Power Smart Employment Impacts

DSM Programs, Rates and Codes and Standards, F2008 to F2037

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

GLOSSARY OF TERMS

ACEEE	American Council for an Energy-Efficient Economy
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BCUC	British Columbia Utilities Commission
CDM	Conservation and Demand Management (alternative term for DSM)
DSM	Demand-Side Management
DTA	Digital Terminal Adapter
F	Fiscal (Year)
FTE	Full-time Equivalent
GDP	Gross Domestic Product
GST	Goods and Service Tax
GWh	Gigawatt-hour (1,000,000 kW.h)
HRV	Heat Recovery Ventilation
HST	Harmonized Sales Tax (combined provincial and federal sales tax)
HVAC	Heating, Ventilating and Air Conditioning
I/O	Input-Output
IPSP	Integrated Power System Plan
ITC	Investment Tax Credit
kW	Kilowatt
LCC	Life-Cycle Cost
LTAP	Long-Term Acquisition Plan
NPV	Net Present Value (discounted future value expressed in base year dollars)
OPA	Ontario Power Authority
PS	Power Smart
PST	Provincial Sales Tax (Social Series Tax)
PY	Person-Year (one-year of full-time employment)
STB	Set-Top Box
SWEEP	Southwest Energy Efficiency Project

DEFINITIONS

Direct Impact	The initial investment expenditures in a DSM measure, which are used in the I/O model to estimate the indirect and induced (spin-off) effects.
Indirect impacts	Additional economic activity that is generated as BC suppliers and installers purchase intermediate goods and services (estimated in the I/O model).
Induced Impacts	Additional activity generated when the suppliers pay out extra wages to their employees, who in turn purchase more consumer goods and services.
Investment Effects	Direct, indirect and induced employment estimated from the initial DSM investment expenditures in programs, rates, codes and standard measures.
Re-spending Effects	Direct, indirect and induced employment estimated from consumers' re-spent electricity bill savings in the economy.
DSM Programs	BC Hydro Power Smart programs (e.g., Refrigerator Buyback) designed to influence customers to reduce energy use by removing barriers to energy efficiency and conservation
Conservation Rates	BC Hydro electricity rate structures undertaken to conserve energy or promote energy efficiency.
Building Codes	Energy efficiency regulations within various building codes (e.g. provincial, municipal).
Product Standards	Energy efficiency regulations pertaining to energy using and energy controlling products and equipment for sale within Canada and British Columbia.

EXECUTIVE SUMMARY

This study estimates the impacts on provincial employment for the period of F2008 through F2037 based on the BC Hydro Power Smart Demand-side Management (DSM) Plan for fiscal years F2008 through F2028.[1] Employment impacts are estimated for BC Hydro's DSM programs, conservation rate structures, and provincial and federal energy regulations relating to buildings and equipment. The analysis was undertaken using the BC Input-Output (I/O) Model from Statistics Canada together with DSM Plan data supplied by BC Hydro.

Overview of Results

- This study estimates that BC Hydro Power Smart's energy conservation and efficiency initiatives will create more than 193,000 jobs over the 30-year period of analysis.[2]
- BC Hydro's current DSM Plan, as filed with the 2008 Long Term Acquisition Plan (LTAP) Evidentiary Update, is expected to save nearly 245,000 gigawatt-hours (GWh) over the 30-year study period, or an average 8,100 GWh annually through 2037.[3]
- The plan involves investment expenditures totalling $3.9 billion ($2008) in net present value terms—$2.0 billion from BC Hydro and $1.9 billion of net (less utility incentives) from customers.
- These expenditures give rise to direct employment through the purchase of labour and materials, and indirect and induced jobs from business activity in the supply chain and spending of wages.
- Induced employment is also created by the spending and re-spending of energy bill savings from the investment in lower-cost DSM.
- Table ES-1 summarizes the provincial employment impacts that are estimated to result from this initial investment and re-spending of savings. Results are shown for both cumulative job creation over the 30-year period and an average annual employment impact.

Table ES-1
Employment Impact Summary
(Person-years, F2008-F2037)

	Cumulative Impact			Average Annual Impact
Program Category	**Investment Effect**	**Re-spending Effect**	**Both Effects**	**Investment + Re-spending**
DSM Programs	49,474	50,893	100,367	3,346
Conservation Rates	1,605	37,327	38,932	1,298
Building Codes	4,734	5,417	10,151	338
Product Standards	4,050	39,832	43,882	1,463
Total	**59,863**	**133,469**	**193,332**	**6,445**

[1] Employment reported throughout this study is expressed as undiscounted person-years. A PY or "full-time equivalent" (FTE) is defined as one full-time job lasting one year. For the purpose of this study, one PY is defined as being equal to one job, allowing the terms to be used interchangeably.

[2] This number includes impacts from various codes and standards measures accomplished in partnership with other organizations implemented through the City of Vancouver, federal and BC government energy efficiency regulations. See BC Hydro (2008), *Long-Term Acquisition Plan: Evidentiary Update*.

[3] Expenditures are made from F2008 to F2028; however, savings extend through to F2037.

- While employment is the focus of this study, other key measures of economic impact were assessed for the DSM portfolio activities. These initiatives are estimated to generate provincial GDP of $6.6 billion ($2008 NPV) over the study period, or an average $220 million a year.
- The provincial and federal governments are estimated to collect $1.2 billion ($2008 NPV) in taxes, or nearly $40 million annually as a result of these activities.

Key Findings

- The impacts estimated herein are "gross" in that they do not take account of the employment displaced due to potential supply-side projects avoided by the DSM activity. Specifically, to the extent that a given DSM component displaces the need for another resource option, such as a new generating unit, the employment that would have been created by that displaced resource is not deducted, or netted out, from the DSM employment.
- Overall, the results of this study are comparable, on an employment per dollar of DSM investment basis, to similar estimates made elsewhere. For example, the Power Smart DSM programs alone generate an estimated 34.4 PYs per million dollars spent. This "employment intensity" compares to an estimated 38.5 PYs/$million from a 2008 Ontario Power Authority study (adjusted to exclude displaced generation effects) and 33.5 PYs/$million from a 2005 Power Smart study.
- This study shows that demand-side resources lead to substantial job creation over the lifetime of the DSM measures.
    - ⇒ Investment expenditures are the primary source of employment during the initial years of the DSM Plan. However, jobs from the re-spending of customer energy savings quickly ramp up and overtake this investment-related employment, which declines as the investment is fully expensed.
    - ⇒ The re-spending employment impact continues to increase over the study period, with the cumulative effect of DSM energy savings, until it reaches a plateau. This impact persists for the regulated codes and standards, but falls off gradually in the case of DSM programs and rates.
    - ⇒ Because the employment impacts from the re-spending of bill savings are ongoing, they are comparable to the operation and maintenance jobs associated with supply-side resources. Likewise, the employment created to acquire and install DSM measures is comparable to the construction jobs for electricity generation projects.
- Since most of the regulated appliances and equipment are manufactured outside British Columbia, the employment impacts from product standards are largely due to the re-spending of energy savings. Building components, in contrast, have a higher percentage of their initial expenditures sourced from within the province, so that investment jobs are a significant share of total employment.
- Regional investment and re-spending impacts can be approximated by allocating the initial investment expenditures based on energy savings by region. Using this approximation, the direct employment impacts are distributed as follows: Lower Mainland 48.4%, Vancouver Island 21.2%, Southern Interior 21.1% and Northern Interior 9.3%. The indirect and induced impacts, on the other hand, can occur anywhere in the province and so cannot be regionally allocated here.
- Generally, DSM investments are more labour-intensive, creating jobs that are geographically dispersed, spread over many small firms and ongoing in nature. Capital-intensive supply-side projects tend to focus their employment in shorter-term jobs, specialized companies in population centres, and professional occupations such as planning and engineering.

- Similar to the conclusion reached in a national US study, BC Hydro's Power Smart activities may be the most invisible and least appreciated energy success story—in terms of energy saved, environmental impacts avoided and sustainable jobs created—since the inception of DSM programs in the province.[4]

[4] Ehrhardt-Martinez and Laitner (2008), *The Size of the U.S. Energy Efficiency Market: Generating a More Complete Picture.* Summarized in Section 2.5

1.0 INTRODUCTION

The purpose of this study is to estimate the impacts on provincial employment for the period of F2008 through F2037 based on the BC Hydro Power Smart Demand-side Management (DSM) Plan. Launched in 1988, Power Smart has helped to generate economic benefits through the introduction and diffusion of energy-saving measures across British Columbia. BC Hydro has continued to improve and broaden its DSM activities, culminating in the most recent (F2008) DSM Plan examined in this study.

In addition to the Power Smart programs, the study considers the employment impacts from BC Hydro's conservation rate structures as well as those from provincial and federal energy codes and standards, which are supported by BC Hydro's Power Smart activities. The latter apply to energy-using equipment, buildings and building components in BC.

Employment impacts are estimated using the most recent version (2006 update) of the BC Input-Output Model from Statistics Canada.[1] Data for the analysis have been provided by BC Hydro, based on a methodological approach adopted in an earlier Power Smart employment study that was to be followed here.[2]

1.1 The Economic Advantage of DSM

It is generally understood that DSM programs can be effective in reducing energy demand at lower cost than the construction of new power plants to meet growing electricity needs. However, the contribution of these programs to creating and sustaining provincial employment is sometimes overlooked. Electricity generation or "supply-side" projects are often perceived as being more beneficial to the economy because of the intense employment that is created during their construction phase.

Yet if all the economic impacts arising from DSM programs are quantified over the lifetime of the DSM measures, the total employment benefits are significant. This advantage has been demonstrated in other studies and is due, in large part, to the simulative effect from the re-spending of increased household income resulting from customers' energy bill savings.[3]

1.2 BC Hydro's Long-Term Acquisition Plan

The 20-year DSM Plan used herein is part of a BC Hydro submission to the BC Utilities Commission (BCUC) for its 2008 Long-Term Acquisition Plan (LTAP).[4] This submission sets out future actions to meet the provincial government's 2007 BC Energy Plan objectives and included an electricity demand and supply analysis, an update of potential resource options and a new Power Smart DSM Plan.[5]

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[1] Employment reported throughout this study is expressed as undiscounted person-years.

[2] G.E. Bridges & Associates Inc. (2005), *Power Smart Impacts on Employment in BC*.

[3] See for example: Southwest Energy Efficiency Project (2002), *The New Mother Lode: The Potential for More Efficient Electricity Use in the* Southwest; Ehrhardt-Martinez and Laitner (2008), *The Size of the U.S. Energy Efficiency Market: Generating a More Complete* Picture; and G.E. Bridges & Associates Inc. (2005), *Power Smart Impacts on Employment in BC.*

[4] BC Hydro (2008), *Long-Term Acquisition Plan Application: Evidentiary Update*.

[5] For the provincial objectives, see Province of British Columbia (2007), *The BC Energy Plan: A Vision for Clean Energy Leadership*.

BC Hydro's DSM Plan consists of an array of measures to reduce electricity use. Three key elements, along with their supporting initiatives, make up the plan:[6]

- DSM programs (residential, commercial and industrial);
- Conservation rate structures (inclining block rates); and
- Building codes and product standards.

1.3 Study Scope

This study estimates the annual and total (cumulative) employment impacts by individual DSM component for BC Hydro's Power Smart programs, rate structure initiatives, and codes and standards over the F2008-F2037 timeframe. For each component, initial investment expenditures are used to estimate the direct employment resulting from construction or installation of the DSM measure(s). Input-output analysis is then applied to estimate the indirect and induced (spin-off) effects of the initial spending as it reverberates through the provincial economy.[7]

Also for each DSM component, the energy cost savings are used to estimate the employment generated from the re-spending of additional household income. Bill savings persist through F2037, beyond the timeframe of the DSM expenditures themselves.

