ENERGY EFFICIENCY:

ENGINE OF ECONOMIC GROWTH IN CANADA

A Macroeconomic Modeling & Tax Revenue Impact Assessment

MARCH 2014

ENE

Note: As of Oct 30, 2014 ENE is now Acadia Center

Acadia Center

Acknowledgements

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About ENE / Acadia Center

Over the past 15 years, Environment Northeast (ENE) has built a successful track record of providing solutions to advance state and regional efforts to promote effective clean energy and climate policy. To more accurately reflect its growing geographic scope, multi-disciplinary and evolving approach, ENE is excited to announce the adoption of a new name – Acadia Center – and brand, as reflected in its new logo and website. The new name better reflects the organization's scope of work, its multi-disciplinary approach and its forward-looking mission.

Acadia Center is a non-profit, research and advocacy organization committed to advancing the clean energy future. Acadia Center is at the forefront of efforts to build clean, low carbon and consumer friendly economies. Acadia Center's approach is characterized by reliable information, comprehensive advocacy and problem solving through innovation and collaboration.

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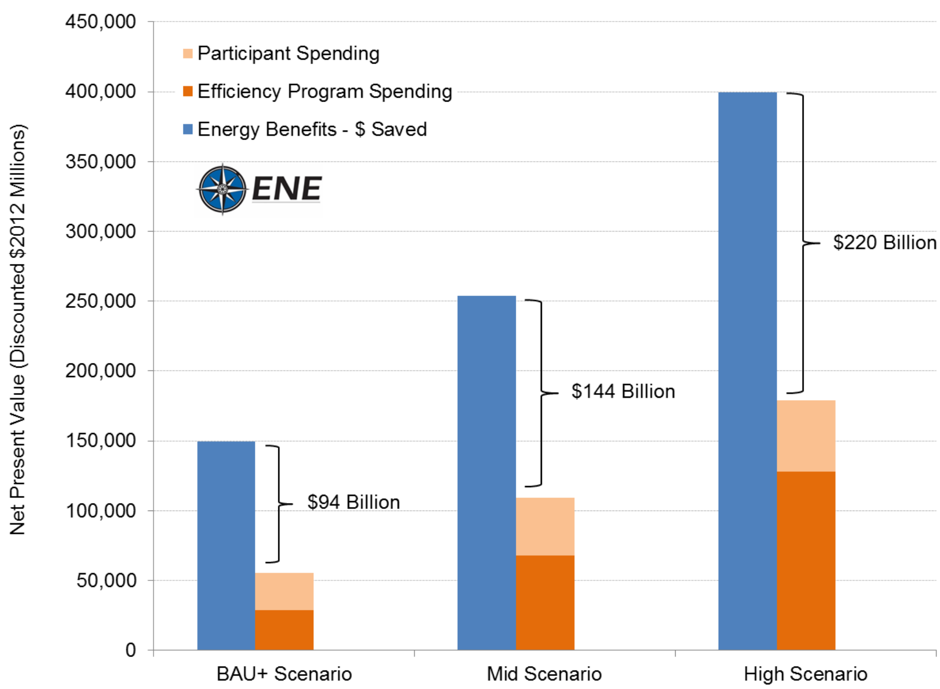
Executive Summary

The way energy is used can be dramatically improved to reduce unnecessary waste. The Canadian economy has become more energy efficient over time, but in common with most countries, significant economic energy savings potential remains untapped. This waste costs consumers and industry, and stunts the competitiveness of the economy.

Improved energy efficiency reduces energy waste while providing the same or better level of service (heating, lighting, etc.). It is a low-cost energy resource option that delivers multiple economic, societal, and environmental benefits. Energy efficiency reduces the need to purchase energy supply, and in the process delivers significant direct financial savings to consumers and industry through reduced energy bills. In this study, the efficiency programs modeled return $3 to $5 in savings for every $1 of program spending, and total net benefits – dollars left in Canadians' pockets – from $94 billion to $220 billion (see Figure ES-1).

The goal of this analysis is to understand the overall macroeconomic impact from a range of energy savings generated by energy efficiency programs. In other words, how dollars spent on energy efficiency and the resulting direct savings flow through provincial economies, and impact overall economic and job growth in Canada. (See diagram on page 5.)

Figure ES-1: Total Lifetime Energy Benefits versus Fifteen Years of Program and Participant Spending – *National cases where all provinces implement programs for all fuel types simultaneously*



In Canada, households alone spent $28B on energy (excluding transportation fuels) in 2012. This does not include spending on fuel assistance programs.

By comparison, total residential sector investment – program and participant – in the first year under the energy efficiency scenarios is $1.2B.

Overview – Macroeconomic Modeling Study

This study builds on ENE's *Energy Efficiency: Engine of Economic Growth in Eastern Canada* (2012), and uses the same framework to quantify the total <u>net</u> macroeconomic impacts – dollars of Gross Domestic Product (GDP) and jobs – from cost-effective energy efficiency solutions across all Canadian provinces. The study considers electric, natural gas, and liquid fossil fuel (light and heavy fuel oils) efficiency programs that generate energy savings in residential, commercial/institutional, and industrial sectors (transportation sector not included). The macroeconomic impacts are modeled using a multi-province policy forecasting model by Regional Economic Models, Inc. (REMI). The study also estimates provincial and federal tax revenue impacts for two representative national scenarios.

The project team consisted of analysts from ENE, Dunsky Energy Consulting, and Economic Development Research Group. The team was assisted by a project steering committee, which included representatives from Natural Resources Canada and the National Energy Board. An informal advisory group consisting of provincial departments of energy, utilities, and other experts was also consulted.

ENE did not model specific existing or planned energy efficiency programs. As a result, this study does not provide prescriptive energy efficiency solutions. Rather this is an attempt to quantify a range of savings targets (see Table ES-1) that are considered robust to aggressive but realistic and achievable based on cost-effective savings potential studies and experience in other jurisdictions. For example, Nova Scotia reduced demand for electricity by approximately 1.52% in 2012, and the current North American leader – Massachusetts – has approved an annual electric savings target of 2.60% by 2015. The underlying costs and benefits for each scenario are based on the targets in Table ES-1. This approach results in a range of economic outputs and indicators (e.g. GDP per $1 of program spending) that can be applied to generate more targeted estimates of the economic benefits for a chosen plan.

Table ES-1: Annual Efficiency Savings Targets by Fuel Type (% of Annual Consumption)

	BAU+ Scenario	Mid Scenario	High Scenario
Electricity	1.00%	1.75%	2.50%
Natural Gas	0.75%	1.25%	1.75%
Liquid Fossil Fuels	1.30%	1.75%	2.50%

For electricity and natural gas the three savings targets reflect: a) an incremental (up to 1%) increase in savings over current levels of effort in most jurisdictions (BAU+); b) a level of effort that would place a province among current leaders (Mid); and, c) a North American-leading level of effort (High). Liquid fossil fuel energy efficiency savings are largely unexploited, which means there is significant "low hanging fruit" and makes a relatively high BAU+ annual reduction target achievable. It is important to note that the savings targets are not in addition to existing efforts (i.e. savings from existing utility programs have been added back into provincial demand forecasts). Also, the energy efficiency scenarios deliver cost-effective energy savings (i.e. efficiency savings cost less than supplying additional energy).

Other impressive direct benefits include 11,200 to 30,000 petajoules (PJ) in lifetime energy savings and maximum annual energy savings ranging from 720 PJ to 1,500 PJ at the national level. To put the maximum annual savings in context, Quebec's total energy demand (excluding transportation) was approximately 1,150 PJ in 2011. Also, total greenhouse gas (GHG) emission reduced or avoided are approximately 650 to 1,650 Mt CO_2e. Maximum annual avoided GHG emissions under the mid-range scenario are 69 Mt CO_2e, or 10% of Canada's total GHG emission in 2011.

Modeling Results

The results of the macroeconomic modeling and tax revenue impact assessment – for national-level scenarios – are summarized by the following five key findings. In total 122 federal and provincial scenarios were assessed. The full report with detailed appendices is available at: www.env-ne.org.

1. Energy efficiency significantly increases GDP and stimulates growth in employment.

Other assessments of energy efficiency programs show large direct savings to consumers and growth in energy service jobs. By looking at the broader, macroeconomic impact of those savings, ENE's study shows that the savings generated by efficiency programs frees up money for new spending (in the residential sector) and promotes increased competitiveness among businesses and thus added economic output. This significantly increases GDP, household income, and job creation in Canada compared to the base case economic forecast. Under the national "all fuels" scenarios summarized in Table ES-2:

- Average annual spending of $1.9 billion (BAU+ scenario), $4.5B (Mid), and $8.5B (High) over 15 years results in a net increase in GDP of $230B, $387B, and $583B, respectively, over the study period (2012-2040). This is $8 to $5 of GDP for every $1 of program spending.
- The scenarios generate a net increase of 1.5 million to 3.9 million job-years (one job for a period of one year), or 52 to 30 job-years per million dollars of program spending.
- The maximum annual net increase in GDP ranges from $19B to $48B, and the maximum annual net increase in employment ranges from 121,000 to 304,000 jobs.
- This is a net impact assessment. The modeling results incorporate the negative ratepayer effects, or costs, to fund programs and losses from avoided electricity generation.

Table ES-2: Summary of Canada-wide Economic Impacts from Electric, Natural Gas, and Liquid Fossil Fuel Efficiency Programs under Three Investment Targets (2012-2040) – *Cases where all provinces implement programs for all fuel types simultaneously*

Canada -- All Fuels	BAU+	Mid	High
Total Efficiency Program Costs ($2012 Millions)	28,564	67,617	127,780
Net Increase in GDP ($2012 Millions)	**230,407**	**386,970**	**582,504**
Maximum Annual GDP Increase ($2012 Millions)	18,798	32,704	47,586
GDP per $1 of Program Spending	8.1	5.7	4.6
GDP per $1 of Program & Participant Spending	4.1	3.5	3.3
Net Increase in Employment (Job-years)	**1,489,260**	**2,548,842**	**3,885,402**
Maximum Annual Employment Increase (Jobs)	121,406	209,969	303,523
Job-years per $Million of Programs Spending	52	38	30
Job-years per $Million of Program & Participant Spending	27	23	22

2. Most of the economic impact is from savings that flow back into local economies and increase the competitiveness and productivity of business and industry.

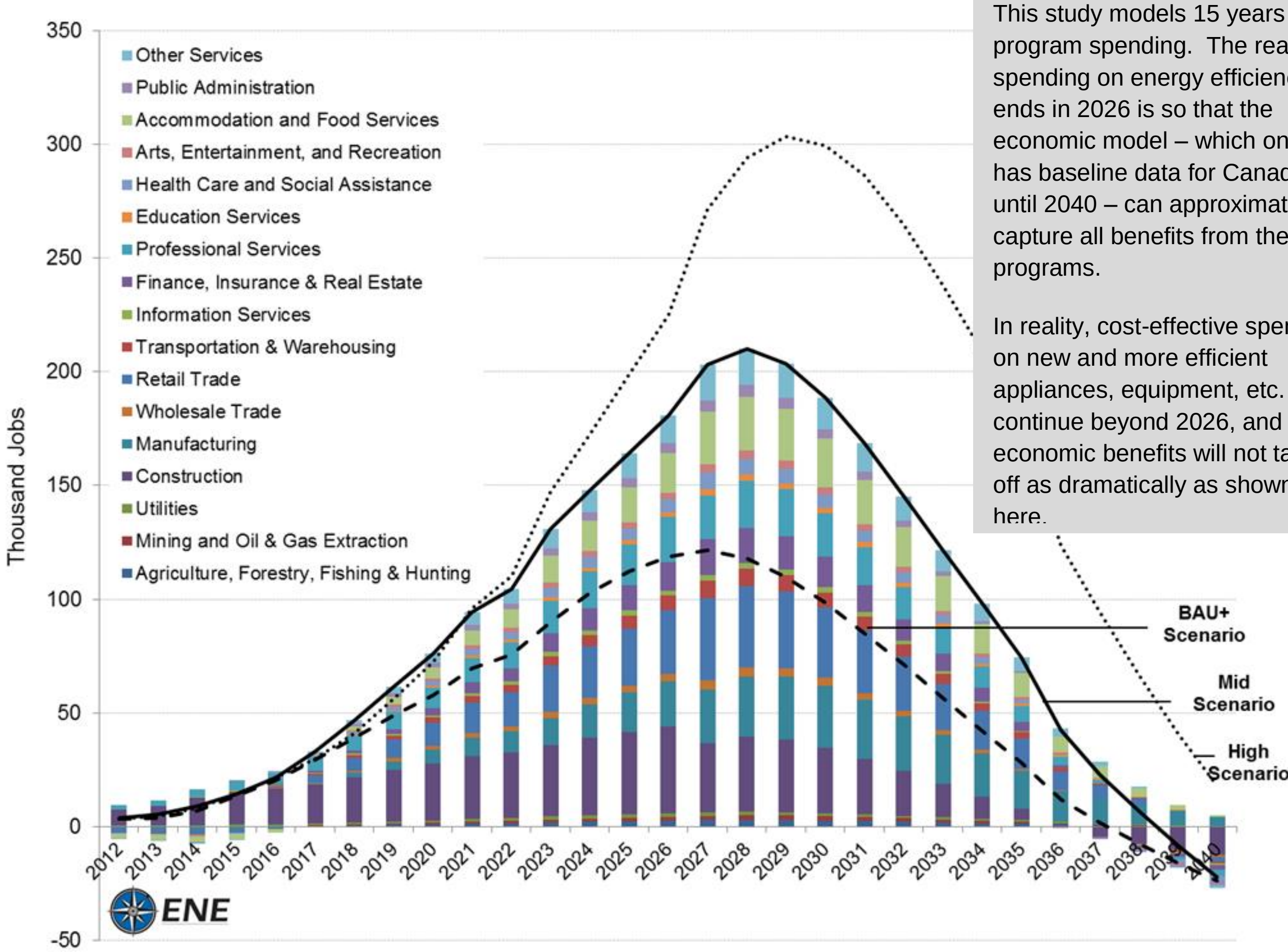
While energy efficiency programs generate growth in energy service jobs (and associated spill-over effects), it is the persistent effects of the savings realized by consumer and industry that drive 75-85% of the overall macroeconomic impact. Lower energy bills cause increases in other forms of consumer spending, for example renovations, dining out, and travel. Lower energy bills also reduce the costs of doing business in the region, bolstering the global competitiveness of local employers and promoting additional demand for products and services throughout supply chains. This finding explains why energy efficiency is such a powerful economic stimulus and effective means of generating jobs.

3. The benefits are distributed across sectors in the Canadian economy.

Energy efficiency program spending and the resulting energy savings generate economic growth and jobs across a wide range of sectors (see Figure ES-2). The sectors of the economy related to delivering the efficiency programs – construction, retail sales, professional services, and manufacturing – see more increased employment in the early years (2012-2026) when efficiency program implementation is modeled. After 2026, households and industry continue to realize energy savings and lower energy bills.

These savings have an even bigger influence on local job creation, particularly in: retail sales, travel/tourism and food services, manufacturing, construction, and professional services.

Figure ES-2: Total Net Employment Impact in Canada by Sector (2012-2040) – *Case where all provinces implement programs for all fuel types simultaneously*



This study models 15 years of program spending. The reason spending on energy efficiency ends in 2026 is so that the economic model – which only has baseline data for Canada until 2040 – can approximately capture all benefits from the programs.

In reality, cost-effective spending on new and more efficient appliances, equipment, etc. will continue beyond 2026, and economic benefits will not tapper off as dramatically as shown here.

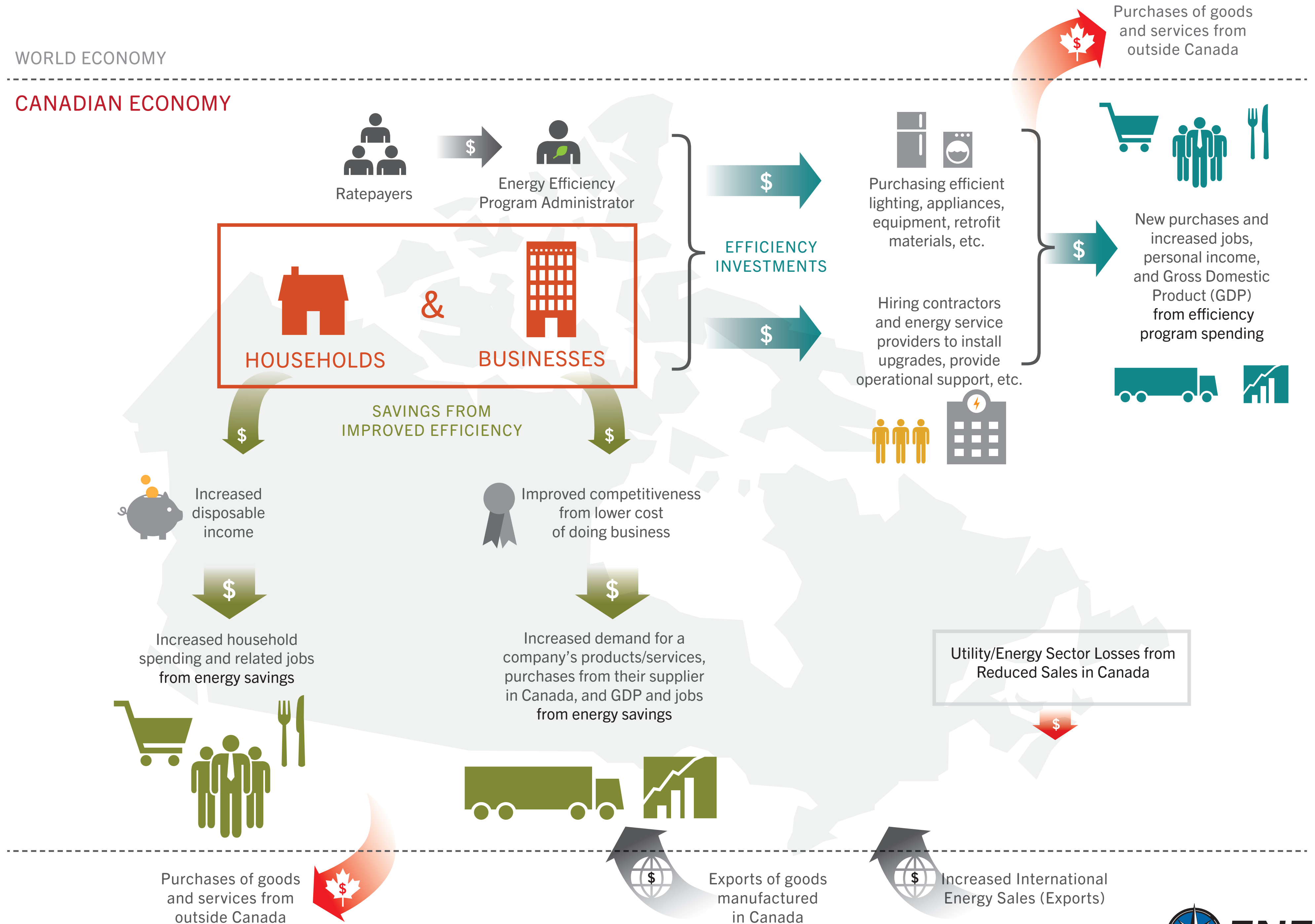
4. Simultaneous implementation of programs further increases the economic impact.

When provinces implement efficiency programs for more than one fuel type at the same time the economic benefits are even greater. For example, under the national investment scenarios in Table ES-2, the simultaneous delivery of efficiency programs for all three fuel types adds $12.5 billion in additional GDP under the BAU+ scenario, $20.5B under the Mid scenario, and $28.4B under the High scenario. In terms of employment, simultaneous delivery adds over 52,000 job-years (BAU+), 118,000 job-years (Mid), and 171,000 job-years (High) to the national economy compared to the sum of scenarios where all provinces implemented efficiency programs for only one fuel type. Similarly, the overall economic impact is greater in cases when multiple provinces implement efficiency programs at the same time.

5. Energy efficiency investments increase government revenue.

Inherent with the introduction of efficiency programs is financial relief for consumers and businesses through reduced fuel purchases and avoided sales tax. However, this study shows that the net increase in economic output generates additional tax revenue that more than compensates for the loss. Under the case where all provinces implement efficiency programs for all fuel types, the average annual net increase in personal income tax, corporate income tax, and sales tax collections is up to $2.7 billion at the federal level, and as high as $2.0 billion at the provincial level.

Macroeconomic Impacts from Investing in Energy Efficiency



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Introduction

Energy is an essential part of everyday life. Energy powers appliances and equipment, provides heating and cooling functions in homes and buildings, and fuels the transport of goods and people. Yet, across Canada, the same level and quality of service enjoyed today can be achieved using much less energy. Eliminating energy waste will reduce energy costs for consumers and business, improve industrial competitiveness, and – as this study shows – drive significant economic growth and jobs.

Energy efficiency policies and programs deliver energy savings and reduce waste. Instead of purchasing electricity and fuel, energy savings are "procured" through appliance and equipment standards and building codes set by government, as well as through energy efficiency programs administered by utilities, government, and/or independent organizations. The International Energy Agency (IEA) recently called energy efficiency the world's "first fuel" and stated that without efficiency, IEA member countries "would now be consuming – and paying for – about two-thirds more energy than they currently use."[1]

In addition to being an abundant and low-cost energy resource option, energy efficiency generates individual and economy-wide benefits. Efficiency programs reduce demand for energy supply, which in turn:

- Lowers consumer and industry energy bills, resulting in savings that are invested in local economies, increasing productivity, and creating jobs;
- Reduces the burden on existing energy infrastructure and the need for new and costly upgrades;
- Improves the energy intensity of an economy, increasing local and national energy security;
- Generates non-energy benefits, for example improved productivity and comfort (e.g. better lighting, insulation, draft proofing), water savings, and improved health and safety;
- Reduces the energy burden of vulnerable populations, freeing income for other basic needs such as food, housing, and medication;
- Reduces energy poverty and government spending on fuel assistance programs;
- Helps cost-effectively reduce greenhouse gas emissions and other air pollution; and
- Helps mitigate against the trend of rising health-care costs by curbing air pollution.

Despite the multiple benefits, market failures limit investment in energy efficiency – even when energy efficiency is the cost-effective option (i.e. efficiency savings that cost less than supplying additional energy). Efficiency programs like the ones modeled in this study address market failures by offering access to information and support as well as financial incentives that help customers and business make efficiency upgrades such as improved building insulation, testing and sealing air ducts, high-efficiency lighting, and high-performance boilers and water heaters.

As interest in and implementation of energy efficiency increases, it is important to understand the economic impact of these investment choices – both from the point of view of those investing in efficiency measures and the economy as a whole. To date, the direct effects – i.e. the amount of energy and money saved – from efficiency programs are regularly evaluated and it is understood that efficiency programs deliver significant direct savings to consumers and business. This study addresses the next question: To what extent do these savings flow through economies and impact overall economic conditions and job growth?

Study Overview

This project is an extension of ENE's *Energy Efficiency: Engine of Economic Growth in Eastern Canada* (2012),[2] and uses the same framework to quantify the net macroeconomic impacts – in terms of dollars of Gross Domestic Product (GDP) and jobs – of cost-effective energy efficiency solutions across the ten Canadian provinces.[i] The study considers electric, natural gas and liquid fossil fuel efficiency programs that generate energy savings in the Residential and the Commercial and Industrial (C&I) market segments. The macroeconomic impacts are modeled using a multi-province policy forecasting model by Regional Economic Models, Inc. (REMI). In total, 122 national and provincial scenarios are evaluated. The study also estimates high-level provincial and federal tax revenue impacts for two representative national scenarios.

