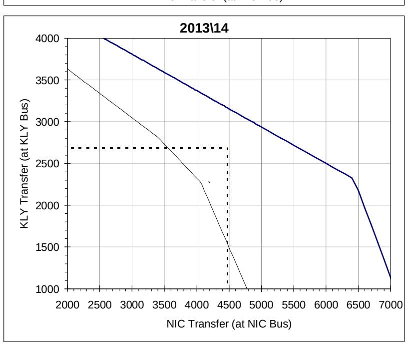


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: System Generic
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjuste	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4754	4871	4930	5019	5056	5114	5173	5290	5349	5407
Installed Cap (Adjuste	4754	4871	4930	5019	5056	5114	5173	5290	5349	5407
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	6464	6581	6640	6699	7207	7266	7324	7428	7486	8045
Installed Cap (Adjuste	6464	6581	6640	6699	7207	7266	7324	7428	7486	8045
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	3143	3248	3293	3366	3385	3429	3472	3574	3618	3661
Max NIC Transfer	4842	4935	4972	5010	5461	5497	5532	5608	5643	6134
Req Trans @ KLY/NIC	8780	8923	9067	9215	9365	9518	9676	9839	10002	10168
Req Trans @ LM	8476	8610	8744	8881	9022	9164	9310	9461	9612	9766
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	346	692	922	1154	1697	1685	1664	1800	1776	2205

Maximum Columbia Generation

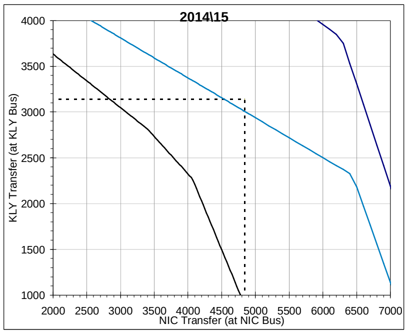


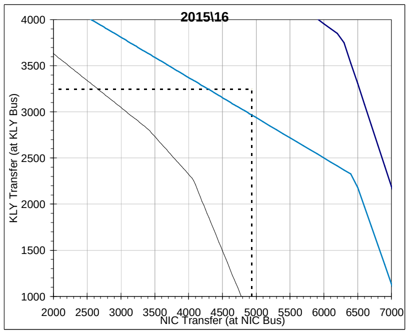


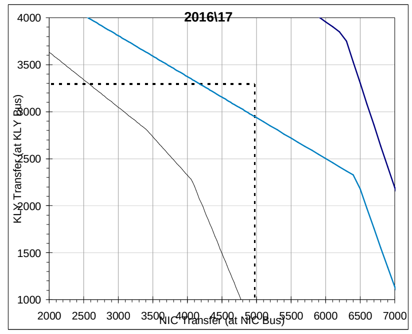
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: System Generic
Load Forecast: October 2004 Forecast - Heavy Winter

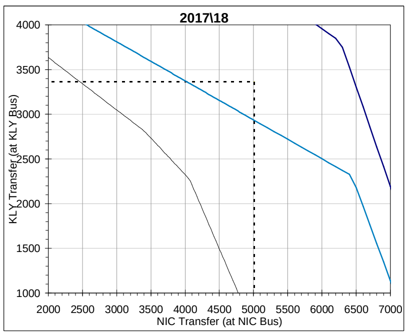
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1523	1580	1718	1796	1945	2050	2339	2455	2604	1526
Installed Cap (Adjuste	1523	1580	1718	1796	1945	2050	2339	2455	2604	1526
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4005	4109	4109	4168	4285
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4005	4109	4109	4168	4285
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5883	5948	6007	6054
Installed Cap (Adjuste	5599	5599	5695	5695	5701	5701	5883	5948	6007	6054
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2279	2331	2480	2558	2537	2488	2547	2552	2586	2689
Max NIC Transfer	4045	4047	4133	4133	4173	4162	4351	4404	4446	4476
Req Trans @ KLY/NIC	6322	6331	6280	6280	6247	6257	6105	6063	6030	7164
Req Trans @ LM	6101	6110	6061	6061	6031	6040	5896	5856	5824	6960
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	-802	-779	-321	-36	-120	-265	-36	-54	-34	112

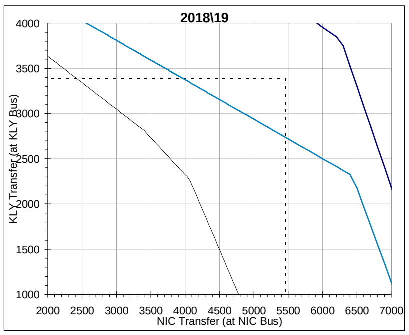
Maximum Columbia Generation (Continued)

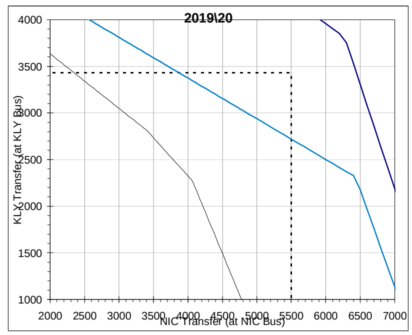


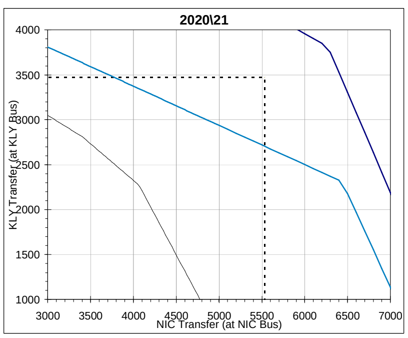


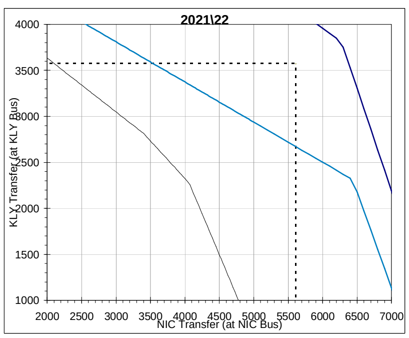


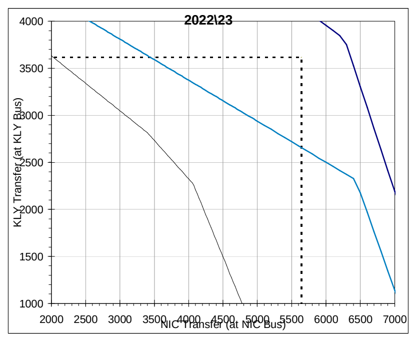


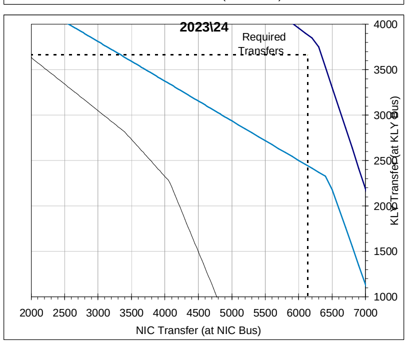








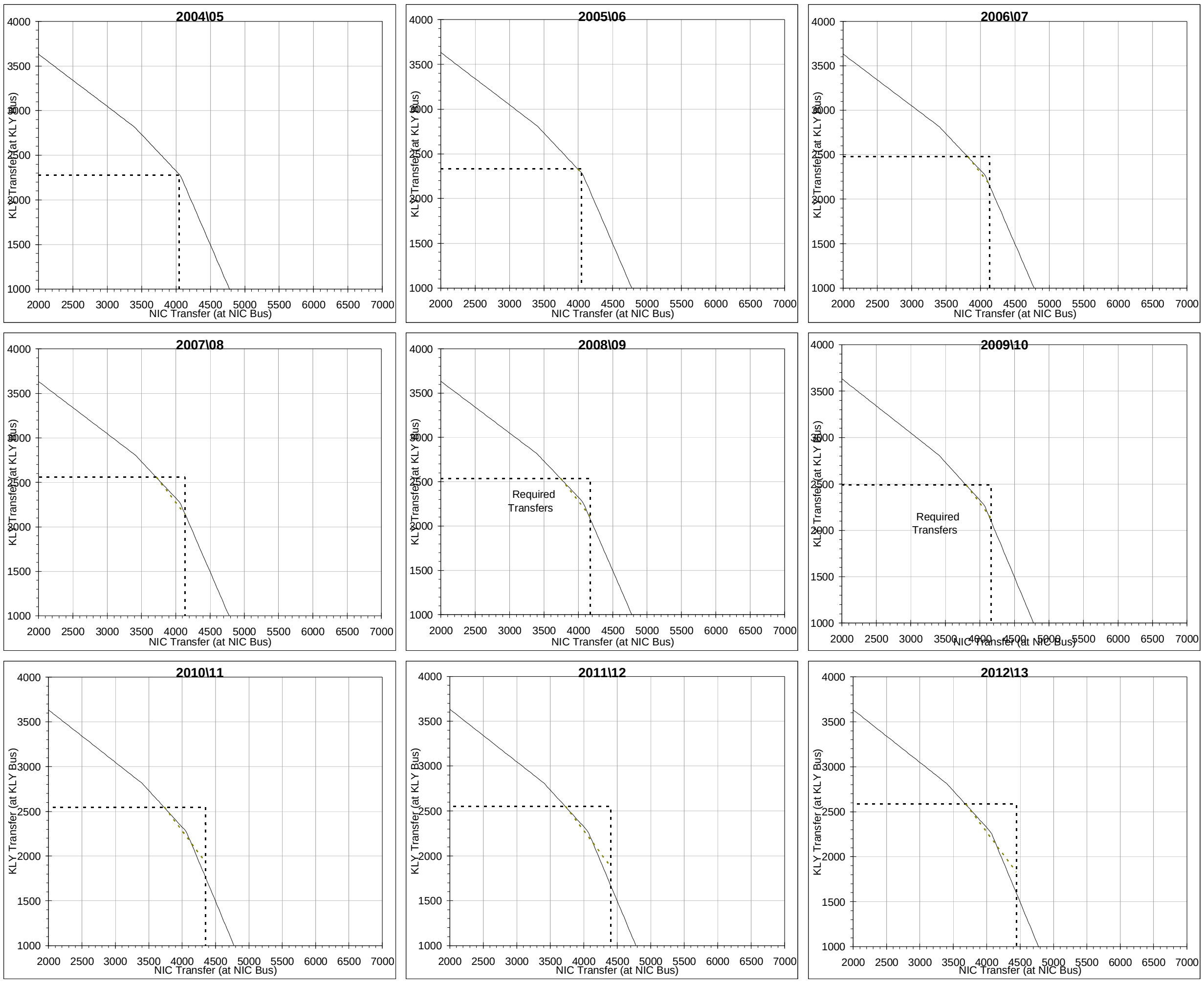


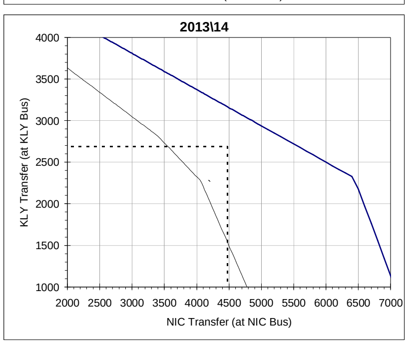


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: System Generic
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	814	760	814	845	550	614	683	666	739	405
Installed Cap (Adjust	814	760	814	845	550	614	683	666	739	405
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4754	4871	4930	5019	5056	5114	5173	5290	5349	5407
Installed Cap (Adjust	4754	4871	4930	5019	5056	5114	5173	5290	5349	5407
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	6464	6581	6640	6699	7207	7266	7324	7428	7486	8045
Installed Cap (Adjust	6464	6581	6640	6699	7207	7266	7324	7428	7486	8045
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	3143	3248	3293	3366	3385	3429	3472	3574	3618	3661
Max NIC Transfer	4842	4935	4972	5010	5461	5497	5532	5608	5643	6134
Req Trans @ KLY/NIC	7985	8182	8264	8375	8844	8924	9003	9180	9259	9793
Req Trans @ LM	7784	7972	8050	8155	8598	8674	8748	8917	8991	9491
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	1247	1422	1428	1458	1812	1810	1800	1938	1926	2319

Maximum Peace Generation

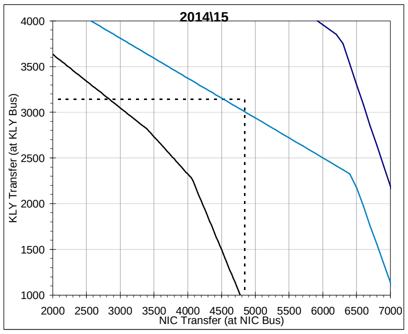


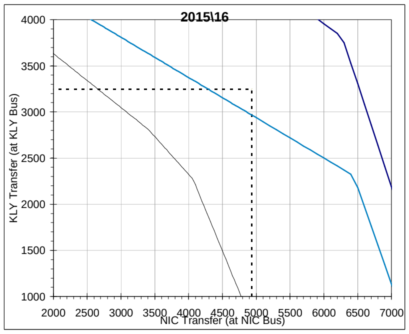


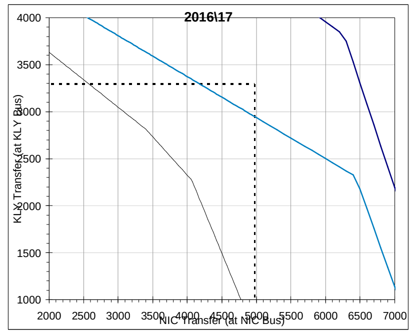
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: System Generic
Load Forecast: October 2004 Forecast - Heavy Winter

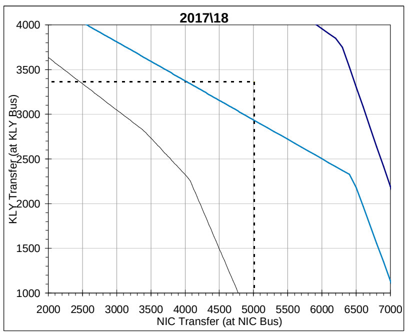
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1523	1586	1705	1799	1911	2016	2163	2236	2357	1526
Installed Cap (Adjust	1523	1586	1705	1799	1911	2016	2163	2236	2357	1526
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4005	4109	4109	4168	4285
Installed Cap (Adjust	3820	3828	3978	4055	4101	4005	4109	4109	4168	4285
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5883	5948	6007	6054
Installed Cap (Adjust	5599	5599	5695	5695	5701	5701	5883	5948	6007	6054
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2279	2331	2480	2558	2537	2488	2547	2552	2586	2689
Max NIC Transfer	4045	4047	4133	4133	4173	4162	4351	4404	4446	4476
Req Trans @ KLY/NIC	6322	6325	6294	6276	6282	6291	6281	6281	6274	7164
Req Trans @ LM	6101	6104	6074	6058	6063	6072	6061	6060	6053	6960
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	-802	-749	-342	-22	-164	-308	-260	-328	-339	112

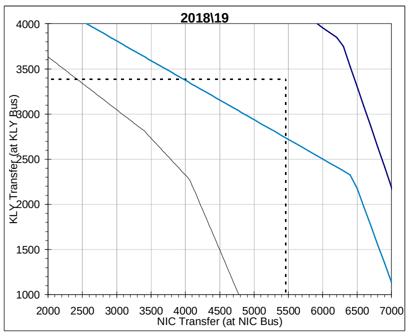
Maximum Peace Generation (Continued)

