

**Response of the National Round Table
on the Environment and the Economy to its
Obligations Under the *Kyoto Protocol*
*Implementation Act***

September 2007

Transmittal Letter from the Chair

September 2007

Dear Minister:

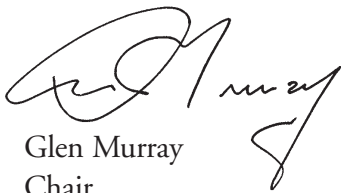
We are pleased to submit to you the National Round Table on the Environment and the Economy's (NRTEE) response to its obligations under the *Kyoto Protocol Implementation Act* with respect to the government's Climate Change Plan and Statement.

In carrying out its statutory obligations, the NRTEE has undertaken research, gathered information, and produced a written response as required. This activity focused on addressing Subsections 10(1)(b)(i) and 10(1)(b)(ii) of the Act. As allowed for under Subsection 10(1)(b)(iii), the NRTEE has also reviewed and commented upon broader aspects of the Act as it relates to the government's Plan and Statement.

With this document, the NRTEE has fulfilled the filing requirements of Section 10 of the *Kyoto Protocol Implementation Act*.

On behalf of the NRTEE, I wish to thank officials of Environment Canada for their cooperation in providing information which we used in the preparation of this response. We hope this will be useful to you and your department in approaching and evaluating expected emissions reductions from federal climate change policies and measures in the future.

Yours sincerely,



Glen Murray
Chair

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National Round Table
on the Environment
and the Economy

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National Round Table on the Environment and the Economy

About Us

The National Round Table on the Environment and the Economy (NRTEE) is dedicated to exploring new opportunities to integrate environmental conservation and economic development, in order to sustain Canada's prosperity and secure its future.

Drawing on the wealth of insight and experience represented by our diverse membership, our mission is to generate and promote innovative ways to advance Canada's environmental and economic interests in combination, rather than in isolation. In this capacity, it examines the environmental and economic implications of priority issues and offers advice on how best to reconcile the sometimes competing interests of economic prosperity and environmental conservation.

The NRTEE was created by the government in October 1988. Its independent role and mandate were enshrined in the *National Round Table on the Environment and the Economy Act*, which was passed by the House of Commons in May 1993. Appointed by Governor in Council, our members are distinguished leaders in business and labour, universities, environmental organizations, Aboriginal communities and municipalities.

How We Work

The NRTEE is structured as a round table in order to facilitate the unfettered exchange of ideas. By offering our members a safe haven for discussion, the NRTEE helps reconcile positions that have traditionally been at odds.

The NRTEE is also a coalition builder, reaching out to organizations that share our vision for sustainable development. We believe that affiliation with like-minded partners will spark creativity and generate the momentum needed for success.

And finally, the NRTEE acts as an advocate for positive change, raising awareness among Canadians and their governments about the challenges of sustainable development and promoting viable solutions.

We also maintain a secretariat, which commissions and analyses the research required by our members in their work. The secretariat furnishes administrative, promotional and communications support to the NRTEE.

Our Current Projects

The members of NRTEE meet four times a year to review their progress and agree on new priorities for action. Our current projects focus on:

- Clean Air Act Program
- Climate Change Adaptation Policy

Our Publications

The NRTEE produces *Review*, a quarterly newsletter about our activities including research updates, new publications and special events and it is available in either paper or electronic formats. For a free subscription, please visit our Web site at <http://www.nrtee-trnee.ca>.

We also produce a range of other publications on sustainable development issues. A complete list and order form are available on request (order.dept@renoufbooks.com).

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**Response of the National Round Table
on the Environment and the Economy to its
Obligations Under the *Kyoto Protocol*
*Implementation Act***

September 2007

1. Background

On June 22, 2007, the *Kyoto Protocol Implementation Act* (henceforth KPIA, or C-288), received Royal Assent.

