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March 27, 2017

British Columbia Utilities Commission
Sixth Floor, 900 Howe Street, Box 250
Vancouver, BC, V6Z 2N3
Attn: Erica Hamilton, Commission Secretary
By Web Posting

Dear Madam:

Re: BC Hydro F2017-F2019 Revenue Requirements Application,
BCUC Project No. 3698869
BC Sustainable Energy Association and Sierra Club BC responses to Information Requests

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Pursuant to the amended regulatory timetable approved by Order -20-17 [Exhibit A-22] and BCUC Rule 14, attached please find the responses of the interveners BC Sustainable Energy Association and Sierra Club BC to information requests regarding BCSEA-SCBC's evidence filed in this proceeding [Exhibit C1-8]. The following files are attached:

- 2017-03-27 BCSEA-SCBC response to BCUC A-25 re BCH RRA.pdf
- 2017-03-27 BCSEA-SCBC response to CEABC C4-7 re BCH RRA.pdf
- 2017-03-27 BCSEA-SCBC response to CEC C10-9 re BCH RRA.pdf
- 2017-03-27 BCSEA-SCBC response to NIARG C11-9 re BCH RRA.pdf

Please contact the undersigned regarding any questions about these responses to information requests.

Yours truly,

William J. Andrews

Barrister & Solicitor
Encl.

BRITISH COLUMBIA UTILITIES COMMISSION

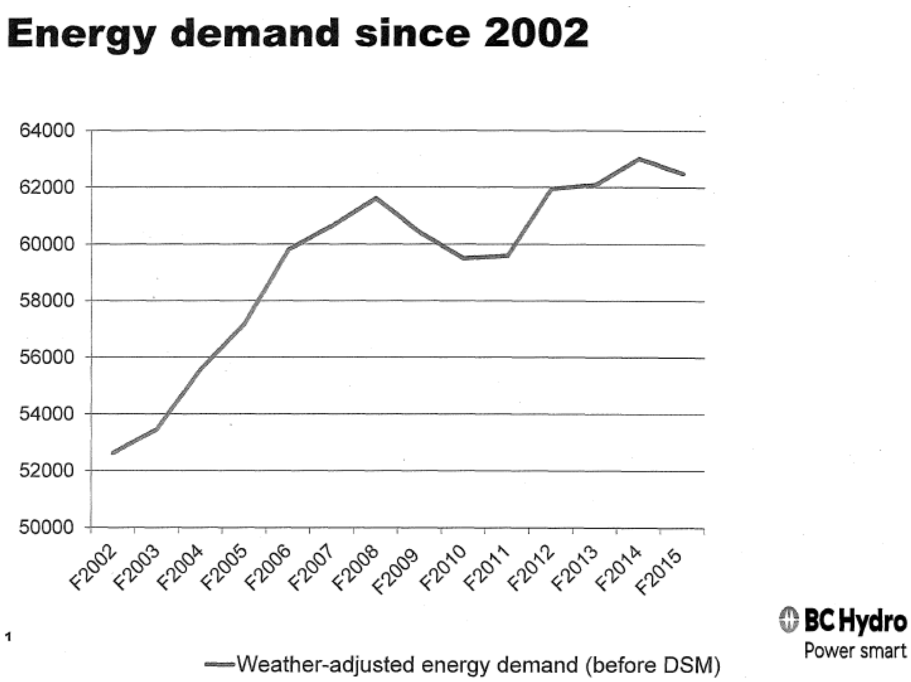
BCUC Project No. 3698869
British Columbia Hydro and Power Authority
F2017 to F2019 Revenue Requirements Application

British Columbia Sustainable Energy Association and Sierra Club British Columbia
Response to Clean Energy Association BC (CEABC)
Information Request No. 1 on Intervener Evidence
March 27, 2017

1.0 Reference: Exhibit C1-8, Intervener Evidence of BCSEA-SCBC, testimony of James Grevatt, Energy Futures Group, Inc. ("EFG") page 20.

