

Name: Eoin Finn

Date: October 11, 2017

Please see attached letter regarding an expansion of comments I made at the October 5th Community Input Session in Vancouver. The expansion was requested by Chairman Morton.

Oct. 11th, 2017

Re: E. Finn address of Oct. 5th – supplementary evidence

Sirs/Madam:

At the community input session in Vancouver on October 5th, Chairman Morton asked me to submit some additional information to support statements I made in my address. My statements were focused mainly in four areas:

1. The DSM provision of the Clean Energy Act and its effects on BC Hydro’s demand forecast;
2. BC Hydro’s poor financial state;
3. Rate effects of the Keeyask/Bipole and Muskrat Falls projects; and
4. The likelihood that a BC LNG industry will develop.

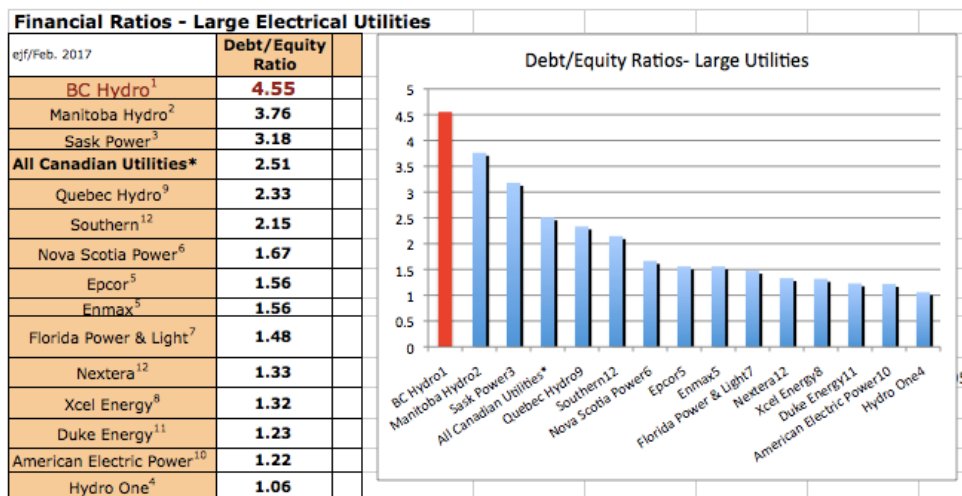
I submit the following supplemental material in support of my comments.

1. DSM and BC’s Clean Energy Act

In the Act, Section 2(b) (BC’s Energy Objectives) explicitly states that the Authority (BC Hydro) is “to take demand-side measures and to conserve energy, including the objective of the authority reducing its expected increase in demand for electricity by the year 2020 by at least 66%”. I do not see compliance with that directive reflected in BC Hydro’s demand forecasts. I suggest that, were it to be so, the forecasted demand would be met by a far more aggressive DSM than the paltry 1% (602GWh) achieved so far and satisfying it would not require the construction of Site C. Other utilities are exceeding 4% saving.

2. BC Hydro’s poor financial state

As many commenters have stated, BC Hydro’s finances are in something of a mess. A key measure of its financial health - its debt-to-equity ratio - is 4.55:1. As shown in the graph following, that is much greater than that of its Utility industry peers.¹



¹ http://www.bclaws.ca/civix/document/id/complete/statreg/10022_01#section2

The primary reason for this is because of Hydro's aggressive use of an accounting device called deferral accounts. Using this device, the annual shortfall in operating revenue has been continually added to BC Hydro's rapidly growing ~\$30B debt/deferrals burden. The BC government has, by imposing a unique accounting standard on BC Hydro, allowed this financial manipulation to occur by circumventing the attentions of an independent regulator.

3. Rate effects of the Muskrat Falls and Keeyask/Bipole projects

Long-term dam projects run serious risks of budget overruns, power gluts, borrowing rate hikes and depressed export prices – all of which combine to make Site C a high-risk project. BC Hydro has chosen to ignore the recent dam-building experience of two peer-group Canadian utilities, suggesting instead that these are “outliers”. Published thumbnails of these projects highlight the difficulties they have encountered:

Muskrat Falls (Newfoundland & Labrador)

- Budget overrun (\$6.7Billion -> \$12.7B); Approved with no regulatory review - lessons for BC;
- Latest expected power cost (2019): \$233 per MWh – triple what BC Hydro is postulating for Site C's UEC;
- Nalcor Customer bills are set to double from \$150/mo. -> \$300/mo.

Keeyask/Bipole III (Manitoba) – built mainly for export to U.S.

