PEMBINA institute

British Columbia Green Buildings Map: Methodology Backgrounder

For:	External review	**Date:**	Dec. 2, 2015
By:	Maximilian Kniewasser, Annie Russell	**Project:**	British Columbia Green Buildings Map
Re:	Methodology backgrounder		

SUMMARY

The second phase of the Clean Energy Jobs Map focuses on quantifying and locating employment in B.C.'s energy-efficient building sector including jobs from the construction of high-performance buildings, the energy renovation of existing buildings, and the manufacturing and supply of high-performance components.

The map aims to capture a snapshot of B.C.'s "green" construction industry, capturing the number and distribution of jobs over a typical recent year. The numbers of direct and indirect jobs are estimated for the province as a whole by multiplying the total costs of projects by established jobs factors. The locations of projects and manufacturing plants are mapped to indicate geographic distribution.

Our analysis gives a total of 23,200 direct and indirect jobs; Table 1 indicates the breakdown by sector.

Table 1: Jobs supported by energy-efficient buildings in B.C. for a recent representative year (rounded to the nearest 100)*

	Residential	Commercial, Institutional & Mixed Use	Manufacturing and Supply	Total
Retrofit	**5400**	**3700**	**2300**	**11300**
LiveSmart	500	0	100	600
Power Smart	1800	1500	700	4100
PowerSense	500	400	300	1200
Non-program	2600	1800	1100	5500
Construction	**1000**	**6200**	**4800**	**12000**
Part 3	700	6200	4600	11400
Part 9	300	0	200	500
Total	**6400**	**9800**	**7000**	**23200**

* We chose to focus on a recent representative year, as the various data sources were not available for one particular recent year. Note: Numbers do not add due to rounding

Estimating and locating jobs from high-performance new construction:
For this exercise, we consider as "high performance building" any building that meets one of the following certifications: BOMA BESt, Green Globes, LEED, Passive House, Living Building Challenge, and houses rated at or above EnerGuide 80. EnergyStar and R-2000 homes were not included due to lack of data.

Building information and location was collated from the LEED Project Profiles database[1], the BOMA BESt Certified Buildings database[2], the Green Globes Certified Buildings database[3], the International Passive House Institute Database[4], the Registered Living Building Challenge Projects map[5], the B.C. Major Projects Inventory[6], and Natural Resources Canada's EnerGuide database[7].

Residential homes rated at EnerGuide 80+ are not geolocated to respect confidentiality of NRCan data; instead, the location of these projects is mapped approximately based on their forward sortation area (the first three digits of the postal code).

Estimating jobs from building construction:
Job estimates for Part 3 buildings are derived from taking cost information for buildings in the B.C. Major Projects Inventory that qualify with one of the above-described certifications, and which are currently under construction, and multiplying them by job factors. Job estimates for Part 9 are taken from the number of EnerGuide 80+ homes constructed in B.C., averaged out over a five period.

Estimating jobs from energy retrofits:
The retrofit job numbers are based on grants awarded during the LiveSmart B.C. program (from 2008 to 2013)[8], Power Smart (2009 to 2013, 2015)[9,10] and PowerSense (2013, 2014)[11,12]. The total cost of the retrofit was estimated as slightly more than double the value of the grant, to include funds provided by the building owner.[13] The average annual grant amount was used, to smooth variations in program uptake and represent a "typical" year. In addition, we included retrofit investments that occur without incentive programs, based on findings by B.C. Hydro.[14]

We deliberated long on whether or not to include the LiveSmart BC program in our analysis, as the program was discontinued on March 31, 2014. We chose to include the program as it was active over most of the time period we studied and provided one of the best data sources on investment in energy retrofits in B.C. available.

Estimating and locating jobs from manufacturing of high-performance components:
The jobs in this sector are not quantified explicitly; rather, they are represented by the indirect job estimates from construction and renovation projects (Table 2).

A list of high-efficiency manufacturers in B.C. was provided by the Ministry of Energy and Mines and supplemented by a scan of insulated panel producers. The location of known

manufacturing facilities of efficient windows and doors, high-efficiency insulation and structurally insulated panels, and high-efficiency HVAC equipment are shown on the map.

