

1
2 **DEAR MR WRUCK**

3 *Oct 18, 2017*

4 *We reply to your request for comments on the Alternative Portfolios in your letter*
5 *A-22 re:-1=*

6 *1 The underlying assumptions regarding the Alternative Portfolios*
7 *(see the Key Assumptions table for descriptions of all key assumptions);*
8 *and*

9 *2 The calculations, inputs and assumptions used in the Alternative-*
10 *Portfolio Spreadsheet*

11
12 **EXECUTIVE SUMMARY AND CONCLUSIONS---**

13 *We focus on just one basic underlying assumption, where we have several*
14 *independent pieces of evidence BC Hydro's assumption and calculations*
15 *are incorrect and we will explain why.*

16 *BC Hydro states they now have **48,857 GWhrs** Heritage energy and need*
17 *5,100 GWhrs from Site C in future.*

18 **Black and white moot question**

19 *BCUC should require BC Hydro to fill in one moot black and white*
20 *question whether Heritage totals more than 48,857 GWhrs.*

21 *Appendix S below is a table of BC generating plants from Wikipedia, (or*
22 *BC Hydro posted "Quick Facts" Jan. 2017 showing a list of 30 plants, whichever*
23 *correctly shows all plants)*

24 *BCUC should ask BC Hydro Please fill in the average energy capability of*
25 *each plant, witnessed by Deloitte and add them up (that information is*
26 *readily available in BC Hydro dispatch or generation or archives).*

27 *If it totals over 48,857 GWhrs, it will postpone if and when Site C is*
28 *required (see Table 3-8) and BC Hydro should so indicate.*

29 *IF it comes to 54,000 GWhrs or more, **BCUC can reasonably conclude***
 30 ***Site C is not needed** and proceed from there, simplifying the inquiry and*
 31 *minimizing related costs.*

32 ***EVIDENCE HERITAGE Capacity exceeds 54,000 GWhr***

33 *Below are several pieces of incontrovertible pieces of independently found*
 34 *evidence*

35

36

37 *1/Dr Vern **Ruskin** submitted **F26-7, F 26-8 and F-308** which show*
 38 *heritage energy capacity is around **54,721 GWhr/year** using*
 39 *information directly supplied by BC Hydro.*

40 *Please also see Appendix R*

41 *He also believes a very serious and costly engineers error; assuming*
 42 *48,857 GWhr for Heritage energy, possibly*

43 *i/misled bc Hydro to start Site C in 2014 ,and possibly*

44 *ii/misled the BC government to issue instruction No. 7, to BCUC dated*
 45 *March 6 2014 to BCUC, that the Heritage energy shall be taken as slightly*
 46 *less than 49,000 GWhrs/year.*

47

48

49 *Long ago Dr Ruskin originally planned and directed the Heritage system with a 45*
 50 *person staff, knows its details, and after retirement volunteered to research future*
 51 *ways to stop the needless rate spiral.*

52

53 ***2 Mr. Roger Bryenton P.Eng MBA found Heritage energy is***
 54 ***54,260 GWhr using info from the BC Hydro Annual Reports and Service***
 55 ***Plans, over the period of 2013 to 2017 .***

56 ***1. "Averaging and normalizing Heritage resources for "average flows",***
 57 ***results actual Heritage Resources capability is **54,260 GWhrs/year,*****
 58 ***(average flows)."***

59 ***2. that differs from the number erroneously shown as 48,857 GWhr by***
 60 ***5,403 GWhr, ie more than the entire 5,100 output of Site C.***

61 3. **It is clear that there is NO NEED for Site C.** The costly error
 62 created by using RRA data thus appears to support a need for Site C
 63 *capacity and might have misled BC Hydro to start Site C in 2014.*
 64

65 **3 BC Hydro,s Own 2017 Figures show Heritage capacity in**
 66 **Table 3-8 was understated in the Terms of Reference for**
 67 **this inquiry**

68 **4 In its (load-resource balance table 3-8 REF #!1) BC Hydro says it has only 48857**
 69 **GWh of energy. This amount underlines its case for building Site C. But elsewhere,**
 70 **BC Hydro claims to have 59345 GWh (REF#2)from BC HYDRO. The difference is**
 71 **more than the production of Site C. If indeed the latter source is correct, then by BC**
 72 **Hydro's own arithmetic there is no need for Site C for years to come, at least.**