Consistent with the 2005 Power Smart employment study, the impacts estimated herein are "gross" in that they do not take account of the employment displaced due to potential supply-side projects avoided by the DSM activity. Specifically, to the extent that a given DSM component displaces the need for another resource option, such as a new generating unit, the employment that would have been created by that displaced resource is not deducted, or netted out, from the DSM employment. This analysis can not be completed at this time because there is no Long Term Acquisition Plan without DSM.

Geographic Coverage

For estimating the direct impacts of Power Smart DSM programs and conservation rates, the analysis covers the residential, commercial and industrial sectors of BC Hydro's integrated service area. It excludes the utility's non-integrated service areas and other parts of the province not served by BC Hydro.

In the case of the direct impacts of energy codes and standards, employment impacts are estimated for the entire province. For all the DSM initiatives, the indirect and induced effects are reported province-wide.

Measuring Employment

Newspaper accounts of construction projects typically report the number of jobs, which is often an estimate of how many people worked for any duration at the job site. Since typically these projects have many different combinations of occupations engaged for varying lengths of time, "jobs" are not a particularly meaningful statistic for employment measurement.

[6] Supporting initiatives include public awareness and education, community investment, community partnerships, local government engagement, a network of Power Smart specialists, codes and standards support, and technology innovation and information technology.

[7] See Section 2.1 for a definition of these effects.

An accepted measure for normalizing jobs is to define a "person-year" (PY) of employment. A PY or "full-time equivalent" (FTE) is defined as one full-time job lasting one year.[8] For the purposes of this study, one PY is defined as equal to one job, allowing the terms to be used interchangeably below.

1.4 Harmonized Sales Tax

The BC government has declared its intention to harmonize the Provincial Sales Tax (PST) with the federal Goods and Services Tax (GST) effective July 1, 2010.[9] Two aspects of the proposed Harmonized Sales Tax (HST) have implications for provincial DSM initiatives.

First, the PST portion of the new HST tax base will be enlarged to the broader GST tax base. As a result, sales taxes will be higher for final consumers, since the PST will be charged on previously exempt goods and services. The retail PST exemptions on certain energy conservation equipment will be eliminated and final consumers will pay 12 per cent HST on all of these products.

There is a provincially administered HST exemption for residential energy use in order to maintain the previous PST exemption on residential building energy use.[10] The HST will be combined with the GST input tax credit (ITC) for businesses, which will reduce business costs. The after-tax cost of energy for the commercial and industrial sectors will effectively decrease by 7 per cent, since the previous PST paid will now be rebated along with the GST portion of the ITC. This means that effectively PST and GST sales taxes on business purchases of all (energy and investment) inputs will be eliminated, as businesses will be rebated their full HST ITC. However, one exception to this rule applies. Large commercial customers who have sales in excess of $10 million and are not classified as "producers" will see no change in the after-tax cost of electricity until 2015, at which time they will begin to get the PST portion of the HST rebated back over the 2015-2018 period.[11]

The December 2008 version of BC Hydro's DSM Plan on which this study is based did not anticipate the HST. While harmonization will alter the relative after-tax costs of DSM and energy inputs for small commercial, some large commercial and industrial customers, affecting financial incentives to invest in DSM, these changes are not reflected in the data used here. The HST should not influence uptake of the non-discretionary DSM initiatives, specifically the conservation rates and codes and standards. Nevertheless, adjustments to the I/O model have been made to update the study results to the extent possible, as explained in Appendix A.

[8] A PY is equal to one person working full-time for one year. Two people working full-time for six months also add up to one FTE.

[9] Province of BC (2009), "Harmonized Sales Tax to Boost Investment, Job Creation."

[10] Province of BC (2009), *Backgrounder: Harmonized Sales Tax (B.C. HST)*.

[11] Commercial businesses that are classified as producers with sales over $10 million will get the full PST and GST ITC as of July 1, 2010. The ITC restriction applies only to large commercial businesses that are not producers (primarily retail and all financial institutions) and will not receive their PST portion of the ITC until 2015 to 2018. See Appendix A.

2.0 BACKGROUND

This section provides an overview of the BC Input-Output (I/O) model and a summary of several studies investigating the employment impacts of DSM programs in other jurisdictions.

2.1 Input-Output Model

The BC I/O Model is a sub-model of Statistics Canada's Interprovincial Input-Output Model. Based on 2006 economic data, it encompasses 302 industries, 727 commodities and 170 final demand categories. The model is comprised of three matrices: "MAKE," which allocates the production of commodities among industries; "USE," which establishes the production functions of industries and determines the commodity inputs by industries; and "FINAL DEMAND," which defines the accounting balance between total demand and domestic production.

Together, these three matrices form a complete representation of the BC economy, including all intermediate transactions between industries, primary inputs (e.g., wages), and commodity and export proportions. By performing the appropriate mathematical manipulations, a normalized Impact Table is generated that itemizes the economic impacts (output, gross domestic product, labour income, employment and taxes) associated with a $1.00 increase in spending on a particular commodity or by a particular industry.[12] It is this Impact Matrix, when multiplied against the spending estimates for each DSM program, which generates the economic impacts of the program throughout the provincial economy.

Direct, Indirect and Induced Impacts

I/O models are used to examine how direct spending will create additional spin-off activity in related sectors within the broader economy.[13] The sum of this economic activity, defined as the total economic impact, is composed of direct (initial spending) and indirect and induced (spin-off) components:

- *Direct impacts* refer to the initial investment expenditures (e.g., on home retrofits), which are used in the I/O model to estimate the spin-off impacts below;
- *Indirect impacts* refer to the additional economic activity that is generated as BC suppliers of the incremental materials (e.g., insulation manufacture) purchase intermediate goods and services; and
- *Induced impacts* refer to the additional activity generated when the BC suppliers pay out wages to their employees, who in turn purchase more consumer goods and services.

Multipliers

The results of I/O analysis can be used to calculate an economic "multiplier," which expresses the total (direct, indirect and induced) economic impact as a scalar of the direct impact. A high multiplier means that a particular expenditure generates more business (supplier) activity within the economy than expenditures with lower multipliers.

[12] Employment for each of the 302 industries in the I/O model is calculated by dividing wages and salaries plus mixed income by each industry's average annual wage rate (adjusted from its 2006 level in order to calculate 2008 employment).

[13] A challenge for the I/O analysis is that it requires a detailed breakdown of labour and investment inputs into the 727 possible commodity categories.

The size of the multiplier depends on several factors, the most important being the degree of upstream processing (prior to final use) in the economy and the extent of imported goods used in that processing. In general, the more self-sufficient the economy is in a particular good or service (i.e., the fewer the imports), the higher is the multiplier.

2.2 Investment and Re-spending

Employment is created by the initial investment in a DSM measure and the re-spent economic returns from the energy savings that investment generates. Both the "investment effect" and the "re-spending effect" include their own direct, indirect and induced impacts (described above).

Investment Effects

Investment effects are the initial stimulus from the incremental investment in the DSM program, which are used in the BC I/O model to estimate the indirect spin-offs when suppliers purchase intermediate goods and services to supply the DSM measures. Induced impacts are also generated as additional labour income is spent within the provincial economy. The total impact of the investment effect is the utility and customer investment dollars expended on the DSM measure(s), including all associated indirect and induced impacts.

Re-spending Effects

Re-spending effects arise from the increase in consumer income due to reduced power bills.[14] Since DSM activities by definition cost less than the electricity supply they displace, investment in these programs produces a net gain to society equal to the energy cost savings.[15] This freed-up income can be re-spent and, through the indirect and induced impacts, additional economic activity is generated. The total re-spending effect is the re-spent customer bill savings, including all associated indirect and induced impacts.

Re-spending Assumptions

Once the energy bill savings have been estimated, it is necessary to specify how consumers will spend their cost savings, since different expenditure patterns will have correspondingly different implications for provincial employment. The assumption made here is that BC energy consumers will spend their bill savings in the same manner that they arrange their regular expenditure basket of imported and domestic consumer goods and services, as determined by Statistics Canada.

The specification is more problematic for commercial and industrial consumers. These sectors are comprised of provincially and foreign-owned businesses that will spend their cost savings in ways that are difficult to predict. For example, companies may choose to re-invest in additional production capacity, put more money into DSM, retire debt or pass the savings onto provincial and extra–provincial shareholders (e.g., through dividends). Spending on increased production, additional DSM, or paying dividends to BC shareholders creates employment in BC, whereas retiring debt or paying dividends to out-of-province shareholders does not.

Since a detailed analysis of corporate expenditure patterns of potential energy bill savings is outside the scope of this study, it was assumed that the energy savings would be spent as follows:

[14] Customer net energy savings from DSM are treated as an increase in after-tax income.
[15] The avoided cost used in the 2008 DSM Plan is $88/MW.h ($F2006).

- Residential – 100 per cent consumer expenditure based on the Statistics Canada pattern of provincial household expenditures (which includes out of province spending);
- Commercial – 50 per cent labour, 30 per cent investment and 20 per cent outflow from BC (e.g., dividends, retained earnings); and
- Industrial – 40 per cent labour, 40 per cent investment and 20 per cent outflow.

Given the capital intensity of the industrial sector, a higher level of investment expenditure is assumed relative to the commercial sector. A 20 per cent outflow of corporate energy bill savings has been applied here, recognizing that a zero per cent outflow would be much more unlikely.

2.3 Power Smart Study 2005

In 2005, BC Hydro commissioned a study to estimate the provincial employment impacts from its prevailing (F2002-F2011) DSM Plan. Adopting a similar approach to this study, the 2005 report used the 2003 BC I/O Model from Statistics Canada and input data supplied by BC Hydro.

Investment Effects

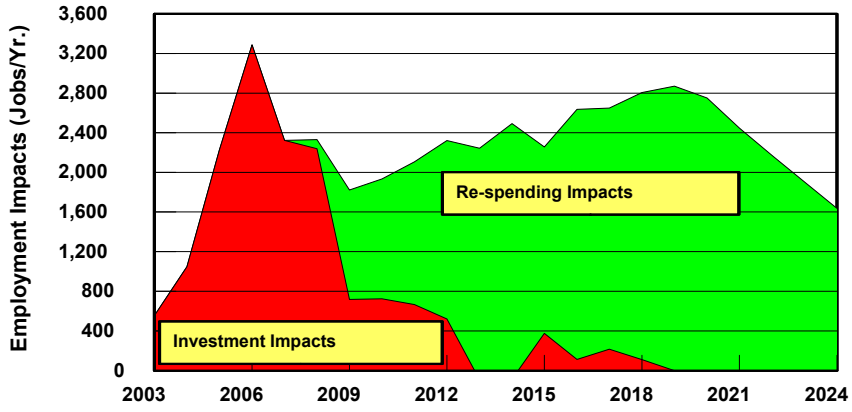
The 2005 study results were based on $1.5 billion ($2003) in total investment expenditures, consisting of $663 million ($2003) for BC Hydro's 10-year Power Smart capital plan and $797 million ($2003) in net participant expenditures. The investment was estimated to create approximately 22,100 person-years of construction and installation related work, most of it during the F2002-F2011 period.

