Energy Efficiency:

Engine of Economic Growth in Eastern Canada

A Macroeconomic Modeling & Tax Revenue Impact Assessment

May 2012

With support from:

Government of New Brunswick
Government of Nova Scotia
Government of Prince Edward Island
Government of Québec (Fond vert)
Natural Resources Canada

ENE
Environment Northeast

Acknowledgments

ENE would like to thank Bruno Gobeil, Brent Langille, and Philippe Dunsky of Dunsky Energy Consulting, Inc., as well as Lisa Petraglia and Brett Piercy of Economic Development Research Group, Inc. for their collaboration on this project; the project steering committee: Mike Proud, Anne Grant, Keith Melvin, Marc DeBlois, and Glenn Davis; and the following individuals who kindly lent us their time and insights as we developed assumptions for the analysis and finalized the report: Susan Atkinson, John Appleby, Lorne Bay, Monique Brugger, Maude Chabot-Pettigrew, David Coon, Darwin Curtis, Imran Damani, Philippe Doyon, Michel Francoeur, Steven Guilbeault, Brendan Haley, Philip Hatheway, Jean-François Lamarre, Michel Losier, Dave McCulloch, John Odenthal, Roger Peters, George Richardson, Anne Robinson, Lesley Rogers, David Taylor, and Bob Younker.

ENE would like to extend its appreciation to the Eastern Premiers Secretariat and the Governments of Québec, New Brunswick, Nova Scotia, Prince Edward Island, and Natural Resources Canada for financially supporting this project.

Any errors, omissions, or opinions expressed in this report are the responsibility of ENE alone.

Authors

Leslie Malone & Jamie Howland, ENE

Bruno Gobeil, Brent Langille & Philippe Dunsky, Dunsky Energy Consulting

Lisa Petraglia, Economic Development Research Group

About ENE

ENE (Environment Northeast) is a non-profit organization that researches and advocates innovative policies that tackle our environmental challenges while promoting sustainable economies. ENE is at the forefront of state and regional efforts to combat global warming with solutions that promote clean energy, clean air and healthy forests.

Leslie Malone, Canada Program Director | 613-667-3102 | lmalone@env-ne.org
356 MacLaren Street, Ottawa, ON K2P 0M6

Headquarters 8 Summer Street, POB 583, Rockport, ME 04856, 207-236-6470
www.env-ne.org |admin@env-ne.org| Daniel L. Sosland, Executive Director
Boston, MA | Hartford, CT | Providence, RI | Ottawa, ON, Canada

Executive Summary

Energy efficiency – an abundant, clean, and low-cost energy resource – is an important component of modern energy systems and has emerged as a key policy tool to help address high energy costs, improve productivity, spur economic growth, and reduce emissions. The Chairman of the International Energy Agency, the Hon. Martin Ferguson, recently called energy efficiency "the 'quiet giant' of clean energy options" and said that "[I]n the near term, energy efficiency and energy savings remain the single most important means of seeking to meet climate and energy security goals in a cost-effective manner."

As investments in energy efficiency programs increase, it is necessary to understand economic effects on individual program participants and on the economy as a whole. Microeconomic benefits to ratepayers and program participants are typically analyzed and verified through public program design processes (see Figure ES-1, on the following page). However, less is known about macroeconomic benefits of efficiency investments and how both costs and benefits impact the economy as a whole.

This study quantifies macroeconomic impacts – economic output, including Gross Domestic Product (GDP) and job growth – of expanded investment to approximately capture all cost-effective energy efficiency (efficiency that is lower cost than supplying additional energy) in the provinces of Québec, New Brunswick, Nova Scotia, and Prince Edward Island. The case-study also provides a high-level assessment of efficiency's impact on government tax collections. This analysis expands and corroborates studies which found – in theory and in practice – that investing in energy efficiency produces significant positive direct and non-direct economic benefits in New England.

