
2008 Long Term Acquisition Plan



APPENDIX F11
Estimated Unit Energy Cost Adjustment Values

1.1 Estimated UEC Cost Adjustment Values

In the 2005 Resource Options Report (ROR), BC Hydro presented Unit Energy Costs (UEC) at a base level only (e.g. costs at the plant gate with interconnection) and the full impact of adding alternative resources to the system was undertaken through portfolio analysis. While both the British Columbia Utilities Commission and several intervenors accepted the need and benefit of portfolio modelling, a concern was raised during the 2008 Long-Term Acquisition Plan (LTAP) Intervenor Engagement sessions that the UEC tables provided in the 2006 Integrated Electricity Plan/LTAP were being used out of context and that it was difficult to compare resource options on base UECs when there are other costs and credits associated with the resource options. These can include the cost of firm transmission, line losses, greenhouse gas (GHG) offset costs, capacity credit and wind integration costs.

As such, the 2008 LTAP has included an adjustment to the UEC calculations to provide an “indicative” allowance for these additional cost factors. These adjusted UECs are shown in the supply curves and Table 3-21 of Section 3.3 and are taken from the “Mid” case in the table below. It should be noted that these numbers are directional and will not necessarily reflect the end result of the LTAP portfolio modeling exercise. The following outlines the basis for the adjustment factors:

- **Cost of incremental Firm Transmission (CIFT)** – A capacity charge for firm transmission based on delivery from the project gate to the Lower Mainland using values from the British Columbia Transmission Corporation (BCTC) Bulk Transmission System CIFT for the NITS 2004 Facilities Study, Supplemental CIFT posting - 24 August 2007, Scenario 2. The CIFT values, in \$/kW-yr, were applied against the installed capacity for the associated project. The BCTC document is located at:
<http://www.bctc.com/NR/rdonlyres/3B501B1C-4661-476B-A103-A26DF4E96651/0/CIFT2005supplemental24August2007.pdf>
- **GHG costs** – These are estimates of GHG offset costs applicable to GHG emissions from natural gas-fired generating plants based on levelized values over the period 2012-2027, derived from GHG price forecasts in the Natsource report “2007 Greenhouse Gas Offset Forecast Report for BC Hydro, December 1, 2007” applied to the emission factors

of the resource option. The real levelized medium GHG price forecast used to calculate the UECs for the “Mid” case was \$21 per tonne.

- **Line Losses** –These are the estimated costs for project energy losses based on delivery to the Lower Mainland using the methodology outlined in the BCTC report “Peak Load Incremental Losses for the Bulk Transmission System, November 27, 2007”. This document is located at: http://www.bctc.com/NR/rdonlyres/5CF35AA8-9D67-4825-87E4-A251F1D99CD0/0/BULKSYSTEMINCREMENTAL_LOSSES_2008.pdf
- **Capacity Credit** – Applied to project dependable capacity, and ELCC for intermittent resources, using a unit value of \$25.9/kW-yr for capacity in the Lower Mainland, and dividing by the average annual energy.
- **Wind Integration Cost** – Based on \$10/MWh of average annual wind energy. See Appendix F-3.
- **Carbon Tax** – Based on the 2012 (approximately \$1.50/GJ) and onward, BC Carbon Tax, applicable to natural gas fired generation. See Section 1.2 in the following document: http://www.bcbudget.gov.bc.ca/2008/bfp/2008_Budget_Fiscal_Plan.pdf

In addition to the “Mid” calculation of adjusted UEC for each project, Table 1 also shows a range of “Low” and “High” values. These values are based on the following variations in input data assumptions:

Capital Costs Uncertainty – assumed as per the cost uncertainties identified in the 2005 ROR (i.e. -10% / +20% for “Low” cost uncertainty, -10% / +40% for “Mid” cost uncertainty, -10% / +60% for “High” cost uncertainty).

Gas Price Uncertainty – assumed as: the “Medium” gas price of \$6.85/GJ for the “Low” calculation, the “High” gas price of \$10.95/GJ for the “Mid” and High” UEC calculations. The low gas price scenario is not used given its associated low probability of occurrence.