The project team consisted of analysts from ENE, Dunsky Energy Consulting (DEC), and Economic Development Research Group (EDR Group). The team was assisted by a project steering committee, which included representatives from Natural Resources Canada and the National Energy Board. An informal advisory group of representatives from provincial departments of energy, utilities, and other experts was also consulted. Steering and advisory committee input was solicited in the development of the modeling assumptions and inputs, and to review the draft final report.

The purpose of this study is to understand the overall macroeconomic impact from energy efficiency programs. ENE did not model existing or planned efficiency programs; rather this is an attempt to quantify a range of hypothetical levels of effort that are considered robust to aggressive, but realistic and achievable based on cost-effective savings potential studies and experience in other jurisdictions. The study results are applicable even if they do not exactly match planned investments; the multipliers for GDP and jobs can be applied to more specific investment levels to generate estimates of economic benefits for a chosen provincial ramp-up plan.

Canadian Energy Use Snapshot

This study considers energy efficiency programs that reduce demand for electricity, natural gas, and liquid fossil fuels (light and heavy fuel oils) in the aforementioned sectors of the Canadian economy. Transportation and agriculture end use demand are not included, nor is fuel used for electricity generation. Energy demand from the oil and gas sector is also excluded so as not to overestimate the energy savings and thus economic benefits generated by energy efficiency programs.[ii] The sub-set of demand included in this assessment was approximately 5,000 PJ or 63% of total end use demand in Canada in 2011 (see Figure 1).[3]

This study combines the commercial/institutional and industrial sectors into one C&I market segment. At the national level, the breakdown between the residential and C&I market segments is approximately 26% versus 74% (see Figure 2).[4] Within these sectors, the fuel types covered in this study account for approximately 85% of total secondary energy consumption.[5]

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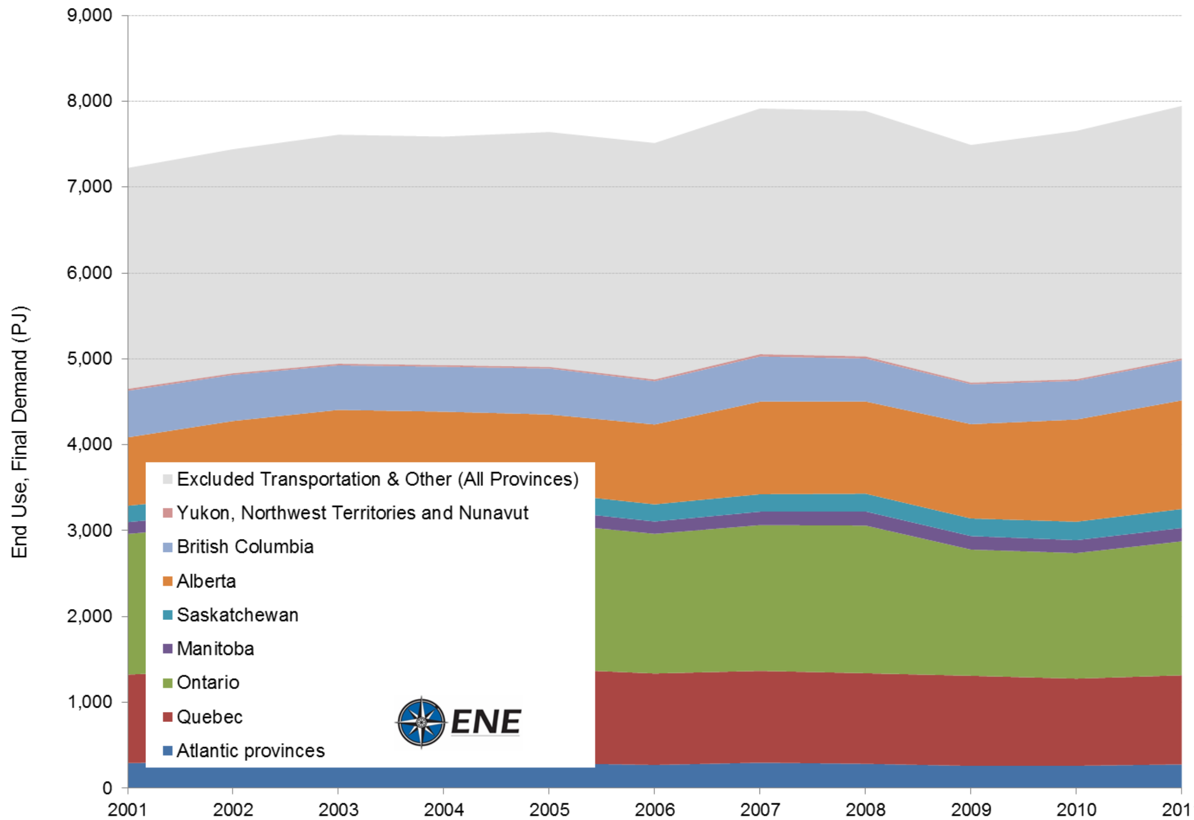
[i] The energy systems in the territories are meaningfully different and require special consideration outside of this particular assessment.

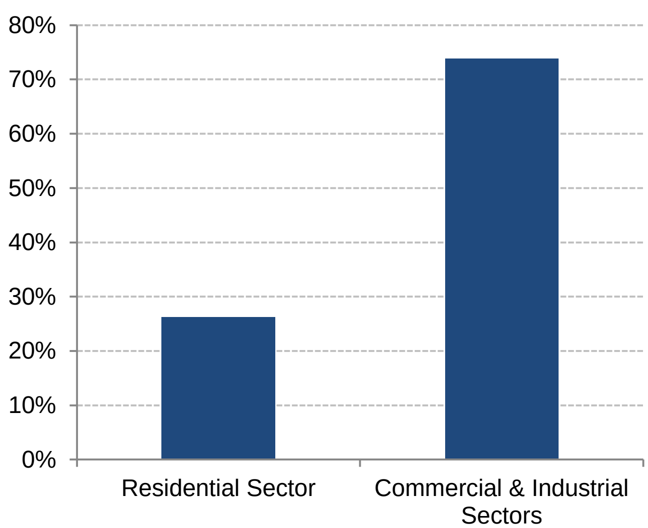
[ii] The study assumes limited opportunity to implement upstream oil and gas energy efficiency programs. Demand from these facilities is removed from the industrial sector demand forecasts (natural gas or refined petroleum products), and thus the estimates for energy savings on which the economic impacts are based. Figure 1 includes end use demand from the mining, oil, and gas sector – approximately 804 PJ in 2011 – as it is difficult to establish what portion of that demand is from the mining sector and mobile sources.

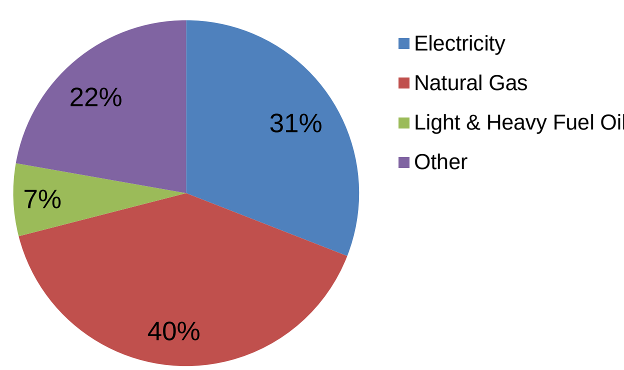
Figure 1: End Use Demand in the Residential, Commercial/Institutional, and Industrial Sectors, by Province and Territory (2001-2011)



Source: Statistic Canada. Table 128-0016 - Supply and demand of primary and secondary energy in terajoules, annual (accessed: 2013-11-29)

Figure 2: Secondary Energy Use in the Residential and Commercial and Industrial Sectors and by Fuel Type in Canada (% Share, 2011)





Source: NRCan OEE Comprehensive Energy Use Database Tables (accessed: 2014-03-17)

The breakdown between fuel types – and to a lesser extent sectors – will vary between provinces. Proximity to resources as well as historic decisions based on energy prices and resulting investment in energy infrastructure contribute to the fuels consumed in each province or region (see Table 1). These regional differences in fuel use, among other factors, influence the modeling inputs for each province, and the macroeconomic modeling results.

Table 1: Secondary Energy Use in the Residential, Commercial, and Industrial Sectors across Canada by Fuel Type (% Share, 2011)[6]

	BC & Territories	AB	SK	MB	ON	QC	ATL
Electricity	32%	13%	28%	45%	28%	58%	34%
Natural Gas	33%	56%	57%	44%	47%	20%	5%
Light & Heavy Fuel Oil	6%	6%	5%	3%	4%	7%	29%
Other	29%	25%	10%	8%	21%	15%	32%

In terms of energy efficiency in the Canadian context, Natural Resources Canada`s Office of Energy Efficiency estimates that the improvement in energy efficiency of the Canadian economy between 1990 and 2010 was approximately 25.3%, and that these gains reduced total energy use (including transportation energy use) from what it otherwise would have been by approximately 1,680 PJ in 2010.[7] This level of energy savings is approximately equal to the maximum annual energy savings under the highest investment scenario in this study (see Table 3 on pg. 15); however, even with prior efficiency gains in the residential, commercial, and industrial sectors, the energy savings under the High scenario are additional cost-effective investment opportunities.

All provinces have some form of energy efficiency policies and programs in place; however, the scope and scale of the investment varies. As in other jurisdictions, there remains significant potential to reduce energy waste in Canada. The IEA estimates that, under the current policies and programs of its member countries, two thirds of the economic energy efficiency potential will be untapped through to 2035.[8] Realizing the cost-effective savings will benefit consumers and industry by reducing energy bills and increasing competitiveness, and as this study demonstrates, past and future investments in energy efficiency translate into significant economic growth and job creation.

Methodology

The study was conducted in three phases. The first phase establishes the energy efficiency policy scenarios and the direct effects – i.e. energy savings, program spending levels, and dollars of energy savings – associated with each scenario, which are quantified and summarized in the next section of the report. These direct effects are key inputs for the economic model used in the second phase to estimate the macroeconomic impacts of the various energy efficiency scenarios. The third phase involves using outputs from the economic model to estimate changes in government tax revenue from investment in energy efficiency. The three phases are briefly described below. Additional information with respect to the model and the modeling assumptions and inputs is provided in the appendixes.

This study is an extension of ENE's *Energy Efficiency: Engine of Economic Growth in Eastern Canada* (2012), which followed the same structure to assess increased investment in energy efficiency to approximately capture all cost-effective energy efficiency (efficiency that cost less than supplying additional energy) in Quebec, New Brunswick, Nova Scotia, and Prince Edward Island for three energy types (electricity, natural gas, and liquid fossil fuels – light and heavy fuel oils) with investments sustained over a 15-year period. The current study generates modeling inputs and results for the remaining six provinces as well as re-runs for the initial provinces in an updated all-provinces REMI model.[iii] The national modeling results include all ten provinces.

Phase 1: Model Assumptions and Inputs

To assess the macroeconomic impacts of energy efficiency, ENE worked with Dunsky Energy Consulting (DEC) to create policy scenarios that could be compared against the business as usual economic forecast generated by the model. This involved developing assumptions and direct effects for each policy scenario, which DEC did using the four-step "top-down" analysis process outlined below.

1. **Energy Savings** – The REMI economic model inputs are ultimately based on the total units of energy saved under each policy scenario. This top-down approach involves establishing a range of energy savings targets (% of annual consumption) for each fuel type (see Table 2). For electricity and natural gas the three savings targets reflect: a) an incremental (up to 1%) increase in savings over current levels of effort in most provinces (BAU+); b) a level of effort that would place a province among current leaders (Mid); and, c) a level of effort that would approach all cost-effective efficiency and make a province a leader in North American (High). Liquid fossil fuel energy efficiency savings are largely unexploited, which leaves significant "low hanging fruit" and is the reason why a relatively high BAU+ annual reduction target is achievable.

Table 2: Annual Efficiency Savings Targets by Fuel Type (% of Annual Consumption)

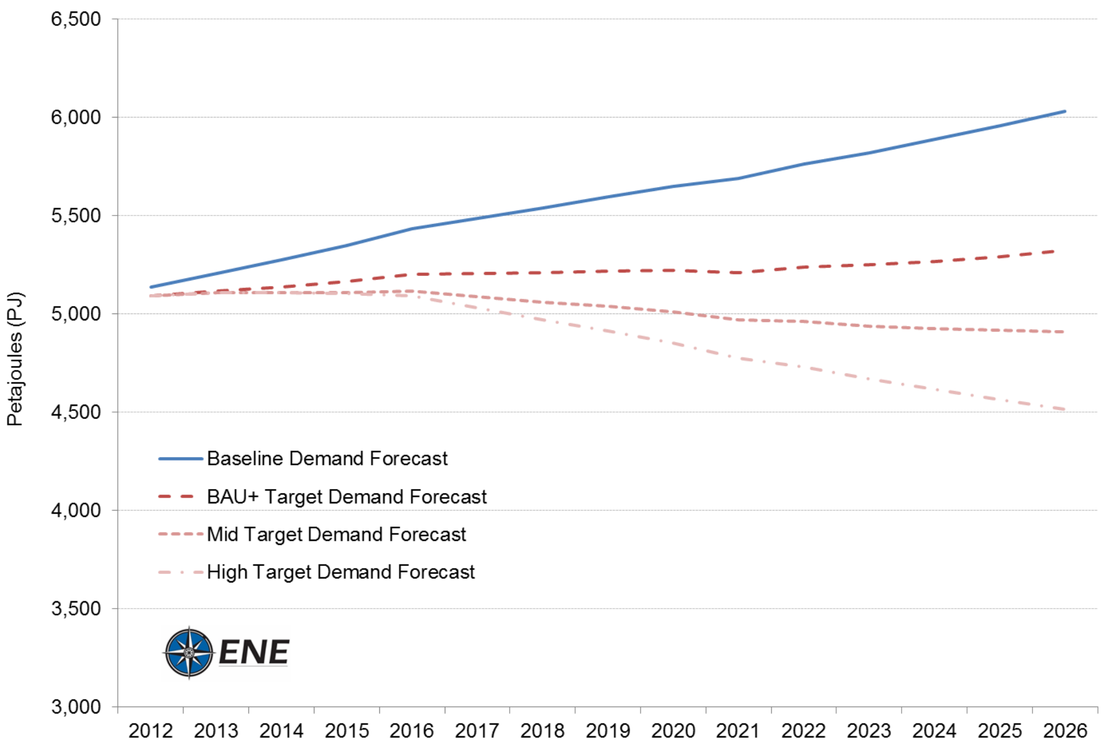
	BAU+ Scenario	Mid Scenario	High Scenario
Electricity	1.00%	1.75%	2.50%
Natural Gas[iv]	0.75%	1.25%	1.75%
Liquid Fossil Fuels	1.30%	1.75%	2.50%

[iii] The avoided electricity costs for Nova Scotia were updated to incorporate new publicly available data. Otherwise, the inputs for Québec, New Brunswick, Nova Scotia, and PEI remain the same. The modeling results for the individual provincial runs vary between studies as a result of moving from a four-region model based on 2007 Statistics Canada data to a ten province model based on 2008 data, and because the results are now presented using a $2012 base year.
[iv] No natural gas programs were evaluated in Prince Edward Island or Newfoundland and Labrador.

To note, ENE did not model existing or planned energy efficiency programs. Province-specific considerations that affect the actual level of cost-effective efficiency savings in a jurisdiction at a given time should be addressed through a full potential study. The economic outputs and indicators (e.g. GDP per $1 of program spending) from this study can then be applied to generate more targeted estimates of the economic benefits for a chosen plan.

Provincial energy demand forecasts for each fuel type were acquired from the National Energy Board.[v] The effect of existing or planned utility efficiency programs are removed from forecasts (i.e. units of energy saved are added back into the forecasts, effectively increasing projected demand).[vi] The targets in Table 2 are then applied to the adjusted provincial energy demand forecasts to generate three levels of incremental annual energy savings over a fifteen year period (2012-2026) for each fuel type (see Figure 3).[vii] The BAU+ target is achieved in year one and the ramp-up periods for the Mid and High targets are three and five years, respectively. Incremental annual energy savings are divided into two market segments based on the breakdown in Appendix A4.

Figure 3: Baseline Demand Forecast (All provinces, all Fuel Types) and the Demand Forecasts under the Three Energy Efficiency Savings Targets (BAU+, Mid, and High)



[v] To maintain consistency with ENE's initial energy efficiency macroeconomic study for eastern Canada, provincial energy demand forecasts from the National Energy Board's 2009 *Energy Futures* Reference Case were used. Newfoundland and Labrador's provincial forecast for Refined Petroleum Products was used in lieu of the NEB forecast. Demand from the oil and gas sectors was removed from the industrial forecasts so as not to overestimate energy savings, costs, and benefits. Where possible, electric and natural gas forecasts were checked against other utility and provincial forecasts.

[vi] The results of this study show the economic impact of efficiency programs compared to a case with no programs. The intent was not to model existing savings plus an additional, for example, 1% savings per year.

[vii] The actual level of annual savings in a province may already exceed the BAU+ scenario. For example, electricity demand in Nova Scotia was reduced by approximately 1.52% in 2012 as a result of efficiency investments.

2. **Program and Participant Costs** – Efficiency program costs represent the total level of investment required to run programs that achieve the target level of savings. These costs include program administration and financial incentives. Participant costs represent the total level of investment required by individuals and businesses that participate in an energy efficiency program after taking into account the costs borne by the program administrator. Program and participant spending introduces new costs to segments of the local economy[viii] as well as new investments or benefits elsewhere (e.g. high-efficiency equipment manufacturers, installation contractors), and these direct effects are key inputs for the model.

   The final cost structure – unit program and participant costs – is based on existing provincial energy efficiency program costs, where available, and other assumptions regarding the measure costs (participant costs plus incentives), and costs related to an increasing level of effort.[ix] The unit program and participant costs – which are provided in Appendix A6 – were applied to the incremental annual energy savings to generate total annual program and participant costs by province, fuel type, and market segment over the fifteen-year investment period. First-year and average annual program costs are also provided in Appendix A6.

3. **Energy Benefits (or Avoided Costs) –** Efficiency programs generate direct savings for consumers and businesses by reducing the need to purchase electricity supply and fuel. The net savings to consumers and business (the energy savings less the efficiency costs) reduce the cost of living and doing business, which, when input into the model, drive new investment and economic output.

   The direct energy benefits represent the monetary benefit from not having to generate or consume the next (marginal) unit of energy. In this analysis, electric avoided costs include avoided energy, capacity, and transmission and distribution costs. For natural gas they include the commodity price plus transportation and distribution costs. For light and heavy fuel oils, the avoided cost is deemed equal to the market price. DEC used existing or where necessary developed avoided cost forecasts for each province and fuel type (see Appendix A7).

   Average efficiency measure lifespans (see Appendix A5) are applied to the incremental energy savings to establish annual lifetime energy savings for each efficiency investment scenario. The avoided cost values (e.g. $/MWh) were then applied to the annual lifetime energy savings to generate total annual energy benefits by province, fuel type, and market segment for each efficiency target level.

   Since this is a net impact assessment, ENE and DEC also developed macroeconomic flow assumptions related to reduced energy demand and production. This allows the model to determine what portion of a province's avoided cost (i.e. benefit) may actually be offset (and from where in Canada) from reduced energy demand. The macroeconomic flows include offsets in the electric utility sector and other relevant sectors (e.g. turbine manufacturers) from lost electricity sales. The study adopted the National Energy Board's assumptions from its *Energy Futures* reports regarding the availability of export markets and infrastructure, and thus does not include sector offsets for natural gas or oil.

[viii] In this study, program costs are collected from all ratepayers (i.e. the household and business segments of the economy) regardless of whether they adopt efficiency measures. Participant costs are outlaid by a sub-set of the same ratepayers. Costs are allocated between the segments based on the spending breakdown (no cross-subsidization).
[ix] The scope of the analysis did not include establishing a specific list of efficiency measures that would be implemented for each province, fuel type, and target scenario. Instead, the study models "levels of effort" or annual savings targets, and unit costs were established using a top down approach that estimated program and participant costs to implement a portfolio of measures to achieve the specified level of effort. The strategic approach for the policy or investment scenarios as well as efficiency measures that could be included in program portfolios are provided in Appendix A2.

4. **Cost-effectiveness Tests –** While the investment scenarios are not based on a "bottom-up" energy efficiency potential study, the cost-effectiveness of DEC's scenarios were tested using three standard industry benefit/cost tests: the Total Resource Cost test, the Program Administrator Cost test, and the Participant Test.[x] All scenarios except for two returned net positive savings.[xi] In other words, this macroeconomic assessment is based on cost-effective levels of investment in energy efficiency.

Phase 2: Macroeconomic Modeling

Economic Development Research Group (EDR Group) was retained to conduct the modeling for the study, and used the multi-region Policy Insight + model by Regional Economic Model, Inc. (REMI). The REMI model is a dynamic economic model that integrates four methodologies: Input-Output tables, General Equilibrium, Econometric, and Economic Geography.[9] A detailed overview of the REMI model is available in Appendix A1.

A ten provinces REMI model was specifically built for this study to estimate the net economic output from energy efficiency policy scenarios by comparing a base case annual forecast to the new forecast when energy-related costs and savings or new dollars of investment are proposed. In total 122 scenarios were considered to establish a broad range of results, and can be categorized as:

Provincial Scenarios
A) Cases where one province implements efficiency programs for one fuel type (electricity, natural gas, or liquid fossil fuels) at the three investment levels (BAU+, Mid, High)
B) Cases where one province implements efficiency programs for all fuel types simultaneously (electricity, natural gas, and liquid fossil fuels) at the three investment levels (BAU+, Mid, High)

National Scenarios
C) Cases where all provinces implement efficiency programs for one fuel type at the three investment levels (BAU+, Mid, High)
D) Cases where all provinces implement efficiency programs for all fuel types simultaneously at the three investment levels (BAU+, Mid, High)

Phase 3: Tax Revenue Impact Assessment

The tax revenue impacts of two representative national policy scenarios (all provinces, all fuels at the "Mid" and "High" investment levels) were assessed by EDR Group outside the REMI model using a post-processor spreadsheet model. The high-level assessment considered changes to federal and provincial tax collections for three select tax concepts: a) Personal Income Tax; b) Corporate Income Tax; and c) Sales Tax.

Effective tax rates were established from Statistics Canada data and federal and provincial budget documents. These rates were then applied to the REMI output series that were identified as the economic activity driving the tax revenue sources (e.g. the personal income effective tax rate applied to the net increase in personal income). Additional information on the methodology for the tax revenue assessment is available in Appendix A9.

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[x] Conservative applications of the tests as no Other Program Impacts (e.g. value of avoided emissions) are included.
[xi] To be considered cost-effective, the benefit/cost ratio must be great than one. The benefit/cost ratio for the Alberta and Saskatchewan "High" natural gas scenarios was 0.99 due to low natural gas prices and relatively high program and participant unit costs estimates for the province.

Direct Effects

The goal of this study is to look beyond the direct effects of spending on efficiency programs, which are typically evaluated by energy efficiency studies, and quantify the broader macroeconomic impacts (GDP and jobs). However, the direct effects are also important, and before even considering the macroeconomic benefits it is obvious that the benefits from investing in energy efficiency are significant.

