MIPUG/CAC-Harper 001

Subject: Retained Earnings

Question Mr. Harper proposes to view Manitoba Hydro's Retained Earnings as "customer dollars" for the purposes of NFAT assessment. Please confirm that although domestic customer rates are designed on the basis of contributing to reserves, there is no right of ownership, entitlement, future cash payouts/dividends or other claims that ratepayers have on the retained earnings of Hydro.

Response:

Confirmed.

MIPUG/CAC-Harper 002

Subject: Interest Rate

Question: Please confirm that Mr. Harper's revised economic analysis does not provide any ability to assess the potential effects of a future change in the real interest rate (i.e., outside of changes in interest rates related to inflation). Please indicate whether Mr. Harper sees this as a substantial weakness to this analysis or not, and provide the rationale.

Response:

Not confirmed. Economic evaluations look at cash flows (both benefits and costs) as they occur and, as described in Mr. Harper's evidence (pages 15-16), compare alternatives by calculating the net present value for each using a discount rate. Future interest costs are not considered when establishing the cash flows associated with each alternative and therefore changes would not impact on this part of the analysis. However, they are a consideration in establishing the discount rate as it reflects the time value of money for "person" from whose perspective the analysis is being undertaken. To the extent there is uncertainty regarding future interest rates, this can be reflected in the approach proposed by Mr. Harper through either a) the choice of the specific interest rate used to determine the discount rate or b) undertaking sensitivity analyses (per Mr. Harper's evidence, pate 41). See also the response to PUB/CAC-Harper 7 a).

MIPUG/CAC-Harper 003 a)

Subject: US Transmission, Econalysis Consulting Services Report, page 27 ECS Table #5.

Question: Please provide a table that provides the cashflows and steps to calculate NPVs before and after adjustment for MH responsible for 2/3 of the cost of US transmission (calculating Plans 14a and 5a.)

Response:

The cashflows for the Plan 14 Reference case can be found in the NFAT Application , Appendix 9.3, page 91, Table 001. Manitoba Hydro's investment in the US transmission impacts the following columns:

- Transmission – US T/L
- Total Capital
- Capital Taxes
- Fixed O&M

Table 002 on the following page provides the Reference case cash flows for Plan 15 – where the only difference from Plan #14 in terms of capital and capital-related costs is the increased investment in US transmission. Therefore, for purposes of establishing the cashflows associated with Plan #14 a, the values in the above four columns in Table 001 were replaced with the cashflows for the comparable columns from Table 002. The initial Table 001 for Plan #14 and the revised Table 001 a (for Plan 14 a) are provided below. In each case the net present values of the columns using 5.2% are set out at the bottom each Table. When the -$4,368.7 M value for the All Gas Reference case is subtracted from each result, we obtain the values for Plan #14 and Plan #14 a) as shown in ECS Table 5.

A similar analysis was not undertaken for Plan 5 a) since the cash flow changes between Plan 5 and Plan 5 a) are the same as those for Plan 14 versus Plan 14 a) – the difference in NPV as between Plans 14 and 14 a) was subtracted from the NPV for Plan 5 to determine the NPV value for Plan 5 a).

MIPUG/CAC-Harper 3 a) – Table #A: Cash Flows and NPV for Plan #14

Plan #14 - K19/C25/750MW (WPS Sale &Inv)