The study uses a multi-province policy forecasting model by Regional Economic Models, Inc. (REMI) to project macroeconomic impacts of expanded efficiency programs in comparison to a scenario where no programs exist. The study analyzes expanded efficiency programs for electricity, natural gas, and liquid fossil fuels – fuel oil, propane, and kerosene. The modeled efficiency investment levels – "Business As Usual+ or BAU+," "Mid," and "High" – were generated using three annual efficiency savings targets for each fuel type (see Table ES-1). The three savings targets reflect: a) an incremental increase in effort over current levels (BAU+); b) a level of effort that approaches all cost-effective efficiency (Mid); and, c) a level of investment that would place the provinces among current leaders (High). This approach overcomes limited up-to-date and public information on the energy efficiency potential in each province, and offers the added value of projecting a range of benefits based on a wider scope of potential investment.

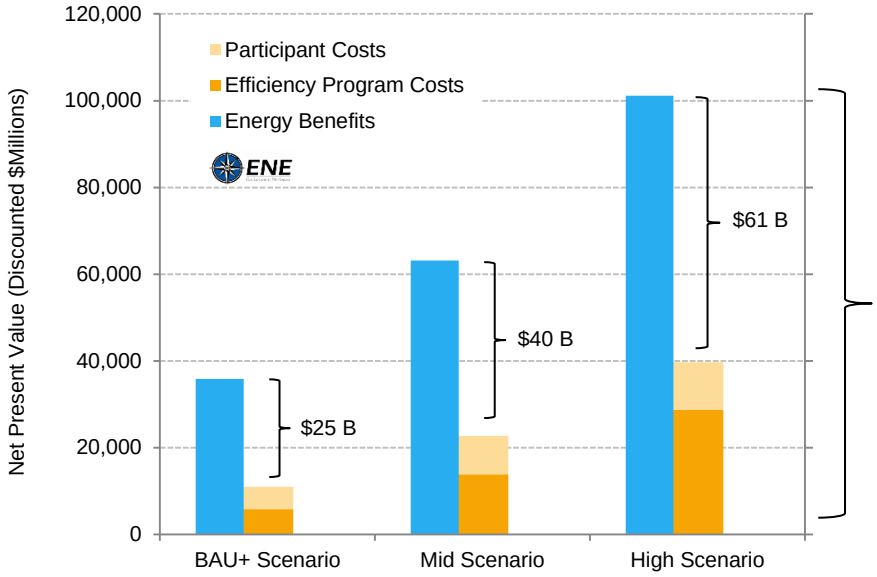
Table ES-1: Annual Efficiency Savings Targets by Fuel Type and Province (% of Annual Consumption)

	BAU+ Target	Mid Target	High Target
Electricity	QC, NB: 0.5% NS, PEI: 1.0%	QC, NB: 1.0% NS, PEI: 1.75%	QC, NB: 1.5% NS, PEI: 2.5%
Natural Gas	0.75%	1.25%	1.75%
Liquid Fossil Fuels	1.3%	1.75%	2.5%

The Mid and High investment levels are significantly higher than current program budgets in the provinces, but all scenarios result in cost-effective energy savings based on the Total Resource Cost Test, the Program Administrator Cost Test, and the Participant Cost Test. From the standpoint of economic resource acquisition, procurement of all cost-effective energy efficiency makes the most sense for ratepayers and consumers because it is the lower-cost resource option. In general, the authors have chosen to present a conservative estimate of the potential energy cost savings and economic impacts

from expanded investment in energy efficiency programs. If energy costs rise above the forecasts used in the study, or externalities such as carbon costs are included, savings in the energy systems would further increase (i.e. greater net benefits in Figure ES-1), along with associated economic benefits.

Figure ES-1: Net Present Value of Energy Savings versus Program and Participant Investment – All Fuels



Costs are invested into the efficiency program-related spending and activity; **Energy Benefits** (or avoided costs) flow back into the local economy as households spend savings to purchase goods and services, and businesses and industry reduce their costs. These contribute to the positive change in economic output – **Increased GDP, Jobs,** etc**. –** and results in a **Net Increase** in tax revenue.

Modeled scenarios relied on representative efficiency programs for each fuel type, using assumptions about costs and savings for program measures in each market segment. Assumptions were based on data from current programs as well as program expansion proposals and cost-effectiveness studies. Efficiency program assumptions were developed by Dunsky Energy Consulting, Inc., and were established after discussions with program administrators and experts in the field of energy efficiency. Expanded efficiency programs were modeled over 15 years, and funding ramp-up periods were incorporated to reflect sustainable program growth rates. The model continues for another 13 years to approximately capture the economic benefits achieved over the life of efficiency measures. In reality, programs would likely continue beyond this 15 year window of investment, and benefits will accrue beyond 2040 (Canadian data for the REMI model was only available to 2040).

