BC Transmission
CORPORATION
Building Connections

Economic Analysis of Network Upgrades for Mica Peaking Unit Integration

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System Planning & Performance Assessment

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In the *System Impact Study of (NITS) Update – Mica and Revelstoke Peaking Units (Contingency Resource Plan 2) (SPA 2008-55)* hereafter referred to as "SIS Report", two system reinforcement options: SRS-1 and SRS-2 were proposed to accommodate Mica Unit 5 and Unit 6. Per BC Hydro's request, the third option (SRS-3) is also considered in this economic analysis. In this document, the good faith project cost estimates prepared in a Pre-NITS study phase were used in the Net Present Value (NPV) analysis for economic comparisons among the options.

1. Project Scope of System Reinforcement Options

Option SRS-1: Recommended Option in SIS Report

a. 50% series compensation on 5L71 and 5L72 (NIC-MCA) in 2013;

b. One 500 kV shunt capacitor bank at Nicola substation in 2014; and

c. Load-shedding RAS may be required to address the double contingency of 5L71/72 in 2014.

Option SRS-2: Downie Station plus New Line 5L78

a. 40% series compensation on 5L71 and 5L72 (NIC-MCA)[1] in 2013;

b. Build new 500 kV switching station Downie and loop 5L71 and 5L72 into the new Downie station to form 5L73/74, MCA-Downie and 5L71/72, Downie-NIC in 2014; and

c. Build new line (5L78) from Revelstoke station to new Downie station in 2014.

Option SRS-3: Downie Station plus New Lines 5L78 (REV-Downie) and 5L7X (Downie-MCA).

a. Add new line 5L7X from Downie station to Mica station to Option SRS-2 in 2014.

The one-line diagrams of the three options are attached in Appendix 1.

[1] which is about 50% series compensation to the lines from Nicola to Downie.

2. System Losses Analysis

In general, one of the major benefits of building new transmission line(s) is system losses saving. However, the new 500 kV line (5L78) proposed in Option SRS-2 and Option SRS-3 only ties two large generating stations to each other; loss saving are not expected to be significant.

Based on typical generation patterns at Mica and Revelstoke stations provided by BC Hydro, three generation output scenarios that represent seasonal characteristics in winter, spring freshet time and typical summer, were considered for Mica and Revelstoke stations in order to simplify the losses analysis:

1) 1900 MW from Mica and Revelstoke each – two months per year;
2) 1500 MW from Mica and Revelstoke each – six months per year; and
3) 1350 MW from Revelstoke and ~ 0 MW from Mica – four months per year.

The losses saving benefits for the system reinforcement options were estimated with plant capacity factor (CF) of 0.6. The CF 0.7 and CF 0.8 were applied to evaluate sensitivity. The annual average losses savings are summarized in Table 1 for the three options.

Table 1: Summary of System Losses Saving Analysis[2]

Transmission System Reinforcement Options	Losses Saving with CF 0.6	Losses Saving with CF 0.7	Losses Saving with CF 0.8
Option SRS-1	0 (base)	0 (base)	0 (base)
Option SRS-2	-1.1 GWh	-1.5 GWh	- 1.8 GWh
Option SRS-3	7.2 GWh	9.2 GWh	11.5 GWh

Observations of Table 1:

1) In Option SRS-2, building a tie line, 5L78, between Downie and Revelstoke actually results in a slight increase in system losses because more power flows over the 50% series compensated Downie-NIC 5L71/72 lines and less over the

[2] In Table 1 Summary of System Losses Saving Analysis, a minus (-) number means net system losses, and a plus (+) number means system losses savings.

uncompensated ACK-NIC lines. More balanced flows would result in lower losses due to the fact that losses are proportional to the square of line loading.

2) In Option SRS-3, the new line 5L7x from Mica to Downie reduces the system losses compared to Option SRS-1 and Option SRS-2.

3. Economic Comparison

In this economic analysis, Net Present Value (NPV) is calculated for each option considering project direct capital cost, overhead (OH), Operating & Maintenance costs, loss savings, and monetized EENS values.