Table 2: Job Factors used by the Pembina Institute (Jobs / $1 Million)

	Direct	Indirect	Combined
Construction[15]	6.0	4.0	10.0
Retrofit[16]	15.9	3.6	19.5

DISCUSSION AND METHODOLOGY LIMITATIONS

Scope

Whenever possible we used data that gave job estimates for 2015 (effective to the end of Q4 2015). When this was not possible, we used data averaged out over several recent years. As such, our map shows jobs supported over a typical recent year. We include direct jobs for construction and retrofit, and indirect for manufacturing and suppliers.

As we attempt to quantify jobs related to energy efficiency in the building sector, there are two possible approaches (and some hybrids of the two):

(1) Try to quantify jobs resulting from projects targeting "beyond code" energy efficiency;
(2) Try to quantify the segment of the construction industry that works on energy systems, irrespective of the level of performance of the building.

We opted for option (1) because we want to emphasize the economic benefits occurring due to beyond mandated energy performance in buildings. We use certification as a proxy for "beyond code" performance. However, we should note that since the code is by definition the worse acceptable buildings, most buildings will include elements that go beyond minimum prescriptive code performance, even if they are not going for certification. We should also note that only a portion of the total construction cost for certified buildings is related to the energy system of the building. We are less here trying to estimate the size of the energy efficiency, and more focused on estimating the size of the industry working in leading green buildings, or in the retrofit market.

Job factors

The job factors are based on the B.C. Stats Input-Output Multipliers for 2006 and 2008 as cited by the Federation of Canadian Municipalities and Green Jobs B.C.[17] These numbers were cross-referenced against a wide range of job factors found for construction and retrofit, available in the appendix.

Construction job numbers

Construction jobs for simple buildings (Part 9) are based on data provided by NRCan, which lists all buildings that have an EnerGuide score of 80 and higher and what year they were built in. We

averaged out the data for the last five years that we had full access of data to (2006-2010).[18] This is multiplied by the average cost of constructing an energy-efficient Part 9 home in B.C., estimated at $380,000[19], to get total investment dollars. The above described job factors for construction are then applied to get annual job numbers.

Construction job numbers for complex buildings (Part 3) are calculated from building projects in the B.C. Major Project Inventory that had the status of "Construction Started" and were identified as targeting one of the above energy-efficiency certifications. To be conservative, only projects with an expected completion date of Q4 2015 or later were included, so as not to count projects that may be completed by the time the project is launched. Each project's cost was multiplied by the direct and indirect job factors for construction and divided by the average construction length for the project's cost bracket (as calculated from the MPI durations and summarized in Table 3) to give an annual estimate.

Because the MPI only includes projects over $15 million, our methodology does not capture construction jobs from lower-cost Part 3 buildings. As such, our construction jobs are likely underestimated. We hope to update the study to include this segment of the market. Anecdotal evidence suggests that this segment attracts significant investments in energy efficiency in B.C.

Table 3: Construction length for Part 3 building by cost bracket (years)

Cost Bracket (Million $)	Average Construction Length (Yrs)	Number of Projects
<50	3.89	6
50-99	2.77	5
100-199	6	4
200-299	3.75	3
300-399	6.25	1
500-599	5	1
600-699	8.10	3
2000	20.75	1
4000	21.25	1

Retrofit job numbers

The retrofit job numbers are based on grants awarded during the LiveSmart B.C. program (from 2008 to 2013)[20], Power Smart (2009 to 2013, 2015)[21,22] and PowerSense (2013, 2014)[23,24]. Only spending allocated for residential and commercial projects was considered; program spending on industrial, low income, conservation and education, admin, innovation and advertisement and supporting initiatives was not included. Where applicable, program total costs were divided into residential and commercial spending based on the cost numbers provided in program reports.[25]

Detailed info for Power Smart and PowerSense data can be found in Appendix 2 and 3. Table 4 below summarizes total spending by the programs considered in this project.

