Environment Canada Environnement Canada

A Climate Change Plan for the Purposes of the *Kyoto Protocol Implementation Act*

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Preface – The *Kyoto Protocol Implementation Act*

This document constitutes the Climate Change Plan for 2011 that the Government is required to publish under Section 5 of the *Kyoto Protocol Implementation Act* (KPIA). The KPIA received Royal Assent on June 22, 2007. This is the fifth iteration of the Plan required under the Act, the previous having been released on June 2, 2010.

Legal Requirements

As per the KPIA, this Plan fulfills the following legal requirements:

Section 5 of the Act provides that:

"Within 60 days after this *Act* comes into force and not later than May 31 of every year thereafter until 2013, the Minister [of the Environment] shall prepare a Climate Change Plan that includes:

(a) a description of the measures to be taken to ensure that Canada meets its obligations under Article 3, paragraph 1, of the Kyoto Protocol, including measures respecting:
  i) regulated emission limits and performance standards,
  ii) market-based mechanisms such as emissions trading or offsets,
  iii) spending or fiscal measures or incentives,
  iii.1) a just transition for workers affected by greenhouse gas emission reductions, and
  iv) cooperative measures or agreements with provinces, territories or other governments.

(b) for each measure referred to in paragraph (a),
  i) the date on which it will come into effect, and
  ii) the amount of greenhouse gas emission reductions that have resulted or are expected to result for each year up to and including 2012, compared to the levels in the most recently available emission inventory for Canada;

(c) the projected greenhouse gas emission levels in Canada for each year from 2008 to 2012, taking into account the measures referred to in paragraph (a), and a comparison of those levels with Canada's obligations under Article 3, paragraph 1, of the Kyoto Protocol;

(d) an equitable distribution of greenhouse gas emission reduction levels among the sectors of the economy that contribute to greenhouse gas emissions".

In addition, paragraphs (e) and (f) of section 5 (1) stipulate that the Government must publish:

"(e) a report describing the implementation of the Climate Change Plan for the previous calendar year; and

(f) a statement indicating whether each measure proposed in the Climate Change Plan for the previous calendar year has been implemented by the date projected in the Plan and, if not, an explanation of the reason why the measure was not implemented and how that failure has been or will be redressed."

Section 9 also requires that the Minister of the Environment prepare, within 120 days after the Act comes into force, a statement setting out the greenhouse gas emission reductions that are reasonably expected to result for each year up to and including 2012 from each regulation and measure.[1]

[1] No similar requirement exists for any of the Plans following the 2007 Plan. To review the statement, please see the 2007 Climate Change Plan.

Introduction

The Government of Canada takes the challenge of climate change seriously and has a plan for reducing greenhouse gas (GHG) emissions in a way that achieves real environmental and economic benefits for all Canadians.

Canada is committed to reducing its economy-wide GHG emissions by 17% below 2005 levels by 2020, which is equivalent to reducing Canada's 2020 emissions to 607 megatonnes (Mt). This target was set internationally in the Copenhagen Accord, and is aligned with that of the United States (U.S.). Our target was formally reiterated in the Cancun Agreement, adopted in December 2010.

Canada has been an active participant in the United Nations Framework Convention on Climate Change (UNFCCC) since its establishment, and has been working with international partners to negotiate a new fair and effective international climate change agreement for the post-2012 period. In December 2010, Canada participated in the 16th Conference of the Parties (COP16) to the UNFCCC in Cancun, Mexico. COP16 culminated with the Cancun Agreement, which acknowledges that all major emitters need to take action in order to succeed in effectively addressing climate change. The Agreement also provides a framework to formally anchor the GHG emission reduction pledges of all major economies, both developed and developing, as listed in the Copenhagen Accord (the main outcome of COP15). Countries with emission reduction targets or commitments under the Agreement are responsible for more than 85% of GHG emissions. Finally, the Cancun Agreement introduces reforms that will increase the transparency and accountability of all countries in meeting their targets.

Developing countries are increasingly important players in global efforts to combat climate change. However, many developing countries will also be the most severely impacted by the negative impacts of climate change and have limited capacities and resources to adapt. Therefore, as part of Canada's commitment to support developing countries in effectively addressing climate change, it is providing $400 million in new and additional climate change financing. This funding represents part of Canada's share of the US$30 billion of fast-start financing for 2010-2012 pledged by developed countries under the Copenhagen Accord, and reiterated in the Cancun Agreement, to support climate change mitigation and adaptation in developing countries.

Over the last several years, the Government has undertaken a number of initiatives to achieve domestic GHG reductions. These measures include regulations, codes and standards, targeted investments and incentives, and tax measures. In addition to developing programs that directly reduce emissions, Canada also put in place complementary measures aimed at educating consumers and providing businesses and the general public with an array of options for reducing their environmental impact.

Going forward, the Government has announced that it will focus on a sector-by-sector regulatory approach, beginning with the largest sources of emissions. Given the high degree of economic integration between Canada and the U.S., Canada's approach will be aligned with that of the U.S. where it is appropriate and in Canada's best interests to do so. This regulatory agenda will continue to be supported by targeted complementary measures designed to advance Canada's transition to a clean energy economy.

Under Canada's plan to address climate change, actions have already been taken regarding two of the largest sources of GHG emissions: the electricity[2] and transportation[3] sectors. Together, these

[2] For more information on the coal-fired electricity regulations, please see: *Key Elements of Proposed Regulatory Approach* (http://www.ec.gc.ca/default.asp?lang=En&n=714D9AAE-1&news=55D09108-5209-43B0-A9D1-347E1769C2A5) and *Canada's Electricity Story* (http://www.ec.gc.ca/default.asp?lang=En&n=714D9AAE-1&news=0A6CF209-AF7A-4913-A27F-527B4ECF811B)

sectors accounted for 39% of national emissions in 2005[4] and addressing them will yield important results and move Canada closer to meeting its 2020 target. Overall, the actions that have been taken or announced by the federal and provincial governments are projected to reduce emissions by about 65 Mt by 2020, bringing Canada one quarter of the way to meeting its 2020 target level of 607 Mt.

There is more work to be done in order to close the remaining gap. The Government will continue to execute its comprehensive climate change plan by developing and implementing additional regulatory measures and strengthening existing ones. The Government's plan will reduce emissions in the short, medium, and long terms, while maintaining Canada's economic competitiveness and the ability to create jobs for Canadians.

This 2011 Climate Change Plan for the Purposes of the *Kyoto Protocol Implementation Act* does not include a comprehensive inventory of climate change actions taken by the Government of Canada. Rather, only federal actions that will result in emission reductions during the Kyoto Protocol compliance period (2008-2012) are included in this Plan. As such, the measures contained in this Plan should be viewed as part of Canada's broader approach to addressing GHG emissions and the challenges associated with climate change.

[3] For more information on regulating the transportation sector, please see: *Regulating On-road GHG Emissions* (http://www.ec.gc.ca/default.asp?lang=En&n=714D9AAE-1&news=0F384925-9836-4936-B20F-A551607EEC95) and *Key Features of Canada's Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations* (http://www.ec.gc.ca/default.asp?lang=En&n=714D9AAE-1&news=4EF678F8-D8EE-404E-8F31-4F85289FCCC8)

[4] *Canada's Greenhouse Gas Target and Emissions Projections* (http://www.climatechange.gc.ca/default.asp?lang=En&n=DC025A76-1).

Commitment to Transparency

Section 10 of the *Kyoto Protocol Implementation Act* (KPIA) requires the National Round Table on the Environment and the Economy (NRTEE) to review each annual Climate Change Plan within 60 days after it is published. Additionally, the Commissioner of the Environment and Sustainable Development (CESD) is required to prepare a report on the Plans at least once every two years. At present, the NRTEE has provided reviews of the 2007, 2008, 2009, and 2010 Plans. The CESD's review of the 2007 and 2008 Plans was completed in 2009 and its review of the 2009 and 2010 Plans will be published in the future. Wherever possible and appropriate, the Government has adapted each Climate Change Plan and improved reporting based on observations and recommendations made by the NRTEE and the CESD.

In the first KPIA Plan of 2007, the Government provided individual emission reduction projections for each measure as required by the Act. In its subsequent review, the NRTEE recommended that the Government account for interaction effects between programs that could result in an overstatement of reductions. Starting with the 2008 Plan, the Government has used a modelling approach to provide an integrated report of measures, in addition to reporting the expected reductions for each measure consistent with the requirements of the Act. Overall integrated estimates differ from the aggregate of the individual measures because the former account for interaction effects. The NRTEE welcomed this methodological change, noting that the 2008 Plan was a "significant improvement" from the 2007 Plan. The NRTEE also acknowledged improvements in the level of detail provided for each measure in the 2008 Plan.

Further improvement continued in the 2009 Plan with refinements based on recommendations from the CESD. For example, the Plan provided uncertainty analysis for the greenhouse gas (GHG) reductions associated with most measures and included emission reduction ranges. The 2009 Plan also provided greater detail on the provisions for a just transition for workers affected by emission reduction measures, as well as on efforts to ensure an equitable distribution of emission reductions across sectors of the economy (both required by the Act). Finally, greater detail was provided on the implementation status of the measures.

The 2010 Plan further reflected the Government's commitment to continuously improve its reporting on GHG emission reduction measures. In its 2008 report on managing air emissions, the CESD observed that estimates of GHG reductions attributed to the Clean Air and Climate Change Trust Fund were unreliable and not supported by adequate analytical rigour. In the development of the 2010 Plan, government officials contacted provincial and territorial colleagues requesting descriptions of measures put in place using Trust Fund resources, as well as estimates of expected emission reductions from those measures. A number of provinces and territories responded, and their input was reflected in the emission reductions identified in the 2010 Plan and reflected in the modelling of a baseline scenario. As recommended by NRTEE in its response to the 2009 Plan, the integrated modelling in the 2010 Plan also used consistent definitions of emission reductions, which the NRTEE welcomed as helping to provide a more reliable estimation of emission reduction.

In addition, the 2010 Plan responded, as far as was feasible, to a 2009 CESD recommendation to report on actual GHG emission reductions achieved over the Kyoto period (2008-2012). Each year, in accordance with UNFCCC reporting requirements, the Government of Canada publishes a National GHG Emissions Inventory. As the Inventory process takes two years to complete, 2010 was the first year for which actual data covering the Kyoto compliance period was available. Since 2010, Environment Canada has used the GHG emission estimates included in the Inventory to provide actual national emissions in the KPIA Plans. At a program level, however, the Government's ability to respond to this recommendation is limited by the nature of the Inventory statistics. Providing data on actual reductions achieved on a measure-by-measure basis is not feasible because data on actual emissions is not available at the required level of disaggregation. Nevertheless, the Government of Canada responded to the CESD recommendation by committing to provide, where possible, estimated emission reductions achieved for the measures in the Plan, clearly indicating the methodology used. In its review of the 2010 Plan, the NRTEE applauded the continued improvement in forecasting, methodology, and additional transparency.

The current Plan includes improvements to the information provided on each measure and program details are now presented in a new layout to facilitate linkages to the Act to ensure greater transparency and accountability. In addition, the 2011 Plan provides greater clarity on the consistency of quality assurance and verification systems, by improving the description of methodologies, calculations, and assumptions, including a specific explanation of how the criterion of additionality was defined and met. Finally, improved sensitivity analyses have been developed and integrated into the Plan particularly as it relates to the reference case and alternative scenarios.

Canada's Kyoto Protocol Targets and Obligations

Under the Kyoto Protocol, a number of developed countries committed to individual emission reduction targets for a basket of six greenhouse gases (GHG) (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, hydrofluorocarbons and perfluorocarbons) for the period covering 2008-2012. Canada's target under the Kyoto Protocol corresponds to an average emission reduction of 6% below 1990 levels over the compliance period.

Canada has met, and will continue to meet, a series of requirements under the Kyoto Protocol. These include: maintaining a national system for the estimation of GHG emissions; submitting periodic "national communications" that include additional information to the material submitted to the UNFCCC; submission of various reports (including the "Initial Report under the Kyoto Protocol" and "Report on Demonstrable Progress under the Kyoto Protocol"); and payment of various fees including those in support of the International Transaction Log that manages transactions between National Registries of GHG.

The Kyoto Protocol was signed in 1997, but only entered into force in 2005. In recent years, programs and policies that begin to reduce Canada's emissions have been put in place but their benefits may not be fully felt during the Kyoto period. Canada's climate change plan is focused on meeting the goal of a 17% reduction in GHG emissions from 2005 levels by 2020, consistent with Canada's commitments under the Cancun Agreement.

The first commitment period of the Kyoto Protocol began January 1, 2008, and ends December 31, 2012. Kyoto Protocol Annex B Parties are required to submit their annual GHG emissions data in the form of a national inventory report, with the final report for 2012 due on April 15, 2014. The degree to which a signatory Party has met its emission reduction obligations under the Kyoto Protocol will be assessed after its final report has been filed in 2014, at which point Parties' compliance will be determined.

Actions to Address Climate Change

The Government aims to reduce Canada's greenhouse gas (GHG) emissions by 17% by 2020 compared to 2005 levels through a sector-by-sector approach. Although the Government of Canada has implemented and will continue to implement a number of initiatives to reduce GHG emissions in order to achieve this target of 607 Mt by 2020, not all aspects of this approach are reflected in this Plan. This Plan includes only programs and policies announced and funded as of March 31, 2011, that will result or are expected to result in emission reductions during the Kyoto Protocol compliance period (2008-2012), as required under section 5 (1) (a) of the *Kyoto Protocol Implementation Act*. It should be noted that emission reduction values reported in this Plan may differ from those reported in previous Plans, and these differences are the result of updated data, methodologies, or program conditions.

Pursuant to the requirements of section 5 (1) (a) (iii.1) of the Act regarding measures respecting a just transition for workers affected by GHG emission reductions, the Government has determined that the implementation of regulatory or other measures in this Plan will not generate significant impacts on employment in regulated industries. For this reason measures aimed at ensuring a just transition for workers are not necessary.

Similarly, section 5 (1) (d) of the Act requires that the Government ensure "an equitable distribution of GHG emission reduction levels among the sectors of the economy that contribute to GHG emissions". The analysis conducted by the Government indicates that the measures included in this Plan involve moderate emission reductions in a variety of sectors, often the result of incentives to consumers. Furthermore, the Government has adopted a sector-by-sector approach to reduce emissions, and sectors presently unaffected by current measures may be targeted in future years as the Government continues to develop and improve its climate change programming.

Additional details pertaining to the projected employment levels and GHG emission reduction levels across economic sectors are provided in Annex 2.

Regulating Energy Efficiency – Strengthening Energy Efficiency Standards

Description of measure - KPIA Section 5 (1) (a)

The Government is in the process of amending energy efficiency regulations under the *Energy Efficiency Act*. Stricter regulations will lead to inefficient products disappearing from the market, leaving only the better performing items. The resulting energy savings contribute to the mitigation of GHG emissions. Consultation with provinces, territories, and stakeholders is considered essential in the development of fair and meaningful standards.

As part of the Clean Air Regulatory Agenda, the first of three planned amendments to the energy efficiency regulations was published on December 24, 2008. The amendment prescribed seven new minimum energy performance standards and increased the stringency of existing standards for four products. In addition, this amendment specified regulations that will phase out the use of inefficient light bulbs in most areas of regular use by 2012 (under an amendment pre-published April 16, 2011, this would be revised to 2014). The second of the three planned amendments pre-published on June 12, 2010, prescribes six new minimum energy performance standards and increases the stringency of existing standards for eight products. Publication of this amendment and pre-publication of a third amendment are planned for 2011. Bulletins covering 17 products that may be included in the third amendment were posted on Natural Resources Canada's website in 2010.

ENERGY STAR labelling complements the standards by leading consumers to the best performing equipment. A recent survey found that 84% of Canadian consumers who bought or who were planning to buy home electronics say that ENERGY STAR-qualified products influenced their purchasing decision.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

This measure came into effect on April 1, 2007. The published or pre-published completion dates for the 25 products, plus numerous sub-categories, covered by the first two amendments noted above are distributed throughout the reporting period.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)		**Projected Reductions (Mt)**[5]		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	0.08	0.20	N/A	N/A	N/A
GHG Reductions	0.09	0.22	0.61	1.05	1.42
High Estimate	0.10	0.24	N/A	N/A	N/A

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

This measure was not fully implemented in the sense that two amendments were delayed and remain to be published. Subject to program decisions, planning would include publication of the two remaining amendments in 2011-12. The measure ends March 31, 2011.

Since 2008, seven new product standards and four improved standards have been implemented. As completion dates are reached for specific products in 2010, they are integrated with compliance procedures. As noted above, six new standards and eight revised standards were pre-published in June 2010. The process for implementation of these standards, as well as pre-publication of a third amendment, was advanced in 2010.

In fiscal year 2010-11, ENERGY STAR criteria were developed for ten new and existing products. Seventy companies joined the ENERGY STAR initiative in fiscal year 2010-11, bringing the total to just over 1,300 participants.

The expected reduction of GHG emissions for 2009 indicated in the 2010 KPIA Plan was 0.23 Mt. However, the actual impact was lower than estimated due to delays in the publication of the amendment.

[5] The impacts to 2012 summarize figures cited in the December 24, 2008, published amendments, the June 12, 2010, pre-published amendments, and the impact of labelling.

Reducing Greenhouse Gas Emissions from New Cars and Light Trucks

Description of measure - KPIA Section 5 (1) (a)

The Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations were published in *Canada Gazette*, *Part II* in October 2010 and establish progressively stringent fleet average GHG emissions standards for new vehicles sold in model years 2011 through 2016. These regulations introduce GHG emission standards aligned with those in the U.S. and apply to companies that manufacture new cars and light trucks in Canada, or import these vehicles into Canada for the purpose of sale. Also in October 2010, the Government of Canada published a Notice of Intent in *Canada Gazette*, *Part I* to develop standards for new passenger automobiles and light trucks of model years 2017 to 2025, in coordination with the U.S. Environmental Protection Agency.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations came into force on September 23, 2010 (the day the Regulations were registered).

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)[6]		**Projected Reductions (Mt)**		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	0	0	0.01	0.01	0.06
GHG Reductions	0	0	0.07	0.22	0.45
High Estimate	0	0	0.08	0.31	0.59

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

Regulations were implemented by the projected date and are underway. Activities during 2010 included:

- Discussions with regulatees (manufacturers and importers of new vehicles subject to the Regulations) to address reporting requirements, submission of evidence of conformity, etc.
- Drafting of a guidance document to assist regulatees.

Regulating Renewable Fuels Content

Description of measure - KPIA Section 5 (1) (a)

- The Renewable Fuels Regulations are a key element of the Government's Renewable Fuels Strategy. The Regulations fulfill the commitments, under the Renewable Fuels Strategy, of reducing GHG emissions from liquid petroleum fuels and creating a demand for renewable fuels in Canada.

[6] No reductions were realized in 2008 and 2009, as the regulations came into effect in 2010.

- Neither the gasoline nor the pending diesel and heating oil requirements of the Regulations is subject to a termination date.
- Stakeholders include the Canadian public, industry, and government.
- The Regulations require fuel producers and importers to have an average renewable fuel content of at least 5% based on the volume of gasoline produced and imported, starting December 15, 2010. The Regulations include provisions that govern the creation of compliance units, allowing trading of these units among participants, and also require record keeping and reporting to ensure compliance. The Regulations also include provisions requiring an average 2% renewable fuel content in diesel fuel and heating distillate oil. This requirement has been proposed to start July 1, 2011. A regulatory proposal was published on February 26, 2011, for a 60-day public comment period.
- The Regulations are estimated to result in incremental reductions of GHG emissions over and above the reductions attributable to existing provincial requirements already in place.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

Regulations for 5% renewable content based on the gasoline pool came into force in September 2010, with the requirement starting December 15, 2010.

Amendments to set a start date for the 2% requirement in diesel fuel and heating oil were proposed in *Canada Gazette, Part I* on February 26, 2011. A coming-into-force date of July 1, 2011, has been proposed.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)		Projected Reductions (Mt)		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	0	0	0.03	1.30	1.65
GHG Reductions	0	0	0.03	1.30	1.65
High Estimate	0	0	1.78	3.91	4.42

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The starting date for the 5% renewable fuel in gasoline requirement was delayed 3.5 months, to December 15, 2010, from September 2010, in response to comments received on the regulatory proposal. The impacts of this delay on expected GHG reductions is estimated to be a reduction of about 0.16 Mt of reductions in 2010, compared to the estimates reported in the 2009 KPIA.

The start date for the 2% requirement for renewable fuel in diesel and heating oil requirement has been conditional upon the successful demonstration of the use of renewable diesel under the range of Canadian conditions. The Government has intended for this requirement to come into effect by 2011 or earlier. The proposed July 2011 starting date for the 2% renewable fuel in diesel and heating oil requirement is within the expected timeline.

An improved estimation of GHG reductions, which includes the proposed date of July 1, 2011, and updates to the GHG impacts estimation methodology for biodiesel, resulted in a reduction of GHG emission reductions of 0.68 Mt in 2011 and 0.36 Mt in 2012, as compared to what was reported for the 2009 KPIA.

Following completion of the cost-benefit analysis and consultations with industry stakeholders, provinces, and members of the Canadian Environmental Protection Act National Advisory Committee (CEPA NAC), the Regulations for 5% renewable content based on the gasoline pool were published in *Canada Gazette, Part II* on September 1, 2010.

The Regulations include a second requirement for 2% renewable fuel content in diesel fuel and heating oil that was intended to be brought into force by amending the Regulations once technical feasibility has been demonstrated. Natural Resources Canada assessed the technical feasibility through the National Renewable Diesel Demonstration Initiative (NRDDI). This work was completed in 2010 and successfully demonstrated the technical feasibility of renewable diesel fuel use under a range of Canadian conditions, subject to lead times for industry to put in place the necessary infrastructure.

Pulp and Paper Green Transformation Program

Description of measure - KPIA Section 5 (1) (a)

The objective of the Pulp and Paper Green Transformation Program (PPGTP) is to improve the environmental performance of pulp and paper mills in Canada. The PPGTP was announced in June 2009 and eligible firms were allocated credits based on their production of black liquor (a biofuel) from January to May 2009. Credits were allocated at a rate of $0.16/litre, with 24 companies representing 38 mills across Canada receiving credits. Firms may draw on these credits until March 31, 2012, to finance approved capital projects with environmental benefits, such as investments in energy efficiency or the production of renewable energy from forest biomass. Credits earned at one pulp and paper facility may be spent on eligible projects at any Canadian pulp and paper mill(s) owned by the same company. Expected outcomes of the program include:

- Improved energy efficiency at Canadian pulp and paper mills;
- Increased production of renewable energy at Canadian pulp and paper mills;
- Improved environmental performance of Canadian pulp and paper mills; and,
- Investments in innovation and technology that contribute to an environmentally and commercially sustainable pulp and paper industry in Canada.

While not specifically designed to achieve GHG reductions, environmental improvements associated with the PPGTP include direct GHG reductions (from lower fossil fuel use at mill sites), as well as indirect GHG reductions (from increased renewable electricity production and electricity savings).

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The measure came into effect in June 2009.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)			Projected Reductions (Mt)	
	2008[7]	**2009**	**2010**[8]	**2011**	**2012**
Low Estimate	0	0	0.02	0.39	1.04
GHG Reductions	0	0	0.02	0.41	1.09
High Estimate	0	0	0.03	0.43	1.15

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The measure is fully implemented and operating according to the expected timelines. The PPGTP has been in operation since June 2009.

In the 2010 calendar year, contribution agreements for 51 projects were signed. Twenty-one projects were physically completed by proponents. Project reports, including information on the environmental benefits achieved, are submitted upon completion of projects. Reports detailing mill environmental performance are then submitted and evaluated by the PPGTP for the subsequent two years.

As of March 2011, the PPGTP has signed contribution agreements for 66 projects. Another 16 project proposals have been received and are in various stages of review. The PPGTP expects to receive all remaining project proposals in the 2011 calendar year.