The KPIA stipulates that the Government of Canada is obligated to prepare—on an annual basis—a Climate Change Plan describing measures and policies enacted by the government to “ensure that Canada meets its obligations under Article 3, paragraph 1, of the Kyoto Protocol” [Subsection 5(1)]. The first annual plan is to be prepared within 60 days of the KPIA coming into force. The KPIA further provides that “Within 120 days after this Act comes into force, the Minister of the Environment shall prepare a statement setting out the greenhouse gas emission reductions that are reasonably expected to result for each year up to and including 2012...” as a result of the Climate Change Plan. The government’s Climate Change Plan and Statement were released simultaneously on August 21, 2007, and entitled “A Climate Change Plan for the Purposes of the *Kyoto Protocol Implementation Act 2007*.”

Subsection 10(1) of the Act requires the National Round Table on the Environment and the Economy (NRTEE or Round Table) to, within 60 days of publication of the Climate Change Plan stipulated in Subsection 5(1), and within 30 days of the publication of the Statement stipulated in Subsection 9(2), perform the following with respect to the Plan or Statement:

- a) *undertake research and gather information and analyses on the Plan or statement in the context of sustainable development; and*
- b) *advise the Minister on issues that are within its purpose, as set out in section 4 of the National Round Table on the Environment and the Economy Act, including the following, to the extent that they are within that purpose:*
 - i) *the likelihood that each of the proposed measures or regulations will achieve the*

emission reductions projected in the Plan or statement;

- ii) *the likelihood that the proposed measures or regulations will enable Canada to meet its obligations under Article 3, paragraph 1, of the Kyoto Protocol, and*

- iii) *any other matters that the Round Table considers relevant.*

This report represents the response of the National Round Table on the Environment and the Economy to the requirements created by the *Kyoto Protocol Implementation Act* with respect to the government’s Climate Change Plan and Statement. In carrying out its statutory obligations, the NRTEE has undertaken research and gathered information. This activity has focused on addressing Subsections 10(1)(b)(i) and 10(1)(b)(ii). As allowed for under Subsection 10(1)(b)(iii), the NRTEE has also reviewed and commented upon broader aspects of the KPIA as it relates to the government’s Plan and Statement.

In accordance with the stipulations of the Act, the report has been provided to the Minister of the Environment. This fulfils the NRTEE’s current obligations under the KPIA.

2. Introduction

The issue of climate change, and Canada’s response to it, has been at the heart of the National Round Table on the Environment and the Economy’s work for many years.

The NRTEE has, for example, been examining questions related to the use of fiscal policy to promote long-term greenhouse gas (GHG) emissions reductions, climate change adaptation in the Canadian context, and a long-term technology scenario for how Canada might substantially reduce its GHG emissions while meeting the energy needs of a growing economy.

The provisions of the KPIA are quite specific in allowing the NRTEE to carry out its obligations in light of the purpose that has been defined for the organization under the *National Round Table on the Environment and the Economy Act*. And so the NRTEE has chosen to combine in this document some specific analysis of the government's Climate Change Plan and Statement with commentary on salient policy and analytical issues related to Canada's climate change response, based in part on the Round Table's previous work and understanding. In doing so, it is fulfilling its obligations with respect to an assessment of the government's Plan and Statement, while providing a broader information base and perspective on the issue of climate change within the context of Canada's long-term sustainability.

The NRTEE finds it necessary to respectfully place on the record its view that its role is not to hold the government specifically to account for any actions or non-actions with respect to sustainable development issues. This specific oversight role is mentioned nowhere in the NRTEE Act that sets out its fundamental purpose. The NRTEE's purpose—as defined in Section 4 of the *National Round Table on the Environment and the Economy Act*—is to provide a broad policy advisory role to the federal government. That purpose has, over the Round Table's history, been further defined by the decisions and choices made by the membership of the NRTEE, which is an authority accorded to them by the *Act*. The specific intent of the *Act*, and effective result of our approach, has been to establish the NRTEE as an independent source of policy advice to government flowing from its unique perspective on environment and economy issues.

The necessary starting point for this report is some definition and commentary of what it is the Round Table has been asked to do under the KPIA. Using the formulation found in the KPIA, the NRTEE was asked to assess the

“likelihood” that the government Plan and Statement would achieve their stated objectives—objectives that the KPIA sets out as “reasonably expected,” implying a degree of uncertainty and qualification—including the objectives agreed to by Canada under the Kyoto Protocol. The Round Table was obligated to “advise the Minister” within a designated and relatively short time frame.