The EENS analysis results for the three options are summarized in Table 2 (for details, please refer to *Loss of Load Expectations due to Load Shedding RAS Operation for the MCA Peaking Units Integration – Optional Study* prepared by System Planning and Performance Assessment, BCTC).

Table 2: Summary of EENS Study

Transmission System Reinforcement Options	EENS
Option SRS-1	1.1 MWh / Year
Option SRS-2	0.3 MWh / Year
Option SRS-3	0.0 MWh / Year

NPV calculation work-sheet is attached in Appendix 2 and the analysis results with CF 0.6 are summarized in Table 3.

Table 3: Summary of NPV Analysis (2009$) with CF0.6

Transmission System Reinforcement Options	SRS-1	SRS-2	SRS-3
Direct Capital Cost	$38.92M	$148.01M	$260.82M
OH	$1.36M	$5.18M	$9.13M
Property Tax	$6.23M	$8.32M	$10.63M
OMA	$6.11M	$22.17M	$38.55M
Loss Savings	$0M (Reference)	-$0.97M	$6.58M
EENS	$0.04M	$0.01M	$0.0M
Total:	$52.7M	$184.7M	$312.6M

Notes:

- NPV is calculated up to Fiscal Year 2050;
- Real discount rate 6%;
- Rate $74 / MWh for system losses; and
- Rate $3.41 / KWh for EENS[3].

The sensitivity study results for the different CFs are summarized in table 4.

Table 4: Summary of NPV Analysis (2009$)

Transmission System Reinforcement Options	NPV with CF 0.6	NPV with CF 0.7	NPV with CF 0.8
Option SRS-1	$52.7M	$52.7M	$52.7M
Option SRS-2	$184.7M	$184.9M	$185.2M
Option SRS-3	$312.6M	$310.7M	$308.7M

This economic analysis clearly shows Option SRS-1 to be the most cost-effective plan for integrating the Mica peaking units.

[3] For details on this, please refer to the EENS study report prepared by System Planning and Performance Planning, BCTC

4. Discussion on the impact of Mica Unit 6 Deferral

In BC Hydro's Contingency Resource Plan 2 (CRP2), Mica Unit 5 is scheduled to enter service in 2013, with Mica Unit 6 coming on line the following year. A delay in the in-service date of Mica Unit 6 may make building the 5L71/72 series capacitor station in two stages economic. Two alternatives have been considered in the SIS Report to ultimately achieve 50% series compensation of 5L71/72:

1. Single-Stage Alternative: By 2013, provide 50% series compensation of 5L71/72 with each bank having a continuous rating of 2960 Amps; the project direct cost is about $43.3M.
2. Two-Stage Alternative:
   - (i) By 2013, provide 40% series compensation of 5L71/72 with each bank having a continuous rating of 2460 Amps; the project direct cost is about $35.0M.
   - (ii) When Mica Unit 6 enters service, Increase the series compensation level from 40% to 50% upgrade each bank to a continuous rating of 2960 Amps. The direct cost of this stage would be approximately $12M[4].

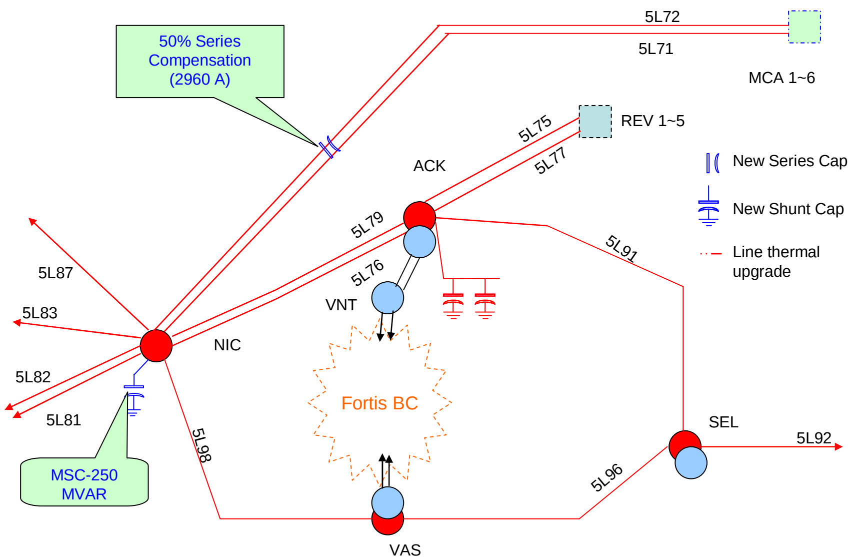
According to the preliminary economic comparison based on the very approximate cost estimate, a four-year deferral of Mica Unit 6 is the break-point. That is, if Mica Unit 6 enters service before 2018, the single-stage alternative is preferable. In addition, from a bulk transmission system planning point of view, it is generally acceptable to reserve transmission capacity for the future demands within the next 10 years[5]. Therefore, if Mica Unit 6 is deferred more than 10 years, the two-stage Alternative would likely be recommended.