Figure 4: Total Lifetime Energy Benefits (aka Avoided Costs) versus Fifteen Years of Program and Participant Spending – *National cases where all provinces implement programs for all fuel types simultaneously*

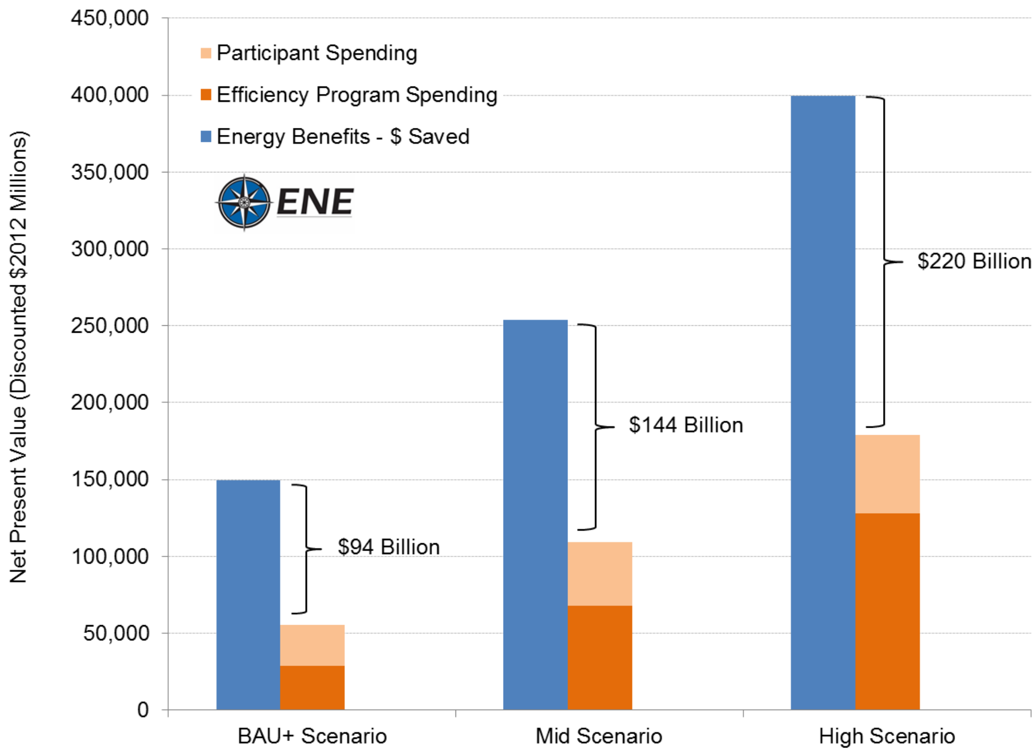


Figure 4 compares the total program and participant spending over a fifteen year period (2012-2026) to the lifetime energy benefits that the investments generate in Canada. Under the national investment scenarios, energy efficiency saves $3 to $5 for every $1 of program spending, and total net savings are $94 billion to $220 billion.[xii]

In Canada, households alone spent $28B on energy (excluding transportation fuels) in 2012, and this does not include government and utility spending on fuel assistance programs.[10] By comparison, total residential sector investment – program and participant – in the first year under the energy efficiency scenarios is $1.2B. Redeploying energy dollars into energy efficiency programs would generate significant direct economic benefits to Canadian consumers and industry, and as outlined in the following section, would drive significant new economic growth.

[xii] The "BAU+" scenario results in $5.2 of energy savings for every $1 of program spending, and the "High" scenario returns $3.1 of savings per $1 of program spending. The savings ratio declines at the higher efficiency targets as it becomes more expensive to procure the deeper levels of savings and more program dollars are directed to financial incentives.

The total units of energy saved in Canada under each of the energy efficiency scenarios assessed are provided in Table 3. Total lifetime and maximum annual greenhouse gas (GHG) emissions reduced or avoided are provided in Table 4. Approximately 85% of the energy savings and 83% of the avoided GHG emissions in Canada are generated in four provinces: British Columbia, Alberta, Ontario, and Quebec.

Table 3: Lifetime Energy Savings in Canada by Fuel Type (common units and PJ) under the Energy Efficiency Targets (BAU+, Mid, and High)

	Electricity		Natural Gas		Liquid Fossil Fuels	TOTAL
	(GWh)	(PJ)	*(Mm3)*	(PJ)	(PJ)	(PJ)
Total Lifetime Energy Savings						
BAU+	*924,126*	3,327	*125,381*	4,649	3,183	11,158
Mid	*1,711,096*	6,160	*220,151*	8,162	4,685	19,007
High	*2,826,297*	10,175	*332,400*	12,324	7,209	29,708
Maximum Annual Energy Savings						
BAU+	*66,649*	240	*7,421*	275	206	721
Mid	*120,782*	435	*11,651*	432	268	1,135
High	*153,944*	554	*15,180*	563	352	1,469

Reduced or avoided GHG emissions (in megatonnes of carbon dioxide equivalent or Mt CO_2e) were calculated by multiplying the annual lifetime energy savings – generated through 15 years of efficiency program implementation – by the emission factor for the marginal resource or fuel in each province (see Appendix A8). Energy savings and reduced or avoided GHG emissions for each province are provided in the tables in Appendix A10.

Table 4: Reduced or Avoided Greenhouse Gas Emissions (megatonnes of carbon dioxide equivalent) in Canada under the Energy Efficiency Targets (BAU+, Mid, and High)

	Electricity	Natural Gas	Liquid Fossil Fuels	TOTAL
Total Reduced/Avoided GHG Emissions (Mt CO2e)				
BAU+	180	237	231	648
Mid	319	416	340	1,076
High	500	628	523	1,652
Maximum Annual Avoided GHG Emissions (Mt CO2e)				
BAU+	15	14	15	44
Mid	27	22	19	69
High	38	29	26	92

Macroeconomic Modeling Results

Energy efficiency programs generate savings for consumers, business, and industry by reducing the need to purchase electric supply and fuel. In addition to lowering energy bills, energy savings drive new spending and economic activity – across sectors and regions – and increase GDP, household income, and jobs. This section presents the results for the national as well as select provincial scenarios, and shows the significant, economy-wide benefits of large-scale investments in energy efficiency.

Overview of the Economic Impact

Each evaluated energy efficiency scenario can be segmented into four major components that are relevant to generating the economic impact (positive or negative):

- **Investment Spending** – the annual dollars of new demand for goods and services created through efficiency program-related spending and the participants' investment to add energy efficiency measures.

- **Participant (net) Savings** – the difference between the value of the annual energy saved by households and businesses that participate in efficiency programs, and the cost they incur to add energy efficiency measures to a home, office, or factory.

- **Ratepayer Costs** – the cost to offer the programs (residential program costs are assumed to be paid by residential ratepayers; C&I program costs by C&I ratepayers).

- **Local Sector Offsets** – the losses due to reduced demand for energy, which depending on the case may include some reduction in local utility business and/or fuel retail sales, as well as local industry sector losses when new generation plants are no longer needed.

The pattern of economic impact which results stems from the characteristics of these direct economic effects, including: the timing and magnitude of the investment spending (2012-2026); the persistence of participants' (net) savings through 2040; ratepayer costs to fund programs through 2026; the percent of residential vs. C&I participants; and the scale of the investment relative to a province's GDP. Assumptions regarding how new dollars of demand are introduced into the model as well as historic economic interdependencies between provinces (and the rest of the world) in terms of traded goods and services and labour/commuter flows will also affect the magnitude of the total economic impact, but to a lesser extent.[xiii]

Once the direct effects have been introduced, the model's set of structural equations – complete with region-specific response parameters that describe how an economy functions and adjusts over time – solves for an alternative annual economic forecast (which is compared to the base case economic forecast). Embedded in the result are dynamic multiplier effects that take the direct effects encountered in a year and amplify them (positively or negatively).

The most important feature here is what type of economic actor (or participant) is experiencing a change in spending power or a change in cost structure. If the participant is a household, then the impact is consumer spending driven. If it is a business (indirect), then it is predicated on the business's production

[xiii] Historic economic interdependencies are captured within the REMI macroeconomic impact forecasting system and are conditional on the relative competitiveness of each province (against the national average).

function (which describes what supplies and services the business requires to produce its output) and that business' output-to-cost elasticity. The REMI model reports a total impact concept, and although it does not report separate induced and indirect contributions, it accounts for both. The total economic impacts (jobs, sales, GDP, or real household income) are expressed as a difference relative to what that value (in a given year) would be without the program.

National Results

Table 5 and Figures 4 to 6 summarize results from the national scenarios where all provinces implement efficiency programs for all fuel types (electricity, natural gas, and liquid fossil fuels) simultaneously at the three investment levels (BAU+, Mid, and High). Tables 7 to 9 summarize the national results for the individual fuel scenarios. **A key finding of the study is that all of the national (and provincial) level results – regardless of the scenario – deliver significant net positive total impacts to the Canadian economy** compared to the base case economic forecast that does not include additional investment in efficiency programs.[xiv]

Table 5: Summary of Canada-wide Economic Impacts from Electric, Natural Gas, and Liquid Fossil Fuel Efficiency Programs under Three Investment Targets (2012-2040) – *Cases where all provinces implement programs for all fuel types simultaneously*

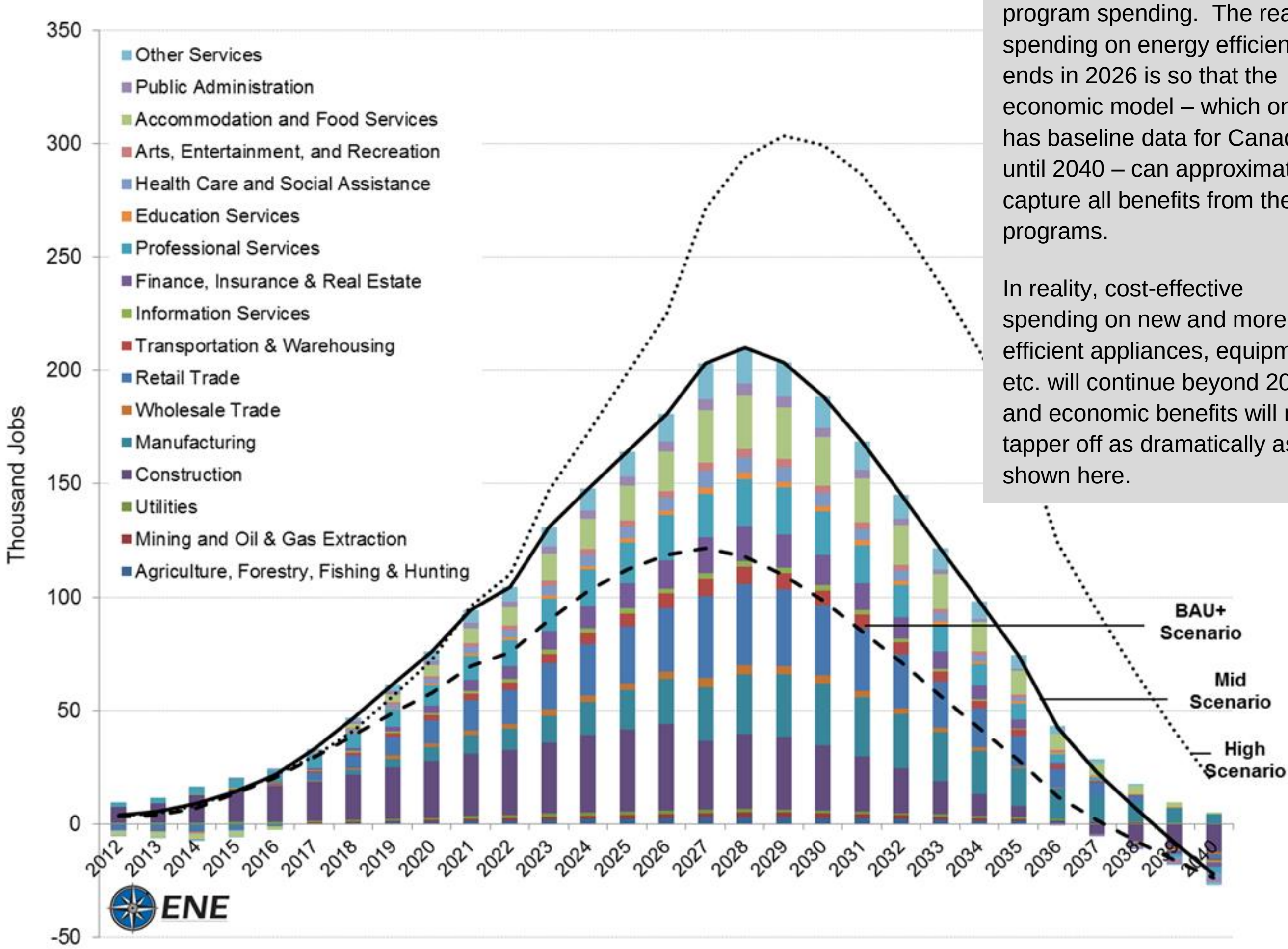
Canada -- All Fuels	BAU+	Mid	High
Total Efficiency Program Costs ($2012 Millions)	28,564	67,617	127,780
Net Increase in GDP ($2012 Millions)	**230,407**	**386,970**	**582,504**
Maximum Annual GDP Increase ($2012 Millions)	18,798	32,704	47,586
GDP per $1 of Program Spending	8.1	5.7	4.6
GDP per $1 of Program & Participant Spending	4.1	3.5	3.3
Net Increase in Employment (Job-years)	**1,489,260**	**2,548,842**	**3,885,402**
Maximum Annual Employment Increase (Jobs)	121,406	209,969	303,523
Job-years per $Million of Programs Spending	52	38	30
Job-years per $Million of Program & Participant Spending	27	23	22

Table 5 shows the total program costs over a fifteen year period (2012-2026) and the resulting increase in GDP and employment over the entire study period (2012-2040). The efficiency scenarios generate a total net increase (including any negative impacts from funding efficiency programs and changes in the electric sectors) in GDP ranging from $230 billion to $583 billion. This translates into $8 to $5 of GDP for every $1 of program spending or $3 to $4 for every $1 of program and participant spending. The maximum annual increase in GDP ranges from approximately $19 billion to $48 billion. These scenarios also generate a total net increase in employment in Canada ranging from 1.5 million to 3.9 million job-years (one job-year is equivalent to one job for a period of one year). This translates into 52 to 30 job-years per million dollars of program spending or 27 to 22 job-years per million of program and participant spending. The maximum annual increase in employment ranges from approximately 121,000 to 304,000 jobs.

[xiv] This is a net impact assessment that accounts for program administrators' and program participants' costs as well as offsets in the electric utility sector and other relevant sectors (e.g. turbine manufacturers) from lost electricity sales. Economic response factors (e.g. GDP per $1 program spending) above zero represent a net positive impact. To note, the study adopted the National Energy Board's assumptions from its *Energy Futures* reports regarding the availability of export markets and infrastructure, and thus does not include sector offsets for natural gas or oil.

Figure 5 illustrates the annual breakdown of new jobs by sector under the scenario where all provinces implement energy efficiency programs for all fuel types simultaneously at the national level. The REMI model tracks employment results across 59 NAICS industries, which ENE has aggregated into the 17 categories presented in Figure 5.

Figure 5: Total Net Employment Impact in Canada by Sector (2012-2040) – *Case where all provinces implement programs for all fuel types simultaneously*



This study models 15 years of program spending. The reason spending on energy efficiency ends in 2026 is so that the economic model – which only has baseline data for Canada until 2040 – can approximately capture all benefits from the programs.

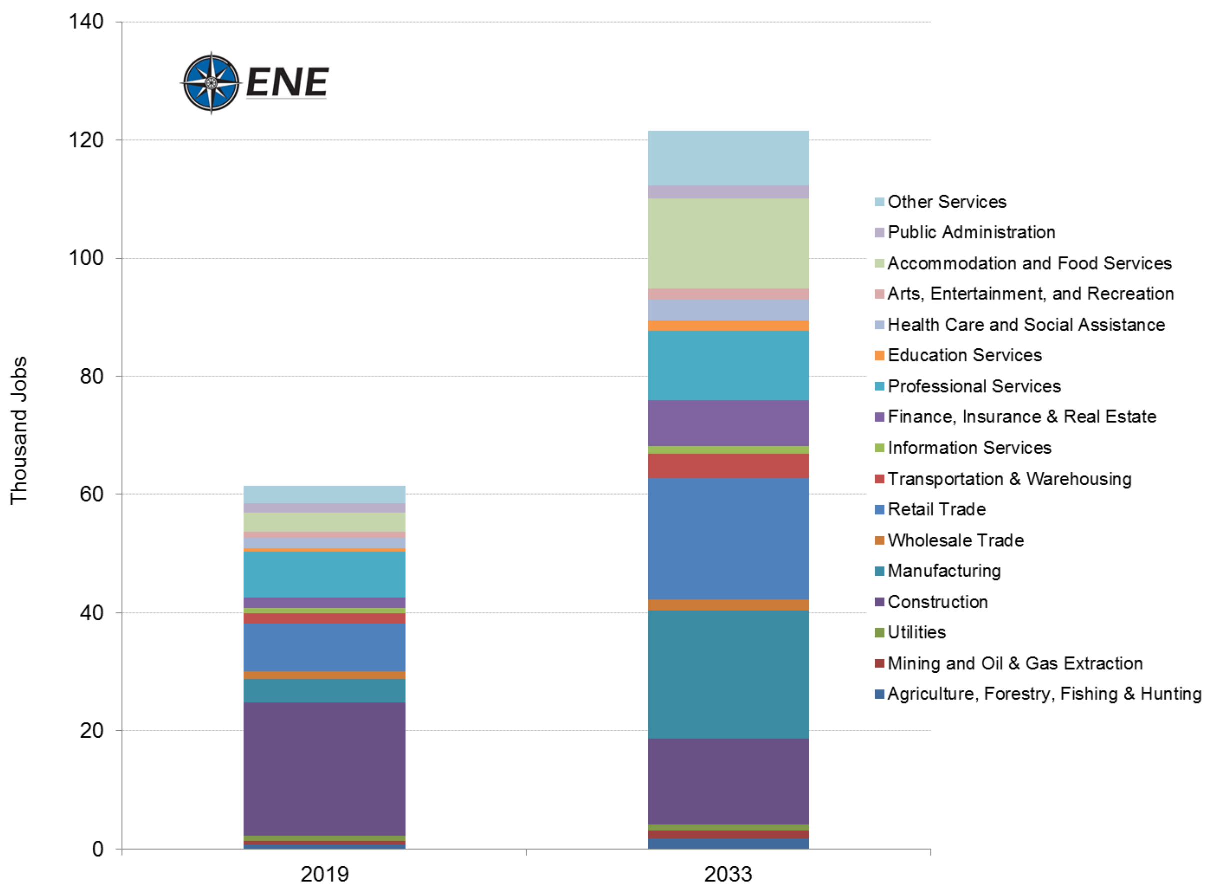
In reality, cost-effective spending on new and more efficient appliances, equipment, etc. will continue beyond 2026, and economic benefits will not tapper off as dramatically as shown here.

Figure 6, below, isolates two years from the above annual employment output series (Mid scenario): the mid-point (i.e. 2019) for the 15 years of efficiency program spending, also known as the investment interval (2012-2026) and the mid-point (i.e. 2033) for the post-investment interval (2027-2040). These two years – 2019 and 2033 – are used to distinguish job impacts tied to implementing energy efficiency programs compared to the job changes influenced by the persistent energy savings generated by these programs in the post-investment period.[xv, xvi]

[xv] The first mid-point (2019) captures some of the accumulating effects from the growing energy savings; however, the net increase in jobs during this interval is due primarily to spending related to implementing efficiency programs.
[xvi] The study assumes only fifteen years of program spending so that the REMI model – which has Canadian data until 2040 – can approximately capture all of the economic benefits over the lifetime of the measures implemented. In reality, spending on energy efficiency measures would likely not abruptly end in 2026 and thus employment (and GDP) benefits would not tapper off as dramatically as they do in Figure 4 (and Figure 6). To note, the model will eventually correct to zero post-2040. The net impact in later years does not reflect a negative structural change in the economy.

Intuitively, in the first interval the most pronounced increase in jobs comes from sectors of the Canadian economy related to delivering efficiency programs: construction, retail sales, professional services, and manufacturing. In the second interval, households and industry are consuming fewer units of electricity and fuel and thus realizing lower energy bills. Consumers' increased disposable income goes toward retail purchases, dining out, travel, etc.; generating local employment in those and other sectors. Industry's cost of doing business is reduced, thus improving its relative competitiveness, and generating new demand for products and service from domestic and export markets. The fulfillment of new "orders" drives employment across various sectors of the Canadian economy, including manufacturing, construction, professional services, etc.

Figure 6: Total Net Employment Impacts by Sector for Select Years (2019 and 2033 midpoints) — *Case where all provinces implement programs for all fuel types simultaneously at the "Mid" investment level*



In addition to showing how changes in each sector contributes to the overall increase in jobs, Figure 6 also highlights the difference between the intervals in terms of the magnitude of the overall increase – 61,400 jobs in 2019 compared to 121,500 jobs in 2033. In the first interval, the economic impacts are largely the result of efficiency program spending. In the second interval, the positive economic impacts are driven almost entirely by the energy savings generated by the efficiency programs – since investment spending ended in 2026 – and these effects deliver a greater overall increase in jobs.

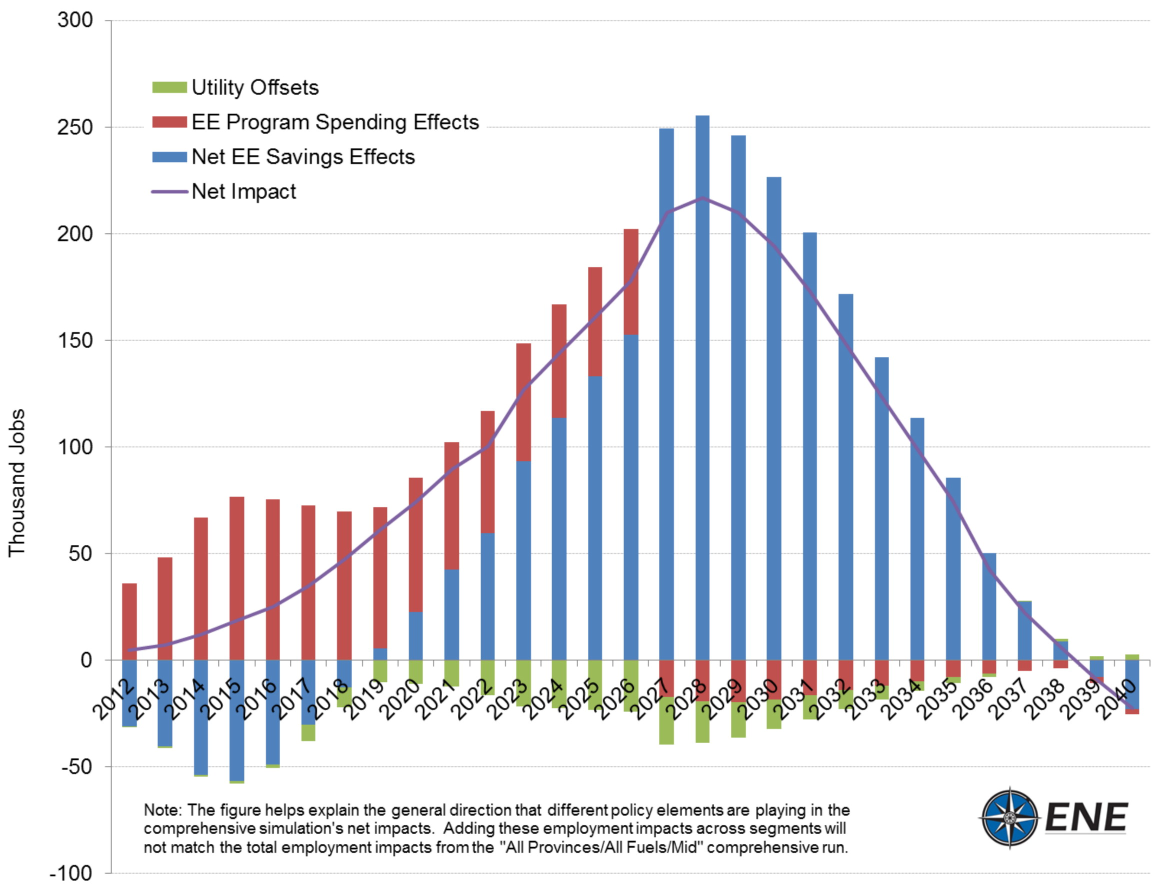
A key finding of this study is that the majority of the economic benefit is derived from the lifetime savings generated by energy efficiency improvements as opposed to the initial spending on program administration and investment to adopt energy-efficient measures. The GDP and employment impacts from implementing an energy efficiency programs are not insignificant; however, this study shows that, on average, 86% of the total net increase in GDP and 74% of the total net increase in employment in Canada come from avoided energy costs, which increase household disposable income, and improve the relative competitiveness of industry (see Table 6).