TABLE 001
ECONOMIC SUMMARY
NFAT 2012

Energy Price Reference
Discount Rate Reference
Capital Cost Reference

	Capital and Related Costs (Millions of 2014$)									Net Average Flow Related Revenue (Millions of 2014$)					
	Conawapa	Keeyask	Thermal	Wind	Transmission		Total	Capital	Fixed	Gross	Water	Thermal	Power	Net	Total
FYB	GS	GS	GS	GS	GOT	US T/L	Capital	Taxes	O&M	Revenue	Rental	Burn	Purchases	Revenue	NPV
2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2014	31.71	221.41	0.00	0.00	21.01	3.78	277.90	1.39	0.00	311.23	102.98	19.82	98.34	90.08	
2015	87.48	485.83	0.00	0.00	18.92	6.75	598.98	4.38	0.00	341.10	101.10	23.49	102.11	114.39	
2016	182.24	643.32	0.00	0.00	25.89	17.15	868.60	8.73	0.00	351.61	99.26	24.63	104.47	123.24	
2017	212.03	779.65	0.00	0.00	37.88	24.95	1054.51	14.00	0.00	367.37	97.30	26.31	107.43	136.33	
2018	254.86	549.74	0.00	0.00	39.82	103.34	947.77	18.74	0.00	351.91	95.21	26.94	108.58	121.18	
2019	260.97	393.19	0.00	0.00	50.71	85.16	790.03	22.69	13.01	378.89	95.14	25.52	108.28	149.94	
2020	719.36	160.55	0.00	0.00	3.54	157.85	1041.30	27.90	44.86	617.12	102.28	20.22	123.67	370.96	
2021	1154.84	55.71	0.00	0.00	42.90	0.00	1253.46	34.16	42.99	697.22	102.84	22.23	133.26	438.89	
2022	1036.87	0.00	0.00	0.00	22.26	0.00	1059.12	39.46	41.65	694.56	101.65	22.24	135.74	434.92	
2023	740.43	0.00	0.00	0.00	37.45	0.00	777.88	43.35	39.80	664.06	99.33	22.12	139.94	402.68	
2024	512.79	0.00	0.00	0.00	64.84	0.00	577.64	46.24	38.24	641.23	97.13	24.58	145.52	374.00	
2025	336.82	0.00	0.00	0.00	86.88	0.00	423.70	48.35	50.89	661.04	101.75	21.82	113.58	423.89	
2026	124.05	0.00	0.00	0.00	102.39	0.00	226.44	49.49	49.35	862.16	109.86	21.76	114.33	616.22	
2027	39.15	0.00	0.00	0.00	0.00	0.00	39.15	49.68	47.92	899.07	109.90	21.29	125.05	642.84	
2028	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.68	46.91	889.29	108.23	22.00	128.24	630.82	
2029	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.68	48.20	868.89	106.31	22.04	131.31	609.24	
2030	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.68	43.02	859.25	104.97	21.57	133.01	599.70	
2031	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.68	41.70	846.94	103.31	22.04	136.64	584.95	
2032	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.68	40.22	828.23	101.62	22.09	139.90	564.62	
2033	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.68	39.21	804.17	99.84	22.11	143.08	539.15	
2034	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.68	38.27	781.53	98.11	22.27	147.20	513.94	
2035	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.68	39.54	741.75	96.43	22.07	143.82	479.43	
2036	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.68	36.10	672.95	94.82	22.47	128.55	427.11	
2037	0.00	0.00	0.36	0.00	0.00	0.00	0.36	49.68	35.57	640.80	93.20	22.58	129.84	395.19	
2038	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.68	35.06	615.74	91.55	22.53	134.49	367.17	
2039	0.00	0.00	100.11	0.00	0.00	0.00	100.11	50.07	37.47	592.43	89.94	22.48	146.19	333.82	
2040	0.00	0.00	128.75	0.00	9.28	0.00	138.03	50.66	34.09	589.00	88.66	21.37	156.31	322.66	
2041	0.00	0.00	16.22	0.00	0.00	0.00	16.22	50.74	36.95	570.11	86.66	38.13	158.02	287.31	
2042	0.00	0.00	79.53	0.00	0.00	0.00	79.53	51.13	36.51	555.62	85.12	42.52	164.06	263.91	
2043	0.00	0.00	108.56	0.00	9.28	0.00	117.84	51.72	36.07	545.01	83.76	44.88	172.02	244.36	
2044	0.00	0.00	96.75	0.00	0.00	0.00	96.75	52.21	41.37	541.23	82.55	51.48	180.82	226.39	
2045	0.00	0.00	111.72	0.00	73.08	0.00	184.80	53.12	43.86	516.67	80.70	66.61	181.87	187.49	
2046	0.00	0.00	16.63	0.00	0.00	0.00	16.63	53.20	44.56	505.17	79.26	80.82	187.57	157.51	
2047	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.20	43.31	491.59	77.99	84.47	196.24	132.89	
2048	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.20	42.07	504.47	79.32	77.30	188.56	159.30	
2049	0.00	0.00	0.00	0.00	10.59	0.68	11.28	53.20	44.61	504.47	79.32	77.30	188.56	159.30	
2050	0.00	0.00	0.00	0.00	10.27	1.37	11.64	53.20	43.11	504.47	79.32	77.30	188.56	159.30	
2051	0.00	0.00	0.00	0.00	24.85	4.11	28.96	53.20	42.78	504.47	79.32	77.30	188.56	159.30	
2052	0.00	0.00	0.00	0.00	28.87	6.16	35.03	53.20	42.46	504.47	79.32	77.30	188.56	159.30	
2053	0.00	0.00	0.00	0.00	20.54	18.49	39.04	53.20	42.15	504.47	79.32	77.30	188.56	159.30	
2054	0.00	0.00	0.00	0.00	17.63	18.49	36.12	53.20	41.84	504.47	79.32	77.30	188.56	159.30	
2055	0.00	0.00	0.00	0.00	0.87	19.18	20.05	53.20	42.71	504.47	79.32	77.30	188.56	159.30	
2056	0.00	0.00	0.00	0.00	10.47	0.00	10.47	53.20	55.02	504.47	79.32	77.30	188.56	159.30	
2057	0.00	0.00	0.00	0.00	5.23	0.00	5.23	53.20	39.25	504.47	79.32	77.30	188.56	159.30	
2058	0.00	0.00	0.00	0.00	8.72	0.00	8.72	53.20	54.48	504.47	79.32	77.30	188.56	159.30	
2059	0.00	0.00	0.00	0.00	14.83	0.00	14.83	53.20	41.62	504.47	79.32	77.30	188.56	159.30	
2060	0.00	0.00	0.00	0.00	20.93	0.00	20.93	53.20	51.26	504.47	79.32	77.30	188.56	159.30	
2061	0.00	0.00	0.00	0.00	25.29	0.00	25.29	53.20	35.76	504.47	79.32	77.30	188.56	159.30	
2062	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.20	66.75	504.47	79.32	77.30	188.56	159.30	
2063	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.20	35.76	504.47	79.32	77.30	188.56	159.30	
2064	0.00	0.00	0.00	0.00	10.42	2.09	12.50	53.20	66.75	504.47	79.32	77.30	188.56	159.30	
2065	0.00	0.00	0.00	0.00	8.65	4.18	12.82	53.20	38.66	504.47	79.32	77.30	188.56	159.30	
2066	0.00	0.00	0.00	0.00	1.04	12.53	13.57	53.20	66.75	504.47	79.32	77.30	188.56	159.30	
2067	0.00	0.00	0.00	0.00	9.01	18.79	27.80	53.20	35.76	504.47	79.32	77.30	188.56	159.30	
2068	0.00	0.00	0.00	0.00	19.28	56.37	75.65	53.20	66.75	504.47	79.32	77.30	188.56	159.30	
2069	0.00	0.00	78.30	0.00	33.08	56.37	167.75	53.20	38.66	504.47	79.32	77.30	188.56	159.30	
2070	0.00	0.00	106.94	0.00	2.67	58.46	168.07	53.20	53.00	504.47	79.32	77.30	188.56	159.30	
2071	0.00	0.00	16.22	0.00	32.44	0.00	48.66	53.20	37.50	504.47	79.32	77.30	188.56	159.30	
2072	0.00	0.00	79.48	0.00	17.02	0.00	96.51	53.20	53.00	504.47	79.32	77.30	188.56	159.30	
2073	0.00	0.00	108.56	0.00	28.73	0.00	137.28	53.20	36.63	504.47	79.32	77.30	188.56	159.30	
2074	0.00	0.00	96.75	0.00	50.02	0.00	146.76	53.20	51.26	504.47	79.32	77.30	188.56	159.30	
2075	0.00	0.00	109.64	0.00	75.23	0.00	184.87	53.20	38.66	504.47	79.32	77.30	188.56	159.30	
2076	0.00	0.00	16.63	0.00	77.10	0.00	93.73	53.20	53.00	504.47	79.32	77.30	188.56	159.30	
2077	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.20	37.50	504.47	79.32	77.30	188.56	159.30	
2078	0.00	0.00	0.00	0.00	9.28	0.00	9.28	53.20	53.00	504.47	79.32	77.30	188.56	159.30	
2079	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.20	40.40	504.47	79.32	77.30	188.56	159.30	
2080	0.00	0.00	0.00	0.00	54.81	0.00	54.81	53.20	53.00	504.47	79.32	77.30	188.56	159.30	
2081	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.20	35.76	504.47	79.32	77.30	188.56	159.30	
2082	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.20	35.76	504.47	79.32	77.30	188.56	159.30	
2083	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.20	35.76	504.47	79.32	77.30	188.56	159.30	
2084	0.00	0.00	0.00	0.00	10.59	0.68	11.28	53.20	35.76	504.47	79.32	77.30	188.56	159.30	
2085	0.00	0.00	0.00	0.00	10.27	1.37	11.64	53.20	38.66	504.47	79.32	77.30	188.56	159.30	
2086	0.00	0.00	0.00	0.00	24.85	4.11	28.96	53.20	35.76	504.47	79.32	77.30	188.56	159.30	
2087	0.00	0.00	0.00	0.00	28.87	6.16	35.03	53.20	35.76	504.47	79.32	77.30	188.56	159.30	
2088	0.00	0.00	0.00	0.00	20.54	18.49	39.04	53.20	35.76	504.47	79.32	77.30	188.56	159.30	
2089	0.00	0.00	0.00	0.00	16.76	18.49	35.25	53.20	38.66	504.47	79.32	77.30	188.56	159.30	
2090	0.00	0.00	0.00	0.00	0.00	19.18	19.18	53.20	38.66	504.47	79.32	77.30	188.56	159.30	
Salvage Value	2.31	0.00	6.54	0.00	10.30	4.78	23.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
PV @ 5.05%	4000.14	2857.05	193.35	0.00	449.81	337.17	7837.52	779.59	651.85	11808.35	1938.98	705.38	2816.45	6347.54	
												Net Present Value		-2921	
5.05%	97.77	0.00	276.43	0.00	435.40	202.26	1011.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5.20%	$3,960.40	$2,845.69	$184.13	$0.00	$441.46	$333.29	$7,764.97	$754.24	$630.61	$11,503.89	$1,893.81	$679.14	$2,733.04	$6,197.89	-2951.94