It is also important at this juncture to be clear about what the NRTEE's report does not do. Because the government combined the Plan and the Statement in its own document, the Round Table has focused its analysis and assessment on how the Plan translates action into results, as expressed in the Statement. As a result, the NRTEE has not focused any analytical attention on the policies and measures *per se*. Consistent with its principal objectives under the KPIA, the NRTEE conducted a qualitative analysis of the assumptions underlying each of the specific measures and policies with a view to establishing the likelihood that such measures and policies would achieve their stated reduction objectives. It is not in the Round Table's mandate to comment on the merits of the measures and policies themselves. It is only concerned with the question of whether the measures and policies might reasonably be expected to achieve the emission reductions expressed in the Statement. Furthermore, because the government's Statement expresses the reductions achieved only in the Kyoto time period (2008–2012), the NRTEE is not in a position to comment on emission reductions that would likely be achieved as a result of the Plan beyond 2012.

The NRTEE further notes that since it is obligated to carry out this analytical function for 2007 through to 2012, its assessment must necessarily be considered an iterative one. It expects that further information and understanding about the actual versus expected outcomes set out in the government's Plan and Statement will emerge and evolve. As judgements

about whether signatories to the Kyoto Protocol have met their obligations are withheld until the conclusion of the protocol's time period, so too must the NRTEE's final judgment and conclusion be cumulative. In short, this is the first word on the subject, not the last. Although the NRTEE believes that the analytical approach it has taken is pragmatic and appropriate, it should not therefore be seen in any way as comprehensive or definitive.

The specific methodology is described in more detail in the section that follows.

3. Methodology

In response to its responsibilities under the KPIA, the NRTEE developed an analytical framework by which to evaluate the “likelihood” that the proposed measures or regulations will achieve the projected emission reductions in the Plan, and the likelihood that the proposed measures will allow Canada to meet its requirements under the Kyoto Protocol. Once NRTEE members approved the approach, the NRTEE evaluated the measures presented in the Plan. NRTEE members reviewed significant stages of the research and analysis and provided final approval of this report.

An initial assessment of the necessary (and available) analytical tools and methodologies led the NRTEE to conclude that the best approach to assessing “likelihood” was to determine whether the estimates themselves were accurate descriptions of the outcomes that could reasonably be expected from the policies and program initiatives described in the government's Plan and Statement. This amounts to an analysis of the policy effectiveness of the various measures. Given the nature of the mandate and the timelines involved, the presentation of a qualitative sense of predictive accuracy as opposed to a complete modelling of policy outcomes was chosen as the most appropriate. As

a result, the NRTEE has derived, where possible, a qualitative conclusion for each policy or measure. The statistical evidence and underlying assumptions suggest one of the following:

- an overestimate of eventual emissions reductions
- a reliable estimate of eventual emissions reductions
- an under-estimate of eventual emissions reductions

Where insufficient information is available to make such a determination, that fact is noted.

To be clear, the NRTEE is not in a position to provide a definitive statement on the emissions reduction level attributable to each policy and measure. Rather, it is providing an assessment—on the basis of what it knows about the underlying assumptions—of whether the measures and policies described in the Plan are likely to result in the suggested emissions reduction levels.

In considering the necessary elements of its analysis, the NRTEE was able to determine that four issues typically arise in the development and establishment of policy approaches to climate change (or any other complex economic policy). As a result, it formed the expectation that the government's Plan and Statement and underlying analysis would provide due consideration of these issues. And so its analysis required in part an assessment of the effects of the following: *additionality*, *free ridership*, *rebound effects*, and *policy-interaction effects*.

Problems of *additionality* arise when the stated emissions 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 emissions reductions from an initiative have already been included in the business-as-usual Reference Case: emissions reductions will effectively be double-counted.

A related problem, that of *free ridership*, arises when stated reductions include the results of behaviour that are rewarded but not influenced by the policies. This can occur when subsidies are paid to all purchasers of an item, regardless of whether they purchased the item because of the subsidy. Those who would have purchased the product regardless are termed *free riders*, and their behaviour has already been accounted for in the Reference Case. Not correcting for this implies that induced emissions reductions will be over-estimated by the proportion of free-riders.