In its conclusions, EFG advances the view that BC Hydro should pursue a higher level of DSM program expenditures and that *"doing so will provide greater cost-effective benefits to ratepayers…".*

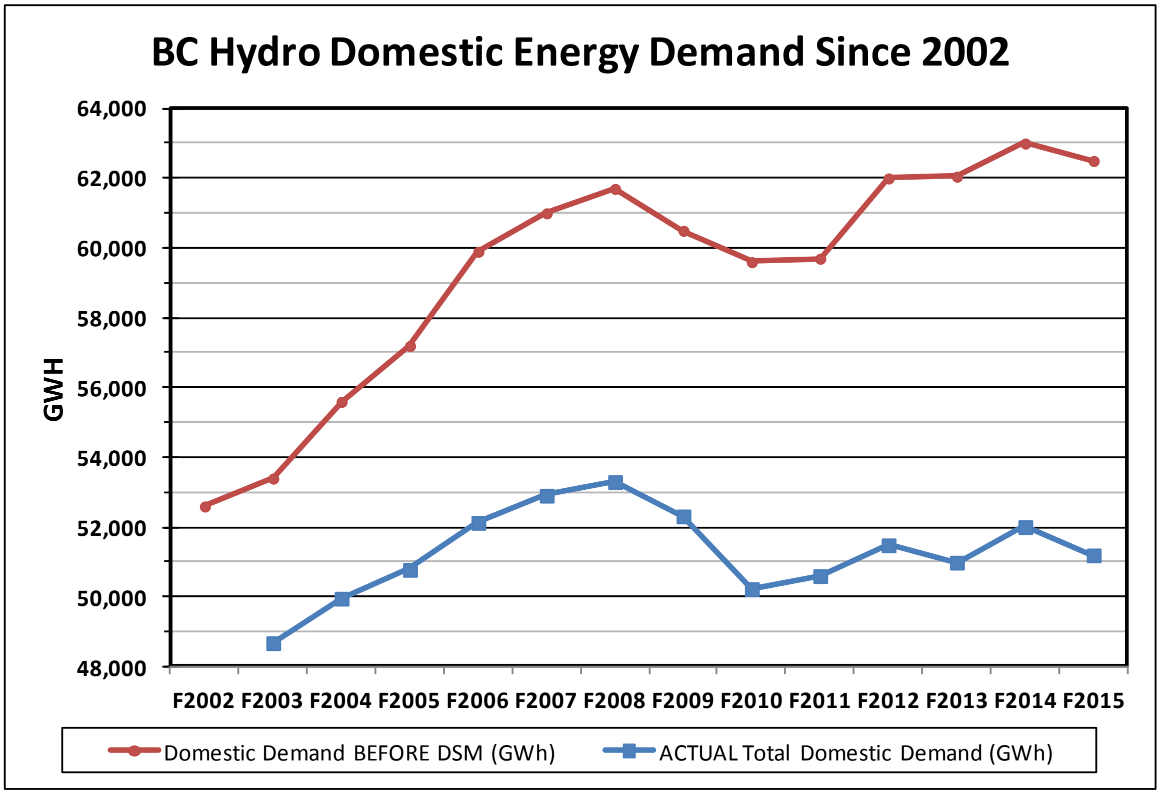
To put the quantity of energy saved by demand side management ("DSM") into the perspective of BC Hydro's total domestic load, BC Hydro has provided the following chart (taken from a BC Hydro briefing dated December 12, 2016, entitled "Site C Project Update"):



Note that this chart does not describe the actual domestic load that has occurred over the time period, but rather the hypothetical load that would have occurred if BC Hydro had not invested over $1.5 billion into its DSM efforts. According to Exhibit B-1-1, Appendix A, Schedule 2.2, in the past 10 years alone, BCH has amortized $540 million into electricity rates, and there is still a balance of $907 million remaining to be amortized into future rates.

In this chart, BC Hydro has done the work of adding back the impacts of DSM over the period -- albeit the hypothetical impacts, since these demands never actually happened. If the actual domestic loads that did occur over this period (taken from Exhibit B-1-1, Appendix A, Schedule 14, line 10, or from BC

Hydro's response to CEBC IR 2.31.3, Exhibit B-15) are added to this chart, the difference between the two lines represents the savings attributed to DSM over the period, as shown in the following chart:



On this chart, the upper line (red) is the same as the previous chart, and the lower line (blue) depicts the ACTUAL Total Domestic Load that did occur, for comparison to the hypothetical load that would have pertained in the absence of DSM savings. From this chart, it is evident that the DSM savings reached 11,000 GWh/yr in F2013 and have increased since then.