GHG Offset Cost Uncertainty – assumed as: \$17 per tonne for the “low” UEC calculation and \$42 per tonne for the “High” UEC calculation.

Table 1 – Detailed Adjusted Unit Energy Costs

Resource Option	Project Name	Installed Capacity (MW)	Effective Capacity ¹ (MW)	Average Annual Energy (GWh)	Annual Firm /Effective Energy ² (GWh)	Base UEC @ 6% Cost of Capital	CIFT (\$/MWh)	GHG Offset Cost (\$/MWh)	Line Losses (\$/MWh)	Capacity Credit (\$/MWh)	Carbon Tax (\$1.5/GJ)	Wind Integration Cost Adder (\$/MWh)	Total Adjusted UEC (\$/MWh)		
													Mid	Low	High
Biomass	Bundle-Biogas with Existing Capture	5	5	40	38	44	3	-	3	(3)	-	-	46	44	54
Small Hydro	LM Small Hydro Bundle1	32	11	168	106	54	-	-	-	(2)	-	-	53	47	74
Geothermal	South Meager Geothermal Project	100	100	800	800	59	-	-	-	(3)	-	-	55	51	79
Biomass	Bundle - Biogas with No Capture	8	8	64	61	63	1	-	2	(3)	-	-	63	60	76
Small Hydro	LM Small Hydro Bundle2	87	25	458	319	65	-	-	-	(1)	-	-	64	57	90
Small Hydro	LM Small Hydro Bundle3	179	49	898	637	75	-	-	-	(1)	-	-	74	66	104
Small Hydro	CI Small Hydro Bundle1	35	1	142	112	74	4	-	4	(0)	-	-	82	74	111
Small Hydro	KLY Small Hydro Bundle1	36	2	148	100	78	3	-	2	(0)	-	-	82	75	113
Biomass	Biomass - Municipal Solid Waste	51	51	408	408	88	(3)	-	0	(3)	-	-	82	78	100
Small Hydro	LM Small Hydro Bundle4	212	33	1,012	716	84	-	-	-	(1)	-	-	84	75	117
Small Hydro	EK Small Hydro Bundle1	25	0	95	71	75	5	-	4	(0)	-	-	84	77	114
Small Hydro	KLY Small Hydro Bundle2	32	2	128	93	84	3	-	2	(0)	-	-	89	80	122
Wind	Peace Wind Bundle 1	117	25	492	492	70	5	-	5	(1)	-	10	89	82	117
Wind	Peace Wind Bundle 2	232	49	947	947	72	5	-	5	(1)	-	10	91	84	120
Small Hydro	NC Small Hydro Bundle1	79	12	360	272	84	4	-	4	(1)	-	-	91	83	125
Small Hydro	NIC Small Hydro Bundle1	81	2	325	244	85	3	-	3	(0)	-	-	91	83	125
Small Hydro	EK Small Hydro Bundle2	115	2	432	297	83	5	-	5	(0)	-	-	92	84	125
Small Hydro	VI Small Hydro Bundle1	10	4	37	28	97	-	-	-	(3)	-	-	94	84	133

¹ Effective Load Carrying Capacity for intermittent resources and Dependable Capacity for non-intermittent resources.

² Firm Energy Load Carrying Capacity for intermittent resources and Annual Firm Energy for non-intermittent resources.

