Demand Side Management Backgrounder

BC Hydro ("BCH") has been engaged in some sort of energy conservation or demand side management since the early 1980's. Sometimes these efforts are known as Power Smart and other times simply as "DSM". Measuring the effectiveness of these efforts in terms of money spent for results achieved is an extremely difficult, if not impossible, task. The simple questions to be answered are:

1. Whether users of electricity reduced their electricity consumption because of BCH's efforts including financial incentives?

2. Whether they would have made reductions without them?

3. Do any reductions result from specific Power Smart programs?

Because of the number of variables that have to be measured, the interrelationships among them and the constant changes to Power Smart programs including consolidations, there are no simple answers to these questions.

Econometric studies in this field have shown that utilities consistently and universally overestimate the energy savings that result from their demand side management efforts.[1]

Dr. Mark Jaccard, former Chair of the B.C. Utilities Commission and Simon Fraser University professor, has very recently attempted to look at the effectiveness of certain Canadian electrical utility spending on demand side management and the results are contained in an as yet unpublished academic paper. According to media reports[2], the effectiveness of this spending is overstated. As electric utilities across North America spend more money on attempts to reduce demand through conservation measures, perhaps other Canadian researchers will follow Dr. Jaccard's lead in attempting to determine whether the money has been well spent.

Interestingly as loftier conservative targets are embedded into utility resource plans, the higher the risk that electric utilities will have to rely on electricity spot markets to make up any differences. This is yet another risk that has to be added to the already long list of forecasting uncertainties, e.g. level of economic activity, natural gas supply and prices, transmission constraints, precipitation levels in western Canada and the U.S., availability of generators, greenhouse gas pricing etc. etc., that affect prices and the availability of supply in the these markets.

When demand side management fails, consumers pay twice. Once for the failed effort and again for the generation required to fill the void. Very little, if any mention is ever

[1] "Demand Side Management and Energy Efficiency in the United States, David S. Loughran and Jonathan Kulick, page 24 of Appendix 1, "Final Argument of IPPBC – British Columbia Hydro and Power Authority 2008 Long-Term Acquisition Plan", Appendix 1 that can be found at http://www.bcuc.com/Documents/Arguments/2009/DOC_21744_04-27_IPPBC_Final-Argument.pdf

[2] Globe and Mail, October 22, 2010, Appendix 2 as attached.

made of this significant risk while considerable attention is given to the apparent cost of being "long" in electricity.

While the micro analysis approach to determining the effectives of individual programs is necessary, it is also important to gage the success or failure of Power Smart over the last ten years from the macro level. Rather than tracking the performance of each individual component of the Power Smart portfolio, the performance of the entire portfolio can be benchmarked against expenditures, i.e. the net effect.

Taking this macro view is particularly important since individual programs have no way of judging the "rebound" effect – that is the propensity of consumers, when faced with an efficiency gain, to simply find new ways to use more of the product (i.e. efficiency programs are often self-defeating in the bigger picture). Only by looking at the overall macro results can the total effectiveness be seen.

Ten Year's Worth of Expenditures

It is very difficult to determine how much BCH has spent over the last decade on Power Smart. There is no consistently followed measure of this spending in BCH's Annual Report or other publicly available information such as B.C. Utilities Commission ("BCUC") regulatory filings. Generally Power Smart expenditures are considered to be capital expenditures but it is not always clear whether the associated administrative costs or corporate overheads are included in the published figures.

The energy savings attributed to Power Smart include the consumer response to BCH's rate increases but the costs associated with implementing these increases, although not significant, may or may not be allocated to Power Smart expenditures. The so-called energy "savings" also include electrical generation projects that are subsidized by BCH. The generation expansion at a Canfor pulp and paper mill in Prince George is a case in point[3]. There is no difference between this generation and independent power generation except the subsidy BCH paid to Canfor.

The best estimate of BCH's spending on Power Smart from fiscal 2001 to fiscal 2011 is about $1 billion[4][5]. If the amount BCH's customers also spent on electricity conservation is added to BCH's spending the amount increases by at least 200%. The total of the two amounts is known as the "Total Resource Cost". The portion of the customer's contribution to electricity conservation is often ignored. Customers pay for the investments that they have to make to achieve savings (e.g. on energy efficient light bulbs), and also for BCH's DSM costs through increased rates.