To date, signed PPGTP projects are expected to generate over 2 million MWh/year of renewable energy and save 4.7 million GJ/year as a result of energy efficiency improvements.

ecoENERGY for Renewable Power

Description of measure - KPIA Section 5 (1) (a)

The four-year ecoENERGY for Renewable Power (ecoRP) program was launched in April 2007 and ended on March 31, 2011. ecoRP is providing incentives to increase Canada's supply of clean electricity from renewable sources such as wind, biomass, low-impact hydro, geothermal, solar photovoltaic, and ocean energy. The program provides an incentive of 1 cent/kWh for up to ten years to qualifying projects. Payments to recipients will end in fiscal year 2020-21. In 2007, at the time of program design, it was estimated that the program would encourage about 14.3 terawatt-hours of electricity annually, or about 4,000 megawatts (MW) of renewable power capacity. GHG emission reductions are expected to be between 6 and 6.7 Mt annually by March 2012.

Partners and stakeholders include independent power producers, provincial crown corporations, electrical utilities, and cooperatives.

[7] GHG reduction estimates are not provided for 2008 or 2009 because no PPGTP projects were physically completed in those years and thus, there were no measurable GHG reductions.

[8] Actual reductions are provided for 2010 because certain PPGTP projects were physically completed in 2010. These projects begin generating GHG reductions, relative to the pre-project conditions, upon project completion – that is, at the time when project equipment becomes operational. The quantity of emissions reductions attributable to these projects has been verified by program technical experts. These reductions are "actual" because they accrued to Canadians in 2010.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The ecoRP came into effect and began operations on April 1, 2007.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)[9]		Projected Reductions (Mt)		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	N/A	N/A	3.70	5.40	5.90
GHG Reductions	1.13	2.19	3.90	5.60	6.00
High Estimate	N/A	N/A	4.21	6.04	6.50

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

As of December 31, 2010, ecoRP had 100 projects with contribution agreements representing 4,301 MW of renewable power capacity, expected production of 13.2 TWh annually, and commitments of $1.32 billion in contribution funding over 14 years. At the end of the calendar year, 77 projects were commissioned (i.e. in operation) and eligible to receive the production incentive representing 3,284 MW of renewable power capacity and commitments of over $1 billion over 14 years.

In calendar year 2011, it is expected that 27 projects will be commissioned.

As of December 31, 2010 the measure had committed 92% of contribution funding to 100 projects. Once the 100 projects with contribution agreements are producing electricity for a full calendar year, the maximum expected GHG emissions reductions will be at around 5.6 Mt by December 2011. The most recently available data indicates that to date, 25 projects have been commissioned in 2011.

ecoENERGY for Renewable Heat

Description of measure - KPIA Section 5 (1) (a)

The ecoENERGY for Renewable Heat initiative is investing in incentives and industry development to support the adoption of clean renewable thermal technologies such as solar air and solar hot water for water and space heating in buildings.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

This measure started on April 1, 2007.

[9] Previously, data for this program was reported by fiscal year. The numbers in this year's Plan have been adjusted to calendar year.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)[10]		Projected Reductions (Mt)		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	N/A	N/A	0.02	0.02	0.02
GHG Reductions	0.004	0.010	0.02	0.03	0.03
High Estimate	N/A	N/A	0.02	0.03	0.03

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

This measure is fully implemented and terminated on March 31, 2011.

During 2010, 943 applications from proponents in the industrial, commercial, and institutional sectors to install solar air and solar hot-water systems were received, and contribution agreements were signed with applicants for 582 projects. These agreements represent 594 systems, bringing the program total to 1,268 systems installed well over its four-year target of 700 systems.

In addition, 9 of 14 contribution agreements with partners (utilities, developers, and buyers' groups) for pilot projects to test large-scale deployment mechanisms for solar water heating systems in the residential sector were active in 2010. Under these pilot projects, in 2010, 591 solar water heating systems were installed in Canadian homes, bringing the program total to 1,154 domestic solar water systems.

ecoENERGY for Buildings and Houses

Description of measure - KPIA Section 5 (1) (a)

The ecoENERGY for Buildings and Houses program is investing to encourage the construction and operation of more energy-efficient buildings and houses through a range of complementary activities.

Specific activities include, but are not limited to: implementing new design tools and training programs (e.g., Dollars to $ense workshops, workshops on new building design simulation and RetSCREEN); updating building energy codes; building benchmarking; rating and labelling; promoting labelling systems for housing (e.g., EnerGuide Rating System); engaging in ongoing dialogue and cooperation with provincial and territorial programs; increasing awareness of energy efficiency approaches in buildings such as building optimization; and establishing and maintaining partnerships to encourage energy efficiency capacity building. The resulting energy savings contribute to the mitigation of GHG emissions.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The program came into effect on April 1, 2007.

[10] Previously, data for this program was reported by fiscal year. The numbers in this year's Plan have been adjusted to calendar year.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)		Projected Reductions (Mt)		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	0.44	0.74	1.05	1.24	1.48
GHG Reductions	0.58	0.99	1.40	1.66	1.97
High Estimate	0.72	1.24	1.75	2.07	2.46

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The ecoENERGY for Buildings and Houses program was fully implemented by the projected date. The program ended on March 31, 2011.

During fiscal year 2010-11, approximately 4,000 building owners, managers, operators, designers, and builders had received energy management training. As of March 31, 2011, almost 350 commercial buildings received energy labels as part of a pilot energy management labelling and benchmarking program.

ecoENERGY Retrofit Initiative

Description of measure - KPIA Section 5 (1) (a)

The ecoENERGY Retrofit Initiative provides incentives for energy efficiency improvements in homes and small and medium-sized organizations in the institutional, commercial, and industrial sectors. The program is made up of three components:

- ecoENERGY Retrofit – Homes: Provides home and property owners with grants up to $5,000 per unit to offset the cost of making energy efficiency improvements. The Retrofit – Homes program involves residential energy efficiency assessments by certified energy advisors and is complemented by a suite of provincial programs.
- ecoENERGY Retrofit – Small and Medium Organizations: Provides financial incentives to facilities meeting specified criteria based on the estimated amount of energy saved by retrofit activities.
- ecoENERGY Retrofit: Included funding in 2007-08 for the Existing Buildings Initiative, which promoted behavioural changes and energy-saving retrofits to improve energy efficient practices through financial incentives, partnerships, and training and advice.

The resulting energy savings contribute to the mitigation of GHG emissions.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The program came into effect on April 1, 2007**.**

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)		Projected Reductions (Mt)		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	0.27	0.62	1.06	1.23	1.23
GHG Reductions	0.29	0.66	1.23	1.30	1.30
High Estimate	0.30	0.69	1.36	1.37	1.37

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The ecoENERGY Retrofit Initiative was fully implemented by the projected date. The initiative ended on March 31, 2011.

As of March 31, 2011, up to 500,000 homeowners are expected to have completed energy efficiency upgrades eligible for grants (compared to 275,588 homeowners as of March 31, 2010). These upgrades will reduce their annual energy consumption by about 21% and GHG emissions by approximately 3 tonnes per house per year.

As of March 31, 2011, 1,299 contribution agreements for small and medium organizations have been signed.

Actual outcomes in 2009 were higher than projected because of higher participation levels that followed increases to Retrofit – Homes incentives. However, as noted in Annex 1, estimated reductions have been reduced in light of 2010 evaluation findings.

ecoENERGY for Industry

Description of measure - KPIA Section 5 (1) (a)

The ecoENERGY for Industry program aims at encouraging information-sharing regarding new technologies and best practices in industrial energy use, as well as training and specialized assessments for energy managers to identify and implement energy-saving projects. The resulting energy savings contribute to the mitigation of GHG emissions.

ecoENERGY for Industry is an industry-government partnership delivered through the Canadian Industry Program for Energy Conservation (CIPEC). CIPEC encourages industrial energy efficiency improvements and reductions in GHG emissions through a number of voluntary activities, including: Dollars to $ense energy management workshops, site-specific industrial energy assessment incentives, and recognition programs for industrial energy-efficiency leaders.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The program came into effect April 1, 2007.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)		Projected Reductions (Mt)		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	0.51	0.82	0.37	0.40	0.40
GHG Reductions	0.64	1.02	1.43	1.54	1.54
High Estimate	0.77	1.22	1.59	1.70	1.70

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The ecoENERGY for Industry program was fully implemented by the projected date. The program ended on March 31, 2011.

As of March 31, 2011, a total of 4,100 industrial energy managers had been trained and the CIPEC network continued to grow (compared to a figure of just over 3,100 as of March 31, 2010).

The expected reduction of GHG emissions indicated in the 2010 KPIA Plan for 2009 was between 0.27 and 1.17 Mt. Actual results for 2009 are within the expected range.

ecoENERGY for Aboriginal and Northern Communities

Description of measure - KPIA Section 5 (1) (a)

The ecoENERGY for Aboriginal and Northern Communities program provided funding to support renewable energy projects, improve energy efficiency, and encourage the adoption of alternative energy sources in Aboriginal and northern communities.

The ecoENERGY for Aboriginal and Northern Communities program, delivered by Indian and Northern Affairs Canada (INAC), equipped Aboriginal and northern communities with the knowledge and tools to increase the energy efficiency of community infrastructure; to access renewable energy opportunities; and to implement cost-effective renewable energy projects. The program promoted environmentally sustainable communities, but also provided funding to allow Aboriginal and northern communities to be able to access economic development opportunities that would directly benefit their communities.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The measure came into effect on April 1, 2007.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)		Projected Reductions (Mt)		
	2008	**2009**[11]	**2010**	**2011**	**2012**
Low Estimate	0	0.001	0.002	0.003	0.009
GHG Reductions	0	0.001	0.002	0.003	0.009
High Estimate	0	0.001	0.007	0.012	0.031

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The measure was fully operational in fiscal year 2007-08 and was fully subscribed by November 2010. The program sunset on March 31, 2011.

Since April 1, 2007, a total of 208 funding applications had been received by the ecoENERGY for Aboriginal and Northern Communities Program. The number of funding applications received by the program steadily increased from 24 applications in fiscal year 2007-08 to 97 applications in fiscal year 2010-11.

In fiscal year 2010-11, the program funded 47 projects in 42 communities. The program was fully subscribed by November 2010. The funded projects can be broken down as follows:

- 12 community energy planning
- 18 energy efficiency
- 17 renewable energy

It is important to note that the program does not enter into multi-year funding arrangements with proponents; therefore applicants reapplied on an annual basis.

As of March 31, 2011, a total of 124 projects in 97 Aboriginal and northern communities had received federal funding. The breakdown of projects funded from fiscal year 2007-08 to fiscal year 2010-11 is as follows:

- 25 community energy planning
- 41 energy efficiency
- 57 renewable energy

Of the funded renewable energy and energy efficiency projects, 19 have been commissioned as of December 31, 2010, and it is anticipated that another 12 projects would be fully commissioned by the program end date of March 31, 2011.

Interest in the ecoENERGY for Aboriginal and Northern Communities Program continued to build, evidenced through inquiries received from Aboriginal and northern communities, federal programs, provincial and territorial governments, industry, and utilities. It is anticipated that rising global fuel costs and the associated energy sustainability challenges faced by Aboriginal and northern communities will continue into the future.

[11] The GHG emission reductions for this program are calculated in tonnes. When converting the values into megatonnes, rounding resulted in identical values for the Low, Expected, High values for the 2009 reductions.

ecoAUTO Rebate Program

Description of measure - KPIA Section 5 (1) (a)

The ecoAUTO Rebate Program, administered by Transport Canada and delivered in partnership with Service Canada, provided a cash incentive to Canadians to help the environment by buying or leasing more fuel-efficient vehicles. The federal Government offered rebates from $1,000 to $2,000 toward the purchase or lease (12 months or more) of new fuel-efficient vehicles for the model years 2006, 2007, and 2008. Only new eligible vehicles purchased or leased between March 20, 2007, and December 31, 2008, and for which a rebate application form was received by March 31, 2009, qualified for the rebate.

Vehicles whose combined fuel consumption (55% city, 45% highway) was at or below the program's fuel consumption targets of 6.5 litres per 100 kilometres for cars and 8.3 litres per 100 kilometres for light trucks were eligible for a rebate. Flex-fuel passenger vehicles, which are capable of operating with either gasoline or a fuel blend of 15% gasoline and 85% ethanol (E85), received a rebate of $1,000 if their E85 combined fuel consumption rating was no more than 13.0 litres per 100 kilometres. The full rebate schedule was as follows:

Range of combined fuel consumption (litres per 100 km)	Passenger cars	Light-duty trucks	Flex-fuel vehicles E85 combined fuel consumption
5.5 or less	$2,000	$2,000	$1,000
5.6 – 6.0	$1,500	$2,000	$1,000
6.1 – 6.5	$1,000	$2,000	$1,000
6.6 – 7.3	$0	$2,000	$1,000
7.4 – 7.8	$0	$1,500	$1,000
7.9 – 8.3	$0	$1,000	$1,000
8.4 – 13.0	$0	$0	$1,000

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The program was in effect from March 20, 2007, to March 31, 2009. With the release of application forms, the program was fully implemented as of October 1, 2007.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)		Projected Reductions (Mt)		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	0.01	0.01	0.01	0.01	0.01
GHG Reductions	0.01	0.01	0.01	0.01	0.01
High Estimate	0.03	0.03	0.03	0.02	0.02

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The program was implemented as planned and ended on March 31, 2009, which was the last date to submit an application form for eligible vehicles. Overall, the ecoAUTO Rebate Program received over 182,300 applications and issued over 169,200 rebates. In addition, the toll-free number received over 113,500 inquiries and the program's website recorded 875,000 visits.

Green Levy

Description of measure - KPIA Section 5 (1) (a)

The Green Levy applies to passenger vehicles with a fuel consumption rating of 13 litres or more per 100 kilometres (55% city and 45% highway) and is imposed at rates ranging from $1,000 to $4,000. The Green Levy is payable by the manufacturer or importer of new vehicles delivered after March 19, 2007, and by the importer of used vehicles, if the used vehicle was originally put into service (in any jurisdiction) after March 19, 2007. The Canada Revenue Agency and the Canada Border Services Agency are responsible for the administration of the Green Levy, working with manufacturers and importers of vehicles to facilitate its application.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The Green Levy came into effect on March 20, 2007.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)		Projected Reductions (Mt)		
	2008[12]	**2009**	**2010**	**2011**	**2012**
Low Estimate	0.10	0.14	0.17	0.20	0.23
GHG Reductions	0.10	0.14	0.17	0.20	0.23
High Estimate	0.09	0.14	0.19	0.23	0.28

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The measure was fully implemented as projected.

ecoENERGY for Personal Vehicles Program

Description of measure - KPIA Section 5 (1) (a)

The ecoENERGY for Personal Vehicles program aims at providing Canadians with information and decision-making resources to assist them with buying, driving, and maintaining their vehicles in a manner that reduces fuel consumption and GHG emissions. Such resources include but are not

[12] The high scenario identified marginally lower reductions in 2008 than the low scenario due to the methodology underpinning the calculation of anticipated reductions. Please refer to Annex 1 for additional information.

limited to the Fuel Consumption Guide, a training curriculum for novice drivers, and fuel efficient driver campaigns for experienced drivers that focus on idle reduction, tire inflation, and ecoDriving (improved driving habits).

This program also includes management of the Memorandum of Understanding (MOU) Respecting Automobile Greenhouse Gas Emissions between the Government of Canada and the Canadian Automotive Industry. The MOU voluntarily committed the Canadian automotive industry to achieve a 5.3 Mt reduction in GHG emissions from passenger cars and light duty trucks in 2010. Industry intended to meet the target through the introduction of advanced and highly fuel-efficient technologies (e.g., hybrid electric, diesel vehicles, etc.).

The resulting fuel savings contribute to the mitigation of GHG emissions.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The MOU was signed on April 5, 2005. The other program measures came into effect on April 1, 2007.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)		Projected Reductions (Mt)		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	0.06	0.11	0.15	0.16	0.16
GHG Reductions	0.08	0.14	0.20	0.21	0.21
High Estimate	0.10	0.18	0.25	0.26	0.26

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The ecoENERGY for Personal Vehicles program was fully implemented by the projected date. The program ended on March 31, 2011.

In fiscal year 2010-11, over 580,000 novice drivers were trained using materials from the Auto$mart fuel efficient driving curriculum.

The expected reduction of GHG emissions indicated in the 2010 KPIA Plan for 2009 was 0.09 Mt. The actual impact was higher than estimated as a result of greater than projected uptake of the program.

After publishing a report on the first interim goal, the MOU was mutually terminated in 2010 by the Government of Canada and industry in response to the introduction of GHG emission regulations for light duty passenger cars and trucks.

ecoMOBILITY

Description of measure - KPIA Section 5 (1) (a)

The ecoMOBILITY program aims to reduce emissions from the urban passenger transportation sector by helping municipalities attract residents to less polluting forms of transportation. It provides financial support to municipalities and regional transportation authorities for transportation demand

management (TDM) projects that reduce emissions by shifting personal automobile travel to other modes, reducing the number and length of car trips, and shifting trips to less congested times and routes. The program is also helping build national capacity to implement TDM measures through research, training, professional development, and the development of materials/resources. The program ends in March 2012.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The program came into effect in April 2007.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)[13]		Projected Reductions (Mt)		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	0	0	0.11	0.11	0.11
GHG Reductions	0	0	0.11	0.11	0.11
High Estimate	0	0	0.22	0.22	0.22

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The program is being implemented by the dates projected. ecoMOBILITY has 13 projects in 12 communities across Canada. All are well underway and gearing up for their final year as projects are to be completed by December 31, 2011, prior to the ending of the program in March 2012. A workshop was held in March 2010 that brought together the funding recipients to share their experience, lessons learned to date, and to discuss results measurement approaches.

The program also developed a number of tools and resources to support TDM project implementation and build national capacity. Some of the new resources published include: a Social Marketing Planning Guide – changing transportation behaviours; Bicycle End-of-Trip Facilities – a guide for Canadian municipalities and employers; and, a Compendium of Canadian Survey Research – on consumer attitudes and behavioural influences affecting sustainable transportation options. All resources can be found on Transport Canada's Urban Information Network website along with the dozen case studies and issue papers published this year. Learning events such as conferences are another forum for disseminating information resources. Representatives of the ecoMOBILITY program were present at seven conferences either via conference sessions, workshops, as speakers and/or hosting the ecoMOBILITY booth. In addition, to date, this fiscal year the program hosted five webinars, which attracted approximately 500 participants.

For the program's upcoming sunset year, the focus will be on publishing the remaining guides and case studies currently under development and the continuation of information dissemination initiatives to assist municipalities and transportation authorities to effectively implement TDM. Next year will also initiate the implementation of the measurement strategy to capture the program's results with respect to the implementation of TDM measures.

[13] Projects under the program did not begin until 2009 and were not expected to yield reductions until 2010.

National Vehicle Scrappage Program

Description of measure - KPIA Section 5 (1) (a)

The national vehicle scrappage program “Retire your Ride” offered incentives to Canadians who owned old vehicles (model year 1995 and older) to retire them. Program participants could chose one of: a free transit pass, membership in a car-sharing program, a rebate on the purchase of a newer vehicle (model year 2004 and later), or $300 cash. The primary goal of the program was to reduce smog-forming emissions; secondary goals were to reduce GHG emissions by promoting sustainable transportation alternatives, and to prevent the release of toxic substances into the environment by ensuring the responsible recycling of vehicles.

The program was delivered by the national not-for-profit organization Summerhill Impact, formerly known as the Clean Air Foundation, and a network of provincial delivery organizations. The program was announced in Budget 2007 and ended on March 31, 2011.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The national program was launched in January 2009. Between August and December 2008, an interim approach allowed program delivery in seven provinces.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)		Projected Reductions (Mt)		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	0.001	0.009	0.017	0.009	0
GHG Reductions	0.001	0.012	0.019	0.011	0
High Estimate	0.001	0.021	0.034	0.019	0

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

National program operation began in January 2009 and ended on March 31, 2011. The launch of the national program was delayed from July 2008 to January 2009 to allow time to finalize program delivery by partners. An interim approach allowed program delivery in seven provinces until full implementation was completed.

Operating in all provinces, the Retire Your Ride program permanently retired approximately 72,000 vehicles in the calendar year 2010, reducing GHG and smog-forming emissions by an estimated 19,400 tonnes and 2,600 tonnes, respectively. About 350 vehicle recyclers processed vehicles retired through the program, in accordance with a National Code of Practice to prevent the release of harmful substances in the environment.

ecoTechnology for Vehicles Program

Description of measure - KPIA Section 5 (1) (a)

Announced in February 2007, ecoTECHNOLOGY for Vehicles (eTV) program helps reduce passenger vehicle emissions by encouraging the adoption of advanced vehicle technologies in the Canadian fleet of light-duty vehicles. The program focuses on five technology areas:

- Improvements in engine, power train, light weight materials, components, and vehicle design
- Diesel technologies
- Battery technologies
- Plug-in hybrid electric and gasoline-hybrid electric technologies
- Hydrogen and fuel cell technologies

The program's test results help inform the development of regulations, codes, and standards for the next generation of advanced vehicles, including electric, fuel cell, and plug-in electric hybrid vehicles, among others. Results also help Canadians to better understand the benefits of new technologies, highlighting their environmental performance and accelerating their acceptance in Canada.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The program came into effect in April 2007.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)	**Projected Reductions (Mt)**			
	2008	**2009**[14]	**2010**	**2011**	**2012**
Low Estimate	0	0.03	0.05	0.07	0.09
GHG Reductions	0	0.07	0.10	0.15	0.20
High Estimate	0	0.20	0.28	0.41	0.56

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The program ended on March 31, 2011, and was implemented by the dates projected.

From 2007 to 2011, the program conducted tests and evaluations on over 50 different advanced vehicle technologies (AVTs) in order to inform policies, programs, emergent codes and standards, and the program's outreach activities to reduce barriers to the uptake of these technologies.

The eTV program participated in over 80 outreach events across Canada in order to increase public awareness about AVTs through hands-on demonstrations, information dissemination, and ride and drive opportunities. The program also continued to develop its extensive public website, providing Canadians with access to various forms of information on AVTs.

[14] Actual results of the program will only be known once the program results measurement is completed in 2011-12. In accordance with the methodology provided, only projected reductions for 2009 are available (not actual).

During fiscal year 2010-11, the eTV program continued its outreach efforts by producing a video series, photo gallery, and animations to complement the current collection of multimedia on the program website. These multimedia tools supplement the technical specification sheets, educational articles, newsletters, results, and research reports that are maintained on the website for information dissemination.

In addition to the program's participation in over 20 outreach events in 2010-11, eTV organized two successful media events that produced several in-depth articles in various news sources. The program also worked in partnership with the Canadian Science and Museum Technology Corporation to develop an Edukit and Virtual Program around the theme of vehicles and the environment, both geared to high school students and teachers.

In addition to the four AVTs and low rolling resistance tires purchased for testing and evaluation in fiscal year 2010-11, September of 2010 marked the start of early testing of battery electric vehicles (BEVs) in Canada. Transport Canada's Memorandum of Understanding with Mitsubishi Motor Sales of Canada has provided eTV with a unique opportunity to use test results to measure the energy consumption of these vehicles, helping Canadians to better understand BEVs and their potential environmental benefits in Canada. eTV plans to publish results on all testing and evaluation on various electric vehicles in an aggregated report in the spring of 2011.

An additional outcome of eTV's technology evaluation work has been its contribution to the amendment and development of codes and standards related to AVTs, such as work conducted with the Canadian Standards Association, Society of Automotive Engineers, and other government departments to address electric vehicles. Through its work on various committees, eTV has been able to put forward, based on its own testing experiences, proposals that take into account the Canadian context (e.g., climate and road conditions).

ecoENERGY for Fleets Program

Description of measure - KPIA Section 5 (1) (a)

The ecoENERGY for Fleets program aims at generating reductions in fuel use and related costs, air pollutants, and GHG emissions through measures targeted at both operators and managers of Canada's commercial and institutional road vehicle fleets. The resulting energy savings contribute to the mitigation of GHG emissions.