Table 4: Annual spending considered in-scope from B.C. based retrofit programs ($million)

Program	Total yearly program DSM spending	Residential	Commercial	Total in-scope for this project	Total including private contribution*
Power Smart	180.2	57.0	45.6	102.6	2018.1
PowerSense	42.2	14.5	13.2	27.7	56.2
Live Smart	14.2	14.2	0.0	14.2	28.8

*** In-Scope program spending is multiplied by 2.03 to account for private contribution**

For each program, the average yearly grant totals were increased by 103% to include homeowner and commercial contributions, based on survey results by the Acadia Center.[26] Detailed info for the private contribution factor used can be found in Appendix 4.

It is worth flagging that Power Smart, PowerSense, and LiveSmart BC programs reflect only a portion of retrofits completed in the province. Interviews with homeowners conducted by BC Hydro to quantify free ridership and spill effect of the LiveSmart program showed that between F2009 and F2011, the LiveSmart program had a spillover rate of 12% from participants, and an estimate spillover of 84% outside of program participants. That is, for each unit of energy saved as a result of grants provided, 0.94 units of energy were saved due to retrofits conducted without incentives. We use this 94% spillover estimate as a lower bound for the additional retrofits investments conducted outside of the grant program.[27] The investments by the retrofit programs, private contribution to the programs, and the out of program retrofits together gives the total investments in retrofits in B.C.

The total investment is then multiplied by the job factors for renovation to estimate job creation from energy retrofit.

Manufacturing & supply job numbers

Jobs from manufacturing and supply are calculated form the indirect job numbers for construction and retrofit described above.

By estimating the jobs from investments in energy retrofits and high performance buildings, we are not capturing the manufacturing and supply jobs related to investments in regular code construction. However, high-energy performance building products may still be used in regular code buildings/non-certified buildings (for example, most Passive House windows are not used in Passive House projects). Furthermore, there are products that naturally fit into energy efficiency – all insulation products, for example, whether for code or beyond-code buildings. Therefore we are certainly underestimating this sector here.

On the other hand, not all high-performance building materials used in B.C. buildings are actually produced in B.C. There certainly is some leakage. The two effects balance each other, but we estimate that the former would dominate latter and therefore the total number of manufacturing jobs attributable to energy efficiency is probably greater than the value provided here.

There remains uncertainty in what exactly is included in the indirect jobs. There is value in better understanding what specific indirect jobs energy efficient building construction supports, as this will help to better estimate the employment benefits from energy efficiency in BC. This could be the focus of future study.

Lastly, we want to address the additionality of energy efficiency jobs. The debate on what jobs we see as being created as we increase energy efficiency policy vs. just changing the nature of the work is a lively one (arguably construction jobs of new buildings would have occurred regardless if the building is green or not. However, we would argue that the retrofit and manufacturing jobs are additional to what would have occurred in a BAU world.). We do not attempt to answer this debate with this project. Rather, we want to highlight that the clean tech sector in general and the high performance buildings sector in particular are already a vibrant economic driver in B.C., and that finding solutions to our energy and environmental problems already provides much economic activity and many jobs.

Other energy efficiency related employment

Because of the difficulty of quantifying employment associated with the energy management, we have not included this portion of the building energy efficiency labour force in the job estimates. We estimate that the energy management of existing buildings account for relatively few jobs compared to the construction and renovation sector.

We also do not consider the induced jobs occurring from energy savings. Studies have shown that the re-spending in the economy of money saved form energy efficiency is the largest economic and employment driver from energy efficiency.[28]

SUMMARY OF FINDINGS

Our analysis gives a total of 23,200 direct and indirect jobs[29]. New construction of high performance buildings generate 12,000 jobs; 1,000 in the residential sector, 6,200 in the commercial & institutional sector, and 4,800 indirect jobs, mostly in the manufacturing and supply sector. Retrofits account for 11,300 jobs, with 5,400, 3,700, and 2,300 for residential, commercial & institutional, and indirect/manufacturing respectively. Table 5 gives the detailed job numbers.

