

BC Hydro Electricity Self-Sufficiency Backgrounder

With one minor exception, BC Hydro (“BCH”) has planned its electrical system on the basis of self sufficiency since its inception. The reason is simple – almost all of its generating facilities are hydro electric and are subject to variations in reservoirs inflows because of the weather. The electricity demand still has to be met during the duration of the drought and this requires firm supplies of electricity. Not ones that might be there but ones that BCH owns or controls or has long term contracts for.

The key features of a drought are that no one can predict when it will occur and how long it will last. This can only be confirmed after the fact. For energy planning purposes, BCH uses the instrument-recorded drought or “critical period” from October 1940 – April 1946.

Since electricity is such a critical component of the fabric of the life in B.C. and in particular the economy, and because B.C. has some of the cheapest sources of electrical generation in the world, self-sufficiency has meant generation within the boundaries of the Province. There has been one instance of a short term firm purchase from outside these boundaries but the security and cost of transmission that isn’t controlled by BCH is an extremely important factor that always has to be considered.

A brief review of BCH’s application of the principal of self-sufficiency is set out below.

BC Hydro 1995 Integrated Electricity Plan

This document states the following¹:

“The hydroelectric resources in BC Hydro’s system rely primarily on annual stream flows from melting snowpack to fill reservoirs. Since stream flows vary from year to year, it is important that BC Hydro determine the capability of the system during critical water conditions - the lowest stream flow sequence on record. Currently the critical period is based on stream flow conditions from October 1940 to April 1946. During better stream flow periods (about 80 percent of the time) secondary (non-firm) energy is available. The secondary energy can significantly increase the energy output from the existing system.”

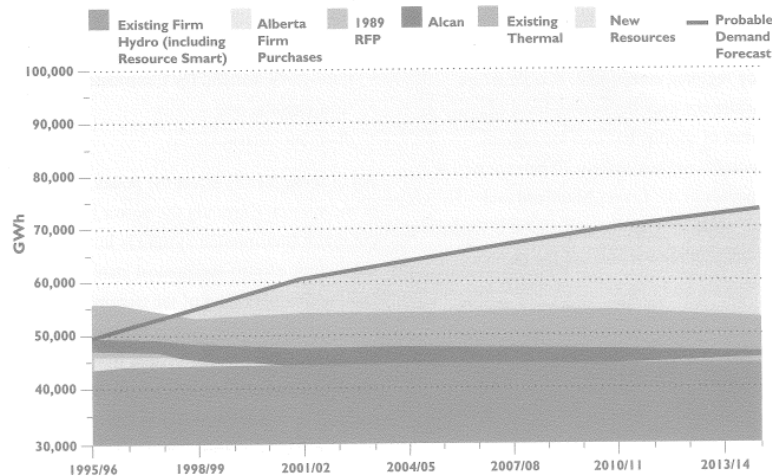
In the same document² can be found the graph that is set out immediately below. BCH consistently uses the form of the graph to illustrate its energy demand and firm supply outlook. The lowest area on the chart, “Existing Firm Hydro (including Resource Smart),” shows the amount of firm energy that these hydro assets can produce in the drought or critical period. Subject to minor changes such as additions or improvements and deratings to BCH’s existing hydro generation, it remains relatively constant over the years.

¹ BC Hydro 1995 Electricity Plan, Page 3-6.

² BC Hydro 1995 Electricity Plan, Page 3-10.

Figure 3.4:

1995 Energy Demand-Supply Outlook



The additional generating resources that are required to meet the probable demand are shown on the graph as being stacked on top of the existing firm resources. It should be noted that there was a 5,000 GWh surplus in the beginning of the outlook period. Throughout the mid 1980's to the mid 1990's there was a surplus of energy primarily caused by the completion of BCH's Revelstoke project. Even with this surplus BCH had to import electricity for domestic purposes in 1993³. Large hydro projects produce new supplies of electricity in large increments and it is very difficult to match supply with demand. The output from the Revelstoke project had to be exported until the domestic demand caught up.

There is no practical difference between the "cushion" created by the coming into service of a large hydro project and the 3,000 GWh "insurance" requirement by 2020 of the Clean Energy Act except that the 2020 insurance requirement will be a much smaller percentage of the domestic demand than the cushion created by the Revelstoke project.