- Manitoba Hydro's recent 2017-2018 rate application² is a sobering read;
- Budget overrun \$6.5B -> \$8.7B; In-service date 2 years delayed;
- Increased Debt burden- by 2020, 70% of Manitoba Hydro's domestic revenues will go for servicing an expected \$25 Billion debt. This will risk a downgrade of Manitoba's credit rating for its entire provincial debt;
- The effect on Customer rates: 7.9% increases for each of next 5 years, with a warning of up to 18% hikes if interest rates go up 100 basis points or wholesale rates in U.S. hub continue falling. With QE (Quantitative Easing) ending in the U.S. and predictions of electricity supply gluts causing electricity futures to fall further, both of those outcomes are more than possible.

Both of these projects are very comparable in scale and complexity to Site C. Both illustrate the various risks of long-term dam construction projects that are beginning to afflict the Site C project. They are not “outliers” - worldwide experience with building dams was recently echoed by the Munk school at the University of Toronto³: **In the energy sector, a 2013 study by Flyvbjerg and Atif Ansar found that, of 245 large hydro dam projects in 65 countries, the cost escalated on average by 90 percent between the final approved*

²https://www.hydro.mb.ca/regulatory_affairs/pdf/electric/general_rate_application_2017/02.0_tab_2_key_messages_and_reasons_for_a_rate_increase.pdf

³https://munkschool.utoronto.ca/imfg/uploads/334/imfg_perspectives_n011_costoverruns_matti_siemiatycki.pdf. Original reference: 10 Flyvbjerg, B., and Ansar, A. 2014. Should we build more large dams? the actual costs of hydropower megaproject development. *Energy Policy*, March, 1–14.

budget and the completed project. There was no improvement in budget accuracy over the 70 years of data that the study covered.¹⁰

4. Likelihood of a BC LNG Industry

BC Hydro's forecast suggests that a 3-project BC LNG export industry would consume almost 60% (2800 GWh) of Site C's output. However, it has not factored into that estimate the probability that the industry – or specifically these three projects requesting grid power- will actually materialize. That is a serious error, because:

- There is currently a large and growing glut of LNG supply in the target Asia-Pacific market. Japan (over 1/3rd of the 265 million tonnes of worldwide annual LNG demand) has commenced reactivating over 40 of the 54 nuclear reactors mothballed since the Fukushima disaster of 2011. In the wake of that disaster, Japan's power-generation needs for LNG fuel sparked an LNG seller's market in Asia. LNG prices spiraled to a peak of \$18.50/million BTUs (mmBTU). This in turn triggered a worldwide spate of "Final Investment Decisions" (FIDs) in new LNG plants to liquefy the methane supplies made abundant by new directional drilling/fracturing (fracking) techniques. The resulting oversupply caused Asian LNG prices to plummet back to the ~\$6/mmBTU price that has prevailed since late 2014. Prices of the ubiquitous commodity may fall further as the supply glut threatens to grow (100% by 2025 to 600 million tonnes per annum) much faster than worldwide demand growth (2-4% p.a.);
- Unlike the 16 active LNG export projects in the U.S. (easily converted from earlier roles as LNG import terminals, 2 of them already in service), the 20+ proposed BC LNG plants are almost all "greenfield" sites requiring long pipelines from N.E. BC gas fields to expensive, skilled labour-short, First Nations-owned locations on the BC coast. At LNG prices below US\$10, BC plants, whose capex costs are around \$1,000/tonne of LNG, are uneconomic and uncompetitive with a slew of proposed U.S. (16), Russian (3), Iranian/Qatari (3), African (6) and Australian (6) LNG export plants, most of them located in far less costly areas of the world. Details of the 45 proposed LNG export plants, in various stages of completion, that will double the world LNG supply over the next decade are shown following. The green shading on the right shows a balancing of world supply-demand not occurring until the mid-2030s at best (if annual demand doubles to 4.5%).
- China – long expected to need LNG to assist its switch from using coal as a power-generation source, is instead being served by the construction of two "Power of Siberia" pipelines⁴ which will bring 50 million tonnes of Russian gas – not expensively liquefied, shipped and regasified LNG – to its factories, homes and (maybe) power utilities every year for 30 years when completed in 2019-20. China is also developing its own extensive shale-gas reserves – the 13th largest in the world (Canada's are 21st).

⁴ <http://www.gazprom.com/about/production/projects/pipelines/built/ykv/>

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efj/July 2017 **New/Expanded LNG Production facilities coming onstream by end 2025 *** 2025 4.50%