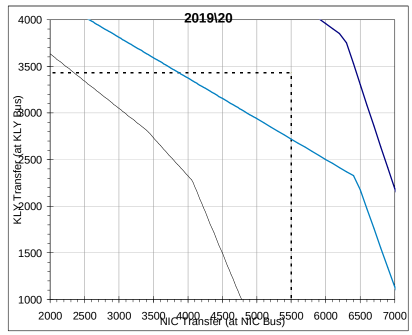


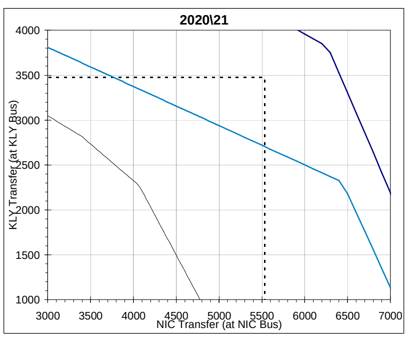


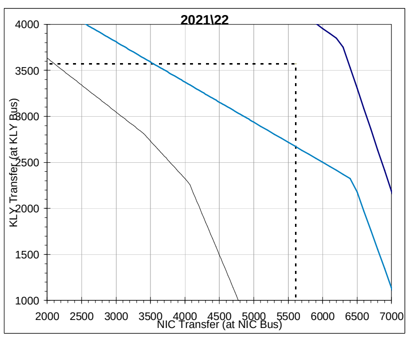


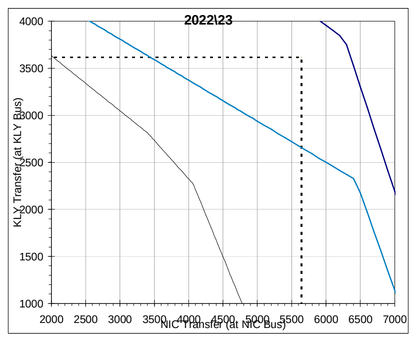


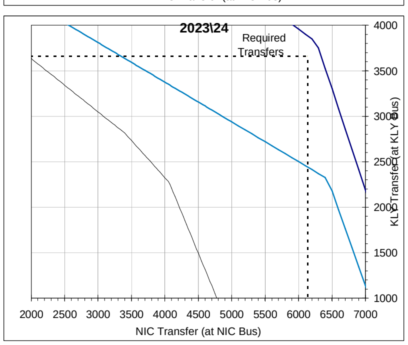












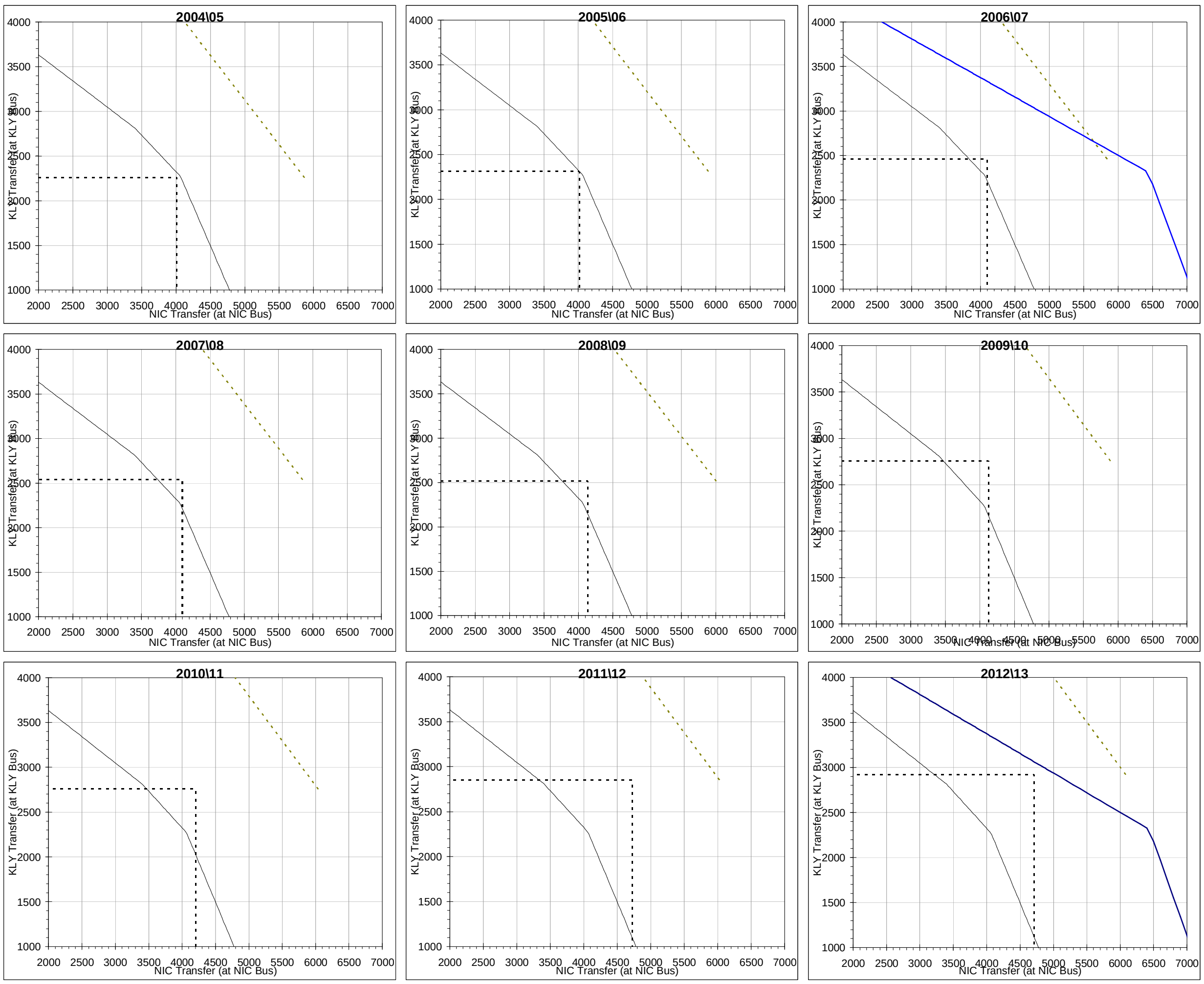
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: System Generic
Load Forecast: October 2004 Forecast - Heavy Winter

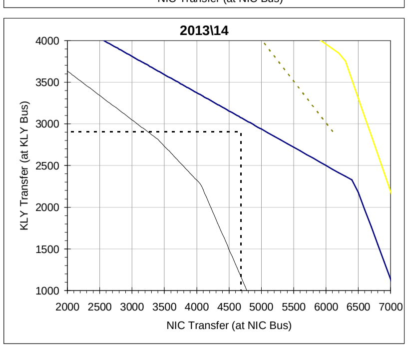
Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	814	760	814	845	550	614	683	666	739	405
Installed Cap (Adjust	814	760	814	845	550	614	683	666	739	405
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4754	4871	4930	5019	5056	5114	5173	5290	5349	5407
Installed Cap (Adjust	4754	4871	4930	5019	5056	5114	5173	5290	5349	5407
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	6464	6581	6640	6699	7207	7266	7324	7428	7486	8045
Installed Cap (Adjust	6464	6581	6640	6699	7207	7266	7324	7428	7486	8045
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	3143	3248	3293	3366	3385	3429	3472	3574	3618	3661
Max NIC Transfer	4842	4935	4972	5010	5461	5497	5532	5608	5643	6134
Req Trans @ KLY/NIC	7985	8182	8264	8375	8844	8924	9003	9180	9259	9793
Req Trans @ LM	7784	7972	8050	8155	8598	8674	8748	8917	8991	9491
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	1247	1422	1428	1458	1812	1810	1800	1938	1926	2319

Appendix 7: Nomogram Analysis for Scenario 6

This appendix summarizes details of the N-1 nomogram analysis for scenario 6.

Minimum Coastal Generation:147MW

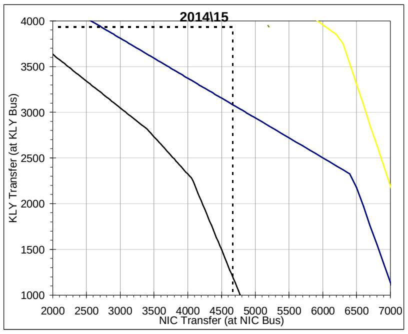


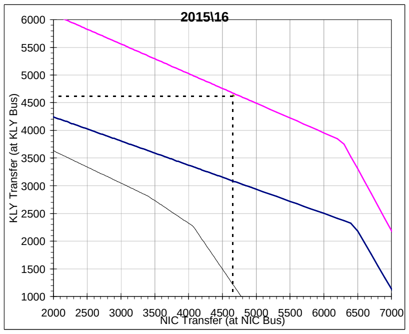


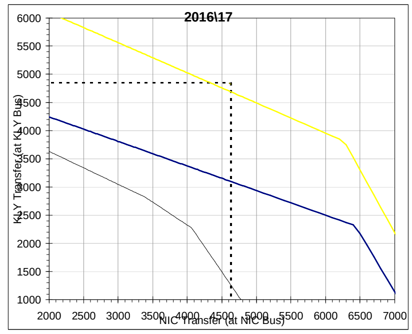
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: Site-C
Load Forecast: October 2004 Forecast - Heavy Winter

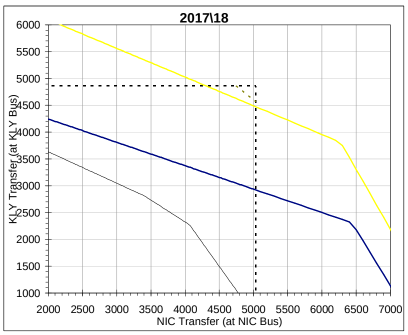
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjuste	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4465	4557	4557
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4327	4373	4465	4557	4557
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5766	6331	6331	6320
Installed Cap (Adjuste	5599	5599	5695	5695	5701	5701	5766	6331	6331	6320
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2854	2921	2907
Max NIC Transfer	4011	4013	4099	4098	4137	4125	4205	4723	4710	4685
Req Trans @ KLY/NIC	8127	8203	8302	8391	8523	8649	8799	8881	9005	9012
Req Trans @ LM	7767	7838	7929	8011	8131	8248	8385	8459	8571	8691
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	-1293	-1251	-830	-543	-659	-525	-596	-61	-131	-264

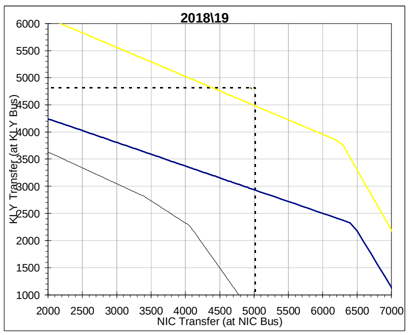
Minimum Coastal Generation: 147 MW (Continued)

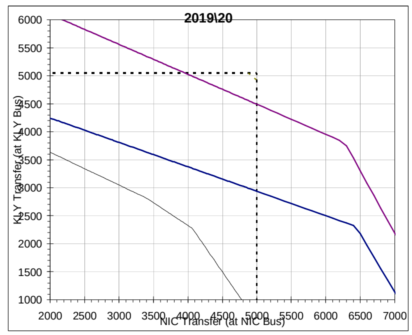


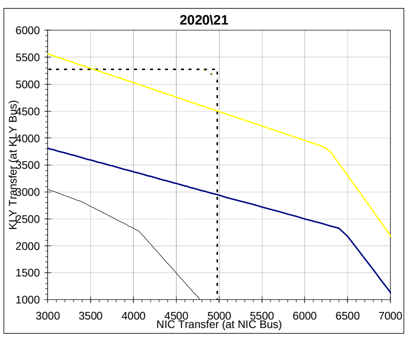


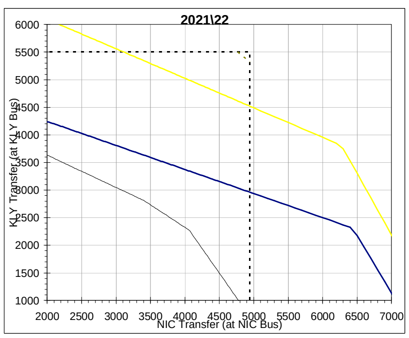


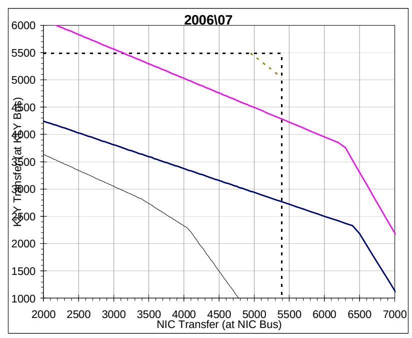


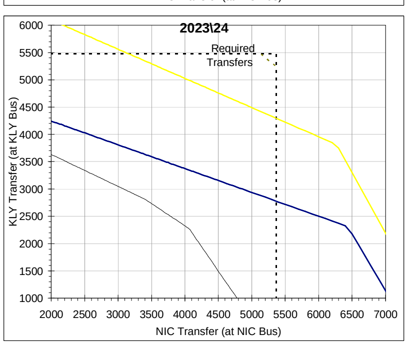








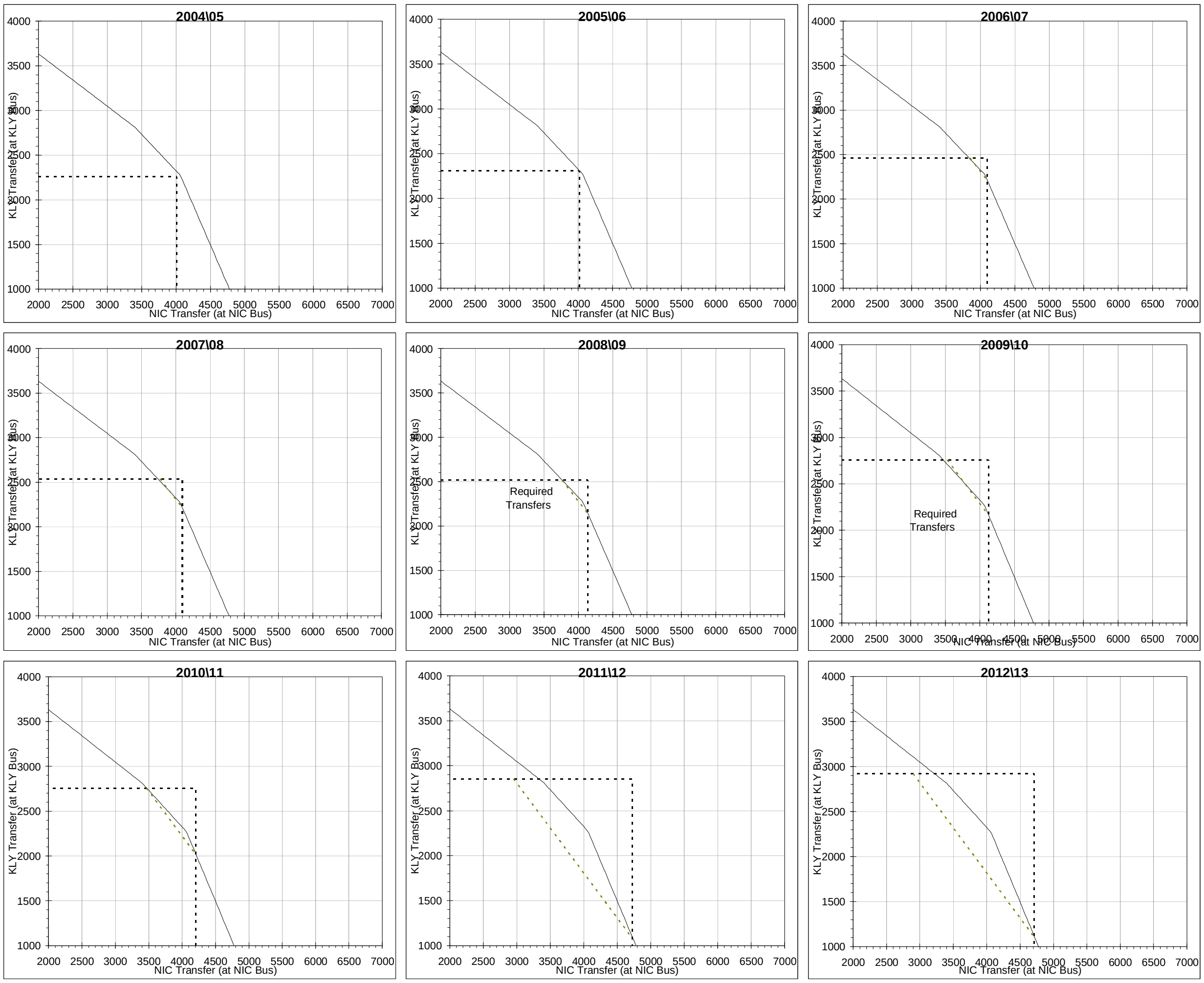


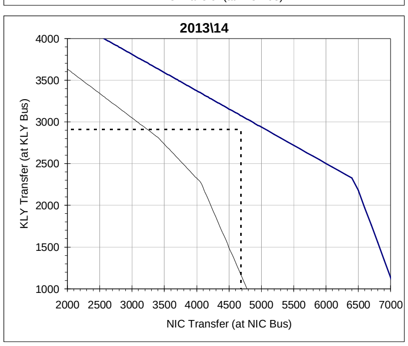


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: Site-C
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjust	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	5700	6400	6643	6674	6652	6895	7138	7382	7382	7382
Installed Cap (Adjust	5700	6400	6643	6674	6652	6895	7138	7382	7382	7382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	6320	6320	6320	6770	6770	6770	6770	6756	7256	7256
Installed Cap (Adjust	6320	6320	6320	6770	6770	6770	6770	6756	7256	7256
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	3931	4618	4848	4861	4820	5049	5276	5503	5488	5472
Max NIC Transfer	4670	4652	4635	5035	5016	4998	4980	4947	5388	5369
Req Trans @ KLY/NIC	9141	9296	9451	9602	9760	9924	10094	10267	10434	10609
Req Trans @ LM	8809	8948	9089	9233	9379	9528	9683	9839	9997	10158
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	-158	-26	99	641	767	900	1039	1167	1683	1475

Maximum Columbia Generation

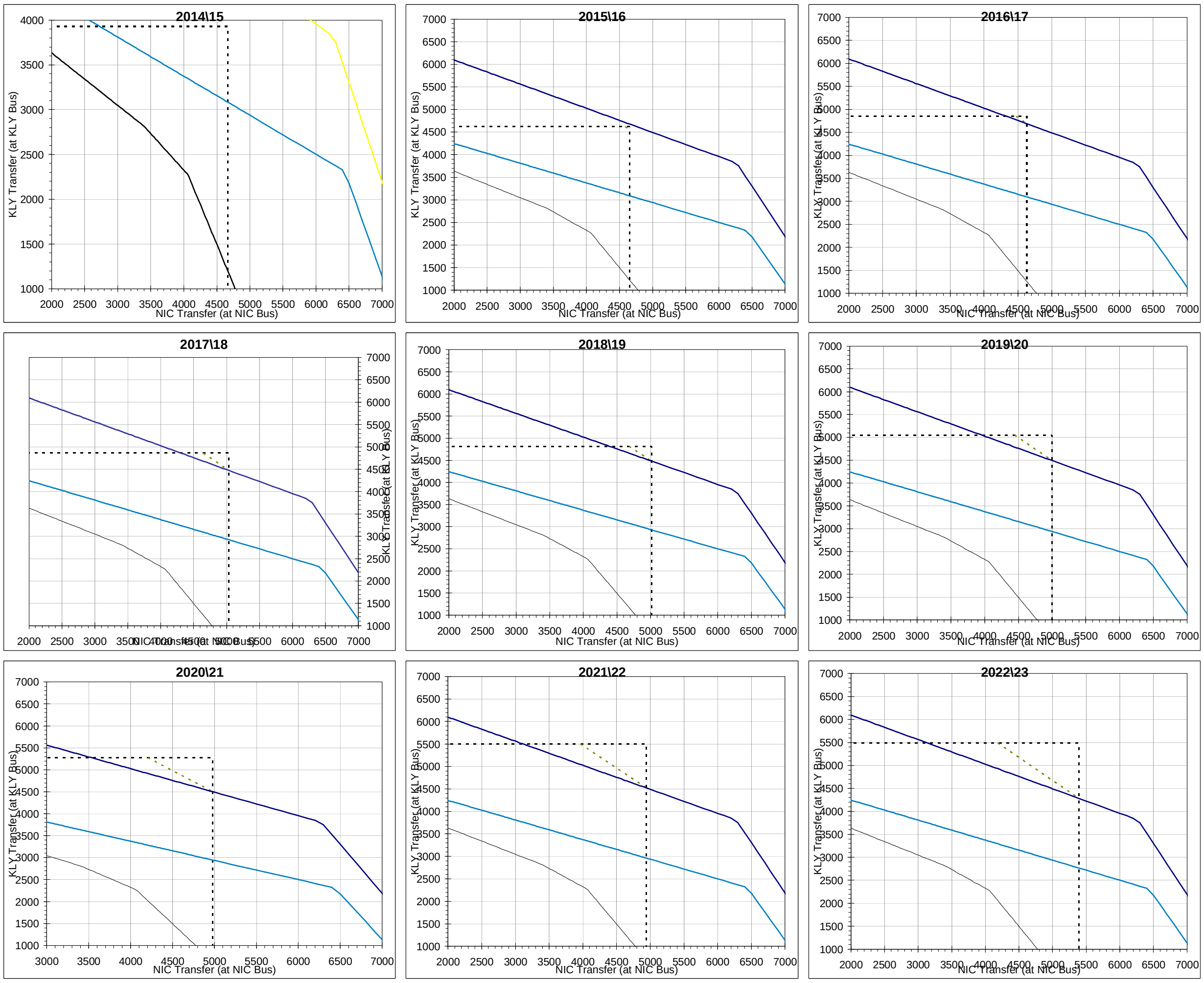


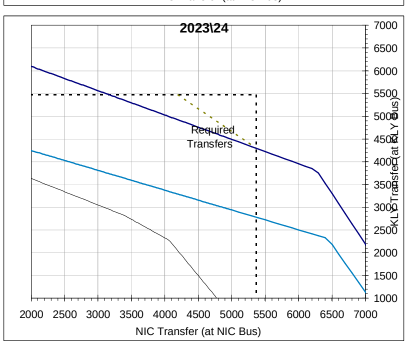


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: Site-C
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1858	1875	1987	2071	2228	2341	2550	3065	3176	1446
Installed Cap (Adjuste	1858	1875	1987	2071	2228	2341	2550	3065	3176	1446
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4465	4557	4557
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4327	4373	4465	4557	4557
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5766	6331	6331	6320
Installed Cap (Adjuste	5599	5599	5695	5695	5701	5701	5766	6331	6331	6320
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2854	2921	2907
Max NIC Transfer	4011	4013	4099	4098	4137	4125	4205	4723	4710	4685
Req Trans @ KLY/NIC	6268	6324	6307	6308	6276	6285	6221	5806	5817	7592
Req Trans @ LM	6050	6103	6087	6088	6058	6067	6007	5610	5620	7363
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	-1137	-1090	-714	-502	-487	-590	-417	88	19	-49