Table 6: Components of the Economic Output (% average over study period) – *Case where all provinces implement programs for all fuel types simultaneously at the "Mid" investment level*

	GDP	Employment
Percent of Output Resulting from Efficiency Investment	14%	26%
Percent of Output Resulting from Energy Savings	86%	74%

This important finding is illustrated in Figure 7, which reconfigures Figure 4 to show the elements of the total effect instead of the net change in employment by sector. A significant portion of the positive effect in the investment interval comes from the efficiency program spending. As net positive energy savings accumulate they exert a larger effect in the latter years of the investment interval, and are the sole positive effects contributing to the net increase in jobs post-2026.

Figure 7: Increase in Jobs (Canada), Segmented by the Elements Contributing to Total Net Impact: 1) Effects from Efficiency Program Spending; 2) Effects from $ of Savings; and 3) Utility Offsets – *Case where all provinces implement programs for all fuel types simultaneously at the "Mid" investment level*



Tables 7 to 9 summarize the results for the remaining national scenarios. These are cases where all provinces simultaneously implement efficiency programs for one fuel type at three investment levels.

Table 7: Summary of Canada-wide Economic Impacts from Electric Energy Efficiency Programs (2012-2040) – *Cases where all provinces simultaneously implement programs for one fuel type*

Canada -- Electric	**BAU+**	**Mid**	**High**
Total Efficiency Program Costs ($2012 Millions)	20,219	45,568	84,683
Net Increase in GDP ($2012 Millions)	**96,722**	**183,289**	**281,964**
Maximum Annual GDP Increase ($2012 Millions)	8,832	17,479	26,192
GDP per $1 of Program Spending	4.8	4.0	3.3
GDP per $1 of Program & Participant Spending	2.8	2.6	2.4
Net Increase in Employment (Job-years)	**677,775**	**1,270,371**	**2,001,637**
Maximum Annual Employment Increase (Jobs)	58,119	114,094	172,641
Job-years per $Million of Programs Spending	34	28	24
Job-years per $Million of Program & Participant Spending	20	18	17

Table 8: Summary of Canada-wide Economic Impacts from Natural Gas Energy Efficiency Programs (2012-2040) – *Cases where all provinces simultaneously implement programs for one fuel type*

Canada -- Natural Gas	**BAU+**	**Mid**	**High**
Total Efficiency Program Costs ($2012 Millions)	5,300	14,022	27,476
Net Increase in GDP ($2012 Millions)	**21,553**	**37,000**	**51,674**
Maximum Annual GDP Increase ($2012 Millions)	1,976	3,527	5,152
GDP per $1 of Program Spending	4.1	2.6	1.9
GDP per $1 of Program & Participant Spending	1.5	1.4	1.2
Net Increase in Employment (Job-years)	**172,459**	**297,309**	**424,658**
Maximum Annual Employment Increase (Jobs)	13,457	23,527	33,477
Job-years per $Million of Programs Spending	33	21	15
Job-years per $Million of Program & Participant Spending	12	11	10

Table 9: Summary of Canada-wide Economic Impacts from Liquid Fossil Fuel (Light & Heavy Fuel Oils) Efficiency Programs (2012-2040) – *Cases where all provinces simultaneously implement programs for one fuel type*

Canada -- Liquid Fossil Fuels	**BAU+**	**Mid**	**High**
Total Efficiency Program Costs ($2012 Millions)	3,045	8,027	15,621
Net Increase in GDP ($2012 Millions)	**99,622**	**146,111**	**220,437**
Maximum Annual GDP Increase ($2012 Millions)	7,030	10,029	14,242
GDP per $1 of Program Spending[xvii]	32.7	18.2	14.1
GDP per $1 of Program & Participant Spending	16.4	12.0	11.2
Net Increase in Employment (Job-years)	**586,715**	**862,684**	**1,287,924**
Maximum Annual Employment Increase (Jobs)	44,574	61,193	82,395
Job-years per $Million of Programs Spending	193	107	82
Job-years per $Million of Program & Participant Spending	97	71	65

[xvii] The GDP and job reaction factors for liquid fossil fuels are significantly higher due primarily to the high price of fuel oil (and thus avoided energy costs) relative to electricity and natural gas. Lower unit program costs as a result of more low-cost savings opportunities are also a factor

Another **key finding** from the study is that economic output is greater when provinces implement efficiency programs for all fuel types simultaneously. For example, under the national investment scenarios, the simultaneous delivery of efficiency programs across all three fuel types adds $12.6 billion (BAU+), $20.6 billion (Mid), or $28.4 billion (High) in additional GDP to the national economy compared to the sum of the individual fuel programs (Table 5 vs. Tables 7 through 9). With respect to employment, simultaneous delivery adds over 52,300 job-years (BAU+), 118,000 job-years (Mid), or 171,000 job-years (High). This is due to heightened competitiveness created by greater energy savings from multiple fuel programs running in tandem.

Economic output is also increased when more than one province is implementing efficiency programs for one or all fuel types. For example, the simultaneous response when all provinces implement electric efficiency programs – under the Mid scenario – adds $13.2 billion and over 53,000 job-years to the economy compared to the aggregate of the results for the individual provincial electricity runs (Table 7 versus tables in Appendix A10). The simultaneous effect is also present for the other fuel types, and when all provinces implement programs for all fuel types simultaneously. In the multi-province cases each province reaps the benefits of its own program yielding energy savings, and when a province is linked to a surrounding trade area(s) that is/are also benefiting from an energy efficiency program, a larger economic gain occurs. The spill-over effects are generated by increased competitiveness and inter-provincial trade. A province will satisfy some of its new internal demand through within-province production, which requires additional supplies – some of which will come from other provinces. The remainder of the increased internal demand will be satisfied by extra-provincial (imported) goods and services – which have become more competitively priced – as well as labour from surrounding provinces.

Standalone Provincial Results

Table 10 summarizes the GDP and job response factors per dollar of spending for the scenarios where one province implements efficiency programs for all fuels simultaneously. As previously stated, the study is a net impact assessment that accounts for ratepayer losses to fund the programs as well as utility sector offsets. **Ratios above zero represent a net benefit or gain (as opposed to 1, as in a standard benefit/cost test)**. In all of the provincial scenarios, investing in efficiency generates in a net positive increase in terms of GDP and jobs. Results for each province by fuel type and investment scenario are available in the tables in Appendix A10.

There are a number of factors that explain the variation between provinces in terms of the level of economic output and resulting metrics in Table 10. When energy efficiency spending is introduced into an economy, the province-specific response is a function of:

- The size and comprehensiveness of a province's economy, and its relationship to all surrounding provinces in the model in terms of trade flows;
- The relative cost-of-doing business and cost-of-living conditions in the province;
- The magnitude and timing of the net energy benefits (i.e. energy benefits minus spending);[xviii]

[xviii] A province with smaller cumulative energy benefit may still have a higher 2012$ based GDP impact if it realizes net energy savings sooner than a province that spends a lot to achieve large avoided cost if the latter province's payback period is relatively long (net savings occurring later push out the model's positive impacts). In nominal terms the impact may be as large as expected, but the result is reduced when scaled back to a 2012$ basis due to forecasted CPI assumptions in the model.

- The Residential versus C/I split with respect to the net energy benefits since directing savings into the C/I market segment of the model has a greater economic impact;
- The scale of the investment in the context of a province (i.e. as a percent of GDP), and other characteristics of the direct effects from a policy scenario, as outlined on page 16.

Table 10: Provincial Economic Total Impact Metrics – *Cases where each province implements programs for all fuel types simultaneously at each investment level*[xix]

	Provincial GDP							Provincial Employment					
	GDP per $1 of Program Spending			GDP per $1 of Program & Participant Spending				Job-years per $Million of Program Spending			Job-years per $Million of Program & Participant Spending		
	BAU+	Mid	High	BAU+	Mid	High		BAU+	Mid	High	BAU+	Mid	High
BC	12.4	9.2	5.8	7.2	6.1	4.4		77	57	37	45	38	28
AB	7.8	4.5	3.6	3.8	2.8	2.6		38	22	18	18	14	13
SK	6.2	3.8	2.9	2.8	2.2	2.0		42	26	20	19	15	14
MB	7.2	4.6	3.6	3.7	2.9	2.6		56	36	28	29	22	20
ON	6.0	4.1	3.4	3.0	2.5	2.4		42	29	25	21	18	17
QC	9.7	5.9	4.9	5.1	3.7	3.6		72	44	37	38	27	26
NB	6.4	3.8	2.7	3.4	2.4	2.0		51	31	22	27	19	16
NS	7.9	5.3	4.0	4.3	3.3	2.8		63	42	31	34	27	22
PE	4.6	2.8	2.1	2.5	1.8	1.5		44	28	21	24	18	15
NL	5.2	3.5	2.8	3.0	2.3	2.1		40	27	22	23	18	17
Canada	*8.1*	*5.7*	*4.6*	*4.1*	*3.5*	*3.3*		*52*	*38*	*30*	*27*	*23*	*22*

For example, in Table 11, British Columbia, Ontario, and Québec are the leading provinces in terms of total electric efficiency spending and energy benefits; however, the GDP per $1 of Program and Participant Spending Ratio varies significantly. In addition to differences between the underlying makeup of the provincial economies, there are factors from the scenarios developed by DEC that affect the results. British Columbia may not have the largest energy benefits (see scenario in Table 11), but the province outranks all others in terms of cumulative net energy savings. British Columbia has the highest ratio of energy benefits per dollar of spending, primarily due to having relatively low efficiency program costs and relatively high avoided costs in later years. The magnitude of the net energy benefits and the sectors that receive them – a larger share of the avoided costs directed at the C/I sector – as well as the fact that ratepayers begin realizing net benefits sooner, all contribute to the relatively high results in BC.

Table 11: Illustrative Comparison of Key Factors Contributing to a Province's Economic Output & Metrics

	Electric "Mid" Scenario		
	BC	**ON**	**QC**
Total Energy Benefits (Nominal $M)	50,764	70,021	60,105
Net Energy Benefits (Nominal $M)	40,393	28,421	38,472
% of Avoided Cost to C/I Sector	77%	77%	73%
GDP per $1 of Electric Program Spending	**9.6**	**2.5**	**4.8**

[xix] The modeling inputs and results are based on data that was publicly available as of August 2013. In the case of Ontario, estimates may differ from Ontario's Long Term Energy Plan (LTEP) and are based on pre-LTEP data.

Energy Efficiency, Economic Growth, and the "Rebound Effect"

The "rebound effect" – the concept that energy savings from improved efficiency are offset by a smaller corresponding increase in energy use (and emissions) – is a real and intuitive phenomenon. However, there is much debate about the magnitude of the effect, and little empirical evidence to support claims that the majority of energy savings, or even a meaningful amount, would be offset by a corresponding increase in demand – either at the micro- or macro-level.[11]

Energy efficiency drives economic growth and it follows that the increased economic output – GDP, income, and jobs – will require energy and result in additional consumption. However, energy spending is only a small portion of GDP (6-8%), which means, on average, less than 10 cents of every dollar saved and re-invested would likely be spent on energy.[12] In general, the increased demand for energy will be a fraction of the energy saved.

A simplified example: A homeowner in New Brunswick benefits from an efficiency program and reduces heating fuel costs by $2,000, and uses the savings to hire a contractor to build a new deck. Energy costs make up approximately 2% of wood products delivered by sawmills.[13,14] If the energy used to transport the wood and builder(s) to the job-site and power the equipment is considered, a conservative (i.e. high) estimate of the energy costs embedded in the deck is 5%. Since $1 spend on heating oil is approximately $1 spent on energy,[xx] of the $2,000 invested, $100 (or 1/20th) could arguably contribute to the rebound effect.

Further, the additional energy purchased is not necessarily fossil fuels. Using the above example, over 50% of the energy consumed by the forest product sector is renewable fuels and cogeneration is common.[15,16] The additional economic activity generated by efficiency may result in a relatively small bump in energy use elsewhere, but total energy use and GHG emissions will be significantly reduced.

While increased energy consumption may be the result of increased economic activity, this does not change the fundamental improvement in energy productivity – the amount of energy needed to provide services – which energy efficiency delivered.

[Excerpted from ENE's *Energy Efficiency: Engine of Economic Growth in Eastern Canada*]

[xx] In reality, distribution and marketing are also included in the per-unit cost of heating fuels (equal to 10-20%).

Tax Revenue Impact Assessment

It is important to consider tax revenue changes as a result of new policy measures and investments. This is especially relevant to energy efficiency policies and programs which on the surface reduce demand for energy and fuel sales, and thus government tax collections. However, the results of this study show that efficiency programs drive significant economic growth across all sectors of the Canadian economy, and the efficiency stimulus has a net positive impact on government tax collections.

This section presents the results of the tax revenue impact assessment for the case where all provinces simultaneously implement efficiency programs for all fuel types at the "Mid" investment target. Details on the methodology and assumptions, as well as the results from a second representative scenario – all provinces, simultaneous all fuels at the "High" investment target – are available in Appendix A9.

Federal and Provincial Tax Revenue Impacts

The assessment considers three tax concepts: 1) Sales Tax, 2) Personal Income Tax, and 3) Corporate Income Tax. To estimate the change in government tax revenue, an effective tax rate for each of the tax concepts is applied to a specific REMI model metric, which is considered the "proxy tax base." Changes in sales and personal income tax are derived from net personal income impact results, and changes in corporate income tax are derived from net GDP impacts.

For all three tax concepts, the significant increase in economic activity generates additional tax revenue that would more than compensate for the direct loss of provincial and federal sales tax collections from reduced fuel sales (see Table 12). In other words, the spending on efficiency measures, the improved competiveness of industry, the re-investment of energy bill savings, and the resulting job growth all contribute to net increase in government revenues. Direct sales tax losses (see next section) are embedded in the net (sales tax) values in Table 12.

Table 12: Average Annual Tax Revenue Change at the Provincial and Federal levels for Select Taxes (Million 2012$) – *Case where all provinces implement programs for all fuel types simultaneously at the "Mid" investment level*

	Net New Revenues, Average Annual (Million 2012$)			
Million 2012$	**Sales Tax**	**Personal Income**	**Corporate Income**	**Sum**
Federal	$289	$1,267	$225	$1,781
British Columbia	$71	$77	$23	$172
Alberta	$0	$109	$33	$143
Saskatchewan	$17	$24	$6	$47
Manitoba	$20	$31	$4	$55
Ontario	$167	$204	$54	$425
Quebec	$141	$203	$35	$380
New Brunswick	$9	$10	$2	$21
Nova Scotia	$14	$19	$4	$37
Prince Edward Island	$2	$2	$0	$4
Newfoundland & Labrador	$6	$6	$2	$14

Direct Sales Tax Losses

To estimate the sales tax losses that are embedded in Table 12, federal and provincial sales tax rates were applied (net exemptions) to direct scenario data developed by Dunsky Energy Consulting projecting annual bill savings by residential, commercial, and industrial customers.

Table 13 presents the decrease in provincial and federal sales tax collections. For all three fuel types, the majority of the energy savings occur in the Commercial/Industrial (C/I) market segment. See Appendix A9 for results by fuel type and market segment.

Table 13: Direct Sales Tax Losses from Reduced Fuel Sales (Million 2012$) – *Case where all provinces implement programs for all fuel types simultaneously at the "Mid" investment level*

	Direct Sales Tax Foregone, Average Annual (Million 2012$)
Federal	$569.7
British Columbia	$1.2
Alberta	-
Saskatchewan	$9.1
Manitoba	$3.1
Ontario	$291.5
Quebec	$139.4
New Brunswick	$10.4
Nova Scotia	$21.4
Prince Edward Island	-
Newfoundland & Labrador	$13.1

To note, the direct annual sales tax losses may be over-stated as there is likely to be additional fuel consumption as each province's economy produces more personal income and GDP (see text box on page 25 for more information on the rebound effect). Also, for both the tax revenue impacts and the direct sales tax losses, the values should be interpreted as more indicative of revenue changes near 2012 as no projections of tax policy has been attempted.

Conclusions

This study demonstrates that energy efficiency provides important economy-wide benefits in addition to the direct participant savings on which efficiency programs are often justified. By expanding the analysis to a macro-level assessment of the economic impacts of energy efficiency (including ratepayer costs and losses to electric generators and fuel suppliers), ENE and its collaborators show that energy efficiency is a unique energy resource, capable of generating significant net economic benefits in the Canadian economy.

Energy efficiency policies and programs are already delivering energy saving and economic growth in Canada. If all provinces invested in efficiency programs over a 15-year period at the target levels assessed in this study the total net increase in GDP and employment would be approximately: $97 to $282 billion (2012$) and 678,000 to 2,001,000 job-years from electric efficiency; $22 to $52 billion and 173,000 to 425,000 job-years from natural gas efficiency; and $100 to $220 billion and 587,000 to 1,288,000 job-years from liquid fossil fuels (light and heavy fuel oils) efficiency.

Simultaneous action – i.e. simultaneously implementing electric, natural gas, and liquid fossil fuel programs in a province or across all provinces – results in even greater economic benefits due to increased competitiveness, inter-provincial trade, and other synergistic effects. For the national scenarios, simultaneous action adds approximately $12.5 billion in additional GDP under the BAU+ scenario, $20.5 billion under the Mid scenario, and $28.4 billion under the High scenario; resulting in a total net increase in GDP of $230 billion, $387 billion, and $583 billion, respectively. In terms of employment, simultaneous delivery adds over 52,000 job-years (BAU+), 118,000 job-years (Mid), and 171,000 job-years (High) to the national economy for a total net increase in employment of 1,489,000 job-years, 2,549,000 job-years, and 3,885,000 job-years, respectively. Under the national mid-range scenario, the maximum annual increase in GDP is $33 billion (2012$), or approximately equivalent to 1.8% of Canada's GDP in 2012.[xxi,17] The maximum annual increase in employment is 210,000 jobs, which is approximately 15% of the unemployment level in Canada in 2012.[xxii,18]

A key finding of this study is that only approximately 25% or less of the macroeconomic impact is a result of the direct spending by program administrators and program participants and related non-direct effects (e.g. administration costs and incentives plus participant spending to purchase efficient appliances and equipment, contractor jobs to implement a weatherization program, and local spending resulting from those salaries, etc.). The majority – 75% or more – of the changes to economic output is a result of the direct energy benefits realized by households, business, and industry, and the ensuing non-direct effects. When households realize lower energy bills, there are increases in other forms of spending such as dining out, renovations, travel/tourism, etc. Lower energy bills also reduce the cost of doing business in a region, improving in the process the relative competitiveness of industry, which drives additional growth.

This finding helps explain why energy efficiency is such a powerful economic stimulus and effective means of generating jobs. It also helps explain why a dynamic macroeconomic modeling study that captures the persistent energy benefits year-over-year in addition to the short-term program and participant spending effects – which basically swap one type of spending for another – delivers higher results and economic multipliers than other studies. In all scenarios – national and provincial – the

[xxi] Canada's total GDP in 2012 was 1.820 trillion (2012$).
[xxii] The level of unemployment in Canada in 2012 was estimated to be 1,368,400 people.

macroeconomic response factors (e.g. GDP per $1 of program spending) are above zero, which signifies a net positive impact since the REMI model results include ratepayer costs to fund the program and negative utility sector offsets.

The results of the tax revenue impact assessment indicate that the significant increase in economic activity generates an increase in government tax revenue that would more than compensate for the direct loss of provincial and federal sales tax collections from reduced fuel sales. Under the case where all provinces implement efficiency programs for all fuel types at the mid-range investment level, the net increase in personal income tax, corporate income tax, and sales tax at the federal level is approximately $1,781 million, and at the provincial level the net increase in collections is approximately $1,298 million. This is a high-level estimate of the net fiscal impacts.

The levels of energy efficiency investment and energy savings considered in this study are significant. At the national level, total lifetime energy savings range from approximately 11,200 to 29,700 PJ, and maximum annual energy savings are 720 to 1,500 PJ. To put the savings in context, Quebec's total residential, commercial, and industrial end use demand (excluding transportation) was 1,150 PJ in 2011.[19] The potential GHG emissions reductions are also meaningful. At the national level, total reduced or avoided emissions are approximately 650 to 1,700 Mt CO_2e, and the maximum annual reduction in GHGs is 40 to 90 Mt CO_2e. Maximum annual savings at the mid-range investment level – 69 Mt CO_2e – is approximately equal to 10% of Canada's total emissions (or 12% of total energy sector emissions) in 2011.[20] While the levels of investment and savings are significant, it is important to reiterate that the efficiency programs modeled are cost-effective investments (efficiency savings are lower cost than supplying additional energy).

Consumers benefit from energy efficiency programs that lower energy bills, improve living standards, and create jobs. Industry benefits from energy efficiency programs that lower energy bills and the cost of doing business in a province and improve its relative competiveness and increase market share (sales). Government benefits from increased revenue, reduced spending on fuel assistance and other social programs, and avoided healthcare costs associated with air emissions and pollution. In general, the Canadian economy as whole benefits from a lower-cost energy system that attracts and retains industry as well as the significant growth in personal income, GDP, and jobs as a result of investing in the energy efficiency resource.

APPENDICES

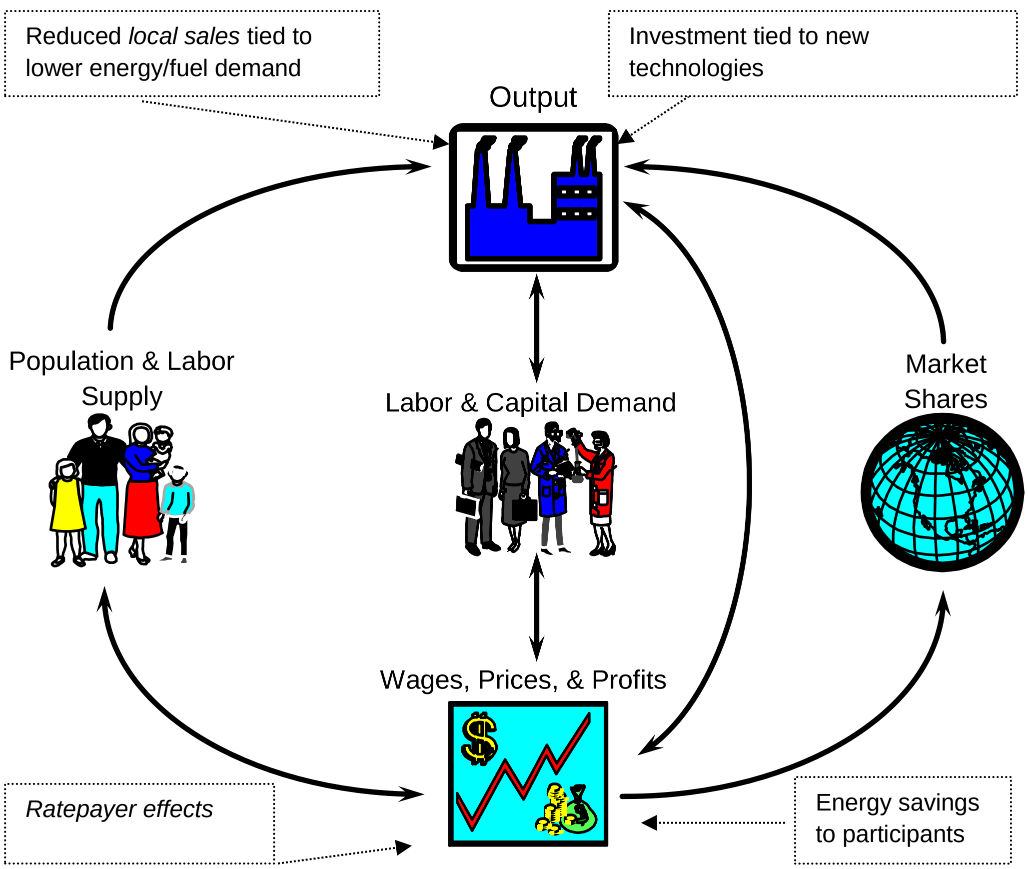
APPENDIX A1 – REMI PI+ Policy Forecasting Model

This appendix describes the economic model used in the study and additional background information.