Table 5: Jobs supported by energy efficient buildings in B.C. (unrounded numbers)

	Residential	Commercial, Institutional & Mixed Use	Manufacturing and Supply	Total
Retrofit	**5361**	**3680**	**2253**	**11294**
LiveSmart	457		104	561
Power Smart	1838	1471	749	4058
PowerSense	468	426	308	1202
	2598	1783	1092	5473
Construction	**1027**	**6154**	**4788**	**11969**
MPI	698	6154	4569	11421
Part 9	329		219	548
Total	**6388**	**9835**	**7040**	**23263**

Review Process

The external review is currently ongoing.

Appendix 1: Comparison of Job factors.

Sector	Organization	Study/Report		Job Factor
Construction Industry	Green Jobs BC	Buildings, Energy Efficiency Retrofits and Green Jobs in BC	BC	6.46 jobs/$1M **(direct),** 10 jobs/$1M **(direct and indirect)**
	American Council for an EE Economy	How Does EE Create Jobs? Fact Sheet Understanding the True Benefits of Both Energy Efficiency and Job Creation	US	20.3 jobs/$1M US (**direct, indirect, induced**). For overall US economy: 17 jobs/$1M US (direct, indirect, induced).
	Federation of Canadian Municipalities	Building Canada's Green Economy: The Municipal Rule	Can	6 jobs/$1M (**direct)**, 10 jobs/$1M (**direct and indirect)**
Retrofit	Green Jobs BC	Buildings, Energy Efficiency Retrofits and Green Jobs in BC	BC	15.93 jobs/$1M **(direct),** 18.51 jobs/$1M **(direct and indirect)**
	Sundquist, E.	Estimating Jobs from Building Energy Efficiency	US	4.3 jobs/$1M for large industrial retrofits; 7.4 jobs/$1M for multifamiliy EE retrofits; 9.1 jobs/$1M for single family EE retrofits **(All direct)**
	Columbia Institute	Building Fast Action for Climate Change and Green Jobs: This Green House	Can	20 jobs/$1M; 16.7jobs/$1M in USA
	Institute for Market Transformation and Political Economy Research Institute	Analysis Job Creations and Energy Cost Savings	US	12.1/$1M Operational Improvements 9.58/$1M Multifamily Capital Upgrade 9.24/$1M Commercial Capital Upgrade **(Direct and Indirect)**

	HR&A / Living Cities	The Benefits of Energy Efficiency in MultiFamily Affordable Housing	US	10 jobs/$1M

Appendix 2: Overview of BC Hydro Power Smart DSM expenditures in the building sector

Here we describe the methodology we used to estimated investment dollars in retrofits stimulated by BC' Hydro's Power Smart program. We take BC Hydro DSM spending over a five-year period (2009-2013) to take a yearly average. This gives an average DSM expenditure of $180 million/year, based on submissions to the BCUC. Not all of the $180 million will be spent on areas we consider in scope: for retrofits we include the residential and commercial incentives, but exclude spending on industrial and portfolio-level programs. Between 2009 and 2013, 32% of total DSM expenditures went to residential and 25% to commercial programs. 43% of the spending was out of scope (see Table A2-1).[30]

Table A2-1: BC Hydro past DSM expenditures broken down by sector ($millions)
Data from BCUC

Sector	5 years total? (2009-2013)	1 year average	% of total spend
Residential	285	57	32%
Commercial	228	46	25%
Industrial	232	46	26%
Portolio-Level	156	31	17%
Total	901	180	100%

Source: http://www.bcuc.com/Documents/Proceedings/2008/BCH_LTAP_B-1-1_APPENDICES/Appendix%20K.pdf

This gives DSM investments on residential and commercial of $57.0 and $45.6 million respectively (see Table A2-2).