Such measures include training and education (e.g., SmartDriver training), sharing of best practices (e.g., Fuel Management 101 workshops), idle-reduction campaigns for truck drivers, and technical demonstrations promoting the adoption of existing and emerging new technologies.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The program came into effect on April 1, 2007.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)		Projected Reductions (Mt)		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	0.10	0.20	0.29	0.31	0.31
GHG Reductions	0.13	0.26	0.38	0.41	0.41
High Estimate	0.16	0.33	0.48	0.51	0.51

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The ecoENERGY for Fleets program was fully implemented by the projected date. The program ended on March 31, 2011.

In fiscal year 2010-11, over 7,500 commercial drivers participated in Smart Driver training workshops and over 270 participants took part in Fuel Management 101 workshops to promote greater uptake of transportation energy efficiency practices. Additionally, the program provided financial and technical support to 12 freight carriers for a technical demonstration of the effectiveness of certain fuel-saving technologies for trucks on Canadian roads.

The expected reduction of GHG emissions indicated in the 2010 KPIA Plan for 2009 was 0.14 Mt. The actual impact was higher than estimated at that time. Final reports that included full performance-related data were received following the submission of the 2010 Plan.

ecoFREIGHT Program

Description of measure - KPIA Section 5 (1) (a)

The ecoFREIGHT program engaged the freight transportation industry in a greater uptake of technologies and practices that reduce fuel consumption, criteria air contaminants, and GHG emissions. The program became effective April 2007 and ended in March 2011.

Technologies that can reduce GHG emissions and/or air pollutants in the freight transportation industry are available. Significant barriers to the widespread adoption of these emissions-reducing technologies exist, including the risk to the financial bottom line in a highly competitive industry, concern about the impacts of new technologies on costly equipment and capital, the lack of an established track record for new technologies, and the lack of independent and “real world” information on technologies options.

The program helped mitigate these barriers and encouraged a broader adoption of new and proven technologies and practices in the freight industry by providing financial support for technology demonstration and installation, performance information, and seeking partnerships with industry.

The program included six initiatives.

1. Freight Technology Demonstration Fund (FTDF): Established 12 cost-shared demonstration projects to test and measure new and under-used freight transportation technologies in real world conditions, and disseminated information to industry.

2. Freight Technology Incentives Program (FTIP): Provided cost-shared funding to companies and non-profit organizations in freight transportation for 26 projects to help them to purchase and install proven emission-reducing technologies.

3. ecoFREIGHT Partnerships: Built and maintained partnerships within the transportation sector, including air and rail modes, to reduce emissions from transportation through voluntary actions that can support the regulatory framework.

4. National Harmonization Initiative for the Trucking Industry (NHITI): Identified regulatory barriers and solutions in collaboration with provinces and territories, so that the Canadian trucking industry could embrace emission-reducing technologies such as speed-limiters and aerodynamic truck equipment.

5. Marine Shore Power Program (MSPP): Program information provided separately in this Plan.

6. ecoEnergy for Fleets: Program information provided separately in this Plan.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The measure came into effect in April 2007.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)	**Projected Reductions (Mt)**			
	2008	**2009**[15]	**2010**	**2011**	**2012**
Low Estimate	0	0.98	1.12	1.25	1.37
GHG Reductions	0	0.98	1.12	1.25	1.37
High Estimate	0	1.05	1.24	1.38	1.51

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The program ended on March 31, 2011, and was implemented by the dates projected. With the exception of the MSPP, all ecoFREIGHT initiatives ended in 2010-11.

In 2010-11, ecoFREIGHT program activities focused on completing and measuring the emissions results of the 38 projects funded under the program, and disseminating those projects' results to the industry. These projects took place across Canada, in each transportation modes.

[15] Actual results of the program will only be known once the program results measurement is completed in 2011-12. In accordance with the methodology provided, only projected reductions for 2009 are available (not actual).

Memoranda of Understanding (MOU) signed under the ecoFREIGHT Partnerships initiative with the Railway Association of Canada (RAC) and with the aviation sector (Aviation) have reported encouraging results:

- The rail industry GHG emission intensity decreased by 23.3% in 2008 compared with the 1990 baseline. The 2009 Locomotive Emissions Monitoring Report will be released in 2011. RAC's Memorandum of Understanding expired December 31, 2010.

- In the air industry, between 1990 and 2009, the average annual fuel efficiency improvement in litres per total revenue-tonne-kilometre was 1.9%, surpassing the Aviation MOU-established target of 1.1% improvement per year. The industry achieved a 30% total reduction between 1990 and 2009, compared to the MOU target of a 24% reduction to be achieved by 2012.

In 2010, Transport Canada continued to participate actively in international committees and working groups, with a dedicated focus on GHG emission reductions: International Civil Aviation Organization, International Maritime Organization, Organization for Economic Cooperation and Development, International Transport Forum, the United Nations Commission on Sustainable Development Asia-Pacific Economic Cooperation, and the Commission on Environmental Cooperation. Through this participation, Transport Canada supported the development of international environmental standards, practices, and guidelines, with the goal of reducing GHG emissions and air pollutants, and improving the efficiency of the transportation sector.

Under the NHITI, two studies were commissioned examining the performance and potential safety implications of emerging add-on aerodynamic devices in the trucking industry. This includes the "Truck Trailer Side Skirts" study, which reports on commercially available designs, their construction materials and mounting methods, cost, whether there are any side effects on vehicle safety such as on brake cooling, and their ability to provide side underrun protection to vulnerable road users such as cyclists.

The "Winter Traction Performance of Low Rolling Resistance (LRR) Tires for Heavy Duty Tractor Trailers" study investigated the effects that the LRR tires certified by SmartWay (California Air Resources Board regulations) will have on the winter traction performance of tractor-trailers that also operate in cold weather climates such as Canada.

The ecoFREIGHT Program results measurement will commence in 2011 and its final report will be available in early 2012.

Marine Shore Power Program

Description of measure - KPIA Section 5 (1) (a)

The Marine Shore Power Program demonstrates how ships can turn off their auxiliary diesel engines while docked and connect to the city's electrical grid using specially designed equipment to power the ship's load (e.g., lighting, air conditioning, communication equipment, etc.). The Marine Shore Power Program's objective is to identify and document the best technologies to reduce emissions from idling ship engines in urban centres.

The main barriers to the implementation of marine shore power in Canadian ports include the initial cost of these installations for port and terminal operators, the lack of experience in Canada with this technology, and the lack of a proven business case for shore power in the freight industry.

The program helps to overcome these barriers by providing financial contributions for demonstration projects and by disseminating the information generated by these projects to encourage broader adoption in the marine industry.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

The program was implemented April 2007 and ends in March 2012.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)	Projected Reductions (Mt)			
	2008	**2009**[16]	**2010**	**2011**	**2012**
Low Estimate	0	0.003	0.004	0.004	0.004
GHG Reductions	0	0.003	0.004	0.004	0.004
High Estimate	0	0.003	0.004	0.004	0.007

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

Following consultations with industry in the fall of 2007, the program funding round was not held until after amendments to the *Canadian Marine Act* came into force in 2008 so that Canadian Port Authorities could be eligible for funding. To ensure the full completion of projects, the program was extended to 2012. This falls within the Kyoto commitment period.

Two projects were selected under the program. The Vancouver Fraser Port Authority was selected to build a marine shore power installation for cruise ships on the East and West berths at their Canada Place facility. The construction was completed and the marine shore power installation has been available and monitored since the 2009 cruise vessel season. Transport Canada has received the project's final report and results will be made available on its website.

The second project was announced in September 2010. The Prince Rupert Port Authority project will demonstrate shore power for container ships at its Fairview Terminal. Both projects are on track.

In its final year, the Marine Shore Power Program activities will focus on completing the monitoring of the Prince Rupert Project, disseminating project results to the industry to mitigate the information barriers associated with adopting marine shore technology, and initiating the program's performance assessment. The program's final report will be available in 2012-13 once the program is completed and its results have been measured.

[16] Actual results of the program will only be known once the program results measurement is completed in 2011-12. In accordance with the methodology provided, only projected reductions for 2009 are available (not actual).

Promoting Sustainable Urban Transit

Description of measure - KPIA Section 5 (1) (a)

The Public Transit Tax Credit (PTTC) allows individuals to claim a non-refundable tax credit for the cost of monthly public transit passes or those passes of a longer duration, effective July 1, 2006. The credit was extended in Budget 2007 to electronic fare cards and weekly passes when used on an ongoing basis. The objectives for the measure outlined in Budget 2006 were to provide assistance to Canadians by making transit more affordable, reduce traffic congestion in urban areas, and improve the environment by lowering GHG emissions.

Date measure has or will come into effect - KPIA Section 5 (1) (b) (i)

This tax credit applies to the cost of eligible public transit passes for travel occurring after June 30, 2006. The expansion of the credit to the costs of electronic fare cards and weekly passes when used on an ongoing basis became effective starting January 1, 2007.

Greenhouse gas emission reductions - KPIA Section 5 (1) (b) (ii)

	Actual Reductions (Mt)		Projected Reductions (Mt)		
	2008	**2009**	**2010**	**2011**	**2012**
Low Estimate	0.02	0.02	0.02	0.02	0.02
GHG Reductions	0.03	0.03	0.03	0.03	0.03
High Estimate	0.81	0.82	0.84	0.86	0.89

Implementation status and activities for the previous calendar year - KPIA Sections 5 (1) (e) and 5 (1) (f)

The measure was fully implemented for the 2006 and later tax years, as committed in the 2006 federal budget.

Provincial and Territorial Collaboration and Action

This section addresses the descriptive requirements of paragraph 5 (1) (a) (iv) of the *Kyoto Protocol Implementation Act* to include measures respecting cooperative measures or agreements with provinces, territories, or other governments, as well as paragraphs 5 (1) (b) (i) and (ii).

The Government of Canada recognizes the important role that provinces and territories play in combating climate change. Provincial and territorial governments control many of the levers for action towards reducing greenhouse gas (GHG) emissions from a number of key sectors, including electricity generation, residential, commercial, and institutional buildings, transportation, agriculture, and waste management.

The Government of Canada, provinces, and territories are currently pursuing a number of climate change initiatives across Canada. There are some commonalities – for example, energy efficiency and conservation efforts often figure prominently – but approaches to climate change do vary among provinces and territories. Quebec and British Columbia introduced carbon taxes on October 1, 2007, and July 1, 2008, respectively. In 2007, Alberta passed the *Climate Change and Emissions Management Amendment Act* to regulate GHG emissions from large industry. Together, Alberta and Saskatchewan are making substantial investments in carbon capture and storage technology and are also pursuing regulatory frameworks. Ontario and Nova Scotia are taking action to reduce emissions from electricity generation, with Ontario phasing out the use of all coal-fired power plants and Nova Scotia putting in place regulated caps on GHG and air pollutant emissions from power generation facilities. Moreover, British Columbia, Manitoba, Ontario, and Quebec, along with several American states, are participating in the Western Climate Initiative, which aims to create a common carbon market. The Government of Canada is also working with provinces and territories through a number of other substantial investments in clean energy and infrastructure development.

In Budget 2007, the $1.5 billion Clean Air and Climate Change Trust Fund was established to support those provinces and territories that identify major projects that will result in real reductions in GHG emissions and air pollutants. Importantly, while the Government of Canada provided funding to provincial and territorial governments through the Trust Fund, it is provincial and territorial governments themselves that are responsible for allocating the funds to specific programs. Further, the Trust Fund was established on an arms-length basis, and provincial and territorial governments are not required to report to the Government of Canada on how they used Trust Fund resources.

In response to recommendations by the Commissioner of the Environment and Sustainable Development, the Government of Canada approached provinces and territories about quantifying reductions associated with the Trust Fund. These efforts have resulted in an improved understanding of how Trust Fund resources are being utilized. This information was compiled in last year's Plan; several provincial governments indicated that they used the resources received from the Trust Fund to finance their overall provincial climate change plans.

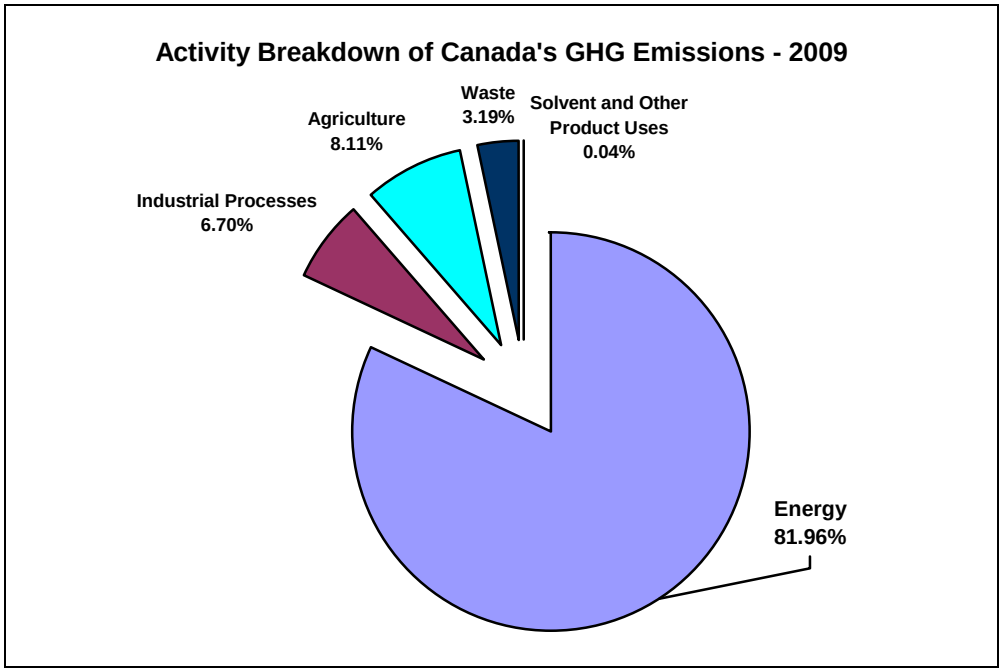
As with the previous year's Plan, the current Plan takes into account all provincial and territorial actions that affect GHG emissions in the estimate of baseline emissions before accounting for other federal programs identified in this Plan. This ensures that all of the actions provinces and territories have taken to reduce emissions – including those actions directly or indirectly supported by the federal Trust Fund – are fully taken into account in the baseline projection of emissions that is used to evaluate the impact of federal actions (other than the Trust Fund) on GHG emissions.[17]

[17] Since integrated modelling has been done from a baseline that includes provincial and territorial programs, some of which complement federal actions, the impact of federal actions may be understated since all interaction effects between provincial/territorial and federal programs will be netted out from the estimated federal reductions.

Canada's Greenhouse Gas Emissions in 2009

According to the latest National Greenhouse Gas Inventory, total greenhouse gas (GHG) emissions in Canada in 2009 were approximately 690 Mt, a decrease of approximately 6% (42 Mt) from the revised 2008 total (732 Mt). This was the second year in a row that emissions decreased, caused in part by the global recession and reduced use of coal for electricity generation.

On an activity basis, energy activities produced the majority of Canada's GHG emissions in 2009, at 82% or 566 Mt (73% fossil fuel combustion, 9% fugitive sources). The remaining 18% of total Canadian emissions was largely generated by activities within the agriculture (8% of total emissions) and industrial processes sectors (7%), with minor contributions from the waste (3%) and solvent and other product use activities.



Estimating Emission Reductions

The Emissions Inventory for 2009 is the second for the Kyoto Protocol reporting period. Since many of the measures that are detailed in this Plan were implemented in 2006, the early effects of those measures are captured in the inventory data. In order to evaluate program performance for 2008 and 2009, it is necessary to compare National Inventory emissions to a scenario that assumes no federal government action.

The table below presents "actual" emission reductions attributable to the federal measures identified in this Plan for 2008 and 2009. In the absence of the federal measures, emissions for 2008 and 2009 are projected to be 734 Mt and 694 Mt respectively. Comparing projected emissions excluding federal measures to actual emissions reported in the National Inventory Report (732 Mt for 2008 and 690 Mt for 2009), emission reductions attributable to federal actions for the "most likely" baseline are 2 Mt in 2008 and 4 Mt in 2009.

Paragraph 5 (1) (b) of the Act requires that the GHG emission reductions that have resulted, or are expected to result, for each year up to and including 2012, be compared to the levels in the most recently available emission inventory for Canada. Estimating the "actual" reductions attributable to federal government measures, and moreover any provincial, territorial, and utility programs, is highly challenging. There are many variables at play that influence the estimation of "actual" reductions:

- The pace of economic growth: In recessionary periods like the ones experienced in 2008 and 2009, companies and consumers are less likely to have undertaken investments aimed at improving energy efficiency or reducing emissions. While there may also be increased interest in energy savings opportunities under recessionary periods, the short-term impact of reduced investment levels tends to prevail, lowering the effectiveness of government programs.
- Energy prices: Energy prices also influence the effectiveness of government programs. In periods of high energy prices, price plays a greater role in influencing consumer behaviour. This tends to reduce the incremental impact of government-sponsored programs.
- Provincial and territorial programs: A key assumption of this analysis is that the impact of provincial and territorial programs is estimated prior to estimating the impact of federal programs. This tends to place greater weight on the emission reduction potential of provincial/territorial programs or conversely less weight on the emission reduction potential of federal programs.

Estimating "actual" reductions relative to the National Inventory Report requires the development of a counter-factual baseline. Thus, the 2009 baseline estimates Canadian emissions for that year while excluding the effects of federal Government programs announced after 2006 (i.e. those programs detailed in this Plan).[18] The baseline does include the effects of federal measures announced before 2006, as well as the effects of all current provincial government policies and programs discussed earlier. This 2009 baseline can be compared against the 2008 and 2009 Emissions Inventory to evaluate the effectiveness of measures. This is discussed in detail in Annex 1 of this Plan.

Canada's Emission Levels in 2008 and 2009 (Mt)

	2008 Emissions	2009 Emissions
Estimated "actual" emissions excluding federal government measures	734	694
Actual emissions	732	690
Emission reductions attributable to federal government actions	2	4

As "Federal Measures" emission reductions were estimated, sensitivity analysis was undertaken. This sensitivity analysis focused on the uncertainty related to the effectiveness of federal programs. The table below illustrates the impact of using alternative assumptions for the effectiveness of government programs. Using the "low" effectiveness assumption, "actual" emission reductions for the "most likely" baseline are 1 Mt in 2008 and 3 Mt in 2009. Using the "high" effectiveness assumption, "actual" emission reductions for the "most likely" baseline are 3 Mt in 2008 and 5 Mt in 2009.

[18] In order to more precisely comply with the spirit and intent of the *Kyoto Protocol Implementation Act*, a "No-Federal Programs" case was developed. This case assumes that only those federal GHG reduction programs, regulations, and standards that were fully funded or implemented in 2006 are reflected. It does, however, include current provincial and territorial policies.

Canada's Emission Levels in 2008 and 2009 (Mt) – Sensitivity				
	2008 Emissions		2009 Emissions	
	Low	High	Low	High
Estimated "actual" excluding federal government measures	733	735	693	695
Actual emissions	732	732	690	690
Emission reductions attributable to federal government actions	1	3	3	5

Canada's Emissions Levels from 2008 to 2012

In accordance with paragraph 5 (1) (c), the text and the table below set out Canada's actual emissions for 2008 and 2009 as reported in the latest National Inventory Report, along with the projected greenhouse gas (GHG) emission levels for 2010 to 2012 and how these levels compare with Canada's obligations under Article 3, paragraph 1, of the Kyoto Protocol. In addition to the expected reductions from federal GHG mitigation measures and policies, provincial plans and actions are expected to contribute to lowering Canada's emission levels over the 2008 to 2012 time period. The projected emission levels will ultimately be verified by the National Inventory Reports, with the Report covering 2008 actual emissions (the first year of the Kyoto Protocol period) submitted on April 15, 2010, and the final report on emissions within Kyoto Protocol period (i.e. covering 2012) due on April 15, 2014. The degree to which Canada has met its emission reduction obligations under the Kyoto Protocol will be assessed after its final report has been filed in 2014.

Canada's allowable emissions under the Kyoto Protocol for the period 2008 to 2012 are 2,792 Mt.

The Government of Canada uses Environment Canada's integrated Energy, Emissions, and Economy Model for Canada (E3MC) to estimate the reduction for the overall integrated package of measures. The modelled runs incorporated the individual initiatives and aggregated the results to estimate Canada's net emission reductions from a continuing trends baseline to report the remaining emission levels for 2010-2012. The use of the model responds to the National Round Table on the Environment and the Economy's (NRTEE) suggested methodological improvement for an "integrative accounting of the emission reduction estimates".

There are a number of key determinants that influence energy supply and demand, and emissions. These determinants include: the pace of economic growth, population and household formation, energy prices (e.g., world oil price and price of refined petroleum products, regional natural gas prices, and electricity prices), technological change, policy decisions, and consumer response to policy price and government actions. Varying any one of these assumptions could have a material impact on the energy and emissions outlook.

Taking all these drivers into consideration could result in the development of some 27 alternative baselines:

- Three economic growth rates: low, most likely, and high
- Three energy price scenarios: low, most likely, and high
- Three effectiveness of government program scenarios: low, most likely, and high

As a basis for assessing the additional reductions required to achieve the GHG emission reduction targets implied by the *Kyoto Protocol Implementation Act*, nine alternative baselines of projected emissions excluding government measures were constructed. Given a projection period of 2010 to 2012 and that preliminary economic growth rates for 2010 are in the public domain, it was decided to use only one set of economic growth rates – those reported in Budget 2011 – and sensitivity analysis was performed around the following energy price and program effectiveness scenarios:

- Three energy price scenarios: low, most likely, and high
- Three effectiveness of government program scenarios: low, most likely, and high

The most likely scenario as well as the overall high and overall low scenarios are presented in this Plan.

EMISSIONS LEVELS – REFERENCE CASE

The projected emissions growth is highly dependent on forecasting assumptions, such as the pace of economic growth and world oil prices. The short-term economic outlook underlying the emissions reference case is grounded in the GDP growth forecast contained in Budget 2011.[19] The Department of Finance regularly surveys private sector economic forecasters on their views on the outlook for the Canadian economy. The economic forecasts reported in this budget, and that form the basis of the Department's fiscal forecasts, are based on a survey conducted in early March 2011 and include the views of 15 private sector economic forecasters.

As illustrated in the table below, the near-term economic projection based on a survey of similar private sector economic forecasters has varied. While the average real GDP growth for the 2010 to 2012 period is similar, there is significant variation in the year-to-year rate of growth. This affects the emissions estimates presented here.

Change in Underlying Real GDP Growth Between the 2010 and 2011 KPIA Plans (%)

	2010	2011	2012	Average 2010-2012
2010 KPIA Plan (Budget 2010)	2.6	3.2	3.0	2.6
2011 KPIA Plan (Budget 2011)	3.1	2.9	2.8	2.6

Under the reference case, the economy is projected to grow at 2.6% per year over the 2010 to 2012 period.[20] Over the same period, the world oil price is assumed to average about $87 per barrel (in US$2010).[21] The natural gas price at Henry Hub is assumed to average about $4.54 per thousand cubic feet (in US$2010).

Under the reference case, Canada's baseline emissions levels (excluding the measures described in this Plan) would be expected to increase from 690 Mt in 2009 to 740 Mt in 2012. Through the federal measures presented in this Plan, emissions levels are expected to be about 5 Mt below the baseline at 721 Mt in 2010 and about 9 Mt below the baseline at 731 Mt in 2012. Given actual emissions for 2008 and 2009 (732 Mt and 690 Mt, respectively) and the reductions anticipated from the measures in this Plan, domestic emissions are expected to be some 805 Mt above Canada's Kyoto Protocol target of 2,792 Mt during the 2008 to 2012 period. This does not include emissions related to land use, land change, and forestry (LULUCF), which will be factored in over the entire compliance period.

[19] Budget 2011 was tabled in the House of Commons on March 22, 2011, by the Honourable James M. Flaherty, Minister of Finance, but was not adopted prior to the dissolution of Parliament on March 26, 2011.
[20] This is similar to the average growth rate assumed in the 2010 KPIA Plan.
[21] The world oil price in the 2010 KPIA Plan was assumed to average $76 per barrel, while the natural gas price at Henry Hub was assumed to average $6.1 per thousand cubic feet (mcf).