Maximum Columbia Generation (Continued)

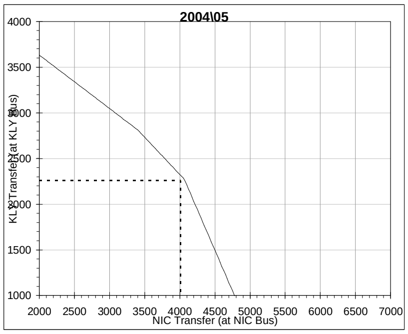


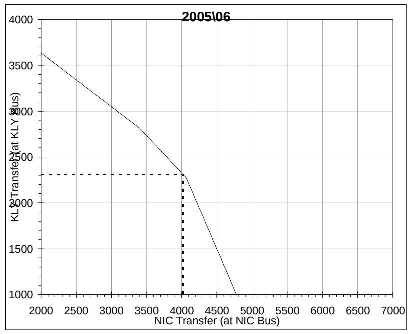


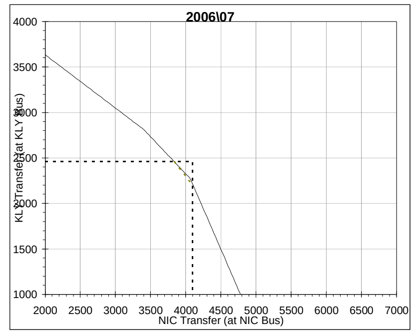
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: Site-C
Load Forecast: October 2004 Forecast - Heavy Winter

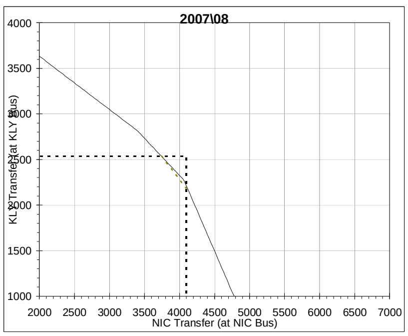
Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	562	147	175	147	292	442	597	762	728	891
Installed Cap (Adjust	562	147	175	147	292	442	597	762	728	891
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	5700	6400	6643	6674	6652	6895	7138	7382	7382	7382
Installed Cap (Adjust	5700	6400	6643	6674	6652	6895	7138	7382	7382	7382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	6320	6320	6320	6770	6770	6770	6770	6756	7256	7256
Installed Cap (Adjust	6320	6320	6320	6770	6770	6770	6770	6756	7256	7256
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	3931	4618	4848	4861	4820	5049	5276	5503	5488	5472
Max NIC Transfer	4670	4652	4635	5035	5016	4998	4980	4947	5388	5369
Req Trans @ KLY/NIC	8600	9205	9322	9506	9499	9490	9481	9466	9671	9662
Req Trans @ LM	8373	8948	9059	9232	9225	9217	9208	9193	9385	9377
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	835	1315	1221	1252	1106	956	801	635	672	508

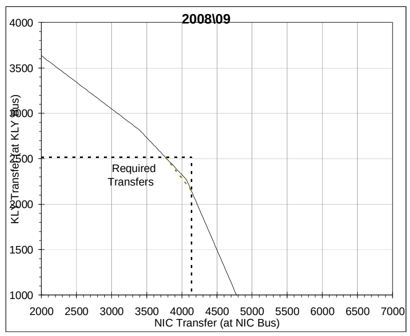
Maximum Peace Generation

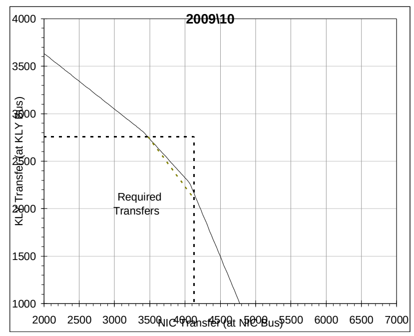


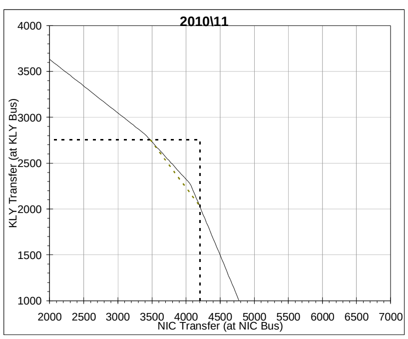


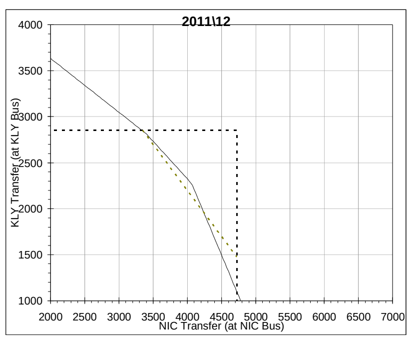


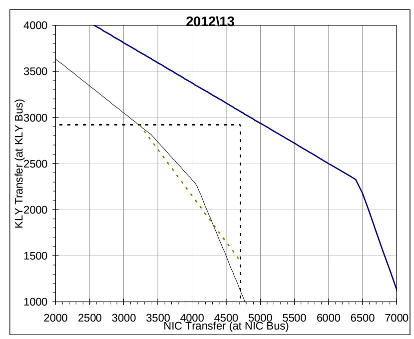


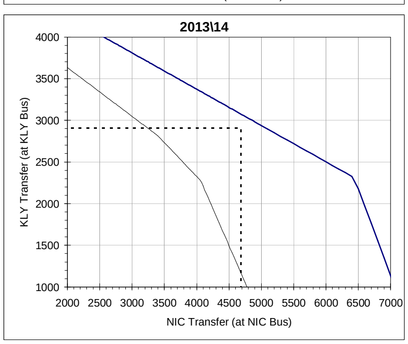








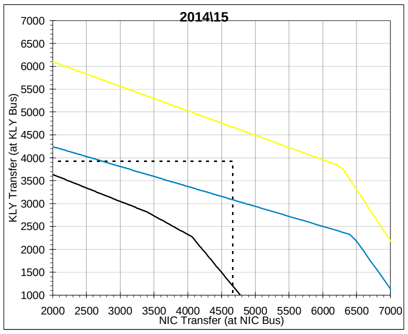


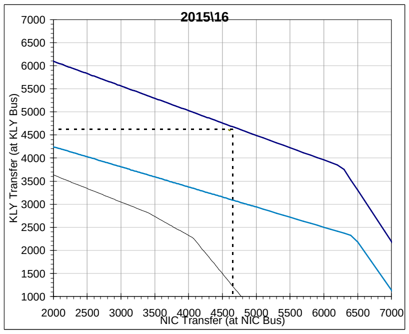


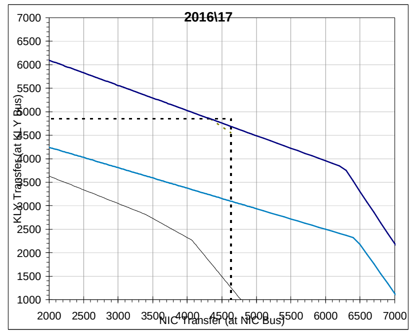
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: Site-C
Load Forecast: October 2004 Forecast - Heavy Winter

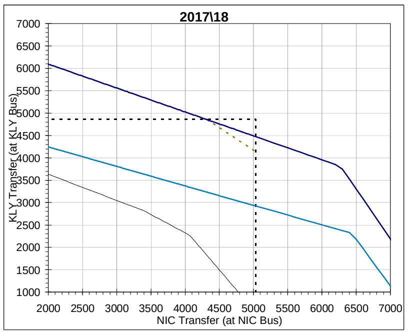
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1858	1875	1996	2098	2219	2394	2538	2659	2828	1446
Installed Cap (Adjuste	1858	1875	1996	2098	2219	2394	2538	2659	2828	1446
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4465	4557	4557
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4327	4373	4465	4557	4557
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5766	6331	6331	6320
Installed Cap (Adjuste	5599	5599	5695	5695	5701	5701	5766	6331	6331	6320
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2854	2921	2907
Max NIC Transfer	4011	4013	4099	4098	4137	4125	4205	4723	4710	4685
Req Trans @ KLY/NIC	6268	6324	6297	6280	6285	6232	6233	6197	6150	7592
Req Trans @ LM	6050	6103	6078	6062	6066	6017	6018	5979	5934	7363
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	-1137	-1090	-670	-378	-497	-351	-431	-390	-385	-49

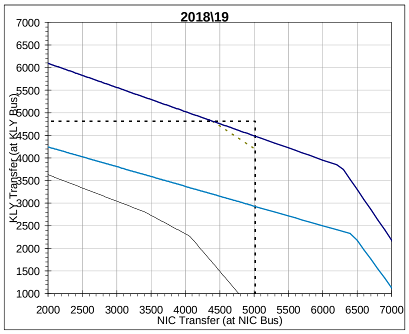
Maximum Peace Generation (Continued)

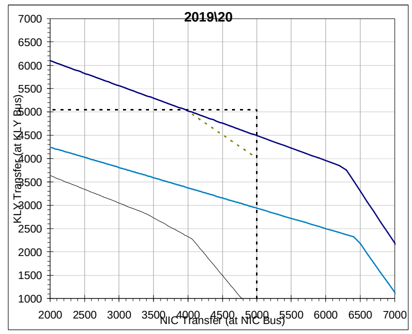


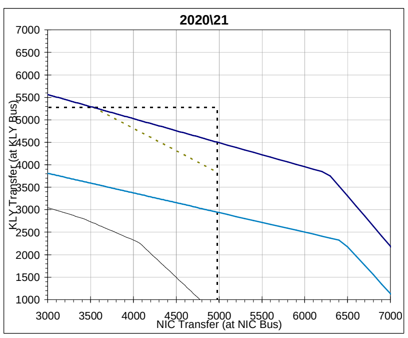


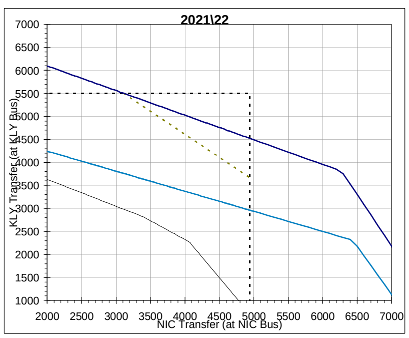


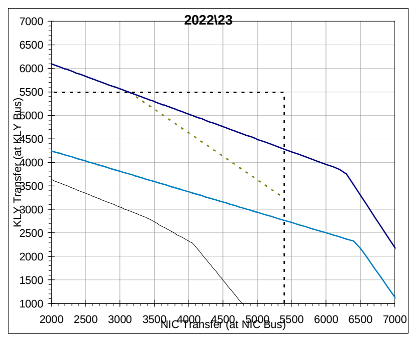


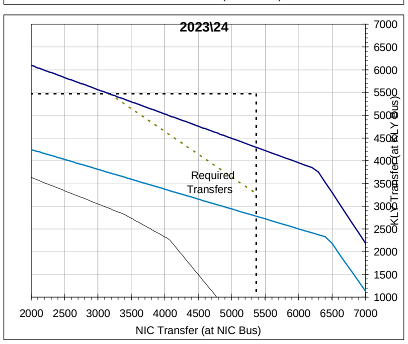












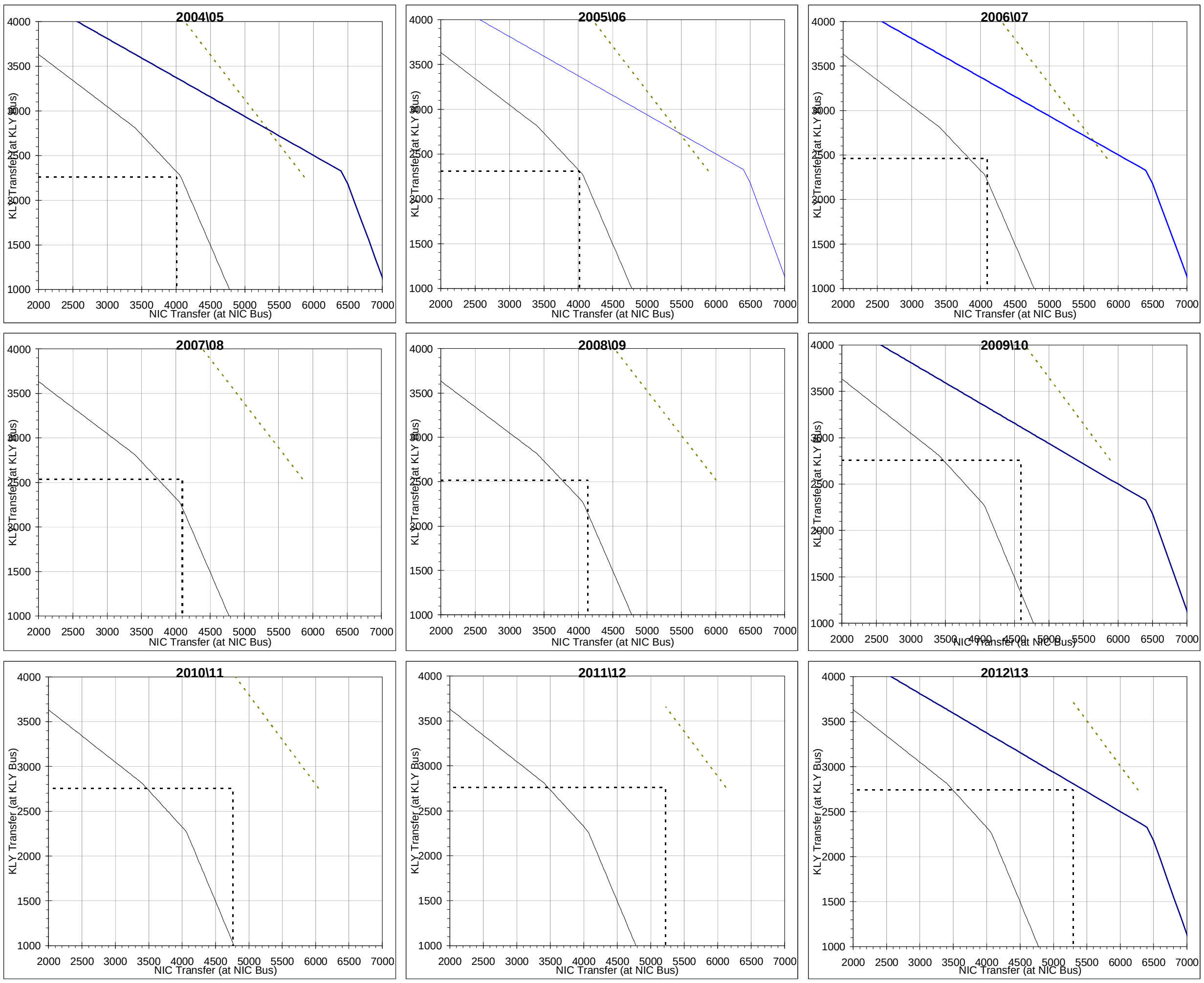
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: Site-C
Load Forecast: October 2004 Forecast - Heavy Winter

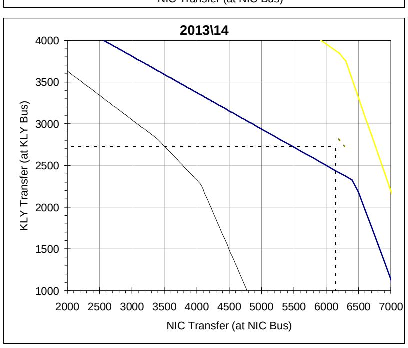
Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	562	147	301	448	555	882	1220	1568	1713	1861
Installed Cap (Adjuste	562	147	301	448	555	882	1220	1568	1713	1861
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	5700	6400	6643	6674	6652	6895	7138	7382	7382	7382
Installed Cap (Adjuste	5700	6400	6643	6674	6652	6895	7138	7382	7382	7382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	6320	6320	6320	6770	6770	6770	6770	6756	7256	7256
Installed Cap (Adjuste	6320	6320	6320	6770	6770	6770	6770	6756	7256	7256
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	3931	4618	4848	4861	4820	5049	5276	5503	5488	5472
Max NIC Transfer	4670	4652	4635	5035	5016	4998	4980	4947	5388	5369
Req Trans @ KLY/NIC	8600	9205	9182	9172	9208	9009	8809	8610	8627	8640
Req Trans @ LM	8374	8948	8926	8916	8949	8760	8570	8378	8391	8404
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	835	1315	1396	1670	1469	1551	1623	1668	1932	1735

Appendix 8: Nomogram Analysis for Scenario 7

This appendix summarizes details of the N-1 nomogram analysis for scenario 7.