Table A2-2: BCH DSM expenditures going assumed for Clean Jobs Map

Group	Total DSM ($millions)	Residential	Commercial	Total for Pembina study
BC Hydro	180	57.0	45.6	102.6

Please note: not all expenditures from the residential and commercial programs of Power Smart are for retrofits. Some of the money will go towards equipment rebates, such as the purchase and

installation of high efficiency electric heat pumps. While this is still an energy efficiency retrofit, it may not be representative of the job factors we are using. Direct retrofit jobs will likely be lower for equipment retrofits than suggested by our job factors. However, in equipment retrofit scenarios, the indirect job factors likely underestimate the job creation by manufacturing of high efficiency building materials/components/equipment and other suppliers, which we consider in scope. As such we assume that, on balance, these factors balance each other out. We are constrained by the level of detail in the data available to us, and are therefore forced to make this assumption.

Considering the above paragraph, we want to re-emphasize that we make conservative assumptions throughout the project (not including Part 9 construction projects below $15 million, underestimating manufacturing and supplier jobs in B.C. etc.). The one exception is the above-described assumption that DSM program spending will primarily go towards retrofits.

Appendix 3: Overview of Fortis PowerSense DSM expenditure in the buildings sector

Fortis Inc's DSM program is known as PowerSense. Fortis has two different programs for its electric and natural gas businesses. These programs were referred to as PowerSense Electric and PowerSense Natural Gas as late as 2014. We were unable to find a common source for the two program expenditures. Each is described below.

PowerSense Electric information is from Fortis Inc. submissions to the BCUC on planned DSM expenditures for its electric business in 2013. Fortis planed to spend $7.9 million on electricity DSM in total in 2013, of which 50% and 26% are for residential and commercial programs respectively. 24% of the spending is out of scope (see Table A3-1).[31]

Table A3-1: PowerSense Electric DSM spending for 2013

Sector	Money spent ($ millions)	Ratio
Residential	3.944	50%
Commercial	2.085	26%
Industrial	0.364	5%
Program Total	6.393	81%
Supporting initiatives	0.725	9%
Planning & Evaluation	0.76	10%
Total	7.878	100%

DSM data for PowerSense Natural Gas was received directly from Fortis (See table A3-2). The data provided is for planned DSM expenditures. We use the 2014 data in our analysis. Only residential and commercial program expenditures are included.

Table A3-2: DSM data provided by Fortis for DSM on its natural gas business

Program Area and Service Territory	Utility Expenditures ($1000s)					
	2014	2015	2016	2017	2018	Total
Residential						
FEI	9,469	10,220	10,396	10,252	11,138	51,476
FEVI	1,089	1,154	1,162	1,102	1,183	5,691
Total	10,558	11,375	11,559	11,355	12,321	57,167
Commercial						
FEI	9,617	10,128	9,623	9,289	9,125	47,782
FEVI	1,515	1,677	1,792	1,765	1,754	8,503
Total	11,132	11,805	11,415	11,054	10,879	56,285
Industrial						
FEI	1,738	2,185	2,516	2,874	2,932	12,245
FEVI	174	220	253	291	297	1,234
Total	1,912	2,404	2,770	3,165	3,228	13,479
Low Income						
FEI	2,307	2,574	2,833	3,044	3,381	14,138
FEVI	322	305	332	401	390	1,750
Total	2,629	2,879	3,165	3,446	3,770	15,888
Conservation Education and Outreach						
FEI	2,160	2,203	2,247	2,292	2,338	11,241
FEVI	240	245	250	255	260	1,249
Total	2,400	2,448	2,497	2,547	2,598	12,490
Innovative Technologies						
FEI	1,106	1,138	1,214	1,199	1,281	5,938
FEVI	101	105	69	93	28	396
Total	1,207	1,242	1,283	1,292	1,309	6,334
Enabling Activities						
FEI	4,109	4,687	4,250	4,374	4,437	21,856
FEVI	406	464	420	433	439	2,162
Total	4,515	5,150	4,670	4,806	4,876	24,017
ALL PROGRAMS						
FEI	30,505	33,134	33,081	33,324	34,632	164,676
FEVI	3,848	4,169	4,278	4,340	4,350	20,984
Total	**34,353**	**37,303**	**37,358**	**37,664**	**38,982**	**185,660**

Note: FEI is FortisBC Energy Inc, FEVI is Fortis BC Energy Ince Vancouver Island

Fortis' electric and natural gas DSM expenditures are combined to inform the residential and commercial program expenditures used in our project. Total DSM expenditures for Fortis' electric and natural gas business is $42.2 million/yr. Of this, $14.5 million is for residential programs, and $13.2 million is for commercial programs. 34% of Fortis' DSM expenditure is out of scope (see Table A-3-3).