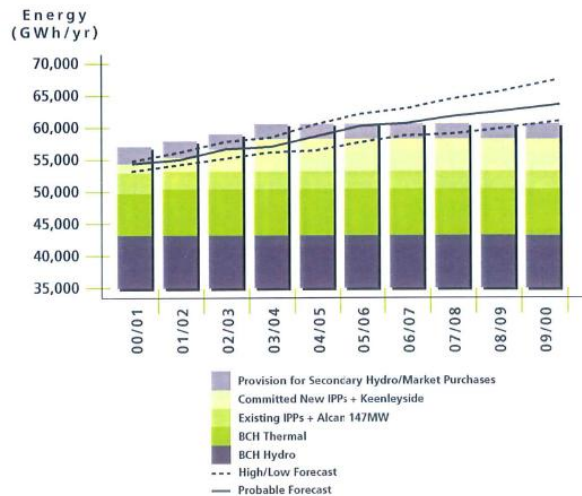
January 2000 – An Update to the 1995 IEP

In the twilight period of the last provincial NDP government, BCH issued an update to the 1995 Integrated Electricity Plan. Unlike this plan, the update was not preceded by any extensive consultation or subject to any regulatory oversight. For the first time it showed "Provision for Secondary Market Purchases" in the amount of 2,500 GWh as being part of the plan to meet BCH's probable demand. Technically, BCH could still claim it was using the critical water sequence for planning purposes, but in reality, the 2,500 GWh amount represents most of the difference between the amount of energy that BCH's hydro generation can produce in the critical and average periods. Put another way in a drought, BCH would have to purchase 2,500 GWh to meet domestic requirements.

³ Vancouver Sun article, July 29, 1993, Appendix 1, as attached.

The secondary market purchases were a euphemism for imports with no certainty about where they were going to come from, whether the transmission was available to deliver them to the interconnection points on B.C. borders, and the price that would be paid for them. It was an unstated gamble on electrical energy security as clearly shown in the graph set out immediately below⁴.

Figure 1. Energy Balance with Existing and Committed Resources



California Energy Crisis

In 2000 – 2001, the California energy crisis hit and for those who may have forgotten why self-sufficiency is so fundamental to BCH’s ability to meet its customers’ demand without becoming insolvent, it was a stark reminder. According to a BCH press release⁵:

“As has been well documented in the media, the events in California were the result of a lack of new generating capacity and increased demand, while higher natural gas, colder than normal temperatures and lower than normal precipitation are also across most of western North America.

It is important to understand that at all times the electricity requirements of British Columbia always come first. We have not sold off the energy stored behind our dams for short-term profit. In fact, this fiscal year we will be a net importer”

There should be added to the above list: market manipulation, Chapter 11 filings by major California utilities such as Pacific Gas and Electric⁶, and transmission choke points.

⁴ Executive Summary, Integrated Electricity Plan, An Update to the 1995 IEP, page II.

⁵ March 3, 2001, BC Hydro document, “Budgets Adjusted to Reflect Low Inflow Projections”, Appendix 2, as attached.

While BCH was able to take advantage of California's predicament by selling its capacity at very high prices, BCH faced an energy crisis because of projected low reservoir inflows in 2001. Fortunately, the low snowpack and corresponding inflows, which were mitigated to some extent by extremely heavy spring rainfall in the Peace basin, turned out to be a one year phenomenon and much shorter in duration than the critical period in the 1940s, which also occurred across western North America. The consequences of this type of longer term drought would have been dire to BC Hydro. According to media reports⁷:

"BC Hydro may have to spend \$1 billion or more on extra power to meet domestic demand during its current operating year, according to an internal B.C. Hydro report released yesterday by the Opposition B.C. Liberals..."

But lower than normal amounts of snow this year mean B.C. Hydro will be forced to buy power on the open market, where prices have been soaring. The report said that water levels will be near record low this year, and that "probability to get close to normal water [levels] is slim to none."

The report said that the "cost of energy increases over 2001 is in the range for \$1 billion to \$1.5 billion."

At the time, BCH was publishing indicative market prices such as those set out below and it is very important to note the low value of the Canadian dollar which is beyond BCH's control.

⁶ April 6, 2001, BC Hydro document, "BC Hydro responds to Pacific Gas & Electric of California's bankruptcy filing", Appendix 3, as attached.

