

## Economic Uncertainty Analysis Results March 12, 2014

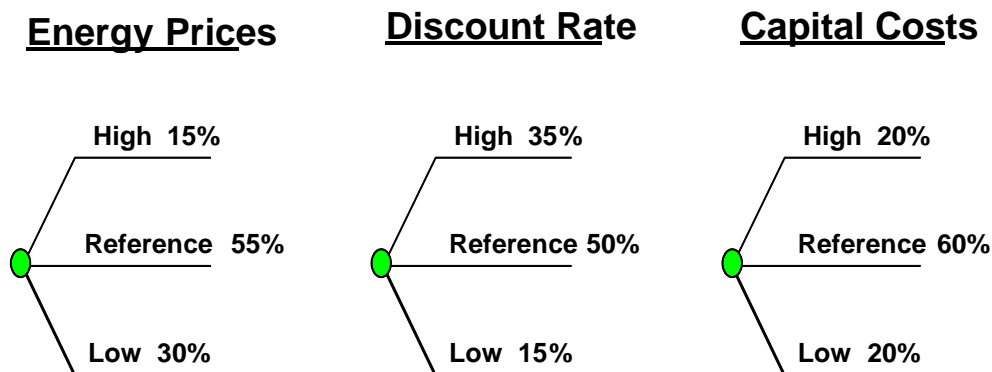
### Updated Analysis with Revised Capital Costs and Revised Common Factors

The economic uncertainty analysis has been updated to reflect two changes:

- updated treatment of **capital costs** for Keeyask and Conawapa and associated probabilities,
- updated treatment of **common factors** (costs and revenues common to all alternatives).

#### Capital Costs

As a result of recently receiving General Civil Contract bids for Keeyask, Manitoba Hydro has updated its capital cost estimates for Keeyask and Conawapa. Furthermore, to reflect the greater certainty in these new estimates, the low, reference and high probabilities have been updated. The updated probabilities are presented below.



#### Common Factors

In conducting project risk analysis, it is the incremental costs and revenues associated with each project that should be included, and common costs and revenues associated with the existing system should be removed. This is of particular importance when incorporating discount rate uncertainty. Manitoba Hydro has updated and improved its approach to removing common costs and revenues.

#### Results

The latest results with these two updates are presented below. Relative to All Gas – Ref – Ref – Ref, expected values range from essentially zero to more than \$600M. Plans 4 and 5 have the