The *rebound effect* describes the increased use of a more efficient product resulting from the implied decrease in the price of use: for example, a more efficient car is cheaper to drive and so people may drive more. Emissions reductions will generally be overestimated by between 5% and 20% if estimates do not account for increased consumption due to the *rebound effect*.

Finally, emissions-reduction policies such as the ones defined in the Plan interact with each other, with a resulting impact on their overall effectiveness. A policy package containing more than one specific 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 is known as *policy interaction effects*.

The remainder of this report examines the effectiveness of the specific policies proposed within the Plan and then discusses the projected emissions reductions in the context of Canada's Kyoto Protocol commitments.

4. Analysis and Assessment

The Plan details expected emissions reductions resulting from policy initiatives relative to a business-as-usual Reference Case, as defined in Canada (2006c). The stated emissions reductions in the Plan are derived from initiative-level

evaluations performed by Environment Canada, Natural Resources Canada (NRCan), and Transport Canada.

Establishing accurate forecasts of emissions reductions for one to six years from the present is a difficult task for anybody, and an attempt has been made to recognize this throughout the report. Evaluating others' projections is more difficult, given that individual projections may use different assumptions and different techniques. This difficulty is further compounded by the short time frame allowed for under the NRTEE's reporting requirements in the KPIA. In response to a request from the NRTEE, Environment Canada provided explanatory information on the assumptions and methodologies used to determine the expected emissions reductions resulting from the measures in the Statement. However, even with this information, there are cases where the NRTEE has had to make further assumptions about the methodological approaches used, or cases where assumptions have been used to calculate contrasting emissions scenarios. These are identified as much as possible without delving into unnecessary detail. In several instances in the Plan, differing accounting standards are used to describe the emissions reductions accruing from a particular initiative. While these inconsistencies do not necessarily constitute unreliable estimates of program impacts, they can lead to problems interpreting the eventual emissions profile.

In general, the impact of policies appears to be stated in terms of the induced reduction in emissions realized in a given year that can be attributed to the policy, relative to the Reference Case from Canada (2006c) (i.e., a 1-Mt reduction in 2008 implies that emissions will be 1 Mt more than those declared in the Reference Case as a result of the policy). This contention is supported by Table 1, created by the NRTEE, which shows clearly that when the total emissions reductions for the Plan are subtracted

Table 1: Interpretation of Reductions as Relative to the Reference Case

Year	2008	2009	2010	2011	2012
Reference Case Emissions¹	792 MT	809 MT	828 MT	835 MT	842 MT
Changes to Regulatory Standards	4.9	6.2	58.5	62.6	74.5
Fiscal Incentives or Direct Investment	3.7	6	8.4	9.8	9.9
Information-provision programs	1.7	2.7	3.9	4.2	4.5
Climate Change and Clean Air Trust	16	16	16	16	16
Total Projected Emissions Reductions	26.5	30.9	86.8	92.6	104.8
Implied Emissions Trajectory	766	779	741	742	747.1
Stated Emissions Trajectory (page 19 of Plan)	766	786	742	746	739
Difference (%)	<1% in all cases				

from the emissions trajectory for the Reference Case, the derived emissions sequence is within a 1% margin of error of the emissions profile stated in the Plan (Canada 2007a, page 19).

While the above analysis implies that a particular definition for “reductions” has been adopted, elsewhere in the Plan, some policy impacts are stated in different terms (for example, in terms of their cumulative impact). Such inconsistency eliminates the ability to compute expected realized emissions as the difference between stated reductions and Reference Case emissions.² In the analysis that follows, stated emissions reductions are intended to be interpreted as shown in the table above: The sum of stated reductions for a given year should correspond to the expected difference between the Reference Case and forecasts of realized emissions.

For the analysis that follows, the policies and programs set out in the government’s Plan and Statement are subdivided into three broad types:

1. Changes to regulatory standards
2. Policies that provide fiscal incentives and direct investment for GHG reduction
3. Information-based initiatives

The division of policies and the accompanying stated emissions reductions from the Plan are shown in Tables 2, 3, and 4.

