The Task

There has been much written about “green” energy and more particularly, electrical energy. It has many citizens asking what they might do to be part of the solution while waiting for the more traditional leadership to take initiatives that would lead to reductions in the consumption of fossil fuels.

Solar energy has captured the imaginations of many spurred in a major way by the leadership of several European countries.

Because the financial entry huddle for a solar panel installation is relatively small, individuals are now giving the idea of personal, residential installations very close examination.

As finances are at the heart of this kind of consideration several people thought it would be helpful to have a look at the cost / benefits to see if the benefits might exceed the up front costs in 2015/2016.

The Method and Assumptions

Investing money in a 10 panel, net metering installation is easy to determine simply by asking those who are now doing these installations for a quotation.

Since there is no one size fits all, because the installations are all custom built ,everyone is understandably shy about giving too firm a price for the package.

The closest number for a 10 panel array from a co-op program seems to be about $6,500 to $7,500. This is where the investor receives the benefit of no commercial mark-up on the cost of equipment. Clearly a quote from those doing installations where there is a mark-up will be higher.

The next part of the process is to make assumptions. For the reader’s benefit he/she might get value out of reading the 2015/16 – 2017/18 BC Hydro Service Plan, as submitted to the BC Utilities Commission (1). This document is useful for context, especially pages 15 and 16. BC Hydro increased electricity rates in 2014 by 9%; in 2015 by 6% and in 2016 plans to increase rates by 4% and in 2017 by 3%. These rate increases are election cycle driven and do nothing to clear the $5.3 billion yet to be collected from customers and held back from investment expenses over the period 2006 through to 2015. To overcome an absence of any official outlook for future rates an annual 2.5% increase, representing a CPI change, is used in the calculations (2). The duration of the calculation is for 25 years, in line with warrantees.

To have future benefits, in this case an avoidance of paying BC Hydro for self-generated electricity, it is necessary to discount those benefits to their present values (PV). The traditional way is to pick the prevailing long-term bond yield. The current Government of Canada long-term yield is approximately 2.2%. Provincial bond yields are normally a little greater so the discount rate picked for these calculations is 3%.

So to recap, the future rates for BC Hydro are projected to increase at a rate of 2.5% annually, despite recent different experiences, for the next 23 years after 2017. These future rates are the benefits if the resident does not have to pay them because of self-generating 2,750 KWhrs each year. To bring to a PV a discount rate of 3% is applied.

The BC Hydro Residential Rate Format

Readers are likely familiar with the BC Hydro billing, but for the record it includes a basic /fixed daily amount of 17.64 cents. There is no indication this may change but one cannot be certain. There is also a 5% "rate rider" amount that is adjustable and is variable because it is a percentage on the previous amounts that include charges for usage. These two charges have not been brought into the PV calculations.

The PV calculations are only based upon the projected future rates for KWhrs consumed. BC Hydro is currently using a two Tier rate system where the Tier one rate is 7.97 cents per KWhr and the Tier two is 11.95 cents per KWhr.
A residential customer can enjoy the lower rate for up to 1,350 KWhrs in a 60 day billing period then slides into the higher rate for all above that amount. In annual terms Tier one is about 8,000 KWhrs. The generally accepted view is residential customers use on average about 12,000 KWhrs per year. Customer life styles, where one lives in BC and what access one has to natural gas supplies, makes the notion of an average annual consumption very problematic .

There is an obvious advantage for a customer to be able to keep his/hers usage/demand below the ceiling amounts for Tier one rates.

The chart that follows demonstrates the consumption pattern for one residential customer who is living on a Gulf Island where there is no natural gas available. Winter months consumption is suppressed by the use of a wood furnace and a heat pump. This individual used 12,000 KWhrs in 2015 so used a blend of both Tier rates to arrive at a final billing amount for the year. The Tier two rates mostly affected the winter billing months.