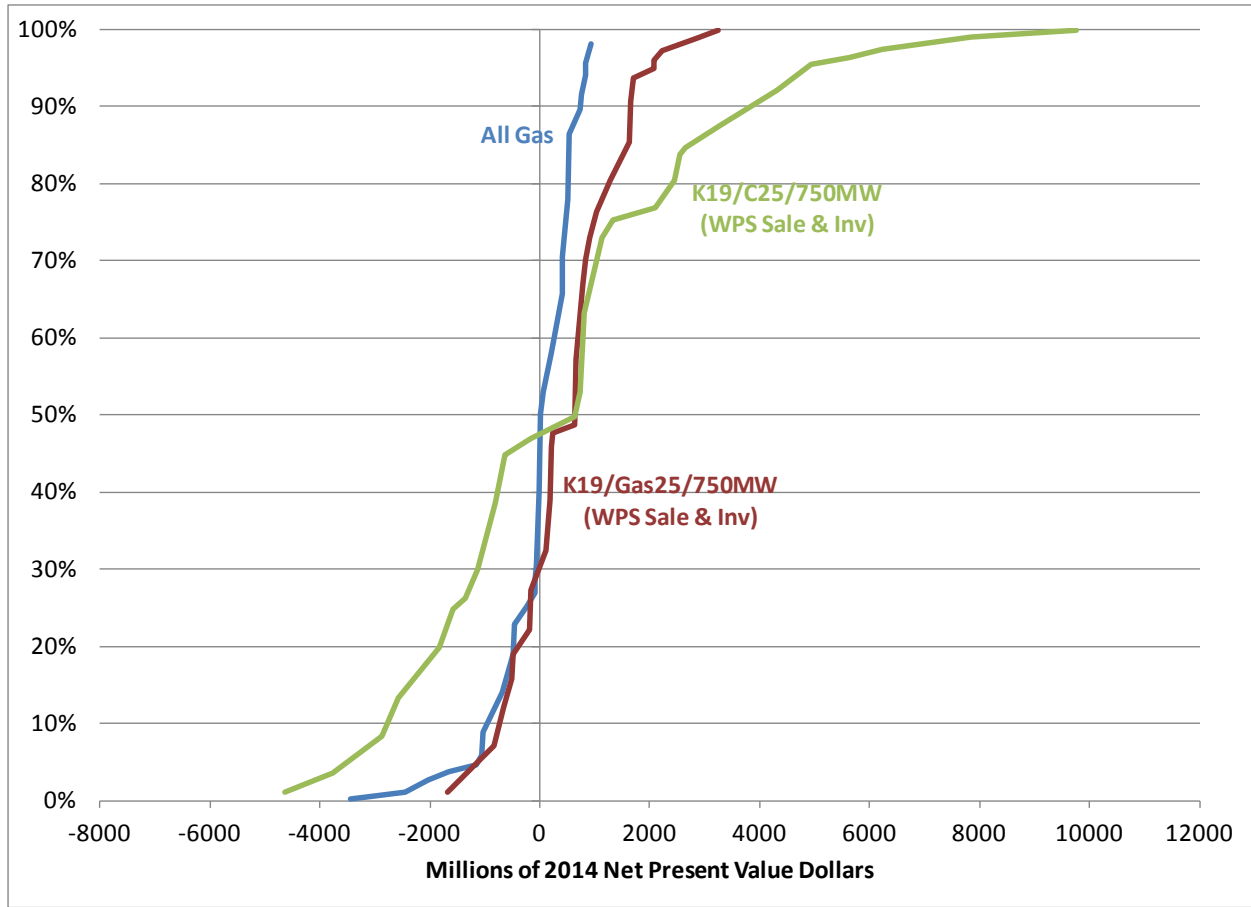
highest expected value. Plan 1 has the lowest expected value. Again relative to All Gas – Ref – Ref – Ref, 10<sup>th</sup> percentile values range from -\$700M to -\$2.8B. All plans have some downside risk. Plans 4 and 5 have the least downside risk. Plan 14 has the most downside risk. Based on the S-curves, Plan 1 is dominated by Plan 5, and the fundamental choice on an economic basis is between Plans 5 and 14 (assuming Plan 4 is not a feasible option).

Revised Capital Costs and Revised Treatment of Common factors

Development Plan			1	2	4	8	5	14
			All Gas	K22/Gas	K19/Gas24 /250MW	CCGT/C26	K19/Gas25 /750MW	K19/C25 /750MW
			WPS Sale & Investment					
Energy Prices	Discount Rates	Capital Costs	Millions of 2014 NPV Dollars					
Low	Low	H	-1062	-1401	-851	-1501	-516	-1583
		Ref	-68	16	646	106	906	632
		L	734	1205	1898	1449	2086	2539
	Ref	H	-463	-1751	-1512	-2398	-1331	-3755
		Ref	208	-677	-334	-1085	-172	-1827
		L	750	232	658	15	795	-167
	High	H	-88	-1782	-1761	-2625	-1675	-4640
		Ref	416	-891	-748	-1480	-651	-2876
		L	823	-133	110	-519	205	-1356
Ref	Low	H	-2033	-120	543	325	236	2111
		Ref	-1039	1296	2040	1932	1658	4326
		L	-237	2486	3292	3275	2837	6233
	Ref	H	-671	-585	-260	-910	-492	-1130
		Ref	0	489	917	403	667	798
		L	542	1397	1910	1503	1634	2458
	High	H	17	-716	-620	-1343	-837	-2562
		Ref	520	175	393	-198	187	-798
		L	927	933	1251	762	1043	722
High	Low	H	-3454	892	1647	2005	645	5631
		Ref	-2460	2309	3143	3612	2066	7846
		L	-1658	3498	4396	4955	3246	9752
	Ref	H	-1158	402	797	469	112	1340
		Ref	-487	1476	1974	1782	1271	3268
		L	55	2384	2967	2882	2238	4928
	High	H	-82	210	368	-156	-186	-627
		Ref	422	1101	1381	989	837	1137
		L	828	1859	2239	1949	1694	2657