#	Country	Site	MPA	Startup Year	Target Market	Year	Demand Growth Rate p.a.**	D=S	FID taken ?	
							World LNG Demand (MTPA)	Year	Gth. Rate	
1	Russia	Yamal LNG (Novatek, Total, CNPC)	16.5	2018-20	Asia	2013	240	0	2.6%	Yes
1	Russia	Vladivostok LNG	0.0	FID Postponed	Europe	2014	243	1	2.6%	
2	Russia	Shell, Gazprom Baltic LNG	0.0	2023	Europe	2015	245	2	0.9%	
3	Russia	Novatek Arctic LNG 2	26.0	2025	Europe	2016	265	3	8.0%	
4	Qatar	North Field development	30.0	2024	Europe/	2017	277	4	4.5%	
5	Qatar	Qatar Gas, ExxonMobil Barzan Gas	10.0	2017	Europe/Asia	2018	289	5	4.5%	Yes
6	Australia	Chevron Gorgon LNG	15.6	2017	Asia	2019	302	6	4.5%	Yes
7	Australia	CNPC,LNGL Fisherman's Landing LNG	0.0	FID Postponed	Asia	2020	316	7	4.5%	
8	Australia	PetroChina Shell Arrow LNG	0.0	Cancelled	Asia	2021	330	8	4.5%	
9	Australia	INPEX Ichthys LNG (Darwin)	8.9	2018	Asia	2022	345	9	4.5%	Yes
10	Australia	Prelude Floating LNG	3.6	2018	Asia	2023	361	10	4.5%	Yes
11	Australia	Chevron Wheatstone LNG	8.9	2018	Asia	2024	377	11	4.5%	Yes
12	Australia	Browse FLNG	0.0	Cancelled	Asia	2025	394	12	4.5%	
13	Australia	Sunrise LNG	0.0	Cancelled	Asia	2026	412	13	4.5%	
14	Australia	Santos/GDF Bonaparte LNG	0.0	Cancelled	Asia	2027	430	14	4.5%	
15	Papua New Guinea	Gulf LNG	8.0	2020	Asia	2028	449	15	4.5%	
16	Papua New Guinea	BP Tanqouh LNG (Train 3 Expansion)	3.8	2020	Asia	2029	470	16	4.5%	Yes
17	Indonesia	Inpex Abadi Floating LNG	7.5	2019	Asia	2030	491	17	4.5%	
18	Malaysia	Petronas Floating LNG-1 (Sarawak)	1.2	2017	Asia	2031	513	18	4.5%	Yes
19	Sarawak	Petronas Bintulu LNG Train 9	3.5	2017	Asia	2032	536	19	4.5%	
20	Malaysia	Petronas Floating LNG-2 (Sabah)	0.0	FID postponed	Asia	2033	560	20	4.5%	
21	Iran	Iran LNG	10.8	2019	Europe/Asia	2034	585	21	4.5%	Yes
22	Equatorial Guinea	Ophir Fortuna GORLNG project	0.0	FID postponed	Europe	2035	612	22	4.5%	
23	Nigeria	NNPC, Chevron, Shell and BG Olokola LNG	0.0	FID Postponed	Europe	2036	639	23	<-	
24	Mozambique	Eni/Anadarko Rovuma LNG	0.0	FID Postponed	Europe/Asia	2037	668	24	<-	
25	Mozambique	Eni-Kogas-CNPC Coral FLNG	3.6	2022	Europe/Asia	2038	698	25	<-	
26	Tanzania	BG,Statoil Tanzania LNG	10.0	2021	Asia	2039	729	26	<-	
27	Cameron	Engie/SNH/ GDF Suez Kribi LNG	0.0	FID postponed	Europe	2040	762	27	<-	
28	U.S.	Alaska LNG (BP, ConocoPhillips, Exxon)	0.0	FID Postponed	Asia	2041	796	28	<-	
29	U.S.	Magnolia LNG	8.0	FID Postponed	Europe	2042	832	29	<-	
30	U.S.	Shell/BG Lake Charles LNG	0.0	FID Postponed	Europe/Asia	2043	870	30	<-	
31	U.S.	Cheniere Corpus Christi LNG	13.5	2018	Europe/Asia	2044	909	31	<-	Yes
32	U.S.	Dellfin FLNG (off Louisiana coast)	13.0	2022	Europe/Asia	2045	950	32	<-	
33	U.S.	Dominion Cove Point LNG (Maryland)	5.9	2018	Japan, India	2046	993	33	<-	Yes
34	U.S.	Tellurian Driftwood LNG	26.0	2025	Europe/Asia	2047	1037	34	<-	
35	U.S.	Kinder-Morgan Elba Island LNG (Georgia)	4.0	2019	Europe	2048	1084	35	<-	Yes
36	U.S.	Leucadia Oregon LNG	0.0	Cancelled	Asia	2049	1133	36	<-	
37	U.S.	Mitsubishi, NYK Cameron LNG	12.0	2019	Europe/Asia	2050	1184	37	<-	Yes
38	U.S.	Freeport LNG (Freeport, Texas)	16.4	2019	Europe/Asia	2051	1237	38	<-	Yes
39	U.S.	Veresen Jordan Cove LNG (Coos Bay, Oregon)	0.0	FID Postponed	Asia	2052	1293	39	<-	
40	U.S.	NextDecade RioGrandeLNG (Brownsville, TX)	27.0	2022	Europe/Asia	2053	1351	40	<-	
41	U.S.	Joyts Point Comfort LNG-nearshore FLNG (TX)	9.0	2022	Europe/Asia	2054	1411	41	<-	
42	U.S.	Bempra-Woodside Port Arthur LNG (B'ville, TX)	10.0	2021	Europe/Asia	2055	1475	42	<-	
43	U.S.	QatarGas,Conoco,Exxon LNG ("Golden Pass)	0.0	FID Postponed	Europe	2056	1541	43	<-	
44	U.S.	Venture Global Calcasieu Pass LNG (La.)	10.8	2021	Europe/Asia	2057	1611	44	<-	
45	U.S.	Kenai LNG	0	To be closed	Asia	2058	1683	45	<-	