Table A3-3: Fortis' electric and natural gas combined DSM expenditures used in our project ($million)

Program	Total DSM expenditure	Residential	Commercial
PowerSense	42.2	14.5	13.2

Appendix 4: Private contribution

The DSM programs only fund a portion of the cost of retrofit projects. The rest is funded privately (or publically for public buildings). We refer to this private contribution to retrofit projects simply as "private contribution". Data on private contribution was difficult to obtain. We base our factor on a 2014 study by the Acadia Center, which used surveys from Manitoba that break down energy efficiency retrofits by program spending, private spending and total expenditures on retrofit projects.[32] The private contribution for Manitoba is 1.03 times the program spending. Total spending therefore is 2.03 (see table A4-1). This was cross-referenced to expected contribution factor from BC Hydro.[33]

Table: Program and private contribution to energy efficiency initiatives based on Survey data from Manitoba.

Manitoba	Electric (c/kwh)	NG (c/m3)
Unit Program Costs	2.7	9.5
Unit Participant Costs	2.2	11.8
Total Costs	4.9	21.3
Private contribution	0.81	1.24
Total spending including private contribution	2.03	

Endnotes

[1] http://leed.cagbc.org/Leed/projectprofile_EN.aspx
[2] http://www.bomabest.com/certified-buildings/
[3] http://www.greenglobes.com/newconstruction/certified.aspx
[4]http://www.passivhausprojekte.de/index.php#s_bf18546217c0e02b1e69a4a4aec42556
[5] http://living-future.org/projectmap
[66] http://www2.gov.bc.ca/gov/content/employment-business/economic-development/industry/bc-major-projects-inventory
[7] Data request (July 7 2015) for EnerGuide homes 80 or higher (2009-2011) and corresponding three digit postal codes.
[8] Data provided by Rylan Nowell, October 2013
[9] The percentage of total DSM spending on residential and commercial DSM programs is taken from a 5 year forecast from 2009 to 2013 (Table 10) http://www.bcuc.com/Documents/Proceedings/2008/BCH_LTAP_B-1-1_APPENDICES/Appendix%20K.pdf .
[10] Total DSM spending is taken from a 10 year commitment to spend $1.6 Billion on DSM (assumed to be $160 million per year). From 2014/2015 annual report: https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/accountability-reports/financial-reports/annual-reports/bc-hydro-annual-report-2015.pdf
[11] Spending on DSM by Fortis's electric business is from a 2014 submission to the BCUC. http://www.fortisbc.com/About/RegulatoryAffairs/GasUtility/NatGasBCUCSubmissions/Documents/140924_FBC%202015-2016%20DSM%20Expenditures%20-%20ICG%20IR1%20Response_FF.pdf
[12] Spending on DSM by Fortis' natural gas business is from personal communication with Beth Ringdahl and based on 2014 DSM numbers.
[13] Factor for participant spending based on a business as usual scenario for Manitoba, which is based on survey data (Appendix 6). Acadia Centre, *Energy Efficiency: Engine of Economic Growth in Canada* (March 2014) http://acadiacenter.org/wp-content/uploads/2014/11/ENEAcadiaCenter_EnergyEfficiencyEngineofEconomicGrowthinCanada_EN_FINAL_2014_1114.pdf.
Cross referenced against expected contribution factor in: BC Hydro, *Power Smart Employment Impacts* (2010).
[14] "The evaluated average free-ridership and participant spillover was 44 and 12 per cent respectively. The evaluation also estimated non-participant spillover of 543 TJ e per year or 84 per cent of program gross savings."BC Hydro. "Evaluation of the LiveSmart BC Efficiency Incentive Program," 2012.
[15] Federation of Canadian Municipalities, *Building Canada's Green Economy: The Municipal Role* (2011). Citing Statistics Canada "National Input-Output Multipliers" 2006, M-level aggregation. https://fcm.ca/Documents/reports/Building_Canadas_green_economy_the_municipal_role_EN.pdf
[16] Green Jobs BC, *Buildings, Energy Efficient Retrofits, and Green Jobs in BC* (Jan 2013). http://greenjobsbc.org/wp-content/uploads/2012/01/GJBC-building-retrofits.pdf
[17] Federation of Canadian Municipalities, *Building Canada's Green Economy: The Municipal Role* (2011). Citing Statistics Canada "National Input-Output Multipliers" 2006, M-level aggregation. https://fcm.ca/Documents/reports/Building_Canadas_green_economy_the_municipal_role_EN.pdf
[18] We assume that the average construction time for energy efficient Part 9 building in BC is 1 year.
[19] We took the average of two cost estimates per square footage and multiplied this by the size of an average BC new home, which we define at 2,000 ft^2. The Business case for Passiv House. Retrieved from: http://canphi.ca/wp-content/uploads/2015/07/Passive-House_BusinessCase_2015.pdf
- Assumes average new home is 2000 ft2
[20] Data provided by Rylan Nowell, October 2013
[21] The percentage of total DSM spending on residential and commercial DSM programs is taken from a 5 year forecast from 2009 to 2013 (Table 10) http://www.bcuc.com/Documents/Proceedings/2008/BCH_LTAP_B-1-1_APPENDICES/Appendix%20K.pdf .