In order to investigate the complementary nature of efficiency programs across fuel types and jurisdictions, in addition to modeling scenarios where each province acts alone to implement one fuel type ("independent"), the analysis includes scenarios where a province implements programs for all fuel types at once ("all fuels"); and scenarios where all four provinces implement programs for one or all fuel types simultaneously ("simultaneous"). In all cases, the all fuels and simultaneous, multi-province action resulted in greater economic benefits to a province or the region, due to increased regional competitiveness, intra-provincial trade and other synergistic effects. For example, there is a 14 percent increase in GDP in the region ($73,662 million vs. $83,955 million from 2012 to 2040) and a 12 percent increase in employment (557,040 job-years vs. 625,112 job-years from 2012 to 2040) when provinces move from acting alone to simultaneously implementing all fuels efficiency programs under the Mid investment scenario.

Although sixty scenarios are assessed, for the purposes of an overview, the scenarios where each province acts alone and implements programs for all fuel types are presented below. This provides an understanding of the potential from cases that are administratively feasible in the near- and mid-term.

The following tables show the economic impact of the "all fuels" expanded energy efficiency investments scenarios for each of the four Eastern Canadian provinces. The REMI model outputs include the impact of paying for the programs, participant costs, and decreases in activity in affected sectors, and therefore the results represent the net benefits to the economy. The goal of the analysis is to understand the overall macroeconomic benefits of expanded energy efficiency programs. The study results are applicable even if they do not exactly match planned investments and GDP and jobs indicators can be applied to more specific investment levels to generate estimates of economic benefits for a chosen provincial ramp-up plan.

Table ES-2: Summary of Québec Economic Impacts from Electric, Natural Gas, and Liquid Fossil Fuels Efficiency Programs (2012-2040) – *Cases where province implements all fuel programs simultaneously*

All Fuels – Québec	**BAU+**	**Mid**	**High**
Total Efficiency Program Costs ($2011 Millions)	**4,531**	**11,337**	**23,058**
Net Increase in GDP ($2011 Millions)	**37,070**	**62,892**	**94,447**
Maximum Annual GDP Increase ($Millions)	2,577	4,480	6,668
Increase in Employment (Job years)	**273,918**	**479,508**	**732,631**
Maximum Annual Employment Increase (Jobs)	20,222	34,402	46,188
Job-Years per $Million of Program Spending	60	42	32
Job-Years per $Million of Program & Participant Spending	32	26	23
Rest of the Four Provinces Economy			
Increase in GDP ($Millions)	*715*	*1,156*	*1,676*
Increase in Employment (Job Years)	*3,385*	*5,613*	*8,392*

Table ES-3: Summary of New Brunswick Economic Impacts from Electric, Natural Gas, and Liquid Fossil Fuels Efficiency Programs (2012-2040) – *Cases where province implements all fuel programs simultaneously*

All Fuels – New Brunswick	**BAU+**	**Mid**	**High**
Total Efficiency Program Costs ($2011 Millions)	**417**	**1,061**	**2,108**
Net Increase in GDP ($Millions)	**1,502**	**2,189**	**3,046**
Maximum Annual GDP Increase ($Millions)	90	143	218
Increase in Employment (Job years)	**10,714**	**17,032**	**24,819**
Maximum Annual Employment Increase (Jobs)	626	936	1,359
Job-Years per $Million of Program Spending	26	16	12
Job-Years per $Million of Program & Participant Spending	12	10	9
Rest of the Four Provinces Economy			
Increase in GDP ($Millions)	*269*	*378*	*527*
Increase in Employment (Job Years)	*1,896*	*2,741*	*3,879*

Table ES-4: Summary of Nova Scotia Economic Impacts from Electric, Natural Gas, and Liquid Fossil Fuels Efficiency Programs (2012-2040) – *Cases where province implements all fuel programs simultaneously*