Canada's Projected Emission Levels – Reference Emission Scenario					
	Actual Emissions (Mt)		Projected Emissions (Mt)		
	2008	2009	2010	2011	2012
Emissions excluding federal government measures	734	694	726	729	740
Emissions including federal government measures	732	690	721	723	731
Emission reductions from federal measures	2	4	5	7	9

The baseline includes the effects of existing provincial government policies and programs, including those financed by the Clean Air and Climate Change Trust Fund, as well as federal measures announced before April 1, 2006. The combined impact of federal measures announced after April 1, 2006 (and detailed in this Plan) is then estimated to establish a projection of emissions including all measures to date.

EMISSIONS LEVELS – ALTERNATIVE SCENARIOS

Given the uncertainty concerning key modelling assumptions, a set of alternative baselines was developed focused on the following drivers[22]:

- Energy prices: low, most likely, and high world oil price (West Texas Intermediate) and North American natural gas price (Henry Hub).
- Consumer responsiveness to government prices: low, most likely, and high responsiveness to government programs.

In these alternative scenarios, the Budget 2011 economic growth rates for the 2010 to 2012 period prevail. Any variation in the GDP growth rate is due to the interaction with the world oil price and the North American natural gas price.

- The world oil price is assumed to average about $73 per barrel (US$2010) in the low price case and $102 per barrel (US$2010) in the high price case.
- The North American natural price is assumed to average about $4.2 per mcf (US$2010) in the low price case and $5 per mcf (US$2010) in the high price case.
- Consumer responsiveness is assumed to be at the high level in the high responsiveness case and at the low level in the low responsiveness case.

Higher world oil and natural gas prices generally have the effect of increasing energy efficiency, thereby reducing emissions. Likewise, higher energy costs tend to increase the cost of production, thereby lowering manufacturing activity and resulting in lower emissions from these sectors of the

[22] Consideration was given to using alternative economic growth rates for the projection. However, as preliminary economic growth rates for 2010 are in the public domain making the projection period only two years, it was decided to use the economic growth rates reported in Budget 2011. In very short projection periods, there is considerable information to inform projections, as such there is less room for large changes from a "most likely" scenario, limiting the impact on emissions levels.

economy. As an oil-exporting country, however, higher world oil prices will also stimulate increased oil and gas production activity in Canada and increase emissions from that part of the economy.

For the purpose of illustrating sensitivity analysis, only the lowest and highest alternative emission scenarios are presented.

The lowest alternative emission scenario is represented in the table below.

Canada's Projected Emission Levels – Lowest Emission Scenario					
	Actual Emissions (Mt)		Projected Emissions (Mt)		
	2008	2009	2010	2011	2012
Emissions excluding federal government measures	733	693	726	722	733
Emissions including federal government measures	732	690	719	713	721
Emission reductions from federal measures	1	3	7	9	12

Through the federal measures presented in this Plan, emissions levels are expected to be about 7 Mt below the baseline at 719 Mt in 2010 and about 12 Mt below the baseline at 712 Mt in 2012 in the Lowest Emission Scenario. Given actual emissions for 2008 and 2009 (732 Mt and 690 Mt, respectively) and the reductions anticipated from the measures in this Plan, Canada expects to be some 783 Mt above its Kyoto Protocol target of 2,792 Mt during the 2008 to 2012 period in this scenario.

The highest alternative emission scenario is represented in the table below.

Canada's Projected Emission Levels – Highest Emission Scenario					
	Actual Emissions (Mt)		Projected Emissions (Mt)		
	2008	2009	2010	2011	2012
Emissions excluding federal government measures	735	695	726	737	745
Emissions including federal government measures	732	690	723	732	738
Emission reductions from federal measures	3	5	3	5	7

Through the federal measures presented in this Plan, emissions levels are expected to be about 3 Mt below the baseline at 723 Mt in 2010 and about 7 Mt below the baseline at 738 Mt in 2012 in the Highest Emission scenario. Given actual emissions for 2008 and 2009 (732 Mt and 690 Mt, respectively) and the reductions anticipated from the measures in this Plan, Canada expects to be some 823 Mt above its Kyoto Protocol target of 2,792 Mt during the 2008 to 2012 period in this scenario.

Conclusion

With this document, the Minister of the Environment has responded to the publication requirements of Section 5 of the *Kyoto Protocol Implementation Act*.

Provision of Comments

Pursuant to paragraph 5 (3) (a) of the *Kyoto Protocol Implementation Act*, persons are welcome to submit comments about the Plan to the Minister of the Environment, care of:

Director General, Strategic Policy Branch
Environment Canada
22nd Floor – 10 Wellington St.
Gatineau, Quebec
K1A 0H3

Comments must be provided in writing by July 2, 2011.

Annex 1

Methodology for Estimating the Expected Greenhouse Gas Emissions Reductions

Introduction

This annex describes the approaches taken to calculate estimated reductions from the measures detailed in the Plan. Two types of estimation procedures were used. Reduction estimates have been calculated on a case-by-case basis for the individual measures in the document as per section 5 (1) (b) (ii) of the Act. In addition, Environment Canada's integrated Energy, Emissions, and Economy Model for Canada (E3MC) was used to estimate the overall emission reductions for the integrated package of measures and the modelled results were used to report on Canada's emission reductions and total remaining emission levels for 2008-2012, thereby satisfying section 5 (1) (c) of the Act.

Lead departments have developed and applied the methodologies for the calculation of emissions reductions associated with individual measures under their respective responsibility. These individual program methodologies have been provided to Environment Canada and are reproduced below. Environment Canada also has developed and applied specific methodologies for the estimation of overall emissions reductions from the combined effect of these individual programs. This allows for the incorporation of negative and positive interaction effects among government measures in order to construct a robust estimate of their combined impact on national emissions.

The advice of the National Round Table on the Environment and the Economy is a key factor in the Government's methods for estimating reductions. The "Response of the National Round Table on the Environment and the Economy to its Obligations Under the *Kyoto Protocol Implementation Act*" (September 2007) suggested certain methodological improvements for the development and presentation of reasonably expected emission reductions. These included the following:

- Transparency and clarity regarding assumptions and methodologies.
- Consistency in accounting for emission reductions over the relevant time period.
- Integrative accounting of results, where all programs are assessed in an integrated manner and the overall contribution accounts for positive and negative interactions between measures and regulations.

Estimates for Reductions from Individual Measures

This section describes the methodologies used to generate emission reductions from individual measures, as well the resulting emissions levels for Canada in 2008-2012 that are required under paragraphs 5 (1) (b) (ii) of the Act.

Expected reductions from individual measures were estimated by the responsible department, with related parameters incorporated into E3MC. The methodologies for each individual measure are described below.

Regulating Energy Efficiency

Methodology for Actual Reductions 2008-09

Regulations setting minimum energy performance standards effectively remove products that do not meet the standard from the marketplace, with the impact on energy use realized as the existing stock of those products is exhausted. The estimates provided in the Regulatory Impact Analysis Statement (RIAS) for these standards are the source of the estimated actual reductions of these measures.

For each product proposed for regulation, Natural Resources Canada calculates an initial estimate of the energy savings based on the following factors:

- estimates of the current (baseline) level of efficiency of the least efficient, most popular product (determined from internal studies, testing reports, and industry data)
- estimates of a proposed minimum performance level based on engineering studies and experience in other regulating jurisdictions
- expected (baseline) sales or shipments of the product that do not comply with the prospective standard (based on industry data, technological change, and market analysis of trends)
- aggregating on an annual basis the energy savings resulting from the sales of a compliant product

The methodology is the same for actual and projected reductions, but the timing of regulatory amendments is subject to the regulatory process and thus may vary between the two. Information provided during the commentary period following pre-publication may also have an effect on the impact estimates. Impacts for equipment labelling are a percentage of regulatory impacts.

Uncertainty Analysis for Actual Reductions 2008-09

Program methodology combines third-party sector-level data and forecasts, results of published studies and evaluations, and GHG conversion factors and, in doing so, the methodology for calculating the energy impacts of minimum energy performance standards employs conservative assumptions. Over the course of the regulatory process, planning estimates are revised as further analysis and validation through consultation occurs. To create a range for this Plan, qualitative self-assessment considered the uncertainty surrounding the calculated actual reductions to be low, hence a range of +/- 10% is provided.

Methodology for Projected Reductions

The methodology is the same for actual and projected reductions.

- As noted above, initial estimates are refined through the regulatory process, and the details are published in the RIAS.
- On April 16, 2011, the Government of Canada pre-published in the *Canada Gazette, Part I* its intent to delay the coming into force of standards for general service lighting (light bulbs). When finalized, this would delay impacts from this standard and associated labelling activity, which would reduce the projected reductions for 2012. The emission reduction calculations have been adjusted accordingly.

In addition, impacts for labelling programs for equipment are estimated as a percentage of regulatory impacts, based on program analysis.

The estimated energy savings are converted to GHG reductions using standard GHG conversion factors.

Reductions are considered fully incremental for this time period. Regulations address sales of inefficient products that continue to be traded despite the availability of more effective, commercially-acceptable alternatives, while labelling provides consumers with information required to identify the more efficient choices for the type of product they wish to buy.

With respect to section 5 (b) (ii) of the Act, it is not immediately possible to make comparisons between the actual and projected emission reductions achieved by the equipment, buildings and houses, retrofit and industry programs and the National Emissions Inventory, primarily with regard to emission reductions achieved from electricity savings. Natural Resources Canada will work with Environment Canada to resolve questions related to input data and definitions to determine the appropriate relationship between electricity savings and emission reductions from electricity generation.

Uncertainty Analysis for Projected Reductions

Projected reductions are provided as reflected in the RIAS (December 24, 2008; April 16, 2011). The impacts are adjusted as required to account for changes to regulatory timing (e.g., the inclusion of general service lighting under Amendment 10 resulted in a longer consultation period).

It should be recognized that though the estimated reduction profile (by year) has changed in response to regulatory and market conditions, the long-term GHG impacts (to 2020) of energy efficiency regulations are expected to be greater than previously estimated. The decline in expected reductions in the early years of the regulatory framework should be considered deferred rather than lost.

Reducing Greenhouse Gas Emissions from New Cars and Light Trucks

The passenger automobile and light truck GHG emission regulations apply to companies that manufacture or import new passenger automobiles and light trucks of the 2011 and subsequent model years for the purpose of sale in Canada. The standards will require substantial environmental improvements from new vehicles and would put Canadian GHG emission standards at par with U.S. national standards. Effectively, therefore, there will be common Canada-U.S. GHG emission standards beginning in 2012.

Through the implementation of the proposed standards, it is anticipated that the average GHG emission performance of the 2016 Canadian fleet of new cars and light trucks would achieve an average level of 157 g CO_2/km (252 g CO_2/mile). This would represent an approximate 25% reduction compared to the new vehicle fleet that was sold in Canada in 2008.

Methodology for Actual Reductions 2008-09

The follow steps were taken to estimate “actual” emissions related to the implementation of the passenger automobile and light-duty truck GHG emission regulations:

- A baseline without any measures was developed (i.e. No Programs Case)
- An alternative baseline was developed to reflect the implementation of all provincial and territorial emission reduction actions (Provincial Actions). This included provincial and territorial programs aimed at reducing emissions from road transportation (e.g., biofuel standards, public transit incentives, and other measures).

- The difference between the passenger and light duty vehicle emissions in the Provincial Actions Baseline and the same categories of emissions in the National Emission Inventory represent "actual" emission reductions.

The issue of additionality was addressed by comparing the emissions under a modelled scenario where only the passenger automobile and light-duty truck GHG emission regulations are modelled to a scenario where the regulations are modelled in combination with other measures aimed at reducing road transportation emissions (e.g., ecoTRANSPORT measures and biofuel regulations). This provides the "incremental" impact of the regulation, taking all other road transportation-related measures into consideration.

Uncertainty Analysis for Actual Reductions 2008-09

The uncertainty ranges generated for the mandatory passenger automobile and light-duty truck GHG emission regulations were generated using the lowest and highest alternative emission scenarios. In addition, a low and high consumer response in terms of purchase of new vehicles was also modelled.

Methodology for Projected Reductions

Environment Canada's E3MC model was used to estimate the emissions reductions from the mandatory passenger automobile and light-duty truck GHG emission regulations. Actual sales-weighted and on-road fleet fuel economy performance for 2008 and 2009 is included in the E3MC reference case. The sales-weighted fuel economy performance for cars and light-duty trucks was provided by Transport Canada[23], while the on-road performance was provided by the Office of Energy Efficiency at Natural Resources Canada. E3MC has four broad vehicle categories: small cars, large cars, light-duty trucks, and SUVs. For each category, E3MC has new vehicle sales, price of new vehicles, on-road stock, survival rates, average fuel economy performance, vehicle-kilometres travelled, energy use, and associated emissions. These parameters are reported on an annual basis.

The modelling of the targeted reductions under the mandatory passenger automobile and light-duty truck GHG emission regulations was approached as follows:

- *Establishing the baseline:* To provide a robust projection of passenger automobile and light-duty truck energy use, E3MC is calibrated using the most recent transportation data from Statistics Canada and the Office of Energy Efficiency. The model considers historic vehicle sales, cost, energy use, and new vehicle fuel efficiency to project across vehicle classes. E3MC then aggregates these results and provides an overall outlook on vehicle performance and vehicle energy consumption. The baseline assumes a continuous improvement in new vehicle fuel efficiency driven by policy in the U.S., energy prices, and adoption of more efficient technology. E3MC explicitly models passenger automobiles (i.e. small and large cars), light-duty trucks, and SUVs. Vehicle sales, cost, and new vehicle fuel economy performance were established for each category. Total energy use for the on-road stock for each vehicle class was projected.[24]

[23] The Government of Canada, in conjunction with the motor vehicle industry, sets Company Average Fuel Consumption (CAFC) targets annually. The CAFC targets represent the maximum weighted average fuel consumption numbers for new light-duty vehicles. There are two annual CAFC targets for new light-duty vehicles – one for passenger cars and another for trucks. Historically, Canada's CAFC targets have been harmonized with the Corporate Average Fuel Economy (CAFE) standards in the U.S. The current CAFC goal is 8.6 litres per 100 km for passenger cars and 10.2 litres for light-duty trucks. For 2008, the sales-weighted performance for the fleet is 7.1 litres per 100 km for passenger cars and 9.5 litres per 100 km for light-duty trucks.

[24] Population over the age of 18 was chosen as a key driver for projecting energy use and associated emissions from passenger vehicles and light-duty trucks. Statistical analysis shows that population over the age of 18 is the most highly correlated driver, and hence represents the "best-fit".

- Under the business-as-usual (BAU) scenario, there are two possible assumptions for vehicle fuel performance. First, vehicle fuel performance remains at the CAFC standard for the entire period (i.e. 8.6 litres per 100 km for passenger cars and 10.2 litres per 100 km for light-duty trucks). Second, continuous improvement in fuel economy is driven by policy in the U.S., energy prices, and technology independent of the proposed regulations. Given the influence of the U.S. policy on the Canadian market, fuel economy of new vehicles is assumed to improve over the projection period.
- *Modelling the mandatory passenger automobile and light-duty truck GHG emission regulations:* The response of automobile manufacturers to the mandatory regulations is estimated using new vehicle fuel efficiency projections calculated based on cost-minimizing adoption of emission-reducing technologies. For example, due to their relative cost effectiveness, improvements in the emissions performance of air conditioning units in passenger vehicles and light-duty trucks are expected to be adopted by all automobile manufacturers (reduction in refrigerant leakage and improved operating efficiency). The total improvement in emissions performance of passenger automobiles and light-duty trucks is therefore the combined effect of improvements to vehicle air conditioning units plus other adoptions of emission reducing technologies in ascending order of cost.
- *Targeted reductions:* The reductions are assumed to be the difference between new fleet emissions performance in the BAU and emissions under the mandatory passenger automobile and light-duty truck GHG emission regulations scenario. Given the choice of BAU emission levels for passenger and light-duty trucks, the estimated reduction levels could be considered as the "best" representation of the incremental impact of the mandatory regulation.[25] The estimated reductions explicitly capture effects such as the rebound effect (i.e. consumers driving greater distance than expected due to lower driving costs) and additionality.

With respect to additionality:

- Emissions intensity of passenger automobile and light-duty trucks is assumed to improve throughout the period in the BAU case, so the impact of the regulations does not include "normal" efficiency improvements in response to rising fuel prices in the forecast.
- The emissions reduction impact of passenger automobile and light-duty truck GHG emission regulations is assessed under several scenarios:
    - The passenger automobile and light-duty truck GHG emission regulations are modelled as the only action. This provides a reduction estimate under the assumption of maximum additionality (as presented in the main body of this Plan).
    - The passenger automobile and light-duty truck GHG emission regulations are modelled in combination with other measures aimed at reducing road transportation emissions (e.g., ecoTRANSPORT measures and biofuel regulations). This provides the "incremental" impact of the regulation, taking all other road transportation-related measures into consideration, as recommended by the National Roundtable on the Environment and Economy (and presented in the table below).

[25] Based on industry sources, some 40% of a model year is sold in the previous calendar year, with the remaining 60% being sold in the model year calendar year. As such, reductions are anticipated for 2010, resulting from the purchase of model year 2011 vehicles sold in 2010.

Greenhouse Gas Emission Reductions Net of Other Transportation Measures					
	Actual Reductions (Mt)[26]		Projected Reductions (Mt)		
	2008	2009	2010	2011	2012
GHG Reductions	0	0	0.04	0.15	0.32

As the emissions reduction will only start in 2010, a comparison between this measure and the National Emissions Inventory is not possible at this time.

Uncertainty Analysis for Projected Reductions

The analysis of the impact of the mandatory passenger automobile and light-duty truck GHG emission regulations is sensitive to assumptions regarding vehicle sales, technology options and associated costs, gasoline and diesel prices, and market (consumer and manufacturer) behaviour. Given the numerous combinations and permutations, sensitivity analysis was done using the lowest and highest alternative emission scenarios. In addition, the low and high consumer response was also modelled.

Regulating Renewable Fuels Content

Methodology for Actual Reductions 2008-09

Reductions start in 2010. See Projected Reductions.

Uncertainty Analysis for Actual Reductions 2008-09

Reductions start in 2010. See Projected Reductions.

Methodology for Projected Reductions

The estimated emission reductions were calculated by multiplying emission factors by the renewable fuel volumes required to meet the federal and existing provincial mandates. The emission factors used were based on Natural Resources Canada's GHGenius model. The emissions factors are presented in the following table.

[26] No reductions were realized in 2008 and 2009, as the regulations came into effect in 2010.

Emissions Factors Used (based on NRCan's GHGenius model)	
Renewable fuel type	**Emission factor Mt CO_2e per billion litres renewable fuel**
Corn ethanol	1.190
Wheat ethanol	1.470
U.S. central ethanol (corn)	0.740
Canola biodiesel	3.012
Soy biodiesel	2.704
Tallow biodiesel	3.228
Diesel – west	3.663
Diesel – east	3.456
Kerosene	3.348
Kerosene reduction – west	0.415
Kerosene reduction – east	0.203
Nestle HVO	1.470
U.S. soy biodiesel	2.463

The anticipated reductions are based on the total volume of renewable fuels that would be required by the federal regulations, minus the volume of renewable fuels from provincial regulations that had been finalized at the time (ethanol: British Columbia, Saskatchewan, Ontario, and Manitoba; biodiesel: British Columbia, Alberta, and Manitoba). The reduction estimate for the 2011 KPIA is an approximation based on a proposed July 2011 start date for the federal biodiesel regulation amendments. As for previous estimates, ethanol and biodiesel volumes in the market prior to 2010 are not accounted for.

The business as usual (BAU) scenario is based on an estimated growth in demand for gasoline, diesel fuel, heating distillate, and renewable fuels. The demand volumes for these fuels were calculated by starting with the actual demand for 2008 and applying growth rates. These growth rates were based on annual increases in demand, predicted in Natural Resources Canada's "Canadian Energy Outlook for the years 2008-2020."

The emission reductions attributable to provincial mandates were subtracted from the overall reductions to arrive at the incremental reductions due to federal actions.

Uncertainty Analysis for Projected Reductions

A range of GHG emission reductions was estimated based on either including or excluding the effect of provincial regulations on the incremental volume of renewable fuel volume required by the federal Renewable Fuels Regulations. The high estimate is the expected GHG reductions based on the total volume of renewable fuels that would be required by the federal regulations. The low estimate is the expected GHG emission reductions based on the total volume of renewable fuels that would be

required by the federal regulations, minus the volume of renewable fuels from finalized provincial regulations (British Columbia, Saskatchewan, Ontario, Alberta, and Manitoba).

In calculating estimated emission reductions, assumptions were made regarding the distribution of the various types of renewable fuels, based on the current and planned production of renewable fuels in Canada. It was also assumed that some level of imports of renewable fuels, primarily from U.S., would be needed during the first three years of the regulations coming into force while domestic production capacity expands.

Natural Resources Canada's GHGenius tool also models life-cycle emissions based on various input parameters and pathway assumptions.

Pulp and Paper Green Transformation Program

Methodology for Actual Reductions 2008-09

Actual reductions are defined as those GHG reductions actually achieved as of the end of December 2010, that is, those reductions resulting from projects that were physically completed during 2010 that resulted in a change in operating conditions, relative to pre-project conditions, during that calendar year. The reductions presented include a "direct" and an "indirect" component. Annual reductions were calendarized by multiplying by the proportion of the year over which a project was operational (e.g. if a project was physically completed at the end of June 2010 - halfway through the year - calculated annual emission reductions were divided by two).

"Direct reductions" are those GHG reductions resulting from reduced usage of fossil fuels on mill sites. To calculate "direct reductions", each mill's annual post-project usage of fossil fuels and biomass (physical quantities) was compared to its pre-project annual usage. Each change in the physical quantity of a fuel used was converted to GHG (tonnes of CO_2e) to yield the net reductions using the National Council for Air and Stream Improvement's accepted factors for pulp and paper facilities (NCASI v3.2).

"Indirect reductions" are those GHG reductions resulting from increased production of electricity from renewable sources (biomass or spent pulping liquor) or electricity savings from energy efficiency improvements. It is assumed that the production of renewable electricity and electricity savings offset the production of electricity by conventional producers. To calculate "indirect reductions" each mill's post-project production of renewable electricity and usage of electricity was compared to its pre-project production/usage. Each change in electricity production/usage was converted to GHGs (tonnes of CO_2e) using a national emissions factor for marginal electricity generation (0.46588 tonnes CO_2e/MWh).

Information on mill energy usage was provided by the proponents through their project proposals, a series of post-project reports, and confirmed through technical evaluation by the PPGTP. In addition, selected projects are subject to site audits by PPGTP technical staff.

Uncertainty Analysis for Actual Reductions 2008-09

All GHG reduction figures provided for the 2010 calendar year are based on data available as of early March 2011. Proponents may continue to submit amendments to approved projects past this date, thus there exists the potential for GHG reductions to change. In addition, figures may be adjusted based on the results of project technical reviews and/or audits (program experience to date has demonstrated the potential for a project's GHG reduction estimates to be adjusted in either direction). For this reason, actual GHG reductions are presented as a range (±5% of calculated reductions). Low

estimates were selected as the actual expected reductions, as they reflect conservative program estimates.

Methodology for Projected Reductions

Projected reductions are defined as those reductions expected to be achieved during the 2011 and 2012 calendar years, based on project proposals received as of March 2011. To date, proposals for $876 million (92%) of available PPGTP funds have been received by the program. Thus, these projects are deemed a sufficient basis on which to calculate projections for the final years of the program.

Projected reductions are those reductions resulting from PPGTP projects that are expected to be physically completed in either 2011 or 2012, summed with the reductions attributable to projects that were completed in the previous year(s) (e.g., projects that generate GHG reductions that were completed in 2010 are considered to generate GHG reductions in 2010, 2011, and 2012). Emission reductions are expected to persist throughout the operational lifespan of the project equipment. All PPGTP projects are expected to be completed in 2012.