Development Plan			1	2	4	8	5	14
			All Gas	K22/Gas	K19/Gas24 /250MW	CCGT/C26	K19/Gas25 /750MW	K19/C25 /750MW
			WPS Sale & Investment					
			Millions of 2014 NPV Dollars					
10th Percentile - "Risk"			-953	-862	-727	-1457	-728	-2768
25th Percentile			-244	-622	-290	-980	-178	-1537
75th Percentile			483	1026	1339	916	992	1314
90th Percentile - "Reward"			738	1448	2019	1898	1655	3850
Expected Value			-9	268	651	143	450	303
Ref-Ref-Ref NPV			0	489	917	403	667	798

Revised Capital Costs and Revised Treatment of Common factors



**Original Analysis**

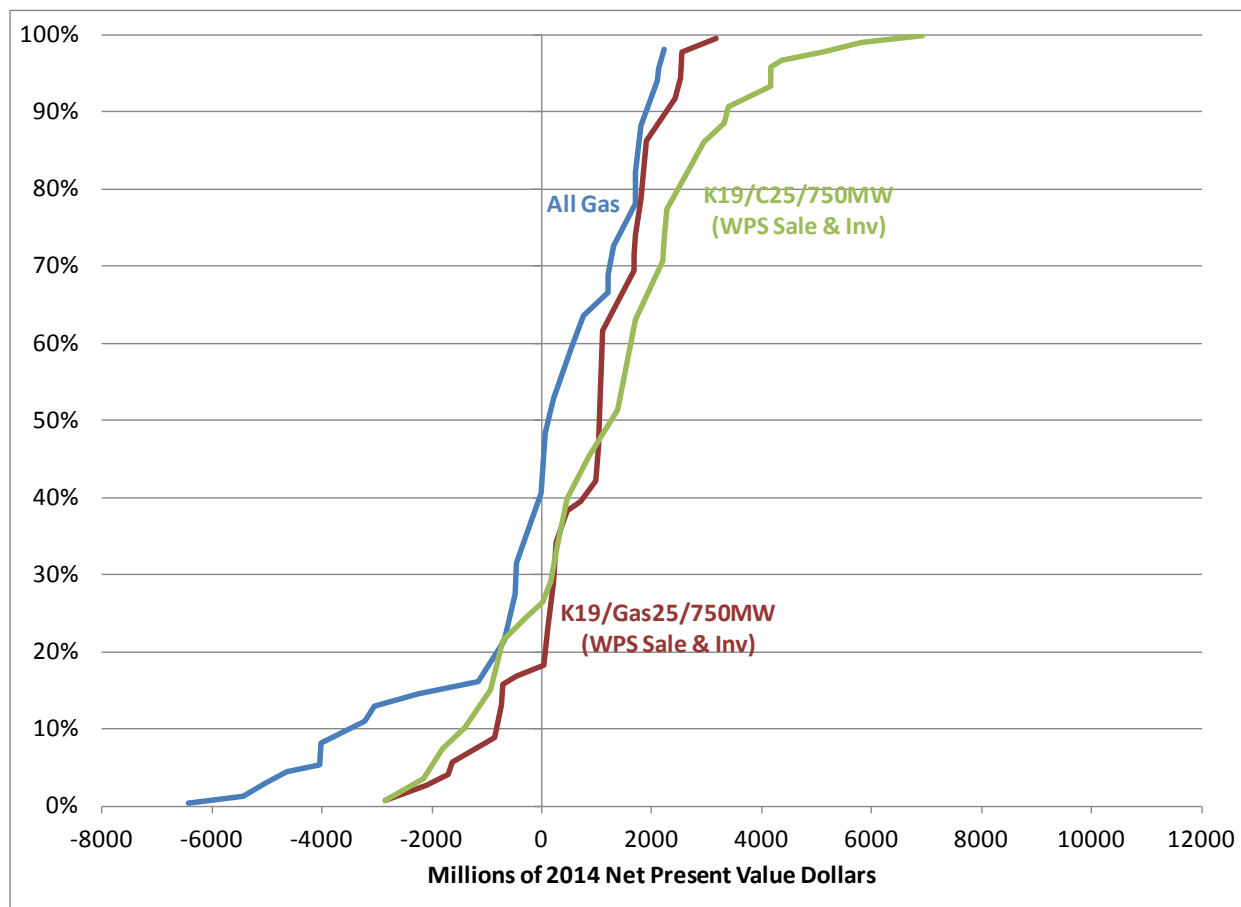
For comparison, the results with the original capital costs and the original common factor treatment, as presented in Chapter 10 of the NFAT submission, are presented below. Relative expected values range from roughly -\$100M to \$1.1B. Plans 4, 5 and 14 have the highest expected values. Plan 1 has the lowest expected value. 10<sup>th</sup> percentile values range from -\$800M to -\$3.5B. All plans have some downside risk. Plans 4 and 5 have the least downside risk. Plan 1 has the most downside risk. Based on the S-curves, Plan 1 is dominated, and the fundamental choice on an economic basis is between Plans 5 and 14.