MIPUG/CAC-Harper 3 a) – Table #B: Cash Flows and NPV for Plan #14 a)

K19/C25/750MW (WPS Sale & No Inv)

TABLE 001
ECONOMIC SUMMARY
NFAT 2012

Energy Price: Reference
Discount Rate: Reference
Capital Cost: Reference

	Capital and Related Costs (Millions of 2014$)									Net Average Flow Related Revenue (Millions of 2014$)					
	Conawapa	Keeyask	Thermal	Wind	Transmission		Total	Capital	Fixed	Gross	Water	Thermal	Power	Net	Total
FYB	GS	GS	GS	GS	GOT	US T/L	Capital	Taxes	O&M	Revenue	Rental	Burn	Purchases	Revenue	NPV
2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2014	31.71	221.41	0.00	0.00	21.01	5.28	279.40	1.40	0.00	311.23	102.98	19.82	98.34	90.08	
2015	87.48	485.83	0.00	0.00	18.92	8.56	600.79	4.40	0.00	341.10	101.10	23.49	102.11	114.39	
2016	182.24	643.32	0.00	0.00	25.89	17.93	869.38	8.75	0.00	351.61	99.26	24.63	104.47	123.24	
2017	212.03	779.65	0.00	0.00	37.88	24.95	1054.51	14.02	0.00	367.37	97.30	26.31	107.43	136.33	
2018	254.86	549.74	0.00	0.00	39.82	146.07	990.49	18.97	0.00	351.91	95.21	26.94	108.58	121.18	
2019	260.97	393.19	0.00	0.00	50.71	100.61	805.48	23.00	13.01	378.89	95.14	25.52	108.28	149.94	
2020	719.36	160.55	0.00	0.00	3.54	278.17	1161.63	28.81	47.98	617.12	102.28	20.22	123.67	370.96	
2021	1154.84	55.71	0.00	0.00	42.90	0.00	1253.46	35.08	46.21	697.22	102.84	22.23	133.26	438.89	
2022	1036.87	0.00	0.00	0.00	22.26	0.00	1059.12	40.37	44.90	694.56	101.65	22.24	135.74	434.92	
2023	740.43	0.00	0.00	0.00	37.45	0.00	777.88	44.26	42.92	664.06	99.33	22.12	139.94	402.68	
2024	512.79	0.00	0.00	0.00	64.84	0.00	577.64	47.15	41.22	641.23	97.13	24.58	145.52	374.00	
2025	336.82	0.00	0.00	0.00	86.88	0.00	423.70	49.27	53.76	661.04	101.75	21.82	113.58	423.89	
2026	124.05	0.00	0.00	0.00	102.39	0.00	226.44	50.40	52.09	862.16	109.86	21.76	114.33	616.22	
2027	39.15	0.00	0.00	0.00	0.00	0.00	39.15	50.60	50.55	899.07	109.90	21.29	125.05	642.84	
2028	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.60	49.42	889.29	108.23	22.00	128.24	630.82	
2029	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.60	50.61	868.89	106.31	22.04	131.31	609.24	
2030	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.60	45.33	859.25	104.97	21.57	133.01	599.70	
2031	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.60	43.90	846.94	103.31	22.04	136.64	584.95	
2032	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.60	42.32	828.23	101.62	22.09	139.90	564.62	
2033	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.60	41.21	804.17	99.84	22.11	143.08	539.15	
2034	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.60	40.19	781.53	98.11	22.27	147.20	513.94	
2035	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.60	41.37	741.75	96.43	22.07	143.82	479.43	
2036	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.60	37.85	672.95	94.82	22.47	128.55	427.11	
2037	0.00	0.00	0.36	0.00	0.00	0.00	0.36	50.60	37.25	640.80	93.20	22.58	129.84	395.19	
2038	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.60	36.67	615.74	91.55	22.53	134.49	367.17	
2039	0.00	0.00	100.11	0.00	0.00	0.00	100.11	50.99	39.01	592.43	89.94	22.48	146.19	333.82	
2040	0.00	0.00	128.75	0.00	9.28	0.00	138.03	51.57	35.57	589.00	88.66	21.37	156.31	322.66	
2041	0.00	0.00	16.22	0.00	0.00	0.00	16.22	51.65	38.37	570.11	86.66	38.13	158.02	287.31	
2042	0.00	0.00	79.53	0.00	0.00	0.00	79.53	52.05	37.86	555.62	85.12	42.52	164.06	263.91	
2043	0.00	0.00	108.56	0.00	9.28	0.00	117.84	52.64	37.36	545.01	83.76	44.88	172.02	244.36	
2044	0.00	0.00	96.75	0.00	0.00	0.00	96.75	53.12	42.61	541.23	82.55	51.48	180.82	226.39	
2045	0.00	0.00	111.72	0.00	73.08	0.00	184.80	54.03	45.04	516.67	80.70	66.61	181.87	187.49	
2046	0.00	0.00	16.63	0.00	0.00	0.00	16.63	54.12	45.69	505.17	79.26	80.82	187.57	157.51	
2047	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.12	44.39	491.59	77.99	84.47	196.24	132.89	
2048	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.12	43.10	504.47	79.32	77.30	188.56	159.30	
2049	0.00	0.00	0.00	0.00	10.59	0.68	11.28	54.12	45.59	504.47	79.32	77.30	188.56	159.30	
2050	0.00	0.00	0.00	0.00	10.27	1.37	11.64	54.12	44.04	504.47	79.32	77.30	188.56	159.30	