Re-spending Effects

Employment impacts from the re-spending of electricity cost savings are ongoing over the life of the DSM measures. The 2005 study estimated that Power Smart would create around 26,700 PYs of re-spending employment. This is equivalent to 1,200 jobs each year across the BC economy between F2002 and F2023, extending 12 years beyond the end of the capital program.

The sum of the investment and re-spending impacts indicated 48,800 PYs of employment or about 2,200 jobs annually. These employment impacts are depicted in Figure 2-1.

Figure 2-1
BC Hydro 2005 Study: Total Employment Impacts, 2003-2024



2.4 Ontario Power Authority 2008

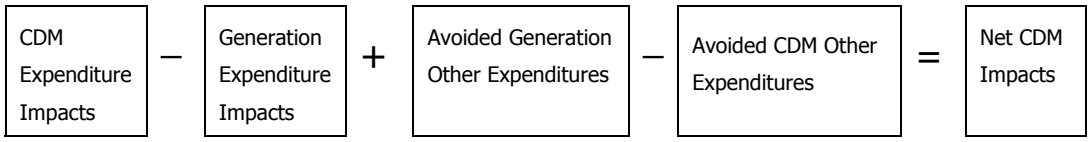
In 2008, the Ontario Power Authority (OPA) released a study on the employment impacts of the energy conservation activities in its 2006 20-year Integrated Power System Plan (IPSP).[16] The study assessed the OPA's $9.9 billion conservation and demand management (CDM) programs—energy efficiency, demand management, fuel switching and customer-based generation—and compared these four program areas to its $26.4 billion generation plan. The analysis was based on a modified version of Statistics Canada's Ontario I/O model that had been regionalized to provide both provincial and local impacts.

Study Approach

The authors used the Ontario provincial I/O model to assess the economic impacts of alternative expenditure scenarios:

- $9.9 billion in CDM investment expenditures;
- $9.9 billion in expenditures on other (non-CDM) goods and services in the economy;
- $26.4 billion in electricity generation expenditures; and
- $26.4 billion in expenditures on other (non-generation) goods and services.

The net impacts of CDM were then calculated as the difference between CDM and generation investment expenditures plus the difference between the avoided generation and CDM other expenditures (see the diagram below). The latter difference represents the amount of freed-up income from investing in CDM rather than generation that would have been spent on other goods and services in the economy. That is to say, these are the CDM cost savings (avoided costs less CDM expenditures) potentially available to be re-spent on other goods and services, primarily by the CDM program participants.



The second term in the diagram shows the displacement effect from not investing $26.4 billion in generation infrastructure in the Ontario economy. The first difference is negative, given the smaller investment in CDM. However, with the addition of the re-spending out of CDM cost savings, the overall net economic impacts from conservation become positive.

Study Results

Based on this approach, OPA's conservation expenditures were estimated to generate 57,000 PYs of employment over the study period (see Table 2-2). Dividing the employment total by the $9.9 billion in CDM expenditures yields a normalized total employment coefficient of 5.8 PYs per $million invested.

[16] IndEco Strategic Consulting Inc. and Econometric Research Ltd. (2008), *Employment Impacts of Energy Conservation in Ontario*.

Table 2-2
OPA Conservation and Demand Management Total Employment Impacts[17]
(Person-years, 2007-2027)

	Energy Efficiency	Demand Management	Fuel Switching	Customer-Based Generation	Total
Investment Expenditures ($2007)	4,719	1,070	1,857	2,245	9,891
Total Employment (PYs)	40,967	8,259	8,688	-881	57,034
Employment Intensity (PYs/$million)	8.7	7.7	4.7	-0.39	5.8
"Adjusted" Intensity[a] (PYs/$million)	51.0	41.9	34.3	13.9	38.5

[a] Excludes the displacement effects of generation expenditure impacts.

Comparison to BC Hydro 2005

The reported results in the 2008 Ontario study differ from those of the 2005 BC Hydro employment study because a different methodology was used. The BC Hydro study estimated 48,800 PYs of total employment from utility and participant net expenditures of $1.46 billion. The resulting employment intensity estimate of 33.4 PYs/$million is much higher than the (unadjusted) OPA estimate of 5.8 PYs/$million, since the 2005 BC Hydro study did not account for the displacement effects on the generation expenditure impacts.[18]

However, when these displacement effects are excluded from the OPA analysis, the "adjusted" total employment intensity of 38.5 PYs/$million is comparable to the BC Hydro intensity. Regardless of their differences, both studies demonstrate that DSM expenditures create significant employment impacts where both investment and re-spending impacts are tracked throughout the provincial economy.

2.5 American Council for an Energy-Efficient Economy 2008

The American Council for an Energy-Efficient Economy (ACEEE) conducted a study to investigate the development, deployment and impacts of new energy efficiency technologies across the US economy.[19] The study concluded that DSM may be the most invisible, least understood, least-polluting and fastest-growing energy success story of the past 50 years, and that its contribution to US energy security, economic productivity and climate change mitigation is not properly appreciated.

Key findings of the ACEEE study include:

- The energy intensity of the US economy has declined steadily, with today's power consumption per dollar of economic output at about half of its 1970 level.

[17] The study assessed the OPA's conservation and demand management (CDM) programs (similar to BC Hydro's DSM programs only), which include, energy efficiency, demand management, fuel switching and customer-based generation activities.
[18] The scope of the 2005 BC Hydro employment study was limited to the DSM investment and re-spending effects, given that the "generation effects" were to be handled within BC Hydro's Integrated Electricity Plan (IEP) process. As mentioned above, an earlier BC Hydro study did factor in these displacement effects, which resulted in lower employment estimates. See G.E. Bridges & Associates Inc. (1996), *Economic and Employment Impacts of Power Smart and Provincial Energy Standards.*
[19] Ehrhardt-Martinez and Laitner (2008), *The Size of the U.S. Energy Efficiency Market: Generating a More Complete Picture.*

- Since 1970, energy efficiency has met about three-fourths of the national demand for new energy-related services.
- Annual investment in energy efficiency technologies currently supports 1.6 million jobs nationwide. An estimated $300 billion (US) was invested in energy efficiency in 2004—three times the amount spent on conventional energy supply.
- Given the right investment in energy efficiency, the US could cost-effectively reduce energy consumption by 25 to 30 per cent or more over the next two to three decades.
- Investments in better technologies could increase the annual energy efficiency market by nearly $400 billion to more than $700 billion by 2030, with total cumulative investments in efficiency infrastructure of $7 billion over the 2008-2030 timeframe.

Investment by Industry

The shares of energy efficiency investments vary considerably across US sectors. Investment in the buildings sector was found to be the largest, at $178 billion, or around 60 per cent of total energy efficiency investment in 2004. Of this buildings-related investment, approximately half was made in energy-efficient appliances and electronics—30 per cent in commercial buildings and 20 per cent in residential buildings. In the industrial sector, energy efficiency investments amounted to about $75 billion, representing one-quarter of the 2004 total. In transportation, these investments were $33 billion, for an 11 per cent sectoral share.

Interestingly, the ACEEE study found that the pattern of investments did not mirror the pattern of energy use across sectors. While buildings received the majority (62 per cent) of energy efficiency investments, they accounted for about 40 per cent of US energy consumption in 2004. Likewise, within the buildings sector, expenditures on energy-efficient appliances and electronics (48 per cent) well exceeded the 8 per cent share of total energy consumed by these devices.

In the industrial sector, the energy efficiency investment share (about 25 per cent) was lower than the energy use share (around 34 per cent). Transportation also received a less-than-proportionate share of efficiency expenditures, with only 11 per cent of investment but 28 per cent of energy consumption.

Employment

According to the ACEEE study, $300 billion in US energy efficiency investment supported some 1.6 million jobs in 2004. Of the employment total, approximately two-thirds, or nearly one million jobs, were in the buildings sector.

Within buildings, energy efficiency investments in the appliance and electronics subsector generated the most employment (more than 370,000 jobs), followed by the residential construction and renovation industries (316,000) and their commercial counterparts (301,000). Other significant employment levels were associated with efficiency investments in the industrial sector (351,000 jobs), transportation (151,000) and utilities (139,000).

2.6 Southwest Energy Efficiency Project 2002

The Southwest Energy Efficiency Project (SWEEP) undertook a study of conservation potential for six southwestern states that included an I/O analysis of energy efficiency investments.[20] The US Southwest is a high-growth region where DSM efforts have lagged, air quality is a rising concern and additional power plants are planned, including some new coal-fired facilities.

Employment Impacts

The SWEEP study modelled two scenarios: a "business-as-usual" base scenario, and a high efficiency scenario that gradually increases electricity efficiency between 2003 and 2020. I/O analysis was performed to compare the employment impacts between demand-side and supply-side options. Among its findings are:

- The electric utility industry in the Southwest supports only 4 to 5 direct jobs per $million (US) of investment expenditures, as compared to 11 to 16 jobs in the construction sector, 17 to 27 jobs in the services sector, and 23 to 33 jobs in the retail sector.
- The coal mining industry, which supports coal-fired generation in the region, gives rise to 5 to 8 jobs per $million invested.
- The additional job creation from energy efficiency investments is derived from the difference in employment intensity of the sectors involved in delivering energy efficiency and power supply.
- New electricity generation tends to be more capital-intensive and less labour-intensive than efficiency investments.

The study concluded that shifting expenditures away from new generation in favour of energy efficiency measures would have a positive effect on state and regional economies and employment. In other words, by maximizing investment in cost-effective DSM programs, these southwestern states would simultaneously maximize economic growth and employment.[21]

[20] Southwest Energy Efficiency Project (2002), *The New Mother Lode: The Potential for More Efficient Electricity Use in the Southwest.* This study encompassed Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming.

[21] Since the "re-spending impacts" are derived from the electricity cost savings (i.e., net benefits), the maximization of economic benefits should coincide with the maximization of employment impacts through estimation of the re-spending impacts. The implication is that both employment and economic growth are maximized when optimal DSM investment is attained.

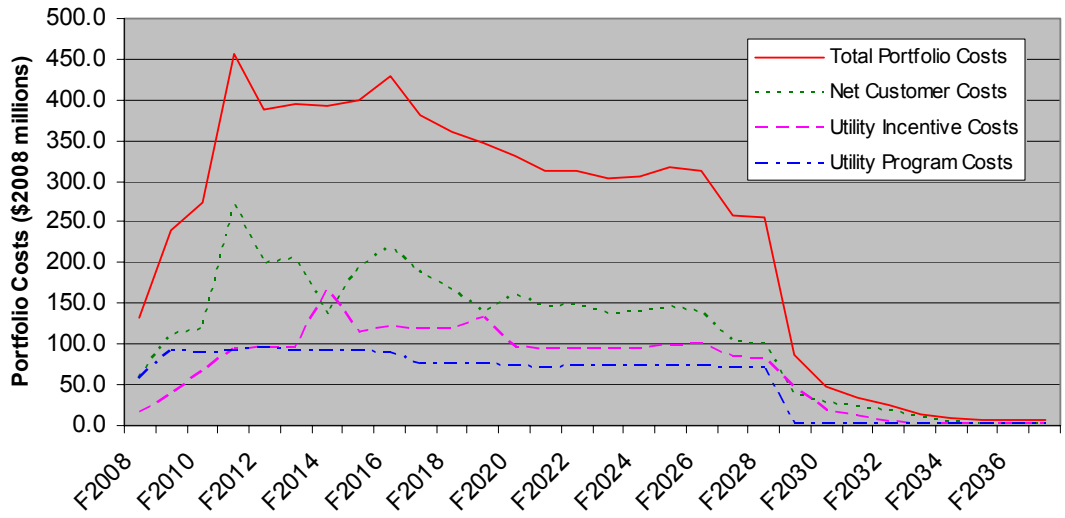
3.0 DSM PORTFOLIO REVIEW

Employment impacts are driven by the DSM portfolio expenditures, while re-spending impacts are driven by the resulting energy savings, which are reviewed below.