The calculation of "direct" and "indirect" projected reductions was completed using the same methodology as described for actual reductions. Projected GHG reductions were calendarized in the same manner as the actual GHG reductions, based on forecasted project completion dates. Changes in fuel consumption and electricity production/usage were taken from project proposals as submitted by proponents. The majority of projects used in calculations have been approved by the PPGTP and were therefore subject to technical verification.

It was not considered appropriate to adjust projected reductions for additionality given the scope and nature of the PPGTP. The PPGTP funds projects with environmental improvements in Canadian pulp and paper mills. Given the lack of investment capital available to these companies, the likelihood of these projects, many of which have very low returns-on-investment, being implemented was considered extremely minimal. This assumption is further supported by the fact that even projects demonstrating high returns-on-investment were not being implemented prior to the introduction of the PPGTP. Extreme capital constraints (worsened by the economic downturn) force mills to devote their limited resources to emergency maintenance, rather than the type of system-level improvements funded by this program. Based on this, all of the projected emissions reductions associated with PPGTP projects are considered directly attributable to this program.

PPGTP funding is offered to Canadian pulp and paper companies based on their production of black liquor, a by-product of the chemical pulping process. As such, it is targeted at only one segment of the wider Canada pulp and paper industry, making a direct comparison of the GHG produced by the industry and the reductions attributable to the PPGTP less informative. That being said, the 2008 National Inventory Report (NIR) listed the GHG emissions from the Canadian pulp and paper sector (stationary sources) as 4.54 Mt CO_2e. Direct reductions[27], from lower fossil fuel usage on mill sites, attributable to the PPGTP over the Kyoto reporting period (2008-2012) are estimated at 0.59 Mt (13% of total sector emissions). The PPGTP estimate treats emissions from biomass combustion (black liquor and hog fuel) in a manner consistent with the NIR, that is, only CH_4 and N_2O emissions are considered. Emission reductions are calculated by subtracting mills' post-project GHG emissions from their pre-project emissions (the baseline).

[27] Please note this is only the "direct" contribution - it does not include the emissions offset as the result of electricity savings or green energy production.

Uncertainty Analysis for Projected Reductions

All projected GHG reductions provided for the 2011 and 2012 calendar years are based on estimates provided by proponents as of March 2011. Proponents may continue to submit amendments to approved projects past this date, thus there exists the potential for GHG reductions to change. Figures may also be adjusted based on the results of project technical reviews and/or audits (program experience to date has demonstrated the potential for a project's GHG reduction estimates to be adjusted in either direction), as well as in the event of project delay. Projected GHG reductions are presented as a range (±5% of calculated reductions). Because not all project proposals have been submitted, and the PPGTP expects additional GHG emission reductions will be associated with at least some of these expected proposals, the calculated projected GHG reductions were selected as the expected reductions (the low estimates were deemed too low, given that more project proposals are expected to be received).

ecoENERGY for Renewable Power

Methodology for Actual Reductions 2008-09

Renewable power projects supported under the ecoENERGY for Renewable Power (ecoRP) program provide quarterly invoices for each project showing actual metered production measured during each quarter. Yearly production is calculated by adding production of the four quarters in each year.

The GHG emission factor used for the estimates of GHG reductions is based on the GHG emission intensity of marginal electricity generation in each province (since it is assumed that incremental renewable power generation replaces existing generation at the margin). To obtain a national factor, the emissions factor for the marginal fuel in each province was weighted by the provincial share of electricity generation and then summed. Thus, a cross-Canada GHG emission factor of 465.88 t/GWh was used. The value of the emission factor used directly influences the estimate of GHG reductions. Any uncertainties in the emission factor therefore have a direct impact on the uncertainty of the emissions estimate.

GHG emission reductions were estimated using the following equation:

GHG emission reductions = Actual renewable energy production × GHG emission factor

Uncertainty Analysis for Actual Reductions 2008-09

These are actual reductions based on actual production. The program considers that all projects funded are incremental and would not have been done without program support.

Methodology for Projected Reductions

To calculate GHG emission reduction for future years, "renewable energy production" is estimated based on expected production provided for each project.

The program is designed to encourage 14.3 terawatt-hours of electricity production per year by 2011-12 (translates to about 4,000 megawatts of renewable power capacity). The terawatt-hour target is directly related to the program's transfer payment budget of $1.43 billion through a production incentive equivalent to 1 cent/kWh. Consequently, the calculations of GHG emissions are related to the amount of electricity produced on a yearly basis, i.e. GWh or TWh, and the transfer payments made to recipients.

The amount of electricity produced is dependent on two key factors:

- The amount of megawatts from each of the renewable sources (wind, hydro, biomass, solar PV, etc.) and when these megawatts come online or are commissioned and
- The expected capacity factor for each technology.

At program inception, the following assumptions were used:

Fiscal year	Cumulative expected capacity	Cumulative average capacity factor	Expected production per fiscal year	High forecast GHG reduction
	MW	%	GWh/yr	Mt CO_2
2007-08	1,120	37.37%	2,139	0.996
2008-09	2,020	40.33%	4,726	2.20
2009-10	2,970	42.42%	8,023	3.74
2010-11	4,000	43.64%	11,689	5.45
2011-12	4,000	43.64%	14,314	6.67

These numbers were later refined as projects came online and more certainty about their production was available. A switch to calendar year was also made in 2011.

Year of production	Annual expected production	Annual actual production	Annual expected GHG reduction	Annual actual/expected GHG reduction
	GWh/yr	GWh/yr	(Mt CO_2/yr)	(Mt CO_2/yr)
2008	2,742.83	2,435.40	1.28	1.13
2009	5,461.49	4,713.15	2.54	2.20
2010	9,027.08	9,027.08	4.21	4.21
2011	12,974.41	12,974.41	6.04	6.04
2012	13,952.88	13,952.88	6.50	6.50

Note: 2008 and 2009 numbers are actual, 2010 to 2012 are expected. The numbers are all on a calendar-year basis.

Uncertainty Analysis for Projected Reductions

The uncertainties surrounding these factors and how they were mitigated at the program development stage are described below.

- For each year (2007 to 2011), the program estimated certain megawatts of capacity per technology coming online or being commissioned. About 4,000 MW of projects were expected to be commissioned by March 31, 2011, which is the end of the implementation period for the program. The expectations surrounding the type and timing of projects coming online were based on industry consultations, technical expertise, and on intelligence from the Wind Power Production Incentive (WPPI) program.
- Most renewable energy sources are intermittent and each renewable technology has a different capacity factor[28]. During program design, the capacity factors used for each technology type were based on consultations with industry, recommendations of the Commissioner of the Environment and Sustainable Development, and experience from the WPPI program. As a result, each technology has a maximum limit on the capacity factor.

The uncertainties surrounding the low and expected emission reductions take these two factors into consideration.

Contribution agreements are signed for each project based on the maximum allowable production that a project will generate. This constitutes the high projection level of the expected production and GHG reductions.

Under the WPPI program, the predecessor program to ecoRP for wind power, the actual production level has been shown to be on average 90% of this high projection level. Because the ecoRP program includes deterrents for underproduction, it is believed that this 90% level constitutes a low projection level.

Expected projection is estimated at 93% of the high level based on past performances of projects.

In summary: The high projection level for GHG reductions is the total production estimate for all projects as shown under their contribution agreements multiplied by the GHG emission factor discussed above.

It is not feasible to make comparisons between the actual and projected emission reduction calculations achieved via ecoENERGY for Renewable Power and the National Emissions Inventory due to fundamental differences in the scope of analysis and methodology between the national inventory data and that of the program. Program objectives are specific to renewable energy deployment projects and the associated GHG emission reductions are achieved on a project specific basis. Conversely, the National Emissions Inventory for the electricity subsector captures large and periodic fluctuations in year-to-year emissions that can result from numerous factors (e.g., economic slowdowns, fluctuations in the national electricity supply mix), which fall outside the scope of the program and therefore make a direct comparison very difficult.

[28] The capacity factor relates actual electricity produced to the theoretical total capacity of a power installation and is expressed in percent. The higher the capacity factor, the higher the production of electricity per megawatt of capacity. As a simplified example, if the wind is expected to blow 30% of the time, a wind turbine would have a capacity factor of 30%.

ecoENERGY for Renewable Heat

Methodology for Actual Reductions 2008-09

For the projects in the industrial, commercial, and institutional sectors, GHG emission reductions were estimated based on:

- associated energy savings of individual systems and
- an emission factor based on avoided fuels.

Specifically, GHG reductions are calculated for each system in the following manner. The energy saved or displaced per year for each system is determined using one of the following modelling software: RETScreen, SWIFT, WATSUN, TRNSYS, T*Sol, Enerpool, Polysun, or F-Chart. These models have been tested and evaluated for accuracy. The calculated energy saved is multiplied by a factor based on the fuel displaced. Presented in terms of tonnes CO_2 equivalent per GJ saved or displaced, the factors used were: 0.05069 (natural gas); 0.06275 (propane); 0.07328 (fuel oil); and 0.150 (electricity). The factors used for natural gas, propane, fuel oil, and electricity were 0.05069, 0.06275, 0.07328, and 0.150 tonnes CO_2 equivalent per GJ saved or displaced, respectively.

It was assumed that all systems deployed under the program are incremental and would not have been deployed in absence of the program. This assumption is reasonable since in the past, when an incentive was not available, the systems were not deployed.

Uncertainty Analysis for Actual Reductions 2008-09

The projects that contribute to actual reductions have been completed and, given that the size of the systems and the modelled energy savings and fuel displaced are known, uncertainties have been addressed. Therefore, low, high, and expected GHG emissions reduction numbers are same.

Methodology for Projected Reductions

For the projects in the industrial, commercial, and institutional sectors, GHG emission reductions were estimated based on:

- the number of expected systems completed,
- the associated energy savings of individual systems, and
- an emission factor based on avoided fuels.

The number of systems expected to be completed annually and the associated energy savings of individual systems were based on the funding level and the program experience acquired under the Renewable Energy Deployment Initiative (REDI) program. Under the REDI program, the systems also estimated energy savings per year for each system using one of the following modelling software: RETScreen, SWIFT, WATSUN, TRNSYS, T*Sol, Enerpool, Polysun, or F-Chart. Presented in terms of tonnes CO_2 equivalent per GJ saved or displaced, the factors used were: 0.05069 (natural gas); 0.06275 (propane); 0.07328 (fuel oil); and 0.150 (electricity). The emissions factor used for natural gas, propane, fuel oil, and electricity were 0.05069, 0.06275, 0.07328, and 0.150 tonnes CO_2 equivalent per GJ saved or displaced, respectively.

For deployments under the residential pilot initiative, the typical residential hot water system is expected to result in 1.5 tonnes of GHG emission reductions. The number of projects expected was multiplied by 1.5 to determine the estimated GHG emission reductions.

It is not feasible to make comparisons between the actual and projected emission reduction calculations achieved via ecoENERGY for Renewable Heat and the National Emissions Inventory due to fundamental differences in the scope of analysis and methodology between the national inventory data and that of the program. Program objectives are specific to renewable energy deployment projects and the associated GHG emission reductions are achieved on a project-specific basis. Conversely, the National Emissions Inventory for the heat subsector captures large and periodic fluctuations in year-to-year emissions that can result from numerous factors (e.g., economic slowdowns, fluctuations in the national electricity supply mix), which fall outside the scope of the program and therefore make a direct comparison very difficult.

Uncertainty Analysis for Projected Reductions

The uncertainties surrounding these factors and how they were mitigated at the program development stage are described below:

1) The estimate for the expected number of systems to be supported by the program was based on experience with the Renewable Energy Deployment Initiative (REDI) program, knowledge of the solar thermal industry and the level of program funding and adjusted given the experience of the first years of the program. The expected reductions were based on the assumption that the program will support the deployment of 1,268 units of solar thermal systems (air and water heating) in institutional, commercial, and industrial (ICI) sectors, and complete nine residential pilot projects for a total of 1,154 solar domestic water systems.

2) Expected energy savings resulting from the supported systems were based on the modelled results of completed projects under the REDI program. For residential pilot projects, the energy savings per system was based on the solar energy yield of a typical solar system as tested at the National Solar Test Facility.

3) Emissions factors for avoided fuels: The relative proportion of fuels displaced for systems supported by the program was based on the proportion of fuels displaced for systems completed under the REDI program, and on the energy use split for hot water in Canada's commercial and residential sector as per the Energy Use Data Handbook published in June 2005. The forecast of the fuel displaced has a large degree of influence on the estimate of GHG reductions since the fuel types displaced have significantly different emissions factors.

ecoENERGY for Buildings and Houses

Methodology for Actual Reductions 2008-09

This program has several elements, the impacts of which were calculated individually.

Housing Component:

Home energy ratings (actual observations) are submitted to the program by energy advisors. For existing housing and new housing, the impact assumptions described under Projected Reductions Methodology are applied to monitored results. Also for new housing, actual housing starts are monitored and applied to the impact assumptions noted under Projected Reductions Methodology annually. Program results are calculated with actual observations recorded in the program database.

Buildings Component:

New Buildings

- Actual updated code impact is based on:
  - an assessment of the energy efficiency gains of the updated code over the previous building code;
  - estimates of commercial and institutional floorspace construction; and
  - an estimate of the compliance rate to the building code.
- The actual impact of the building design validation service is calculated using the actual energy efficiency gains of the designs over the current building code.

Existing Buildings

- The actual impact of training and information workshops is estimated using:
  - the number of participants reached;
  - the average energy use of buildings participating in a typical Office of Energy Efficiency program; and
  - the expected percentage of improvement in energy efficiency following participation in training and information workshops.

Uncertainty Analysis for Actual Reductions 2008-09

Program methodology combines monitored participation, third-party sector-level data and forecasts, results of published studies and evaluations, and GHG conversion factors. Participation is accurately measured, but the other elements seldom elaborate on the accuracy of their quantitative conclusions. Thus conservative assumptions are made. To create a range for this Plan, qualitative self-assessment considered the uncertainty surrounding the calculated actual reductions to be medium; hence a range of +/- 25% is provided.

Methodology for Projected Reductions

Housing Component:

- New Housing: The expected energy savings per house were calculated by comparing the average (baseline) energy consumption of typical new homes with the average energy consumption of houses rated under best-in-class energy efficiency initiatives such as the R-2000 Standard and ENERGY STAR for New Homes. To obtain total energy savings, the savings per house is multiplied by the number of houses expected to be built and labelled. The impact of the program's training activities on (baseline) general construction practices is also included and is measured by tracking the improving performance of typical new homes and housing starts.

- Existing Housing: Overall energy savings were calculated by taking the average energy savings resulting from actions taken as a result of energy evaluations and the expected improvements per evaluated home, and multiplying these savings by the number of homes that are expected to be evaluated each year and those that have not converted their participation to a post-retrofit evaluation.

Buildings Component[29]**:**

- New Buildings
  - The anticipated impact of the updated energy code for buildings is based on:
    - estimates of the energy efficiency gains of the updated code over the previous (baseline) energy code;

[29] The sub-bullets for new and existing buildings are multiplicative.

        - forecasts of commercial and institutional floorspace in new construction; and
        - estimates of the compliance rate to the building code.
    - The anticipated impact of the building design validation service was estimated using
        - the expected number of designs validated;
        - the expected energy efficiency gains per unit of floorspace, compared to the current building code (baseline); and
        - the expected average floorspace of buildings participating in the program.
- Existing buildings
    - The anticipated impact of training and information workshops was estimated using
        - the expected number of participants reached and the number of buildings they represent;
        - the average (baseline) energy use of buildings participating in a typical Office of Energy Efficiency buildings program; and
        - the expected percentage of improvement in energy efficiency.

The estimated energy savings are converted to GHG reductions using standard GHG conversion factors.

Reductions are considered fully incremental for this time period, and are based on conservative assumptions. The development process and publication of an updated energy code for buildings encourage and enable more energy efficient building codes. The information, training, and capacity building elements address what is sometimes referred to as the “significant status quo bias” of energy consumers.

With respect to section 5 (b) (ii) of the Act, it is not immediately possible to make comparisons between the actual and projected emission reductions achieved by the equipment, buildings and houses, retrofit and industry programs and the National Emissions Inventory, primarily with regard to emission reductions achieved from electricity savings. Natural Resources Canada will work with Environment Canada to resolve questions related to input data and definitions to determine the appropriate relationship between electricity savings and emission reductions from electricity generation.

Uncertainty Analysis for Projected Reductions

Expected reductions represent conservative estimates of program impacts. For this Plan, qualitative self-assessment considered the uncertainty surrounding the calculated actual reductions to be medium; hence a range of +/- 25% is provided.

In the building sector, the estimates face uncertainties that are explained below:

- **Buildings Component:**
    - Updated energy code: We use estimates based on investment data provided by Informetrica Ltd. Estimated compliance rates with building energy codes are based on American studies. Finally, floorspace growth is highly dependent on economic cycles; forecasted floorspace growth may not fully reflect the economic situation that prevails during program implementation.
    - Energy training and information workshops: The expected energy efficiency is based on international studies related to impacts of information and awareness programs. The most conservative number was used.

- **Housing Component:**
  - Existing Housing: Reductions are based on information collected from annual surveys that revealed that program participants who did not submit a grant application still carried out at least one recommended improvement. On-site verification was not performed.
  - New Housing: Energy ratings are determined by modelling software.

ecoENERGY Retrofit Initiative

Methodology for Actual Reductions 2008-09

Homes Component: Actual grant applications provide the basis for this calculation. Eligible retrofits are verified on-site by a Natural Resources Canada certified Energy Advisor. File submissions are evaluated for risk and may be subjected to three levels of quality assurance. Energy savings are based on pre- and post-retrofit evaluations and use computer generated calculations based on standard operating conditions normalized for lifestyle and average weather conditions.

Small and Medium Organizations – Buildings and Industry: Actual contribution applications provide the basis for this calculation, with energy savings calculated by a certified technologist or professional engineer.

Uncertainty Analysis for Actual Reductions 2008-09

Given the amount of actual data that is collected, the level of quality assurance, and the 3% standard accuracy of the blower door test that is a key element of the home energy evaluation, the uncertainty surrounding the calculated energy savings from retrofit projects is low. For the program as a whole, however, the findings of an evaluation conducted in 2010 indicated a net-to-gross ratio of 0.70 to 0.78, which is used here to create a new range for the estimated impacts. The adjusted expected actual reductions are set at the mid-point of the range for 2008 and 2009.

Methodology for Projected Reductions

Projected reductions from this program were estimated using information from technical and past program files, specifically, the average savings and participation rates for each sub-component of the initiative, subject to the limitations of the program design.

- **Homes Component:** The estimate of emissions saved was based on the expected energy savings per house multiplied by the number of houses expected to participate in the program. Energy savings were based on Natural Resources Canada's program experience in this area, while the number of houses was estimated using a combination of past program participation and current funding levels.
- **Small and Medium Organizations – Buildings and Industry:** The impact estimates represent the expected average energy savings per project multiplied by the expected number of projects, based on experience with past program participation and subject to current funding levels.
- **ecoENERGY Retrofit – Existing Buildings Initiative:** The estimated energy reduction was based on actual proposals received and their associated energy reduction estimates.

The estimated energy savings are converted to GHG reductions using standard GHG conversion factors.

The baseline assumption is that grant applicants would not have made investments to realize the expected incremental energy savings without encouragement from the program. However, a range is provided considering the uncertainty of this assumption.

With respect to section 5 (b) (ii) of the Act, it is not immediately possible to make comparisons between the actual and projected emission reductions achieved by the equipment, buildings and houses, retrofit and industry programs and the National Emissions Inventory, primarily with regard to emission reductions achieved from electricity savings. Natural Resources Canada will work with Environment Canada to resolve questions related to input data and definitions to determine the appropriate relationship between electricity savings and emission reductions from electricity generation.

The unadjusted reductions, comparable to those stated in previous Plans, are presented in the table below.

Actual Reductions (Mt)		Projected Reductions (Mt)		
2008	**2009**	**2010**	**2011**	**2012**
0.39	0.89	1.58	1.75	1.75

Uncertainty Analysis for Projected Reductions

Free-ridership was initially expected to have minimal influence on expected GHG reductions. This is due to incentive eligibility being designed to minimize this practice (e.g., requiring a minimum one-year project payback period for those Small and Medium Organization projects receiving funding; requiring a pre-project energy assessment or audit; not incenting projects that begin prior to official approval being received from Natural Resources Canada).

Projected reductions are provided as a range to reflect the inherent uncertainty and risks involved in program delivery. Expected reductions represent a conservative estimate of program impacts.

- Small and Medium Organizations - Average project size estimates proved to be over-estimated, as SMO projects submitted are at a lower average size than expected. In order to increase the number of project submissions and meet energy reduction targets, the program intensified and targeted promotion, accelerated approval processes in order for proponents to start their projects faster, eliminated the 12-month waiting period for subsequent project proposals, and signed collaboration agreements with provincial energy efficiency programs. These mitigating activities had positive impacts on a number of project submissions, as it is estimated that the number of projects will be 50% over the original estimates. However, the total energy reduction will be lower than the initial estimates, mainly due to the lower-than-estimated average yield (project size), measured in GJs for energy and Kts for GHG.
- ecoENERGY Retrofit includes the final year of the Existing Buildings Initiative, a program that began in 1998. The 2008 results (ascribed to ecoENERGY Retrofit) were not fully met, as many proponents withdrew their projects due to the end of the program.

A 2010 evaluation that covered the elements of this program concluded that net-to-gross ratios for their impacts ranged from 0.26 to 0.84. The net-to-gross at the higher end of this range was for the homes component of the program. Given that the homes component is the largest element of program impacts, the combined impact for the program overall may result in a net-to-gross ratio of 0.70 to 0.78. Some further analysis would help determine the most appropriate number for adjusting estimates and ranges of actual and potential reductions. However, for this Plan, the range of projected reductions has been adjusted to 0.70-0.78 of the previous expected levels, and the adjusted expected reduction in each year is set at the mid-point of the range.

ecoENERGY for Industry

Methodology for Actual Reductions 2008-09

Actual reductions were calculated by multiplying the average energy savings per participating facility (based on technical studies and past program files) by the actual number of participants for the informational and the instructional elements of the program. Energy savings (by fuel) were converted to GHG reductions using standardized conversion factors.

Uncertainty Analysis for Actual Reductions 2008-09

Program methodology combines monitored participation, results of published studies and evaluations, and GHG conversion factors. Participation is accurately measured, but the other elements seldom elaborate on the accuracy of their quantitative conclusions. Thus conservative assumptions are made. To create a range for this Plan, qualitative self-assessment considered the uncertainty surrounding the calculated actual reductions to be low on participation and medium on energy savings, hence a range of +/- 20% is provided.

Methodology for Projected Reductions

Estimated reductions were calculated by multiplying the average energy savings per participating facility (based on technical studies and past program files) by the expected number of participants for the informational and the instructional elements of the program. The average of energy savings across participating facilities recognizes that some will take no action while others will achieve higher savings. Energy savings (by fuel) were converted to GHG reductions using standardized conversion factors.

These calculations for estimating avoided emissions were done separately for the two program components: (1) energy savings from the Canadian Industry Program for Energy Conservation (CIPEC) and (2) energy savings from site-specific energy assessments. The baseline assumption is that the participants would not otherwise have undertaken actions to achieve these incremental energy savings.

With respect to section 5 (b) (ii) of the Act, it is not immediately possible to make comparisons between the actual and projected emission reductions achieved by the equipment, buildings and houses, retrofit and industry programs and the National Emissions Inventory, primarily with regard to emission reductions achieved from electricity savings. Natural Resources Canada will work with Environment Canada to resolve questions related to input data and definitions to determine the appropriate relationship between electricity savings and emission reductions from electricity generation.