⁷ March 20, 2011, Globe and Mail, "BC Hydro faces \$1-billion shortfall, internal report says", Appendix 4, as attached.

BC Hydro Sales Management

Indicative Market Prices (C\$/MWh)

April 5, 2001

	<u>6x16</u>	<u>7x24</u>	<u>Forward Exchange Rate</u>
Balance - Apr - 01	535.15	488.65	0.63533
May-01	517.01	479.60	0.63635
Jun-01	651.12	578.25	0.63736
Jul-01	736.23	627.59	0.63838
Aug-01	985.29	808.21	0.63940
Sep-01	624.59	580.86	0.64042
Oct-01	514.46	478.44	0.64145
Nov-01	490.29	455.71	0.64247
Dec-01	512.82	469.71	0.64350
Jan-02	480.98	422.84	0.64452
Feb-02	401.21	365.36	0.64555
Mar-02	317.05	313.64	0.64658
Q3-01	779.49	669.17	0.64145
Q4-01	504.25	466.95	0.64452
Q1-02	398.39	366.10	0.64761
Q2-02	205.93	176.47	0.65071
1 year, May 01 Start	539.10	482.82	0.64197

The prices which were based on the Mid-Columbia market were astronomic and not just “soaring” as described in the above media report. The lesson to be learned from the California crisis is to always be self-sufficient in energy and capacity.

Integrated Electricity Plan 2006

This plan included very extensive public consultation, including from a committee representing a broad cross section of interests including BC Business Council, BC Hydro, BC Citizens for Public Power, Greater Victoria Chamber of Commerce, West Coast Environmental Law Association, Joint Industrial Electricity Steering Committee and the Clean Energy Association. In the committee notes⁸ under the heading: “Preliminary Recommendations Around Self-Sufficiency Options” it states:

“There was consensus around the table regarding the issue of self-sufficiency. See Table 9 at the end of the document to view group member preferences surrounding this recommendation. In general, the group was strongly against relaxing the self-sufficiency criteria to allow Hydro to rely on importing energy. All Committee members accepted or supported both the direction of self-sufficiency and planning on

⁸ Integrated Electricity Plan (IEP) Provincial IEP Committee, September 22-23, 2005 Final Meeting Notes page 47.

having more energy than required by self-sufficiency. However, underlying this latter position, a large portion of the Committee felt strongly that planning to build excess was justifiable as having a buffer to guard against unforeseen future consequences (higher than forecast demand, attrition of expected supply). Support for this long position would be much less, and would be far from unanimous, if it was geared towards generating surplus for exports.. ”

As part of an advertising campaign to support the consultation process for the Integrated Electricity Plan a BCH advertisement⁹ contained the following:

“An energy self-sufficient British Columbia

Over the next 20 years, our energy needs in B.C. are expected to grow 50% and meeting this demand will cost roughly \$23 billion. It is our goal that B.C. is energy self-sufficient so that we have enough power right here in the province to meet our own needs, with enough insurance to respond to changes in opportunities. Obviously, meeting this goal represents a significant challenge, but with the support of our customers and the people of British Columbia, it’s a challenge we can, and will, meet.”

In the 2006 Throne Speech is says¹⁰:

“Alternative Energy will form an integral part of your government’s expanded energy vision. It is a critical part of your government’s goal to improve air and water quality and fisheries management. That goal obliges us to set new goals for conservation. The updated energy vision will include new conservation targets to help make British Columbia electricity self-sufficient within the decade ahead.”

In BCH’s 2006 Long Term Acquisition Plan and 2006 Integrated Electricity Plan that were filed with the B.C. Utilities Commission there is material and analysis relating to self-sufficiency and the insurance required to “respond to changes in opportunity”. The analysis covers the present values of the rate impacts of hypothetical supply portfolios ranging from 6,000 GWh of imports to those with 4,000 GWh of insurance. About the only conclusion that can be reached is that the outcomes depend on a multitude of variables that must be separately forecast, e.g. electricity market, natural gas, greenhouse gas and independent power generation price forecasts.

As indicated by the chart in Appendix 6, as attached, BCH has been a large importer of electricity for a long period of time. In F2006 imports were about 18% of domestic requirements. As indicated in Appendix 7, as attached, reservoir inflows for the past decade have been relatively normal. But for the decrease in the demand for electricity because of the world economic recession that started in 2008, imports would have been even higher.