The Seasonal Generation Pattern for Solar Panels In the Gulf of Georgia

With a look at the same chart it is readily seen that the generation of electricity by solar panels is highly seasonal and in direct contrast with residential customer demand. This data is from an operating array on Saltspring Island. For this installation the per standard panel annual generation was 310 KWhrs, so the lesser amount used in these PV calculations of 275 per panel is conservative. BC interior sites could generate 328 KWhrs per year per panel.

The Present Values of Tiers One and Two

The following chart is a simplification of the effect of the preceding assumptions and projections. The area above Tier one is where the economics of an investment in solar panels begins to be positive. When a person's life style and living circumstances dictate annual electricity consumption levels above 14,000 KWhrs then there is a strong likelihood that all self-generation will be replacing higher electricity rates. Obviously some self- management of consumption can increase benefits.

The PV of only using Tier one electricity is $5, 240. The unknown risk is if the top of Tier one is dropped to a lower ceiling amount. This does not appear a great risk mostly because the use of this Tier is to help financially challenged customers.

The PV of substituting all self-generation at the Tier two rates is $7,926. This amount is sufficiently greater than the likely cost of a new 10 panel installation, particularly if done using the co-op model to reduce the cost of the hardware.

If BC Hydro becomes more aggressive in setting rates post 2017 then it only makes the net value of the solar panel installation greater.

Supplementing these PVs would be any credits one could earn with generation surpluses sent into BC Hydro.

Conclusions

There is a reasonably persuasive financial case supporting the investment in a 10 solar panel array, with net metering, by residential customers of BC Hydro if their annual consumption of electricity is 14,000 KWhrs and above.

There is a case for a larger installation if the customer is using close to or more than 20,000 KWhrs annually.

(1) 2015/16—2017/18 BC Hydro Service Plan
(2) Statistics Canada; Consumer Price Index, historical summary (1996 – 2015)

Appendix A; Accumulating PV total Savings from not buying 2,750 KWhrs at Tiers 1 and 2.

After accounting for annual rate increases and a PV calculation using a 3% discount rate, for each year to 26.

Year	$ At Tier 1 rates	$ At Tier 2 rates
1	211.21	319.09
2	424.63	641.42
3	637.75	963.50
4	849.71	1,283.89
5	1,060.93	1,603.09
6	1,270.85	1,920.50
7	1,479.89	2,236.41
8	1,687.75	2,550.59
9	1,894.61	2,863.19
10	2,100.44	3,174.38
11	2,305.14	3,483.91
12	2,508.90	3,792.41
13	2,711.71	4,099.17
14	2,913.48	4,404.37
15	3,114.39	4,708.21
16	3,314.15	5,010.43
17	3,512.96	5,311.24
18	3,710.70	5,610.90
19	3,907.42	5,908.56
20	4,103.34	6,205.03
21	4,296.89	6,497.85
22	4,487.85	6,786.77
23	4,677.00	7,073.37
24	4,865.66	7,359.27
25	5,053.41	7,644.17
26	5,240.16	7,926.17

These values would change;
If a different discount rate used (Japan just went negative interest rate)
If BCH increased its KWhr rates faster than 2.5% per year
If site and panel productivity is greater or less than 275 per panel per year.

An individual's break even point will depend upon what blend of the two Tiers consumption used will be. It will also depend upon how successful the individual residential customer is in bring a seasonal consumption pattern closer into the seasonal pattern of solar generation.

Appendix B; The seasonality of Solar generation for the BC Gulf Islands and the Seasonal Pattern of Residential Consumption (one household). The variations are expressed in % of the Annual Totals.

60 day res. billing/consumption pattern		Monthly generation	
Oct-Dec	18.3 %	Oct	5.9 %
		Sep	9.2 %
Aug-Oct	14.8 %	Aug	12.9 %
		Jul	15.0 %
Jun-Jul	11.5 %	Jun	15.4 %
		May	14.7 %
Apr-Jun	16.0 %	Apr	10.7 %
		Mar	7.7 %
Jan-Mar	17.7 %	Feb	4.4 %
		Jan	2.1 %
Dec-Jan	21.7 %	Dec	2.0 %

These pattern of consumption and solar generation vary from specific location to location and for each residential customer.