Original Quilt from Chapter 10

Development Plan			1	2	4	8	5	14
			All Gas	K22/Gas	K19/Gas24 /250MW	CCGT/C26	K19/Gas25 /750MW	K19/C25 /750MW
			WPS Sale & Investment					
Energy Prices	Discount Rates	Capital Costs	Millions of 2014 NPV Dollars					
Low	Low	H	-4043	-3792	-3190	-3529	-2855	-2841
		Ref	-3049	-2532	-1877	-2482	-1616	-1410
		L	-2247	-1590	-890	-1627	-703	-292
	Ref	H	-463	-1212	-911	-1531	-730	-2155
		Ref	208	-278	95	-704	257	-929
		L	750	408	837	-29	974	20
	High	H	1204	25	117	-517	203	-1810
		Ref	1708	785	963	187	1060	-698
		L	2114	1336	1580	762	1674	157
Ref	Low	H	-5014	-2511	-1796	-1703	-2103	853
		Ref	-4020	-1251	-482	-656	-865	2284
		L	-3217	-309	504	199	49	3402
	Ref	H	-671	-46	341	-43	109	470
		Ref	0	887	1346	784	1097	1696
		L	542	1573	2089	1459	1813	2645
	High	H	1308	1091	1258	764	1041	268
		Ref	1812	1851	2104	1468	1898	1380
		L	2218	2402	2721	2044	2512	2235
High	Low	H	-6435	-1499	-692	-23	-1694	4372
		Ref	-5441	-239	621	1024	-456	5803
		L	-4638	703	1607	1879	458	6922
	Ref	H	-1158	941	1398	1336	713	2940
		Ref	-487	1874	2403	2163	1701	4166
		L	55	2560	3146	2838	2417	5115
	High	H	1210	2017	2246	1951	1691	2203
		Ref	1713	2777	3092	2656	2549	3315
		L	2120	3328	3709	3231	3163	4170