Minimum Coastal Generation:147MW

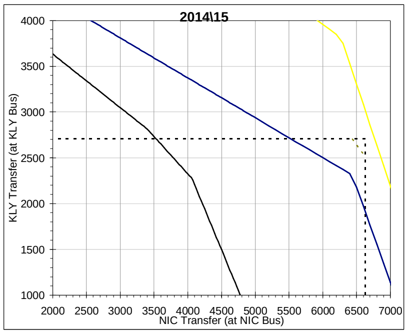


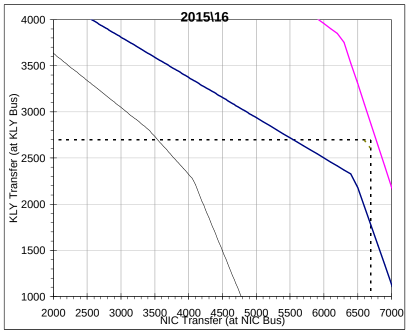


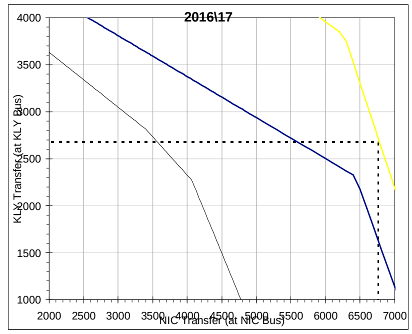
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: MCA-REV
Load Forecast: October 2004 Forecast - Heavy Winter

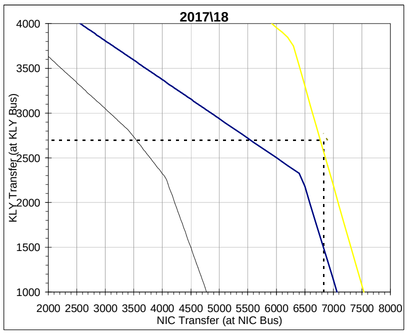
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjuste	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	6201	6358	6873	6965	7904
Installed Cap (Adjuste	5599	5599	5695	5695	5701	6201	6358	6873	6965	7904
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2762	2737	2723
Max NIC Transfer	4011	4013	4099	4098	4137	4592	4757	5225	5297	6142
Req Trans @ KLY/NIC	8127	8203	8302	8391	8523	8650	8801	8885	9010	9012
Req Trans @ LM	7767	7838	7929	8011	8131	8248	8385	8459	8571	8691
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	-1293	-1251	-830	-543	-659	-58	-44	347	268	1102

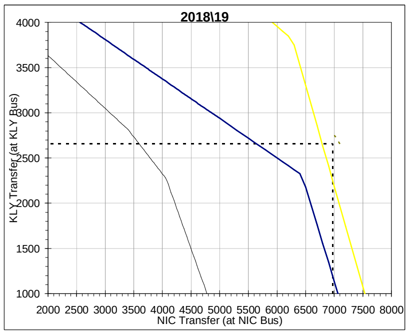
Minimum Coastal Generation: 147 MW (Continued)

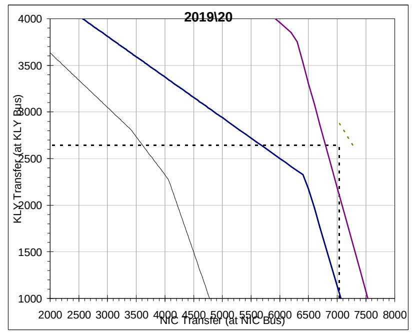


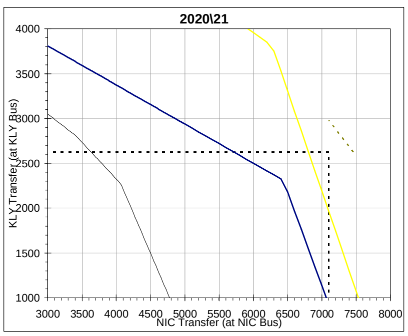


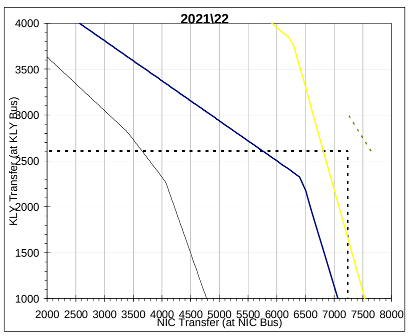


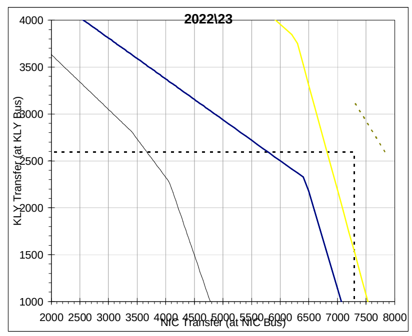


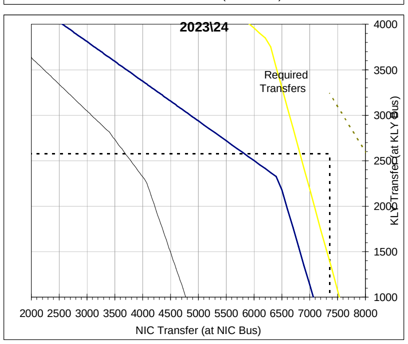








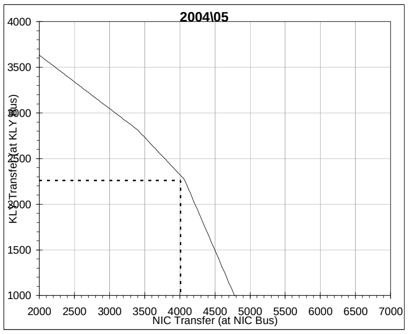


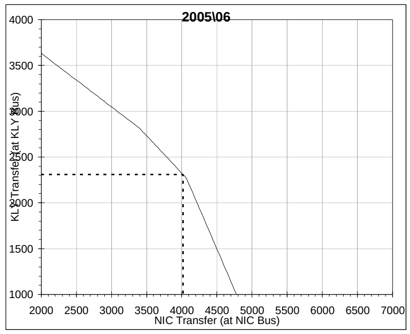


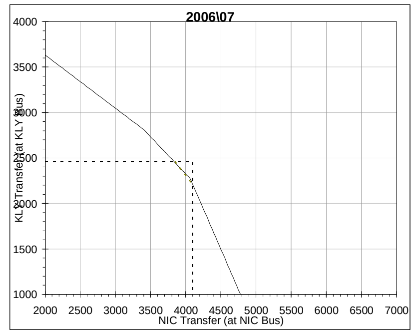
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: MCA-REV
Load Forecast: October 2004 Forecast - Heavy Winter

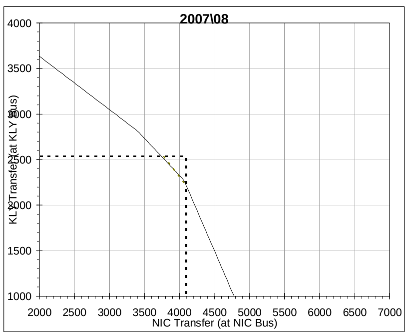
Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjust	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Installed Cap (Adjust	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	8455	8547	8639	8731	8915	9007	9099	9269	9361	9453
Installed Cap (Adjust	8455	8547	8639	8731	8915	9007	9099	9269	9361	9453
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2708	2695	2682	2696	2656	2641	2625	2608	2594	2578
Max NIC Transfer	6627	6694	6759	6824	6973	7036	7101	7233	7297	7358
Req Trans @ KLY/NIC	9141	9291	9443	9597	9756	9917	10084	10254	10426	10601
Req Trans @ LM	8809	8948	9089	9233	9379	9528	9683	9839	9997	10158
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	1441	1346	1246	1171	1121	1009	892	837	714	584

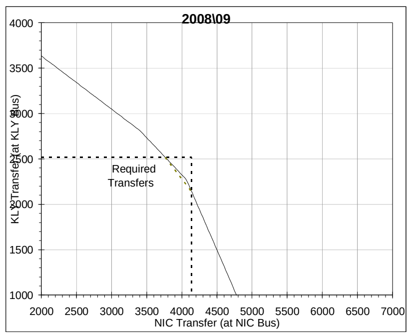
Maximum Columbia Generation

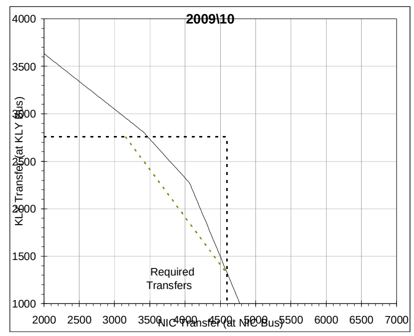


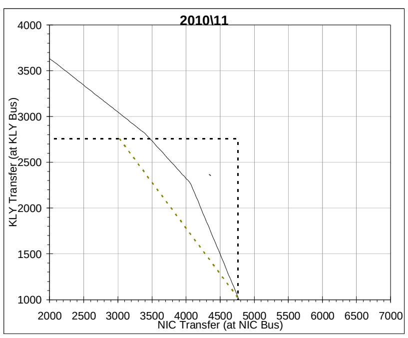


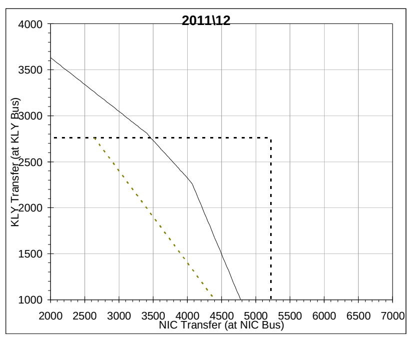


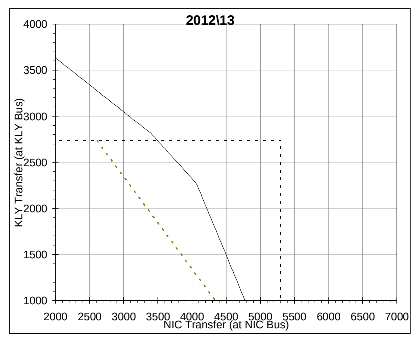


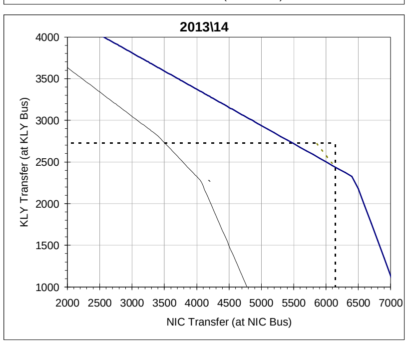








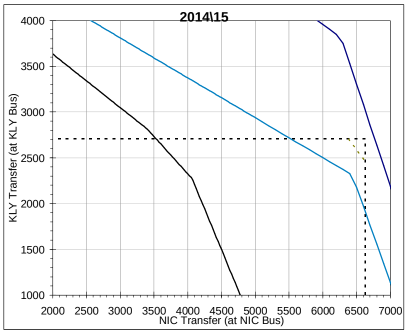


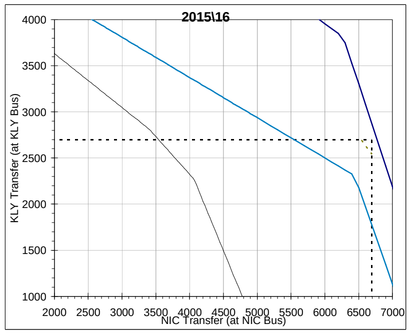


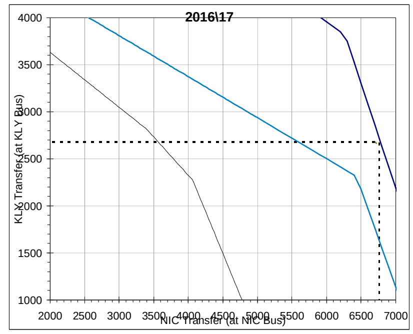
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: MCA-REV
Load Forecast: October 2004 Forecast - Heavy Winter

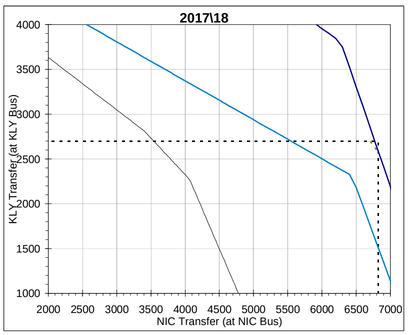
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1858	1875	1987	2071	2228	2727	3014	3510	3702	533
Installed Cap (Adjuste	1858	1875	1987	2071	2228	2727	3014	3510	3702	533
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	6201	6358	6873	6965	7904
Installed Cap (Adjuste	5599	5599	5695	5695	5701	6201	6358	6873	6965	7904
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2762	2737	2723
Max NIC Transfer	4011	4013	4099	4098	4137	4592	4757	5225	5297	6142
Req Trans @ KLY/NIC	6268	6324	6307	6308	6276	5911	5779	5401	5342	8579
Req Trans @ LM	6050	6103	6087	6088	6058	5710	5584	5217	5159	8286
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	-1137	-1090	-714	-502	-487	96	103	446	358	867

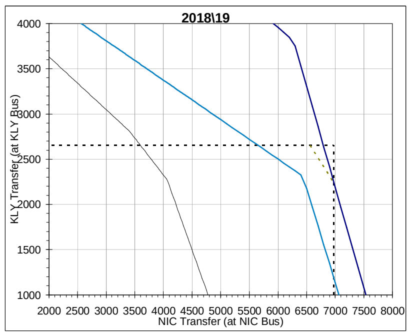
Maximum Columbia Generation (Continued)

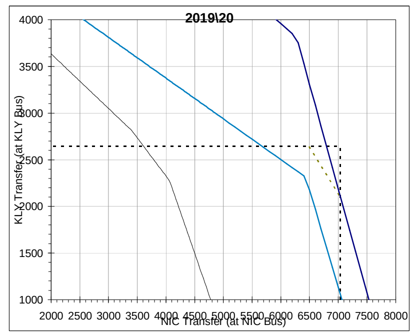


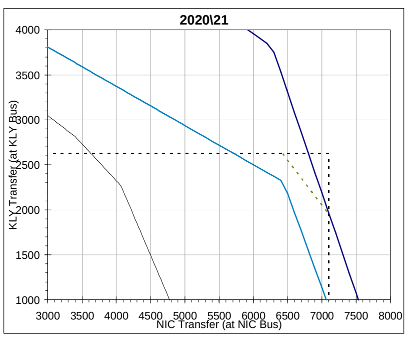


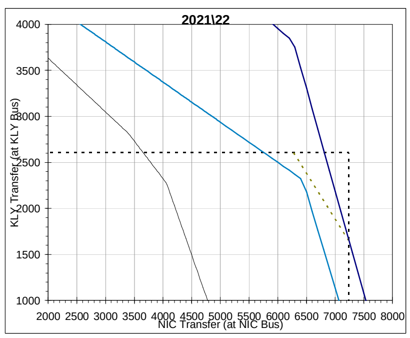


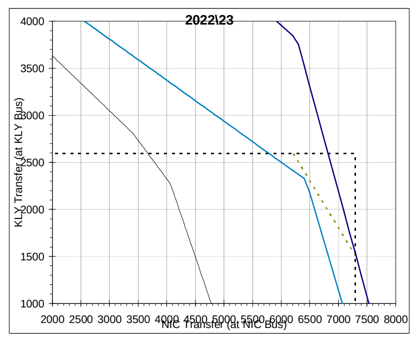


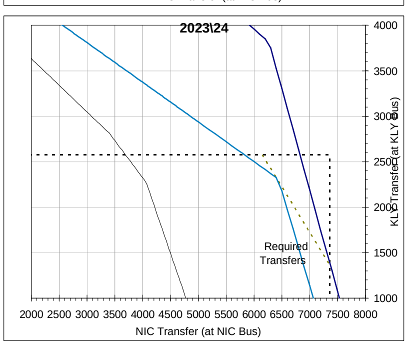








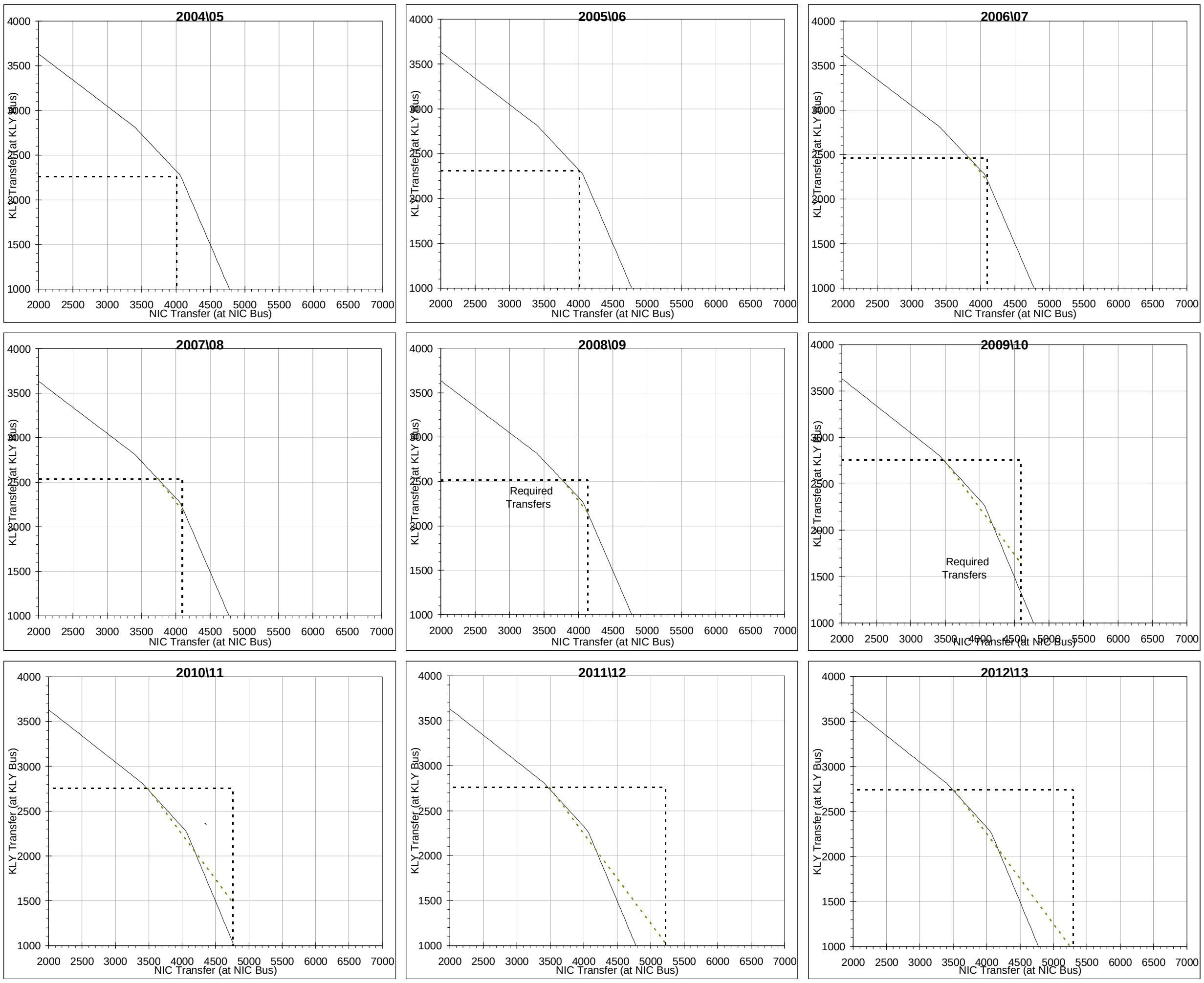


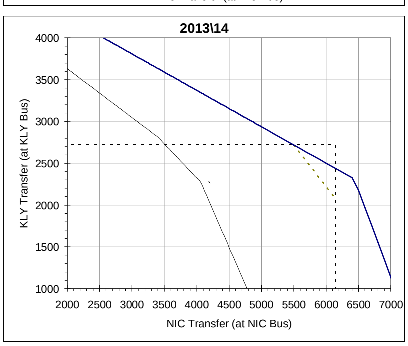


Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: MCA-REV
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	270	580	799	1025	1339	1574	1812
Installed Cap (Adjust	147	147	147	270	580	799	1025	1339	1574	1812
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Installed Cap (Adjust	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	8455	8547	8639	8731	8915	9007	9099	9269	9361	9453
Installed Cap (Adjust	8455	8547	8639	8731	8915	9007	9099	9269	9361	9453
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2708	2695	2682	2696	2656	2641	2625	2608	2594	2578
Max NIC Transfer	6627	6694	6759	6824	6973	7036	7101	7233	7297	7358
Req Trans @ KLY/NIC	9087	9235	9385	9400	9214	9133	9052	8885	8804	8726
Req Trans @ LM	8809	8948	9089	9103	8923	8846	8768	8606	8528	8452
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	1492	1398	1301	1241	1222	1130	1032	996	888	773