This section provides a preliminary outlook on staging the 50% series compensation on 5L71/72 project to address the uncertain schedule of Mica Unit 6. Further optimization shall be performed with detailed cost estimates if the scheduled in-service date for Mica Unit 6 is significantly delayed.

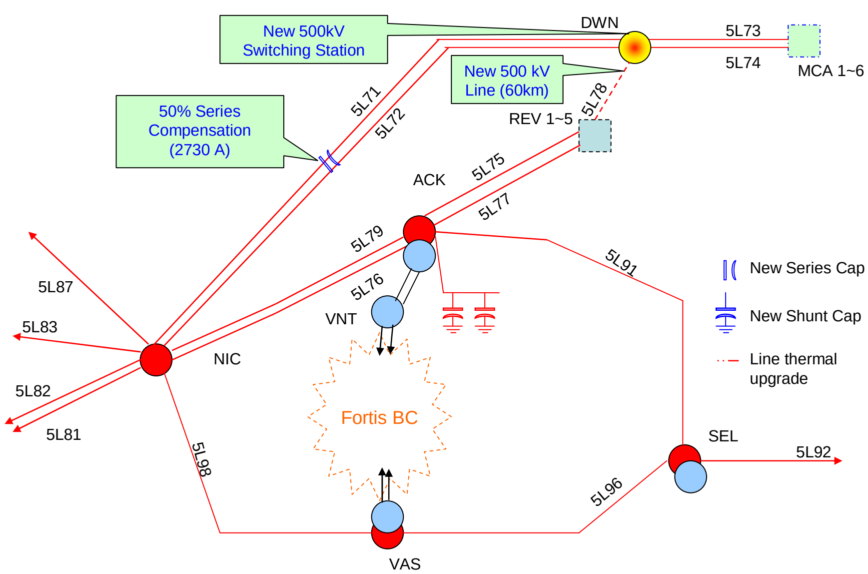
[4] There is no cost estimate done by Engineering Service Provider for the series capacitor expansion from 40% to 50% plus thermal upgrade. At this stage, the direct cost is estimated as 1.5 times of the difference between $43M (50% series compensation) and $35M (40% series compensation) for economic comparison only.

[5] This is only a planning practice in general; it is not a planning standard. In project development, an economic comparison is usually required to optimize this.

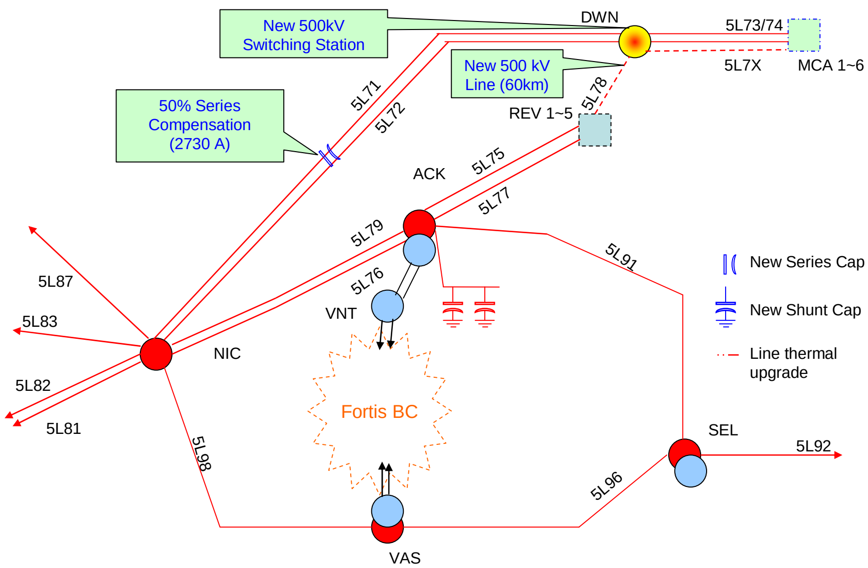
Appendix 1: One-Line-Diagrams for SRS options