2051	0.00	0.00	0.00	0.00	24.85	4.11	28.96	54.12	43.67	504.47	79.32	77.30	188.56	159.30	
2052	0.00	0.00	0.00	0.00	28.87	6.16	35.03	54.12	43.30	504.47	79.32	77.30	188.56	159.30	
2053	0.00	0.00	0.00	0.00	20.54	18.49	39.04	54.12	42.95	504.47	79.32	77.30	188.56	159.30	
2054	0.00	0.00	0.00	0.00	17.63	18.49	36.12	54.12	42.61	504.47	79.32	77.30	188.56	159.30	
2055	0.00	0.00	0.00	0.00	0.87	19.18	20.05	54.12	43.43	504.47	79.32	77.30	188.56	159.30	
2056	0.00	0.00	0.00	0.00	10.47	0.00	10.47	54.12	55.71	504.47	79.32	77.30	188.56	159.30	
2057	0.00	0.00	0.00	0.00	5.23	0.00	5.23	54.12	39.90	504.47	79.32	77.30	188.56	159.30	
2058	0.00	0.00	0.00	0.00	8.72	0.00	8.72	54.12	55.10	504.47	79.32	77.30	188.56	159.30	
2059	0.00	0.00	0.00	0.00	14.83	0.00	14.83	54.12	42.21	504.47	79.32	77.30	188.56	159.30	
2060	0.00	0.00	0.00	0.00	20.93	0.00	20.93	54.12	51.26	504.47	79.32	77.30	188.56	159.30	
2061	0.00	0.00	0.00	0.00	25.29	0.00	25.29	54.12	35.76	504.47	79.32	77.30	188.56	159.30	
2062	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.12	66.75	504.47	79.32	77.30	188.56	159.30	
2063	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.12	35.76	504.47	79.32	77.30	188.56	159.30	
2064	0.00	0.00	0.00	0.00	10.42	2.09	12.50	54.12	66.75	504.47	79.32	77.30	188.56	159.30	
2065	0.00	0.00	0.00	0.00	8.65	4.18	12.82	54.12	38.66	504.47	79.32	77.30	188.56	159.30	
2066	0.00	0.00	0.00	0.00	1.04	12.53	13.57	54.12	66.75	504.47	79.32	77.30	188.56	159.30	
2067	0.00	0.00	0.00	0.00	9.01	18.79	27.80	54.12	35.76	504.47	79.32	77.30	188.56	159.30	
2068	0.00	0.00	0.00	0.00	19.28	56.37	75.65	54.12	66.75	504.47	79.32	77.30	188.56	159.30	
2069	0.00	0.00	78.30	0.00	33.08	56.37	167.75	54.12	38.66	504.47	79.32	77.30	188.56	159.30	
2070	0.00	0.00	106.94	0.00	2.67	58.46	168.07	54.12	53.00	504.47	79.32	77.30	188.56	159.30	
2071	0.00	0.00	16.22	0.00	32.44	0.00	48.66	54.12	37.50	504.47	79.32	77.30	188.56	159.30	
2072	0.00	0.00	79.48	0.00	17.02	0.00	96.51	54.12	53.00	504.47	79.32	77.30	188.56	159.30	
2073	0.00	0.00	108.56	0.00	28.73	0.00	137.28	54.12	36.63	504.47	79.32	77.30	188.56	159.30	
2074	0.00	0.00	96.75	0.00	50.02	0.00	146.76	54.12	51.26	504.47	79.32	77.30	188.56	159.30	
2075	0.00	0.00	109.64	0.00	75.23	0.00	184.87	54.12	38.66	504.47	79.32	77.30	188.56	159.30	
2076	0.00	0.00	16.63	0.00	77.10	0.00	93.73	54.12	53.00	504.47	79.32	77.30	188.56	159.30	
2077	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.12	37.50	504.47	79.32	77.30	188.56	159.30	
2078	0.00	0.00	0.00	0.00	9.28	0.00	9.28	54.12	53.00	504.47	79.32	77.30	188.56	159.30	
2079	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.12	40.40	504.47	79.32	77.30	188.56	159.30	
2080	0.00	0.00	0.00	0.00	54.81	0.00	54.81	54.12	53.00	504.47	79.32	77.30	188.56	159.30	
2081	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.12	35.76	504.47	79.32	77.30	188.56	159.30	
2082	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.12	35.76	504.47	79.32	77.30	188.56	159.30	
2083	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.12	35.76	504.47	79.32	77.30	188.56	159.30	
2084	0.00	0.00	0.00	0.00	10.59	0.68	11.28	54.12	35.76	504.47	79.32	77.30	188.56	159.30	
2085	0.00	0.00	0.00	0.00	10.27	1.37	11.64	54.12	38.66	504.47	79.32	77.30	188.56	159.30	
2086	0.00	0.00	0.00	0.00	24.85	4.11	28.96	54.12	35.76	504.47	79.32	77.30	188.56	159.30	
2087	0.00	0.00	0.00	0.00	28.87	6.16	35.03	54.12	35.76	504.47	79.32	77.30	188.56	159.30	
2088	0.00	0.00	0.00	0.00	20.54	18.49	39.04	54.12	35.76	504.47	79.32	77.30	188.56	159.30	
2089	0.00	0.00	0.00	0.00	16.76	18.49	35.25	54.12	38.66	504.47	79.32	77.30	188.56	159.30	
2090	0.00	0.00	0.00	0.00	0.00	19.18	19.18	54.12	38.66	504.47	79.32	77.30	188.56	159.30	
Salvage Value	2.31	0.00	6.54	0.00	10.30	4.78	23.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
PV @ 5.05%	4000.14	2857.05	193.35	0.00	449.81	337.17	7837.52	779.59	651.85	11808.35	1938.98	705.38	2816.45	6347.54	
												Net Present Value		-2921	
5.05%	97.77	0.00	276.43	0.00	435.40	202.26	1011.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5.20%	$3,960.40	$2,845.69	$184.13	$0.00	$441.46	$472.86	$7,904.54	$767.99	$658.54	$11,503.89	$1,893.81	$679.14	$2,733.04	$6,197.89	-3133.18