The multi-region Policy Insight + (PI+) economic model by Regional Economic Model, Inc. (REMI) is used to quantify the economic impact of various energy efficiency investment scenarios. The REMI model is a dynamic model that integrates four methodologies: Input-Output tables, General Equilibrium, Econometric, and Economic Geography. For more information, see: www.remi.com/the-remi-model.

In REMI, a provincial economy is composed of five blocks: 1) Output; 2) Population and Labor Supply; 3) Labor and Capital Demand; 4) Wages, Prices, and Profits; and 5) Market Shares (see Figure A1-1). In a multi-region model (of ten provinces) you can envision ten economies such as in Figure A1-1 that exhibit inter-region feedback for labor flows (commuters) and trade in manufactured goods and services. Unique to the REMI model among the class of "competing" regional economic impact frameworks is the linkage to the 'market shares' block. Policies or investments that change the underlying cost-of-doing business for an industry in a region will affect that industry's relative competitiveness (relative to the national average for that industry) and its ability to retain/gain sales within its own region, elsewhere in the multi-region marketplace, and trade outside of the country.

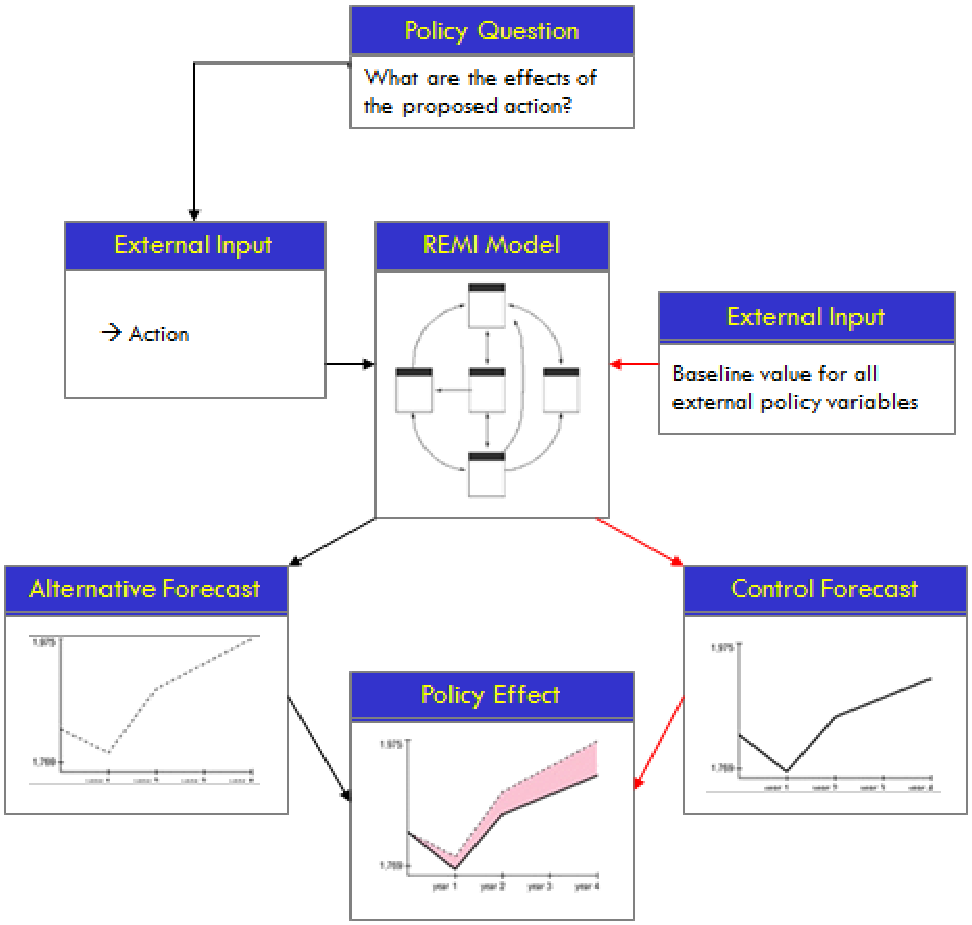
Figure A1-1: REMI Economic Forecasting Model – Basic Structure and Linkages



Source: EDR Group, Inc.

The REMI model identifies estimates of the economic (and demographic) impacts of a new policy scenario by comparing a base case annual forecast – using the above structure/feedbacks – to the annual forecast when energy-related costs and savings or new dollars of investment are proposed (i.e. the alternative forecast). Figure A1-2 portrays this relationship. To note, the underlying data used to build the ten provinces REMI model is from Statistics Canada (last historic year 2008).

Figure A1-2: Identifying Economic Impacts in the REMI Framework



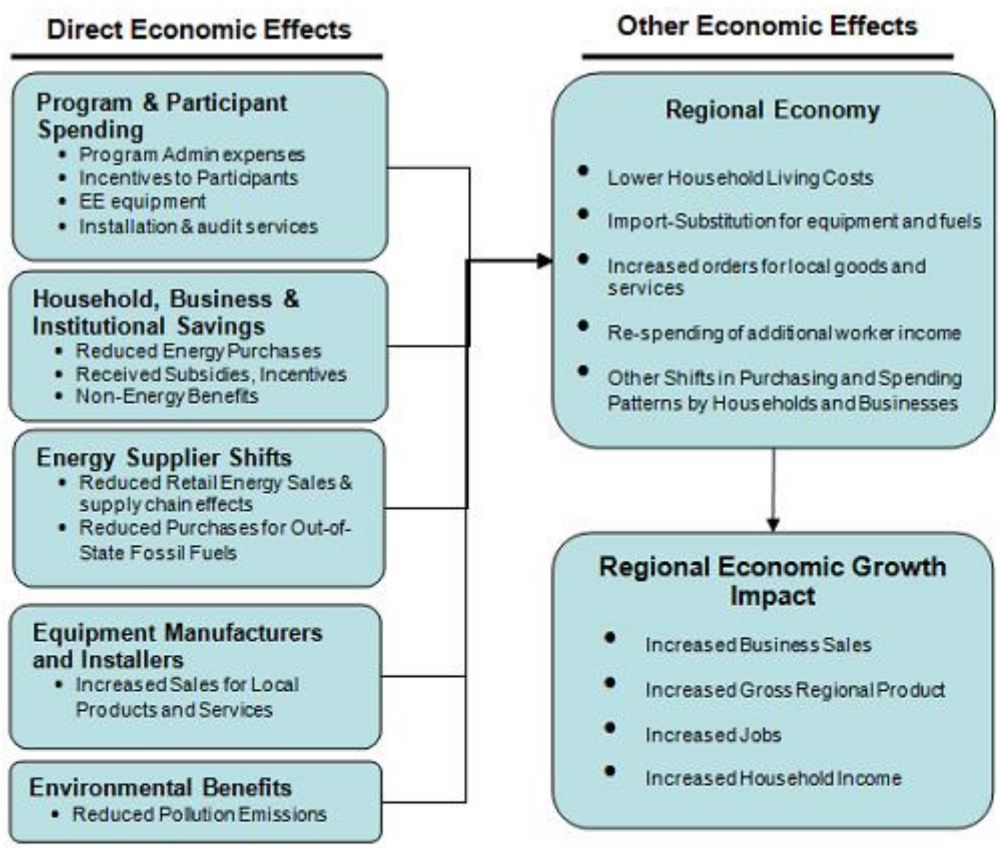
Source: EDR Group, Inc.

For the study, the policy-specific changes (i.e. the annual change in program spending, participant spending and energy benefit or avoided energy costs) related to each fuel type/efficiency target scenario are introduced in the province where the action will occur. To introduce the changes into a province in the multi-regional REMI model it is necessary to describe what the spending buys and from which sectors, and further the predominance of local sectors. An offset in spending on deferred future capacity investments and/or sales is also described (i.e. sectors that will see less business). The combination of annual ratepayer effects (to fund the program and participant out-of-pocket), and the value of the avoided cost benefit defines the *net energy savings by broad customer segment*. The Commercial/Industrial *net energy savings* values are allocated between commercial and industrial, and then distributed across the mix of relevant NAICS industries (59) within a province using the fuel-shares contained within the model.

When a province has an economic event (a shock, positive or negative) in the multi-regional model, the model's structure depicting how that province will respond is activated; so too are a set of cross-border (province) influences (spillovers) from (i) the policy's relative competiveness effects, and from (ii) trade-flow responses that province has with every other provinces as defined in the model. The dynamic can be compounded when all provinces pursue the policy at the same time, and a simultaneous solution will be driven by direct policy changes within each province and how those exert spillovers on every other region in the model.

Translating the ways in which a proposed energy policy/program will affect energy customers (e.g. change in price, consumption, or both), a region's economic self-sufficiency (replace imported purchases of energy generating inputs with more locally provided energy conserving devices/services), and the cost to achieve these goals are relevant direct effects that exert an influence on the local economy. Figure A1-3, below, enumerates the set of direct effects that are possible with a broad range of energy policies/programs. Not all of the direct effects shown were considered with respect to the energy efficiency scenarios analyzed. Excluded from the REMI simulations were monetized environmental benefits, non-energy benefits (not identified), and renewable energy aspects.

Figure A1-3: REMI Model Capabilities to Capture Energy Program Elements in the Regional Economy



Source: EDR Group, Inc.

In addition to fuel and target-specific assumptions used to frame the energy efficiency scenarios, the following assumptions were necessary to assign scenario-specific direct information into appropriate policy levers in the REMI model:

- Scenario data (investment cost, avoided energy cost, program related costs) pertaining to the "C&I" segment was first allocated to Commercial versus Industrial (23 percent and 77 percent respectively), and then to the underlying (NAICS) industries within each category using Statistics Canada 2010 energy consumption data.

- ENE and Dunsky Energy Consulting provided estimates of inter-provincial macroeconomic flows as a basis for isolating the local extent of (within province) reduced industry activity when demand for a fuel is reduced as a result of energy efficiency.

- New investment demands that arise from energy efficiency adoption will require local contractor labor for the installation share of fuel-specific projects within a customer segment. All other investment requirements represent dollars of "demand" and the REMI model's industry-specific regional purchase coefficients will determine how much of those dollars translate into local sales.

- ENE provided the composition of investment goods and services for energy efficiency program spending and for participant spending by fuel type and by customer-segment (see Appendix A3).

APPENDIX A2: Energy Efficiency Target Scenario Overview

There are many ways to achieve the energy savings targets. Table A2-1, below, illustrates a mix of potential strategies aimed at meeting the targets in Table 2 (page 10) of this report. To note, it is assumed that government enabling policies will be necessary to achieve the more aggressive levels of energy savings; however, the cost (and associated benefits) of developing and implementing these policies are not included in this assessment.

Table A2-1: Illustrative Overview of Strategic Direction that Informed the Development of the Inputs for Each Efficiency Investment Scenario

	Strategic Direction of Scenarios		
	BAU+ Scenario	**Mid Scenario**	**High Scenario**
Summary	Intensify moderately current effort	Put provinces among EE leaders	Put provinces as EE leaders (i.e. No. 1)
Degree to which low cost measures are pursued	Aggressive	Relatively Aggressive	Extremely Aggressive
Degree to which high cost measures are pursued	Moderate	Aggressive	Extremely Aggressive
Financial support	30-40% of costs	50-60% of costs + preferred financing (low cost/interest-free)	70-80% of costs + preferred financing (low cost/interest-free)
Government policies	BAU	BAU + some enabling policies (enhanced building codes & product standards, mandatory building labeling)	Aggressive enabling policies

The following are examples of potential low and high cost efficiency measures that may be included in the provincial program portfolios modeled.

Table A2-2: Examples of Low and High Cost Energy Efficiency Measures for Each Market Segment

	Residential	Commercial/Institutional	Industrial
Low Cost Measures			
	Lighting (CFLs, LEDs)	Lighting (HPT8s, LEDs)	Lighting (HPT8s, LEDs)
	Energy Star Appliances	Controls	Energy Efficient Pumps
	Air Sealing	Energy Efficient Refrigeration	Energy Efficiency Motors
High Cost Measures			
	Insulation	Efficient Boilers	Efficient Boilers
	Energy Efficient Heating Systems (e.g. heat pumps)	HVAC Retro-commissioning	Production Line Upgrades
	Solar Domestic Hot Water (DHW)	Efficient Chillers	Efficient Chillers

APPENDIX A3 – Efficiency Program Spending Allocation by Industry Sector

This appendix summarizes the allocation assumptions related to energy efficiency investments. The tables show what percent of total spending on energy efficiency programs and by program participants goes to which industry sector in the model.

Table A3-1: REMI Industry Allocation for Program and Participant Spending by Market Segment for Electricity

	Electricity						
	Program Spending				**Participant Spending**		
Supplying Industry (Local & Not Local)	Residential	Commercial	Industrial		Residential	Commercial	Industrial
Wood Product Manufacturing	1%	0%	0%		1%	0%	0%
Non-metallic Mineral Production Manufacturing	1%	1%	0%		1%	1%	0%
Machinery Manufacturing	3%	8%	15%		3%	9%	17%
Computer, Electronic Product Manufacturing	1%	3%	3%		1%	3%	3%
Electrical Equipment, Appliance Manufacturing	2%	10%	15%		2%	11%	17%
Plastics, Rubber Product Manufacturing	2%	2%	0%		2%	2%	0%
Wholesale Trade	1%	2%	2%		1%	2%	2%
Paper	2%	0%	0%		2%	0%	0%
Construction	63%	54%	45%		70%	60%	50%
Retail	15%	0%	0%		17%	0%	0%
Professional Services	4%	14%	14%		0%	11%	11%
Utilities	6%	6%	6%		0%	0%	0%

Table A3-2: REMI Industry Allocation for Program and Participant Spending by Market Segment for Natural Gas & Liquid Fossil Fuels

	Natural Gas & Liquid Fossil Fuels						
	Program Spending				**Participant Spending**		
Supplying Industry (Local & Not Local)	Residential	Commercial	Industrial		Residential	Commercial	Industrial
Wood Product Manufacturing	1%	0%	0%		1%	0%	0%
Non-metallic Mineral Production Manufacturing	1%	1%	0%		1%	1%	0%
Machinery Manufacturing	5%	13%	25%		6%	14%	28%
Computer, Electronic Product Manufacturing	1%	3%	3%		1%	3%	3%
Electrical Equipment, Appliance Manufacturing	5%	5%	5%		6%	6%	6%
Plastics, Rubber Product Manufacturing	2%	2%	0%		2%	2%	0%
Wholesale Trade	1%	2%	2%		1%	2%	2%
Paper	2%	0%	0%		2%	0%	0%
Construction	63%	54%	45%		70%	60%	50%
Retail	10%	0%	0%		11%	0%	0%
Professional Services	4%	14%	14%		0%	11%	11%
Utilities	6%	6%	6%		0%	0%	0%

APPENDIX A4 – Efficiency Program Spending Sector Split

The efficiency spending is split between two market segments: Residential and Commercial/Industrial (C&I). The breakdown in Table A4-1 is based on the demand share in the National Energy Board 2009 *Energy Futures* (Reference Case) for each province and fuel type.[21] It is also assumed that 10% of C&I spending is on public buildings, which is accounted for differently in the REMI model.

Table A4-1: Energy Efficiency Program Spending "Split" between Residential and C&I Market Segments

	Electric		Natural Gas		Liquid Fossil Fuels	
	Residential	C&I	Residential	C&I	Residential	C&I
Newfoundland						
BAU+	40%	60%	-	-	60%	40%
Mid	36%	64%	-	-	60%	40%
High	33%	67%	-	-	60%	40%
Ontario						
BAU+	30%	70%	48%	52%	23%	77%
Mid	28%	72%	48%	52%	23%	77%
High	27%	73%	48%	52%	23%	77%
Manitoba						
BAU+	40%	60%	25%	75%	5%	95%
Mid	36%	64%	25%	75%	5%	95%
High	33%	67%	25%	75%	5%	95%
Saskatchewan						
BAU+	20%	80%	25%	75%	4%	96%
Mid	18%	82%	25%	75%	4%	96%
High	16%	84%	25%	75%	4%	96%
Alberta						
BAU+	18%	82%	40%	60%	1%	99%
Mid	15%	85%	40%	60%	1%	99%
High	13%	87%	40%	60%	1%	99%
British Columbia						
BAU+	36%	64%	52%	48%	6%	94%
Mid	32%	68%	52%	48%	6%	94%
High	28%	72%	52%	48%	6%	94%
Quebec						
All	35%	65%	19%	81%	19%	81%
New Brunswick						
All	35%	65%	19%	81%	19%	81%
Nova Scotia						
All	26%	74%	19%	81%	19%	81%
Prince Edward Island						
All	26%	74%	19%	81%	19%	81%

APPENDIX A5 – Efficiency Measure Lifespan

Energy efficiency measure costs and savings are accounted for in the model in the year in which they actually occur. For example, an average measure installed in 2012 will have its full cost reflected in that year, with per year energy savings occurring every year over its lifespan of 10-26 years, depending on the fuel type and investment scenario (BAU+, Mid, or High).[xxiii] This provides an accurate model of the measure's real-world economic impacts.

Table A5-1: Average Energy Savings Lifespan (Years)

	Electric			Natural Gas			Liquid Fossil Fuels		
	BAU+	Mid	High	BAU+	Mid	High	BAU+	Mid	High
NL	12	13	16	-	-	-	17	19	22
ON	13	14	17	17	19	22	15	17	20
MB	12	13	16	16	18	21	15	17	20
SK	13	14	17	16	18	21	15	17	20
AB	13	14	17	17	19	22	15	17	20
BC	13	14	17	17	19	22	15	17	20
QC	13	14	17	16	18	21	16	18	21
NB	13	14	17	16	18	21	16	18	21
NS	13	14	17	16	18	21	16	18	21
PE	13	14	17	-	-	-	16	18	21

Table A5-2: Average Energy Saving Lifespan by Fuel Type and Sector (Years)

	Residential			Commercial & Industrial		
	BAU+	Mid	High	BAU+	Mid	High
Electric	10	11	14	14	15	18
Natural Gas	21	23	26	15	17	20
Liquid Fossil Fuels	21	23	26	15	17	20

[xxiii] Developed by Dunsky Energy Consulting (DEC) and based on existing programs and DEC's experience and expertise.

APPENDIX A6 – Program and Participant Costs

The electric and natural gas unit program costs for British Columbia and unit program and participant costs for Manitoba are based on publicly available data on the provinces' energy efficiency program budgets (utility or government data). For British Columbia, the electric program incentive value was removed from participant spending, and because the province's current targets are closer to the "High" scenario, costs were scaled according to DEC's escalator. Measure costs (incentive plus participant spending) were adjusted to be roughly the same as those of Manitoba.

In Ontario, total electric program spending at the portfolio level as well as total annual savings at the portfolio and sector levels are available in Conservation and Demand Management (CDM) reports. To generate the additional level of detail needed to determine the breakdown of unit costs by sector and type of spending (administration, incentive, or participant), the ratio of program versus participant spending from Manitoba and British Columbia was applied. Measure costs were then brought in-line with other jurisdictions, and administration costs were adjusted to maintain the $/kWh costs from the OPA data. Natural gas costs are based on program data from Union Gas; however, adjustments were made using data from British Columbia and Manitoba. DEC's final unit costs are constrained by: 1) the level of spending in Ontario; 2) the savings targets; 3) an assumption that measure costs (participant + incentive) should be similar across provinces; and, 4) experience from other jurisdictions.

In the jurisdictions without publicly available data – Alberta, Saskatchewan, and Newfoundland & Labrador – the electric and natural gas unit costs are based on an average of British Columbia and Manitoba, and at the portfolio level the unit costs have been adjusted to account for the sector mix in each province.

The liquid fossil fuels unit costs are based on a combination of: 1) ENE's New England and Eastern Canadian macroeconomic impacts studies; 2) Efficiency Maine's Triennial Plan (2011-2013) for the residential and commercial unit program costs; and 3) Québec data for the industrial sector unit costs. The spending breakdown (administration, incentive, and participant) was allocated based on data from Maine and Québec, with priority given to the data from Québec.

Note that the participant costs are decreasing in the High and Max scenarios because the more aggressive energy savings targets rely on significant financial support to successfully pursue the higher-cost measures, thus transferring more of the costs to the program administrators.

Table A6-1: Levelized Unit Program and Participant Cost – All Sectors (nominal dollars)[xxiv]

	Electric (cents/kWh)			Natural Gas (cents/m3)			Liquid Fossil Fuels ($/GJ)		
	BAU+	Mid	High	BAU+	Mid	High	BAU+	Mid	High
NL									
Unit Program Costs	2.8	3.4	3.9	-	-	-	2.5	4.7	6.4
Unit Participant Costs	1.8	1.7	1.4	-	-	-	2.5	2.5	1.6
Total Costs	4.6	5.1	5.3	-	-	-	5.0	7.2	8.0
ON									
Unit Program Costs	4.6	5.7	6.7	6.2	9.8	13.6	1.9	3.6	4.8
Unit Participant Costs	3.2	2.9	2.5	14.8	12.4	10.4	1.9	1.9	1.2
Total Costs	7.8	8.6	9.2	21.0	22.2	24.0	3.8	5.5	6.0
MB									
Unit Program Costs	2.7	3.5	4.1	9.5	15.1	20.7	1.2	2.2	3.0
Unit Participant Costs	2.2	2.0	1.7	11.8	9.8	8.2	1.2	1.2	0.7
Total Costs	4.9	5.5	5.8	21.3	24.9	28.9	2.4	3.4	3.7
SK									
Unit Program Costs	2.6	3.4	4.0	7.4	11.5	15.7	1.2	2.3	3.1
Unit Participant Costs	1.7	1.6	1.3	14.3	11.9	9.9	1.2	1.2	0.7
Total Costs	4.3	5.0	5.3	21.7	23.4	25.6	2.4	3.5	3.8
AB									
Unit Program Costs	2.6	3.3	4.0	8.6	13.5	18.7	1.9	3.6	4.8
Unit Participant Costs	1.7	1.5	1.3	13.0	10.9	9.1	1.9	1.9	1.1
Total Costs	4.3	4.8	5.3	21.6	24.4	27.8	3.8	5.5	5.9
BC									
Unit Program Costs	2.8	3.3	3.8	9.3	14.5	20.0	1.5	2.7	3.7
Unit Participant Costs	1.5	1.4	1.2	12.1	10.2	8.5	1.5	1.4	0.9
Total Costs	4.3	4.7	5.0	21.4	24.7	28.5	3.0	4.1	4.6
QC									
Unit Program Costs	3.4	4.4	5.6	5.6	9.1	12.2	1.3	2.4	3.2
Unit Participant Costs	3.0	2.8	2.2	5.7	4.7	3.9	1.2	1.2	1.0
Total Costs	6.4	7.2	7.8	11.3	13.8	16.1	2.5	3.6	4.2
NB									
Unit Program Costs	3.4	4.4	5.6	5.6	9.1	12.2	1.3	2.3	3.2
Unit Participant Costs	3.0	2.8	2.2	5.7	4.7	3.9	1.2	1.2	1.0
Total Costs	6.4	7.2	7.8	11.3	13.8	16.1	2.5	3.6	4.2
NS									
Unit Program Costs	4.0	4.9	5.9	5.5	8.9	11.8	1.2	2.3	3.1
Unit Participant Costs	3.3	3.0	2.5	5.6	4.7	3.9	1.2	1.2	1.0
Total Costs	7.3	7.9	8.4	11.1	13.6	15.7	2.5	3.6	4.2
PE									
Unit Program Costs	4.0	5.0	5.9	-	-	-	1.2	2.3	3.1
Unit Participant Costs	3.3	3.0	2.5	-	-	-	1.2	1.2	1.0
Total Costs	7.3	8.0	8.4	-	-	-	2.5	3.5	4.2

[xxiv] Separate residential, commercial, and industrial unit program and participant costs were generated and applied to the residential, commercial, and industrial annual energy savings forecast for each province and fuel type.