Maximum Peace Generation

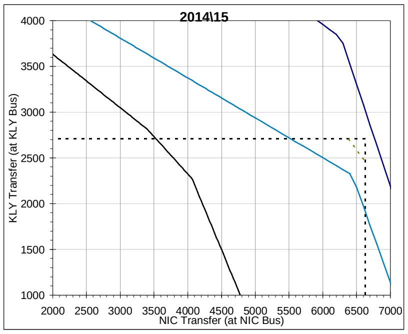


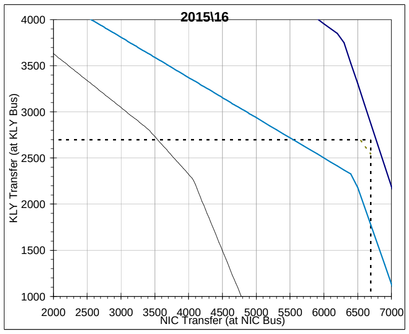


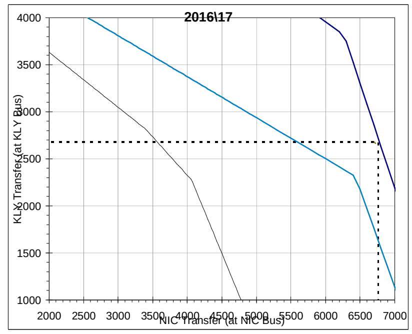
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: MCA-REV
Load Forecast: October 2004 Forecast - Heavy Winter

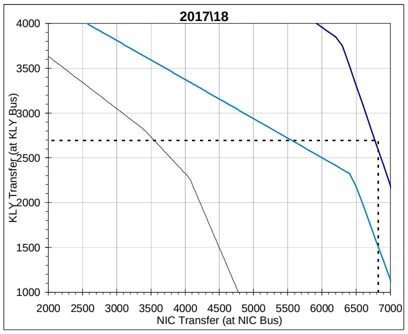
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1858	1875	1997	2098	2219	2394	2538	2617	2732	862
Installed Cap (Adjust	1858	1875	1997	2098	2219	2394	2538	2617	2732	862
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Installed Cap (Adjust	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	6201	6358	6873	6965	7904
Installed Cap (Adjust	5599	5599	5695	5695	5701	6201	6358	6873	6965	7904
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2762	2737	2723
Max NIC Transfer	4011	4013	4099	4098	4137	4592	4757	5225	5297	6142
Req Trans @ KLY/NIC	6268	6324	6297	6280	6285	6237	6239	6246	6252	8219
Req Trans @ LM	6050	6103	6078	6062	6066	6017	6018	6017	6021	7948
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	-1137	-1090	-671	-378	-497	-307	-461	-567	-724	1176

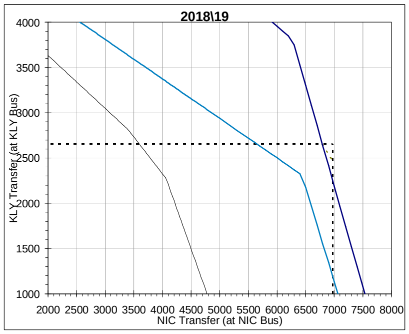
Maximum Peace Generation (Continued)

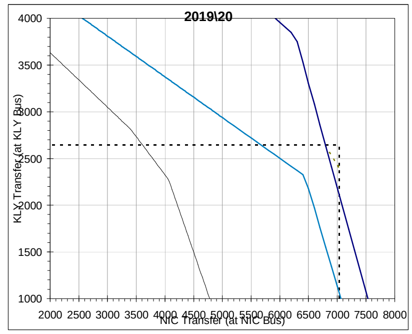


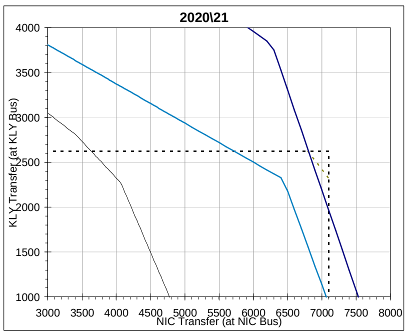


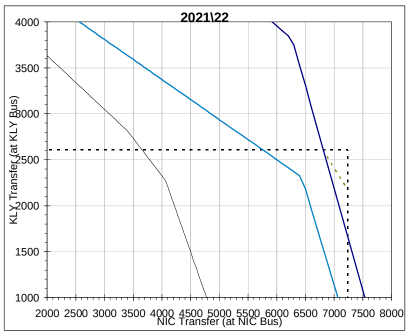


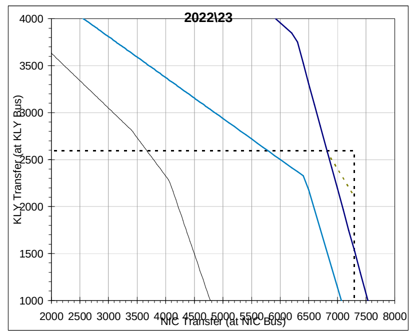


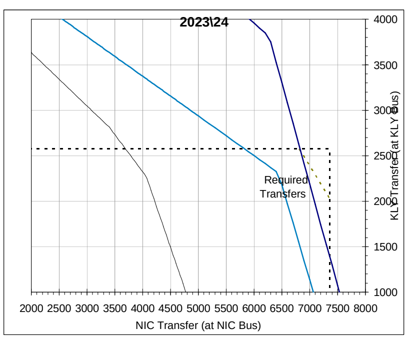












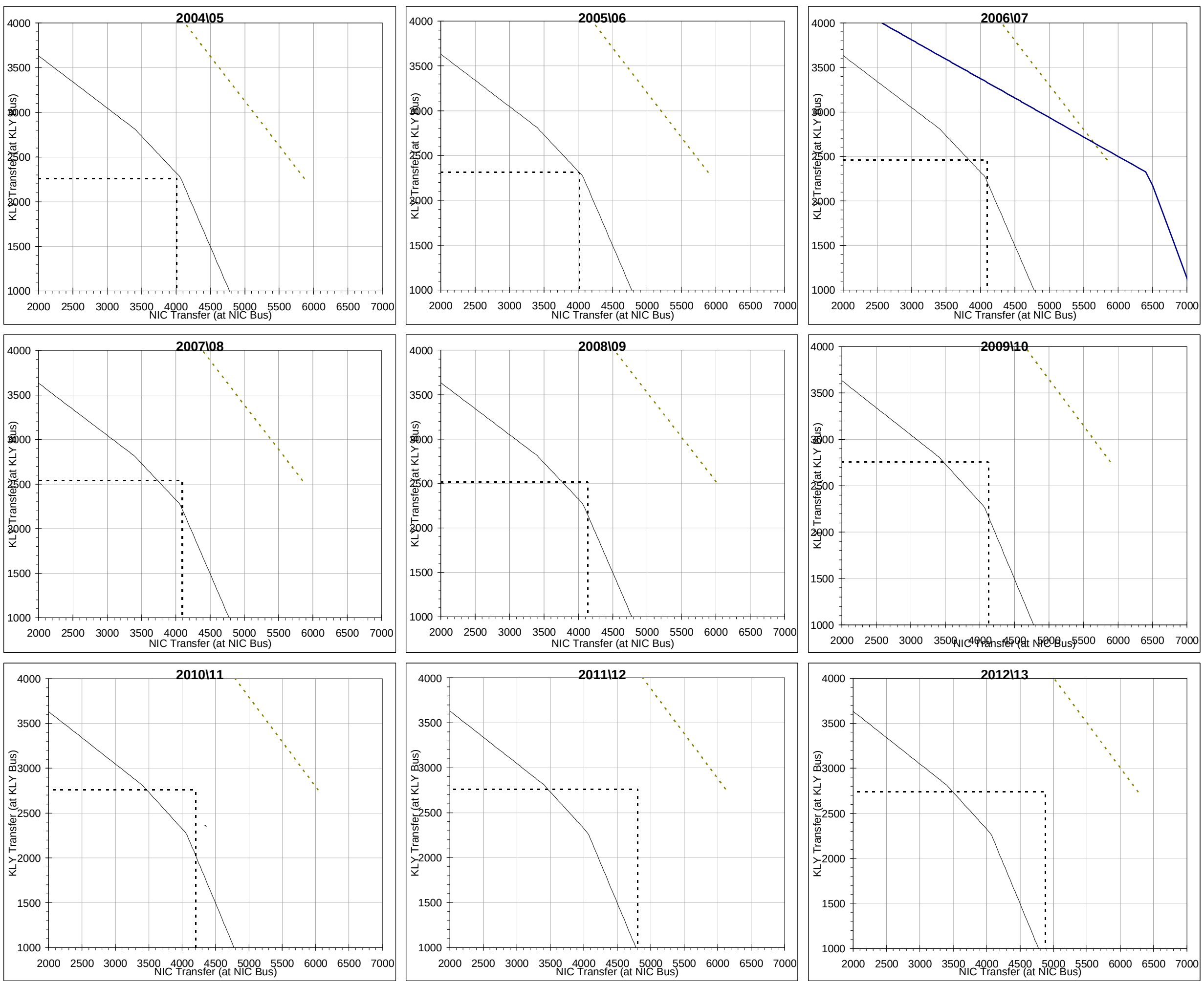
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: MCA-REV
Load Forecast: October 2004 Forecast - Heavy Winter

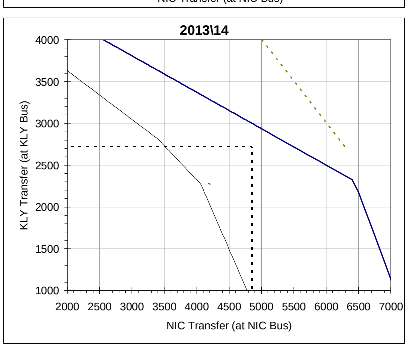
Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	213	376	527	684	849	1011	1178
Installed Cap (Adjust	147	147	147	213	376	527	684	849	1011	1178
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Installed Cap (Adjust	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	8455	8547	8639	8731	8915	9007	9099	9269	9361	9453
Installed Cap (Adjust	8455	8547	8639	8731	8915	9007	9099	9269	9361	9453
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2708	2695	2682	2696	2656	2641	2625	2608	2594	2578
Max NIC Transfer	6627	6694	6759	6824	6973	7036	7101	7233	7297	7358
Req Trans @ KLY/NIC	9087	9235	9385	9464	9440	9431	9421	9410	9400	9391
Req Trans @ LM	8809	8948	9089	9163	9137	9128	9117	9104	9094	9084
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	1492	1398	1301	1185	1021	870	713	548	386	218

Appendix 9: Nomogram Analysis for Scenario 8

This appendix summarizes details of the N-1 nomogram analysis for scenario 8.

Minimum Coastal Generation:147MW

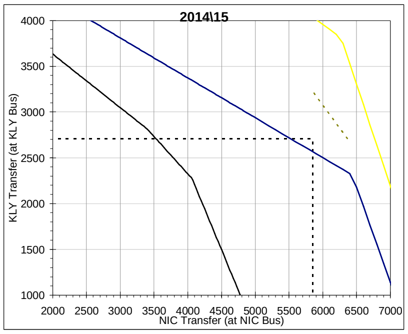


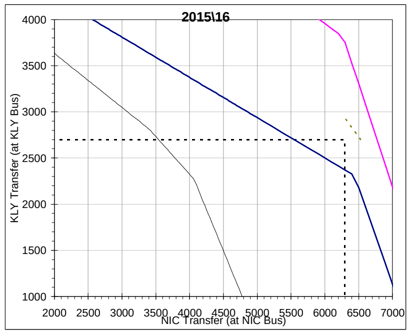


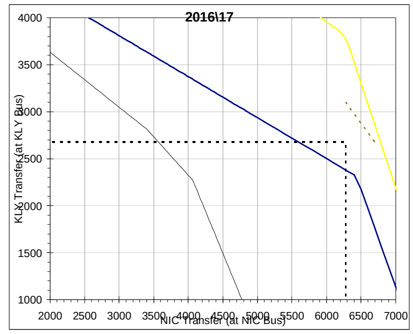
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: ALB-EKT coal
Load Forecast: October 2004 Forecast - Heavy Winter

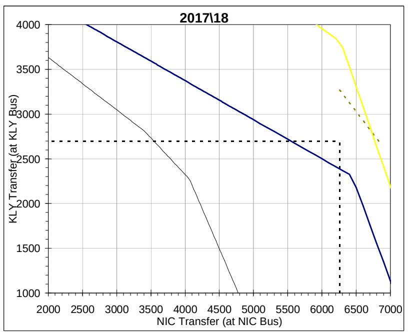
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjuste	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5766	6423	6515	6504
Installed Cap (Adjuste	5599	5599	5695	5695	5701	5701	5766	6423	6515	6504
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2762	2737	2723
Max NIC Transfer	4011	4013	4099	4098	4137	4125	4205	4808	4881	4856
Req Trans @ KLY/NIC	8127	8203	8302	8391	8523	8649	8799	8883	9008	9012
Req Trans @ LM	7767	7838	7929	8011	8131	8248	8385	8459	8571	8691
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	-1293	-1251	-830	-543	-659	-525	-596	-70	-148	-184

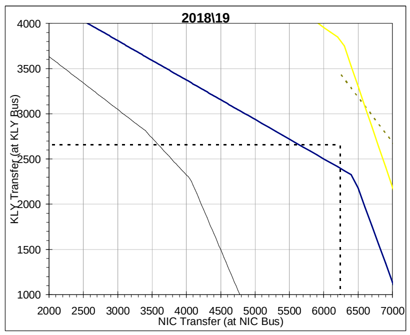
Minimum Coastal Generation: 147 MW (Continued)

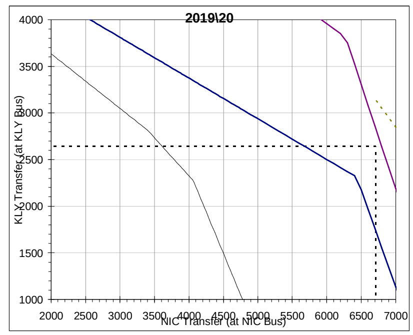


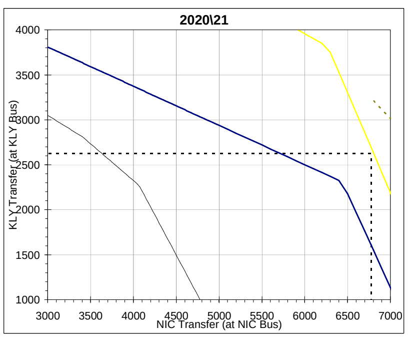


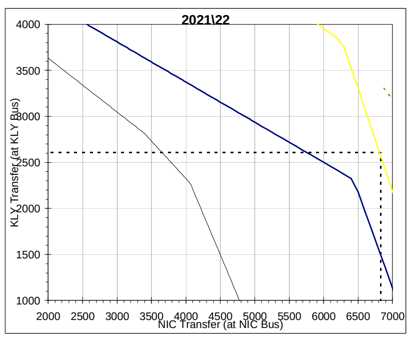


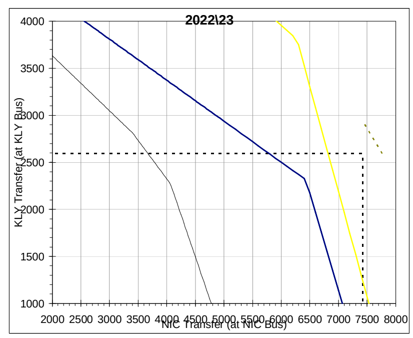


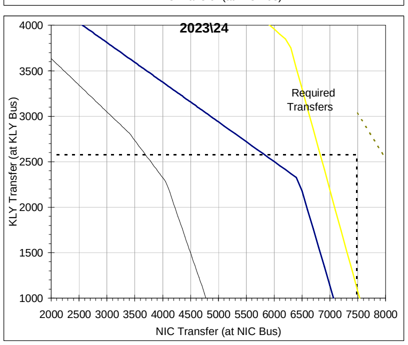








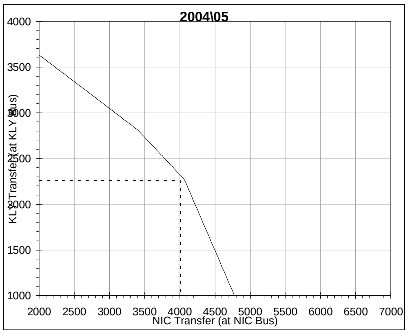


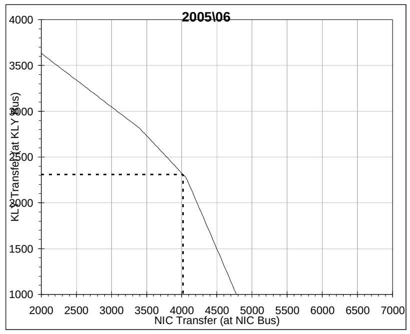


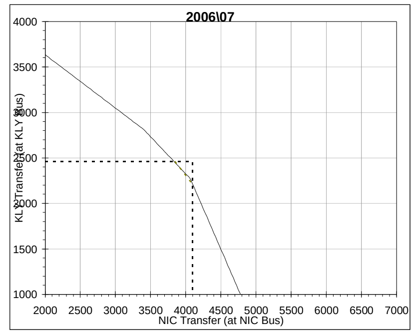
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: ALB-EKT coal
Load Forecast: October 2004 Forecast - Heavy Winter