Uncertainty Analysis for Projected Reductions

Preliminary expected reductions are provided as a range to reflect two possible scenarios regarding the types of industrial firms that participate in both the CIPEC program and the site assessments. High-end expected reductions include large final emitters (LFEs) in both sub-initiatives, while the low-end expected reductions include non-LFE participation only. The expected reductions represent conservative estimates of program impacts.

ecoENERGY for Aboriginal and Northern Communities

Methodology for Actual Reductions 2008-09

Actual reductions have been defined by the program as those that are a result of measures that have been fully commissioned (operational) and therefore are displacing fossil fuels or electricity provided via the electrical grid. It is assumed that GHG emission reductions will begin the month after the date of commission. For projects implemented/commissioned during 2008 and 2009, the reductions from this program are calculated from GHG emission estimates submitted in project proposals and final project reports, not always through monitored data.

The issue of additionality was not formally addressed for the actual reductions reported for 2008 and 2009. However, the majority of the reductions are a result of measures implemented within Aboriginal and northern community infrastructure, which falls under the mandate of INAC. In future reporting years, INAC will work with Natural Resources Canada to identify any projects that may have received funding from multiple funding programs to ensure that the additionality issue has been addressed.

The ecoENERGY for Aboriginal and Northern Communities Program's main objective is to reduce GHG emissions in Aboriginal and northern communities. The program's goal is to support projects in Aboriginal and northern communities that will result in an estimated 1.3 Mt GHG reduction over a 20-year period once projects have been commissioned. Due to the scale of the program, a comparison of the actual reductions resulting from the ecoENERGY for Aboriginal and Northern Communities Program to the National Emissions Inventory is not possible.

All proponents are required to submit detailed data in their proposals, with separate requirements for renewable power projects and energy efficiency projects. A data requirements document is provided to proponents to assist in the collection of this information. It is recommended that proponents submit a RETScreen[30] analysis with their proposals. The GHG reduction estimates that are submitted by proponents are then sent for technical review by a third party.

Renewable Energy Projects

GHG emission reductions = Project electricity production × GHG emission factor

The project electricity production is calculated using the maximum power capacity, capacity factor, and project lifetime for the project.

Energy Efficiency Projects

GHG emissions reductions = Baseline emissions – Calculated project emissions

The project proponent decides if the baseline energy consumption will be estimated using system specifications or if historic metered data will be used. Baseline emissions are calculated as follows:

Baseline emissions = Total energy consumption x GHG emission factor

[30] **RETScreen Clean Energy Project Analysis Software** is a unique decision support tool developed with the contribution of numerous experts from government, industry, and academia. The software is used to evaluate the energy production and savings, costs, emission reductions, financial viability, and risk for various types of Renewable-energy and Energy-efficient Technologies (RETs).

The GHG emission factor for renewable energy and energy efficiency projects is based on the source of base case electricity. There are three possibilities in Aboriginal and northern communities as follows (and in some cases multiple sources may apply):

1. **Central Grid System** – power was previously provided through a connection to a centralized electrical grid (e.g., a provincial grid), or where project power is sold directly to a centralized grid.

2. **Isolated Grid System** – like the centralized grid case, except where an isolated/local grid system exists where grid-connected generating assets provide power only to a local area versus a larger jurisdiction (e.g., a whole province).

3. **Off-Grid / On-Site Generation** – instead of being connected to a grid, power is generated by on-site generation specific to the project site.

Uncertainty Analysis for Actual Reductions 2008-09

For Aboriginal and northern communities, there are three general possibilities for electricity sources: central grid system (e.g., provincial grid), isolated grid system, and off-grid/on-site generation. This information is critical for the program's GHG estimates since the source of electricity (coal, diesel, hydro) has an impact on the GHG emission factor for both renewable energy and energy efficiency projects as it is based on avoided fossil fuels.

The amount of electricity produced by a renewable energy project is dependent on the following factors:

- The megawatts derived from the renewable energy source (wind, hydro, biomass, solar PV, etc.) and
- The expected capacity factor for each renewable energy technology.

The following assumptions have been made for reporting low, high, and expected emissions for the program:

High – The original GHG reduction estimates provided in project proposals.

Exception: Third-party technical review sometimes results in a higher GHG reduction estimate than that submitted in the project proposal. In this case, the third-party review estimate is recorded as the high estimate for the project.

Low – The GHG emission reductions calculated during the third-party technical review.

Exception: Third-party technical review sometimes results in a higher GHG reduction estimate than that submitted in the project proposal. In this case, the project proposal estimate is recorded as the low estimate for the project.

Expected – The GHG emission reductions calculated for the project by the third-party technical review.

Exception: In the absence of a third-party technical review, the GHG reduction estimates submitted in the project proposal are reported as expected estimates for the project.

Methodology for Projected Reductions

The ecoENERGY for Aboriginal and Northern Communities Program will assist in the development of installed electrical generation in Aboriginal and northern communities. It is anticipated that once all projects supported by the program are commissioned, the resulting displacement of natural gas, coal, and diesel-electric generation will produce a 1.3 Mt reduction of GHG emissions over the project life-cycle (assumed to be 20 years).

Estimated reductions from this program are estimated using information provided in project proposals submitted by proponents. Each proponent is required to submit detailed data in their proposals, with separate requirements for renewable power projects and energy efficiency projects. A data requirements document is provided to proponents to assist in the collection of this information. It is recommended that proponents submit a RETScreen analysis with their proposals. The GHG reduction estimates that are submitted by proponents are then sent for technical review by a third party.

The issue of additionality was not formally addressed for the projected reductions reported for 2010, 2011, and 2012. For future reporting periods, INAC will work with Natural Resources Canada to identify any projects that may have received funding from multiple funding programs to ensure that the additionality issue has been addressed.

Renewable Energy Projects

GHG emission reductions = Project electricity production × GHG emission factor

The project electricity production is calculated using the maximum power capacity, capacity factor, and project lifetime for the project.

Energy Efficiency Projects

GHG emissions reductions = Baseline emissions – Calculated project emissions

The project proponent decides if the baseline energy consumption will be estimated using system specifications or if historic metered data will be used. Baseline emissions are calculated as follows:

Baseline emissions = Total energy consumption x GHG emission factor

The GHG emission factor for renewable energy and energy efficiency projects is based on the source of base case electricity. There are three possibilities in Aboriginal and northern communities as follows (and in some cases multiple sources may apply):

1. **Central Grid System** – power was previously provided through a connection to a centralized electrical grid (e.g., a provincial grid), or where project power is sold directly to a centralized grid.

2. **Isolated Grid System** – like the centralized grid case, except where an isolated/local grid system exists where grid-connected generating assets provide power only to a local area versus a larger jurisdiction (e.g., a whole province).

3. **Off-Grid / On-Site Generation** – instead of being connected to a grid, power is generated by on-site generation specific to the project site.

Uncertainty Analysis for Projected Reductions

For Aboriginal and northern communities, there are three general possibilities for electricity sources: central grid system (e.g. provincial grid), isolated grid system, and off-grid/on-site generation. This information is critical for the program's GHG estimates since the source of electricity (coal, diesel, hydro) has an impact on the GHG emission factor for both renewable energy and energy efficiency projects as it is based on avoided fossil fuels.

The amount of electricity produced by a renewable energy project is dependent on the following factors:

- The megawatts derived from the renewable energy source (wind, hydro, biomass, solar PV, etc.) and
- The expected capacity factor for each renewable energy technology.

The following assumptions have been made for reporting low, high, and expected emissions for the program:

High – The original GHG reduction estimates provided in project proposals.

Exception: Third-party technical review sometimes results in a higher GHG reduction estimate than that submitted in the project proposal. In this case, the third-party review estimate is recorded as the high estimate for the project.

Low – The GHG emission reductions calculated during the third-party technical review.

Exception: Third-party technical review sometimes results in a higher GHG reduction estimate than that submitted in the project proposal. In this case, the project proposal estimate is recorded as the low estimate for the project.

Expected – The GHG emission reductions calculated for the project by the third-party technical review.

Exception: In the absence of a third-party technical review, the GHG reduction estimates submitted in the project proposal are reported as expected estimates for the project.

ecoAUTO Rebate Program

Methodology for Actual Reductions 2008-09

Actual GHG emissions reductions from the ecoAUTO Rebate Program can only be estimated, not measured directly, as the only data available are the total number of vehicles sold in Canada during the program, as well as the number of ecoAUTO-eligible vehicles that were sold. The incremental impact of the program on those sales was estimated using assumptions about the impact of the program and other important factors, such as fuel price and general economic conditions, on the behaviour of manufacturers and consumers. The North American Feebate Analysis Model (NAFAM), developed by Transport Canada, was used.

The range of estimates for 2008 and 2009 represents the most up-to-date estimate of the impact of the program, based on information available at the time of the preparation of the Plan. A complete

evaluation of the performance of the ecoAUTO Rebate Program is currently underway, the results of which were not available in time for inclusion in this Plan.

To calculate the actual GHG emission reductions from the ecoAUTO Rebate Program, Transport Canada relied on:

1) The ex-ante analysis that was conducted using the NAFAM model and
2) An ex-post analysis that was conducted using ex-post program data and a simple model that was developed for the task. This model made use of information about the number and characteristics of eligible vehicles purchased. Assumptions were made about the characteristics of the vehicles that would have been bought had there been no program. This analysis was conducted in the context of the ecoAUTO Rebate Program Performance Measurement.

Ex-Ante Analysis

Like Environment Canada's Energy, Emissions, and Economy Model for Canada (E3CM), the NAFAM model approximates consumers' and manufacturers' decisions using Qualitative Choice Theory. These decisions are based on the price of buying and operating a vehicle compared with the perceived trade-off between energy savings through improved fuel efficiency and the incremental capital and operating costs. In order to determine the impact of the policies on GHG emissions, Transport Canada's model incorporates a simplified version of Natural Resources Canada's Champagne model, a light-duty vehicle stock accounting framework.

In the NAFAM model, the impact of the policy is estimated against a "base case" scenario where the model is run without any policy intervention. With everything else being held constant, all the changes in the values observed are associated with the policy. The model compares the characteristics of a vehicle, its use, and actual sales number, with or without the policy. This is how the analysis takes into account the free-rider issue. The estimate of annual GHG emission reductions due to the ecoAUTO Rebate Program is calculated by using the difference between the annual emissions estimate calculated for the base case and the annual estimate calculated for the policy scenario. The resulting difference gives the incremental annual emission reductions attributed to the ecoAUTO Rebate Program.

The NAFAM model was calibrated to the most up-to-date database available reflecting the characteristics of 2003 model-year vehicles available for sale in the North American market (Canada and United States). These vehicles are then "modified" with new fuel efficient technologies through time, using assumptions about consumer preferences, fuel price, technology cost, fuel consumption improvements, and industry production plans reflecting decision making in a North American market.

In the NAFAM model, the manufacturers' response is calculated by estimating how 2003 model-year vehicles evolve through time, given assumptions about how often vehicles are modified, and what the costs associated with increasing a vehicle's fuel efficiency are. Given the ecoAUTO program was announced in Budget 2007 and was in effect for only two years, the model did not attempt to assess the impact of the program with respect to manufacturers' decisions on the vehicles made available over this period.

Ex-Post Analysis

The estimate of annual GHG emission reductions due to the ecoAUTO Rebate Program was calculated by using the difference between the annual emissions estimate calculated for the base case and the annual estimate calculated for the policy scenario, making assumptions about the impact of the program on:

- the characteristics of vehicles sold had the program not be implemented;
- free ridership; and
- vehicle usage.

The resulting difference gave the incremental annual emission reductions attributed to the ecoAUTO Rebate Program. Results from the ex-post analysis indicated a likely program impact of between 0.02 and 0.04 Mt in 2008 and 2009, which led to a decision not to update the analysis using the NAFAM model given that both analyses yielded very similar results.

Uncertainty Analysis for Actual Reductions 2008-09

The analysis of the impact of the ecoAUTO Rebate Program is sensitive to assumptions regarding vehicle operating cost and market (consumer and manufacturer) behaviour.

Ex-Ante Analysis

Uncertainty analysis was conducted to estimate the potential impact of variations in fuel price and rebound assumptions on the GHG emission reduction estimates. The following is a description of the assumptions made by Transport Canada for the Low, Expected and High cases. Those cases represent sensitivities to the most recent development in fuel prices and the impact of changes in operating costs on vehicle use (the rebound effect).

In Transport Canada's model, consumer behaviour is represented by assumptions about consumers' price elasticity of demand, their valuation of potential fuel savings, and the rebound effect. Changes in fuel costs have a direct impact on the potential fuel savings achieved when reducing a vehicle's fuel consumption – for a given change in fuel consumption, a higher fuel price will lead to higher savings. The $0.80 per litre fuel price represents the Canadian average motor gasoline prices for the 12-month period ending in November 2004, which was the time period when the 2003 model-year vehicles were manufactured and sold. The fuel price of $1.10 per litre represents the average gasoline prices observed in Canada from March 2007 (introduction of the ecoAUTO program) to December 2008.

The combination of the high price and not allowing manufacturers to implement incremental technology improvements defines the low and expected impact case as it is expected that the policy will have a smaller incremental effect on consumers in this situation.

In addition, for all cases, the analysis assumes that the rebound effect of better fuel efficiency is 15%, rather than the 23% that was used in the preliminary estimates done when the program was developed in 2006. This change stems from recent studies suggesting that the rebound effect is lower than previously thought. In addition, in making its fuel economy ruling for model year 2011, the National Highway Traffic Safety Administration in the United States has also chosen to use a 15% rebound effect as its expected value.

	Low Case	Expected Case	High Case
Fuel prices (¢ per litre)	110	110	80
Rebound effect	-0.15	-0.15	-0.15

Ex-Post Analysis

In the case of the ex-post analysis, uncertainty analysis was conducted assuming a range of 60% to 80% for the free-rider effect, the 80% representing the number of successful ecoAUTO applicants that did not state that they would have purchased a different vehicle in the absence of the rebate, and 60% being a relatively conservative estimate based on the estimates available in the literature.

The projected emission reductions reported under the ecoAUTO Rebate Program are calculated by taking into account only new gasoline- and diesel-powered light-duty vehicles, while the National Emissions Inventory calculates emissions for all gasoline- and diesel-powered light-duty vehicles. The methodology used to calculate projected emission reductions reported under the ecoAUTO Rebate Program has been peer-reviewed and was based on up-to-date data and assumptions reflecting the state of knowledge at the time of the analysis. Thus, while comparisons cannot directly be made between the projected emission reduction calculations and the National Emissions Inventory, it would be valid to compare the estimated emissions reductions with the level of emissions reported in the Inventory to provide a sense of the relative impact of the program on emissions from the light-duty vehicle fleet.

Methodology for Projected Reductions

Emissions reductions due to the ecoAUTO Rebate Program for the 2010-2012 period were estimated both using the NAFAM model and actual program data, as is described in the "*Actual Reductions*" section.

Uncertainty Analysis for Projected Reductions

The uncertainty analysis related to the potential impact of the ecoAUTO Rebate Program for the 2010-2012 period was conducted both using the NAFAM model and actual program data, as is described in the "*Actual Reductions*" section.

Green Levy

Methodology for Actual Reductions 2008-09

Actual GHG emissions reductions from the Green Levy can only be estimated, not measured directly, as the only data available is the total number of vehicles sold in Canada during the policy, as well as the number of vehicles subject to the Green Levy that were sold. The incremental impact of the Green Levy on those sales was estimated using assumptions about the impact of the policy and other important factors, such as fuel price and general economic conditions, on the behaviour of manufacturers and consumers.

The range of estimates provided for 2008 and 2009 represents the most up-to-date estimate of the impact of the policy, based on available information at the time of the preparation of the Plan.

To estimate actual GHG emission reductions from the Green Levy, Transport Canada used the North American Feebate Analysis Model (NAFAM). Like Environment Canada's Energy, Emissions, and Economy Model for Canada, the model used by Transport Canada approximates consumers' and manufacturers' decisions using Qualitative Choice Theory. These decisions are based on the price of buying and operating a vehicle compared with the perceived trade-off between energy savings through improved efficiency and the incremental capital and operating costs. In order to determine the impact of the policies on GHG emissions, Transport Canada's model incorporates a simplified version of Natural Resources Canada's Champagne model, a light-duty vehicle stock-accounting framework.

In the NAFAM model, the impact of the policy is estimated against a "base case" scenario where the model is run without any policy intervention. With everything else being held constant, all the changes in the values observed are associated with the policy. The model compares the characteristics of a vehicle, its use, and actual sales number, with or without the policy. This is how the analysis takes into account the free-rider issue. The estimate of annual GHG emission reductions due to the Green Levy are calculated by using the difference between the annual emissions estimate calculated for the base case and the annual estimate calculated for the policy scenario. The resulting savings are incremental annual emission reductions attributed to the Green Levy.

The model used for this analysis was calibrated to the most up-to-date data available reflecting the characteristics of 2003 model year vehicles available for sale in the North American market (Canada and United States). These vehicles are then "modified" with new fuel efficient technologies through time, using assumptions about consumer preferences, fuel price, technology cost, fuel consumption improvements, and industry production plans reflecting decision making in a North American market.

Uncertainty Analysis for Actual Reductions 2008-09

The analysis of the impact of the Green Levy program is sensitive to assumptions regarding vehicle operating cost and market (consumer and manufacturer) behaviour. Uncertainty analysis was conducted to estimate the potential impact of variations to those assumptions on the GHG reduction estimates. The following is a description of the assumptions made by Transport Canada for the low, expected, and high cases. These cases represent sensitivities to the most recent development in fuel prices and the impact of changes in operating costs on vehicle use (the rebound effect).

In Transport Canada's model, manufacturers' technology response is estimated by simulating how 2003 model year vehicles are modified through time, given assumptions about how often vehicles are retrofitted (generally over a four- to five-year schedule), and what the costs associated with increasing a vehicle's fuel efficiency are. The sensitivity analysis of the Green Levy now includes a technology response of the policy for the high case. Inclusion of the technology effect in the analysis has the consequence of progressively increasing the impact of the program, as more retrofitted vehicles enter the fleet.

Consumer behaviour is represented by assumptions about consumers' elasticity of demand, their valuation of potential fuel savings, and the rebound effect.

Changes in fuel costs have a direct impact on the potential fuel savings achieved when reducing a vehicle's fuel consumption – for a given change in fuel consumption, a higher fuel price will lead to higher savings. The $0.80 per litre price represents the Canadian average motor gasoline prices for the 12-month period ending in November 2004, which was the time period when the 2003 model year vehicles were manufactured and sold. The fuel price of $1.10 per litre represents the average gasoline prices observed in Canada from March 2007 (introduction of the Green Levy) to December 2008. In 2009 and 2010, average retail fuel prices in Canada were approximately 94.5¢ and 103.5¢ per litre, respectively, well within our range of estimates.

The combination of the high price and allowing manufacturers to implement incremental technology improvements defines the high case, as it is expected that the policy will have a larger incremental effect on consumers in this situation. The assumptions made in the high scenario lead to the greatest impacts by 2012 due to technology adoption. The low and expected scenario assumptions yield a greater initial impact in 2008 due to lower fuel prices, but do not yield as much impact over the longer term.

In addition, for the high case, the analysis now assumes that the rebound effect of better fuel efficiency is 15%, rather than the 23% that was used for the preliminary estimates that were provided in 2006. This change stems from recent studies suggesting that the rebound effect is lower than previously thought. In addition, in making its fuel economy ruling for model year 2011, the National Highway Traffic Safety Administration in the United States has also chosen to use a 15% rebound effect as its expected value.

	Low Case	Expected Case	High Case
Fuel prices (¢ per litre)	80	80	110
Rebound effect	-0.23	-0.23	-0.15

In addition, in 2011, Transport Canada reviewed the market share of vehicles with a combined fuel consumption rating of 13 litres or more per 100 kilometres for the 2007 to 2009 model years and found that their market share has fallen considerably since the introduction of the Green Levy. In fact, this share has fallen more than what was anticipated in the analysis conducted using the NAFAMl. This could indicate that the analysis might have slightly underestimated the impacts of the Green Levy on GHG emissions.

Of course, the introduction of the Green Levy is not the only factor that could have had an impact on the sales of those vehicles. Other factors, such as the rise in fuel prices observed since 2008 and the Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations, are also likely to have played a role.

Increasing fuel prices could have prompted consumers to stay away from vehicles consuming more fuel, while manufacturers could be expected to start changing the vehicles they offer on the market ahead of the entry into force of the regulations, as it typically takes a manufacturer about four years to bring a new vehicle to the market.

Given the uncertainty associated with evaluating the individual impact of all of these factors, it is expected that the range of estimates of the impact of the Green Levy provided by the ex-ante analysis still represents the most likely range of impact of the Levy.

The projected emission reductions reported under the Green Levy are calculated by taking into account only new gasoline- and diesel-powered light-duty vehicles, while the National Emissions Inventory calculates emissions for all gasoline- and diesel-powered light-duty vehicles. The methodology used to calculate projected emission reductions reported under the Green Levy has been peer-reviewed and was based on up-to-date data and assumptions reflecting the state of knowledge at the time of the analysis. Thus, while comparisons cannot directly be made between the projected emission reduction calculations and the National Emissions Inventory, it would be valid to compare the estimated emission reductions with the level of emissions reported in the Inventory to provide a sense of the relative impact of the initiative emissions from the light-duty vehicle fleet.

Methodology for Projected Reductions

Emissions reductions due to the Green Levy for the 2010-2012 period were estimated using the NAFAM model, as is described in the "Actual Reductions" section.

Uncertainty Analysis for Projected Reductions

The uncertainty analysis related to the potential impact of the Green Levy for the 2010-2012 period was conducted using the NAFAM model, as is described in the "Actual Reductions" section.

ecoENERGY for Personal Vehicles Program

Methodology for Actual Reductions 2008-09

The program interventions include a number of elements, the impacts of which were calculated individually. The actual energy savings of program interventions were calculated based on the actual number of drivers reached by the program, the expected changes in their behaviour resulting from the program, and the fuel saved because of these changes (as described in under Projected Reductions Methodology).

The goal under the MOU with automobile manufacturers of reducing GHG emissions by 5.3 Mt was a negotiated target that was initially based on the emissions reductions that could be expected from a 25% improvement in fuel efficiency by 2010. The 5.3 Mt target was measured from a reference case level of emissions that was designed to reflect the actions of the automotive industry that would have occurred in the absence of action on climate change. In 2009-10, a third-party verification of the data collection and analysis methodologies used to calculate GHG reductions attributable to the MOU concluded that the methodologies were sound and applied accurately. The 2007 MOU Interim Report concluded that the MOU triggered GHG emission reductions equal to between 3.1 and 3.4 Mt. Note that emissions reductions from the MOU are excluded from KPIA reporting.

Uncertainty Analysis for Actual Reductions 2008-09

Program methodology combines monitored participation, third-party sector-level data and forecasts, results of published studies and evaluations, and GHG conversion factors. Participation is accurately measured; however, information from secondary sources is seldom accompanied by robust explanations of underlying quantitative conclusions. Thus conservative assumptions are made. Where secondary sources have been used to populate variables, the lower end of published ranges was used. Variables were updated as new and more robust information became available, either through case studies or other government and third-party studies. To create a range for this Plan, qualitative self-assessment considered the uncertainty surrounding the calculated actual reductions to be medium, hence a range of +/- 25% is provided.

Methodology for Projected Reductions

The program interventions include a number of elements, the impacts of which were calculated individually. The estimated energy savings of program interventions were calculated based on the expected number of drivers reached by the program, the changes in their behaviour resulting from the program, and the fuel saved because of these changes. That is, multiplying the following variables: expected number of vehicles reached, average annual kilometres travelled per vehicle, estimated percent savings from intervention, estimated retention rate, and GHG emissions per kilometre.

Average fuel consumption data from Statistics Canada for the period prior to the interventions was used as the baseline measure. The baseline assumption is that drivers would not have adopted more fuel-efficient behaviours without the instruction afforded by the program, and thus would not have achieved the incremental fuel savings. The methodology includes a variable for grams of carbon equivalent emissions per kilometre travelled.

Government publications, accepted models, technical studies, and past program files provided information regarding these variables and were the basis for the estimates of participation, rates of adoption, retention of fuel-efficient practices, and the average impact of these practices.