All Fuels – Nova Scotia	**BAU+**	**Mid**	**High**
Total Efficiency Program Costs ($2011 Millions)	**739**	**1,675**	**3,089**
Net Increase in GDP ($Millions)	**4,929**	**8.434**	**11,213**
Maximum Annual GDP Increase ($Millions)	297	509	693
Increase in Employment (Job years)	**34,568**	**58,907**	**81,621**
Maximum Annual Employment Increase (Jobs)	2,524	3,624	4,485
Job-Years per $Million of Program Spending	47	35	26
Job-Years per $Million of Program & Participant Spending	23	22	19
Rest of the Four Provinces Economy			
Increase in GDP ($Millions)	*529*	*885*	*1,296*
Increase in Employment (Job Years)	*3,623*	*6,061*	*8,898*

Table ES-5: Summary of Prince Edward Island Economic Impacts from Electric and Liquid Fossil Fuels Efficiency Programs (2012-2040) – *Cases where province implements all fuel programs simultaneously*

All Fuels – Prince Edward Island	**BAU+**	**Mid**	**High**
Total Efficiency Program Costs ($2011 Millions)	**81.3**	**186.7**	**347.1**
Net Increase in GDP ($Millions)	**135.9**	**354.4**	**475.9**
Maximum Annual GDP Increase ($Millions)	9.8	23.9	34.4
Increase in Employment (Job years)	**1,239**	**2,577**	**3,585**
Maximum Annual Employment Increase (Jobs)	79	153	204
Job-Years per $Million of Program Spending	15	14	10
Job-Years per $Million of Program & Participant Spending	7	9	7
Rest of the Four Provinces Economy			
Increase in GDP ($Millions)	*92*	*191*	*262*
Increase in Employment (Job Years)	*820*	*1,320*	*1,845*

The macroeconomic benefits of efficiency derive from changes in the economy via increased spending on efficiency measures – and the corresponding increase in funding to enable this – and decreased spending on energy. The majority of these impacts (70-90%) result from the energy savings realized by households and business. Lower energy costs increase other forms of consumer spending such as travel/tourism or dining out. Lower energy bills reduce the costs of doing business in the region, bolstering the global competitiveness of local employers and promoting additional growth. Table ES-6 presents the percent of the increased GDP and employment resulting from the efficiency investment versus the energy savings for the scenario where all provinces implement programs for all fuel types at the Mid investment level.

Table ES-6: Percent of Economic Impact Resulting from Efficiency Investment versus Energy Savings – *Scenario where all provinces invest in programs across all fuel types simultaneously at the Mid investment level*

All provinces, All fuels – Mid Level	Region	QC	NB	NS	PEI
GDP					
Percent of GDP Resulting from Efficiency Investment	15%	16%	6%	5%	9%
Percent of GDP Resulting from Energy Savings	85%	84%	94%	95%	91%
Employment					
Percent of Employment Resulting from Efficiency Investment	23%	26%	11%	8%	18%
Percent of Employment Resulting from Energy Savings	77%	74%	89%	92%	82%

While results in Tables ES-2 to ES-5 are informative, they mask the relative contribution of each fuel type to the overall increase in economic output. Figures ES-2 and ES-3 present the total regional increase in GDP ($Millions) and employment (job-years) by fuel type. The figures present aggregate results from the scenarios where all provinces simultaneously implement programs for one fuel type. The totals are greater than the aggregate of the above tables – the individual provinces' all fuels scenario results – due to the fact that, as mentioned above, regional action further increases economic output. Also, the natural gas benefits are relatively low, however, in absolute terms they are high in relation to program investment levels.

Figure ES-2: Total Increase in GDP in QC, NB, NS, and PEI (2012-2040), by Efficiency Investment Scenarios (BAU+, Mid, High), and Fuel Type – *Aggregate of cases where provinces implement each fuel type program simultaneously*