3.1 Expenditures

For both voluntary and non-voluntary (i.e., regulated) measures, investment spending is comprised of utility program costs, utility incentive costs, utility portfolio level costs and net customer costs. Figure 3-1 depicts the DSM portfolio costs over the study period. Costs are expressed as present values in $2008 discounted at a 6 per cent real discount rate.[22] Most of these utility costs occur between F2008 and F2028, but some costs trail off thereafter because some projects will be completed and paid out after F2028.

Figure 3-1
DSM Portfolio Costs by Utility and Consumer
($2008)



The first expenditure component is the utility program costs covering DSM programs ($590 million), conservation rates ($32 million) and Power Smart portfolio level activities ($336 million)—for total expenditures of about $960 million ($2008). The second component is the utility incentive cost totalling $1.1 billion ($2008). Together, these BC Hydro DSM costs represent approximately $2.0 billion ($2008).

The third and final cost component is net customer costs (net of utility incentives), which includes DSM building codes and product standards costs ($880 million), conservation rate customer costs for the industrial sector ($120 million) and the Power Smart DSM program cost ($870 million). These net customer

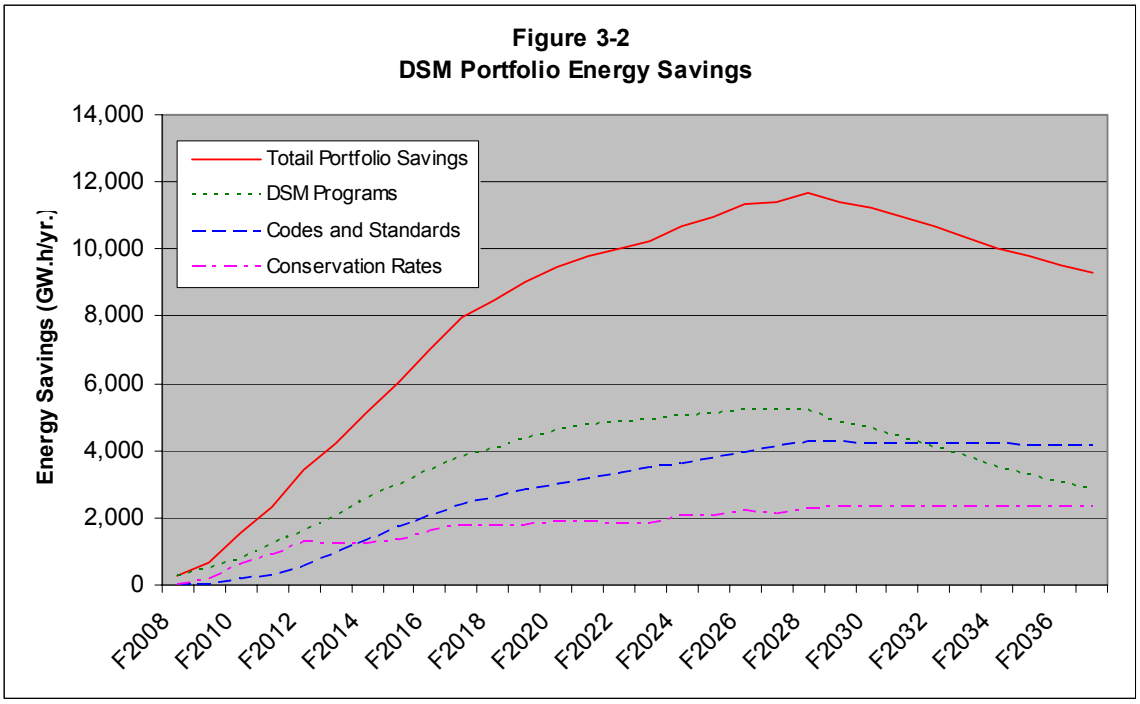
[22] Data on portfolio costs were received in nominal dollars and were previously inflated at 2 per cent annually to approximate the general rate of inflation. These nominal values were then deflated by 2 per cent annually to adjust to real $2008 values.

costs sum to $1.9 billion ($2008). Altogether, total utility and net customer costs for the entire DSM portfolio are estimated at about $3.9 billion ($2008).

3.2 Electricity Savings

By pursuing these DSM initiatives, BC Hydro anticipates total electricity savings of 245,000 GWh over the 30-year study period (see Figure 3-2). This cumulative amount equates to an average 8,200 GWh per year. It is expected that about 44 per cent of the energy savings will come from Power Smart DSM programs, 21 per cent from conservation rates, and 35 per cent from building codes and product standards.

Figure 3-2
DSM Portfolio Energy Savings



Annual energy savings from the DSM portfolio ramp up from 8,440 GWh in F2018 to a peak of about 11,700 GW.h in F2028. After that, savings gradually decline to 9,300 GWh in F2037.

4.0 DSM PROGRAMS

This section estimates the employment impacts of the DSM programs for BC Hydro's integrated service area.

4.1 Programs

The Power Smart DSM programs can be categorized into five groups of measures: residential sector, commercial sector, industrial sector, portfolio level activities and customer load displacement. In total, there are 30 individual programs under the DSM program heading, as listed in Table 4.1.

Table 4-1
List of Power Smart DSM Programs

Residential Sector	Commercial Sector	Industrial Sector
1. Behaviour 2. Voltage Optimization 3. Lighting 4. Sustainable Community 5. Refrigerator Buy Back 6. Low Income 7. New Home 8. Appliances and Electronics 9. Renovation Rebate 10. Sector Enabling Activities	1. Power Smart Partner 2. Product Incentive 3. High Performance Building 4. Voltage Optimization 5. Sustainable Community 6. Sector Enabling	1. Mechanical Pulping 2. PS Partners – Transmission 3. PS Partners – Distribution 4. New Plant Design 5. Sector Enabling
Portfolio Level Activities		**Load Displacement**
1. Public Awareness and Education 2. Community Engagement 3. Technology Innovation 4. Codes and standards Support 5. Information Technology 6. Indirect and Portfolio Enabling		1. Residential 2. Commercial 3. Industrial

While BC Hydro's DSM Plan covers the 21-year period between F2008 and F2028, some utility costs continue beyond that end date, because some projects will be completed and paid out after F2028. The overall period of analysis is 30 years from F2008 through F2037, to capture the energy savings benefits that extend past F2028. The Power Smart goal is to cost-effectively reduce customer electricity requirements, which defers the need for new supply.

4.2 Employment Impacts

In total, the investment and re-spending are forecast to create an estimated 100,400 PYs of employment, or an average annual 3,350 jobs over the 30-year study period, as summarized in Table 4-2. The investment and re-spending components are each about 50 per cent of total employment. Portfolio level expenditures create investment employment impacts, but these expenditures are made in support of other activities and so do not directly contribute to energy savings or re-spending employment.

At a total cost of $2.9 billion (utility and customer), the DSM programs result in an employment intensity of 34.6 PYs/$million of expenditure. This employment intensity figure is comparable to the adjusted 2008 OPA

study estimate (38.5 PYs/$million) and the 2005 Power Smart employment study result (33.5 PYs/$million) discussed earlier.[23]

Table 4-2
Employment Impact Summary: Power Smart DSM Programs[24]
(Person-years, F2008-F2037)

Program Category	Investment	Re-spending	Total
Residential	10,718	11,657	22,375
Commercial	15,811	19,276	35,087
Industrial	12,617	17,887	30,504
Portfolio-level	7,157	0[25]	7,157
Load Displacement	3,171	2,073	5,244
Total	**49,474**	**50,893**	**100,367**

Investment Effects

The Power Smart employment impacts from investment are the result of BC Hydro's program and incentive costs and net customer expenditures, which are estimated to be 49,500 PYs over the 30-year period. These expenditures are required to implement the energy saving measures and are comparable to the construction expenditures and employment from supply-side projects.

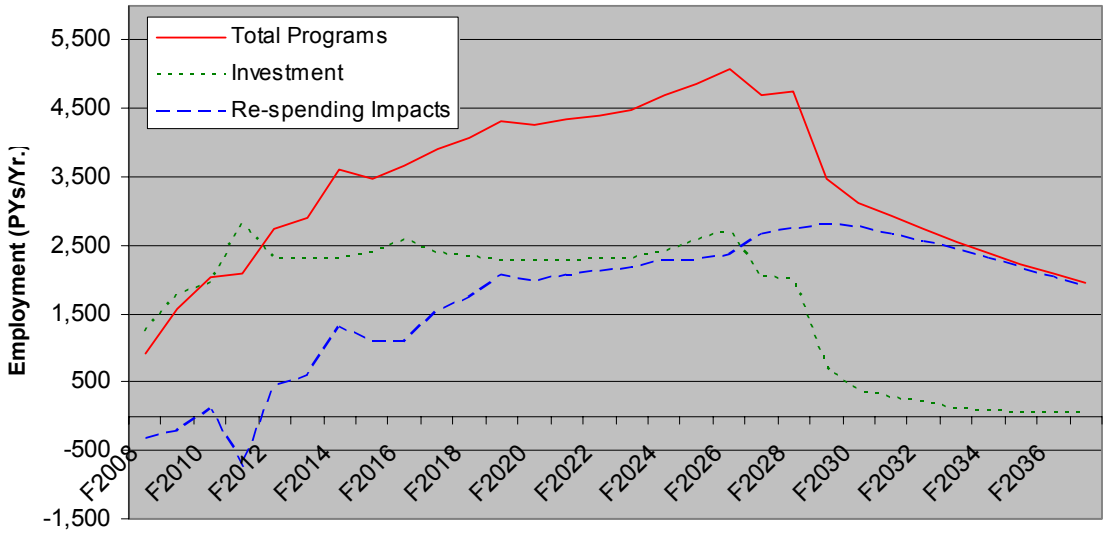
As depicted in Figure 4-1, investment employment ramps up over the initial years of the DSM Plan and achieves a plateau until F2028. Thereafter, it falls fairly rapidly with expenditures, but the decline is mitigated because some projects will be completed and paid out after F2028. Overall, the pattern of investment employment directly follows the expenditure pattern.

Re-spending Effects

The employment impacts from re-spending activity are estimated at 50,900 PYs and are created as a by-product of the economic benefits associated with the DSM expenditures (see Figure 4-1). Since these employment benefits continue, driven by the ongoing energy bill savings, they can be likened to the operation and maintenance employment from supply-side projects.

[23] The DSM program employment intensity is presented here since it can be compared to previous and other figures, whereas figures for conservation rates and codes and standards are not available from other jurisdictions.
[24] This and the other employment impacts reported here are undiscounted annual sums.
[25] Since portfolio level expenditures are common to all utility DSM activities, they do contribute directly to customer bill savings. However, their contribution is included in other categories.