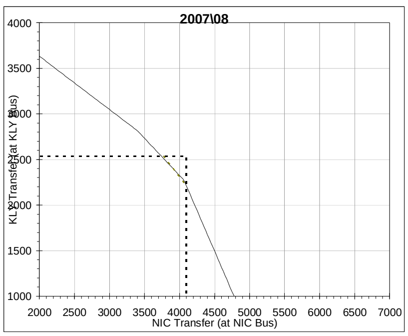
Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	147	147	147	147	147	147	147	147	147	147
Installed Cap (Adjust	147	147	147	147	147	147	147	147	147	147
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Installed Cap (Adjust	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	7604	8104	8104	8104	8104	8645	8737	8815	9499	9591
Installed Cap (Adjust	7604	8104	8104	8104	8104	8645	8737	8815	9499	9591
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2708	2695	2682	2696	2656	2641	2625	2608	2594	2578
Max NIC Transfer	5854	6292	6275	6257	6238	6712	6775	6827	7420	7482
Req Trans @ KLY/NIC	9077	9229	9379	9530	9686	9850	10015	10183	10361	10533
Req Trans @ LM	8809	8948	9089	9233	9379	9528	9683	9839	9997	10158
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	732	1007	826	669	452	504	188	144	352	530

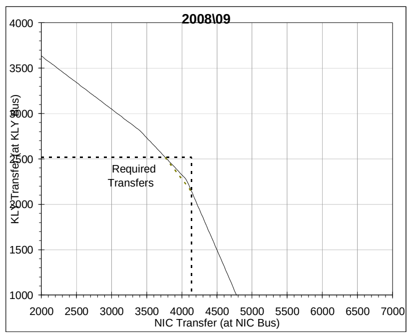
Maximum Columbia Generation

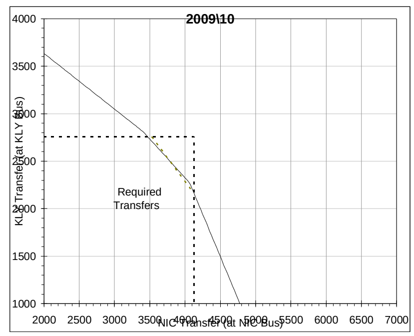


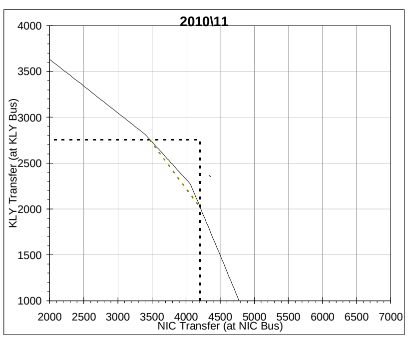


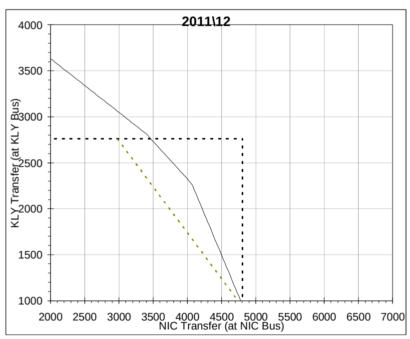


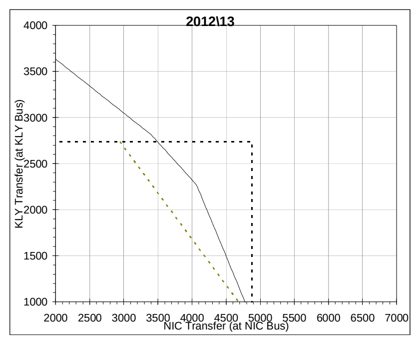


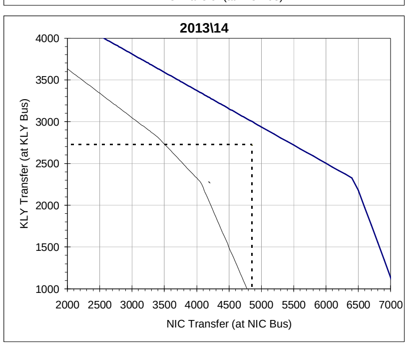








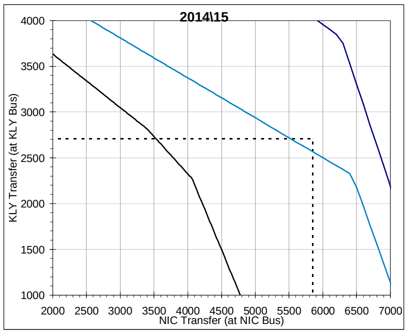


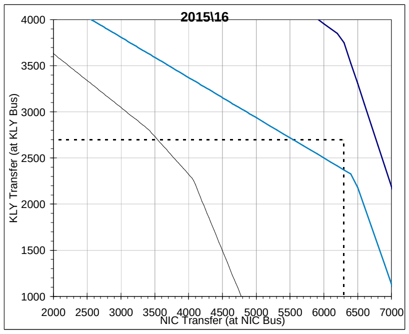


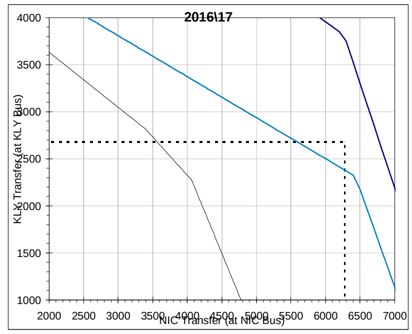
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: ALB-EKT coal
Load Forecast: October 2004 Forecast - Heavy Winter

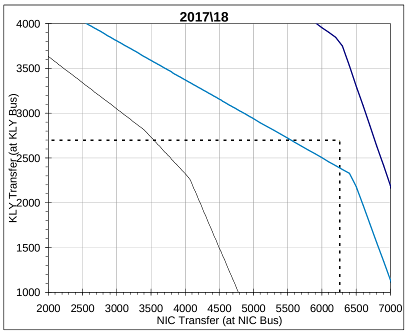
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1858	1875	1987	2071	2228	2341	2550	3139	3327	1459
Installed Cap (Adjuste	1858	1875	1987	2071	2228	2341	2550	3139	3327	1459
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Installed Cap (Adjuste	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5766	6423	6515	6504
Installed Cap (Adjuste	5599	5599	5695	5695	5701	5701	5766	6423	6515	6504
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2762	2737	2723
Max NIC Transfer	4011	4013	4099	4098	4137	4125	4205	4808	4881	4856
Req Trans @ KLY/NIC	6268	6324	6307	6308	6276	6285	6221	5738	5680	7578
Req Trans @ LM	6050	6103	6087	6088	6058	6067	6007	5544	5487	7350
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	-1137	-1090	-714	-502	-487	-590	-417	73	-10	-62

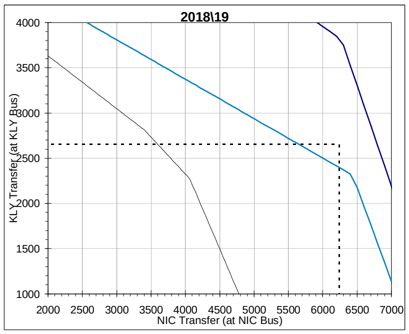
Maximum Columbia Generation (Continued)

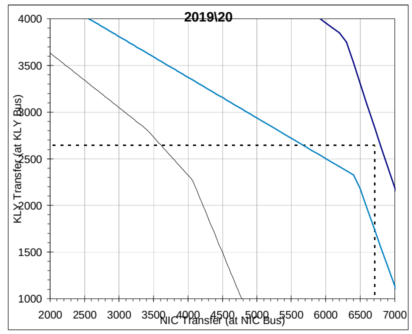


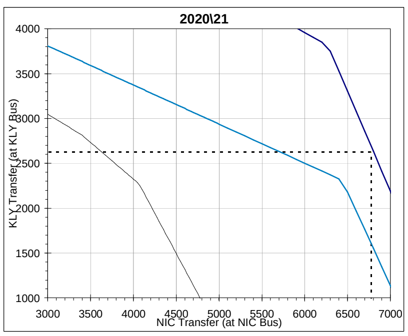


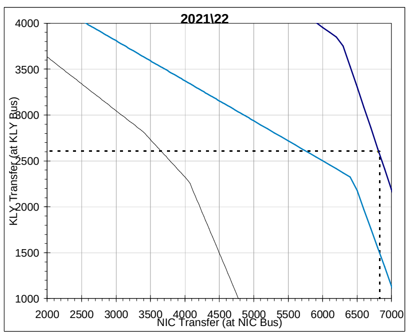


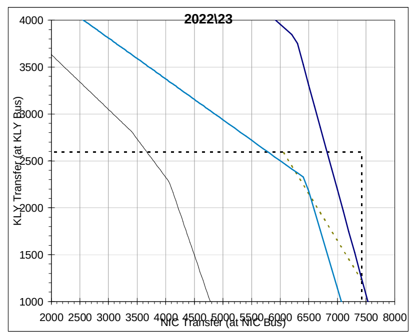


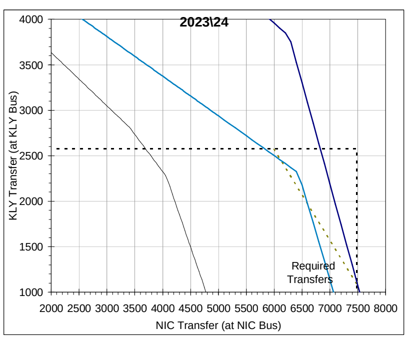








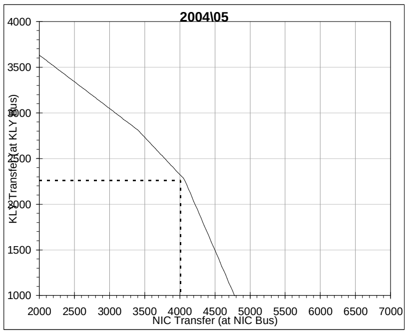


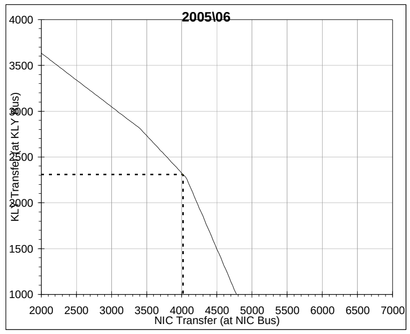


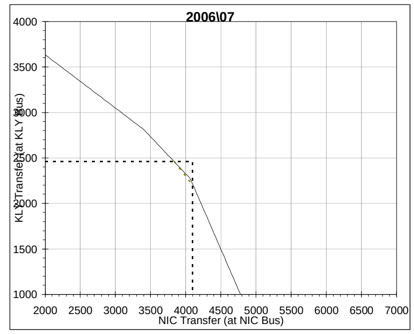
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: ALB-EKT coal
Load Forecast: October 2004 Forecast - Heavy Winter

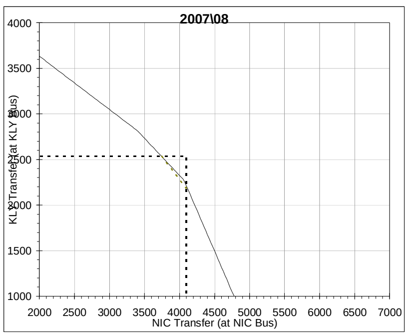
Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	616	367	530	671	866	597	702	852	1728	1968
Installed Cap (Adjust	616	367	530	671	866	597	702	852	1728	1968
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Installed Cap (Adjust	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	7604	8104	8104	8104	8104	8645	8737	8815	9499	9591
Installed Cap (Adjust	7604	8104	8104	8104	8104	8645	8737	8815	9499	9591
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2708	2695	2682	2696	2656	2641	2625	2608	2594	2578
Max NIC Transfer	5854	6292	6275	6257	6238	6712	6775	6827	7420	7482
Req Trans @ KLY/NIC	8559	8984	8953	8949	8891	9348	9396	9399	8647	8569
Req Trans @ LM	8318	8716	8687	8683	8628	9055	9099	9100	8376	8300
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	781	1029	866	726	531	800	694	577	1010	892

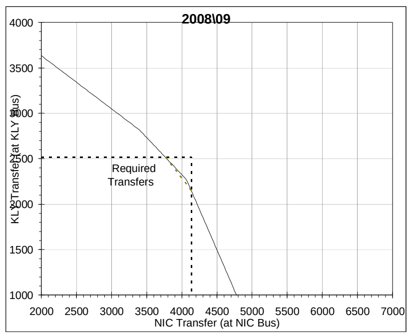
Maximum Peace Generation

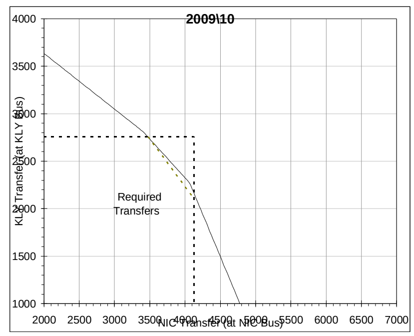


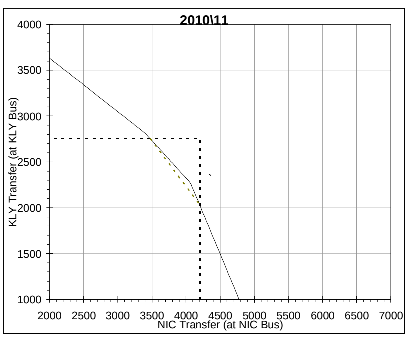


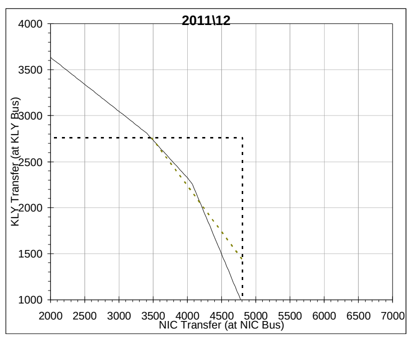


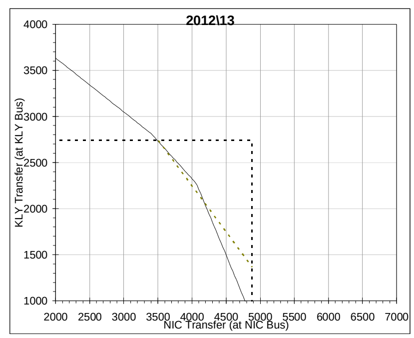


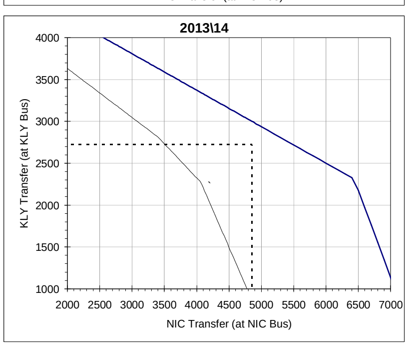








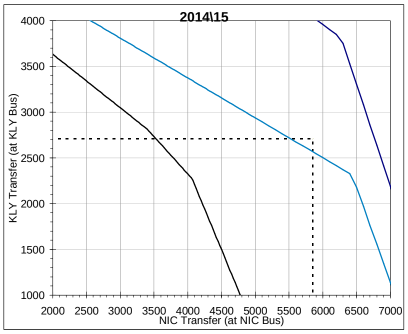


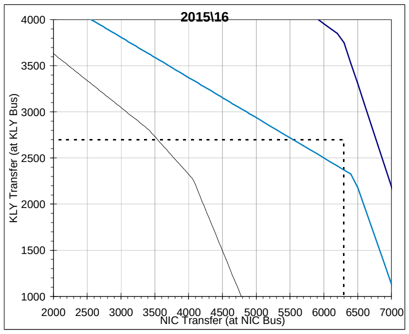


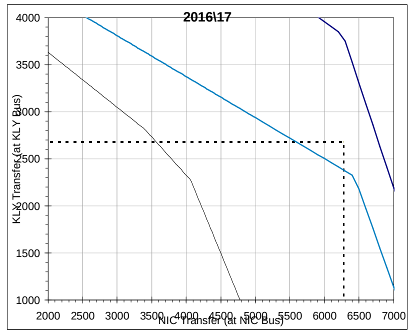
Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: ALB-EKT coal
Load Forecast: October 2004 Forecast - Heavy Winter

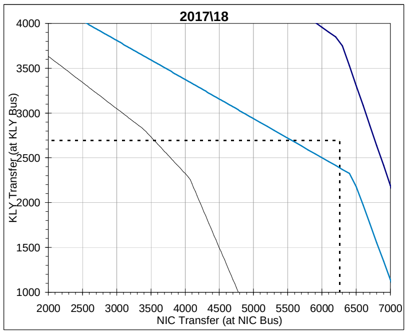
Year	2004\05	2005\06	2006\07	2007\08	2008\09	2009\10	2010\11	2011\12	2012\13	2013\14
LM/VI Generation	1858	1875	1997	2098	2218	2394	2538	2617	2731	1458
Installed Cap (Adjust	1858	1875	1997	2098	2218	2394	2538	2617	2731	1458
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Installed Cap (Adjust	3820	3828	3978	4055	4101	4327	4373	4373	4373	4373
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	5599	5599	5695	5695	5701	5701	5766	6423	6515	6504
Installed Cap (Adjust	5599	5599	5695	5695	5701	5701	5766	6423	6515	6504
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2259	2312	2461	2538	2517	2758	2758	2762	2737	2723
Max NIC Transfer	4011	4013	4099	4098	4137	4125	4205	4808	4881	4856
Req Trans @ KLY/NIC	6268	6324	6297	6280	6286	6232	6233	6239	6246	7579
Req Trans @ LM	6050	6103	6078	6062	6067	6017	6018	6017	6022	7351
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	-1137	-1090	-671	-378	-501	-351	-431	-537	-694	-62