Option SRS-1



Option SRS-2


New 500kV
Switching Station
DWN
5L73/74
New 500 kV
Line (60km)
5L7X
MCA 1~6
50% Series
Compensation
(2730 A)
5L71
5L72
5L78
REV 1~5
ACK
5L75
5L77
5L79
5L91
5L76
VNT
5L87
5L83
NIC
5L82
5L81
5L98
Fortis BC
SEL
5L92
5L96
VAS
New Series Cap
New Shunt Cap
Line thermal
upgrade

Option SRS-3

Appendix 2: Project Direct Cost Estimates and NPV Calculation Worksheets (LF=0.6)

Discount Rate 6%

		NPV Methodology	Total	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
		year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
		1/(1+r)^(n-1)		1	0.9433962	0.8899964	0.8396193	0.7920937	0.74725817	0.7049605	0.6650571	0.6274124	0.5918985	0.5583948	0.5267875	0.4969694	0.468839	0.442301	0.4172651	0.3936463	0.3713644	0.3503438	0.330513	0.3118047	0.2941554	0.2775051	0.2617973	0.2469785	0.2329986	0.21981	0.207368	0.1956301	0.1845567	0.1741101	0.1642548	0.1549574	0.1461862	0.1379115	0.1301052	0.1227408	0.1157932	0.1092389	0.1030555	0.0972222
		Tariff ($/MWh)		74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74
		$/kwh for EENS		3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410	3410
RAS Option	Substation Projects	Direct Cash Flow - Subtotal	$48,251.4	$216.0	$1,558.8	$1,315.2	$9,558.0	$31,902.4	$3,701.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		50% S.C. on 5L71/72	$43,256.8	$216.0	$1,558.8	$1,315.2	$9,055.2	$31,111.6																																				
		500kV 1x250 MVAR Cap at NIC	$4,994.6				$502.8	$790.8	$3,701.0																																			
		Project 3																																										
		Overhead(3.5%)	$1,688.8	$7.6	$54.6	$46.0	$334.5	$1,116.6	$129.5	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		Annual Prop-Tax(70%*1.5%)	$18,693.2					$454.2	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6	$506.6
		Annual M&O Cost(1.1%)	$19,052.6						$475.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8	$530.8
	Transmission Projects	Direct Cash Flow - Subtotal	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		Project 1																																										
		Project 2																																										
		Project 3																																										
		Overhead(3.5%)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		Annual Prop-Tax(0.7*0.8*0.015)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		M&O Cost	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	Credit	Losses Saving in MWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Losses Saving in $k	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		EENS Benefit in MWh	-38.9	0.0	0.0	0.0	0.0	0.0	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
		EENS Benefit in $k	-$132.7	$0.0	$0.0	$0.0	$0.0	$0.0	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7	-$3.7
	Calculation Results	Net Cash Flow	$87,818.7	$223.6	$1,613.4	$1,361.2	$9,892.5	$33,473.2	$4,816.7	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1	$1,041.1
		PV of Net Cash Flow	**$52,655.4**	$223.6	$1,522.0	$1,211.5	$8,306.0	$26,513.9	$3,599.3	$733.9	$692.4	$653.2	$616.2	$581.3	$548.4	$517.4	$488.1	$460.5	$434.4	$409.8	$386.6	$364.7	$344.1	$324.6	$306.2	$288.9	$272.6	$257.1	$242.6	$228.8	$215.9	$203.7	$192.1	$181.3	$171.0	$161.3	$152.2	$143.6	$135.5	$127.8	$120.6	$113.7	$107.3	$101.2