⁹ Appendix 5, as attached.

¹⁰ Province of B.C., Speech from the Throne, February 14, 2006, page 24

When electricity market prices are low, relying on the short term or spot market looks very attractive but as BCH said in a BCUC proceeding and as subsequently confirmed¹¹:

“... any comparison of highly volatile spot market prices and stable long term contract prices must take into consideration the fact that the corresponding energy products are different. Market energy is non-firm, from sources that include coal-fired, nuclear, gas-fired, hydro and wind, and is from external sources, whereas long term contract purchases are for firm physical delivery within province from gas-fired or clean and renewable sources only...”

Self-Sufficiency by 2016 and Insurance by 2020

Any discussion about BCH being self-sufficient by 2016 as required by the Clean Energy Act is academic. In order to achieve this objective Power Smart is going to have to drive down electrical energy use by an amount equal about 70% of the projected new energy load. Based on historical data¹² and as more fully described in “Demand Side Management Backgrounder” the probability of achieving this objective is very remote. In addition, the electrical demand from the oil and gas industry in B.C. is set to dramatically increase especially if one or more liquid natural gas terminals are built in Kitimat and/or Prince Rupert. The proposed EOG, Apache and Encana terminal at Kitimat has a projected in service date in 2015.

The recent Japanese earthquake and tsunami have increased the prospects for liquefied natural gas terminals in B.C.

If BCH doesn't start planning and building transmission and distribution facilities to meet the expected growth in the electricity demand from the oil and gas industry, then the Government is going to suffer a loss of revenue. The world demand and more precisely the Asian demand for liquefied natural gas can be met from other areas such as Qatar, the U.S., western and eastern Australia and eastern Russia.

The Clean Energy Act insurance requirement of 3,000 GWh by 2020 is too distant to be of any consequence and will certainly have no impact on electricity rates for a long time. If as anticipated, the oil and gas industry, including production of natural gas in the Fort Nelson and Dawson Creek areas, natural gas to liquids facilities and liquid natural gas terminals, expands and new mines in B.C. are opened, BCH is going to be hard pressed to meet this new demand and stay self-sufficient, let alone acquire this insurance.

This is not to say that the self-sufficiency requirement should be abandoned or relaxed. Rather it is to point out that there are some serious challenges in meeting this requirement that aren't readily apparent.

Conclusion

¹¹ Appendix 8, as attached.

¹² Appendix 9, as attached.

With one minor exception, self-sufficiency has been a hallmark of BCH's planning since its creation. It is not a new or recently invented concept and has stood the test of time. Putting it into the Clean Energy Act merely codified a very long standing and extremely important practice.

If the shock value of the California energy crisis has dimmed with time then the disruption to the Japanese economy and society from the electricity shortages that are caused by the recent earthquake and tsunami should serve as a stark reminder as to what happens when you don't have enough electricity to meet the demand. In other words, you are not self-sufficient.

Ironically the Japanese literally invented the concept of reliance on others in the name of efficiency especially in the auto industry. According to media reports¹³:

"The disaster has left Toyota and other Japanese manufacturers who pride themselves on just-in-time efficiency in an awkward bind.

Toyota executives say that while the industry's supply chains were designed out of necessity to maximize competitiveness, the company might consider ensuring that its plants have alternative suppliers or that each region is relatively self-sufficient.

"I don't want to think about this, but we are in an earthquake-prone country, so we will have to give serious consideration to what we will do in the future," said Shinichi Sasaki, an executive vice president."

Since BCH relies primarily on hydroelectric generation, which has proven to be more cost effective than thermal generation over the long term, to meet the electricity requirements of its customers, it has to plan for the droughts that occur in this part of the world. It is possible to rely on the spot electricity market to meet part of its requirements including in a drought but it is a highly volatile and illiquid market. Given the absolute "must have" nature of electricity, self sufficiency will continue to be the best course to follow and will result in BCH's rates continuing to be some of the lowest in the world.

There has been media support for self-sufficiency as illustrated in the editorial in the "Province" which is attached as Appendix 11.

Assuming that the spot electricity prices will be lower than long term firm sources, dropping the self-sufficiency requirement will have no impact on BCH's electricity rates until about 2020. BCH claims that with the current and contracted resources, the supply and demand for energy will be in balance until then.

¹³ Associated Press, April 22, 2011, Appendix 10, as attached.