MIPUG/CAC- Harper 003 b)

Subject: US Transmission

Question: If possible, please indicate if the S-Curve with plans 5 and 14 would appear materially different with plans 5a and 14a. If so, please provide.

Response:

The S-Curves for Plans 5a and 14a are the same shape as those for Plans 5 and 14 respectively except they are shifted to the left to account for the greater investment in US Transmission.

MIPUG/CAC-Harper 3 - Figure A: S-Curve: Plans 5 and 14 versus 5a and 14 a

MIPUG/CAC-Harper 003 c)

Subject US Transmission, Econalysis Consulting Services Report, page 51

Question Please indicate if the use of Plan 14a instead of Plan 14 in ECS Table #10 would materially change the result, and if so please provide a revised Table #10 and Figure #14.

Response:

It is assumed that the question was with respect to ECS Table #11, as this is the Table that utilizes Plans #5 and #14. In the original Table #11 the expected value for the Opt 750 plan was close to $200 M higher than that for the Opt 250 plan – suggesting that with the WPS contract (and investment) the 750 MW intertie is more beneficial. However, if Manitoba Hydro is required to pick up the additional investment cost associated with the US Transmission then the expected values are now virtually equivalent, as are the overall risk profiles.

MIPUG/CAC-Harper 3 – : Table A: Probabilistic Analysis: 250 MW vs. 750 MW Intertie (WPS Contract but No WPS Investment)

Development Plan				**4**	**13**	**11**				**14a**	**5a**
Millions 2014 $ - NPV		**Opt 250**		**K19/Gas24/250MW**	**K19/C25/250MW**	**K19/C31/250MW**		**Opt 750**		**K19/C25/750MW (WPS Sale)**	**K19/Gas25/750MW (WPS Sale)**
10th Percentile		-477		-477	-2092	-1708		-509		-1902	-615
25th Percentile		112		112	-807	-487		-46		-486	-174
75th Percentile		1744		1318	1690	1630		1954		1954	846
90th Percentile		3035		2128	3035	2647		3060		3060	1489
Expected Value		1026		832	459	484		1023		635	456
Ref-Ref-Ref NPV		1210		1210	1037	994		1235		1235	786
50th Percentile		1044		1044	755	721		1061		933	677

MIPUG/CAC-Harper 004

Subject: Calculations

Question: Please provide the calculations/spreadsheets used to calculate Table #10, #11, #12 and #13.

Response:

An explanation for the calculations is provided below. In preparing the response an error was identified in the input data used in creating ECS Tables #12 and #13. Revised tables are provided below along with the implications the changes have for the conclusions presented in Mr. Harper's report.

ECS Table #12 (Revised) – Probabilistic Analysis: Protect Conawapa In-Service with a 750 MW Intertie

Development Plan			**6**	**15**	**12**			**6**	**12**			**5**	**14**
NPV 2014$ (Millions)		Path 4A	K19/Gas31/750MW	K19/C25/750MW	K19/C31/750MW		Path 4B	K19/Gas31/750MW	K19/C31/750MW		Path 5	K19/Gas25/750MW (WPS Sale & INV)	K19/C25/750MW (WPS Sale &Inv)
10th Percentile		-767	-767	-2033	-1760		-767	-767	-1760		-312	-403	-1398
25th Percentile		-26	-159	-625	-477		-155	-159	-477		344	14	-18
75th Percentile		2177	1054	2177	1876		1717	1054	1876		2425	1078	2425
90th Percentile		3631	1862	3631	3006		2734	1862	3006		3565	1646	3565
Expected Value		1155	564	804	644		817	564	644		1425	642	1129
Ref-Ref-Ref NPV		1460	955	1460	1210		1081	955	1210		1725	967	1725
50th Percentile		1160	779	1156	926		866	779	926		1470	839	1431

The revised results indicate that, from an economic perspective, it is beneficial to protect the in-service date for Conawapa under both variations of Pathway 4 and also under Pathway 5:

- For Pathway #4 A, protecting a mid 2020s in-service date yields a benefit of $591 M (i.e. $1155 M vs. $564 M) as compared to a cost of $308 M.
- For Pathway #4 B, protecting an early 2030s in-service date yields a benefit of $253 M (i.e. $817 M vs. $564 M) as compared to a cost of $87 M.
- For Pathway #5, protecting a mid-2020s in-service date yields a benefit of $783 M ($1425 M vs. $642 M) as compared to a cost of $308 M.

ECS Table #13 (Revised) – Probabilistic Analysis: Protect Conawapa In-Service with a 250 MW Intertie

Development Plan							**4**	**13**	**11**
NPV 2014$ (Millions)				Path 3A	Path 3B		K19/Gas24/250MW	K19/C25/250MW	K19/C31/250MW
10th Percentile				-477	-477		-477	-1784	-1621
25th Percentile				112	112		112	-499	-400
75th Percentile				1998	1744		1318	1998	1717
90th Percentile				3343	2734		2128	3343	2734
Expected Value				1141	977		832	767	571
Ref-Ref-Ref NPV				1345	1210		1210	1345	1081
50th Percentile				1146	1044		1044	1063	808

The revised results suggest that there is little to no net benefit, from an economic perspective, in protecting the in-service date for Conawapa:

- For Pathway 3A, protecting a mid-2020s in-service date provides a benefit of $309 M (i.e. $1141 M vs. $832 M) as compared to a cost of $308 M
- For Pathway 3B, protecting an early 2030s in-service date provides a benefit of $145 M (i.e. $977 M vs. $832 M) as compared to a cost of $87 M.