Within each of these broad groupings, each of the initiatives was analyzed as follows: First, each initiative was detailed and the emissions reductions attributed to it in the Plan were recapped. Second, the key assumptions and issues to be considered for each policy were

1 Reference Case emissions are smoothed between years by assuming constant emissions growth rates between 2006 and 2010, and again between 2010 and 2015.

2 For example, if the Reference Case called for 800 Mt of emissions in 2010, and a policy was introduced that would save 1 Mt per year for 10 years (cumulative impact of 10 Mt), we should expect realized emissions in 2010 to be 799 Mt. If the cumulative impact of the policy were to be counted in 2010, and subtracted from the Reference Case to yield 790 Mt, this would not be an accurate expectation of realized emissions.

highlighted, where sufficient information was available.³ Where sufficient information was not available, the analysis sought to identify sources of potential estimate imprecision and/or estimates likely to be highly sensitive to modelling assumptions. Where applicable, relevant evidence from the scientific literature was discussed and related to the stated emissions reductions. Third, where possible, a conclusion on the likely accuracy of the stated emissions reductions was reached. Some of the individual policies detailed in the Plan either are too new, provide too few details, or claim emissions reduction effects that are too small for proper analysis. This is particularly the case for the public information programs, where the analysis relies on the scientific literature to provide general conclusions on the outcomes of such programs.

4.1 Analysis of the Plan and Statement in Meeting Stated Objectives

This section sets out the NRTEE's analysis and assessment of the likelihood that each of the proposed measures or regulations contained in the government's Plan and Statement will achieve projected emissions reductions. The measures are discussed broadly in three groupings: changes to regulatory standards, policies that provide fiscal incentives and direct investment for GHG reduction, and information-based initiatives. Detailed evaluations of individual measures can be found in Appendix A.

4.1.1 Regulated emissions limits and performance standards

The majority of the projected emissions reductions stated in the Plan accrue as a result of the Regulatory Framework for Air Emissions and other emissions limits and performance standards. Table 1 summarizes the timing of projected emissions reductions, potential key determinants of results, and evaluation of each of the programs that fall under this broad definition. The four programs projecting specific emissions reductions in Table 1 are as follows:

1. The Regulatory Framework for Air Emissions from large final emitters (LFE)
2. Energy efficiency standards for home appliances
3. Vehicle fuel efficiency standards
4. Renewable fuel content standards

³ In response to a request from the NRTEE, Environment Canada officials provided some of the assumptions and analysis underlying the emissions reductions projected in the Government's Statement; this information was used by the NRTEE in its evaluation of the Plan and Statement wherever possible. Third party analyses were used for comparison with Government assumptions and also for the evaluation of measures which the NRTEE did not have sufficient information.

Table 2: Summary of emissions limits and performance standards

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
Regulatory Framework for GHG Emissions	0	0	49	53	58	<ul style="list-style-type: none"> • relative contribution of internal emissions reductions and technology fund contributions • accounting for technology fund contributions 	Likely overestimate
Regulating Energy Efficiency	.61	.96	1.3	1.4	7.1	<ul style="list-style-type: none"> • <i>rebound effect</i> • policies are compared to the lowest efficiency case • pace of benefits from light bulb ban 	Likely overestimate
Vehicle Fuel Efficiency Standards	3.0	3.9	5.3	5.3	5.3	<ul style="list-style-type: none"> • <i>additionality</i> of reductions 	Reliable, but should not be included
Regulating Renewable Fuels Content Standards	1.3	1.3	2.9	2.9	4.1	<ul style="list-style-type: none"> • full cost accounting of renewable fuels' induced emissions • <i>additionality</i> • uncertainty and potential emissions increases 	Likely overestimate
Total	4.9	6.2	58.5	62.6	74.5		

General Findings:

The NRTEE reached the following conclusions:

- Significant emissions reductions and contributions to future emissions reductions will result from the Regulatory Framework for GHG Emissions. An immediate accounting of expected emissions reductions accruing as a result of contributions to the Technology Fund leads to likely overestimated realized emissions reductions for the 2008–2012 period. Estimates in the Plan treat contributions to the Technology Fund as being equivalent to emissions reductions realized in the time period in

which the contributions are made. However, these contributions will be used to finance emissions reductions programs that will result in an undetermined number of future emissions reductions; conceivably, these reductions could be more, or less, than 1 tonne of realized reductions per \$15 invested. This represents an important inconsistency in accounting for emissions reductions. Regardless of the eventual emissions reductions attributable to the Fund, it would be preferable not to treat investment in potential future emissions reductions as being equivalent to present-day emissions reductions that have been realized.