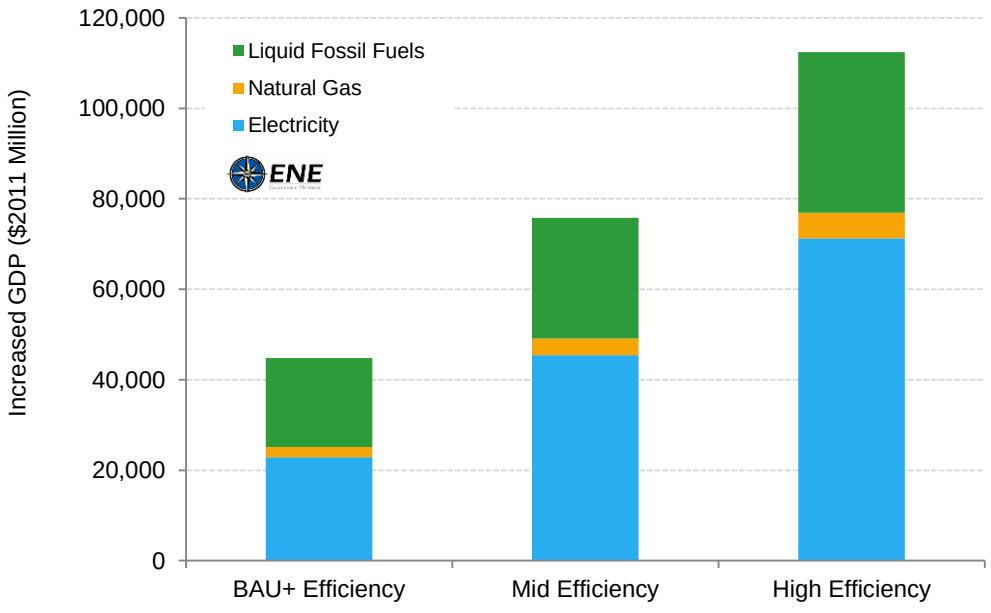
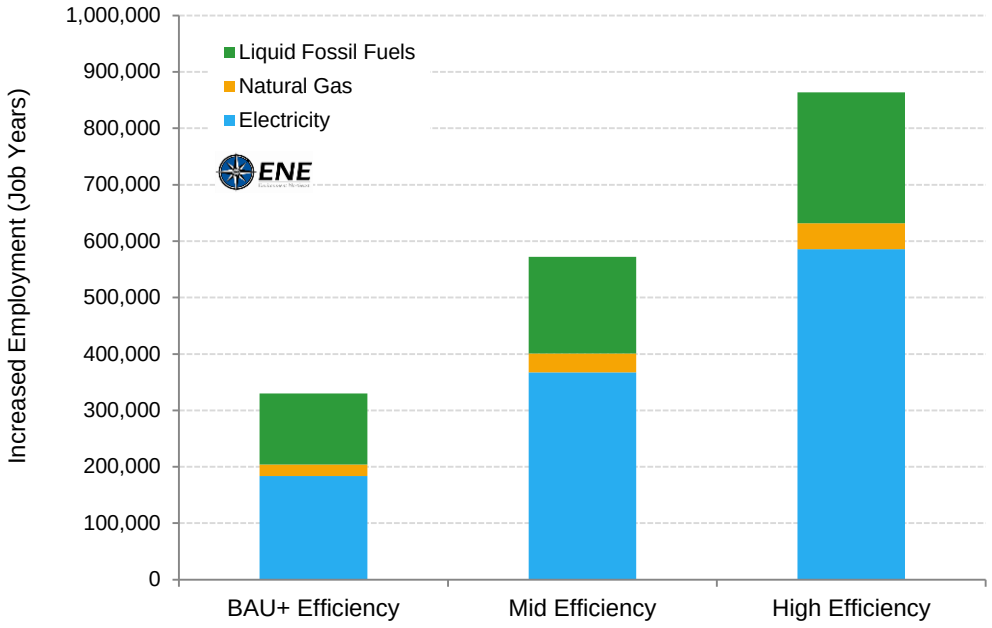


Figure ES-3: Total Increase in Employment in QC, NB, NS, and PEI (2012-2040), by Efficiency Investment Scenarios (BAU+, Mid, High), and Fuel Type – *Aggregate of cases where provinces implement each fuel type program simultaneously*



The modeled results of increased efficiency investments show that efficiency provides significant economy-wide benefits in addition to direct participant savings on which efficiency programs are often justified. Expanding analysis from micro-level, cost-benefit tests to macro-level assessments of the broader economic impacts of efficiency (including losses to electric generators and fuel suppliers) clearly illustrates that investing in energy efficiency is one of the most effective means of improving economic conditions widely, while saving consumers money and reducing emissions.