73 *REF#1 please see the load-resource balance table 3-8 included in the terms*
 74 *of reference sent to all interveners. Their Heritage resources are shown as*
 75 *46,491 GWhrs up to 2023, in 2024 they are shown as 48,857 GWhrs which*
 76 *is the highest number we have taken here.*

77 *That is the supposed justification for showing Site C in 2025 in the table.*

78 *REF #2 We note Heritage energy capacity is 59,345 GWhr directly from*
 79 *BC Hydros own January 2017 Fact sheet*

80

81

82 *Please see*

83 <https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/accountability-reports/financial-reports/annual-reports/bchydro-quick-facts-june-2017.pdf>

86 *It shows 2017 heritage generating capacity =11,869 MW, states 5--times is*
 87 *energy output for hydro= 59,345 Gwh*

88 **Power to Energy Ratios – Rule of Thumb**

89 Power to energy – for large hydro:

90 MW x 5 = GWh per year

91

<p>(of 1 billion watts)</p> <p>Units of energy</p> <ul style="list-style-type: none"> • 1 kilowatt hour (kWh) = 1,000 watts for 1 hour (1,000 watt hours) • 1 megawatt hour (MWh) = 1,000 kWh • 1 gigawatt hour (GWh) = 1,000 MWh • (Note that the abbreviations for prefixes follow metric convention, so kilo is k, while mega and giga are capitalized. The abbreviation for watt is W) <p>Power to Energy ratios—rule of thumb</p> <ul style="list-style-type: none"> • Power to energy—for thermal electric: MW x 8 = GWh per year • Power to energy—for large hydro: MW x 5 = GWh per year 	<table border="1"> <thead> <tr> <th colspan="3">Average Revenue (per kilowatt-hour)¹</th> </tr> </thead> <tbody> <tr> <td>Residential</td> <td>10.6¢</td> <td>10.0¢</td> </tr> <tr> <td>Light industrial and commercial</td> <td>9.1</td> <td>8.6</td> </tr> <tr> <td>Large industrial</td> <td>5.6</td> <td>5.3</td> </tr> <tr> <th colspan="3">Average Annual Kilowatt-Hour Use Per Residential Customer Account</th> </tr> <tr> <td></td> <td>9,958</td> <td>9,919</td> </tr> <tr> <th colspan="3">Peak One-Hour Integrated System Demand (megawatts)</th> </tr> <tr> <td></td> <td>9,602</td> <td>9,441</td> </tr> <tr> <th colspan="3">Lines In Service</th> </tr> <tr> <td>Distribution (kilometres)</td> <td>58,765</td> <td>58,518</td> </tr> <tr> <td>Transmission (circuit kilometres)</td> <td>20,176</td> <td>19,792</td> </tr> </tbody> </table>	Average Revenue (per kilowatt-hour) ¹			Residential	10.6¢	10.0¢	Light industrial and commercial	9.1	8.6	Large industrial	5.6	5.3	Average Annual Kilowatt-Hour Use Per Residential Customer Account				9,958	9,919	Peak One-Hour Integrated System Demand (megawatts)				9,602	9,441	Lines In Service			Distribution (kilometres)	58,765	58,518	Transmission (circuit kilometres)	20,176	19,792	<table border="1"> <tbody> <tr> <td>Walter Hardman</td> <td>8.0</td> </tr> <tr> <td>Whatsban.....</td> <td>54.0</td> </tr> <tr> <td></td> <td style="border-top: 1px solid black;">11,868.7</td> </tr> <tr> <td colspan="2">Thermal</td> </tr> <tr> <td>Fort Nelson</td> <td>73.0</td> </tr> <tr> <td>Prince Rupert</td> <td>46.0</td> </tr> <tr> <td></td> <td style="border-top: 1px solid black;">119.0</td> </tr> <tr> <td colspan="2">Diesel Generation</td> </tr> <tr> <td>† Ah-Sin-Heek</td> <td>7.6</td> </tr> <tr> <td>† Anahim Lake</td> <td>3.9</td> </tr> <tr> <td>† Atlin</td> <td>2.7</td> </tr> <tr> <td>† Bella Bella</td> <td>4.9</td> </tr> <tr> <td>† Dease Lake</td> <td>3.5</td> </tr> <tr> <td>† Eddontenajon</td> <td>1.7</td> </tr> <tr> <td>† Elhlateese</td> <td>0.2</td> </tr> <tr> <td>† Hartley Bay</td> <td>1.1</td> </tr> <tr> <td>† Kwadacha</td> <td>1.8</td> </tr> <tr> <td>† Masset</td> <td>13.1</td> </tr> <tr> <td>† McBride</td> <td>5.0</td> </tr> </tbody> </table>	Walter Hardman	8.0	Whatsban.....	54.0		11,868.7	Thermal		Fort Nelson	73.0	Prince Rupert	46.0		119.0	Diesel Generation		† Ah-Sin-Heek	7.6	† Anahim Lake	3.9	† Atlin	2.7	† Bella Bella	4.9	† Dease Lake	3.5	† Eddontenajon	1.7	† Elhlateese	0.2	† Hartley Bay	1.1	† Kwadacha	1.8	† Masset	13.1	† McBride	5.0
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Expanded portion of BC Hydro Quick Facts June 2017