Table A6-2: First-Year Program Costs – All Sectors and Investment Scenarios (nominal $Millions)[xxv]

	Electric	Natural Gas	Liquid Fossil Fuels	TOTAL
BC	169.0	44.7	13.4	227.1
AB	150.1	122.5	56.0	328.6
SK	43.3	34.4	11.2	88.9
MB	45.1	17.8	5.5	68.4
ON	607.0	135.2	66.3	808.5
NL	24.3	-	8.1	32.4
QC	290.6	24.1	34.8	349.4
NB	23.8	1.2	7.5	32.5
NS	44.6	0.8	10.5	56.0
PE	4.2	-	1.6	5.8
TOTAL	1,402.1	380.5	214.9	1,997.6

Table A6-3: Average Annual Program Costs – All Sectors (nominal $Millions)

	BC	AB	SK	MB	ON	NL	QC	NB	NS	PE
Electric (nominal M$)										
BAU+	225.9	183.9	50.2	58.5	827.4	28.6	345.0	27.0	55.0	6.0
Mid	485.6	424.1	114.2	134.6	1836.6	62.7	881.0	70.0	121.0	13.0
High	873.2	798.2	212.7	253.7	3382.0	114.1	1835.0	145.0	225.0	23.0
Natural Gas (nominal M$)										
BAU+	54.4	154.7	37.9	22.2	172.2	-	29.0	2.0	0.8	-
Mid	144.9	418.5	101.6	60.8	466.8	-	81.0	5.0	2.0	-
High	291.8	844.7	202.4	122.1	940.6	-	160.0	9.0	4.0	-
Liquid Fossil Fuels (nominal M$)										
BAU+	15.9	80.4	13.3	6.6	76.0	9.6	46.0	9.5	13.0	1.9
Mid	42.5	218.4	35.7	17.5	203.0	25.8	124.0	26.0	34.0	5.1
High	84.6	443.3	71.3	35.0	402.2	51.1	247.0	51.0	68.0	10.0

[xxv] The first-year and average annual program costs are presented at the portfolio level. The total program (and participant) costs are the aggregate of the residential, commercial, and industrial program (and participant) costs, which were in turn developed using sector- and province-specific end-use forecasts, measure lifespans, and unit costs.

APPENDIX A7 – Avoided Energy Costs[xxvi]

Electricity

When demand for energy is reduced, the highest cost (or targeted) facility or fuel type "at the margin" and will be affected; this may be an existing or planned generation plant. To accurately determine the economic benefits of an energy efficiency policy scenario, the cost of the energy from the margin resource is used. In this analysis, the avoided cost of electricity includes production costs as well as avoided capacity, transmission, and distribution costs.

To the extent possible, province-specific data is used. The electric avoided costs for Ontario are the Ontario Power Authority's forecasts in the 2011 CDM Guidelines, and the values are assumed to be based on a mix of renewables and thermal generation.[22] Electric avoided costs for Manitoba are based on Manitoba Hydro forecast, and assumes a value based on a mix of imports/exports, renewables, and thermal.[23] The electric avoided costs in British Columbia are based on BC Hydro's forecasts, and the low values (2012-2016) are based on the short-term export market price due to surpluses, and the high values are based on the avoided cost of new generation (mix of a renewables).[24] The avoided costs for Nova Scotia were updated for this study, and are based on Nova Scotia Power's most recently released avoided cost scenarios (value between the low and high scenario).[25] DEC developed annual avoided costs for Newfoundland and Labrador using information provided by advisory committee members. The avoided costs are based on avoided generation from the Holyrood thermal plant (2012-2017) and then the export market. No public data or information was available for the provinces of Saskatchewan and Alberta, so the values used are an average of the electric avoided costs from British Columbia (avoided energy and capacity costs as opposed to the short-term export market price in 2012), Manitoba, and Ontario. Where necessary, forecasts were extended using an annual escalation factor of 2%

Table A7-1: Electric Avoided Costs by Province in Nominal Dollars (2012-2040)

Electricity (nominal $/kWh)													
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2025**	**2030**	**2035**	**2040**
British Columbia	0.03	0.03	0.03	0.03	0.03	0.16	0.17	0.17	0.17	0.19	0.21	0.23	0.26
Alberta	0.10	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13	0.14	0.15	0.17	0.19
Saskatchewan	0.10	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13	0.14	0.15	0.17	0.19
Manitoba	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.12	0.13	0.15
Ontario	0.08	0.08	0.08	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.13	0.14	0.16
Nova Scotia	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.15	0.15	0.17	0.18	0.20	0.22
Newfoundland & Labrador	0.19	0.19	0.20	0.20	0.21	0.14	0.14	0.15	0.15	0.16	0.18	0.20	0.22
Quebec	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.18	0.20	0.22	0.24
New Brunswick	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.12	0.13	0.14
Prince Edward Island	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.11	0.12	0.13	0.14

[xxvi] Avoided cost values are based on data that was publicly available as of August 2013

The electric avoided costs for Québec, New Brunswick, and Prince Edward Island are the same as those used in the previous study – *Energy Efficiency: Engine of Economic Growth in Eastern Canada* (2012). Hydro Québec's 2011 avoided cost forecast was used, and the values are based on the short-term market price (2012-2022) and then wind in 2023.[26] No publicly available information on avoided costs for electricity was available for New Brunswick or Prince Edward Island. Following conversations with NB Power and Maritime Electric, DEC assumed that the avoided costs are the based on the short-term market price (2012-2029 and 2012-2022, respectively), shifting to a natural gas turbine.

Natural Gas

For British Columbia, Alberta, Saskatchewan, Manitoba, and Ontario, the avoided costs for natural gas are based on the Deloitte Commodity Forecast Price for each provinces plus transportation costs to the province as determined from regulated rates.[27] As in the previous study, the avoided costs for natural gas in Québec, New Brunswick, and Nova Scotia are based on Gaz Métro's forecast, and include transportation and distribution costs.[28]

Table A7-2: Natural Gas Avoided Costs by Province in Nominal Dollars (2012-2040)

Natural Gas (nominal $/m3)													
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030	2035	2040
British Columbia													
Residential	0.14	0.15	0.17	0.18	0.19	0.20	0.22	0.23	0.24	0.30	0.33	0.36	0.39
Commercial	0.14	0.15	0.17	0.18	0.19	0.20	0.22	0.23	0.24	0.30	0.33	0.36	0.39
Industrial	0.13	0.14	0.16	0.17	0.18	0.19	0.21	0.22	0.23	0.29	0.32	0.35	0.38
Alberta													
Residential	0.11	0.12	0.14	0.15	0.16	0.18	0.19	0.20	0.22	0.27	0.30	0.33	0.36
Commercial	0.11	0.12	0.14	0.15	0.16	0.17	0.19	0.20	0.21	0.27	0.30	0.32	0.36
Industrial	0.10	0.11	0.13	0.14	0.15	0.16	0.17	0.19	0.20	0.25	0.28	0.31	0.34
Saskatchewan													
Residential	0.09	0.10	0.12	0.13	0.14	0.15	0.17	0.18	0.19	0.25	0.27	0.30	0.33
Commercial	0.09	0.10	0.12	0.13	0.14	0.15	0.17	0.18	0.19	0.25	0.27	0.30	0.33
Industrial	0.09	0.10	0.12	0.13	0.14	0.15	0.17	0.18	0.19	0.25	0.27	0.30	0.33
Manitoba													
Residential	0.14	0.15	0.17	0.18	0.19	0.20	0.22	0.23	0.24	0.30	0.33	0.36	0.39
Commercial	0.14	0.15	0.17	0.18	0.19	0.20	0.22	0.23	0.24	0.30	0.33	0.36	0.39
Industrial	0.11	0.12	0.14	0.15	0.16	0.17	0.19	0.20	0.21	0.26	0.29	0.32	0.35
Ontario													
Residential	0.14	0.15	0.17	0.18	0.19	0.21	0.22	0.23	0.25	0.30	0.33	0.36	0.40
Commercial	0.14	0.15	0.17	0.18	0.19	0.21	0.22	0.23	0.25	0.30	0.33	0.36	0.40
Industrial	0.13	0.14	0.16	0.18	0.19	0.20	0.21	0.23	0.24	0.29	0.32	0.35	0.39

Liquid Fossil Fuels

For all provinces, liquid fossil fuel avoided costs are based on the National Energy Board's price forecast for light fuel oil and heavy fuel oil from the 2009 Energy Futures report (Reference Case).[29] The approach in the previous study was to apply a weighted average cost to total energy savings from all market segments. Where necessary, forecasts were extended using an annual escalation rate of 2%.

Table A7-3: Liquid Fossil Fuel (Light and Heavy Fuel Oils) Avoided Costs by Province in Nominal Dollars (2012-2040)

Liquid Fossil Fuels (nominal $/GJ)													
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2025**	**2030**	**2035**	**2040**
British Columbia													
Residential Light Fuel Oil	27.87	28.79	29.29	29.81	30.32	30.87	31.40	32.01	32.60	39.74	48.44	59.04	65.19
Commercial Light Fuel Oil	27.87	28.79	29.29	29.81	30.32	30.87	31.40	32.01	32.60	39.74	48.44	59.04	65.19
Industrial Heavy Fuel Oil	19.87	20.67	21.09	21.52	21.94	22.40	22.84	23.34	23.83	29.05	35.41	43.17	47.66
Alberta													
Residential Light Fuel Oil	23.18	24.00	24.43	24.87	25.30	25.76	26.21	26.72	27.22	33.18	40.45	49.31	54.44
Commercial Light Fuel Oil	23.18	24.00	24.43	24.87	25.30	25.76	26.21	26.72	27.22	33.18	40.45	49.31	54.44
Industrial Heavy Fuel Oil	15.77	16.49	16.83	17.19	17.54	17.92	18.28	18.70	19.10	23.29	28.39	34.60	38.21
Saskatchewan													
Residential Light Fuel Oil	23.39	24.22	24.64	25.09	25.52	25.99	26.43	26.95	27.45	33.46	40.79	49.72	54.90
Commercial Light Fuel Oil	23.39	24.22	24.64	25.09	25.52	25.99	26.43	26.95	27.45	33.46	40.79	49.72	54.90
Industrial Heavy Fuel Oil	15.90	16.63	16.97	17.33	17.68	18.06	18.42	18.84	19.25	23.47	28.61	34.87	38.50
Manitoba													
Residential Light Fuel Oil	21.19	21.98	22.39	22.81	23.21	23.66	24.08	24.56	25.04	30.52	37.21	45.35	50.08
Commercial Light Fuel Oil	21.19	21.98	22.39	22.81	23.21	23.66	24.08	24.56	25.04	30.52	37.21	45.35	50.08
Industrial Heavy Fuel Oil	14.43	15.13	15.46	15.81	16.14	16.50	16.85	17.25	17.64	21.50	26.21	31.95	35.27
Ontario													
Residential Light Fuel Oil	26.74	27.61	28.08	28.56	29.03	29.53	30.02	30.58	31.12	37.94	46.24	56.37	62.24
Commercial Light Fuel Oil	26.74	27.61	28.08	28.56	29.03	29.53	30.02	30.58	31.12	37.94	46.24	56.37	62.24
Industrial Heavy Fuel Oil	18.12	18.88	19.25	19.63	20.01	20.41	20.80	21.25	21.68	26.43	32.22	39.28	43.37
Newfoundland & Labrador													
Residential Light Fuel Oil	18.35	19.11	19.48	19.87	20.25	20.66	21.05	21.50	21.94	26.74	32.59	39.73	43.87
Commercial Light Fuel Oil	28.06	28.95	29.43	29.93	30.41	30.93	31.43	32.01	32.57	39.70	48.39	58.99	65.13
Industrial Heavy Fuel Oil	13.91	14.61	14.93	15.27	15.60	15.96	16.29	16.69	17.07	20.81	25.37	30.92	34.14
Quebec	24.27	24.54	24.43	24.32	24.19	24.09	23.96	23.87	23.78	23.78	23.78	23.78	23.78
New Brunswick	18.32	18.72	18.76	18.81	18.82	18.89	18.91	18.98	19.03	19.03	19.03	19.03	19.03
Nova Scotia	19.59	19.98	20.01	20.02	20.01	20.06	20.09	20.15	20.19	20.19	20.19	20.19	20.19
Prince Edward Island	21.01	21.34	21.32	21.30	21.28	21.29	21.27	21.30	21.30	21.30	21.30	21.30	21.30

APPENDIX A8 – Greenhouse Gas Emissions

Table A8-1: Marginal GHG Emissions Factors for Electricity Generation and Natural Gas and Liquid Fossil Fuels (Light and Heavy Fuel Oil) Combustion used to Determine Reduced or Avoided Emissions[30], [31], [32]

	Electricity (tonnes CO2e/MWh)	Natural Gas (tonnes CO2e/Mm3)	Liquid Fossil Fuels (tonnes CO2e/PJ)
BC	2012+: 0.00 (mix of renewables generation)	1,916	Light fuel oil: 70,300
			Heavy fuel oil: 74,000
AB	2012+: 0.40 (natural gas generation)	1,918	Light fuel oil: 70,300
			Heavy fuel oil: 74,000
SK	2012+: 0.20 (mix of natural gas & renewables generation)	1,820	Light fuel oil: 70,300
			Heavy fuel oil: 74,000
MB	2012+: 0.20 (mix of natural gas & renewables generation)	1,877	Light fuel oil: 70,300
			Heavy fuel oil: 74,000
ON	2012-2017: 0.40 (natural gas generation)	1,879	Light fuel oil: 70,300
	2017+: 0.20 (mix of natural gas & renewables generation)		Heavy fuel oil: 74,000
QC	2012-2022: 0.45 (mix of oil and natural gas generation)	1,891	73,777 (avg.)
	2023+: 0.00 (wind generation)		
NB	2012-2029: 0.45 (mix of oil and natural gas generation)	1,891	73,732 (avg.)
	2030+: 0.40 (natural gas generation)		
NS	2012-2020: 0.00 (mix of renewables generation)	1,891	73,518 (avg.)
	2020+: 0.40 (natural gas generation)		
PE	2012-2021: 0.45 (oil and natural gas generation)	-	73,544 (avg.)
	2022+: 0.40 (natural gas generation)		
NL	2012-2017: 0.76 (heavy oil generation)	-	Light fuel oil: 70,300
	2018+: 0.20 (mix of natural gas & renewables generation)		Heavy fuel oil: 74,000

Notes:

1. Reduced or avoided GHG emissions from energy efficiency savings in the electricity sector are based on the marginal source(s) of generation (i.e. not the system-wide emissions intensity).
2. New hydroelectric production in Manitoba (entire study period) and Newfoundland & Labrador (post-2017) would offset emissions in export jurisdictions, which is assumed to have a marginal emissions factor based on a mix of natural gas and renewables generation.
3. The study assumes renewables are highest-cost electricity in Nova Scotia from 2012-2020, and thus would be the first taken offline or not built if efficiency increases. In the NS policy context, renewable power will be used when available as NS legislation requires a growing ratio of renewables in NS electricity production (40% by 2020). To meet these targets the utility's contracts with independent wind projects are "must run" when wind is available.
4. In the previous study – *Energy Efficiency: Engine of Economic Growth in Eastern Canada* – a weighted average emissions factor for liquid fossil fuels was applied to total energy savings from all market segments. The current approach is to apply a light fuel oil emissions factor to energy savings from residential and commercial market segments, and a heavy fuel oil emissions factor to savings from the industrial market segment.

APPENDIX A9 – Tax Revenue Impact Assessment

The fiscal impacts of two representative policy scenarios (All provinces/Simultaneous All Fuels at the Mid and High investment levels) were assessed outside the REMI model using a post-processor spreadsheet system wherein EDR Group could capture: a) the correct tax structure; b) the correct effective tax rates; and c) the net change in tax revenue.

Income and GDP data from Statistics Canada,[33] federal tax collection data from the Department of Finance for the 2011-12 fiscal year,[34] and provincial tax collection data from individual departments of finance for the 2011-12 fiscal year[35] were used to establish "effective tax rates" for three select tax concepts: a) Personal Income Tax; b) Corporate Income Tax; and c) Sales Tax.

Table A9-1: Federal and Provincial Effective Tax Rates for Three Tax Concepts

	Personal Income Tax Revenues per $ of Income	Corporate Income Tax Revenues per $ of GDP	Sales Tax Revenues per $ of Income
Canada	$0.114	$0.016	$0.026
British Columbia	$0.046	$0.009	$0.042
Alberta	$0.056	$0.012	$0.000
Saskatchewan	$0.056	$0.011	$0.039
Manitoba	$0.077	$0.008	$0.049
Ontario	$0.057	$0.015	$0.047
Quebec	$0.081	$0.011	$0.056
New Brunswick	$0.061	$0.008	$0.054
Nova Scotia	$0.073	$0.011	$0.055
Prince Edward Island	$0.072	$0.008	$0.054
Newfoundland and Labrador	$0.060	$0.015	$0.057

The economic activity driving each tax revenue source was identified from the REMI model outputs. Personal income tax collections are driven by personal income, corporate income tax collections are largely driven by value added, and sales tax collections are largely driven by (disposable) personal income. These are the REMI output series, or proxy tax bases, against which the effective tax rates are applied. Proxy tax bases are necessary because the REMI model identifies changes in a select (not infinite) set of macroeconomic activities under the investment scenarios, and the model's outputs do not include, for example, changes in corporate income. The model does however track changes in industry-specific annual value-added (GRP or GDP), which is a proxy for movements in corporate income.

Tax Revenue Impact

Estimates for the average annual (net) gain in federal and provincial tax revenue from the net increase in economic output for two representative efficiency policy scenarios are presented in Table A8-2 (Mid scenario) and Table A8-3 (High scenario). These values should be interpreted as more indicative of revenue changes near 2012 as no projections of tax policy has been attempted.

Table A9-2: Average Annual Tax Revenue Change at the Provincial and Federal levels for Select Taxes under the All Provinces, Simultaneous All Fuels "Mid" Investment Scenario

	New Revenues, Average Annual			
Million 2012$	**Sales Tax**	**Personal Income**	**Corporate Income**	**Sum**
Federal	$289	$1,267	$225	$1,781
British Columbia	$71	$77	$23	$172
Alberta	$0	$109	$33	$143
Saskatchewan	$17	$24	$6	$47
Manitoba	$20	$31	$4	$55
Ontario	$167	$204	$54	$425
Quebec	$141	$203	$35	$380
New Brunswick	$9	$10	$2	$21
Nova Scotia	$14	$19	$4	$37
Prince Edward Island	$2	$2	$0	$4
Newfoundland & Labrador	$6	$6	$2	$14

Table A9-3: Average Annual Tax Revenue Change at the Provincial and Federal levels for Select Taxes under the All Provinces, Simultaneous All Fuels "High" Investment Scenario

	New Revenues, Average Annual			
Million 2012$	**Sales Tax**	**Personal Income**	**Corporate Income**	**Sum**
Federal	$444	$1,951	$334	$2,729
British Columbia	$92	$99	$28	$220
Alberta	$0	$175	$51	$227
Saskatchewan	$26	$37	$9	$71
Manitoba	$31	$49	$6	$85
Ontario	$272	$331	$87	$690
Quebec	$219	$316	$54	$589
New Brunswick	$15	$16	$2	$34
Nova Scotia	$20	$26	$5	$51
Prince Edward Island	$3	$4	$0	$7
Newfoundland & Labrador	$9	$9	$3	$21

Direct Sales Tax Losses

Federal and provincial sales tax rates effective January 1, 2013 were applied (net of exemptions) to the direct scenario data projecting annual bill savings by customer segment to estimate the sales tax losses from reduced fuel sales (embedded in above results). The values are indicative of revenue changes near 2012 since the sales tax rates are current, and no projection of tax policy has been attempted. Further, the assessment does not consider any (scenario-induced) altered macroeconomic activity and the potential changes to fuel consumption that may result.