Figure 4-1
DSM Program Employment Impacts



Although re-spending employment might be expected to be proportional to energy savings, such is not the case because this employment is related to the expenditure patterns of the energy savings. Re-spending on investment goods generates impacts that vary from those due to re-spending on consumer goods. In addition, different goods have different import proportions and imported goods do not benefit the provincial economy, apart from the wholesale and distribution margins associated with their sale, which have been included in this study.[26]

Combined Effects

Annual investment employment is larger until F2027, when the cumulative annual re-spending employment begins to exceed the annual investment employment. As the annual investment employment declines, the investment curve approaches and intersects the re-spending curve. At that point, the re-spending impacts are still significant but decline slowly due to the persistence of energy savings from the DSM measures put in place in past years.[27]

4.3 Economic and Regional Impacts

This section summarizes the economic impacts for BC Hydro's DSM programs. Detailed economic impacts are presented in Appendix B. The primary outputs of an I/O model are changes in total provincial output, gross domestic product (GDP), labour income and taxes. Some of these outputs have been used to estimate the indirect and induced employment impacts that are central to this study.

[26] See Appendix C for the Statistic Canada BC import coefficients and adjustments.
[27] The sensitivity of the results is discussed in Section 7.1.

Regional Impacts

I/O model outputs are expressed at the provincial level because there are no detailed intra-provincial trade flow data from which to develop a regional I/O model. However, the employment results can be partially "regionalized" to the extent that the direct investment expenditures can be allocated based on energy savings by region, for which BC Hydro data are available. On the other hand, since the indirect and induced employment impacts can occur anywhere in the province, they cannot be regionally allocated this way.

Table 4-3 summarizes the economic impacts of the DSM programs in terms of changes in the key model outputs.[28] (Note that the table presents direct impacts and "spin-off impacts" for investment and re-spending combined, whereas in Table 4-2 the total impacts are split out for investment and re-spending.)

Table 4-3
Economic and Regional Impacts: Power Smart DSM Programs
($2008 millions NPV, F2008-F2037)

Measure	Direct Impacts[a]					Spin-off Impacts		Total
	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Total Direct	Indirect	Induced	
Output	$891.6	$390.0	$388.2	$171.1	$1,840.9	$601.6	$3,659.8	**$6,102.2**
GDP	$512.0	$223.9	$222.9	$98.2	$1,057.0	$324.2	$2,490.8	**$3,872.0**
Income	$360.5	$157.7	$156.9	$69.2	$744.2	$211.5	$1,914.5	**$2,870.3**
Employment (PYs)	15,788.1	6,905.2	6,873.3	3,029.7	32,596.3	9,410.5	58,360.9	**100,367.7**
Taxes	$97.3	$42.6	$42.4	$18.7	$201.0	$59.5	$372.7	**$633.2**
Provincial taxes	$40.5	$17.7	$17.6	$7.8	$83.7	$26.3	$233.8	**$343.8**
Federal taxes	$56.8	$24.8	$24.7	$10.9	$117.3	$33.2	$138.9	**$289.4**

[a] Distributed regionally according to the pattern of energy savings.

As shown in Table 4-3, DSM program activities (investment and re-spending) are responsible for provincial output of $6.1 billion and GDP of $3.9 billion ($2008) in net present value terms over the study period. Expressed on an average annual basis, provincial output is $203 million and GDP $129 million each year.

DSM expenditures also give rise to $344 million in provincial taxes (income and indirect taxes) and a further $289 million in federal taxes, for total taxes of $633 million ($2008). In average terms, the annual income taxes to both levels of government are $21 million from the DSM program initiatives.

Although federal income taxes are generally higher than provincial income taxes, the table shows that the impact on provincial taxes is greater. The reason is that most of the non-income tax is provincial PST, largely due to the indirect and induced impacts. In addition, provincial taxes include municipal and regional taxes (e.g. business licenses, property taxes, development charges) that, when summed with other provincial taxes, exceed federal taxes.

[28] Output is the total value of all provincial goods and services in BC. GDP is total output less the costs of inputs and is the general measure of net economic contribution to the provincial economy (value-added). Income includes a measure of total wages and salaries from incorporated firms as well as income earned from unincorporated enterprises in the province.

5.0 DSM CONSERVATION RATES

This section estimates the employment impacts of the DSM conservation rates for BC Hydro's integrated service area.

5.1 Conservation Rates

BC Hydro has introduced four conservation rate structures as part of the DSM activities described in the 2008 LTAP.[29] These rate structures reward customers' efforts to reduce their electricity use. "Inclining block rates" charge more for incremental kilowatt-hours, creating a financial incentive for customers to reduce consumption at the higher, second-tier rate.

Since the conservation rates are mandatory, they capture all customers in the rate class and not just voluntary participants, as in the case of DSM programs. BC Hydro's current conservation rates in market are the:

- *residential conservation rate* – a two-step inclining block rate introduced in October 2008: and
- *transmission service rate* – a two-tiered rate, based on customer historical consumption, introduced for transmission voltage customers in April 2006.

The assumption underlying the data used for this employment study is that residential and commercial customers will have a behavioural response to reducing electricity use (e.g., turning off lights when they leave a room, turning down thermostats at night), while industrial customers will incur some expenditures (e.g., investing in energy-efficient equipment) to reduce electricity use at the second-tier rate.

It is recognized that there will be interactions between the energy savings from the conservation rates and those from other DSM programs. However, the expected changes from the rate structures used in this study are derived from elasticity-based modelling (for residential and commercial service) and customer-specific analysis (for industrial transmission service) and are assumed to be independent of the savings from other DSM programs.

5.2 Employment Impacts

The investment and re-spending employment from the DSM conservation rates is estimated to create 38,900 PYs of employment, or an average annual 1,300 jobs over the 30-year study period, as summarized in Table 5-1.

Investment Effects

Consistent with the assumption that residential and commercial customers will primarily have a behavioural response to these rates, investment expenditures and their related employment impact are relatively small. On the other hand, since industrial customers will require some process changes to adjust to their conservation rate, the investment employment is larger than for the other two rate classes.

[29] These rate categories are Transmission Service Rate (TSR), Residential Inclining Block (RIB), Large General Service (LGS) and Small General Service (SGS).

Table 5-1
Employment Impact Summary: DSM Conservation Rates
(Person-years, F2008-F2037)

Program Category	Investment	Re-spending	Total
Residential	208	22,097	**22,305**
Commercial	234	6,187	**6,421**
Industrial	1,163	9,044	**10,206**
Total	**1,605**	**37,327**	**38,932**

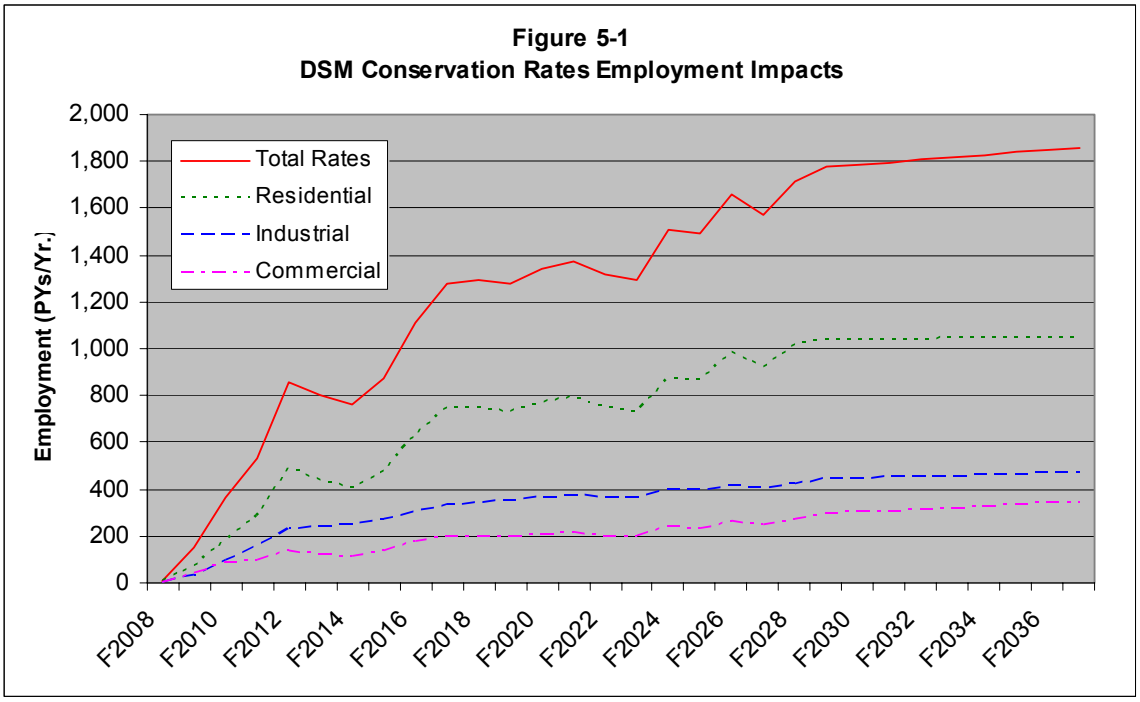
Re-spending Effects

Based on these assumptions and energy savings data supplied, the re-spending employment amounts to 37,330 PYs, which is about 96 per cent of the total employment. The large re-spending employment is the result of the energy savings assumed to be created by these conservation rates, with relatively little investment expenditure, over the forecast period.

Combined Effects

Figure 5-1 depicts the annual conservation rate impacts by rate class as well as total annual employment. Most of the employment impacts are generated from the re-spending of energy savings in the residential rate class, followed by re-spending in the other two rate classes.

Figure 5-1
DSM Conservation Rates Employment Impacts



5.3 Economic and Regional Impacts

This section summarizes the economic impacts for BC Hydro's DSM conservation rates. Details on the economic impacts are presented in Appendix B.

Regional Impacts

As described in Section 4.3 for Power Smart DSM programs, the employment and other economic impact results for conservation rates can be partially regionalized by allocating the direct investment expenditures based on energy savings by region. Only the direct impacts can be regionalized in this way, since the indirect and induced impacts can occur anywhere in the province.

Table 5-2 summarizes the economic impacts of the DSM conservation rates in terms of changes in the key model outputs.

Table 5-2
Economic and Regional Impacts: DSM Conservation Rates
($2008 millions NPV, F2008-F2037)

Measure	Direct Impacts[a]					Spin-off Impacts		Total
	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Total Direct	Indirect	Induced	
Output	$40.1	$17.6	$17.5	$7.7	$82.9	$26.9	$2,028.1	**$2,137.9**
GDP	$21.5	$9.4	$9.4	$4.1	$44.5	$14.3	$1,350.5	**$1,409.4**
Income	$15.3	$6.7	$6.7	$2.9	$31.6	$9.4	$976.0	**$1,017.0**
Employment (PYs)	485.7	212.4	211.4	93.2	1,002.7	338.1	37,591.2	**38,932.0**
Taxes	$3.9	$1.7	$1.7	$0.8	$8.1	$2.6	$234.0	**$244.7**
Provincial taxes	$1.7	$0.8	$0.8	$0.3	$3.6	$1.2	$156.5	**$161.3**
Federal taxes	$2.2	$0.9	$0.9	$0.4	$4.5	$1.5	$77.5	**$83.4**

[a] Distributed regionally according to the pattern of energy savings.

The table shows that DSM conservation rate activities (investment and re-spending) are responsible for provincial output of $2.1 billion and GDP of $1.4 billion ($2008) in net present value terms over the study period. Expressed on an average annual basis, provincial output is $71 million annually and GDP $47 million per year.

DSM conservation rate expenditures (mostly re-spending) also give rise to $161 million in provincial taxes (income and indirect taxes) and a further $83 million in federal taxes, for a total NPV increase of $245 million ($2008). In average terms, the annual income taxes to both levels of government are slightly over $8 million as a result of the DSM conservation rate initiatives.

6.0 DSM CODES AND STANDARDS

This section estimates the employment impacts created by the regulated DSM provisions of federal and provincial building codes and product standards.