In support of reduced GHG emissions from transportation energy use, total projected emissions reductions from the ecoENERGY for Personal Vehicles program in 2010 were 0.20 Mt, which is equivalent to 0.23% of total emissions from the light-duty vehicle sector reported in the (most recently available) 2008 National Emissions Inventory.

Uncertainty Analysis for Projected Reductions

The Government of Canada has a number of programs designed to reduce GHG emissions from the transportation sector. These programs are designed to be complementary. Projected reductions represent conservative estimates of program impacts.

For this Plan, qualitative self-assessment considered the uncertainty surrounding the calculated actual reductions to be medium, hence a range of +/- 25% is provided.

ecoMOBILITY

Methodology for Actual Reductions 2008-09

Because the selection of projects under the program was initially delayed to allow for more national consultations in 2007, it was not assumed that the project implementation would be sufficiently advanced to yield GHG reduction prior to 2010.

The 13 projects funded under the program are subject to an extensive measurement approach based on reductions in distance travelled and fuel used. Actual emissions are not available yet and will be available once the program is completed.

Uncertainty Analysis for Actual Reductions 2008-09

Not applicable at this time.

Methodology for Projected Reductions

Transportation Demand Management (TDM) is the application of strategies and policies to reduce automobile travel demand, or to redistribute this demand to other modes. The program will achieve its GHG impact by funding TDM initiatives that reduce the distance (VKT) travelled by passenger vehicles in urban areas. Various locational and socio-economic factors influence VKT, including land-use, urban sprawl, fuel prices, and car ownership. It is important to note that the effect of the ecoMOBILITY program is linked with the availability of alternatives to personal vehicles. Certain transit-based TDM strategies must be implemented in close collaboration with transit investments, while other strategies such as teleworking and other workplace programs can be implemented more independently.

In 2006, it was assumed that the program could support a reduction in total VKT in urban areas by 3% in 2010 through the direct and indirect (transformative) effects of the program activities. This assumption came from the "high TDM" option outlined in a study commissioned by Transport Canada ("The Impact of Transit Improvements on GHG Emissions: A National Perspective", Transport Canada, March 2005). This option assumed that both transit and non-transit TDM measures would be implemented by municipalities in combination with significant transit infrastructure investments. The 3% reduction was applied to historical VKT data available from Natural Resources Canada, the results were translated into reductions in fuel use and subsequently GHG reductions using EC conversion factors. This methodology yielded a preliminary estimate of 1.6 Mt in 2012.

It was assumed that emission reductions were obtained from specific TDM initiatives stimulated by the program. The reductions were based on the following assumptions:

- 2003 historical passenger vehicle stock (cars and light trucks), distance travelled, and weighted average fuel efficiency were calculated using data from Natural Resources Canada's Office of Energy Efficiency publication "Energy Efficiency Trends in Canada".
- The urban portion of total annual distance travelled (67%) came from "The Impact of Transit Improvements on GHG Emissions: A National Perspective", and was kept constant over the forecast period.
- The 2003-2010 and 2010-2020 energy efficiency improvement growth rates were calculated from data available in Natural Resources Canada's Canada Energy Outlook. Data were interpolated to obtain an annual growth forecast between 2003 and 2010 and between 2010 and 2012.
- The 2003-2010 and 2010-2020 total distance travelled growth rates were calculated from data available in Natural Resources Canada's Canada Energy Outlook. Data were interpolated to obtain an annual growth forecast between 2003 and 2010 and between 2010 and 2012.

The ecoMOBILITY program was redirected in 2009 to focus its activities exclusively on non-transit-based TDM. While transit-based TDM can reduce VKT in the short and longer terms, non-transit-based TDM targeting travel behaviour has less short-term impact. The revised program approach that focuses on a narrower range of non-transit-based TDM strategies necessarily lowered the GHG emission reductions that could be attributed to the program in 2012.

Results from the above-mentioned study on transit investment were used to project the GHG impacts of the softer non-transit-based TDM measures such as workplace travel plans, car sharing, or travel awareness campaigns.

A revised expected scenario assumes a 0.2% reduction of VKT in 2012, yielding an estimated 0.112 Mt reduction.

With respect to additionality, Natural Resources Canada's Canada Energy Outlooks include program funding committed by the federal and provincial governments and by public utilities. Because these energy efficiency growth rates are incorporated in the methodology assumptions, the program's estimated reduction may be considered incremental.

The emission reduction estimates are based on fuel savings due to program activities. Fuel saving results were translated into GHG emission reductions using EC conversion factors by fuel types published in the National Emissions Inventory.

While direct comparisons cannot be made between the projected emission reduction calculations and the National Emissions Inventory, it would be valid to compare the estimated emission reductions with the level of emissions reported in the Inventory to provide a sense of the relative impact of the program.

Uncertainty Analysis for Projected Reductions

A scenario was considered as part of the uncertainty analysis that assumes a VKT reduction of 0.4%, yielding an estimated 0.223 Mt in 2012. This scenario would occur if the replication or multiplier effect of the program was greater than expected.

National Vehicle Scrappage Program

Methodology for Actual Reductions 2008-09

Projected GHG reductions are only a co-benefit, as the focus of the program is on reducing smog-forming emissions, not GHGs. GHG emission reductions are the result of individuals retiring their old vehicle and choosing sustainable forms of transportation, such as public transit or membership in a car-sharing program, or replacing their old vehicle with a more fuel-efficient one, and/or driving less.

It is assumed that the program accelerates vehicle retirement by one year and reduction calculations only consider vehicles retired through the program and only the year following vehicle retirement.

The baseline is emissions produced if a vehicle retired by the program had remained on the road for a year. The actual and projected reductions consider how this vehicle was replaced, either by another mode of transportation or another vehicle.

“Actual” means that emissions reductions reflect measured program results, such as the number of vehicles retired and a survey of program participants to determine post-vehicle retirement behaviour (conducted 6 to 12 months after they retire their old vehicles). Projected reductions are based on anticipated program results.

A database developed specifically to manage the program and track results is used for the calculations. Published data for emission factors for vehicles (by model and model year), annual vehicle use (average distance driven), and transit data (distance travelled and fuel consumed by buses) are the basis for the calculations. Emission factors and vehicle usage data are as consistent as feasible with parameters used for the National Emissions Inventory.

Considering only the year following the retirement of the vehicle limits the calculations to the impact of the program, eliminating “additionality” issues. Without the scrappage program, older vehicles would have reached the “normal” end of their natural life and been replaced by other vehicles or other means of transportation. These emissions are already factored into the National Emissions Inventory and by other emissions reduction measures.

Uncertainty Analysis for Actual Reductions 2008-09

Emissions estimates vary depending on the number of program participants, the incentive selected, and personal transportation behaviours after the old vehicle has been retired. Post-vehicle retirement behaviour is assumed to remain the same as previous results.

The key assumption is that the vehicle scrappage program accelerated the retirement of an older vehicle by one year. Although this is difficult to measure, this assumption is more conservative than the three years used by the California Air Resource Board to assess potential vehicle retirement initiatives.

The range of expected emission reductions reflects minimum and maximum projections for vehicles to be retired.

Methodology for Projected Reductions

Projected and actual emissions reductions are calculated in a similar manner. The projected number of vehicles retired is used in the calculations rather than actual results.

Uncertainty Analysis for Projected Reductions

See “Actual Reductions” section above.

ecoTECHNOLOGY for Vehicles Program

Methodology for Actual Reductions 2008-09

Actual GHG reductions will not be reported until the program results measurement is completed in 2011-12.

Uncertainty Analysis for Actual Reductions 2008-09

Not applicable.

Methodology for Projected Reductions

Direct and transformative GHG savings for the ecoTECHNOLOGY for Vehicles Program (ETVP) were based on estimates calculated from the previous pilot Advanced Technology Vehicle Program, which followed a similar program model on a smaller scale. “Direct savings” refers to reductions from incremental advanced technologies that are embedded in conventional vehicles in the Canadian market. “Transformative savings” refers to reductions from non-conventional advanced vehicles (e.g., hybrids, electric, etc.).

For direct GHG savings it was assumed that 1% of the sales of new vehicles include technologies targeted by the program due to public outreach and education activities of ETVP.

Transformative emissions savings estimates were based on the forecast market shares of advanced technology vehicles over the relevant period. Advanced technology vehicles were defined as vehicles presenting an 11.5% improvement. In comparison, the average improvement of new vehicles was estimated at 7.5%. It was assumed that 20% of these advanced technology vehicle sales were influenced by the ETVP.

In both cases, vehicles were assumed to save 1.6 litres per 100 kilometres and travel 23,500 kilometres per year.

In 2010, the original estimates were reviewed to take into account the impact of the economic downturn by factoring in lower vehicle sales and slower advanced technology penetration rate. Preliminary estimates were based on assumptions made about new vehicle sales, technology penetration, and vehicle distance travelled forecasts. The economic downturn has had a significant impact on vehicle sales. These factors contributed to slower market penetration of advanced technologies and reduced the overall impact of the program within the program timelines to 0.2 Mt in 2012. Initial reduction estimates are not expected to be achieved until at least 2 to 3 years after the end of the program.

With respect to additionality, it was assumed that emission reductions were incremental where they were obtained from technology adoption stimulated by the program.

The emission reduction estimates are based on fuel savings due to program activities. Fuel saving results were translated into GHG emission reductions using EC conversion factors by fuel types published in the National Emissions Inventory.

While comparisons cannot directly be made between the projected emission reduction calculations and the National Emissions Inventory, it would be valid to compare the estimated emission reductions with the level of emissions reported in the Inventory to provide a sense of the relative impact of the program.

Uncertainty Analysis for Projected Reductions

An uncertainty analysis was undertaken to consider both a low and a high scenario. A scenario was developed to further take into account the impact of the economic downturn by factoring in lower vehicle sales and slower advanced technology penetration rate. The low scenario was reviewed to assume lower market penetration of advanced technologies (12% vs. 20%), lower fuel saving (1.2 l/100 km vs. 1.6 l/100 km) applied to lower sales figures (1.49 million vs. 1.52 million), yielding a reduction of only 0.09 Mt in 2012. A higher scenario was estimated based on more optimistic assumptions on fuel saving (1.9 l/100 km vs. 1.6 l/100 km), yielding a reduction of 0.6 Mt in 2012.

ecoENERGY for Fleets Program

Methodology for Actual Reductions 2008-09

The estimated actual energy savings were calculated based on the actual number of transportation professionals reached by the program, the changes in their behaviour resulting from the program, and the fuel saved because of these changes, as described in the “Projected Reductions” section below.

Uncertainty Analysis for Actual Reductions 2008-09

Program methodology combines monitored participation, third-party sector-level data and forecasts, results of published studies and evaluations, and GHG conversion factors. Participation is accurately tracked. Secondary sources, however, seldom elaborate on underlying methodologies supporting their quantitative conclusions. Thus, for impact reporting purposes, where secondary sources have been consulted to populate variables, conservative assumptions are made and therefore the low end of published ranges has been used. For some activities, case studies were conducted to verify Natural Resources Canada’s assumptions with regards to the impact of training in various commercial and institutional fleet sectors. Findings from these studies were employed to qualify impact forecasting and measurement models. Variables have been updated as new and more robust information became available, either through case studies or other government and third-party studies.

To create a range for this Plan, a qualitative self-assessment considered the uncertainty surrounding the calculated actual reductions to be medium, hence a range of +/- 25% is provided.

Methodology for Projected Reductions

This program contains a number of elements, the impacts of which were calculated individually.

The estimated energy savings were calculated based on the expected number of transportation professionals reached by the program, the changes in their behaviour resulting from the program, and

the fuel saved because of these changes. That is, the following variables were multiplied: expected number of vehicles reached, average fuel consumption per vehicle, estimated percent savings from intervention, estimated retention rate, and GHG emissions per unit of fuel.

Average fuel consumption data from Statistics Canada for the period prior to the interventions was taken as the baseline measure. The baseline assumption for projected reductions was that drivers and fleet managers would not have adopted more fuel-efficient behaviours without the instruction and tools afforded by the program, and thus would not have achieved the incremental fuel savings. Follow-up with participants has been conducted in order to verify this assumption. Adjustments in the estimation models were made based on the findings from these follow-up exercises in order to determine actual reductions. The methodology also includes a factor for grams of carbon dioxide equivalent emissions per kilometre travelled.

Government publications, accepted models, technical studies, and past program case studies provided variables and served as the basis for the estimates of participation, rates of adoption of fuel-efficient practices, and the average impact of these practices.

In support of reduced GHG emissions from transportation energy use, total projected emission reductions from the ecoENERGY for Fleets program in 2010 were 0.38 Mt, which is equivalent to 0.47% of total emissions from the heavy-duty and off-road sectors reported in the (most recently available) 2008 National Emissions Inventory.

Uncertainty Analysis for Projected Reductions

The Government of Canada has a number of programs to reduce GHG emissions from the freight transportation sector. Natural Resources Canada's ecoENERGY for Fleets program aims to reduce emissions from freight transportation through behavioural change as a result of training and awareness campaigns. Transport Canada's ecoFREIGHT program aims to reduce emissions from freight transportation through partnerships, promotion of technologies, and addressing regulatory barriers that limit the uptake of emission-reducing technologies. These programs are designed to be complementary; however, there is a potential for overlap between the impacts of the programs. For example, if an emission-reducing technology reduces a truck's overall emissions by 4%, the total remaining emissions is 96%. Any further measures can only impact the remaining 96%. The impact of the overlap is deemed to be very small because the impact of each individual measure is small. Nonetheless, in order to account for potential overlap between Natural Resources Canada's programs and Transport Canada's programs, expected reductions represent conservative estimates of program impacts in all cases.

For this Plan, qualitative self-assessment considered the uncertainty surrounding the calculated actual reductions to be medium, hence a range of +/- 25% is provided.

ecoFREIGHT Program

Methodology for Actual Reductions 2008-09

The 38 projects funded under the program are subject to an extensive GHG emission measurement approach based on fuel saved through the use of clean technology. Actual program emission reduction measurements are not available yet and will be available once the program results measurement is completed in 2011-12.

Uncertainty Analysis for Actual Reductions 2008-09

Not applicable at this time.

Methodology for Projected Reductions

The ecoFREIGHT GHG emission reduction estimates include reductions expected directly from projects funded under the program, as well as reductions from the broader market adoption of technologies (multiplier or transformative effect) fostered by the program's information dissemination activities. Emission reductions from program activities relating to partnership MOUs (from 0.5 Mt in 2009 to 0.9 Mt in 2012) are included incrementally.

In 2007, the GHG preliminary estimates were based on data supplied in the current and previous generations of program applications, actual project Contribution Agreements, and project progress and final reports as available. The data from the previous generation of programs was extrapolated to form the preliminary impact estimates for the ecoFREIGHT program by pro-rating the direct GHG impacts according to the amount of project funding available to the ecoFREIGHT program.

The ecoFREIGHT direct impact was calculated from the forecasted number of projects and their estimated GHG impacts by mode and by technology. The ecoFREIGHT indirect (i.e. multiplier) impact was then calculated by applying a multiplier factor ranging from 1.75 in 2008 to 2.4 in 2012 according to the projected mix of technologies to the direct impact of a particular year. The multiplier effect was primarily influenced by the payback period of the technologies.

In 2010, the preliminary estimates were reviewed and updated with the estimated emission reductions from actual projects receiving funding under the program, rather than information from predecessor programs. Revised assumptions regarding the multiplier effect of the program also took into account the impact of the economic downturn, which reduced the ability/willingness of industry to invest in clean technology projects during the economic recession and thus reduced the number of projects under the program. Finally, the projected reductions were adjusted upward to include the expected GHG emission reductions from: 1) the mandatory implementation of truck speed limiters in Ontario and Quebec (0.4 Mt in 2012), which was achieved with the support of the NHITI initiative of ecoFREIGHT, and 2) the MOUs (0.9 Mt in 2012).

The 2010 expected scenario only includes projected direct reductions of technology projects funded under the ecoFREIGHT program (57.3 kilotonnes of GHG emission reductions in 2012), the reduction from the introduction of speed limiters in Ontario and Quebec supported by the NHITI (0.4 Mt in 2012) and reduction from the MOUs (0.9 Mt in 2012). In this scenario, the multiplier, or indirect effect, was assumed to be delayed until after 2012 due to the economic downturn.

A baseline scenario was not necessary since the emission reduction estimates are based on expected reduction in fuel use and GHG emissions from specific technologies where adoption is stimulated by the program.

With respect to additionality, it was assumed that emission reductions were incremental where they were obtained from projects directly funded by the program. The indirect impact was also assumed to be incremental because it resulted from technology adoption stimulated by the program.

The emission reduction estimates are based on fuel savings due to program activities. Fuel saving results were translated into GHG emission reductions using EC conversion factors by fuel types published in the National Emissions Inventory.

While direct comparisons cannot be made between the projected emission reduction calculations and the National Emissions Inventory, it would be valid to compare the estimated emission reductions with

the level of emissions reported in the Inventory to provide a sense of the relative impact of the program.

Uncertainty Analysis for Projected Reductions

An uncertainty analysis was conducted including a high scenario in which indirect or multiplier reductions are assumed to occur through replication of program projects in the freight industry. The ecoFREIGHT indirect (i.e. multiplier) impact under this scenario was assumed to be achieved within the Kyoto compliance period (2008-2012) and calculated by applying the same factors described earlier to the revised direct impact of a particular year as described above.

Marine Shore Power Program

Methodology for Actual Reductions 2008-09

Because the selection of program projects and the program funding round were not held until after amendments to the *Canadian Marine Act* came into force in 2008, it was assumed that the project implementation would not be sufficiently advanced to yield actual measured GHG reductions prior to 2012.

The two projects funded under the program are subject to an extensive measurement approach based on reductions in fuel used. Actual emissions measurements are not available yet and will be available once the program is completed.

Uncertainty Analysis for Actual Reductions 2008-09

Not applicable at this time.

Methodology for Projected Reductions

The information used to project GHG emission reductions for the Marine Shore Power Program (MSPP) comes from Transport Canada's "Feasibility Study to Determine Suitable Locations for Marine Shore Power Pilot Projects in Canada" (Final Report, July 2005). In this study, 15 sites were analyzed and GHG estimates were calculated based on reductions in fuel use.

The approach averaged out the GHG savings of 11 of the 15 projects analyzed (excluding four projects that were considered to be too expensive to implement). The average net annual GHG savings used was 1.3 kt per project. Savings were calculated primarily based on estimations of marine fuel displaced by electricity.

It was assumed that the funding received would allow four projects to be implemented under the MSPP, each achieving an average net annual GHG reduction of 1.3 kt, for a total of 5.3 kt in 2010. (It was anticipated that there could be a mix of larger and smaller projects together.)

For the "transformative" impact of the program, it was assumed that two more projects would be implemented after 2010 (one in 2010 and one in 2012) as a result of the demonstrations, each also achieving a net annual GHG reduction of 1.3 kt, for a total of 2.6 kt per year in 2012.

Thus, the preliminary reductions initially estimated in 2006 assumed the implementation of a total of six projects of varying sizes. The number and/or size of projects were dependent on increases in the costs of equipment and/or the ability/willingness of promoters to invest in such projects due to changes in economic activity.

In 2010, the original estimates were reviewed to include updated estimated emission reductions from one project underway in the Port of Vancouver and to take into account the impact of the economic downturn by reducing the number of projects that would take place under the program.

Projections were revised downwards such that the expected scenario assumed only two projects would be funded under the program, with an estimated GHG reduction of 4.5 kt in 2012: the Vancouver project with an estimated GHG emission annual reduction of 3.2 kt starting in 2009 and one other project with an estimated GHG annual reduction of 1.3 kt. At that time, program staff were aware that a third project had been developed then withdrawn by the proponent due to the economic recession.

With respect to additionality, it was assumed that emission reductions were incremental where they were obtained from projects directly funded by the program. The indirect impact was also assumed to be incremental because it resulted from technology adoption stimulated by the program.

The emission reduction estimates are based on fuel savings due to program activities. Fuel saving results were translated into GHG emission reductions using EC conversion factors by fuel types published in the National Emissions Inventory.

While direct comparisons cannot be made between the projected emission reduction calculations and the National Emissions Inventory, it would be valid to compare the estimated emission reductions with the level of emissions reported in the Inventory to provide a sense of the relative impact of the program.

Uncertainty Analysis for Projected Reductions

A high scenario was estimated as part of the uncertainty analysis, which included four projects with an estimated GHG emission reduction of 7.1 kt in 2012. It is assumed that two projects would be funded under the program with an estimated GHG reduction of 4.5 kt per year (as per the above low scenario). In addition, two other projects would take place in 2012 with an estimated GHG reduction of 2.6 kt in 2012 as a result of the replication or multiplier effect of the program.

Promoting Sustainable Urban Transit

Methodology for Actual Reductions 2008-09

The estimated emission reductions for the 2011 Plan use the same basic methodology as was used to calculate the estimated emissions reductions for the 2008, 2009, and 2010 Plans. While the methodology is similar, this year's approach differs in the following manners:

- The "**high" actual reduction projection** is based on "Total Claims" rather than "Total Claims by Taxable Individuals". This results in a higher estimate and ensures that all claims are treated equally. The claims are multiplied by the GHG savings per kilometre, distance of average round trip, and annual trips. It is further assumed that all claims are incremental.
- The **expected "actual" reduction projection** follows the same approach with one notable difference. Using statistical techniques, it estimates the incremental number of trips due to the Public Transit Tax Credit and applies this factor to the total claims to estimate the incremental GHG reductions.
- The **expected "low" reduction projection** also follows the same approach, while assuming a shorter commuting distance and lower behavioural response.

Given the nature of the measures, it is virtually impossible to obtain a true actual reduction estimate and compare this with the National Emissions Inventory. Therefore, "actual" reductions are based on an approach that estimates the reduction based on:

- Number of claims received.
- The difference in vehicle emissions. The analysis assumed that a typical car emits 215 grams per kilometre, while using public transit emits 77 grams per kilometre. This implies a savings of 138 grams per kilometre per trip.
- Average commuting distance. This variable ranges from 13 kilometres per round trip to 18 kilometres per round trip. For analytical purposes, an average round trip commuting distance of 15.2 kilometres was assumed.
- Annual trips. It was assumed that some 260 round trips are taken per year.
- A behavioural parameter for the percentage of claimants who stop using cars in favour of public transit due to the measure.

If the measure is assumed to affect the behaviour of all claimants for the Public Transit Tax Credit, then the actual emission reductions due to the measure would be about 0.82 Mt. However, it is highly likely that a significant majority of the claimants would have continued to use public transit in the absence of the measure.

The assumed behavioural impact is based on a study by Litman for the Victoria Transport Policy Institute. The incremental trips are estimated by

- calculating the effective fare reduction (9.0%);
- using a short-term own-price elasticity for the overall market (2.5%); and
- applying these factors to ridership information from the Canadian Urban Transit Association.

Using the Litman approach, the behavioural impact is estimated to be about 7%. Applying this estimate to the total avoided emissions based on tax claims received for the Public Transit Tax Credit, the actual reduction from the measure is estimated to be 0.032 Mt.

Uncertainty Analysis for Actual Reductions 2008-09

The estimated emission reductions from this measure are dependent on key assumptions, including the growth in ridership, the elasticity with respect to transit fare increases, the number of trips, the estimated reduction in vehicle trips (transit-to-auto passenger conversion), and the number of tax claims received for the Public Transit Tax Credit.

Moreover, there is the issue of behaviour. If all the claimants were taking public transit prior to the introduction of the Public Transit Tax Credit, then the actual reductions due to the measure would be zero. In this situation, there would still be avoided emissions if the claimant had access to a car.

The uncertainty analysis focused on a couple of issues:

- The high case assumes that all claimants adjusted their behaviour due to the Public Transit Tax Credit. In this case, the emissions reductions are calculated by: multiplying the number of claims received, the savings per round trip commute, and the number of days.
- The low case assumes a lower commuting distance (10 kilometres instead of 15 kilometres) and a lower behavioural response (5% rather than 6%).