Table A9-4: Direct Sales Tax Dollars Lost from Reduced Fuel Sales by Fuel Type and Market Segment under the All Provinces, Simultaneous All Fuels "Mid" Investment Scenario* (average annual B2012$)

	BC		AB		SK		MB		ON		QC		NB		NS		PE		NL	
	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.
Residential - Electric	0.000	0.010	0.000	0.005	0.000	0.002	0.001	0.003	0.045	0.028	0.027	0.014	0.002	0.001	0.000	0.001	0.000	0.000	0.003	0.002
Residential - Natural Gas	0.000	0.004	0.000	0.006	0.000	0.001	0.000	0.001	0.024	0.015	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Residential - Fuel Oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.004	0.009	0.005	0.001	0.001	0.000	0.001	0.000	0.000	0.002	0.001
All Residential	**0.000**	**0.014**	**0.000**	**0.011**	**0.000**	**0.003**	**0.001**	**0.003**	**0.075**	**0.047**	**0.036**	**0.020**	**0.003**	**0.002**	**0.000**	**0.003**	**0.000**	**0.000**	**0.004**	**0.003**
C&I - Electric	0.000	0.029	0.000	0.036	0.009	0.009	0.001	0.003	0.134	0.084	0.066	0.035	0.004	0.003	0.010	0.006	0.000	0.001	0.005	0.003
C&I - Natural Gas	0.000	0.005	0.000	0.011	0.000	0.088	0.001	0.002	0.027	0.017	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C&I - Fuel Oil	0.001	0.010	0.000	0.038	0.000	0.008	0.001	0.004	0.055	0.035	0.037	0.020	0.003	0.003	0.010	0.005	0.000	0.001	0.003	0.002
All C&I	**0.001**	**0.044**	**0.000**	**0.085**	**0.009**	**0.105**	**0.002**	**0.009**	**0.216**	**0.135**	**0.104**	**0.061**	**0.007**	**0.006**	**0.021**	**0.011**	**0.000**	**0.001**	**0.009**	**0.005**

Table A9-5: Direct Sales Tax Dollars Lost from Reduced Fuel Sales by Fuel Type and Market Segment under the All Provinces, Simultaneous All Fuels "High" Investment Scenario* (average annual B2012$)

	BC		AB		SK		MB		ON		QC		NB		NS		PE		NL	
	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.	Prov.	Fed.
Residential - Electric	0.000	0.017	0.000	0.008	0.000	0.003	0.001	0.004	0.075	0.047	0.046	0.024	0.003	0.002	0.000	0.002	0.000	0.000	0.005	0.003
Residential - Natural Gas	0.000	0.005	0.000	0.008	0.000	0.001	0.000	0.001	0.031	0.020	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Residential - Fuel Oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.006	0.012	0.006	0.002	0.001	0.000	0.001	0.000	0.000	0.002	0.001
All Residential	**0.000**	**0.023**	**0.000**	**0.016**	**0.000**	**0.004**	**0.001**	**0.005**	**0.116**	**0.072**	**0.058**	**0.032**	**0.005**	**0.003**	**0.000**	**0.004**	**0.000**	**0.000**	**0.007**	**0.004**
C&I - Electric	0.000	0.044	0.000	0.056	0.014	0.014	0.001	0.005	0.208	0.130	0.060	0.056	0.006	0.004	0.018	0.009	0.000	0.001	0.008	0.005
C&I - Natural Gas	0.001	0.007	0.000	0.016	0.000	0.126	0.001	0.003	0.039	0.025	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C&I - Fuel Oil	0.001	0.015	0.000	0.056	0.000	0.012	0.002	0.006	0.082	0.051	0.052	0.029	0.004	0.005	0.014	0.007	0.000	0.001	0.005	0.003
All C&I	**0.002**	**0.067**	**0.000**	**0.129**	**0.014**	**0.153**	**0.004**	**0.013**	**0.329**	**0.205**	**0.158**	**0.093**	**0.011**	**0.009**	**0.032**	**0.016**	**0.000**	**0.002**	**0.013**	**0.008**

*NS, PEI, and BC exempt sales tax on residential fuel consumption across all fuel types; BC also exempts electric consumption by C/I segment from sales taxes. MB exempts residential natural gas and liquid fossil fuels. QC exempts residential and C/I natural gas purchases. SK exempts all fuels in all segments except C/I electric consumption. PEI and NWFL do not participate in the proposed natural gas efficiency policy. Alberta does not have provincial sales tax.

APPENDIX A10 – Provincial Macroeconomic Modeling Results & Direct Impacts

BRITISH COLUMBIA

Macroeconomic Impacts

Table A10-1: Macroeconomic Impacts for all British Columbia Scenarios; Includes Total Program and Participant Spending (2012-2026), Total Net Economic Output (2012-2040), and Resulting GDP and Jobs Multipliers

BRITISH COLUMBIA	BAU+	Mid	High
All Fuels -- Simultaneous			
Total Efficiency Program Costs ($2012 Millions)	3,309	7,394	13,449
Total Efficiency Participant Costs ($2012 Millions)	2,389	3,639	4,500
Increase in GDP ($2012 Millions)	**41,159**	**67,743**	**78,529**
Maximum Annual GDP Increase ($2012 Millions)	3,009	4,856	5,474
GDP per $1 of Program Spending	12.44	9.16	5.84
Increase in Employment (Job-years)	**253,997**	**417,773**	**498,453**
Maximum Annual Employment Increase (Jobs)	18,812	29,958	34,630
Job-years per $Million of Programs Spending	77	57	37
Electricity			
Total Efficiency Program Costs ($2012 Millions)	2,518	5,334	9,420
Total Efficiency Participant Costs ($2012 Millions)	1,412	2,276	2,951
Increase in GDP ($2012 Millions)	**27,259**	**49,237**	**51,716**
Maximum Annual GDP Increase ($2012 Millions)	2,020	3,619	3,906
GDP per $1 of Program Spending	10.82	9.23	5.49
Increase in Employment (Job-years)	**168,437**	**302,403**	**331,169**
Maximum Annual Employment Increase (Jobs)	13,272	22,805	25,846
Job-years per $Million of Programs Spending	67	57	35
Natural Gas			
Total Efficiency Program Costs ($2012 Millions)	611	1,591	3,120
Total Efficiency Participant Costs ($2012 Millions)	798	1,117	1,329
Increase in GDP ($2012 Millions)	**2,320**	**3,832**	**4,949**
Maximum Annual GDP Increase ($2012 Millions)	194	336	467
GDP per $1 of Program Spending	3.80	2.41	1.59
Increase in Employment (Job-years)	**18,299**	**30,645**	**41,527**
Maximum Annual Employment Increase (Jobs)	1,338	2,143	2,917
Job-years per $Million of Programs Spending	30	19	13
Liquid Fossil Fuels			
Total Efficiency Program Costs ($2012 Millions)	179	470	909
Total Efficiency Participant Costs ($2012 Millions)	179	246	220
Increase in GDP ($2012 Millions)	**10,000**	**14,498**	**21,578**
Maximum Annual GDP Increase ($2012 Millions)	649	919	1,310
GDP per $1 of Program Spending	55.75	30.85	23.74
Increase in Employment (Job-years)	**57,880**	**84,054**	**124,640**
Maximum Annual Employment Increase (Jobs)	4,019	5,444	7,315
Job-years per $Million of Programs Spending	323	179	137

Direct Effects from Policy Scenarios

Table A10-2: Total Direct Energy Benefits from Avoided Energy Costs ($2012) and Total Energy Saved (PJ) for all British Columbia Scenarios (2012-2040)

BRITISH COLUMBIA	Electricity	Natural Gas	Liquid Fossil Fuels	Total
Energy Benefits		**($2012 Millions)**		
Lifetime Energy Benefits (15 years of programs)				
BAU+ Scenario	15,442	1,841	3,815	21,098
Mid Scenario	28,086	3,181	5,618	36,885
High Scenario	45,811	4,679	8,600	59,090
Energy Benefits per $1 of Program Spending				
BAU+ Scenario	6.35	3.12	22.03	-
Mid Scenario	5.46	2.07	12.38	-
High Scenario	5.04	1.55	9.80	-
Energy Savings		**(PJ)**		
Lifetime Energy Savings (15 years of programs)				
BAU+ Scenario	534	424	202	1,161
Mid Scenario	967	743	298	2,008
High Scenario	1,592	1,118	457	3,167
Maximum Annual Energy Savings				
BAU+ Scenario	36	25	13	74
Mid Scenario	66	38	17	122
High Scenario	94	50	23	167
Maximum Annual Energy Savings vs. Business As Usual				
BAU+ Scenario	11%	11%	19%	-
Mid Scenario	21%	17%	25%	-
High Scenario	30%	22%	33%	-
Avoided Greenhouse Gas Emissions		**(kt CO2e)**		
Lifetime Avoided Emissions (15 years of programs)				
BAU+ Scenario	0	21,934	14,566	36,500
Mid Scenario	0	38,397	21,468	59,865
High Scenario	0	57,758	32,993	90,751
Maximum Annual Avoided Emissions				
BAU+ Scenario	0	1,267	966	2,233
Mid Scenario	0	1,989	1,257	3,246
High Scenario	0	2,590	1,643	4,233

ALBERTA

Macroeconomic Impacts

Table A10-3: Macroeconomic Impacts for all Alberta Scenarios; Includes Total Program and Participant Spending (2012-2026), Total Net Economic Output (2012-2040), and Resulting GDP and Jobs Multipliers

ALBERTA	BAU+	Mid	High
All Fuels -- Simultaneous			
Total Efficiency Program Costs ($2012 Millions)	4,689	11,638	22,350
Total Efficiency Participant Costs ($2012 Millions)	4,874	7,093	8,312
Increase in GDP ($2012 Millions)	**36,509**	**52,810**	**79,939**
Maximum Annual GDP Increase ($2012 Millions)	1,617	3,284	5,025
GDP per $1 of Program Spending	7.79	4.54	3.58
Increase in Employment (Job-years)	**176,234**	**259,849**	**402,094**
Maximum Annual Employment Increase (Jobs)	11,295	16,718	22,957
Job-years per $Million of Programs Spending	38	22	18
Electricity			
Total Efficiency Program Costs ($2012 Millions)	2,066	4,687	8,649
Total Efficiency Participant Costs ($2012 Millions)	1,365	2,194	2,834
Increase in GDP ($2012 Millions)	**10,545**	**18,253**	**30,052**
Maximum Annual GDP Increase ($2012 Millions)	682	1,134	1,932
GDP per $1 of Program Spending	5.10	3.89	3.47
Increase in Employment (Job-years)	**49,368**	**87,643**	**151,005**
Maximum Annual Employment Increase (Jobs)	3,405	5,911	8,851
Job-years per $Million of Programs Spending	24	19	17
Natural Gas			
Total Efficiency Program Costs ($2012 Millions)	1,732	4,575	9,001
Total Efficiency Participant Costs ($2012 Millions)	2,620	3,669	4,368
Increase in GDP ($2012 Millions)	**4,023**	**6,661**	**8,719**
Maximum Annual GDP Increase ($2012 Millions)	290	490	690
GDP per $1 of Program Spending	2.32	1.46	0.97
Increase in Employment (Job-years)	**29,443**	**50,130**	**70,406**
Maximum Annual Employment Increase (Jobs)	2,123	3,326	4,317
Job-years per $Million of Programs Spending	17	11	8
Liquid Fossil Fuels			
Total Efficiency Program Costs ($2012 Millions)	892	2,376	4,700
Total Efficiency Participant Costs ($2012 Millions)	889	1,231	1,109
Increase in GDP ($2012 Millions)	**19,421**	**27,805**	**40,964**
Maximum Annual GDP Increase ($2012 Millions)	1,217	1,690	2,431
GDP per $1 of Program Spending	21.77	11.70	8.72
Increase in Employment (Job-years)	**83,372**	**121,803**	**179,982**
Maximum Annual Employment Increase (Jobs)	5,756	7,448	9,750
Job-years per $Million of Programs Spending	93	51	38

Direct Effects from Policy Scenarios

Table A10-4: Total Direct Energy Benefits from Avoided Energy Costs ($2012) and Total Energy Saved (PJ) for all Alberta Scenarios (2012-2040)

ALBERTA	Electricity	Natural Gas	Liquid Fossil Fuels	Total
Energy Benefits		**($2012 Millions)**		
Lifetime Energy Benefits (15 years of programs)				
BAU+ Scenario	10,719	4,915	13,323	28,957
Mid Scenario	19,056	8,562	19,723	47,340
High Scenario	30,191	12,712	30,531	73,434
Energy Benefits per $1 of Program Spending				
BAU+ Scenario	5.38	2.94	15.47	-
Mid Scenario	4.21	1.94	8.60	-
High Scenario	3.62	1.46	6.73	-
Energy Savings		**(PJ)**		
Lifetime Energy Savings (15 years of programs)				
BAU+ Scenario	474	1,290	789	2,553
Mid Scenario	853	2,269	1,169	4,291
High Scenario	1,389	3,434	1,816	6,639
Maximum Annual Energy Savings				
BAU+ Scenario	32	77	53	162
Mid Scenario	57	121	69	247
High Scenario	80	158	91	329
Maximum Annual Energy Savings vs. Business As Usual				
BAU+ Scenario	13%	10%	17%	-
Mid Scenario	23%	16%	22%	-
High Scenario	32%	21%	29%	-
Avoided Greenhouse Gas Emissions		**(kt CO2e)**		
Lifetime Avoided Emissions (15 years of programs)				
BAU+ Scenario	52,701	66,726	56,933	176,360
Mid Scenario	94,812	117,380	84,339	296,531
High Scenario	154,354	177,628	131,031	463,013
Maximum Annual Avoided Emissions				
BAU+ Scenario	3,538	3,988	3,792	11,319
Mid Scenario	6,377	6,267	4,957	17,602
High Scenario	8,862	8,175	6,548	23,584

SASKATCHEWAN

Macroeconomic Impacts

Table A10-5: Macroeconomic Impacts for all Saskatchewan Scenarios; Includes Total Program and Participant Spending (2012-2026), Total Net Economic Output (2012-2040), and Resulting GDP and Jobs Multipliers

SASKATCHEWAN	BAU+	Mid	High
All Fuels -- Simultaneous			
Total Efficiency Program Costs ($2012 Millions)	1,145	2,781	5,250
Total Efficiency Participant Costs ($2012 Millions)	1,354	1,960	2,323
Increase in GDP ($2012 Millions)	**7,066**	**10,524**	**15,250**
Maximum Annual GDP Increase ($2012 Millions)	469	691	1,028
GDP per $1 of Program Spending	6.17	3.78	2.90
Increase in Employment (Job-years)	**48,319**	**72,621**	**105,865**
Maximum Annual Employment Increase (Jobs)	3,008	4,339	5,981
Job-years per $Million of Programs Spending	42	26	20
Electricity			
Total Efficiency Program Costs ($2012 Millions)	566	1,266	2,312
Total Efficiency Participant Costs ($2012 Millions)	372	596	768
Increase in GDP ($2012 Millions)	**2,314**	**3,956**	**5,888**
Maximum Annual GDP Increase ($2012 Millions)	144	255	391
GDP per $1 of Program Spending	4.09	3.12	2.55
Increase in Employment (Job-years)	**15,495**	**26,964**	**40,648**
Maximum Annual Employment Increase (Jobs)	1,006	1,702	2,277
Job-years per $Million of Programs Spending	27	21	18
Natural Gas			
Total Efficiency Program Costs ($2012 Millions)	429	1,123	2,177
Total Efficiency Participant Costs ($2012 Millions)	833	1,159	1,371
Increase in GDP ($2012 Millions)	**741**	**1,233**	**1,396**
Maximum Annual GDP Increase ($2012 Millions)	66	121	157
GDP per $1 of Program Spending	1.73	1.10	0.64
Increase in Employment (Job-years)	**7,683**	**12,916**	**17,669**
Maximum Annual Employment Increase (Jobs)	527	776	1,094
Job-years per $Million of Programs Spending	18	12	8
Liquid Fossil Fuels			
Total Efficiency Program Costs ($2012 Millions)	150	392	762
Total Efficiency Participant Costs ($2012 Millions)	149	205	184
Increase in GDP ($2012 Millions)	**3,730**	**5,305**	**7,715**
Maximum Annual GDP Increase ($2012 Millions)	227	320	462
GDP per $1 of Program Spending	24.92	13.52	10.12
Increase in Employment (Job-years)	**22,769**	**32,626**	**47,283**
Maximum Annual Employment Increase (Jobs)	1,470	1,928	2,638
Job-years per $Million of Programs Spending	152	83	62

Direct Effects from Policy Scenarios

Table A10-6: Total Direct Energy Benefits from Avoided Energy Costs ($2012) and Total Energy Saved (PJ) for all Saskatchewan Scenarios (2012-2040)

SASKATCHEWAN	Electricity	Natural Gas	Liquid Fossil Fuels	Total
Energy Benefits		**($2012 Millions)**		
Lifetime Energy Benefits (15 years of programs)				
BAU+ Scenario	2,854	1,302	2,975	7,131
Mid Scenario	5,065	2,270	4,384	11,719
High Scenario	8,016	3,375	6,730	18,121
Energy Benefits per $1 of Program Spending				
BAU+ Scenario	4.00	3.14	20.59	-
Mid Scenario	4.14	2.09	11.58	-
High Scenario	3.59	1.61	9.15	-
Energy Savings		**(PJ)**		
Lifetime Energy Savings (15 years of programs)				
BAU+ Scenario	126	364	203	693
Mid Scenario	226	638	299	1,164
High Scenario	368	964	462	1,794
Maximum Annual Energy Savings				
BAU+ Scenario	8	23	13	45
Mid Scenario	15	36	18	68
High Scenario	21	46	23	90
Maximum Annual Energy Savings vs. Business As Usual				
BAU+ Scenario	13%	12%	18%	-
Mid Scenario	24%	18%	24%	-
High Scenario	33%	24%	31%	-
Avoided Greenhouse Gas Emissions		**(kt CO2e)**		
Lifetime Avoided Emissions (15 years of programs)				
BAU+ Scenario	7,000	17,856	14,643	39,499
Mid Scenario	12,572	31,335	21,600	65,507
High Scenario	20,448	47,331	33,305	101,084
Maximum Annual Avoided Emissions				
BAU+ Scenario	468	1,122	974	2,563
Mid Scenario	846	1,749	1,268	3,863
High Scenario	1,181	2,262	1,662	5,105

MANITOBA

Macroeconomic Impacts

Table A10-7: Macroeconomic Impacts for all Manitoba Scenarios; Includes Total Program and Participant Spending (2012-2026), Total Net Economic Output (2012-2040), and Resulting GDP and Jobs Multipliers

MANITOBA	BAU+	Mid	High
All Fuels -- Simultaneous			
Total Efficiency Program Costs ($2012 Millions)	976	2,340	4,414
Total Efficiency Participant Costs ($2012 Millions)	914	1,390	1,716
Increase in GDP ($2012 Millions)	**7,048**	**10,737**	**15,663**
Maximum Annual GDP Increase ($2012 Millions)	477	729	1,099
GDP per $1 of Program Spending	**7.22**	**4.59**	**3.55**
Increase in Employment (Job-years)	**54,722**	**83,909**	**123,300**
Maximum Annual Employment Increase (Jobs)	3,599	5,352	7,877
Job-years per $Million of Programs Spending	**56**	**36**	**28**
Electricity			
Total Efficiency Program Costs ($2012 Millions)	653	1,480	2,737
Total Efficiency Participant Costs ($2012 Millions)	532	857	1,112
Increase in GDP ($2012 Millions)	**3,431**	**5,862**	**8,816**
Maximum Annual GDP Increase ($2012 Millions)	226	399	612
GDP per $1 of Program Spending	5.25	3.96	3.22
Increase in Employment (Job-years)	**27,213**	**47,107**	**71,444**
Maximum Annual Employment Increase (Jobs)	1,837	3,131	4,538
Job-years per $Million of Programs Spending	42	32	26
Natural Gas			
Total Efficiency Program Costs ($2012 Millions)	249	666	1,304
Total Efficiency Participant Costs ($2012 Millions)	308	432	514
Increase in GDP ($2012 Millions)	**639**	**958**	**1,089**
Maximum Annual GDP Increase ($2012 Millions)	59	104	153
GDP per $1 of Program Spending	2.56	1.44	0.84
Increase in Employment (Job-years)	**5,916**	**9,321**	**11,717**
Maximum Annual Employment Increase (Jobs)	444	780	1,115
Job-years per $Million of Programs Spending	24	14	9
Liquid Fossil Fuels			
Total Efficiency Program Costs ($2012 Millions)	74	193	374
Total Efficiency Participant Costs ($2012 Millions)	73	101	90
Increase in GDP ($2012 Millions)	**2,730**	**3,891**	**5,707**
Maximum Annual GDP Increase ($2012 Millions)	170	243	354
GDP per $1 of Program Spending	37.06	20.16	15.26
Increase in Employment (Job-years)	**19,170**	**27,370**	**39,901**
Maximum Annual Employment Increase (Jobs)	1,245	1,713	2,381
Job-years per $Million of Programs Spending	260	142	107

Direct Effects from Policy Scenarios

Table A10-8: Total Direct Energy Benefits from Avoided Energy Costs ($2012) and Total Energy Saved (PJ) for all Manitoba Scenarios (2012-2040)

MANITOBA	Electricity	Natural Gas	Liquid Fossil Fuels	Total
Energy Benefits		**($2012 Millions)**		
Lifetime Energy Benefits (15 years of programs)				
BAU+ Scenario	2,532	696	1,361	4,589
Mid Scenario	4,538	1,213	2,005	7,757
High Scenario	7,308	1,803	3,075	12,186
Energy Benefits per $1 of Program Spending				
BAU+ Scenario	4.02	2.89	19.14	-
Mid Scenario	3.18	1.89	10.76	-
High Scenario	2.77	1.43	8.52	-
Energy Savings		**(PJ)**		
Lifetime Energy Savings (15 years of programs)				
BAU+ Scenario	141	167	102	410
Mid Scenario	255	294	151	700
High Scenario	422	446	232	1,101
Maximum Annual Energy Savings				
BAU+ Scenario	10	10	13	33
Mid Scenario	17	16	18	51
High Scenario	26	21	23	70
Maximum Annual Energy Savings vs. Business As Usual				
BAU+ Scenario	11%	10%	18%	-
Mid Scenario	21%	16%	24%	-
High Scenario	30%	21%	31%	-
Avoided Greenhouse Gas Emissions		**(kt CO2e)**		
Lifetime Avoided Emissions (15 years of programs)				
BAU+ Scenario	7,808	8,440	14,643	30,891
Mid Scenario	14,165	14,888	21,600	50,653
High Scenario	23,451	22,598	33,305	79,354
Maximum Annual Avoided Emissions				
BAU+ Scenario	532	518	974	2,023
Mid Scenario	972	814	1,268	3,054
High Scenario	1,424	1,062	1,662	4,148

ONTARIO[xxvii]

Macroeconomic Impacts

Table A10-9: Macroeconomic Impacts for all Ontario Scenarios; Includes Total Program and Participant Spending (2012-2026), Total Net Economic Output (2012-2040), and Resulting GDP and Jobs Multipliers

ONTARIO	BAU+	Mid	High
All Fuels -- Simultaneous			
Total Efficiency Program Costs ($2012 Millions)	12,005	27,505	50,799
Total Efficiency Participant Costs ($2012 Millions)	11,853	17,946	22,132
Increase in GDP ($2012 Millions)	**72,542**	**111,688**	**173,590**
Maximum Annual GDP Increase ($2012 Millions)	5,933	9,352	14,435
GDP per $1 of Program Spending	6.04	4.06	3.42
Increase in Employment (Job-years)	**500,397**	**801,493**	**1,256,695**
Maximum Annual Employment Increase (Jobs)	38,002	58,167	87,290
Job-years per $Million of Programs Spending	42	29	25
Electricity			
Total Efficiency Program Costs ($2012 Millions)	9,218	20,156	36,449
Total Efficiency Participant Costs ($2012 Millions)	6,414	10,349	13,438
Increase in GDP ($2012 Millions)	**24,415**	**42,602**	**70,620**
Maximum Annual GDP Increase ($2012 Millions)	2,067	26,271	6,931
GDP per $1 of Program Spending	2.65	2.11	1.94
Increase in Employment (Job-years)	**196,060**	**360,835**	**605,536**
Maximum Annual Employment Increase (Jobs)	14,479	26,271	43,560
Job-years per $Million of Programs Spending	21	18	17
Natural Gas			
Total Efficiency Program Costs ($2012 Millions)	1,927	5,103	10,026
Total Efficiency Participant Costs ($2012 Millions)	4,584	6,421	7,644
Increase in GDP ($2012 Millions)	**9,652**	**16,544**	**22,589**
Maximum Annual GDP Increase ($2012 Millions)	834	1,468	2,069
GDP per $1 of Program Spending	5.01	3.24	2.25
Increase in Employment (Job-years)	**79,471**	**135,363**	**188,325**
Maximum Annual Employment Increase (Jobs)	5,680	9,688	13,353
Job-years per $Million of Programs Spending	41	27	19
Liquid Fossil Fuels			
Total Efficiency Program Costs ($2012 Millions)	859	2,246	4,325
Total Efficiency Participant Costs ($2012 Millions)	855	1,177	1,049
Increase in GDP ($2012 Millions)	**32,128**	**46,189**	**69,115**
Maximum Annual GDP Increase ($2012 Millions)	2,057	2,928	4,370
GDP per $1 of Program Spending	37.39	20.57	15.98
Increase in Employment (Job-years)	**190,162**	**275,183**	**410,215**
Maximum Annual Employment Increase (Jobs)	13,108	17,986	25,193
Job-years per $Million of Programs Spending	221	123	95

[xxvii] The modeling inputs and results are based on data that was publicly available as of August 2013. Estimates may differ from Ontario's Long Term Energy Plan (LTEP) and are based on pre-LTEP data.