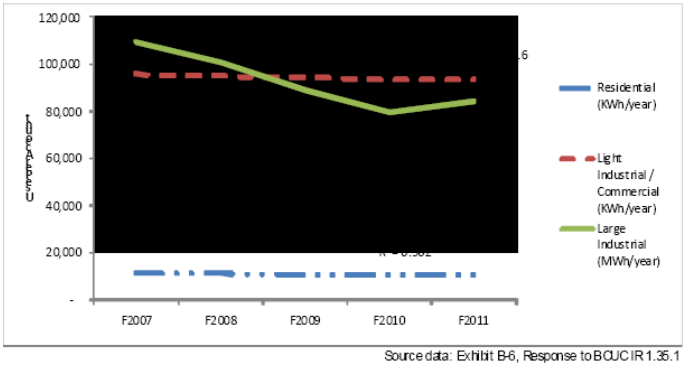
Did the Spending Produce the Desired Results?

[3] BCH Annual Report 2004, Appendix 3, as attached.
[4] Material distributed by CEA at F2011 BC Hydro Revenue Requirements proceeding, Appendix 4 as attached.
[5] Spending on Power Smart has been going on for approximately 30 years. For example in 1994/95 it was $60-63 million. See page 68 of Appendix 5 as attached.

BCH's answer is always the same - that the spending achieved the desired savings. Rather than attempting to examine the complex details of the efficacy of this claim it is more helpful to look at the following graph and response to a question in a BCUC regulatory proceeding.

355.0 Reference: Exhibit B-6, BCUC 1.35.1
Use Per Customer (UPC)

2.355.1 Please confirm whether the following graph accurately reflects historical and forecasted UPC for the period F2007 to F2011. If not, please provide a corrected, updated graph and table.



Source data: Exhibit B-6, Response to BCUC IR 1.35.1

USE PER ACCOUNT (UPC)	Weather Normalized F2007	Weather Normalized F2008	Weather Normalized F2009	FORECAST F2010	FORECAST F2011
Residential (KWh/year)	11,122	11,037	10,775	10,707	10,582
Light Industrial / Commercial (KWh/year)	95,462	94,904	94,606	93,358	93,227
Large Industrial (MWh/year)	109,514	100,523	88,839	79,154	83,929

RESPONSE:

Confirmed. Note that the above historical and forecast data is on a billed sales basis.

616.0 Reference: Exhibit B-11, BCUC 2.354.1.1
Sales Forecast

3.616.1 In response to BCUC 2.354.1.1 BC Hydro has provided a table that restates demand-side management in terms of the incremental conservation of energy. Reference line 11 indicates that for the period F2003 to F2009 residential and commercial accounts have not seen a reduction in their average use per customer (KWh per account /year). Please comment on the effectiveness of BC Hydro's residential and commercial DSM programs over this period. Are any new DSM strategies planned for F2011 to reduce use per account? If "yes", please describe those changes.

RESPONSE:

The actual use per account does not, in and of itself, indicate the effectiveness of DSM initiatives. For example, a dropping level of average customer energy consumption during an economic downturn (with business production and hours being scaled back) would not be evidence of a successful DSM program.

BC Hydro assesses the effectiveness of DSM initiatives by comparing estimated savings to a baseline of consumption in the absence of DSM. BC Hydro's DSM reporting and evaluation activities have confirmed that BC Hydro's DSM initiatives have produced electricity savings relative to baselines. This confirms that in the absence of BC Hydro's DSM initiatives, use per account would have been higher than indicated in the response to BCUC IR 2.354.1.1.

BC Hydro does not plan to change its DSM strategy for F2011 based on the average energy use per customer from F2003 to F2009.

The graph shows that for the period F2007-F2011 during the worldwide economic recession, the use per residential and commercial customer accounts is essentially flat. In the 5 years just prior to F2007, a period of very intense and aggressive DSM program spending, the use per customer actually increased by 7.7%[6].