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94

95

96 **CONCLUSION**

97

98 *1. We are mystified by why BCUC would float alternatives based on wind alone when*
 99 *there are many other alternatives, before finishing to hear all presenters, and provide a*
 100 *six-day turnaround requirement.*

101 *2. We believe a serious costly BC Hydro Engineers error in 2014; assuming*
 102 *48,857 GWhr for Heritage energy, possibly*

103 *2.1/misled BC Hydro to start Site C in 2014, and possibly*

104 *2.2/misled the BC government to issue instruction No. 7 to BCUC dated*
 105 *March 6 2014 to BCUC, that the Heritage energy shall be taken as slightly*
 106 *less than 49,000 GWhrs/year.*

107

108 *2.3/We suggest BCUC should request it now be updated to correspond to*
 109 *reality, namely around 54,260 GWhr year.*

110

111 ***3. The Average Heritage energy capacity is around 54,246***
 112 ***GWhrs/year, and should be used by BCUC in all spreadsheets.***

113 ***4. Our evidence completely supports the conclusion in the Submission of Dr.***
 114 ***Harry Swain F36-1 namely***

115 ***4.1 We don't need Site C and***

116 ***4.2 We don't need a replacement portfolio.***

117

118

119

120 *Yours sincerely*

121 *Signed*

122 ***Vern Ruskin Roger Bryenton Lorne Thomas***

123
124 **APPENDIX R**

125
126 **Alternative Portfolios**

127
128
129 There are 6 easy portfolios of alternative generation available aggregating 4 times the
130 size of Site C at a fraction of it's cost.

131
132 **ADD GENERATORS**

133 **Duncan dam** floods 25 miles back , and has sat without generators for over 50 years. It seems
134 reasonable to installing around 100 MW generators, adding around 276 GWhr/year. Over 50
135 years, it wastefully spilled 13,800 GWhr energy down the river.

136

137 **Keenleyside dam** originally had no generators, and BC Hydro later poorly built a
138 vibrating powerhouse with insufficient generators, only 185 MW that BC Hydro shut down
139 for safety. It needs a better- built powerhouse, 350 MW and 1,445 GWhrs but doesn't
140 need building any new dam. It's wasteful and shameful to leave it shut down, particularly
141 because 2,300 people and good land were flooded out to build Keenleyside dam.



143 *Worse, ten years after construction in 1974, BC Assistant Deputy Minister McNabb, admitted at*
144 *SFU (ref 36)“: Under the Columbia River Treaty, BC Hydro could have avoided building*
145 *Keenleyside dam altogether, and flooding out 2,300 angry people including First Nations, and*
146 *saved good agricultural land and ratepayer’s money (ref #36 in my book “Clean Energy*
147 *Starvation in the Midst of Plenty”, Ruskin, Amazon 2013, ISBN981492222552) (shades*
148 *of Site C?)*

149

150 **Further Old Heritage Plant Upgrades**

151 *From past experience I estimate by this you can add another 2,000 GWhr/year of*
 152 *upgradable potential by redoing all of the "old" sites (assumed at nationalization) that*
 153 *currently represent 12% of capacity but produce a paltry 8% at a capacity factor of 37%,*
 154 *through mostly neglect.*