However, given choice of maintaining more flexibility for future as opposed to less at the same expected overall cost, it would seem reasonable to opt for the "path" that maintains as many options as possible and protect Conawapa's in-service date.

Explanation of Calculations Underlying Tables

ECS Table #10

For purposes of calculating the values in Table #10, the outcome for the Optimum 250 MW Plan under each of the 27 scenarios was established by assuming that Manitoba Hydro chooses for its next major generation resource decision after Keeyask from amongst Plans #4, #11 and #13 (i.e. those with a 250 MW intertie and K19) the plan with the highest NPV value and assigning that NPV value to the Optimum 250 MW Plan for that scenario. Using the probabilities Manitoba Hydro has established for each of the 27 scenarios reference values, expected values and a cumulative probability distribution was then calculated for the Optimum 250 MW Plan.

A similar approach was used for the Optimum 750 MW Plan, except in this case, for each of the 27 scenarios the Optimum 750 MW Plan was assigned the highest of the three NPV values associated with Plans #6, #12, and #15 (i.e.

those plans with a 750 MW intertie and no WPS contract). The Table A sets out the probability quilt for each of the underlying plans and for the Optimum 250 MW and Optimum 750 MW (No WPS) Plans.

ECS Table #11

Table #11 was calculated in a similar manner to Table #10, except in this case the Optimum 750 MW Plan values were established by looking at each of the 27 scenarios, assuming that Manitoba Hydro chooses for its next major generation resource after Keeyask between Plans #5 and #14 (i.e. the two plans with a 750 MW intertie and a WPS contract) the one with the higher NPV and assigning that NPV value to Optimum 750 MW plan under that scenario. Table B sets out the probability quilt associated with the Optimum 250 MW Plan and the Optimum 750 MW Plan (With WPS).

ECS Table #12

Pathway 4A consists of Plan #15 (i.e., a 750 MW intertie, no WPS contract and Conawapa with an in-service date in the mid-2020's) along with those plans that represent alternatives to proceeding with Conawapa in the mid-2020s (i.e. Plans #6 and #12) under such circumstances. The Pathway 4A NPV values were established by assuming Conawapa has been protected for a mid-2020's in-service date and then, for each of the 27 scenarios, also assuming that Manitoba Hydro chooses the best (i.e. highest NPV value) Plan for that scenario. The result is that for each scenario Pathway 4A's NPV is the maximum of the three NPV associated Plans #6, #12 and #15. In order to avoid double counting the "cost of protecting the in-service date" was added to NPV values calculated for each Plan - $308 M for Plan #15 and $87 M for Plans #12 – per PUB/MH I-279. Table C sets out the resulting probability quilt for Pathway 4A and the associated plans. The NPV values for Plans #12 and #15 differ from those in Figure #9 of Mr. Harper's evidence by the amount of the "protection cost" referenced above.

The results for Pathway 4A (which protects a mid-2020s in-service date for Conawapa and therefore includes Plans #12 and #15) are then compared with Plan #6 which will be the default plan if the Conawapa in-service date is not protected) to determine the net benefit of protecting Conawapa for a mid-2020's in-service date.

Pathway 4B consists of those Plan #12 (i.e. a 750 MW intertie, no WPS contract and Conawapa with an in-service date in the early 2030s) along with those plans that represent alternatives to proceeding with Conawapa in the mid-2030s (i.e. Plan #6) under similar circumstances. Pathway 4B's NPV values were established in the same manner as described for Pathway 4A, except in this case it was assumed that for each scenario Manitoba Hydro chose between Plans #6 and #12 the one with the higher NPV value and this value was assigned to Pathway 4B for that scenario. Again, the $87 M "cost of protecting the in-service date" was removed from the cost for Plan #12 in order to avoid double counting. The probabilistic quilt for Pathway 4B is also set out in Table C.

The results for Pathway 4B (which protects an early-2030s in-service date for Conawapa and therefore includes Plan #12) are then compared with Plan #6 (which will be the default plan if the Conawapa in-service date is not protected) to determine the net benefit of protecting Conawapa for an early 2030s in-service date.

Finally, Pathway 5 consists of Plan#14 (i.e., a 750 MW intertie, a WPS contract and Conwapa with an in-service date in the mid-2020s) along those plans that represent alternatives to Plan #14 under similar circumstances (i.e. Plan #5). Pathway 5's NPV value for each scenario was calculated in a manner similar to that for Pathways 4A and 4B except in this case it was assumed that for each scenario Manitoba Hydro chooses between Plans #5 and #14 the one with the higher NPV value and this value was assigned to Pathway 5 for that scenario. Again, the $308 M "cost of protecting the in-service date" was removed from the

cost for Plan #14 in order to avoid double counting. The resulting probabilistic quilt for Pathway 5 is also set out in Table C.

ECS Table #13

Pathway 3A consists of Plan #13 (250 MW intertie and Conawapa with an in-service date in the mid-2020s) along with those plans that represent alternatives to proceeding with Conawapa in the mid-2020s under similar circumstances (i.e. Plans #4 and #11). Pathway 3A's NPV values were established in the same manner as described for the Table #12 Pathways, except in this case it was assumed that for each scenario Manitoba Hydro chooses between Plans #4, #11 and #13 the one with the highest NPV value and this value was assigned to Pathway 3A for that scenario. Again, the $308 M "cost of protecting the in-service date" was removed from the cost for Plan #13 and similarly the $87 M was removed from the cost of Plan #11 in order to avoid double counting. The probabilistic quilt for Pathway 3A is set out in Table #D.

The results for Pathway 3A (which protects a mid-2020s in-service date for Conawapa and therefore includes Plans #11 and #13) are then compared with Plan #4 which will be the default plan if the Conawapa in-service date is not protected) to determine the net benefit of protecting Conawapa for a mid-2020's in-service date.