Building codes require a minimum level of energy efficiency in the design and construction of new residential and commercial buildings. Similarly, product standards stipulate minimum energy efficiency levels in the design and manufacture of products and equipment, which result in reduced energy consumption. These provincial and federal regulations add to the incremental cost to the consumer, creating investment impacts and additional impacts through the re-spending of energy bill savings.

6.1 Product Standards

BC Hydro has worked with government agencies to support and influence the development of new product standards and regulations. These are federal and provincial energy regulations applying to the sale of new equipment and building components in BC, including a number of proposed changes that will promote additional energy efficiency investment and generate energy savings within the province.[30]

The impacts in this study are the result of planned and announced regulatory changes affecting energy-using equipment and building components. Together with marketing and performance labelling programs, these DSM initiatives work in a complementary fashion to gradually ratchet up the average energy efficiency level within each product group.

Table 4-1 lists the 22 product standard categories of energy-using appliances and equipment included in this study.

Table 6-1
Categories of Product Standards

Electronic Equipment	Lighting	Residential
1. Standby Power 2. Set-top Boxes (and DTAs) 3. External Power Supplies 4. Battery Chargers	1. General Service Lighting 2. High-Intensity Discharge (HID) Lamps and Ballasts	1. Windows 2. Ceiling Fans 3. Furnace Blower Motors 4. Torchieres 5. Hot Tubs 6. Small Motors 7. Room Air Conditioning
Appliances	**Commercial**	**Industrial**
1. Clothes Washers 2. Refrigerators 3. Freezers 4. Dishwashers	1. Packaged Terminal AC 2. Icemakers 3. Large AC 4. Commercial Clothes Washers	1. Large Motors

Most of the new energy-using appliances and equipment covered by the product regulations are manufactured outside of BC. This is a key consideration because imported equipment gives rise to little or

[30] The regulations are under the BC *Energy Efficiency* Act, R.S.B.C. 1996, c. 114, and Canada's *Energy Efficiency Act*, S.C. 1992, c. 36.

no provincial employment apart from the wholesale and distribution margins associated with its sale, which have been included in this study.[31]

6.2 Building Codes

Both the province-wide BC Building Code and the City of Vancouver's more stringent Building By-law set minimum energy design regulations for new buildings. These regulations require builders to invest in additional energy efficiency measures that generally eliminate poor and inefficient building practices, benefiting building owners or tenants through lower lifetime operating costs.

Relative to product standards, building code measures have a higher percentage of their initial investment expenditure sourced from within BC. This will result in more employment per dollar invested because a larger share of these mandated building expenditures accrue to local provincial suppliers. Still, as the re-spending impacts on employment are cumulative, they often end up being greater than the initial investment impacts.

British Columbia

The BC Building Code data used in this study are based on estimates made prior to the submission of BC Hydro's 2008 LTAP. For residential buildings, the BC Hydro data assumed that all new construction permitted after F2010 would be required to meet an EnerGuide 80 rating, with energy savings starting in F2012. No further regulated improvements over this standard were assumed in the forecast.

For commercial buildings, including apartments, the BC Hydro forecast assumed that all new buildings after 2008 would have to meet the ASHRAE 90.1-2004 standard, with no subsequent regulated improvements. The BC Building Code was changed in September 2008 to introduce a minimum design standard equivalent to ASHRAE 90.1-2004 for commercial buildings, consistent with the earlier forecast.

In the case of residential buildings, the 2008 BC Building Code mandates new requirements equivalent to an EnerGuide rating of 77 for all new homes. These changes affect insulation standards for houses and multi-family residential buildings under five stories. Builders can choose to meet the prescriptive requirements or comply by achieving an EnerGuide 77 rating. There are other energy efficiency improvements affecting the building envelope and heating systems, but these are covered under the BC product standards.

The employment impacts estimated here are based on the costs to achieve a performance equivalent of EnerGuide 80 for residential buildings and ASHRAE 90.1-2004 for commercial buildings, as per the 2008 LTAP.

City of Vancouver

Vancouver is currently the only Canadian municipality to have enacted its own building code. While both the Vancouver Building By-law and the BC Building Code are derived from the National Building Code of Canada, Vancouver has adopted advanced provisions and is derived from ASHRAE 90.1-2007. The main improvements include increased wall insulation, full basement insulation, greater insulation in unheated slabs, and the mandatory installation of Heat Recovery Ventilation (HRV) systems.[32]

[31] See Appendix C for the Statistic Canada BC import coefficients and adjustments used here.
[32] City of Vancouver (2008), *The Green Homes Program: Building By-law Amendments for New One Family Dwelling, One*

The City of Vancouver Building By-law amendments became effective September 2008 and established a prescriptive compliance path requiring new residential buildings to achieve the equivalent of an EnerGuide 80 rating. However, as in the case of the BC Building Code, the data used for this study assume compliance with EnerGuide 80 after F2010.

For commercial buildings, the 2008 By-law amendments advanced the requirements within the City of Vancouver to reference the more stringent ASHRAE 90.1-2007. Again, these extra improvements were not anticipated in the BC Hydro forecast, so that the estimates of building owner costs and energy savings made here will tend to be underestimated.

6.3 Employment Impacts

Investment Effects

The DSM building code and product standards employment impacts are the result of increased customer expenditures on goods and service complying with the relevant minimum energy efficiency regulations. Based on the data received, expenditures for the building codes are estimated to create 4,730 PYs of employment and those for the product standards 4,050 PYs, for a total investment effect of 8,780 PYs.

Re-spending Effects

Employment from re-spending activity for the codes and standards is generated as a by-product of the economic benefits associated with the initial investment expenditures. The employment impacts from re-spending are estimated at 5,420 PYs for the building codes and 39,830 PYs for the product standards, yielding a total re-spending effect of 45,250 PYs.

The product standards investment employment represents only 10 per cent of the employment total because of the higher import content associated with the investment expenditures. The reason for the low investment impact is that most of the expenditures on the regulated products flow out of the province, creating employment instead where these appliances and products are manufactured (e.g., Korea, Taiwan, Malaysia, Japan, Ontario).

Combined Effects

Based on the data received, the building codes are estimated to create 10,150 PYs of employment and the product standards 43,880 PYs, for a total employment impact of 54,030 PYs over the period of analysis.

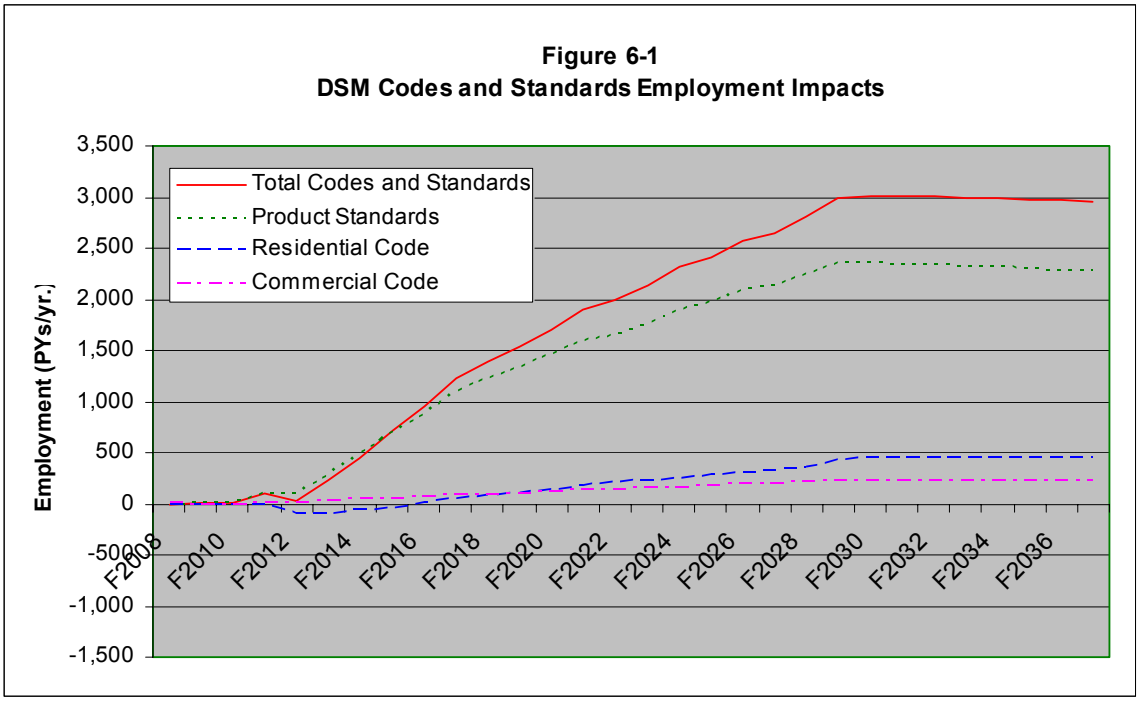
The DSM building codes and product standards impact results are summarized by sub-program grouping in Table 6-2.

Table 6-2
Employment Impact Summary: DSM Codes and Standards
(Person-years, F2008-F2037)

Program Category	Investment	Re-spending	Total
Building Codes			
Residential Codes	3,853	2,369	6,222
Commercial Codes	881	3,049	3,929
Subtotal	4,734	5,418	10,151
Product Standards	4,050	39,831	43,882
Total	**8,783**	**45,249**	**54,033**

Figure 6-1 shows the annual investment and re-spending employment impacts for the DSM codes and standards activities. Since these are regulated DSM measures, there is a steady and continuous increase in employment, driven largely by the energy bill savings that are cumulative and assumed to be mostly re-spent or reinvested in the economy.

Figure 6-1
DSM Codes and Standards Employment Impacts



6.4 Economic and Regional Impacts

This section summarizes the economic impacts for the DSM building codes and product standards. Detailed economic impacts are presented in Appendix B.

Regional Impacts

As described in Section 4.3 for Power Smart DSM programs, the employment and other economic impact results for codes and standards can be partially regionalized by allocating the direct investment expenditures

based on energy savings by region. Only the direct impacts can be regionalized in this way, since the indirect and induced impacts can occur anywhere in the province.

Table 6-3 summarizes the economic impacts of the building codes and product standards in terms of changes in the key model outputs. As shown in the table, the codes and standards activities (investment and re-spending) are responsible for provincial output of $2.2 billion and GDP of $1.3 billion ($2008) in net present value terms over the study period. Expressed on an average annual basis, provincial output is $72 million and GDP $44 million per year.

Table 6-3
Economic and Regional Impacts: DSM Codes and Standards
($2008 millions NPV, F2008-F2037)

Measure	Direct Impacts[a]					Spin-off Impacts		Total
	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Total Direct	Indirect	Induced	
Output	$183.0	$80.1	$79.7	$35.1	$377.9	$182.3	$1,596.2	**$2,156.4**
GDP	$89.5	$39.1	$38.9	$17.2	$184.7	$90.6	$1,032.4	**$1,307.7**
Income	$65.0	$28.4	$28.3	$12.5	$134.1	$59.1	$659.0	**$852.2**
Employment (PYs)	2,681.2	1,172.7	1,167.2	514.5	5,535.6	1,946.6	46,549.9	**54,031.6**
Taxes	$14.5	$6.3	$6.3	$2.8	$30.0	$17.2	$258.7	**$305.9**
Provincial taxes	$5.7	$2.5	$2.5	$1.1	$11.7	$7.7	$171.6	$191.1
Federal taxes	$8.9	$3.9	$3.9	$1.7	$18.3	$9.5	$87.1	$114.8

[a] Distributed regionally according to the pattern of energy savings.