[22] Total DSM spending is taken from a 10 year commitment to spend $1.6 Billion on DSM (assumed to be $160 million per year). From 2014/2015 annual report: https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/accountability-reports/financial-reports/annual-reports/bc-hydro-annual-report-2015.pdf

[23] Spending on DSM by Fortis's electric business is from a 2014 submission to the BCUC. http://www.fortisbc.com/About/RegulatoryAffairs/GasUtility/NatGasBCUCSubmissions/Documents/140924_FBC%202015-2016%20DSM%20Expenditures%20-%20ICG%20IR1%20Response_FF.pdf

[24] Spending on DSM by Fortis' natural gas business is from personal communication with Beth Ringdahl and based on 2014 DSM numbers.

[25] This applies to Power Smart and PowerSense for the electric and natural gas businesses.

[26] Factor for participant spending based on a business as usual scenario for Manitoba, which is based on survey data (Appendix 6). Acadia Centre, *Energy Efficiency: Engine of Economic Growth in Canada* (March 2014) http://acadiacenter.org/wp-content/uploads/2014/11/ENEAcadiaCenter_EnergyEfficiencyEngineofEconomicGrowthinCanada_EN_FINAL_2014_1114.pdf.

Cross referenced against expected contribution factor in: BC Hydro, *Power Smart Employment Impacts* (2010).

[27] "The evaluated average free-ridership and participant spillover was 44 and 12 per cent respectively. The evaluation also estimated non-participant spillover of 543 TJ e per year or 84 per cent of program gross savings."BC Hydro. "Evaluation of the LiveSmart BC Efficiency Incentive Program," 2012.

[28] Acadia Center. "Engine of Economic Growth Canada: A Macroeconomic Modelling & Tax Revenue Impact Assessment. (2014).

[29] Note: all numbers are rounded to the nearest 100

[30] BCUC: http://www.bcuc.com/Documents/Proceedings/2008/BCH_LTAP_B-1-1_APPENDICES/Appendix%20K.pdf

[31] http://www.fortisbc.com/About/RegulatoryAffairs/GasUtility/NatGasBCUCSubmissions/Documents/140924_FBC%202015-2016%20DSM%20Expenditures%20-%20ICG%20IR1%20Response_FF.pdf

[32] Energy Efficiency: Engine of Economic Growth in Canada (2014). Appendix 6. Retrieved from: http://acadiacenter.org/wp-content/uploads/2014/11/ENEAcadiaCenter_EnergyEfficiencyEngineofEconomicGrowthinCanada_EN_FINAL_2014_1114.pdf

[33] BC Hydro, *Power Smart Employment Impacts* (2010).