Pathway 3B consists of Plan #11 (250 MW intertie and Conawapa with an in-service date in the early 2030s) along with those plans that represent alternatives to proceeding with Conawapa in the early 2030s under similar circumstances (i.e. Plan #4). Pathway 3B's NPV values were established in the same manner as described for the Table #12 Pathways, except in this case it was assumed that for each scenario Manitoba Hydro chooses between Plans #4 and #11 the one with the highest NPV value and this value was assigned to Pathway 3B for that scenario. Again, the $87 M "cost of protecting the in-service date" was removed from the cost for Plan #11 in order to avoid double counting. The probabilistic quilt for Pathway 3B is set out in Table #D.

The results for Pathway 3B (which protects an early 2030s in-service date for Conawapa and therefore includes Plan #11 are then compared with Plan #4 which will be the default plan if the Conawapa in-service date is not protected) to determine the net benefit of protecting Conawapa for an early 2030's in-service date.

MIPUG/CAC-Harper 4 – Table A – Probability Quilt for ECS Table #10

Development Plan			3	7	2	4	13	11	6	15	12	Probability
			Opt 250	Opt 750 (No WPS)	K22/Gas	K19/Gas2 4/250MW	K19/C25/ 250MW	K19/C31/ 250MW	K19/Gas3 1/750MW	K19/C25/ 750MW	K19/C31/ 750MW	
Energy Prices	Inflation Rates	Capital Costs										
Low	Low	High	-823	-1120	-1112	-823	-2499	-2071	-1120	-2794	-2238	1.350%
		Ref	116	-172	-241	116	-1406	-1019	-172	-1592	-1129	2.250%
		Low	806	516	396	806	-552	-196	516	-662	-269	0.900%
	Ref	High	-1010	-1293	-1288	-1010	-2682	-2301	-1293	-2993	-2469	4.500%
		Ref	-28	-308	-379	-28	-1555	-1209	-308	-1754	-1319	7.500%
		Low	697	409	289	697	-674	-351	409	-793	-426	3.000%
	High	High	-1153	-1437	-1432	-1153	-2852	-2478	-1437	-3174	-2650	3.150%
		Ref	-142	-425	-497	-142	-1697	-1356	-425	-1903	-1469	5.250%
		Low	604	312	190	604	-793	-474	312	-917	-551	2.100%
Ref	Low	High	393	162	21	393	48	94	122	62	162	2.475%
		Ref	1332	1271	891	1332	1142	1145	1069	1263	1271	4.125%
		Low	2022	2193	1529	2022	1996	1969	1757	2193	2131	1.650%
	Ref	High	228	-27	-135	228	-90	-98	-30	-88	-27	8.250%
		Ref	1210	1152	774	1210	1037	994	955	1152	1123	13.750%
		Low	1934	2112	1441	1934	1918	1852	1672	2112	2017	5.500%
	High	High	111	-146	-255	111	-204	-227	-146	-205	-154	5.775%
		Ref	1122	1066	680	1122	951	895	866	1066	1027	9.625%
		Low	1868	2052	1367	1868	1855	1777	1603	2052	1945	3.850%
High	Low	High	2527	2759	983	1423	2527	2198	1141	2759	2434	0.675%
		Ref	3620	3960	1854	2362	3620	3250	2088	3960	3543	1.125%
		Low	4474	4890	2492	3052	4474	4073	2777	4890	4402	0.450%
	Ref	High	2433	2657	845	1276	2433	2043	1007	2657	2285	2.250%
		Ref	3559	3896	1754	2258	3559	3136	1992	3896	3435	3.750%
		Low	4441	4857	2421	2982	4441	3994	2709	4857	4328	1.500%
	High	High	2374	2599	746	1182	2374	1961	913	2599	2208	1.575%
		Ref	3528	3870	1681	2193	3528	3083	1925	3870	3389	2.625%
		Low	4433	4856	2368	2939	4433	3965	2662	4856	4307	1.050%

MIPUG/CAC-Harper 4 – Table B – Probability Quilt for ECS Table #11

Development Plan			1	3	7	2	4	13	11	6	15	12	5	14	
					Opt 250	Opt 750 (WPS)	K19/Gas24/250MW	K19/C25/250MW	K19/C31/250MW	K19/Gas31/750MW	K19/C25/750MW	K19/C31/750MW	K19/Gas25/750MW (WPS Sale & INV)	K19/C25/750MW (WPS Sale &Inv)	Probability
Energy Prices	Inflation Rates	Capital Costs													
Low	Low	High			-823	-650	-823	-2499	-2071	-1120	-2794	-2238	-650	-2155	1.350%
		Ref			116	274	116	-1406	-1019	-172	-1592	-1129	274	-984	2.250%
		Low			806	943	806	-552	-196	516	-662	-269	943	-79	0.900%
	Ref	High			-1010	-840	-1010	-2682	-2301	-1293	-2993	-2469	-840	-2344	4.500%
		Ref			-28	128	-28	-1555	-1209	-308	-1754	-1319	128	-1135	7.500%
		Low			697	829	697	-674	-351	409	-793	-426	829	-200	3.000%
	High	High			-1153	-982	-1153	-2852	-2478	-1437	-3174	-2650	-982	-2510	3.150%
		Ref			-142	15	-142	-1697	-1356	-425	-1903	-1469	15	-1270	5.250%
		Low			604	738	604	-793	-474	312	-917	-551	738	-311	2.100%
Ref	Low	High			393	352	393	48	94	122	62	162	175	352	2.475%
		Ref			1332	1524	1332	1142	1145	1069	1263	1271	1099	1524	4.125%
		Low			2022	2428	2022	1996	1969	1757	2193	2131	1767	2428	1.650%
	Ref	High			228	208	228	-90	-98	-30	-88	-27	-1	208	8.250%
		Ref			1210	1417	1210	1037	994	955	1152	1123	967	1417	13.750%
		Low			1934	2352	1934	1918	1852	1672	2112	2017	1669	2352	5.500%
	High	High			111	97	111	-204	-227	-146	-205	-154	-124	97	5.775%
		Ref			1122	1337	1122	951	895	866	1066	1027	873	1337	9.625%
		Low			1868	2296	1868	1855	1777	1603	2052	1945	1596	2296	3.850%
High	Low	High			2527	2709	1423	2527	2198	1141	2759	2434	775	2709	0.675%
		Ref			3620	3880	2362	3620	3250	2088	3960	3543	1699	3880	1.125%
		Low			4474	4785	3052	4474	4073	2777	4890	4402	2368	4785	0.450%
	Ref	High			2433	2607	1276	2433	2043	1007	2657	2285	610	2607	2.250%
		Ref			3559	3815	2258	3559	3136	1992	3896	3435	1578	3815	3.750%
		Low			4441	4750	2982	4441	3994	2709	4857	4328	2280	4750	1.500%
	High	High			2374	2548	1182	2374	1961	913	2599	2208	500	2548	1.575%
		Ref			3528	3788	2193	3528	3083	1925	3870	3389	1497	3788	2.625%
		Low			4433	4747	2939	4433	3965	2662	4856	4307	2220	4747	1.050%