DSM expenditures also give rise to $191 million in provincial taxes (income and indirect taxes) and a further $115 million in federal taxes, for a total NPV increase of $306 million ($2008). In average terms, the annual income taxes to both levels of government are just over $10 million as a result of the codes and standards initiatives.

7.0 CONCLUSIONS

This study has estimated the provincial employment benefits of BC Hydro's DSM portfolio activities and has found the DSM program results to be comparable, on a person-year per dollar of investment basis, to similar estimates made in other jurisdictions and in previous analyses of BC Hydro's Power Smart initiatives. Since no information was found on employment impacts from other jurisdictions' conservation rates, codes or standards, there are no estimates for these activities against which to compare the BC Hydro results.

In addition to the aggregate employment benefits, the majority of jobs created by DSM investments (e.g., in the residential and commercial construction and renovation industries) are spread over numerous small firms, geographically dispersed across BC, and reasonably ongoing in nature. By comparison, construction projects tend to focus their employment in specialized jobs (design and construction), companies located in larger cities, and professional occupations such as engineers and planners.

Similar to the conclusion reached in the ACEEE study reviewed earlier, BC Hydro's Power Smart activities may well be the most invisible and least appreciated energy success story—in terms of energy saved, environmental impacts avoided and sustainable job created—since the inception of DSM programs in the province.[33]

Furthermore, as new more expensive supply sources are brought online they will gradually increase electricity rates, thereby increasing potential bill savings and the re-spending effect, which in turn will create more employment per dollar invested in DSM.

7.1 Sensitivity of Results

The use of the BC I/O Model to estimate province-wide impacts allows the most comprehensive assessment of the direct and spin-off employment effects of DSM expenditures throughout the economy. Given that the most up-to-date provincial I/O model has been used for this study, the resulting employment estimates are more sensitive to the accuracy of the data used than the model itself.

The data requirements for an I/O study of DSM activities are essentially the same as those for a life-cycle cost-effectiveness evaluation. In addition, however, it is necessary to know what types of materials have been used, since each material input has a different supply chain and therefore different spin-off impacts associated with its use. As the material and energy costs vary from year to year, it is important to use the most current information available, to improve the accuracy of the employment impact study results.[34]

[33] Ehrhardt-Martinez and Laitner (2008), *The Size of the U.S. Energy Efficiency Market: Generating a More Complete Picture.* Summarized in Section 2.5

[34] For example, using incremental costs of energy-using products that have been estimated at different points in time (e.g., over the 2001-2008 period) imparts an unknown degree of inaccuracy to the input data.

Finally, the I/O model used in this study is a linear representation of the BC economy. Therefore, any percentage increase (or decrease) in net investment in DSM will be reflected in an equal percentage change in the indirect and induced impacts.

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APPENDIX A: TAXATION ADJUSTMENTS AND THE HST

A number of changes have been made to the BC I/O Model to account for changes in tax rates and revenues between 2006 and 2008 and for the planned Harmonized Sales Tax:

- Each model component was adjusted to reduce the GST rate to its current 5 per cent rate from the 6.5 per cent average rate in 2006.
- Wages and salaries and other labour income (from which employment is determined) were adjusted to reflect average wage rate increases by industry between 2006 and 2008.
- The PST rate and GST rate for each of the 727 commodities in the model were eliminated and replaced by a single effective HST rate of 12 per cent.

Future Considerations:

HST Impacts on Businesses

Although there are some temporary exceptions (see further below), the HST will reduce business costs, since it will remove the consumer tax (PST) on purchases of intermediate goods and services. The PST will be combined with the GST and rebated to businesses through the Input Tax Credit (ITC), whereby companies are returned the GST they pay on inputs. The taxation change will have the impact of reducing the cost of purchased inputs, including electricity, for industrial and small commercial customers by 7 per cent. Large commercial businesses with sales over $10 million will temporarily continue to pay the PST portion of the HST on energy purchases.

If, for example, a business is considering investment in a DSM measure to reduce its life-cycle cost (LCC), then the LCC will change by (assuming no change in the operation and maintenance costs and salvage value):

$\Delta LCC = \Delta CC - \Delta EC,$

where CC is the capital cost and EC the energy cost.

If the measure is cost-effective ($\Delta LCC < 0$), then the discounted energy savings must be greater than the capital cost, by definition:

$\Delta EC > \Delta CC$

If, on an after-tax basis, both the capital costs and energy costs decline by 7 per cent (industrial and small commercial), the larger reduction will be on the energy cost savings than on capital costs. A reduction in relative energy cost will discourage businesses from investing in DSM. For large commercial customers with revenues over $10 million, a reduction in project capital costs will increase the attractiveness of the investment, as there are no immediate offsetting reductions in electricity cost savings until 2015. If, however, some of the capital items were previously PST exempt, the outcome is not as clear.

Temporary ITC Restriction on Energy[39]

Commercial businesses that are not classified as "producers' with annual taxable sales in excess of $10 million, as well as all financial institutions, will have the PST portion of their tax rebate temporarily restricted on certain items, including energy. The temporary ITC restriction means that these businesses will continue to pay the PST portion of the HST for the first five years, until it is eliminated in 2018. The BC Ministry of Finance has stated that, if the fiscal situation permits, the PST rebate may be phased in sooner. When the ITC restriction expires, either in 2018 or earlier, all businesses with be rebated the full 12 per cent ITC on purchased inputs, including energy.

Residential HST Impacts

On September 1, 2009, the BC government proposed to preserve its previous PST exemption on residential energy consumption. It will provide a provincially administered point-of-sale PST rebate within the HST for residential energy use (electricity, natural gas, oil and propane) and the Innovative Clean Energy Fund will be eliminated (0.4 per cent).

In addition, the HST will apply to the broader GST tax base, which means that sales taxes on all "GST-able" but previously PST-exempt goods and services. The result is that building-related labour service taxes ("fixtures at common law") will increase from 7 to 12 per cent.

As well, the retail PST exemptions on certain exempt energy conservation equipment will be eliminated and the final consumer will pay 12 per cent HST (on thermal insulation, storm windows and storm doors.)

With respect to the residential implications for LCC analysis, the previous PST exemptions on goods and labour services for energy conservation investments will be eliminated and the 12 per cent HST will apply. The HST will increase the after-tax cost on investing in selected DSM technologies but have no effect on energy cost savings, again discouraging consumers from making DSM investments.

[39] BC Ministry of Finance (2009), *September Budget Update 2009/10 – 2011/12.*, pp. 81-82.

APPENDIX B: ECONOMIC IMPACTS:

DSM Programs and Load Displacement - Investment and Re-spending Effects

B-1: DSM PROGRAMS INVESTMENT EFFECTS ($2008, 6% Discount Rate)	**DIRECT**					**INDIRECT**	**INDUCED**	**TOTAL**
	Lower Mainland	**Vancouver Island**	**Southern Interior**	**Northern Interior**	**Total Direct**			
Output	$854.0	$373.5	$371.8	$163.9	$1,763.1	$574.0	$432.0	**$2,769.1**
GDP	$490.4	$214.5	$213.5	$94.1	$1,012.4	$309.3	$274.7	**$1,596.4**
Labour Income	$343.5	$150.2	$149.5	$65.9	$709.2	$201.7	$163.9	**$1,074.8**
Employment (undiscounted PYs)	14,735.1	6,444.7	6,414.9	2,827.6	30,422.3	8,846.8	7,033.7	**46,302.8**
Taxes	$93.3	$40.8	$40.6	$17.9	$192.7	$56.7	$111.2	**$360.6**
Federal Indirect Taxes	*$5.0*	*$2.2*	*$2.2*	*$1.0*	*$10.3*	*$2.6*	*$17.3*	***$30.2***
Provincial Indirect Taxes	*$20.8*	*$9.1*	*$9.1*	*$4.0*	*$42.9*	*$14.0*	*$47.3*	***$104.2***
Federal Income Taxes	*$49.4*	*$21.6*	*$21.5*	*$9.5*	*$102.0*	*$29.0*	*$33.5*	***$164.6***
Provincial Income Taxes	*$18.2*	*$7.9*	*$7.9*	*$3.5*	*$37.5*	*$11.0*	*$13.1*	***$61.6***

B-2: LOAD DISPLACEMENT INVESTMENT EFFECTS ($2008, 6% Discount Rate)	**DIRECT**					**INDIRECT**	**INDUCED**	**TOTAL**
	Lower Mainland	**Vancouver Island**	**Southern Interior**	**Northern Interior**	**Total Direct**			
Output	$37.6	$16.5	$16.4	$7.2	$77.7	$27.6	$20.4	**$125.7**
GDP	$21.6	$9.5	$9.4	$4.1	$44.6	$14.9	$13.0	**$72.5**
Labour Income	$17.0	$7.4	$7.4	$3.3	$35.0	$9.8	$7.8	**$52.6**
Employment	1,053.0	460.5	458.4	202.1	2,174.0	563.7	433.7	3,171.4
Taxes	$4.0	$1.7	$1.7	$0.8	$8.2	$2.8	$5.4	**$16.4**
Federal Indirect Taxes	*$0.2*	*$0.1*	*$0.1*	*$0.0*	*$0.5*	*$0.1*	*$0.8*	***$1.5***
Provincial Indirect Taxes	*$0.8*	*$0.4*	*$0.3*	*$0.2*	*$1.7*	*$0.7*	*$2.3*	***$4.7***
Federal Income Taxes	*$2.2*	*$0.9*	*$0.9*	*$0.4*	*$4.4*	*$1.4*	*$1.6*	***$7.5***
Provincial Income Taxes	*$0.8*	*$0.3*	*$0.3*	*$0.2*	*$1.6*	*$0.5*	*$0.6*	***$2.8***

B-3: DSM PROGRAMS AND LOAD DISPLACEMENT	**DIRECT**					**INDIRECT**	**INDUCED**	**TOTAL**
INVESTMENT AND RE-SPENDING EFFECTS ($2008, 6% Discount Rate)	**Lower Mainland**	**Vancouver Island**	**Southern Interior**	**Northern Interior**	**Total Direct**			
Output	$891.6	$390.0	$388.2	$171.1	$1,840.9	$601.6	$3,659.8	**$6,102.2**
GDP	$512.0	$223.9	$222.9	$98.2	$1,057.0	$324.2	$2,490.8	**$3,872.0**
Labour Income	$360.5	$157.7	$156.9	$69.2	$744.2	$211.5	$1,914.5	**$2,870.3**
Employment	15,788.1	6,905.2	6,873.3	3,029.7	32,596.3	9,410.5	58,360.9	**100,367.7**
Taxes	$97.3	$42.6	$42.4	$18.7	$201.0	$59.5	$372.7	**$633.2**
Federal Indirect Taxes	*$5.2*	*$2.3*	*$2.3*	*$1.0*	*$10.8*	*$2.7*	*$73.4*	***$86.9***
Provincial Indirect Taxes	*$21.6*	*$9.4*	*$9.4*	*$4.1*	*$44.6*	*$14.7*	*$207.2*	***$266.5***
Federal Income Taxes	*$51.6*	*$22.5*	*$22.4*	*$9.9*	*$106.4*	*$30.4*	*$65.5*	***$202.4***
Provincial Income Taxes	*$18.9*	*$8.3*	*$8.2*	*$3.6*	*$39.1*	*$11.6*	*$26.6*	***$77.3***