Discount Rate 6%

		NPV Methodology	Total	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
		year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
		1/(1+r)^(n-1)		1	0.9433962	0.8899964	0.8396193	0.7920937	0.74725817	0.7049605	0.6650571	0.6274124	0.5918985	0.5583948	0.5267875	0.4969694	0.468839	0.442301	0.4172651	0.3936463	0.3713644	0.3503438	0.330513	0.3118047	0.2941554	0.2775051	0.2617973	0.2469785	0.2329986	0.21981	0.207368	0.1956301	0.1845567	0.1741101	0.1642548	0.1549574	0.1461862	0.1379115	0.1301052	0.1227408	0.1157932	0.1092389	0.1030555	0.0972222
		Tariff ($/MWh)		74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74
		$/kwh for EENS		3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00	3,410.00
Downy Switching Station with REV-DOW line	Substation Projects	Direct Cash Flow - Subtotal	$81,130.0	$216.0	$2,083.2	$2,172.0	$11,635.2	$35,089.6	$29,934.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		40% S.C. on 5L71/72	$35,039.2	$216.0	$1,558.8	$1,315.2	$9,055.2	$22,894.0																																				
		Downie Switching Station	$37,074.0		$524.4	$688.8	$1,998.0	$11,120.4	$22,742.4																																			
		Line termination at REV	$9,016.8			$168.0	$582.0	$1,075.2	$7,191.6																																			
		Overhead(3.5%)	$2,839.6	$7.6	$72.9	$76.0	$407.2	$1,228.1	$1,047.7	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		Annual Prop-Tax(70%*1.5%)	$19,889.6					$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6	$537.6
		Annual M&O Cost(1.1%)	$31,798.2						$563.2	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4	$892.4
	Transmission Projects	Direct Cash Flow - Subtotal	$101,352.0	$1,092.0	$6,606.0	$21,528.0	$23,442.0	$31,542.0	$17,142.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		DOW-REV Line Definition Phase	$4,614.0	$1,092.0	$2,028.0	$1,494.0																																						
		DOW-REV Implemntation Phase	$96,738.0		$4,578.0	$20,034.0	$23,442.0	$31,542.0	$17,142.0																																			
		Overhead(3.5%)	$3,547.3	$38.2	$231.2	$753.5	$820.5	$1,104.0	$600.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		Annual Prop-Tax(0.7*0.8*0.015)	$5,183.7						$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0	$144.0
		M&O Cost	$39,020.5							$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9	$1,114.9
	Credit	Losses Saving in MWh	-40,860.0	0.0	0.0	0.0	0.0	0.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0	-1,135.0
		Losses Saving in $k	-$3,023.6	$0.0	$0.0	$0.0	$0.0	$0.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0	-$84.0
		EENS Benefit in MWh	-$9.1	$0.0	$0.0	$0.0	$0.0	$0.0	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3	-$0.3
		EENS Benefit in $k	-$31.2	$0.0	$0.0	$0.0	$0.0	$0.0	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9	-$0.9
	Calculation Results	Net Cash Flow	$287,815.8	$1,353.8	$8,993.3	$24,529.5	$36,304.9	$69,501.3	$50,053.2	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7	$2,773.7
		PV of Net Cash Flow	**$184,655.9**	$1,353.8	$8,484.3	$21,831.2	$30,482.3	$55,051.5	$37,402.7	$1,955.4	$1,844.7	$1,740.3	$1,641.8	$1,548.8	$1,461.2	$1,378.4	$1,300.4	$1,226.8	$1,157.4	$1,091.9	$1,030.1	$971.8	$916.7	$864.9	$815.9	$769.7	$726.1	$685.0	$646.3	$609.7	$575.2	$542.6	$511.9	$482.9	$455.6	$429.8	$405.5	$382.5	$360.9	$340.4	$321.2	$303.0	$285.8	$269.7