MIPUG/CAC-Harper 4 – Table C – Probability Quilt for ECS Table #12

Development Plan				3	7	2	4	13	11	6	15	12	5	14	
				Path 4A	Path 4B	Path 5	K19/Gas24/250MW	K19/C25/250MW	K19/C31/250MW	K19/Gas31/750MW	K19/C25/750MW	K19/C31/750MW	K19/Gas25/750MW (WPS Sale & INV)	K19/C25/750MW (WPS Sale &Inv)	Probability
Energy Prices	Discount Rates	Capital Costs													
Low	Low	High		-1120	-1120	-650	-823	-2191	-1984	-1120	-2486	-2151	-650	-1847	1.350%
		Ref		-172	-172	274	116	-1098	-932	-172	-1284	-1042	274	-676	2.250%
		Low		516	516	943	806	-244	-109	516	-354	-182	943	229	0.900%
	Ref	High		-1293	-1293	-840	-1010	-2374	-2214	-1293	-2685	-2382	-840	-2036	4.500%
		Ref		-308	-308	128	-28	-1247	-1122	-308	-1446	-1232	128	-827	7.500%
		Low		409	409	829	697	-366	-264	409	-485	-339	829	108	3.000%
	High	High		-1437	-1437	-982	-1153	-2544	-2391	-1437	-2866	-2563	-982	-2202	3.150%
		Ref		-425	-425	15	-142	-1389	-1269	-425	-1595	-1382	15	-962	5.250%
		Low		312	312	738	604	-485	-387	312	-609	-464	738	-3	2.100%
Ref	Low	High		370	181	660	393	356	181	122	370	249	175	660	2.475%
		Ref		1571	1232	1832	1332	1450	1232	1069	1571	1358	1099	1832	4.125%
		Low		2501	2056	2736	2022	2304	2056	1757	2501	2218	1767	2736	1.650%
	Ref	High		220	-11	516	228	218	-11	-30	220	60	-1	516	8.250%
		Ref		1460	1081	1725	1210	1345	1081	955	1460	1210	967	1725	13.750%
		Low		2420	1939	2660	1934	2226	1939	1672	2420	2104	1669	2660	5.500%
	High	High		103	-140	405	111	104	-140	-146	103	-67	-124	405	5.775%
		Ref		1374	982	1645	1122	1259	982	866	1374	1114	873	1645	9.625%
		Low		2360	1864	2604	1868	2163	1864	1603	2360	2032	1596	2604	3.850%
High	Low	High		3067	2285	3017	1423	2835	2285	1141	3067	2521	775	3017	0.675%
		Ref		4268	3337	4188	2362	3928	3337	2088	4268	3630	1699	4188	1.125%
		Low		5198	4160	5093	3052	4782	4160	2777	5198	4489	2368	5093	0.450%
	Ref	High		2965	2130	2915	1276	2741	2130	1007	2965	2372	610	2915	2.250%
		Ref		4204	3223	4123	2258	3867	3223	1992	4204	3522	1578	4123	3.750%
		Low		5165	4081	5058	2982	4749	4081	2709	5165	4415	2280	5058	1.500%
	High	High		2907	2048	2856	1182	2682	2048	913	2907	2295	500	2856	1.575%
		Ref		4178	3170	4096	2193	3836	3170	1925	4178	3476	1497	4096	2.625%
		Low		5164	4052	5055	2939	4741	4052	2662	5164	4394	2220	5055	1.050%

MIPUG/CAC-Harper 4 – Table D – Probability Quilt for ECS Table #13

Development Plan				3	7		4	13	11						
				Path 3 A	Path 3B		K19/Gas2 4/250MW	K19/C25/ 250MW	K19/C31/ 250MW						Probability
Energy Prices	Discount Rates	Capital Costs													
Low	Low	High		-823	-823		-823	-2191	-1984						1.350%
		Ref		116	116		116	-1098	-932						2.250%
		Low		806	806		806	-244	-109						0.900%
	Ref	High		-1010	-1010		-1010	-2374	-2214						4.500%
		Ref		-28	-28		-28	-1247	-1122						7.500%
		Low		697	697		697	-366	-264						3.000%
	High	High		-1153	-1153		-1153	-2544	-2391						3.150%
		Ref		-142	-142		-142	-1389	-1269						5.250%
		Low		604	604		604	-485	-387						2.100%
Ref	Low	High		393	393		393	356	181						2.475%
		Ref		1450	1332		1332	1450	1232						4.125%
		Low		2304	2056		2022	2304	2056						1.650%
	Ref	High		228	228		228	218	-11						8.250%
		Ref		1345	1210		1210	1345	1081						13.750%
		Low		2226	1939		1934	2226	1939						5.500%
	High	High		111	111		111	104	-140						5.775%
		Ref		1259	1122		1122	1259	982						9.625%
		Low		2163	1868		1868	2163	1864						3.850%
High	Low	High		2835	2285		1423	2835	2285						0.675%
		Ref		3928	3337		2362	3928	3337						1.125%
		Low		4782	4160		3052	4782	4160						0.450%
	Ref	High		2741	2130		1276	2741	2130						2.250%
		Ref		3867	3223		2258	3867	3223						3.750%
		Low		4749	4081		2982	4749	4081						1.500%
	High	High		2682	2048		1182	2682	2048						1.575%
		Ref		3836	3170		2193	3836	3170						2.625%
		Low		4741	4052		2939	4741	4052						1.050%