- Given that the estimates provided for Energy Efficiency Standards do not explicitly account for the *rebound effect* of increased intensity of use or increased total appliance stock, and given that the estimates have assumed the best-case scenario (i.e., that everyone would have chosen the least energy efficient model for a replacement in the absence of the policy), it may be concluded that the gains from improved standards are likely overestimated. However, since the exact standards are not defined, it is not possible to compare the Plan's projections to estimates that correct the above assumptions in order to assess the magnitude of any over-estimation. This lack of specific detail also makes it difficult to evaluate the degree to which stated emissions reductions should be understood to be *additional* to those attributed to more stringent efficiency standards already accounted for in the Reference Case.
- Because the Motor Vehicle Memorandum of Understanding (MOU) was signed before the development of the Reference Case, and is explicitly included in the emissions projections contained therein (see Canada 2006c, Annex II), counting these emissions as part of reductions relative to the Reference

Case implies counting the same reductions twice. As a result, given these concerns of *additionality*, the estimation of the reductions is not relevant for the present study.

- The analysis suggests that two factors contributed to the likely over-estimation of the emissions reductions resulting from the Renewable Fuel Content Standard. First, current scientific literature points to a greater range of uncertainty on the emissions displacement factors than those used in the Plan. Second, emissions reductions already included in the Reference Case are counted a second time.

4.1.2 Direct spending, fiscal measures, or incentives

Fiscal measures and direct government spending can be very powerful tools for emissions reduction, but it is important to examine carefully the specific incentives provided.

Each program provides incentives for increased emissions efficiency or energy efficiency, which may not directly translate into net emissions reductions. These programs are particularly subject to problems of *additionality* and *free ridership*.

Table 3: Summary of direct spending, fiscal measures, and incentives

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
ecoENERGY for Renewable Power	2.2	3.7	5.5	6.7	6.7	<ul style="list-style-type: none"> • actual displacement of existing capacity • nature of displaced alternative • <i>additionality</i> • <i>free ridership</i> 	Likely overestimate
ecoENERGY for Renewable Heat Initiative	Less than 0.1 Mt total					<ul style="list-style-type: none"> • insufficient detail 	Insufficient information to reach a conclusion
ecoAUTO Rebate Program	0.1	0.2	0.2	0.2	0.3	<ul style="list-style-type: none"> • accounting for cumulative rather than year-over-year reductions 	Likely overestimate
ecoENERGY Retrofit	0.4	0.7	0.9	1	1	<ul style="list-style-type: none"> • <i>rebound effect</i> • conversion of predicted energy savings to realized emissions reductions realized • treatment of <i>free ridership</i> 	Likely overestimate
ecoMOBILITY Program, Transit Pass Tax Credit	0.2	0.2	0.2	0.2	0.2	<ul style="list-style-type: none"> • elasticity of transit use with respect to price of vehicle trips 	Likely overestimate
Renewable Fuels Strategy	No specific commitment					<ul style="list-style-type: none"> • fuel demand/price projections • renewable fuel GHG footprint 	Insufficient information to reach a conclusion
ecoENERGY for Biofuels Initiative Capital Initiative	No specific commitment					<ul style="list-style-type: none"> • biofuels' GHG footprint 	Insufficient information to reach a conclusion
ecoAGRICULTURE Bioproducts Innovation Program	No specific commitment					Insufficient information	Insufficient information to reach a conclusion
ecoTRUST, funding for Carbon capture and storage	No specific commitment					Insufficient information	Insufficient information to reach a conclusion
Total	3.7	6	8.4	9.8	9.9		

General Findings:

The NRTEE reached the following conclusions:

- As with all subsidy programs, it is difficult to establish the incremental impact of the ecoENERGY for Renewable Power initiative. Statements in the Plan suggest that all new renewable energy production eligible for financing under the Renewable Power Production Incentive (RPPI) would be considered contributions to emissions reductions, thereby ignoring the potential for *free riders* who benefit from receiving the subsidy for projects that would have been built irrespective. The analysis (provided in Appendix A) suggests that the figures in the Plan do not represent incremental reductions in GHG emissions that will occur relative to those already accounted for in the Reference Case. The projections are a reflection of the aggregate displacement of GHG emissions associated with projects financed under the existing Wind Power Production Incentive (WPPI) and the enhanced RPPI, and so represent a double accounting of some reductions. The forecasts suggest some incremental production as a result of the RPPI that is not accounted for in the Reference Case, and emissions reduction numbers should be based on this incremental production only.
- The estimates for the ecoAUTO rebate program are reliable in terms of the lifetime impact of sales of vehicles in the years 2008–2012; however, they do not accurately reflect actual emissions reductions over that period. Given the way in which reductions are defined in the Plan, results for this policy should state the year-by-year emissions reductions realized from the subsidy program.

- As with other programs in the Plan, the ecoENERGY Retrofit Initiatives targets energy efficiency rather than energy consumption, and the results of the program are presented in terms of emissions reductions. Almost systematically, utility and government retrofit programs overestimate the impact of their investments on realized energy demand, largely as a result of directly translating potential gains in efficiency to estimated reductions in energy use, ignoring *rebound effects*, and/or as a result of treating all energy use reductions realized as incremental results of the subsidy programs, ignoring the *free rider effect*. Historical rates of return would suggest achieved emissions reductions of 30–40 kt per-cumulative-program-year, or less than one-sixth of the Plan's estimates. Therefore, the stated emissions reductions are likely overestimates of the eventual realized reductions.
- Because of the Plan's assumption that all new transit trips result in emissions reductions, the Plan slightly overestimates the projected emissions reductions for the Transit Pass Tax Credit.

4.1.3 Information Programs

Information-based programs described in the Plan account for 3.4 Mt per year of emissions reductions. Some research⁴ shows that these types of programs can appear to be powerful tools. Likely the best-known labelling program is EnergyStar, and the US Environmental Protection Agency credits EnergyStar with savings of up to 80 TW-h of electricity in 2001. Studies have pointed out that, in some cases, lack of knowledge may present a significant barrier to technology adoption, so programs that collect and disseminate information on the costs and benefits of particular energy efficiency

⁴ Please see Appendix A for further information on studies on the effectiveness of information programs.

Table 4: Summary of information programs

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
ecoENERGY for Personal Vehicles	0	0.1	0.1	0.1	0.1	<ul style="list-style-type: none"> • consumers are not fully aware of the consequences of their driving behaviour 	Insufficient information to reach a conclusion
ecoENERGY for Buildings and Houses	0.6	0.9	1.2	1.3	1.3	<ul style="list-style-type: none"> • lack of regulatory backstop in building codes • unclear whether existing practices would be adopted 	Insufficient information to reach a conclusion
ecoENERGY for Commercial and Industrial Buildings	0.2	0.3	0.4	0.4	0.4	<ul style="list-style-type: none"> • percentage of <i>free ridership</i> 	Insufficient information to reach a conclusion
EcoTECHNOLOGY for Vehicles	0.2	0.4	0.5	0.7	0.9	<ul style="list-style-type: none"> • lack of information versus lack of fiscal incentives explains some of current driving behaviour 	Insufficient information to reach a conclusion
ecoENERGY for Fleets	0.2	0.3	0.5	0.5	0.5	<ul style="list-style-type: none"> • managers are now aware of the cost of energy and the ways to incite cost-reducing behaviour among employees 	Insufficient information to reach a conclusion
EcoFREIGHT	0.4	0.7	1.2	1.2	1.3	<ul style="list-style-type: none"> • separation of program-induced benefits from natural improvements in energy efficiency 	Insufficient information to reach a conclusion
EcoMOBILITY	0.9	1.2	1.6	1.7	1.7	<ul style="list-style-type: none"> • current barriers exist and can be reduced through information rather than fiscal or regulatory incentives 	Insufficient information to reach a conclusion
Marine Shore Power Program	Less than 0.1 Mt total					<ul style="list-style-type: none"> • infrastructure costs will be paid back in savings at market energy prices • potential cost savings exist but there is a lack of information about these savings 	Insufficient information to reach a conclusion
Eco-AGRICULTURE	No Specific Commitment						Insufficient information to reach a conclusion
Total	1.7	2.7	3.9	4.2	4.5		