To put this amount of savings into context, when BC Hydro conducted its Conservation Potential Review in 2007, its consultants concluded that the "*Upper Achievable*" level of "*Potential Annual Savings (GWh/yr)*" would be approximately 10,800 GWh by F2021. Hence, in the context of the potential savings, BC Hydro appears to have exceeded its upper level of expectations 8 years ahead of schedule.

1.1 In EFG's experience, is 11,000 GWh of savings a high, medium, or low level of achievement to expect from a $1.5 billion level of expenditure? Can you offer other comparators to substantiate this judgment?

Response:

With respect, the hypothesis in the question and the analysis in the preamble are incorrect.

First, Actual Total Domestic Energy Sales does not include transmission and distribution line losses, whereas "weather adjusted system demand (before DSM) does include transmission and distribution line losses. Thus, the difference between the red line and the blue in the second table in the preamble reflects both DSM and line losses, not DSM alone.

Second, the difference between load before and after DSM in given year (even taking into account line losses) cannot be compared directly to DSM expenditures in the same year to get a measure of cost-effectiveness of the DSM spending in that year. This is because some portion of the difference between load before and after DSM in the year is attributable to DSM spending in previous years, and some portion of the DSM spending in the given year will not produce DSM savings until a future year.

It would be more meaningful to compare BC Hydro's reported and evaluated DSM savings results with similar data from leading jurisdictions. One approach to doing this "benchmarking" comparison would be to adopt the protocols used by the American Council for an Energy Efficient Economy in its Annual State Energy Scorecard.[1]

Third, the conclusion in the preamble that "BC Hydro appears to have exceeded its upper level of expectations 8 years ahead of schedule" is incorrect because it is based on confusion between GWh/yr and GWh. The statement in the preamble that the 2007 CPR concludes that the Upper Achievable level "would be approximately 10,800 <u>GWh</u> by F2021" [underline added] is incorrect. The CPR expresses DSM savings estimates in GWh <u>per year</u>. This is referred to as run rate savings, representing an annualized rate of energy savings at a specific point in time. The CPR's use of the run rate savings metric is stated expressly in the preamble itself where CEABC quotes from the CPR regarding an "*Upper Achievable*" level of "*Potential <u>Annual</u> Savings (GWh/<u>yr</u>)*" [underline added].

1.2 In EFG's opinion, how long should the existing DSM savings be counted on to persist? Does EFG believe that the persistence of any given demand side measure should be considered to be equal to the service life of any newly installed equipment, or should it be limited to the number of years before natural conservation would have achieved the same savings? Can you illustrate with any examples from your experience?

Response:

BC Hydro defines "persistence" as "The timeframe during which DSM measures produce electricity savings that are attributable to the utility's actions." Exhibit B-1-1, Appendix GG, pdf p.1569. This is a typical definition in the industry.

As to "how long ... the existing DSM savings [should] be counted on to persist," this will vary according to the type of DSM measure and program. For example the assumed persistence for a measure that is installed in an "early retirement" scenario may be different than the persistence assumed in a "replace on burnout" scenario for the same type of equipment. Different types of DSM measures have different persistence. This is illustrated in Exhibit B-1-1, Appendix V: Demand-Side Management Initiatives Descriptions, where an assumed "Savings Persistence (years)" is provided for each of the different types of DSM measure. For example, the assumed Savings Persistence for the Building Codes and Product and Equipment Standards DSM measures is 30 years [pdf p.1266], and the assumed Savings Persistence for the Behaviour program is 1 year [pdf p.1274]. The weighted average persistence of savings of BC Hydro's demand-side management activities over the period fiscal 2017 to fiscal 2019 is shown in Exhibit B-9, BCUC IR 1.170.1, pdf p.4700.

[1] http://aceee.org/state-policy/scorecard

As to whether “the persistence of any given demand side measure should be considered to be equal to the service life of any newly installed equipment,” savings persistence is defined by the expected duration of the savings not by the service life of newly installed equipment.

As to whether “the persistence of any given demand side measure should be ... limited to the number of years before natural conservation would have achieved the same savings,” the savings attributable to a DSM measure is the difference between energy consumed with the measure and the energy that would have been consumed in a base case without the measure. In EFG’s experience it is normal to take into account that the base case may include end-of-life replacement with more-efficient equipment.