155

156 **CYCLIC Operation of Lake Williston**

157 *(can replace 90% of Site C now at no cost., see my F-308 submission to BCUC)*

158 **Lake Williston behind WAC Bennett dam (Site A) holds 20 years of Peace River**
 159 **flows, so it evens out any high and low flow years.**

160

161

162

	Gwhr	Gwhr	% of Site C
BC Hydro Table 3-8 says Heritage Avg Resources	48,491		
Add Keenlyside Generators	1,445		28%
Add Duncan Generators	276		5%
BC Hydro understated Resources by	4,500		88%
Lake Williston diversity plus cyclic scheduling (ie 5 year moving avg over 20 year span)	4,600		90%
		59,312	
Add Columbia River Treaty	4,100		80%
Sub Total Available Resources		63,412	
Powerex short term potential purchases		5,000	98%
Total Available Resources with Powerex		68,412	

164 *If BC Hydro operated Lake Williston it the way, BC Electric originally planned it ,it could add*
 165 *around 4,600 GWhr (around 90% of Site C capacity), AT NO COST*

166 *BC Hydro's annual reports definitely show they do NOT schedule Lake Williston on a cyclical*
 167 *multi-year basis. On a cyclical basis, the Peace River generation would be higher when the*
 168 *Columbia River and other hydro is lower, and vice versa, which is not shown.*

169

170 This no extra cost energy could halt the rate spiral for ratepayers

171

172 *Flow figures I used are from a joint BPA-BC Hydro computer study so they can be trusted.*

173 *I checked to see if there was diversity between Peace and Columbia Rivers and lower mainland*
 174 *ivers. The low flow at each of these watersheds is not synchronized.*