Direct Effects from Policy Scenarios

Table A10-10: Total Direct Energy Benefits from Avoided Energy Costs ($2012) and Total Energy Saved (PJ) for all Ontario Scenarios (2012-2040)

ONTARIO	Electricity	Natural Gas	Liquid Fossil Fuels	Total
Energy Benefits		**($2012 Millions)**		
Lifetime Energy Benefits (15 years of programs)				
BAU+ Scenario	21,945	8,751	13,901	44,597
Mid Scenario	39,356	15,138	20,389	74,884
High Scenario	63,251	22,300	31,076	116,627
Energy Benefits per $1 of Program Spending				
BAU+ Scenario	2.47	4.70	16.76	-
Mid Scenario	2.02	3.07	9.41	-
High Scenario	1.80	2.30	7.44	-
Energy Savings		**(PJ)**		
Lifetime Energy Savings (15 years of programs)				
BAU+ Scenario	1,167	2,007	747	3,920
Mid Scenario	2,114	3,517	1,097	6,729
High Scenario	3,484	5,298	1,682	10,463
Maximum Annual Energy Savings				
BAU+ Scenario	79	116	48	243
Mid Scenario	144	182	63	388
High Scenario	206	237	82	525
Maximum Annual Energy Savings vs. Business As Usual				
BAU+ Scenario	11%	10%	19%	-
Mid Scenario	21%	16%	25%	-
High Scenario	30%	21%	32%	-
Avoided Greenhouse Gas Emissions		**(kt CO2e)**		
Lifetime Avoided Emissions (15 years of programs)				
BAU+ Scenario	71,128	101,694	53,738	226,560
Mid Scenario	126,562	178,246	78,978	383,785
High Scenario	203,679	268,506	121,050	593,235
Maximum Annual Avoided Emissions				
BAU+ Scenario	4,400	5,860	3,482	13,741
Mid Scenario	7,975	9,208	4,531	21,714
High Scenario	11,423	12,008	5,928	29,360

QUÉBEC

Macroeconomic Impacts

Table A10-11: Macroeconomic Impacts for all Québec Scenarios; Includes Total Program and Participant Spending (2012-2026), Total Net Economic Output (2012-2040), and Resulting GDP and Jobs Multipliers

QUEBEC	BAU+	Mid	High
All Fuels -- Simultaneous			
Total Efficiency Program Costs ($2012 Millions)	4,727	11,950	23,965
Total Efficiency Participant Costs ($2012 Millions)	4,230	7,355	9,151
Increase in GDP ($2012 Millions)	**45,858**	**70,583**	**117,713**
Maximum Annual GDP Increase ($2012 Millions)	3,219	5,258	8,859
GDP per $1 of Program Spending	9.70	5.91	4.91
Increase in Employment (Job-years)	**338,233**	**530,163**	**876,648**
Maximum Annual Employment Increase (Jobs)	24,478	38,338	62,303
Job-years per $Million of Programs Spending	72	44	37
Electricity			
Total Efficiency Program Costs ($2012 Millions)	3,892	9,709	19,634
Total Efficiency Participant Costs ($2012 Millions)	3,398	6,189	7,755
Increase in GDP ($2012 Millions)	**21,357**	**42,542**	**68,872**
Maximum Annual GDP Increase ($2012 Millions)	1,708	3,591	5,876
GDP per $1 of Program Spending	5.49	4.38	3.51
Increase in Employment (Job-years)	**163,597**	**325,917**	**529,839**
Maximum Annual Employment Increase (Jobs)	12,952	26,503	42,215
Job-years per $Million of Programs Spending	42	34	27
Natural Gas			
Total Efficiency Program Costs ($2012 Millions)	324	890	1,705
Total Efficiency Participant Costs ($2012 Millions)	331	463	550
Increase in GDP ($2012 Millions)	**3,803**	**6,287**	**8,566**
Maximum Annual GDP Increase ($2012 Millions)	252	432	604
GDP per $1 of Program Spending	11.73	7.07	5.02
Increase in Employment (Job-years)	**28,193**	**46,796**	**64,205**
Maximum Annual Employment Increase (Jobs)	1,870	3,046	4,115
Job-years per $Million of Programs Spending	87	53	38
Liquid Fossil Fuels			
Total Efficiency Program Costs ($2012 Millions)	511	1,351	2,626
Total Efficiency Participant Costs ($2012 Millions)	502	703	846
Increase in GDP ($2012 Millions)	**20,620**	**28,284**	**39,046**
Maximum Annual GDP Increase ($2012 Millions)	1,293	1,719	2,255
GDP per $1 of Program Spending	40.38	20.94	14.87
Increase in Employment (Job-years)	**146,099**	**200,549**	**275,872**
Maximum Annual Employment Increase (Jobs)	9,735	12,249	15,615
Job-years per $Million of Programs Spending	286	148	105

Direct Effects from Policy Scenarios

Table A10-12: Total Direct Energy Benefits from Avoided Energy Costs ($2012) and Total Energy Saved (PJ) for all Québec Scenarios (2012-2040)

QUEBEC	Electricity	Natural Gas	Liquid Fossil Fuels	Total
Energy Benefits		**($2012 Millions)**		
Lifetime Energy Benefits (15 years of programs)				
BAU+ Scenario	15,740	2,017	9,365	27,122
Mid Scenario	32,339	3,483	13,207	49,029
High Scenario	55,353	5,141	19,010	79,504
Energy Benefits per $1 of Program Spending				
BAU+ Scenario	4.19	6.45	19.00	-
Mid Scenario	3.45	4.06	10.13	-
High Scenario	2.92	3.12	7.50	-
Energy Savings		**(PJ)**		
Lifetime Energy Savings (15 years of programs)				
BAU+ Scenario	666	367	697	1,730
Mid Scenario	1,338	646	1,022	3,007
High Scenario	2,251	982	1,569	4,802
Maximum Annual Energy Savings				
BAU+ Scenario	60	23	44	126
Mid Scenario	108	36	57	201
High Scenario	88	47	75	210
Maximum Annual Energy Savings vs. Business As Usual				
BAU+ Scenario	8%	11%	17%	-
Mid Scenario	15%	17%	23%	-
High Scenario	12%	22%	30%	-
Avoided Greenhouse Gas Emissions		**(kt CO2e)**		
Lifetime Avoided Emissions (15 years of programs)				
BAU+ Scenario	27,124	18,694	51,396	97,214
Mid Scenario	45,358	32,973	75,423	153,754
High Scenario	55,869	50,070	115,789	221,728
Maximum Annual Avoided Emissions				
BAU+ Scenario	4,615	1,168	3,212	8,996
Mid Scenario	8,365	1,832	4,190	14,387
High Scenario	11,172	2,384	5,514	19,070

NEW BRUNSWICK

Macroeconomic Impacts

Table A10-13: Macroeconomic Impacts for all New Brunswick Scenarios; Includes Total Program and Participant Spending (2012-2026), Total Net Economic Output (2012-2040), and Resulting GDP and Jobs Multipliers

NEW BRUNSWICK	BAU+	Mid	High
All Fuels -- Simultaneous			
Total Efficiency Program Costs ($2012 Millions)	433	1,099	2,191
Total Efficiency Participant Costs ($2012 Millions)	393	662	820
Increase in GDP ($2012 Millions)	**2,781**	**4,162**	**5,887**
Maximum Annual GDP Increase ($2012 Millions)	172	267	401
GDP per $1 of Program Spending	6.42	3.79	2.69
Increase in Employment (Job-years)	**22,106**	**33,757**	**48,265**
Maximum Annual Employment Increase (Jobs)	1,438	2,045	2,855
Job-years per $Million of Programs Spending	51	31	22
Electricity			
Total Efficiency Program Costs ($2012 Millions)	309	768	1,551
Total Efficiency Participant Costs ($2012 Millions)	270	490	613
Increase in GDP ($2012 Millions)	**653**	**1,242**	**1,917**
Maximum Annual GDP Increase ($2012 Millions)	43	95	171
GDP per $1 of Program Spending	2.11	1.62	1.24
Increase in Employment (Job-years)	**5,879**	**11,383**	**17,858**
Maximum Annual Employment Increase (Jobs)	368	701	1,253
Job-years per $Million of Programs Spending	19	15	12
Natural Gas			
Total Efficiency Program Costs ($2012 Millions)	18	51	98
Total Efficiency Participant Costs ($2012 Millions)	19	26	31
Increase in GDP ($2012 Millions)	**125**	**208**	**282**
Maximum Annual GDP Increase ($2012 Millions)	8	14	20
GDP per $1 of Program Spending	6.87	4.11	2.89
Increase in Employment (Job-years)	**1,009**	**1,679**	**2,289**
Maximum Annual Employment Increase (Jobs)	66	102	136
Job-years per $Million of Programs Spending	55	33	23
Liquid Fossil Fuels			
Total Efficiency Program Costs ($2012 Millions)	106	280	542
Total Efficiency Participant Costs ($2012 Millions)	104	146	175
Increase in GDP ($2012 Millions)	**1,999**	**2,703**	**3,678**
Maximum Annual GDP Increase ($2012 Millions)	125	162	213
GDP per $1 of Program Spending	18.81	9.65	6.79
Increase in Employment (Job-years)	**15,199**	**20,664**	**28,042**
Maximum Annual Employment Increase (Jobs)	1,002	1,257	1,567
Job-years per $Million of Programs Spending	143	74	52

Direct Effects from Policy Scenarios

Table A10-14: Total Direct Energy Benefits from Avoided Energy Costs ($2012) and Total Energy Saved (PJ) for all New Brunswick Scenarios (2012-2040)

NEW BRUNSWICK	Electricity	Natural Gas	Liquid Fossil Fuels	Total
Energy Benefits		**($2012 Millions)**		
Lifetime Energy Benefits (15 years of programs)				
BAU+ Scenario	761	113	1,555	2,430
Mid Scenario	1,524	197	2,192	3,913
High Scenario	2,565	292	3,150	6,007
Energy Benefits per $1 of Program Spending				
BAU+ Scenario	2.55	6.44	15.17	-
Mid Scenario	2.06	4.03	8.11	-
High Scenario	2.29	3.10	6.02	-
Energy Savings		**(PJ)**		
Lifetime Energy Savings (15 years of programs)				
BAU+ Scenario	53	21	145	218
Mid Scenario	106	37	212	355
High Scenario	178	56	325	559
Maximum Annual Energy Savings				
BAU+ Scenario	4	1	13	18
Mid Scenario	7	2	18	27
High Scenario	10	3	23	36
Maximum Annual Energy Savings vs. Business As Usual				
BAU+ Scenario	6%	11%	18%	-
Mid Scenario	13%	17%	24%	-
High Scenario	18%	22%	31%	-
Avoided Greenhouse Gas Emissions		**(kt CO2e)**		
Lifetime Avoided Emissions (15 years of programs)				
BAU+ Scenario	6,426	1,052	14,643	22,121
Mid Scenario	12,806	1,868	21,600	36,274
High Scenario	21,206	2,850	33,305	57,360
Maximum Annual Avoided Emissions				
BAU+ Scenario	444	66	974	1,483
Mid Scenario	905	104	1,268	2,277
High Scenario	1,309	136	1,662	3,106

NOVA SCOTIA

Macroeconomic Impacts

Table A10-15: Macroeconomic Impacts for all Nova Scotia Scenarios; Includes Total Program and Participant Spending (2012-2026), Total Net Economic Output (2012-2040), and Resulting GDP and Jobs Multipliers

NOVA SCOTIA	BAU+	Mid	High
All Fuels -- Simultaneous			
Total Efficiency Program Costs ($2012 Millions)	**766**	**1,736**	**3,211**
Increase in GDP ($2012 Millions)	**6,075**	**9,202**	**12,789**
Maximum Annual GDP Increase ($2012 Millions)	393	617	921
GDP per $1 of Program Spending	7.94	5.30	3.98
GDP per $1 of Program & Participant Spending	4.28	3.34	2.84
Increase in Employment (Job-years)	**47,976**	**73,158**	**98,634**
Maximum Annual Employment Increase (Jobs)	3,166	4,551	6,694
Job-years per $Million of Programs Spending	63	42	31
Job-years per $Million of Program & Participant Spending	34	27	22
Electricity			
Total Efficiency Program Costs ($2012 Millions)	**613**	**1,334**	**2,437**
Increase in GDP ($2012 Millions)	**2,504**	**4,324**	**6,549**
Maximum Annual GDP Increase ($2012 Millions)	176	321	510
GDP per $1 of Program Spending	4.09	3.24	2.69
GDP per $1 of Program & Participant Spending	2.24	2.02	1.88
Increase in Employment (Job-years)	**20,370**	**35,364**	**53,491**
Maximum Annual Employment Increase (Jobs)	1,338	2,357	3,655
Job-years per $Million of Programs Spending	33	27	22
Job-years per $Million of Program & Participant Spending	18	17	15
Natural Gas			
Total Efficiency Program Costs ($2012 Millions)	**9**	**24**	**46**
Increase in GDP ($2012 Millions)	**76**	**121**	**164**
Maximum Annual GDP Increase ($2012 Millions)	5	8	12
GDP per $1 of Program Spending	8.47	4.98	3.60
GDP per $1 of Program & Participant Spending	4.19	3.26	2.71
Increase in Employment (Job-years)	**626**	**1,010**	**1,344**
Maximum Annual Employment Increase (Jobs)	41	62	83
Job-years per $Million of Programs Spending	69	42	30
Job-years per $Million of Program & Participant Spending	34	27	22
Liquid Fossil Fuels			
Total Efficiency Program Costs ($2012 Millions)	**144**	**378**	**729**
Increase in GDP ($2012 Millions)	**3,481**	**4,722**	**6,000**
Maximum Annual GDP Increase ($2012 Millions)	217	287	392
GDP per $1 of Program Spending	24.18	12.48	8.23
GDP per $1 of Program & Participant Spending	12.19	8.19	6.21
Increase in Employment (Job-years)	**26,912**	**36,596**	**43,393**
Maximum Annual Employment Increase (Jobs)	1,777	2,217	2,953
Job-years per $Million of Programs Spending	187	97	60
Job-years per $Million of Program & Participant Spending	94	63	45

Direct Effects from Policy Scenarios

Table A10-16: Total Direct Energy Benefits from Avoided Energy Costs ($2012) and Total Energy Saved (PJ) for all Nova Scotia Scenarios (2012-2040)

NOVA SCOTIA	Electricity	Natural Gas	Liquid Fossil Fuels	Total
Energy Benefits		**($2012 Millions)**		
Lifetime Energy Benefits (15 years of programs)				
BAU+ Scenario	2,442	56	2,242	4,741
Mid Scenario	4,349	96	3,157	7,602
High Scenario	6,918	140	4,522	11,580
Energy Benefits per $1 of Program Spending				
BAU+ Scenario	4.13	6.45	16.13	-
Mid Scenario	3.38	4.09	8.64	-
High Scenario	2.94	3.18	6.43	-
Energy Savings		**(PJ)**		
Lifetime Energy Savings (15 years of programs)				
BAU+ Scenario	90	10	196	296
Mid Scenario	162	18	287	466
High Scenario	265	27	438	729
Maximum Annual Energy Savings				
BAU+ Scenario	6	0.6	13	20
Mid Scenario	11	1.0	18	29
High Scenario	15	1.3	23	40
Maximum Annual Energy Savings vs. Business As Usual				
BAU+ Scenario	13%	12%	18%	-
Mid Scenario	23%	19%	24%	-
High Scenario	32%	25%	31%	-
Avoided Greenhouse Gas Emissions		**(kt CO2e)**		
Lifetime Avoided Emissions (15 years of programs)				
BAU+ Scenario	1,360	516	14,643	16,519
Mid Scenario	2,681	901	21,600	25,182
High Scenario	5,034	1,353	33,305	39,692
Maximum Annual Avoided Emissions				
BAU+ Scenario	669	32	974	1,675
Mid Scenario	1,213	50	1,268	2,530
High Scenario	1,717	64	1,662	3,444

PRINCE EDWARD ISLAND

Macroeconomic Impacts

Table A10-17: Macroeconomic Impacts for all Prince Edward Island Scenarios; Includes Total Program and Participant Spending (2012-2026), Total Net Economic Output (2012-2040), and Resulting GDP and Jobs Multipliers

PRINCE EDWARD ISLAND	BAU+	Mid	High
All Fuels -- Simultaneous			
Total Efficiency Program Costs ($2012 Millions)	84	193	360
Total Efficiency Participant Costs ($2012 Millions)	72	112	143
Increase in GDP ($2012 Millions)	**384**	**535**	**743**
Maximum Annual GDP Increase ($2012 Millions)	25	36	51
GDP per $1 of Program Spending	4.57	2.77	2.06
Increase in Employment (Job-years)	**3,713**	**5,375**	**7,591**
Maximum Annual Employment Increase (Jobs)	242	312	435
Job-years per $Million of Programs Spending	44	28	21
Electricity			
Total Efficiency Program Costs ($2012 Millions)	63	138	253
Total Efficiency Participant Costs ($2012 Millions)	52	83	108
Increase in GDP ($2012 Millions)	**67**	**109**	**165**
Maximum Annual GDP Increase ($2012 Millions)	6	12	19
GDP per $1 of Program Spending	1.07	0.80	0.65
Increase in Employment (Job-years)	**899**	**1,565**	**2,440**
Maximum Annual Employment Increase (Jobs)	61	100	165
Job-years per $Million of Programs Spending	14	11	10
Liquid Fossil Fuels			
Total Efficiency Program Costs ($2012 Millions)	21	56	107
Total Efficiency Participant Costs ($2012 Millions)	21	29	35
Increase in GDP ($2012 Millions)	**314**	**426**	**575**
Maximum Annual GDP Increase ($2012 Millions)	19	25	33
GDP per $1 of Program Spending	14.84	7.66	5.37
Increase in Employment (Job-years)	**2,811**	**3,808**	**5,143**
Maximum Annual Employment Increase (Jobs)	181	227	282
Job-years per $Million of Programs Spending	133	69	48

Direct Effects from Policy Scenarios

Table A10-18: Total Direct Energy Benefits from Avoided Energy Costs ($2012) and Total Energy Saved (PJ) for all Prince Edward Island Scenarios (2012-2040)

PRINCE EDWARD ISLAND	Electricity	Liquid Fossil Fuels	Total
Energy Benefits		**($2012 Millions)**	
Lifetime Energy Benefits (15 years of programs)			
BAU+ Scenario	150	348	498
Mid Scenario	271	490	761
High Scenario	440	702	1,141
Energy Benefits per $1 of Program Spending			
BAU+ Scenario	2.48	17.04	-
Mid Scenario	2.04	9.13	-
High Scenario	1.80	6.79	-
Energy Savings		**(PJ)**	
Lifetime Energy Savings (15 years of programs)			
BAU+ Scenario	9	29	38
Mid Scenario	17	42	59
High Scenario	27	64	92
Maximum Annual Energy Savings			
BAU+ Scenario	0.6	1.8	2.4
Mid Scenario	1.1	2.3	3.5
High Scenario	1.6	3.1	4.7
Maximum Annual Energy Savings vs. Business As Usual			
BAU+ Scenario	12%	19%	-
Mid Scenario	21%	25%	-
High Scenario	30%	32%	-
Avoided Greenhouse Gas Emissions		**(kt CO2e)**	
Lifetime Avoided Emissions (15 years of programs)			
BAU+ Scenario	1,059	2,117	3,176
Mid Scenario	1,908	3,099	5,007
High Scenario	3,112	4,731	7,843
Maximum Annual Avoided Emissions			
BAU+ Scenario	70	132	202
Mid Scenario	126	172	298
High Scenario	178	225	403

NEWFOUNDLAND & LABRADOR

Macroeconomic Impacts

Table A10-19: Macroeconomic Impacts for all Newfoundland and Labrador Scenarios; Includes Total Program and Participant Spending (2012-2026), Total Net Economic Output (2012-2040), and Resulting GDP and Jobs Multipliers

NEWFOUNDLAND & LABRADOR	BAU+	Mid	High
All Fuels -- Simultaneous			
Total Efficiency Program Costs ($2012 Millions)	431	981	1,789
Total Efficiency Participant Costs ($2012 Millions)	321	490	574
Increase in GDP ($2012 Millions)	**2,226**	**3,379**	**4,926**
Maximum Annual GDP Increase ($2012 Millions)	142	210	307
GDP per $1 of Program Spending	5.17	3.45	2.75
Increase in Employment (Job-years)	**17,373**	**26,961**	**39,635**
Maximum Annual Employment Increase (Jobs)	1,053	1,658	2,310
Job-years per $Million of Programs Spending	40	27	22
Electricity			
Total Efficiency Program Costs ($2012 Millions)	322	696	1,242
Total Efficiency Participant Costs ($2012 Millions)	213	342	441
Increase in GDP ($2012 Millions)	**1,156**	**1,978**	**2,953**
Maximum Annual GDP Increase ($2012 Millions)	75	126	188
GDP per $1 of Program Spending	3.59	2.84	2.38
Increase in Employment (Job-years)	**10,246**	**17,825**	**26,962**
Maximum Annual Employment Increase (Jobs)	636	1,131	1,640
Job-years per $Million of Programs Spending	32	26	22
Liquid Fossil Fuels			
Total Efficiency Program Costs ($2012 Millions)	108	284	547
Total Efficiency Participant Costs ($2012 Millions)	108	148	133
Increase in GDP ($2012 Millions)	**1,017**	**1,394**	**1,957**
Maximum Annual GDP Increase ($2012 Millions)	63	87	124
GDP per $1 of Program Spending	9.37	4.90	3.58
Increase in Employment (Job-years)	**6,628**	**9,102**	**12,597**
Maximum Annual Employment Increase (Jobs)	416	535	717
Job-years per $Million of Programs Spending	61	32	23

Direct Effects from Policy Scenarios

Table A10-20: Total Direct Energy Benefits from Avoided Energy Costs ($2012) and Total Energy Saved (PJ) for all Newfoundland and Labrador Scenarios (2012-2040)

NEWFOUNDLAND & LABRADOR	Electricity	Liquid Fossil Fuels	Total
Energy Benefits		**($2012 Millions)**	
Lifetime Energy Benefits (15 years of programs)			
BAU+ Scenario	1,889	1,130	3,019
Mid Scenario	3,335	1,643	4,978
High Scenario	5,271	2,480	7,750
Energy Benefits per $1 of Program Spending			
BAU+ Scenario	6.08	10.79	-
Mid Scenario	4.96	5.99	-
High Scenario	4.40	4.69	-
Energy Savings		**(PJ)**	
Lifetime Energy Savings (15 years of programs)			
BAU+ Scenario	67	74	141
Mid Scenario	121	107	228
High Scenario	199	163	362
Maximum Annual Energy Savings			
BAU+ Scenario	4	4	9
Mid Scenario	8	6	14
High Scenario	12	8	20
Maximum Annual Energy Savings vs. Business As Usual			
BAU+ Scenario	12%	19%	-
Mid Scenario	23%	25%	-
High Scenario	33%	32%	-
Avoided Greenhouse Gas Emissions		**(kt CO2e)**	
Lifetime Avoided Emissions (15 years of programs)			
BAU+ Scenario	4,960	5,268	10,228
Mid Scenario	8,489	7,682	16,170
High Scenario	13,012	11,671	24,682
Maximum Annual Avoided Emissions			
BAU+ Scenario	249	318	568
Mid Scenario	457	414	871
High Scenario	665	542	1,206

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