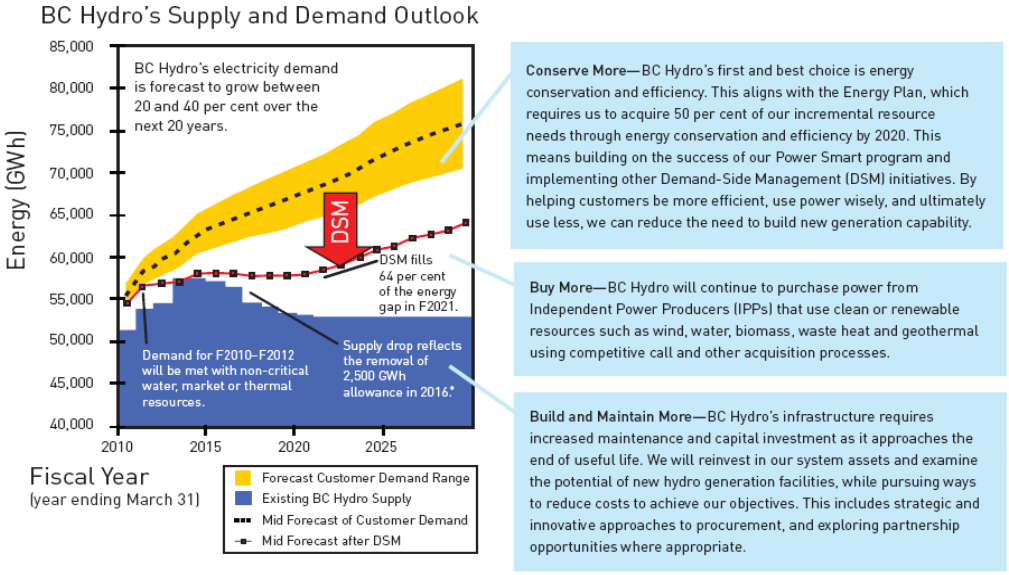
Use per account in the industrial sector does show a marked decline, but this is undoubtedly due to the severe worldwide recession that commenced in 2008 and this demand is recovering with the world economy.

The period is long enough to take into account any lag effects of Power Smart spending. A dollar spent today may not result in any demand reduction for a number of years. Conversely it is also long enough to take into account "reversion" to old habits and the introduction of yet another electronic device that requires more electricity such as flat screen televisions.

BCH's above response to the written question is very telling. Essentially it is saying that demand would have been higher "but for" Power Smart. Even if this response is correct, it doesn't explain how BCH can ever expect to achieve the future conservation driven reductions in the demand that are required to fill the "gap" shown on the following graph, the area referred to as "DSM" between the bottom red line and the dashed line in the middle of the shaded yellow area:[7]

[6] These figures taken from 2008 LTAP, Exhibit B-3, BCH's response to BCUC IR 1.16.1.
[7] BC Hydro Service Plan 2010/11-2012/13, page 4.

BC HYDRO'S ELECTRICITY GAP



Unless the industrial demand for electricity in this Province remains static or shrinks and the population does the same, then the demand for electricity will rise with an increasing population and industrial activity. The graph in Appendix 6 shows this effect.

Use per residential and commercial accounts has to dramatically drop to counter the impact of the rising population and the best that BCH has been able to achieve is a flat demand in relation to these accounts in a period that included a severe world economic recession and only the very beginning of the impacts of GHG pricing including the carbon tax. Since the electricity BCH sells has almost no GHGs and is free from this risk, it should be an attractive substitute for fossil fuel.

Industrial demand which has been relatively static for a very long time, looks set to dramatically increase as new mines in the Province are developed and in particular in the northwest portion of the Province with the construction of the 287 kV transmission line. This demand will also increase as oil and gas facilities are built to produce and export natural gas from the shale formations in the Fort Nelson and Dawson Creek areas. Not all the announced developments will proceed but even after the inevitable attrition, there will be significant new industrial load in the short, medium and long term.