1.3 Would EFG agree that further savings, from this point on, must come predominantly from improvements to the efficiencies of the existing loads, since new loads will already be employing the newest and most efficient technologies?

Response:

In the statement “new loads will already be employing the newest and most efficient technologies” CEABC suggests that all new loads will be as efficient as possible. EFG does not believe that there is evidence that this will be the case, for two primary reasons:

- **First, the statement implies that all consumers will fully comply with energy code requirements and that those code requirements are set at the highest possible efficiency levels. Experience in other jurisdictions is that new codes are set at levels that policy-makers deem to be reasonable, and that code compliance is less than 100%. Product standards are similarly not set at the highest efficiency levels, but rather at reasonably high levels that are palatable to policy makers and that industry deems to be achievable at costs that will not disrupt profitability. In both cases the result is that new loads may be increasingly efficient, but they are certainly not in all cases “employing the most efficient technologies.”**
- **Second, new technologies continue to be developed that can achieve savings relative to what was the most efficient technology of only a few years ago. For example, commercial T8 lighting fixtures that were the most efficient technology at the time they were installed can now be cost-effectively replaced with linear LED fixtures. EFG finds no reason to assume that new, more efficient technologies will not continue to become available that can reduce the energy consumption of “new” loads.**

1.4 In EFG’s experience, at what point do further DSM program expenditures begin to produce diminishing returns, due to the fact that all the best opportunities for efficiency gains have already been exploited?

Response:

EFG disagrees with CEABC's claim that "the best opportunities for efficiency gains have already been exploited". For example, as discussed above in its response to 1.3, there is no evidence that new technologies will not continue to be developed that will produce significant opportunities for future energy savings. That said, as loads get smaller with increased efficiency, the increment of available savings is also likely to get smaller, so returns may indeed "diminish." However, the mere fact that a return is smaller does not mean that it is not economically cost-effective to pursue it. In other words, while it may be preferable to earn a dollar for every dollar invested, earning fifty cents on a dollar invested is still a good thing. Fifty cents is a "diminished" return compared with a dollar return, but that does not mean that it is not a sound investment. There are also considerable likely retrofit opportunities that have not yet been captured.

Many DSM portfolios have historically relied heavily on retail lighting programs to achieve high levels of savings. Opportunities for such inexpensive savings are certainly less at present with the looming transformation of the retail lighting market to LEDs—so portfolio level returns may be said to be diminishing relative to the period when inexpensive lighting savings were prevalent. However, new opportunities continue to emerge. For example, the recent technological advances in "smart" thermostats and in mini-split cold climate heat pumps provide new, cost-effective savings opportunities that were not available just a few years ago. Given the potential for as-yet unannounced innovations, EFG would not presume to predict a point at which "further DSM program expenditures begin to produce diminishing returns."

2.0 **Reference: Exhibit C1-8, Intervener Evidence of BCSEA-SCBC, testimony of James Grevatt, Energy Futures Group, Inc., page 12:**

In discussing the merits of converting electrically-heated homes to using heat pumps, EFG states, *"On average these projects saved nearly 2,500 kWh/year each,... Rebate averages ranged from $570-$800 depending on the specific program and time period. If another 10% of the 300,000 homes with electric resistance heat could cost-effectively install highly efficient heat pumps to replace the existing resistance heating, which seems plausible, it would be four times the number that were completed over the previous eight-year period, with substantial savings for homeowners and (based on the UCT) all BC Hydro ratepayers."*

2.1 Does EFG agree that customers who would be likely to spend the amount of capital on a heat pump would tend to be among the larger energy consumers? Would they, therefore, be likely to obtain all of the 2,500 kWh of savings at the Residential Tier 2 price, which is currently at approximately $0.12/kWh, meaning annual savings would amount to around $300/year?

Response:

CEABC's suggestion is logical if one assumes that consumer decisions are made purely on economic values. However, people also make decisions based on emotion and other non-economic factors. There is no reason to assume that the scenario CEABC presents would necessarily be the case. The better way to predict the characteristics of customers who would be likely to invest in a heat pump would be to examine historical participation data from BCH and current market research. EFG would

not, therefore, agree with CEABC's suggestion without access to additional data.

2.2 Does EFG also agree that there would be no GHG reductions as a result of this heat pump program, since the objective is merely a reduction in electricity consumption?