Original from Chapter 10

Development Plan	1	2	4	8	5	14
	All Gas	K22/Gas	K19/Gas24 /250MW	CCGT/C26	K19/Gas25 /750MW	K19/C25 /750MW
					WPS Sale & Investment	
	Millions of 2014 NPV Dollars					
10th Percentile - "Risk"	-3502	-1249	-898	-1424	-828	-1429
25th Percentile	-560	-248	115	-490	139	-204
75th Percentile	1481	1636	2092	1462	1726	2255
90th Percentile - "Reward"	1905	2007	2479	2070	2256	3377
Expected Value	-70	564	971	459	772	1085
Ref-Ref-Ref NPV	0	887	1346	784	1097	1696



### Updated Analysis with Revised Treatment of Common Factors

For comparison, the results with the original capital cost treatment and the revised common factor treatment are presented below. Revising the treatment of common costs/revenues does not affect the incremental expected NPV between plans, nor does it affect the NPV's for the Ref-Ref-Ref scenario. Relative expected values range from roughly -\$100M to \$1.1B. Plans 4, 5 and 14 have the highest expected values. Plan 1 has the lowest expected value. 10<sup>th</sup> percentile values range from -\$300M to -\$2.0B. All plans have some downside risk. Plans 4 and 5 have the least downside risk. Plan 14 has the most downside risk. Based on the S-curves, Plan 1 is dominated by Plan 5, and the fundamental choice on an economic basis is between Plans 5 and 14. One important impact of the revised treatment of the common costs/revenues is to reduce the downside risk (10<sup>th</sup> percentile values) of all of the plans except for Plan 14 Preferred Development Plan.

Original Capital Costs and Revised Common Factors

Development Plan			1	2	4	8	5	14
			All Gas	K22/Gas	K19/Gas24 /250MW	CCGT/C26	K19/Gas25 /750MW	K19/C25 /750MW
			WPS Sale & Investment					
Energy Prices	Discount Rates	Capital Costs	Millions of 2014 NPV Dollars					
Low	Low	H	-1062	-812	-210	-549	127	140
		Ref	-68	448	1104	499	1365	1571
		L	734	1390	2090	1354	2279	2689
	Ref	H	-463	-1212	-911	-1531	-730	-2154
		Ref	208	-278	95	-704	258	-929
		L	750	408	837	-29	974	20
	High	H	-88	-1267	-1175	-1809	-1089	-3102
		Ref	416	-507	-328	-1105	-232	-1990
		L	823	45	288	-529	383	-1135
Ref	Low	H	-2033	469	1184	1277	878	3834
		Ref	-1039	1729	2498	2324	2116	5265
		L	-237	2671	3484	3180	3030	6383
	Ref	H	-671	-46	341	-43	109	470
		Ref	0	887	1346	784	1097	1696
		L	542	1573	2089	1459	1814	2645
	High	H	17	-201	-33	-527	-251	-1023
		Ref	520	559	813	177	606	89
		L	927	1111	1429	752	1221	943
High	Low	H	-3454	1481	2288	2957	1287	7354
		Ref	-2460	2742	3601	4005	2525	8785
		L	-1658	3684	4588	4860	3439	9903
	Ref	H	-1158	941	1398	1336	713	2941
		Ref	-487	1874	2403	2163	1701	4166
		L	55	2560	3146	2838	2417	5115
	High	H	-82	725	954	660	400	912
		Ref	422	1486	1801	1364	1257	2024
		L	828	2037	2417	1940	1872	2878

Original Capital Costs and Revised Common Factors

Development Plan	1	2	4	8	5	14
	All Gas	K22/Gas	K19/Gas24 /250MW	CCGT/C26	K19/Gas25 /750MW	K19/C25 /750MW
	WPS Sale & Investment					
Millions of 2014 NPV Dollars						
10th Percentile - "Risk"	-1042	-657	-361	-1129	-301	-1999
25th Percentile	-473	-193	144	-528	117	-843
75th Percentile	459	1143	1461	1323	1249	2293
90th Percentile - "Reward"	738	1788	2414	2220	1898	4672
Expected Value	-75	559	966	455	767	1080
Ref-Ref-Ref NPV	0	887	1346	784	1097	1696