Resource Option	Project Name	Installed Capacity	Effective Capacity ¹ (MW)	Average Annual Energy (GWh)	Annual Firm Energy ² (GWh)	Base UEC @ 6% Cost of Capital	CIFT (\$/MWh)	GHG Offset Cost (\$/MWh)	Line Losses (\$/MWh)	Capacity Credit (\$/MWh)	Carbon Tax Cost (\$1.5/GJ)	Wind Integration Cost Adder (\$/MWh)	Total Adjusted UEC (\$/MWh)		
													Mid	Low	High
Small Hydro	LM Small Hydro Bundle5	156	29	709	526	96	-	-	-	(1)	-	-	95	86	134
Wind	Peace Wind Bundle 3	354	74	1,366	1,366	77	5	-	6	(1)	-	10	97	89	128
Small Hydro	SE Small Hydro Bundle1	44	0	166	116	88	5	-	5	(0)	-	-	98	89	133
Small Hydro	PR Small Hydro Bundle1	21	0	74	53	87	6	-	6	(0)	-	-	100	91	135
Small Hydro	NIC Small Hydro Bundle2	66	1	234	153	93	3	-	3	(0)	-	-	100	90	137
Small Hydro	KLY Small Hydro Bundle3	2	0	10	5	96	2	-	3	(0)	-	-	101	92	140
Wind	VI Wind Bundle 1	127	27	416	416	93	-	-	-	(2)	-	10	101	92	139
Wind	Peace Wind Bundle 4	408	86	1,476	1,476	82	6	-	6	(2)	-	10	103	94	135
Small Hydro	CI Small Hydro Bundle2	20	1	83	66	94	4	-	5	(0)	-	-	103	93	140
Small Hydro	NC Small Hydro Bundle2	83	13	362	271	95	4	-	5	(1)	-	-	103	93	141
Small Hydro	LM Small Hydro Bundle6	154	31	664	466	104	-	-	-	(1)	-	-	103	93	145
Small Hydro	PR Small Hydro Bundle2	16	0	54	39	92	6	-	7	(0)	-	-	105	96	142
Biomass	Bundle - Biomass Sawmill Wood Waste	100	100	800	800	104	2	-	3	(3)	-	-	105	95	147
Small Hydro	VI Small Hydro Bundle2	34	12	118	103	108	-	-	-	(3)	-	-	105	94	148
Small Hydro	EK Small Hydro Bundle3	23	1	88	57	96	5	-	5	(0)	-	-	107	97	145
Small Hydro	SE Small Hydro Bundle2	34	0	128	90	97	5	-	5	(0)	-	-	107	97	146
Wind	Peace Wind Bundle 5	353	74	1,195	1,195	87	6	-	6	(2)	-	10	108	99	143
Wind	VI Wind Bundle 2	102	22	312	312	100	-	-	-	(2)	-	10	108	98	148
Small Hydro	KLY Small Hydro Bundle4	31	1	111	84	104	3	-	3	(0)	-	-	110	100	152
Small Hydro	NIC Small Hydro Bundle3	27	1	101	72	104	3	-	4	(0)	-	-	111	100	152
Small Hydro	CI Small Hydro Bundle3	38	1	149	112	104	4	-	6	(0)	-	-	114	103	155
Small Hydro	PR Small Hydro Bundle3	33	0	123	89	101	6	-	7	(0)	-	-	114	104	154
Wind	VI Wind Bundle 3	300	300	2,400	2,400	107	-	-	-	(2)	-	10	115	104	158