Response:

Converting homes from electric resistance heat to efficient heat pumps in B.C. where electricity has low carbon intensity would mainly create *direct* GHG reductions to the extent that fossil-fueled peak generation was offset through the increased efficiency of these loads. However, reducing peak loads and energy use by converting electric resistance heat to more efficient heat pumps could free up future capacity to enable low carbon electrification of existing fossil-fueled loads—thereby creating capacity for GHG reductions through conversions.

2.3 In EFG's experience, what level of return on investment is implied for these customers to make a savings of $300/year? Please explain your calculation. In EFG's opinion, is that level of return considered attractive enough to induce people to make such an investment? If not, what level of incentive would be required to make the return sufficiently attractive?

Response:

As in its response to 2.2, EFG finds the premise of the question—that customers make purchasing decisions based purely on economic considerations—to be flawed. The better way to determine the required level of incentive is to use historical BC Hydro participation data and current market research. EFG points out that the level of incentive that BC Hydro provided to past participants, ranging from $570 to $800, was sufficient to for them to "make the return sufficiently attractive."

2.4 If BC Hydro payed an incentive of $800 per unit for 30,000 units (10% of 300,000) that would cost Hydro ratepayers $24 million. On top of that, they would lose $300/unit/year, or $9 million in lost billing revenue every year. If the energy saved was sold at a market price of $0.03/kWh, that would only compensate the costs by $2.25 million per year. Please explain how this could be considered "*a substantial savings*" for BC Hydro's other ratepayers.

Response:

This responds to CEABC 2.4 and 2.5.

CEABC's analysis incorrectly considers all lost revenue to be a cost. A portion of the hypothetical $9 million in CEABC's analysis derives from BC Hydro's operating costs. This portion would not in theory be lost—rather it would be captured through a rate adjustment. Therefore it would represent neither savings nor a cost to ratepayers, because in aggregate they would be paying the same amount. Presumably BC Hydro would not pay incentives for 30,000 units in a single year. Any necessary rate adjustments would be incremental and gradual, and would only be one factor in determining the level of operating costs that BC Hydro recovers from its customers.

It would be correct to compare the avoided cost of the energy and capacity with the cost to BC Hydro of providing the incentives for these units. If it would cost BC Hydro, and by extension ratepayers, more to provide the energy and capacity than it would to provide the incentives for these units— which is exactly what the UCT is designed to test—then the efficiency investment benefits ratepayers. If the cost to BC Hydro of the efficiency investment is also less than the market price, then it would further benefit ratepayers to make the efficiency investment and sell the excess energy to the market.

2.5 Even if the energy savings were valued at the LRMC of $0.085/kWh, that would still only recoup about $6.4 million per year, so please explain how this could ever recover the $24 million investment when it is losing $2.6 million per year. How can this be considered a benefit to the non-participating ratepayers?

Response:

Please see the response to 2.5.

2.6 Does EFG have experience with other heat pump programs which could displace gas heating and thereby also earn GHG credits? If so, please give some examples of the economics of such programs. What levels of GHG credits do they receive, and what levels of incentives do they require?

Response:

EFG is not aware of programs that have been successful in motivating customers with natural gas heating to fuel switch by installing heat pumps. However, there are heat pump programs in the northeastern U.S. that have had considerable success in motivating customers whose primary heating source is fuel oil or liquid propane to install ductless mini-split heat pumps. In these programs, most, but not necessarily all, of the fossil fuel heating loads are offset by these conversions. Typically, the central heating system is left in place, but is only used in the most extreme weather conditions.

However, it is critical to note that the policy frameworks in these jurisdictions do not provide GHG credits. Determining the value of such installations in the context of GHG credits in BC with its Climate Leadership Plan goal of carbon neutrality could change the value considerably.

2.7 Is ducting required when a heat pump replaces electric resistance heat and if yes what is the median expected cost per conversion? How is this cost factored into the cost effective conversion calculation?

Response:

In cases where a ducted heat pump system is being considered as a replacement for electric resistance heat it would be appropriate to factor the cost of the ductwork into the replacement cost. However, it would make far more sense economically to install ductless mini-split heat pumps to replace electric resistance heat than to use ducted systems. EFG recommends that any replacement initiative that is contemplated by BC

Hydro focus on ductless mini-splits.