175

176

177 APPENDIX S

Name	Date	Capacity (MW)	Location	Owner	Type	Ref
Aberfeldie Dam	1953	24	49°29'56"N 116°21'27"W	BC Hydro	Hydro	[1]
Akolkolex	1995	10	50°49'21"N 118°01'46"W	TransAlta	Hydro	[2]
Alouette Lake	1928	9	49°17'10"N 122°29'14"W	BC Hydro	Hydro	[1]
Arrow Lakes/Keenleyside Dam	2002	185	49°20'22"N 117°46'19"W	Columbia Power Corporation	Hydro	[3]
Ash River	1959	28	49°22'30"N 125°9'12"W	BC Hydro	Hydro	[1]
Ashlu Creek	2010	49.9	49°54'51"N 123°19'30"W	Innergex Renewable Energy	Hydro	[4]
Bonnington Falls	1905	16	Nelson	Nelson Hydro	Hydro	[5]
Boston Bar Hydro (Scuzzy Creek)	1995	6	49°48'41"N 121°27'30"W	Boston Bar LP	Hydro	[6]
Brandywine Creek	2003	7.6	50°03'28"N 123°07'52"W	Run of River Power	Hydro	[7]
Bridge River Power Project	1948	478	50°43'54"N 122°14'33"W	BC Hydro	Hydro	[1]
Brilliant Dam	1944	145	49°19'29"N 117°37'12"W	Columbia Power Corporation	Hydro	[3]
Brilliant Expansion	2009	120	49°19'23"N 117°37'11"W	Columbia Power Corporation	Hydro	[3]
Brown Lake	1996	7	54°01'38"N 129°50'37"W	Capital Power Corporation	Hydro	[8]
Buntzen Lake	1951	73	49°22'30"N 122°52'07"W	BC Hydro	Hydro	[1]
Chesakamus	1957	158	49°56'47"N 123°17'21"W	BC Hydro	Hydro	[1]
China Creek	2005	6.5	Port Alberni	Upnit Power Corporation	Hydro	[9]
Clowhom Dam	1957	33	49°42'41"N 123°32'7"W	BC Hydro	Hydro	[1]
Coats IPP	1985	0.5	Gabriola Island	Crofter's Gleann Enterprises Ltd.	Hydro	[6]
Corra Linn Dam	1932	49	49°28'22"N 117°28'0"W	FortisBC	Hydro	[10]
Cypress Creek	2009	2.8	Gold River	Synex Energy Resources Ltd	Hydro	[11]
Doran Taylor Hydro	1996	5.6	Port Alberni	Summit Power	Hydro	[6]
Douglas Creek (Kwalsa Energy)	2010	27.6	49°46'37"N 122°19'4"W	Cloudworks Energy	Hydro	[12]
Eagle Lake Micro Hydro	2003	0.2	West Vancouver	District of West Vancouver	Hydro	[13]
East Toba	2010	123	Powell River	Plutonic Power	Hydro	[14]
East Twin	1991	1.5	McBride	Brookfield Renewable Power	Hydro	[15]
Eldorado Reservoir	2009	1.1	Kelowna	District of Lake Country	Hydro	[16]
Elko Dam	1924	12	49°17'22"N 115°6'16"W	BC Hydro	Hydro	[1]
Falls River	1930	7	53°58'59"N 129°44'03"W	BC Hydro	Hydro	[1]
Fire Creek (Kwalsa Energy)	2010	25	49°46'59"N 122°14'6"W	Cloudworks Energy	Hydro	[12]
Fitzsimmons Creek	2010	7.5	Whistler	Innergex Renewable Energy	Hydro	[4]
Furry Creek	2004	11	50°43'30"N 130°40'22"W	Fort Chicago Energy Partners	Hydro	[17]
Forrest Kerr Generating Station	2014	195	55°0'58"N 122°12'19"W	AltaGas	Hydro	[18]
Gordon M. Shrum Generating Station	1968	2876	55°0'58"N 122°12'19"W	BC Hydro	Hydro	[1]
Hauer Creek (aka Tete)	2007	3	Valemount	Hauer Creek Power Inc.	Hydro	[6]
Huey Lake (SNP)	1999	3	Dease Lake	Capstone Infrastructure	Hydro	[19]
Hystad Creek	2002	5.7	Valemount	Brookfield Renewable Power	Hydro	[15]
John Hart Dam	1947	126	50°2'35"N 125°18'38"W	BC Hydro	Hydro	[1]
Jordan River Dam	1971	170	48°28'37"N 123°59'51"W	BC Hydro	Hydro	[1]
Kemano Generating Station	1953	790	53°33'48"N 127°56'32"W	Rio Tinto Alcan	Hydro	[20]
Kootenay Canal	1975	583	49°27'10"N 117°30'55"W	BC Hydro	Hydro	[1]
Ladore Falls	1956	47	50°0'53"N 125°23'27"W	BC Hydro	Hydro	[1]
Lajoie Dam	1957	25	50°50'14"N 122°51'29"W	BC Hydro	Hydro	[1]
Lamont Creek (Upper Stave Energy)	2010	28	49°33'58"N 122°21'11"W	Cloudworks Energy	Hydro	[12]
Lois Lake	1930	37.4	Powell River	Brookfield Renewable Power	Hydro	[21]
Lower Bonnington	1925	66	49°27'39"N 117°29'58"W	FortisBC	Hydro	[10]
Lower Clowhom	2009	11	Sechelt	Fort Chicago Energy Partners.	Hydro	[22]