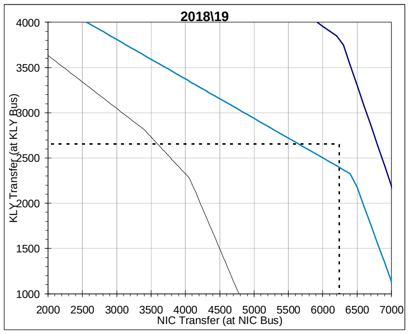
Maximum Peace Generation (Continued)

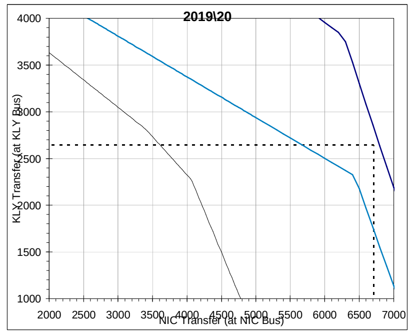


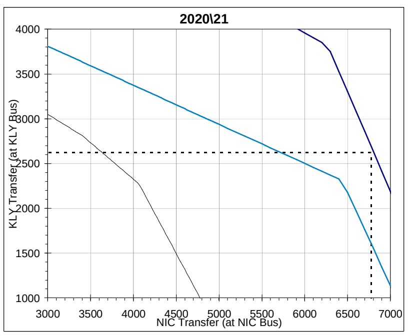


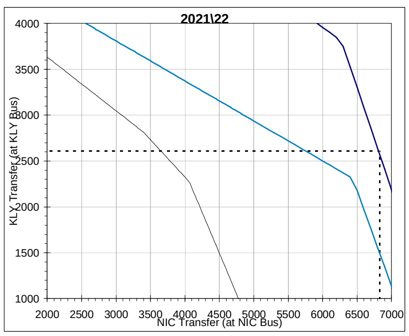


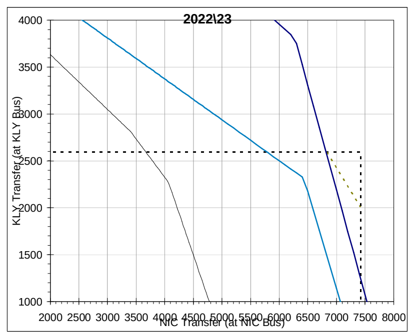


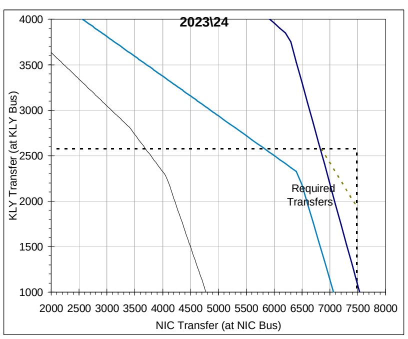












Sequence: SPPA System Plan for RM Portfolios
Generation: Maximum NI & SI generation (Minimums for LM & VI) provided in the NITS Application for SL
Resource Plan: ALB-EKT coal
Load Forecast: October 2004 Forecast - Heavy Winter

Year	2014\15	2015\16	2016\17	2017\18	2018\19	2019\20	2020\21	2021\22	2022\23	2023\24
LM/VI Generation	615	367	530	671	866	597	702	828	989	1153
Installed Cap (Adjust	615	367	530	671	866	597	702	828	989	1153
Redispatch	0	0	0	0	0	0	0	0	0	0
Peace Generation	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Installed Cap (Adjust	4373	4373	4373	4404	4382	4382	4382	4382	4382	4382
Redispatch	0	0	0	0	0	0	0	0	0	0
Columbia Generation	7604	8104	8104	8104	8104	8645	8737	8815	9499	9591
Installed Cap (Adjust	7604	8104	8104	8104	8104	8645	8737	8815	9499	9591
Redispatch	0	0	0	0	0	0	0	0	0	0
Max KLY Transfer	2708	2695	2682	2696	2656	2641	2625	2608	2594	2578
Max NIC Transfer	5854	6292	6275	6257	6238	6712	6775	6827	7420	7482
Req Trans @ KLY/NIC	8559	8984	8954	8950	8891	9349	9397	9425	9427	9420
Req Trans @ LM	8318	8716	8687	8684	8628	9055	9100	9125	9117	9109
Export @ ING	780	780	780	780	780	780	780	780	780	780
Generation Reserves	781	1029	866	726	531	800	694	553	356	187

Appendix 10: Summary of RMR Generations

The following tables summarize the RMR generations (in MW) for all of the developed alternatives:

TABLE 10.1
COASTAL RMR FOR
MAXIMUM TRANSFER FROM NICOLA 500 KV BUS (MAX. COLUMBIA)
230 MW FIRM EXPORT TO THE USA
THE 2004 TRANSMISSION SYSTEM – NO SHEDDING – WITH NU

Year	**Scenario 1** Base Case 1 in 2yr load 230 MW US Exp	**Scenario 2** Alt01-STC& NW Wind 1 in 10yr load 230 MW US Exp	**Scenario 3** Alt02 - REV/MCA 1 in 10yr load 230 MW US Exp	**Scenario 4** Alt03 - SE Coal 1 in 10yr load 230 MW US Exp
2005/06	1072	1360	1360	1360
2006/07	1207	1470	1470	1470
2007/08	1282	1552	1552	1552
2008/09	1427	1702	1702	1703
2009/10	1530	1812	2187	1814
2010/11	1811	2017	2467	2017
2011/12	1924	2517	See note 1	See note 1
2012/13	2069	2627	See note 1	See note 1
2013/14	1022	947	147	959
2014/15	329	147	147	147
2015/16	278	147	147	147
2016/17	331	147	147	147
2017/18	362	147	147	194
2018/19	147	147	147	384
2019/20	147	147	319	147
2020/21	206	147	540	226
2021/22	189	285	847	373
2022/23	261	252	1076	1226
2023/24	147	411	1308	1460

Note 1: Columbia generation cannot be maximized with any amount of coastal RMR

TABLE 10.2
COASTAL RMR FOR
MAXIMUM TRANSFER FROM KELLY LAKE 500 KV BUS (MAX. PEACE)
230 MW FIRM EXPORT ON 5L51/5L52
THE 2004 TRANSMISSION SYSTEM – NO SHEDDING – WITH NU

Year	Scenario 1 Base Case 1 in 2yr load 230 MW US Exp	Scenario 2 Alt01-STC& NW Wind 1 in 10yr load 230 MW US Exp	Scenario 3 Alt02 - REV/MCA 1 in 10yr load 230 MW US Exp	Scenario 4 Alt03 - SE Coal 1 in 10yr load 230 MW US Exp
2005/06	1078	1360	1360	1360
2006/07	1195	1478	1478	1478
2007/08	1285	1578	1577	1577
2008/09	1395	1693	1695	1695
2009/10	1497	1865	1865	1865
2010/11	1641	2006	2006	2006
2011/12	1712	2123	2083	2083
2012/13	1829	2287	2195	2195
2013/14	1022	947	378	959
2014/15	329	147	147	147
2015/16	278	147	147	147
2016/17	331	147	147	147
2017/18	362	147	147	194
2018/19	147	147	147	384
2019/20	147	401	147	147
2020/21	206	730	208	226
2021/22	189	1070	369	356
2022/23	261	1211	528	532
2023/24	147	1356	691	695

TABLE 10.3
COASTAL RMR FOR
MAXIMUM TRANSFER FROM NICOLA 500 KV BUS (MAX. COLUMBIA)
730 MW FIRM EXPORT TO THE USA
THE 2004 TRANSMISSION SYSTEM – NO SHEDDING – WITH NU

Year	**Scenario 5** Base Case 1 in 2yr load 730 MW US Exp	**Scenario 6** Alt01-STC& NW Wind 1 in 10yr load 730 MW US Exp	**Scenario 7** Alt02 - REV/MCA 1 in 10yr load 730 MW US Exp	**Scenario 8** Alt03 - SE Coal 1 in 10yr load 730 MW US Exp
2005/06	1580	1875	1875	1875
2006/07	1718	1987	1987	1987
2007/08	1796	2071	2071	2071
2008/09	1945	2228	2228	2228
2009/10	2050	2341	2727	2341
2010/11	2339	2550	3014	2550
2011/12	2455	3065	3510	See note 1
2012/13	2604	3176	3702	See note 1
2013/14	1526	1446	533	1459
2014/15	814	562	147	616
2015/16	760	147	147	367
2016/17	814	175	147	530
2017/18	845	147	270	671
2018/19	550	292	580	866
2019/20	614	442	799	597
2020/21	683	597	1025	702
2021/22	666	762	1339	852
2022/23	739	728	1574	1728
2023/24	405	891	1812	1968

Note 1: Columbia generation cannot be maximized with any amount of coastal RMR

TABLE 10.4
COASTAL RMR FOR
MAXIMUM TRANSFER FROM KELLY LAKE 500 KV BUS (MAX. PEACE)
730 MW FIRM EXPORT ON 5L51/5L52
THE 2004 TRANSMISSION SYSTEM – NO SHEDDING – WITH NU

Year	**Scenario 5** Base Case 1 in 2yr load 730 MW US Exp	**Scenario 6** Alt01-STC& NW Wind 1 in 10yr load 730 MW US Exp	**Scenario 7** Alt02 - REV/MCA 1 in 10yr load 730 MW US Exp	**Scenario 8** Alt03 - SE Coal 1 in 10yr load 730 MW US Exp
2005/06	1586	1875	1875	1875
2006/07	1705	1996	1997	1997
2007/08	1799	2098	2098	2098
2008/09	1911	2219	2219	2218
2009/10	2016	2394	2394	2394
2010/11	2163	2538	2538	2538
2011/12	2236	2659	2617	2617
2012/13	2357	2828	2732	2731
2013/14	1526	1446	862	1458
2014/15	814	562	147	615
2015/16	760	147	147	367
2016/17	814	301	147	530
2017/18	845	448	213	671
2018/19	550	555	376	866
2019/20	614	882	527	597
2020/21	683	1220	684	702
2021/22	666	1568	849	828
2022/23	739	1713	1011	989
2023/24	405	1861	1178	1153

Table 10.5: Vancouver Island load and resource Balance (1 in 2 year forecast)

Year	VI Demand (including losses) (MW)	Existing Transfer Capacity plus 30 MW Gen on VI (MW)	Additional Transmission Capacity (MW)	Supply Balance (MW)
04/05	2247	1570		-677
05/06	2250	1570		-680
06/07	2266	1570		-696
07/08	2280	1330		-950
08/09	2308	1330	1200	222
09/10	2337	1330	1200	193
10/11	2394	1330	1200	136
11/12	2418	1330	1200	112
12/13	2453	1330	1200	77
13/14	2486	1330	1200	44
14/15	2517	1330	1200	13
15/16	2557	1330	1800	573
16/17	2597	1330	1800	533
17/18	2638	1330	1800	492
18/19	2678	1330	1800	452
19/20	2720	1330	1800	410
20/21	2761	1330	1800	369
21/22	2805	1330	1800	325
22/23	2848	1330	1800	282
23/24	2891	1330	1800	239
24/25	2936	1330	1800	194

Table 10.6: Vancouver Island Load and Resource Balance (1 in 10 year forecast)

Year	VI Demand (including losses) (MW)	Existing Transfer Capacity plus 30 MW Generation on VI (MW)	Additional Transmission Capacity (MW)	Supply Balance (MW)
04/05	2258	1570		-688
05/06	2261	1570		-691
06/07	2277	1570		-707
07/08	2291	1330		-961
08/09	2319	1330	1200	211
09/10	2349	1330	1200	181
10/11	2406	1330	1200	124
11/12	2429	1330	1200	101
12/13	2465	1330	1200	65
13/14	2498	1330	1200	32
14/15	2529	1330	1200	1
15/16	2569	1330	1800	561
16/17	2610	1330	1800	520
17/18	2651	1330	1800	479
18/19	2691	1330	1800	439
19/20	2733	1330	1800	397
20/21	2775	1330	1800	355
21/22	2818	1330	1800	312
22/23	2861	1330	1800	269
23/24	2905	1330	1800	225
24/25	2951	1330	1800	179

Appendix 11: Summary of Reinforcements

Tables 11.1 and 11.2 summarize the bulk transmission reinforcements for all of the developed alternatives. Direct Assignment Facilities are identified as "DAF" all other reinforcements are considered "Network Upgrade":

TABLE 11.1

Year	Scenario 1 Base Case 1 in 2yr load 230 MW US Exp	Scenario 2 Alt01-STC&NW Wind 1 in 10yr load 230 MW US Exp	Scenario 3 Alt02 - REV/MCA 1 in 10yr load 230 MW US Exp	Scenario 4 Alt03 - SE Coal 1 in 10yr load 230 MW US Exp
2005/06				
2006/07	SEL 1200 MVA T4	SEL 1200 MVA T4	SEL 1200 MVA T4	SEL 1200 MVA T4
	SEL 500 kV reactor	SEL 500 kV reactor	SEL 500 kV reactor	SEL 500 kV reactor
2007/08				
2008/09	2 ARN-VIT 230 kV AC Cables	2 ARN-VIT 230 kV AC Cables	2 ARN-VIT 230 kV AC Cables	2 ARN-VIT 230 kV AC Cables
	2 VIT 230 kV Phase-shifters	2 VIT 230 kV Phase-shifters	2 VIT 230 kV Phase-shifters	2 VIT 230 kV Phase-shifters
	2 SAT 230 kV reactors	2 SAT 230 kV reactors	2 SAT 230 kV reactors	2 SAT 230 kV reactors
	2L10 and 2L57 Upgrade	2L10 and 2L57 Upgrade	2L10 and 2L57 Upgrade	2L10 and 2L57 Upgrade
2009/10	5L91 Series Comp.	5L91 Series Comp.	5L91 Series Comp.	5L91 Series Comp.
	5L96 Series Comp.	5L96 Series Comp.	5L96 Series Comp.	5L96 Series Comp.
	5L98 Series Comp.	5L98 Series Comp.	5L98 Series Comp.	5L98 Series Comp.
	KIT-SCGT Interconnection ("DAF")			
	5L71 Series Comp.	5L71 Series Comp.	5L71 Series Comp.	5L71 Series Comp.
	5L72 Series Comp.	5L72 Series Comp.	5L72 Series Comp.	5L72 Series Comp.
	NIC Reconfiguration		NIC Reconfiguration	
2010/11	ING SVC	ING SVC	ING SVC	ING SVC
2011/12		ACK 500 kV MSC	ACK 500 kV MSC	ACK 500 kV MSC
		NIC Reconfiguration	NIC 500 kV MSC # 1	NIC Reconfiguration
2012/13				
2013/14	NIC-MDN 500 kV line 5L83	NIC-MDN 500 kV line 5L83	NIC-MDN 500 kV line 5L83	NIC-MDN 500 kV line 5L83
2014/15	KLY-CKY 500 kV line 5L46	KLY-CKY 500 kV line 5L46	KLY-CKY 500 kV line 5L46	KLY-CKY 500 kV line 5L46
		KDY Upgrade Series Comp.	DOW Switching Station	5L92 Series Comp.
		MLS Upgrade Series Comp.	DOW-REV 500 kV line 5L78	5L94 Series Comp.
		5L1, 5L2, 5L3 Upgrade	NIC 500 kV MSC # 2	SEL-VAS 500 kV Line 5L97
		5L11, 5L12 Upgrade	ING 500 kV SVC	VAS-NIC 500 kV Line 5L99
		KLY 500 kV SVC or shunt		5L97 Series Comp.
		WSN 500 kV SVC or shunt		5L99 Series Comp.
		Site C Interconnection ("DAF")		EKT to CBK Interconnection ("DAF")
		NW Wind Interconnection ("DAF")		
	Generic 3rd tie to VI	Generic 3rd tie to VI	Generic 3rd tie to VI	Generic 3rd tie to VI

TABLE 11.2

Year	**Scenario 5** Base Case 1 in 2yr load 730 MW US Exp	**Scenario 6** Alt01-STC&NW Wind 1 in 10yr load 730 MW US Exp	**Scenario 7** Alt02 - REV/MCA 1 in 10yr load 730 MW US Exp	**Scenario 8** Alt03 - SE Coal 1 in 10yr load 730 MW US Exp
2005/06				
2006/07	SEL 1200 MVA T4	SEL 1200 MVA T4	SEL 1200 MVA T4	SEL 1200 MVA T4
	SEL 500 kV reactor	SEL 500 kV reactor	SEL 500 kV reactor	SEL 500 kV reactor
2007/08				
2008/09	2 ARN-VIT 230 kV AC Cables	2 ARN-VIT 230 kV AC Cables	2 ARN-VIT 230 kV AC Cables	2 ARN-VIT 230 kV AC Cables
	2 VIT 230 kV Phase-shifters	2 VIT 230 kV Phase-shifters	2 VIT 230 kV Phase-shifters	2 VIT 230 kV Phase-shifters
	2 SAT 230 kV reactors	2 SAT 230 kV reactors	2 SAT 230 kV reactors	2 SAT 230 kV reactors
	2L10 and 2L57 Upgrade	2L10 and 2L57 Upgrade	2L10 and 2L57 Upgrade	2L10 and 2L57 Upgrade
2009/10	5L91 Series Comp.	5L91 Series Comp.	5L91 Series Comp.	5L91 Series Comp.
	5L96 Series Comp.	5L96 Series Comp.	5L96 Series Comp.	5L96 Series Comp.
	5L98 Series Comp.	5L98 Series Comp.	5L98 Series Comp.	5L98 Series Comp.
	KIT-SCGT Interconnection (“DAF”)			
	5L71 Series Comp.	5L71 Series Comp.	5L71 Series Comp.	5L71 Series Comp.
	5L72 Series Comp.	5L72 Series Comp.	5L72 Series Comp.	5L72 Series Comp.
	NIC Reconfiguration		NIC Reconfiguration	
2010/11	ING SVC	ING SVC	ING SVC	ING SVC
2011/12		ACK 500 kV MSC	ACK 500 kV MSC	ACK 500 kV MSC
		NIC Reconfiguration	NIC 500 kV MSC # 1	NIC Reconfiguration
2012/13				
2013/14	NIC-MDN 500 kV line 5L83	NIC-MDN 500 kV line 5L83	NIC-MDN 500 kV line 5L83	NIC-MDN 500 kV line 5L83
2014/15	KLY-CKY 500 kV line 5L46	KLY-CKY 500 kV line 5L46	KLY-CKY 500 kV line 5L46	KLY-CKY 500 kV line 5L46
		KDY Upgrade Series Comp.	DOW Switching Station	5L92 Series Comp.
		MLS Upgrade Series Comp.	DOW-REV 500 kV line 5L78	5L94 Series Comp.
		5L1, 5L2, 5L3 Upgrade	NIC 500 kV MSC # 2	SEL-VAS 500 kV Line 5L97
		5L11, 5L12 Upgrade	ING 500 kV SVC	VAS-NIC 500 kV Line 5L99
		KLY 500 kV SVC or MSC		5L97 Series Comp.
		WSN 500 kV SVC or shunt		5L99 Series Comp.
		Site C Interconnection (“DAF”)		EKT to CBK Interconnection (“DAF”)
		NW Wind Interconnection (“DAF”)		
	Generic 3rd tie to VI	Generic 3rd tie to VI	Generic 3rd tie to VI	Generic 3rd tie to VI

Appendix 12: Description of MCA, REV, NI and SI Upgrades

A) Mica and Revelstoke Generation Expansion Projects

5L71 and 5L72 Series Compensation

Based on the criteria of not requiring generation shedding for first contingencies the 5L71/72 series capacitors are currently required. The earliest in-service date is fall 2008. At present, at most one Mica unit needs to be shed.