*: No Canadian, Chinese LNG production facilities included. Also not factored is (small <10%) obsolescence of older LNG plants (esp. Qatar, Malaysia) FID taken? 131.1

** : Historical (10-year 2005-2015) growth rate of worldwide LNG demand was 2.6%

New LNG volume coming onstream by end 2025 323.5 Mtonnes p.a.

Demand equal to or greater than supply

EA approved but on hold pending contracts, financing

New gas pipeline facilities coming onstream in Asia by end 2025

Russia -> China	Power of Siberia-1	27.5	2019-20	China	Probability 100%
Russia -> China	Power of Siberia-2	2.2	Postponed	China	Probability 10%

Region	LNG MTPA increase	% of total increase	# of Active Projects
Russia	42.5	13%	3
Australia	37.0	11%	6
Papua New Guinea	11.8	4%	2
U.S.	155.6	48%	16
Africa	13.6	4%	6
Totals	260.5	81%	33

2016 World LNG Shipments ~265 MTPA Demand is currently growing slowly (2.6% average for past 4 years in Europe. Asia

265

618.22

Sources include: http://www.iqiu.org/sites/default/files/node-page-field_file/IQU-World%20LNG%20Report-2015%20Edition.pdf

- o BC's shale –gas resources are expensive to drill, extract and get to market. In a boom-and-bust commodity market, cost-competitiveness is key, as is the talent pool of skills available to make the industry a success. BC has neither advantage, and its

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fracked gas is competing against facilities closer to S. Asia that can give away gas “associated” with more valuable wells producing oil and condensates.

- Of the three LNG projects cited by BC Hydro as:
 - Fortis/Tilbury Phase 2 expansion suffered a severe blow when its tentative deal to export 800,000 tonnes of LNG a year to Hawaii’s electric utility fell through, in part because Hawaii’s Governor David Ige declared⁵ that “a dollar spent on LNG is a dollar wasted toward achieving Hawaii’s goal of having its energy needs 100% fossil-fuel free by 2045”;
 - Shell’s LNG Canada has indefinitely postponed its FID decision for its Kitimat, BC plant, citing the same “market conditions” reason that have caused oil & gas majors Petronas’ Lelu Island Northwest LNG and Nexen’s Dodge Cove Aurora plant proposals to be scrapped altogether;
 - Woodfibre’s proposed 2.1MTPA plant in Howe Sound has no contracted customers, an inadequate supply pipeline opposed by First Nations and local inhabitants. Woodfibre has no experience in building or operating an LNG plant. If built, it would be the first grid-powered export plant in the world (Norway’s [Snohvit](#) LNG plant on Melkoya Island claims to be grid-powered, but is actually powered by gas turbines on the mainland 4km away in Hammerfest). And Woodfibre is dependant on receiving 1,500 GWh of power from BC Hydro at or below the industrial rate of \$54/MWh – an industry subsidy of \$34 million annually – for scarcely 100 jobs.
 - All three of these proposals face uphill struggles to overcome uniquely Canadian hurdles, including regaining social license, dealing with regulatory and First Nations rights and title issues re fracking, pipelines and liquefaction plant siting. In short, despite its acknowledged shale –gas resources, it is highly unlikely that BC will develop an LNG industry before the mid-2030’s – long after Site C would be in service.

In summary, the low-cost, low-risk solution to any risk of future capacity shortfalls is obvious – get serious about DSM, remove the restrictions on using already-built gas-powered peaking plants, use BC’s entitlement from the Columbia River Treaty and get on with freeing our power grid to utilize the bountiful supply of renewable power in the province to help make the transition to the new green economy which will more usefully employ many more of our workers’ talents than needlessly digging large, costly unstable holes in the ground.

Yours very truly



Eoin Finn, B.Sc., Ph.D., MBA, Vancouver, BC

⁵ <https://cleantechnica.com/2015/08/24/hawaii-governor-david-ige-drops-bomb-no-lng-on-his-watch/>