Malibu Hydro	2005	0.6	Malibu	Malibu Club	Hydro	[23]
Mamquam Hydro	1996	52	Squamish	Atlantic Power Corporation	Hydro	[24]
Marion 3 Creek	2005	4.6	Port Alberni	Marion Creek Hydro Inc.	Hydro	[25]
McDonald Ranch	1993	0.1	Grasmere	McDonald Ranch & Timber Co. Ltd.	Hydro	[6]
McNair Creek Hydro	2004	9.8	Port Mellon	Renewable Power Corp.	Hydro	[26]
Mears Creek	2004	3.8	Gold River	Synex Energy Resources Ltd	Hydro	[11]
Mica Dam	1976	2800	52°43'35"N 118°34'0"W	BC Hydro	Hydro	[8]
Miller Creek	2003	33	Pemberton	Capital Power Corporation	Hydro	[8]
Montrose Creek	2010	73	Powell River	Plutonic Power	Hydro	[14]
Morehead Creek	1994	0.11	Williams Lake	Morehead Valley Hydro	Hydro	[27]
Moresby Lake Generating Station	1990	6.6	Haida Gwaii	Atlantic Power Corporation	Hydro	[28]
Ocean Falls	1922	14.5	Ocean Falls	Boralex	Hydro	[29]
Peace Canyon Dam	1980	694	55°58'57"N 121°59'34"W	BC Hydro	Hydro	[1]
Pine Creek	2009	2.1	Atlin	Taku River Tlingit First Nation	Hydro	[30]
Pingston Creek	2003	45	Revelstoke	Brookfield Renewable Power,	Hydro	[31]
Powell Lake	1911	46	Powell River	TransAlta	Hydro	[21]
Ptarmigan Creek – RBV (Robson Valley)	1993	3.6	McBride	Robson Valley Power Corp	Hydro	[6]
Puntledge	1955	24	49°41'15"N 125°2'3"W	BC Hydro	Hydro	[1]
Raging River 1 Small Hydro	2002	1.8	Port Alice	Raging River Power & Mining Inc.	Hydro	[32]
Revelstoke Dam	1984	2480	51°31'57"N 118°11'40"W	BC Hydro	Hydro	[1]
Ruskin Dam	1930	105	49°11'43"N 122°24'28"W	BC Hydro	Hydro	[1]
Rutherford Creek	2004	49.9	Mount Currie	Innergex Renewable Energy	Hydro	[4]
Seaton Creek Hydro (Homestead)	1997	0.3	New Denver	Homestead Hydro Systems	Hydro	[6]
Sechelt Creek (Salmon Inlet)	1997	17	Sechelt	Macquarie Power & Infrastructure	Hydro	[33]
Seton Powerhouse	1956	48	50°40'23"N 121°55'27"W	BC Hydro	Hydro	[1]
Seven Mile Dam	1979	805	49°14'7"N 117°30'11"W	BC Hydro	Hydro	[1]
Shuswap River	1929	6	50°17'44"N 118°48'45"W	BC Hydro	Hydro	[1]
Soo River	1994	14	50°13'34"N 122°54'41"W	Summit Power	Hydro	[34]
South Cranberry Creek	2008	9	Revelstoke	Advanced Energy Systems Ltd.	Hydro	[6]
South Slocan	1928	54	49°27'24"N 117°31'5"W	FortisBC	Hydro	[10]
South Sutton Creek	2005	5	Port Alberni	South Sutton Creek Hydro Inc.	Hydro	[6]
Spillimacheen	1955	4	50°54'11"N 116°24'33"W	BC Hydro	Hydro	[1]
Stave Falls Dam	1912	91	49°13'46"N 122°21'17"W	BC Hydro	Hydro	[1]
Stokke Creek (Kwalsa Energy)	2010	21	49°42'39"N 122°2'3"W	Cloudworks Energy	Hydro	[12]
Strathcona	1958	64	49°59'48"N 125°3'56"W	BC Hydro	Hydro	[1]
Tipella Creek (Kwalsa Energy)	2010	16.7	49°44'27"N 122°9'44"W	Cloudworks Energy	Hydro	[12]
Tyson Creek Hydro	2009	9.3	Sechelt	Renewable Power Corp.	Hydro	[35]
Upper Bonnington	1907	66	49°27'36"N 117°29'11"W	FortisBC	Hydro	[10]
Upper Clowhom	2009	11	Sechelt	Fort Chicago Energy Partners	Hydro	[22]
Upper Mamquam	2005	25	Squamish	TransAlta	Hydro	[2]
Upper Stave River (Upper Stave Energy)	2010	33.5	49°37'22"N 122°26'58"W	Cloudworks Energy	Hydro	[12]
Wahleach Lake	1952	63	49°15'17"N 121°36'20"W	BC Hydro	Hydro	[1]
Walden North	1993	18	Lillooet	FortisBC	Hydro	[6]
Walter Hardman	1960	8	50°48'36"N 118°3'53"W	BC Hydro	Hydro	[1]
Waneta Dam	1952	490	49°00'15"N 117°36'43"W	BC Hydro, Teck	Hydro	[36][37]
Whatshan Dam	1972	54	49°54'59"N 118°7'0"W	BC Hydro	Hydro	[1]
Woodfibre Dam	1947	2.59	Squamish	Western Pulp LP	Hydro	[38]
Zeballos Lake	2009	23	Zeballos	Zeballos Lake Hydro LP	Hydro	[39]