Any new generation facilities at Mica will result in requiring tripping of two units when at full output for loss of 5L71 or 5L72. This includes Mica G5, Mica G6, and the Mica G1 & G2 upgrade project (130 MW). After Vaseux Lake Terminal Station is in-service the 5L71 & 5L72 lines will be the longest uncompensated lines in the BCTC network.

Under peak load conditions voltage instability in the Nicola area will be a concern. Shunt capacitors (at Nicola) are of some value but are not sufficient to solve the security problem. Series compensation will be required to meet criteria and to prevent a degradation in the existing limits as the load and transfers through Nicola increase.

The compensation should be 40% of the existing lines rated at 3200 amps. The higher current rating is required to handle additional power being injected from Revelstoke once the proposed Downie Creek switching station is built.

Ashton Creek Shunt Capacitor

After Revelstoke G5 is built there will be low voltage problem in the Ashton Creek area due to high transfers from Revelstoke and Selkirk. Voltage collapse could occur for loss of 5L96 (SEL to VAS) or 5L98 (VAS to NIC). Addition of a 250 MVAr 500 kV capacitor at Ashton Creek will improve the voltage profile in the whole region, free up reactive reserves at Revelstoke, and provide voltage security.

Downie Switching Station and a 500 kV Line to Revelstoke

These facilities are required once Mica G5 & G6 and Revelstoke G5 and G6 are built. An additional 122.5 MVAr bus reactor at Downie will also be required. An alternative solution is to series compensate the four 500 kV lines from Revelstoke through Ashton Creek to Nicola. With this alternative generation shedding at Mica would be required.

Some of the Revelstoke power will flow to Downie since the 5L71/72 lines will have series compensation and the 5L75/77 and 5L76/79 line will not. Sufficient compensation in the 5L71/72 lines is required to ensure stability but not so much that the flows on 5L71/72 are excessive and create voltage and transient constraints.

Nicola Shunt Capacitors and SVC

With almost 6000 MW being generated at Mica and Revelstoke and with over 2000 MW being transferred west from Selkirk three 200 MVAr 500 kV Nicola shunt capacitors will be required to maintain voltages at Nicola above 520 kV and ensure voltage security. To maintain the post disturbance Nicola voltage at 515 kV (or higher) a +300/-200 MVAr SVC will be required for loss of 5L71 or 5L72. The SVC is probably required to maintain transient stability but this has not been confirmed yet.

B) SI and NI Transmission Reinforcements

SEL Transformer T4 (1200 MVA) Addition

The transfer capability of the existing SEL transformers (T1, 1200 MVA; T2, 672 MVA; T3, 672 MVA) is 1600 MW to prevent transformer from thermal overload after loss of transformer T1. Based on the base resource plan and DSB return on 2L112 from US, the loading on SEL transformers at daily light load would be about 2220 - 2360 MW in 2006; 2300-2400 MW in 2007; 2300-2430 in 2008; 2330-2465 MW in 2010 and 2300- 2460 MW in 2015. The transfer requirements are above the transfer limit. By adding SEL transformer T4 (1200 MVA) the SEL transformer transfer capability would be increased to 2700 MVA which is enough to transmit the total surplus generation in the Selkirk area plus import from FortisBC, and the power from the US that flows through the 230 kV Nelway – Boundary connection of the area to the BCTC 500 kV system.

SEL 500 kV 123 MVAr Shunt Reactor

During low transfers on the 500 kV lines in the BC South Interior East region, the SEL area generators (SEV, KCL, ALH, etc) are required to run at low output or operate as synchronous condensers to regulate SEL area voltages. Operating the units as synchronous condensers increases power losses.

Installing a 500 kV shunt reactor at 500 kV SEL substation would reduce the reliance on SEL area generators, especially on SEV units to regulate voltages and reduce the losses and consequently lower the operation costs.

5L91/5L96/5L98 Series Compensation

With the 500 kV VAS substation in service, the total transfer capability on 5L91-5L96 (5L98) cut-plane is limited to about 1850 MW to prevent voltage instability for loss of 5L96. Based on the base resource plan and the firm transfer from Alberta plus DSB return on 2L112, the loading on the cut-plane would be about 1900 MW at winter peak load and 2130 MW at summer peak load in 2007; 1900 MW at winter peak- 2150 MW at summer peak in 2010 and 1870 MW at winter peak - 2130 MW at summer peak load in 2015. These transfer requirements are above the voltage stability limit. Based on a preliminary power flow study, with 50% series compensation added to lines 5L91, 5L96 and 5L98, the voltage stability transfer limit could be increased to about 2300 MW, which would meet the transfer requirement.

When the system is at light load, the maximum transfer on the cut-plane would be about between 2300 MW and 2470 MW in terms of base resource plan and load forecast in the year from 2005 to 2015. A series capacitor station with a 2750 Amp rating would be adequate to meet the transfer requirement.

SI East dispatch will have to be curtailed until this series compensation is in service in 2009. Generation shedding can also be considered as a short-term solution. These reinforcements can be deferred by reducing the SI East resource dispatch.

5L94, 5L92 Series Compensation , The Second SEL-VAS-NIC 500 kV Circuit with Series Compensation and Shunt Compensation at ACK and NIC

According to alternative resource plan Alt03 compared to base resource plan, the major generation addition in South Interior from 2005 to 2015 will be:

a. East Kootenay Thermal (EKT) generation plant with the maximum output of 600 MW scheduled in service in 2014;

b. 500 MW import from Alberta in 2014 and 1000 MW in 2015; and

c. REV G5 with the maximum output of 500 MW scheduled in service in 2011.

The loading on 5L91-5L96/98 cut-plane from SEL area surplus generation, the import from FortisBC, DSB return on the BPA Boundary to NLY line plus EKT generation and import from Alberta will be substantially above the thermal limit of 5L91, or 5L96, or 5L98. At summer peak load, the transfer on the cut-plane will be about 3100 MW in 2014 and 3600 MW in 2015 while the thermal over loading capability of 5L91, or 5L96, or 5L98 is only about 3000 MW. When the system load is at daily summer light load the transfer on the cut-plane will be about 3500 MW in 2014 and 4000 MW in 2015. Therefore, a new 500 kV transmission line from SEL to NIC will be required to meet the transfer requirement.

Based on the preliminary power flow studies, the preferred solution is to build the second 500 kV SEL-VAS-NIC circuit with 50% series compensation, the same as 5L96 and 5L98. There may be a need for 50% series compensation on 5L94 and 5L92 respectively, and shunt compensations or SVC at ACK (500 MVAr) and NIC (500 MVAr) to maintain the proper SI pre-contingency voltage profile and post-contingency voltage stability.

5L1, 5L2, 5L3, 5L11, 5L12, KDY and MLS Series Capacitor Station Upgrades

According to alternative resource plan Alt01 compared to base resource plan, the major generation addition in Peace system from 2005 to 2015 will be:

d. Site C hydro plant with the maximum output of 900 MW scheduled in service in 2014; and

e. NW_Wind generation plant with the maximum output of 700 MW scheduled in service in 2014.

At winter peak load and with Maximum Peace generation, the transfer on the cut-plane of 5L1, 5L2 and 5L3 (cut-plane 1) will be about 4340 MW and the transfer on the cut-plane of 5L11, 5L12 and 5L13 (cut-plane 2) will be about 4045 MW in 2014. Both transfers are above the voltage stability limits and also may be beyond the transient stability limits. Furthermore, the transfer on the cut-plane 2 is above the thermal limit (3700 MW) of MLS series capacitor stations. Therefore, the percentage of series compensation at KDY and MLS will require to be increased and additional shunt compensations at WSN and/or KLY may also be required to increase the transient stability and the voltage stability limits. The MLS current ratings would also require upgrading.

At 55% winter peak load which may reflect summer season operation condition, the transfer on the cut-plane 1 will be about 4500 MW in 2014 and the transfer on the cut-plane 2 will be about 4800 MW in 2014. Both transfers are above the transient stability and thermal limit of the lines and series capacitor stations at KDY and MLS. The limiting factor of the Peace transmission lines (5L1, 5L2, 5L3, 5L11, 5L12, 5L13, etc) includes low line clearance. By upgrading these lines, the line thermal over load problems could be removed. At the same time, the MLS and KDY series capacitor stations current ratings also need to be upgraded and the degree of the series compensation would also need to be increased to avoid thermal overloading and increase Peace system transient stability limits.

Based on the preliminary power flow studies to accommodate the new generation of NW_Wind generation (700 MW) and Site C (900 MW), the following Peace system transmission reinforcements are suggested.

- Upgrade KDY series capacitor station:
  Increase series compensation from 50% to 65%
  Increase the rated current from 2310 A to 2500 A
- Upgrade MLS series capacitor station:
  Increase series compensation from 50% to 65%
  Increase the rated current from 1950 A to 2500 A
- Upgrade the line overload capabilities of 5L1, 5L2 and 5L3 from 2500 A to the minimum of 2750 A
- Upgrade the line overload capabilities of 5L11and 5L12 from 2500 A to the minimum of 2750 A
- WSN 500 kV, 500 MVAr Auto shunt Capacitor compensation or SVC
- KLY 500 kV, 500 MVAr Auto shunt Capacitor compensation or SVC

The above transmission reinforcements are based on very preliminary power flow studies. The requirements for the series capacitor stations, line upgrades, VAR compensation are subject to revision when further studies such as transient, system reactive power compensation, SSR, etc. are conducted.

Appendix 13: BCTC's Planning Standards and Criteria

British Columbia Transmission CORPORATION™

C.1: BCTC Planning Standards

Abstract

BCTC power system planning standards are described. These are based on NERC/WECC Planning Standards and other WECC criteria, policies, and programs. Internal BCTC additional planning standards address three requirements not addressed by the NERC/WECC Planning Standards.

Introduction

BCTC is a member of the Western Electricity Coordinating Council (WECC) which is a regional member of the North American Electric Reliability Council (NERC). As a WECC member, BCTC plans and operates its electric system in accordance with planning and operating standards as set by NERC and as augmented by WECC. The NERC/WECC standards establish the envelope within which members plan and operate their systems.

Regional and local differences (economics, geography, system characteristics, weather, etc.) often dictate that more detail is required in planning and operating criteria. The WECC standards are the additional details required for the Western Interconnection (in addition to NERC). BCTC also has some further details applicable within the BCTC system.

The NERC and WECC standards address two fundamental purposes:

> The NERC Planning Standards outline the required planning standards that North American electric utilities (transmission system owners/operators) should follow to maintain acceptable levels of reliability of supply to its own customer loads and bulk power transfers. Long term experience has demonstrated that adherence to these standards will assure a minimum acceptable level of reliability at an acceptable cost.
>
> North American electric utilities should also follow the NERC Planning Standards to ensure that they do not exceed the allowed impacts on neighbouring systems. When a contingency outage occurs in one system, neighbouring power systems also see some effect of this contingency.

WECC has adopted the NERC Planning Standards and augmented them with additional standards and metrics (for example on voltage and frequency deviations related to contingencies). This expanded set of standards are those that must be met by utilities in the WECC region. WECC has documented these NERC standards in WECC's document: "NERC/WECC Planning Standards" available on the WECC website (www.wecc.biz).

WECC allows its members to establish different standards than WECC's for internal systems, but higher standards (more stringent) cannot be imposed on others. If a member implements a lower internal standard, it must accept the impacts inside its system for contingencies in other systems, up to the deviations it has established for itself.

In setting out the standards applicable to system operation, the WECC requires the system to be operated in compliance with the performance metrics incorporated in the NERC/WECC Planning Standards.

In addition, the WECC Minimum Operating Reliability Criteria (MORC) sets out obligations for control areas regarding reliable system operation. For example, MORC establishes generator contingency reserve requirements – the amount of generator operating spinning reserve and non-spinning reserves that must be available in the event of system contingencies. This standard specifies response times and amounts of capacity (generator or interruptible load) that must be on line or available to produce electricity. Operating criteria are also considered in establishing system performance requirements.

WECC also has a number of Policies and Programs, which are similar to standards, that address matters such as use of control and remedial actions schemes. For example, there are redundancy requirements on RAS systems, and there are standards for the addition of Power System Stabilizers on generating units. BCTC meets its WECC membership obligations regarding these Policies and Programs.

To address local conditions, BCTC has established additional system performance standards and variations from the WECC standards which it applies internally to the BCTC system.

BCTC Internal Standards

1. Generator shedding on first contingency.

   BCTC generally does not allow generation shedding for a single, first contingency (i.e., system starts in a normal state). However under special circumstances BCTC applies the following requirements, all of which must be met:

   (a) Generator shedding triggered by transmission system contingencies must meet all applicable NERC/WECC Planning Standards, including those for the initiating contingency. For example, generator shedding of two or more units for a single contingency transmission line outage must meet Category B Standards for a single transmission line outage.
   (b) Generation shedding for a single, first contingency shall not exceed the capacity of the largest unit in the BCTC system.
   (c) Generator shedding is acceptable for single, first contingencies if this will facilitate generator connection at a demonstrated cost savings and not impact other customers. When reinforcements are planned for the system, BCTC will investigate the costs and benefits of removing existing generator shedding required for single first contingencies and endeavor to remove it if there sufficient justification.

2. Under-frequency Criteria

   WECC Disturbance Performance standards prescribe allowed frequency deviation impacts due to contingencies. BCTC applies a lesser internal standard for a double contingency of the BC-US interties when importing heavily. This results in islanding of the BCTC system, and the under-frequency limits for this outage are as follows:

(a) If the BCTC and Alberta systems island together, the Alberta system dynamic frequency will not drop below 59.0 Hz for more than 6 cycles before separating from BCTC by controlled actions. This is the NERC/WECC Planning Standard.
(b) If the BCTC system is islanded from Alberta and the USA systems, the BCTC system frequency may not drop below 57.9 Hz (for any duration) before recovery to a higher frequency.

3. Radial Transmission and Local Network Supply

NERC/WECC Planning Standards allow planned or controlled interruption of customers during single contingency outages of radially supplied customers. These standards do not place any limits on the amount of load or type of customer that may be interrupted. BCTC generally applies the following standards, however due to the geography of British Columbia, topology of the BCTC system, and situational circumstances, some exceptions may occur.

(a) Redundancy is not required for small loads supplied by a radial transmission system or local network.
(b) Service to areas with significant total area loads, where transmission distances are not excessive, will have transmission supply redundancy for improved security.
(c) For small substations, transformer backup, if provided, will be by mobile transformer, system spare transformer, and/or a distribution feeder from another substation. For larger substations, firm transformer capacity will be provided to prevent loss of load on single contingency.
(d) The decision to implement firm supply (i.e., redundancy) is a function of several factors, such as the size of load, location, and cost of implementation, historical performance, risk, cost and feasibility of maintaining the non-redundant facilities.

All other metrics established by the NERC/WECC Planning Standards are followed for planning these local area networks.

Appendix 14: Glossary of Acronyms and Abbreviations

Acronyms and Abbreviations	**Description**
2L10	ING-ARN 230 kV line
2L112	NLY-BDY 230 kV line
2L124	ARN-VIT 230 kV circuit - II
2L129	ARN-VIT 230 kV circuit - I
2L57	ING-ARN 230 kV line
5L46	KLY-CKY 500 kV Line
5L51	ING-CUS 500 kV Line
5L52	ING-CUS 500 kV Line
5L71	MCA-NIC 500 kV Line
5L72	MCA-NIC 500 kV Line
5L83	NIC-MDN 500 kV Line
5L91	SEL-ACK 500 kV Line
5L96	Future SEL-VAS 500 kV Line
5L98	Present SEL-NIC 500 kV Line or future VAS-NIC 500 kV Line
AC	Alternating Current
ACK	Ashton Creek
ARN	Arnott
ASAP	As Soon As Possible
BCHA	BC Hydro
BCHD	BC Hydro Distribution
BCTC	BC Transmission Corporation
BDY	Boundary
BPAT	Bonneville Power Administration
CBK	Cranbrook
CKY	Cheekye
Coastal	Lower Mainland and Vancouver Island together
CRK	Creekside
DAF	Direct Assignment Facilities
DOW	Downie
DSBr	Return of Down Stream Benefits
EAL	Alberta electric system
EKT	East Kootenay Thermal
EPA	Electricity Purchase Agreement
FBC	Fortis BC
GMS	GM Shrum
ILM	Interior to Lower Mainland
ING	Ingledow
IPP	Independent Power Producer
KDY	Kennedy
KIT	Kitimat
kV	Kilo Volt
LM-VI	Lower Mainland to Vancouver Island

MCA	Mica
MDN	Meridian
MLS	McLeese
MVA	Mega Volt Ampere
MVAr	Mega Volt Ampere Reactive
MW	Mega Watt
N-1	forced outage of one transmission element
N-1-1	forced outage of one transmission element when another transmission element is scheduled out for maintenance
NI	North Interior
NIC	Nicola
NITS	Network Integration Transmission Service
NLY	Nelway
NU	Network Upgrade
OASIS	Open Access Same-time Information System
PCN	Peace Canyon
RAS	Remedial Action Scheme
REV	Revelstoke
RMR	Reliability Must Run
SAT	Sahtlam
SCGT	Single Cycle Gas Turbine
SEL	Selkirk
SEV	Seven Mile
SI	South Interior
SIS	System Impact Study
SKA	Skeena
SVC	Static VAr Compensator
TTC	Total Transfer Capability
US	United States of America
USA	United States of America
VAr	Volt Ampere Reactive
VAS	Vaseux substation
VIT	Vancouver Island Terminal
WECC	Western Electricity Co-ordinating Council
WSN	Williston
WTS	Wholesale Transmission Services