Resource Option	Project Name	Installed Capacity (MW)	Effective Capacity ¹ (MW)	Average Annual Energy (GWh)	Annual Firm /Effective Energy ² (GWh)	Base UEC @ 6% Cost of Capital (\$/MWh)	CIFT (\$/MWh)	GHG Offset Cost (\$/MWh)	Line Losses (\$/MWh)	Capacity Credit (\$/MWh)	Carbon Tax (\$1.5/GJ)	Wind Integration Cost Adder (\$/MWh)	Total Adjusted UEC (\$/MWh)		
													Mid	Low	High
Small Hydro	NC Small Hydro Bundle3	112	24	320	320	107	4	-	5	(1)	-	-	115	104	158
Natural Gas - High Gas Price	Small Gas Co-generation Projects (Med GHG)	24	5	67	67	106	-	5	-	(3)	7	-	115	91	127
Wind	LM Wind Bundle 1	131	18	551	417	108	-	-	-	(2)	-	10	116	105	159
Small Hydro	EK Small Hydro Bundle4	81	1	286	190	105	6	-	6	(0)	-	-	117	106	159
Small Hydro	SE Small Hydro Bundle3	65	3	201	98	105	6	-	6	(0)	-	-	117	107	159
Wind	Peace Wind Bundle 6	342	72	1,053	1,053	96	7	-	7	(2)	-	10	118	108	156
Natural Gas - High Gas Price	Burrard Full CCGT - CCGT (Med GHG)	1,100	1,100	8,798	8,798	105	-	8	-	(3)	11	-	120	85	132
Natural Gas - High Gas Price	Burrard Half CCGT - CCGT (Med GHG)	550	550	4,399	4,399	106	-	9	-	(3)	11	-	121	86	133
Wind	KLY Wind Bundle 1	73	15	201	201	108	5	-	3	(2)	-	10	124	113	167
Wind	NIC Wind Bundle 1	79	17	217	217	108	4	-	4	(2)	-	10	124	113	167
Natural Gas - High Gas Price	Greenfield Combined Cycle Gas Turbine - 500 MW (Med GHG)	494	479	3,833	3,833	105	2	8	3	(3)	11	-	125	89	135
Wind	NC Onshore Wind Bundle 1	115	24	396	396	107	5	-	5	(2)	-	10	126	115	169
Wind	VI Wind Bundle 4	226	48	571	571	120	-	-	-	(2)	-	10	128	116	176
Natural Gas - High Gas Price	Greenfield Combined Cycle Gas Turbine - 250 MW (Med GHG)	243	236	1,887	1,887	108	2	8	3	(3)	11	-	128	93	139
Wind	SE Wind Bundle 1	69	14	189	189	108	8	-	6	(2)	-	10	130	118	172
Wind	EK Wind Bundle 1	137	29	378	378	108	8	-	6	(2)	-	10	130	119	173
Natural Gas - High Gas Price	VI Combined Cycle Gas Turbine - 500 MW (Med GHG)	494	479	3,831	3,831	115	-	8	-	(3)	11	-	130	93	140
Natural Gas - High Gas Price	VI Combined Cycle Gas Turbine - 250 MW (Med GHG)	243	236	1,887	1,887	118	-	8	-	(3)	11	-	134	97	144
Wind	NC Onshore Wind Bundle 2	93	19	299	299	115	6	-	6	(2)	-	10	135	123	180
Biomass	Bundle - Biomass					132							135	121	214

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													Mid	Low	High
	Roadside Wood Waste	200	200	1,600	1,600		2	-	4	(3)	-	-			
Wind	LM Wind Bundle 2	35	7	79	79	132	-	-	-	(2)	-	10	140	126	192
Wind	NC Onshore Wind Bundle 3	102	21	308	308	122	6	-	6	(2)	-	10	142	130	191
Wind	NC Offshore Wind Bundle 2	191	55	662	662	135	5	-	0	(2)	-	10	148	134	202
Wind	KLY Wind Bundle 2	106	22	237	237	132	6	-	4	(2)	-	10	149	136	202
Wind	NIC Wind Bundle 2	114	24	256	256	132	5	-	6	(2)	-	10	150	136	202
Wind	NC Offshore Wind Bundle 1	175	51	614	614	133	5	-	6	(2)	-	10	153	139	206
Wind	SE Wind Bundle 2	99	21	223	223	132	9	-	7	(2)	-	10	156	143	209
Wind	EK Wind Bundle 2	199	42	446	446	132	9	-	8	(2)	-	10	156	143	209
Natural Gas - High Gas Price	Greenfield Combined Cycle Gas Turbine - 50 MW (Med GHG)	50	49	391	392	135	2	8	4	(3)	11	-	156	118	170
Wind	NC Onshore Wind Bundle 4	205	43	553	553	137	7	-	7	(2)	-	10	158	144	213
Wind	NC Offshore Wind Bundle 3	203	59	685	685	139	5	-	7	(2)	-	10	159	145	214
Biomass	Biomass Standing Timber (Beetle Kill Timber)	170	170	1,360	1,360	158	2	-	5	(3)	-	-	161	145	224
Wind	NC Offshore Wind Bundle 4	207	60	680	680	142	6	-	7	(2)	-	10	162	143	212
Wind	NC Offshore Wind Bundle 5	203	59	649	649	146	6	-	7	(2)	-	10	166	152	225
Wind	NC Offshore Wind Bundle 6	191	55	594	594	150	6	-	7	(2)	-	10	171	156	231
Wind	NC Offshore Wind Bundle 7	173	50	522	522	155	6	-	8	(2)	-	10	176	160	238