For the period F2011 to F2014, BCH is projecting industrial load to increase 17%[8] which would bring it back to the 2008 level of demand. The development of a liquefied natural gas terminal at Kitimat that would commence operation in 2015 is outside this period.

Pursuing lofty DSM targets is one thing, but hard wiring the expected results into BCH's plans and forecasts is a completely different matter. If the results aren't achieved, and the

[8] BC Hydro F2012 to F2014 Revenue Requirements Application, page 3-5.

evidence of past experience is that they won't be, then there will be electricity shortfalls that will have to be covered.

Micro Break Out at the Macro Level

As has been previously stated, trying to break out which portions of the Power Smart portfolio work and how much they cost is a very difficult and complex undertaking. However, it is instructive to break out the stated savings from the Power Smart portfolio into three basic DSM components, namely codes/standards, rate structures, and Power Smart programs. (Note that rate "structures" does not include rate "level" increases. Rate level increases are supposed to be dealt with in the pre-DSM load forecast.)

The following table illustrates how the principal DSM portfolio from BCH's 2008 Long Term Acquisition Plan ("Portfolio") breaks down in terms of the forecast energy savings by category by the end of a 20 year period to 2028:[9]

Cumulative Energy Savings F2008-F2028 (GWh/yr)

	Codes & Standards	Rate Structures	Programs	TOTAL
Residential	3,870	1,220	1,273	6,363
Commercial	682	496	2,160	3,338
Industrial	209	825	2,403	3,437
TOTAL	4,761	2,541	5,836	13,138
	36%	19%	44%	100%

Clearly there is a great deal of benefit being derived from governmental changes to building construction codes and product standards, as well as from the consumer response to incentivized rate structures. These two categories are very low cost initiatives from BCH's point of view. The significant cost elements come from the implementation of the DSM programs.

According to the table, programs per se are responsible for 44% of the total energy savings at the end of the 20 year period. However, for analytical convenience, BCH makes a very low estimate of the expected savings that will result from rate level increases.

That is to say, the long-term price elasticity used in the pre-DSM load forecast is purposely set at a very low level of -0.05, which causes the Program savings shown above to be significantly overstated. Most econometric analyses put the long-term elasticity at between -0.2 and -0.4 (i.e. as the price of electricity rises 10%, demand decreases by 2 to 4%). BCH's own analysis shows that at a more reasonable long-term elasticity value of -0.15 (, the energy savings that would result purely from the expected rate level increases would be approximately 3,500 GWh per year by 2016 and 4,500 by

[9] Appendix 1, page 20.

2010 (assuming an allowance of 10% for transmission losses)[10]. By underestimating the consumer rate response, BCH effectively shifts that amount of energy savings from "rates" into "programs", thus making the programs look much more effective than they would otherwise be. This is a very significant overstatement that distorts the benefits and costs from the Programs by making them look far more financially attractive than they are. When the Total Resource Costs of the Portfolio are examined (also known as the "All Ratepayers Costs"), it can be seen that the Programs are actually responsible for the lion's share of the total costs, namely 71%, as shown in the following table[11]:

All Ratepayers Costs F2008-F2028 ($ millions)

	Codes & Standards	Rate Structures	Programs	TOTAL
Residential	1,840	34	1,234	3,108
Commercial	325	23	1,815	2,162
Industrial	36	192	2,242	2,470
Portfolio-Level			749	749
TOTAL	2,201	249	6,040	8,489
	26%	3%	71%	100%

Clearly all the DSM components in this portfolio do not show the same degree of cost-effectiveness. Rate structures are very inexpensive, Codes and Standards are the next least costly, and Programs, as a group, are the most costly per unit of energy saved.

Conclusion

If the adjustment were made to properly attribute rate level impacts, the Programs in BCH's DSM Portfolio would produce less than 30% of the estimated savings while accounting for over 70% of the costs. It is also not realistic to assume that Power Smart will decrease demand in the residential and commercial sectors to the extent required for BCH to become self-sufficient by 2016.

[10] 2008 BC Hydro LTAP, Exhibit B-4, response to BCUC IR 2.230.1.
[11] Exhibit 1, page 20.