Discount Rate 6%

		NPV Methodology	Total	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
		year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
		1/(1+r)^(n-1)		1	0.9433962	0.8899964	0.8396193	0.7920937	0.74725817	0.7049605	0.6650571	0.6274124	0.5918985	0.5583948	0.5267875	0.4969694	0.468839	0.442301	0.4172651	0.3936463	0.3713644	0.3503438	0.330513	0.3118047	0.2941554	0.2775051	0.2617973	0.2469785	0.2329986	0.21981	0.207368	0.1956301	0.1845567	0.1741101	0.1642548	0.1549574	0.1461862	0.1379115	0.1301052	0.1227408	0.1157932	0.1092389	0.1030555	0.0972222
		Tariff ($/MWh) for Loss Saving		74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74
		$/kwh for EENS		3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41
Downy Switching Station with MCA-DOW line and REV-DOW line	Substation Projects	Direct Cash Flow - Subtotal	$93,186.4	$216.0	$2,083.2	$2,340.0	$12,289.2	$36,328.0	$39,930.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		40% S.C. on 5L71/72	$35,039.2	$216.0	$1,558.8	$1,315.2	$9,055.2	$22,894.0																																				
		Downie Switching Station	$37,074.0		$524.4	$688.8	$1,998.0	$11,120.4	$22,742.4																																			
		Line termination at Mica	$12,056.4			$168.0	$654.0	$1,238.4	$9,996.0																																			
		Line termination at REV	$9,016.8			$168.0	$582.0	$1,075.2	$7,191.6																																			
		Overhead(3.5%)	$3,261.5	$7.6	$72.9	$81.9	$430.1	$1,271.5	$1,397.6	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		Annual Prop-Tax(70%*1.5%)	$20,690.1					$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2	$559.2
		Annual M&O Cost(1.1%)	$36,462.6						$585.8	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1	$1,025.1
	Transmission Projects	Direct Cash Flow - Subtotal	$226,650.0	$2,304.0	$15,144.0	$46,320.0	$52,674.0	$72,084.0	$38,124.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		DOW-REV Line Definition Phase	$4,614.0	$1,092.0	$2,028.0	$1,494.0																																						
		DOW-REV Implemntation Phase	$96,738.0		$4,578.0	$20,034.0	$23,442.0	$31,542.0	$17,142.0																																			
		DOW-MCA Line Definition Phase	$5,796.0	$1,212.0	$2,496.0	$2,088.0																																						
		DOW-MCA Implementation Phase	$119,502.0		$6,042.0	$22,704.0	$29,232.0	$40,542.0	$20,982.0																																			
		Overhead(3.5%)	$7,932.8	$80.6	$530.0	$1,621.2	$1,843.6	$2,522.9	$1,334.3	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		Annual Prop-Tax(0.7*0.8*0.015)	$11,528.7						$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2	$320.2
		M&O Cost	$87,260.3							$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2	$2,493.2
	Credit	Losses Saving in MWh	266,030.0	0.0	0.0	0.0	0.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0	7,190.0
		Losses Saving in $k	$19,686.2	$0.0	$0.0	$0.0	$0.0	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1	$532.1
		EENS Benefit in MWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		EENS Benefit in $k	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	Calculation Results	Net Cash Flow	$467,286.1	$2,608.2	$17,830.2	$50,363.1	$67,236.9	$112,233.6	$81,719.1	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6	$3,865.6
		PV of Net Cash Flow	**$312,549.6**	$2,608.2	$16,820.9	$44,823.0	$56,453.4	$88,899.5	$61,065.3	$2,725.1	$2,570.8	$2,425.3	$2,288.0	$2,158.5	$2,036.3	$1,921.1	$1,812.3	$1,709.7	$1,613.0	$1,521.7	$1,435.5	$1,354.3	$1,277.6	$1,205.3	$1,137.1	$1,072.7	$1,012.0	$954.7	$900.7	$849.7	$801.6	$756.2	$713.4	$673.0	$634.9	$599.0	$565.1	$533.1	$502.9	$474.5	$447.6	$422.3	$398.4	$375.8