Another important issue is how the change in energy investment type and level, and the resulting impact on the economy, will affect government revenue streams. This is of particular interest with respect to energy efficiency programs given that they reduce the sale of energy products in a jurisdiction, but also drive economic output in other sectors of the economy. To inform this discussion, a high-level tax revenue impact assessment was conducted to supplement the results of the macroeconomic study. As expected, the results show a loss in provincial and federal sales tax collections from the reduced demand for fuels. However, for the scenarios studied – all fuels at the Mid investment level – the significant increase in economic output generates a net increase in collections of personal income tax, corporate income tax, and sales tax. The net gain in government revenue – including direct sales tax losses – is estimated at $243 million in Québec, $9 million in New Brunswick, $27 million in Nova Scotia, $2 million in PEI, and $312 million at the federal level. Thus, the additional tax collections associated with the significant increase in new economic activity more than compensate for the lost sales tax revenue.

The total regional energy savings and reduced greenhouse gas emissions associated with the modeled levels of efficiency investments are also significant. The following table illustrates the possible savings by fuel type at the 'Mid' investment levels (Note: BAU+ and High energy and emissions savings are available in the full report).

Table ES-7: Summary of Eastern Canada Energy Saved and Greenhouse Gas (GHG) Emissions Avoided Under Mid Efficiency Investment Level

	Electricity	Natural Gas	Liquid Fossil Fuels
Energy Savings	**(GWh)**	**(Million m3)**	**(PJ)***
Maximum annual savings	**31,125**	**1,050**	**87**
Maximum savings vs. Business as Usual Demand	13%	17%	23%
Lifetime savings (15 years of programs)	448,310	18,900	1,560
Equivalent GHG Emissions Avoided	**(kt CO_2e)**	**(kt CO_2e)**	**(kt CO_2e)**
Maximum annual avoided emissions	9,170	1,990	6,400
Maximum annual avoided emissions vs. 2010 total regional emissions (four provinces)	7.5%	1.6%	5.2%
Lifetime avoided emissions (15 years of programs)	60,390	36,740	115,250

*1PJ = ~ 27,000,000 litres of fuel oil; 39,000,000 litres of propane

Cost-effective efficiency savings can be found in any energy system, and this region is no exception. This study illustrates that the economic benefits exceed the cost of implementing efficiency measures, and that efficiency investments quickly pay for themselves through increased economic activity and job creation. In fact, the analysis shows that the benefits are greater than commonly recognized even by program administrators and proponents, since expanding the assessment beyond traditional benefit/cost tests introduces the impressive impact to the wider economy.

The region is already accruing economic benefits through existing efficiency program, but as show by this study, provinces have significant incentive to move beyond current investment levels. Positioning themselves among the leading jurisdictions with respect to energy efficiency will require policies that include comprehensive efficiency programs and incentives, and market and workforce development strategies, to overcome barriers to efficiency implementation and deliver lasting benefits. By establishing mandates and complementary policy that lead to the procurement of all cost-effective efficiency across all fuel types in the near-term, government will facilitate significant new, local economic growth that is in line with consumer interests and economic and environmental goals. Avoiding expensive upgrades to aging energy infrastructure; facilitating new industry and centers of excellence; reducing the need for energy assistance programs; and, the value of energy security – not quantified or qualified by this study – further increases the attractiveness of this important energy resource.

Table ES-8: Current Investment in Electric, Natural Gas, and Liquid Fossil Fuels Efficiency Programs in 2011/2012 Compared to Modeled First Year Expanded Program Investment Levels (Millions$)*

All Fuels	2011/12 Efficiency Program Spending (Million$)	1st Year Expanded Efficiency Budget (Million$)
Québec	$279.1	$349.4
New Brunswick	$17.1	$32.5
Nova Scotia	$53.8	$56.0
PEI	$1.5	$5.8

* Estimates for 2011/12 budgets based on: Government of Québec's 2012-13 Budget Plan; NB Budget 2011-2012 (*Main Estimates*); Efficiency Nova Scotia's *Electricity Demand Side Management Plan 2013-2015* (revised) and NS Budget 2012-2013 (*Estimates and Supplementary Detail for the Fiscal Year 2012-2013)*; PEI Office of Energy Efficiency.