Methodology for Projected Reductions

The estimated emission reductions for the 2011 Plan use the same methodology that was used to calculate the estimated emission reductions for the 2008, 2009, and 2010 Plans.

The calculation used information from a variety of sources. The data on public transit trips (ridership) was obtained from Canadian Urban Transit Association statistics. The GHG emission factors were obtained from the Climate Change Transportation Table. A constant 2.5% annual growth in ridership (average of the last four years) was used to project baseline levels of ridership over the 2010-2012 period. Based on a calculation that the tax credit would result in an effective fare reduction of 9%, and using a short-term own-price elasticity for the overall market of 2.5%, which is based on a study by Litman for the Victoria Transport Policy Institute, new (incremental) trips resulting from the tax credit were calculated. These new trips were adjusted to estimate reduced vehicle trips based on information on vehicle occupancy from Transport Canada, and appropriate emissions factors were applied to these figures to produce the emission reduction estimates for each year.

The emissions estimate was also influenced by several other factors:

- The difference in vehicle emissions. The analysis assumed that a typical car emits 215 grams per kilometre, while using public transit emits 77 grams per kilometre. This implies a savings of 138 grams per kilometre per trip.
- Average commuting distance. This variable ranges from 13 kilometres per round trip to 18 kilometres per round trip. For analytical purposes, an average round trip commuting distance of 15.2 kilometres was assumed.
- Annual trips. It was assumed that some 260 round trips are taken per year.

Uncertainty Analysis for Projected Reductions

The estimated emission reductions from this measure are dependent on key assumptions, including the growth in ridership, the elasticity with respect to transit fare increases, the number of trips, the estimated reduction in vehicle trips (transit-to-auto passenger conversion), and the number of tax claims received for the Public Transit Tax Credit.

Moreover, there is the issue of behavioural impact. If all the claimants were taking the public transit prior to the introduction of the tax credit, then the actual reductions would be zero. In this situation, there would still be avoided emissions if the claimant had access to a car.

The uncertainty analysis focused on a couple of issues:

- The high case assumes that the Public Transit Tax Credit affected all claimants' behaviour. In this case, the emissions reductions are calculated by multiplying the number of claims received, the savings per round trip commute, and the number of days.
- The low case assumes a lower commuting distance (10 kilometres instead of 15 kilometres) and a lower behavioural impact (5% rather than 6%).

Provincial Greenhouse Gas Mitigation Programs

Methodology

All provincial actions, such as Ontario's phase-out of coal-fired power plants, provincial renewable promotion programs[31], Quebec's carbon levy, the British Columbia carbon tax and the *Clean Energy Act* (the CEA became law on June 3, 2010), Alberta's *Climate Change Emissions Management Amendment Act*, and Nova Scotia's emissions cap on electricity generation, are included in the business-as-usual base case[32]. Hence, the impact of these programs is reflected in the total emissions estimated for both the core and alternative scenarios examined.

The information used to calculate GHG emission reductions from the various provincial policies comes from provincial legislation and budget documents. For example, the modelling reflects the specific tax rates, emission caps or intensity targets, and penalties for the following major provincial initiatives, among others:

- British Columbia's carbon tax was introduced in the 2008 Budget, with a July 1, 2008, implementation date. The tax was initially set at $10 per tonne of carbon dioxide emissions, and is scheduled to rise by $5 per tonne in each of the next four years, reaching $30 per tonne of CO_2 in 2012.[33]
- Alberta's emissions trading system for large industrial emitters has been in place since July 2007. The system is based on emissions intensity and firms can meet 100% of their obligations by paying $15 per tonne into an Emissions Management Fund, which will be used to "drive innovation, test and implement new technologies, and achieve the goal of greening energy production."[34]
- In October 2007, Quebec implemented a carbon tax based on the following rates: 0.8 cents per litre on gasoline; 0.9 cents on diesel fuel; 0.96 cents on light heating oil; 1.0 cent on heavy heating oil; 1.3 cents on coke used in steel making; 0.5 cents on propane; and $8 per tonne on coal. The province expects to raise about $200 million a year to finance the province's green plan.[35]
- Nova Scotia's regulation that came into force in August 2009 caps GHG emissions at 19.22 million tonnes (cumulative 2010 and 2011), at 18.5 million tonnes (cumulative 2012 and 2013), at 26.32 million tonnes (cumulative 2014 through to 2015), at 24.06 million tonnes (cumulative 2017 through to 2019), and 7.5 million tonnes in 2020.[36]

Canada's Greenhouse Gas Emissions Levels for 2008-2012

The Government of Canada is applying Environment Canada's integrated Energy, Emissions, and Economy Model for Canada (E3MC) to estimate the reduction for the overall integrated package of measures. The modelled runs incorporate individual parameters for each of the initiatives reported

[31] Modelling shows that there is significant interaction between provincial renewable promotion programs and the ecoENERGY for Renewable Power program. As such, the integrated modelling does not reflect significant incremental reductions from the ecoENERGY for Renewable Power program.
[32] Saskatchewan's Bill No. 126 "An Act respecting the Management and Reduction of Greenhouse Gases and Adaptation to Climate Change", received Royal Assent in 2010, but has not yet been proclaimed, pending the approval of the accompanying regulations, which are under development. The actions itemized in this Act will be included in the business-as-usual case once the regulations and actions are fully funded and implemented.
[33] B.C. Ministry of Finance (2008): http://www.leg.bc.ca/38th4th/3rd_read/gov37-3.htm and http://www.sbr.gov.bc.ca/documents_library/notices/BC_Carbon_Tax_Update.pdf.
[34] Government of Alberta (2008): http://environment.alberta.ca/02486.html.
[35] http://www2.publicationsduquebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=5&file=2006C46A.PDF
[36] http://www.gov.ns.ca/just/regulations/regs/envgreenhouse.htm

here – as provided by lead departments – and aggregate the results to report on Canada's net emission reductions and total remaining emission levels for 2008-2012. The use of the model responds to the NRTEE's suggested methodological improvement for an "integrative accounting of the emission reduction estimates."

The E3MC model incorporates an updated energy, emissions, and economy baseline that includes the latest GHG emissions inventory published by Environment Canada. This baseline already incorporates many measures and trends currently underway across Canada. The date of January 1, 2006, has been applied as the cut-off point for defining existing measures that are to be included in the baseline. Some of the measures included in the baseline are complementary to the federal policies presented in this Plan. As such, to avoid double-counting, the impacts from these measures are not included in the total emissions reductions. Since integrated modelling has been done from a baseline that includes provincial and territorial programs, some of which complement federal actions, the impact of federal actions may in some cases be understated since all interaction effects between provincial/territorial and federal programs are netted from estimated federal reductions. Some key assumptions in the baseline that effect federal policies in the 2011 KPIA Plan include:

- The closure of all coal-fired electricity generation plants in Ontario by 2014;
- The adoption of provincial Renewable Portfolio Standards; and
- The implementation of provincial mandates for mandatory content of ethanol in gasoline.

2008-2009 Emissions

The Act requires that the expected emission reductions be compared to the levels in the most recently available emissions inventory for Canada. This stipulation implies that reductions must be "additional to any that would otherwise occur." As the 2008 and 2009 inventories include the impact of actions from all levels of government, it is necessary to specify the hypothetical, unobservable baseline level of emissions (i.e. the baseline without the actions from governments).

In order to ensure that all requirements of the Act are met, the methodology for estimating emission reductions was slightly modified. Specifically, a modified approach was used to develop a "No Federal Programs" baseline that excludes all federal actions announced after January 1, 2006. This counter-factual baseline provides an emissions level in the absence of federal government programs, and was constructed as follows.

1. The following parameters, which are assumed to be not influenced by the measures outlined in this Plan, were incorporated into the baseline:[37]

    - Gross output product: Use of actual 2008 and 2009 provincial and national gross domestic product.
    - Output: Use of actual 2008 and 2009 output levels in either "real or constant dollars" or physical output (e.g., barrels of oil, cubic feet of natural gas, megawatt hours of electricity, tonnes of cement, etc.) as appropriate, as a key driver of emissions estimates.

[37] In using actual GDP and energy price parameters while excluding government climate change policy measures, this methodology implies that government programs have no impact on these core economic parameters. While this is likely not the case, and potentially leads to a small downwards bias in the resulting estimates of actual emission reductions from government programs for 2008 and 2009, this is not expected to materially affect the resulting estimates of actual reductions.

- Electricity generating units: Use of actual emissions performance for 2008 and 2009.
- Energy prices: Use of actual 2008 and 2009 world oil price, North American natural gas price, and end-use product prices (e.g., gasoline, diesel, and electricity).
- Provincial and territorial actions.

2. A No Federal Programs emissions baseline was then generated by the E3MC model, reflecting the impact of actual 2008 and 2009 parameters (as noted above) on energy use and related emissions, but in the absence of federal government policies and programs implemented after January 1, 2006. The impacts of provincial and territorial actions were included.

The No Federal Programs baseline was then compared to the "actual" 2008 and 2009 emissions level reported in the National Inventory Report. The difference in emissions is attributable to the incremental impact of federal government GHG reduction actions for 2008 and 2009.

2010-2012 Emissions

To capture the effects of the Government's climate change programs, the assumptions used for the individual measures as detailed in this Plan were built into the E3MC model. E3MC assumes that consumers of energy respond to the program parameters by altering their decisions regarding purchases and investments based on Qualitative Choice Theory.[38] That is to say, the model assumes that decisions are based on the price of fuel combined with the perceived trade-off between energy cost savings through improved efficiency and capital and operating costs. For example, a program such as the ecoENERGY Retrofit Initiative provides financial support to reduce the cost of implementing an energy efficiency project, encouraging investment by improving the trade-off between the long-term value of energy savings and up-front investment costs.

The 2010-2012 emission levels for Canada were generated by simultaneously modelling the individual emissions reduction measures detailed in this Plan in E3MC. This ensures that measures were assessed in an integrated manner, thereby accounting for any positive and negative interactions between measures and regulations. In addition, the electricity sector in E3MC reflects a North American approach. If there are reductions in domestic electricity demand, there can be increased exports across the United States if relative power costs make it advantageous.

The methodological approach for developing the 2010-2012 emissions levels is similar to that used for estimating "actual" emissions reductions for 2008 and 2009, with the exception that 2008 and 2009 data are aligned to the National Inventory and an emissions projection is produced for 2010 to 2012.

1. Starting with actual emissions data from the National Inventory Report for all years up to 2009, a No Federal Programs baseline projection for 2010 to 2012 was developed using economic drivers in Budget 2011, energy production forecasts for crude oil and natural gas, and the world oil price and North American natural gas price from the National Energy Board. Only the impacts of provincial and territorial actions were included in this baseline.
2. The No Federal Programs baseline for 2010 to 2012 was then compared to an "All Programs" baseline that includes all federal and provincial measures contained in this Plan and implemented after January 1, 2006. The difference in emissions between the No Federal Programs baseline and the All Programs baseline is attributable to the incremental impact of federal government GHG reduction actions for the 2010-2012 period.

[38] Qualitative Choice Theory is based on the work of the Nobel Laureate, Daniel McFadden. Using Dr. McFadden's theory, several other leading economists such as Kenneth Train have applied this theory to estimating demand in key energy using sectors of the economy such as transportation and the built environment.

3. Using this same basic methodology, additional baselines and emissions reduction estimates were developed to support sensitivity and uncertainty analysis, as detailed below.

Uncertainty Analysis

There are a number of key determinants that influence energy supply and demand and emissions. These determinants include: the pace of economic growth; population and household formation; energy prices (e.g., world oil price and price of refined petroleum products, regional natural gas prices, and electricity prices); technological change, policy decisions, and consumer response to policy price and government actions. Varying any one of these assumptions could have a material impact on the energy and emission reduction estimates contained in this Plan.

As a basis for assessing the additional reductions required to achieve the GHG emission reduction targets implied by the *Kyoto Protocol Implementation Act*, nine alternative baselines of projected emissions excluding government measures were constructed. Given a projection period of 2010 to 2012 and that preliminary economic growth rates for 2010 are in the public domain, it was decided to use only one set of economic growth rates – those reported in Budget 2011 – and sensitivity analysis was performed around energy price and program effectiveness.

Given the uncertainty concerning key modelling assumptions, a set of alternative baselines was developed focused on the following drivers:[39]

- Energy prices: low, most likely, and high world oil price (West Texas Intermediate) and North American natural gas price (Henry Hub)
- Consumer responsiveness to government prices: low, most likely, and high responsiveness to government programs

In these alternative scenarios:

- The world oil price is assumed to average about $73 per barrel (US$2010) in the low case and $102 per barrel (US$2010) in the high case.
- The North American natural price is assumed to average about $4.2 per mcf (US$2010) in the low case and $5 per mcf (US$2010) in the high case.
- Consumer responsiveness is assumed to be high in the high case and low in the low case.

Environment Canada's E3MC Model

Environment Canada's E3MC has two components: a bottom-up model of Canada's energy supply and demand structure and a macroeconomic model of the Canadian economy.

The energy supply and demand model is an integrated multi-region, multi-sector North American model that simulates the supply, price, and demand for all fuels. The model can determine energy output and prices for each sector, both in regulated and unregulated markets. It simulates how factors like energy prices and government policies affect the choices that consumers and businesses make in the purchase and use of energy. The model's outputs, which include changes in energy use, energy prices, GHG emissions, investment costs, and possible cost savings from policies, are used to identify the direct effects stemming from GHG reduction measures. The resulting savings and investments from the energy supply and demand model are then used as inputs into the macroeconomic model.

[39] Consideration was given to using alternative economic growth rates for the projection. However, as the preliminary economic growth rates for 2010 are in the public domain, it was decided to use the economic growth rates reported in Budget 2011.

The macroeconomic model is used to examine consumption, investment, production, and trade decisions in the whole economy. It captures not only the interaction among industries, but also the implications for changes in producer prices, relative final prices, and income. It also factors in government fiscal balances, monetary flows, and interest and exchange rates.

More specifically, the macroeconomic model incorporates 133 industries at a provincial and territorial level. It also has an international component to account for exports and imports, covering approximately 100 commodities. The model projects the direct impacts on the economy's final demand, output, employment, price formation, and sectoral income that result from various policy choices. These, in turn, permit an estimation of the effect of climate change policy and related impacts on the national economy.

Treatment of Interaction Effects

The analytical approach permitted by E3MC addresses several key modelling challenges, namely additionality, free ridership, rebound effects, and policy-interaction effects.

The additionality issue refers to the question of what would have happened without the initiative in question. Problems of additionality arise when the stated emission reductions do not reflect the difference in emissions between equivalent scenarios with and without the initiative in question. This will be the case if stated emission reductions from an initiative have already been included in the reference case – emission reductions will effectively be double-counted in the absence of appropriate adjustments. In the E3MC model, additionality is controlled for by the fact that model structure is based on incremental or marginal decision making. The E3MC model assumes a specific energy efficiency or emission intensity profile at the sector and end-use point (e.g., space heating, lighting, auxiliary power, etc.). Under the E3MC modelling philosophy, if the initiative in question was to increase the efficiency of a furnace, only the efficiency of a new furnace would be changed. The efficiency of older furnaces would not change unless those furnaces are retired and replaced with higher efficiency ones. As such, any change in the model is incremental to what is reflected in the business-as-usual assumptions.

A related problem, free ridership, arises when stated reductions include the results of behaviour that would happen regardless of the policy. This can occur when subsidies are paid to all purchasers of an item (e.g., a high efficiency furnace), regardless of whether they purchased the item because of the subsidy. Those who would have purchased the product regardless are termed free-riders. In our model, the behaviour of free-riders has already been accounted for in the reference case. Their emissions are not counted, therefore, toward the impact of the policy. Instead, it is only the incremental take-up of the emissions-reducing technology that is counted.

The rebound effect describes the increased use of a more efficient product resulting from the implied decrease in the price of its use. For example, a more efficient car is cheaper to drive and so people may drive more. Emission reductions will generally be overestimated by between 5% and 20%, if estimates do not account for increased consumption due to the rebound effect. Within the model, there are mechanisms for fuel choice, process efficiency, device efficiency, short-term budget constraints, and cogeneration, which all react to changes in energy and emissions costs in different time frames.[40] All these structures work to simulate the rebound effect – in the example above, the impact of extra kilometres that may be driven as a result of improved fuel efficiency are automatically netted out of the associated emission reduction estimates. Finally, emission reduction policies such as the ones defined

[40] A shift in energy prices will cause cogeneration to shift in the short to medium term, device efficiency to adjust over the short to mid-term, process efficiency to adjust in the mid-term, and fuel choice to react in the mid- to long-term. The actual adjustment times depend on the particular sector.

in the Government's plan interact with each other, with a resulting impact on their overall effectiveness. A policy package containing more than one measure or policy would ideally take into account this impact to understand the true contribution the policy package is making (in this case to emission reductions). This impact is described through what are known as policy interaction effects.

As E3MC focuses on the marginal decisions being made by consumers, industry, and energy producers, the issue of additionality, free-ridership, rebound effects, and policy-interaction effects are addressed in both the business-as-usual case and when analyzing policies and measures.

E3MC is a comprehensive and integrated model focusing on the interactions between sectors and policies. In the demand sectors, the fuel choice, process efficiency, device efficiency, and level of self-generation are all integrally combined in a consistent manner. The model has detailed equations to ensure that all the interactions between these structures are simulated with no loss of energy or efficiency. For example, the electric generation sector responds to the demand for electricity from the energy demand sectors, so any policy to reduce electricity demand in the consumer sectors will impact the electricity generation sector. The model accounts for the emissions in the electricity generation sector, as well as the consumer demand sectors. As the electricity sector reduces its emissions intensity, policies designed to reduce electricity demand in the consumer sectors will cause less of an emissions reduction. The natural gas and oil supply sectors similarly respond to the demands from the consumer sectors, including the demands for refined petroleum products for transportation. As well, the export by supply sectors of their products is also simulated.

Taken as a whole, the E3MC model provides a detailed representation of technologies that produce goods and services throughout the economy and can realistically simulate capital stock turnover and choices among technologies. It also includes a representation of equilibrium feedbacks, such that supply and demand for goods and services adjust to reflect policy. Given its comprehensiveness, E3MC covers all the GHG emissions sources, including those unrelated to energy use.

Simulation of Capital Stock Turnover

As a technology vintage model, E3MC tracks the evolution of capital stocks over time through retirements, retrofits, and new purchases, in which consumers and businesses make sequential acquisitions with limited foresight about the future. This is particularly important for understanding the implications of alternative time paths for emission reductions. The model calculates energy costs (and emissions) for each energy service in the economy, such as heated commercial floorspace or person-kilometre travelled. In each time period, capital stocks are retired according to an age-dependent function (although the retrofitting of un-retired stocks is possible, if warranted by changing economic conditions). Demand for new stocks grows or declines depending on the initial exogenous forecast of economic output (i.e. a forecast that is external to the model and not explained by it) and the subsequent interplay of energy supply-demand with the macroeconomic module. A model simulation iterates between energy supply-demand and the macroeconomic module until there is a convergence. The global convergence criterion is set at 0.1% between iterations. This convergence procedure is repeated for each year over the simulation period.[41] E3MC simulates the competition of technologies at each energy service node in the economy based on a comparison of their cost and some technology-specific controls, such as a maximum market share limit in cases where a technology is constrained by physical, technical, or regulatory means from capturing all of a market. The technology

[41] The energy technology simulation component of the E3MC model (i.e. Energy 2020) does not have an explicit test for convergence because of the algorithm used in the model. The macroeconomic component of the E3MC model (i.e. The Informetrica Model or TIM) is used to test for convergence between the two models because, logically, if one model continues to send the identical information to the other model, then necessarily the other model should find the exact same solution as before. As the initial testing showed that after about three iterations most of the variables in TIM were very close to convergence, the maximum iteration for convergence is set to five.

choice simulation reflects the financial costs, as well as the consumer and business preferences revealed by real-world technology acquisition behaviour.

Model Challenges and Limitations

While E3MC is a very sophisticated analytical tool, no model can fully capture the complicated interactions associated with given policy measures between and within markets or between firms and consumers. Unlike computable general equilibrium models, however, the E3MC model does not fully equilibrate government budgets and the markets for employment and investment. That is, the modelling results reflect rigidities such as unemployment and government surpluses/deficits. Furthermore, the model, as used by Environment Canada, does not generate changes in nominal interest rates and exchange rates, as would occur under a monetary policy response to a major economic event.

Annex 2

Labour and Sector Impact Projections under the Government's Response to the KPIA

Just Transition for Workers

Pursuant to the requirements of paragraph 5 (1) (a) (iii.1) of the Act regarding measures respecting a just transition for workers affected by GHG emission reductions, the Government considered the requirement and determined that the implementation of regulatory or other measures proposed in this Plan will not require significant worker adjustment in regulated industries.

Under a modelled scenario where all the federal mitigation measures included in this Plan are implemented, employment levels are projected to increase from 16.8 million in 2009 to 17.6 million in 2012. This represents approximately 238,000 additional potential jobs per year during the Kyoto Protocol period after the recession. Comparing employment levels under the *Kyoto Protocol Implementation Act* to a reference scenario – a scenario that does not include the measures included in this Plan and only includes those federal measures announced as of January 1, 2006 – the analysis suggests no discernable or statistically significant impact on employment. By 2012, with all of the federal measures included in this Plan implemented, employment is expected to be 17.565 million compared to 17.570 million in the reference case.[42] Based on these results, the Government concluded that there will not be a significant impact on employment. Therefore, there will be no need to plan for measures aimed at worker transitions.

Equitable Distribution Among Sectors

Paragraph 5 (1) (d) of the Act requires the Government to ensure "an equitable distribution of greenhouse gas emission reduction levels among the sectors of the economy that contribute to greenhouse gas emissions". The *Kyoto Protocol Implementation Act* does not offer a definition of "equitable". Moreover, there is no information in the Act that could lead to an inferred or implied definition of "equitable". In the absence of a definition, Environment Canada used its best judgment to assess whether the GHG mitigation measures reported in the Climate Change Plan represent an "equitable distribution of GHG emission reduction levels among the sectors of the economy that contribute to GHG emissions".

The integrated modelling suggests that by 2012, GHG emissions could be some 9 Mt lower than those projected in the business-as-usual case. The model further suggests that the majority of these reductions would occur in the transportation sector (3.9 Mt or about 44% of the reductions that are expected to occur in 2012), the industrial sector (2.5 Mt or about 28% of the reductions that are expected to occur in 2012), and in the electricity sector (1.3 Mt or about 15% of the reductions that are expected to occur in 2012). The buildings sector (residential and commercial sectors) is also expected to make an important contribution (1.1 Mt or some 13%). Based on the targeted incidence of the suite of announced federal mitigation measures, there will be no notable inequities among sectors.

[42] These represent changes in a specific year. Macro-economic changes of this order of magnitude are negligible, and indicate no discernable or statistically significant impact on employment.

Table 1: Projected Sectoral Emission Reductions Under the Government's Response to KPIA (Mt)			
	2010	**2011**	**2012**
Residential	0.07	0.20	0.19
Commercial	0.94	0.99	0.94
Transportation	1.97	3.29	3.92
Industrial (excluding electricity)	1.18	1.67	2.54
Electricity generation	0.42	0.55	1.32
Agriculture, waste, and others	0.00	0.02	0.06
Total	4.6	6.7	9.0

It should be further noted that the emission reductions reported in Table 1 represent where the emission reduction occurs; not where the policies were targeted. This is an important distinction for measures that affect electricity demand, and hence, emissions from the electric power sector, since the incidence of any "burden" of those reductions is more or less distributed across all household, commercial, and industrial consumers of electricity rather than electricity generators per se. This further diminishes the likelihood of an inequitable distribution of burden under the measures included in this Plan.

In general, the reductions under this Plan are derived from national programs where the distribution of reductions would generally follow that of population from region to region. As such, impacts are broadly based, and of a magnitude where there is no evidence of equity concern.

In summary, based on the nature and limited magnitude of the measures included in the Government's Plan for the purposes of the *Kyoto Protocol Implementation Act*, Environment Canada's assessment is that they do not create equity concerns.

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