Conservation Rates - Investment and Re-spending Effects

B-4: CONSERVATION RATES INVESTMENT EFFECTS ($2008, 6% Discount Rate)	DIRECT					INDIRECT	INDUCED	TOTAL
	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Lower Mainland			
Output	$40.1	$17.6	$17.5	$7.7	$82.9	$26.9	$18.8	**$128.6**
GDP	$21.5	$9.4	$9.4	$4.1	$44.5	$14.3	$12.0	**$70.8**
Labour Income	$15.3	$6.7	$6.7	$2.9	$31.6	$9.4	$7.1	**$48.1**
Employment	485.7	212.4	211.4	93.2	1,002.7	338.1	264.1	**1,604.9**
Taxes	$3.9	$1.7	$1.7	$0.8	$8.1	$2.6	$4.9	**$15.6**
Federal Indirect Taxes	*$0.2*	*$0.1*	*$0.1*	*$0.0*	*$0.4*	*$0.1*	*$0.8*	***$1.3***
Provincial Indirect Taxes	*$0.9*	*$0.4*	*$0.4*	*$0.2*	*$1.8*	*$0.6*	*$2.1*	***$4.5***
Federal Income Taxes	*$2.0*	*$0.9*	*$0.9*	*$0.4*	*$4.1*	*$1.3*	*$1.5*	***$6.9***
Provincial Income Taxes	*$0.9*	*$0.4*	*$0.4*	*$0.2*	*$1.8*	*$0.5*	*$0.6*	***$2.9***

B-5: CONSERVATION RATES INVESTMENT AND RE-SPENDING EFFECTS ($2008, 6% Discount Rate)	DIRECT					INDIRECT	INDUCED	TOTAL
	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Lower Mainland			
Output	$40.1	$17.6	$17.5	$7.7	$82.9	$26.9	$2,028.1	**$2,137.9**
GDP	$21.5	$9.4	$9.4	$4.1	$44.5	$14.3	$1,350.5	**$1,409.4**
Labour Income	$15.3	$6.7	$6.7	$2.9	$31.6	$9.4	$976.0	**$1,017.0**
Employment	485.7	212.4	211.4	93.2	1,002.7	338.1	37,591.2	**38,932.0**
Taxes	$3.9	$1.7	$1.7	$0.8	$8.1	$2.6	$234.0	**$244.7**
Federal Indirect Taxes	*$0.2*	*$0.1*	*$0.1*	*$0.0*	*$0.4*	*$0.1*	*$51.6*	***$52.1***
Provincial Indirect Taxes	*$0.9*	*$0.4*	*$0.4*	*$0.2*	*$1.8*	*$0.6*	*$145.6*	***$148.0***
Federal Income Taxes	*$2.0*	*$0.9*	*$0.9*	*$0.4*	*$4.1*	*$1.3*	*$25.9*	***$31.3***
Provincial Income Taxes	*$0.9*	*$0.4*	*$0.4*	*$0.2*	*$1.8*	*$0.5*	*$10.9*	***$13.2***

Codes and Standards Investment and Re-spending Effects

B-6: BUILDING CODES INVESTMENT EFFECTS ($2008, 6% Discount Rate)	DIRECT					INDIRECT	INDUCED	TOTAL
	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Total Direct			
Output	$104.2	$45.6	$45.3	$20.0	$215.1	$114.6	$38.1	**$367.8**
GDP	$45.1	$19.7	$19.6	$8.7	$93.1	$54.9	$24.2	**$172.2**
Labour Income	$31.8	$13.9	$13.9	$6.1	$65.7	$36.0	$14.5	**$116.1**
Employment (undiscounted PYs)	1,373.6	600.8	598.0	263.6	2,836.1	1,249.7	648.5	**4,734.2**
Taxes	$7.4	$3.2	$3.2	$1.4	$15.2	$10.3	$10.7	**$36.3**
Federal Indirect Taxes	*$0.3*	*$0.1*	*$0.1*	*$0.1*	*$0.7*	*$0.5*	*$1.5*	***$2.7***
Provincial Indirect Taxes	*$1.2*	*$0.5*	*$0.5*	*$0.2*	*$2.5*	*$2.4*	*$4.3*	***$9.2***
Federal Income Taxes	*$4.3*	*$1.9*	*$1.9*	*$0.8*	*$8.8*	*$5.4*	*$3.6*	***$17.7***
Provincial Income Taxes	*$1.6*	*$0.7*	*$0.7*	*$0.3*	*$3.2*	*$2.0*	*$1.4*	***$6.7***

B-7: PRODUCT STANDARDS INVESTMENT EFFECTS ($2008, 6% Discount Rate)	DIRECT					INDIRECT	INDUCED	TOTAL
	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Total Direct			
Output	$78.9	$34.5	$34.3	$15.1	$162.8	$67.7	$44.9	**$275.4**
GDP	$44.3	$19.4	$19.3	$8.5	$91.6	$35.7	$28.5	**$155.8**
Labour Income	$33.1	$14.5	$14.4	$6.4	$68.4	$23.1	$17.0	**$108.6**
Employment (undiscounted PYs)	1,307.5	571.9	569.2	250.9	2,699.5	697.9	652.4	**4,049.8**
Taxes	$7.2	$3.1	$3.1	$1.4	$14.8	$6.9	$11.8	**$33.5**
Federal Indirect Taxes	*$0.2*	*$0.1*	*$0.1*	*$0.0*	*$0.4*	*$0.3*	*$1.8*	***$2.5***
Provincial Indirect Taxes	*$1.4*	*$0.6*	*$0.6*	*$0.3*	*$2.8*	*$1.9*	*$5.0*	***$9.8***
Federal Income Taxes	*$4.1*	*$1.8*	*$1.8*	*$0.8*	*$8.4*	*$3.3*	*$3.6*	***$15.3***
Provincial Income Taxes	*$1.5*	*$0.7*	*$0.7*	*$0.3*	*$3.2*	*$1.3*	*$1.4*	***$5.9***

B-8: CODES AND STANDARDS	DIRECT					INDIRECT	INDUCED	TOTAL
INVESTMENT AND RE-SPENDING EFFECTS ($2008, 6% Discount Rate)	**Lower Mainland**	**Vancouver Island**	**Southern Interior**	**Northern Interior**	**Total Direct**	**Lower Mainland**	**Vancouver Island**	**Southern Interior**
Output	$183.0	$80.1	$79.7	$35.1	$377.9	$182.3	$1,596.2	**$2,156.4**
GDP	$89.5	$39.1	$38.9	$17.2	$184.7	$90.6	$1,032.4	**$1,307.7**
Labour Income	$65.0	$28.4	$28.3	$12.5	$134.1	$59.1	$659.0	**$852.2**
Employment	2,681.2	1,172.7	1,167.2	514.5	5,535.6	1,947.6	46,556.8	**54,039.9**
Taxes	$14.5	$6.3	$6.3	$2.8	$30.0	$17.2	$258.7	**$305.9**
Federal Indirect Taxes	*$0.5*	*$0.2*	*$0.2*	*$0.1*	*$1.1*	*$0.8*	*$56.7*	***$58.6***
Provincial Indirect Taxes	*$2.6*	*$1.1*	*$1.1*	*$0.5*	*$5.3*	*$4.4*	*$159.0*	***$168.6***
Federal Income Taxes	*$8.3*	*$3.6*	*$3.6*	*$1.6*	*$17.2*	*$8.7*	*$30.4*	***$56.2***
Provincial Income Taxes	*$3.1*	*$1.4*	*$1.4*	*$0.6*	*$6.4*	*$3.4*	*$12.6*	***$22.4***

APPENDIX C: IMPORT ADJUSTMENTS

In estimating employment impacts of DSM initiatives, it is necessary to identify the import component of each DSM good purchased. While imports do not have a major impact on the provincial economy, the associated distribution margins must be considered. The BC I/O model contains import coefficients that have been assigned to the DSM program categories considered in this study. The default I/O model import coefficients obtained from Statistics Canada were revised for these goods wherever better import information was available.

The import ratios for DSM program technologies and codes and standards are presented in Tables C-1 and C-2, respectively. In both tables, the Statistics Canada Commodity Groupings, as per their commodity definitions, were used to classify the BC Hydro DSM portfolio commodity data.

Table C-1
DSM Program Technology Import Ratios

Power Smart DSM Commodity	Statistics Canada Commodity Grouping	Ratio
RESIDENTIAL PROGRAM		
Lighting	Electric lighting fixtures, excluding portable	96.85%
District Energy Systems	Pumps, compressors, fans and blowers	66.93%
Appliances	Average Washers, Refrigerators, freezers	96.00%
Insulation	Mineral wool (82%) and fibreglass (93%) 50:50	87.50%
Windows	Wooden windows and plastic building supplies (50:50)	45.10%
Electronics (TVs and STBs)	TVs, VCRs and accessories	96.31%
Electric Motors Variable Speed	Electrical generators and motors	96.15%
Heat Pumps	Pumps, compressors, fans and blowers	66.93%
COMMERCIAL PROGRAM		
Lighting	Electric lighting fixtures, excluding portable	96.85%
HVAC	AC, refrigeration equipment, commercial and transport	88.83%
Process Controls	Measuring and controlling instruments	74.90%
IT Technologies	Computer systems design and related services	29.14%
Refrigeration	Household refrigerators and freezers	97.78%
Building Envelope	1/3 insulation, 1/3 window, 1/3 steel framing (97.3%)	75.00%
Generators	Electrical generators and motors	96.15%
INDUSTRIAL PROGRAMS		
Mechanical Pulping	Logging, pulp and paper industry machinery	82.76%
Process and Controls	Measuring & controlling instruments	74.90%
Compressed Air	Pumps, compressors, fans and blowers	66.93%
Fans and Blowers	Pumps, compressors, fans and blowers	66.93%
Conveyance	Conveyors, elevators and hoisting equipment	98.53%
Refrigeration	AC, refrigeration equipment, commercial and transport	88.83%
Motors	Electrical generators & motors	96.15%

Table C-2
Codes and Standards Import Rations

DSM Commodity	Statistics Canada Commodity Grouping	Ratio
PRODUCT STANDARDS		
Windows	Wooden windows and plastic building supplies (50:50)	45.10%
Lighting (all)	Electric lighting fixtures, excluding portable	96.85%
Clothes Washers	Household clothes washers and dryers	98.99%
Dishwasher	Household dishwashers	91.26%
Refrigerators, freezers, icemakers	Household refrigerators and freezers	97.78%
Ceiling Fans	Electrical generators and motors	96.15%
Furnace Motors	Electrical generators and motors	96.15%
Hot Tubs	Pumps, compressors, fans and blowers	66.93%
Electronics (TVs and STBs)	TVs, VCRs and accessories	96.31%
Other Electrical	Radio, stereo, cassette and CD players and accessories	95.85%
Commercial Clothes Washers	Household clothes washers and dryers	98.99%
Air Conditioners	Air conditioning equipment, wall and window	99.63%
Industrial motors	Electrical generators and motors	96.15%
Air Conditioners Large Commercial	AC, refrigeration equipment, commercial and transport	88.83%
BUILDING CODES		
Framing	Wood structural products	19.12%
Insulation	Mineral wool (82%) and fibreglass (93%) 50:50	87.50%
Furnace	Electric and Non-Electric Furnaces 50:50	90.90%
HRV	Fans and air circulation, not industrial	88.45%
Windows (Residential)	Wooden windows and plastic building supplies (50:50)	45.10%
Windows (Commercial)	Metal doors and windows	39.98%
Lighting	Electric lighting fixtures, excluding portable	96.85%
Pumps and Plumbing	Pumps, compressors, fans and blowers	66.93%