investments can be more successful than financial incentives. However, with few exceptions, little evidence exists through which one can evaluate the incremental effect of information-provision programs for emissions control or energy conservation. While it is possible to observe individuals' actions after receiving information, researchers generally do not know what information they had before, what they would have acquired through other channels, and what their decisions would have been without the programs.

General Findings:

The NRTEE finds that the majority of information-dissemination programs discussed in the Plan provide few details and the stated emissions reductions are small relative to margins of error that would exist for estimates from past or similar programs. As such, the discussion of the various measures proposed in Appendix A suggests means by which their emissions reductions might be validated *ex post*.

4.1.4 Clean Air and Climate Change Trust Fund

Summary of Initiative and Emissions Projections

Under the \$1.5 billion Clean Air and Climate Change Trust Fund, a series of third-party trusts have been established to directly support provincial and territorial efforts to reduce emissions. Annual emissions reductions of 16 Mt were attributed to the Fund. Although information provided by Environment Canada suggested that these were estimated on the basis of stated emissions reductions from the Province of Quebec, specific details were not provided. However, the NRTEE notes that details of all provincial activities to be undertaken as a result of the Fund have yet to be determined.

General Findings:

The NRTEE finds that the nature of some of the provincial programs suggests that issues of *additionality* exist. For example, the Quebec plan (as communicated to the NRTEE by Environment Canada) includes reductions in GHG emissions due to projects funded under the WPPI and due to the 5% ethanol content standard. It also sets targets for Quebec industries that will already be affected under the Regulatory Framework for Air Emissions. Without a fully integrated model that includes these transfers to the provinces, the federal policies, and the provincial policies, it is difficult (if not impossible) to attribute incremental emissions reductions to each separately. The NRTEE therefore believes that this area—the *scope* of federal climate change policy and specifically that of federal-provincial coordination in relation to the Trust—could benefit from further elaboration.

Another potential difficulty in evaluating the Trust is the likelihood that for future government plans, more information about provincial programs and measures will be included in the annual plan, adding an extra level of burden on the NRTEE to evaluate the effectiveness of not only the federal government's measures, but a significant number of provincial policies as well.

4.2 Analysis of the Plan and Statement in Meeting Canada's Kyoto Obligations

This section sets out the NRTEE's analysis and assessment of the likelihood that the proposed measures or regulations in the Plan and Statement will enable Canada to meet its obligations under Article 3, paragraph 1, of the Kyoto Protocol.

Table 5: Summary of Clean Air and Climate Change Trust Fund

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
Clean Air and Climate Change Trust Fund	16	16	16	16	16	• <i>additionality</i> of provincial reductions	Insufficient information to reach a conclusion

4.2.1 Canada's Obligations under the Kyoto Protocol

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) commits developed signatories to emissions reductions based on individual commitments. Canada's commitment under Article 3 of the Kyoto Protocol is to reduce emissions to an average of 6% below 1990 levels over the years 2008–2012. Canada's Assigned Amount for the period 2008–2012 is equal to 94% of its aggregate anthropogenic carbon dioxide equivalent (CO₂-eq.) emissions multiplied by five, calculated in Canada's filing of its "Initial Report Under the Kyoto Protocol" (Canada, 2006a) to be equal to 0.94 x 598 Mt of carbon dioxide equivalent (Mt CO₂-eq) x 5, or approximately 2815 Mt.⁵

In order to be considered in compliance with the Kyoto Protocol in terms of total emissions, Canada's emissions must not exceed this amount, except where they are offset through the use of approved flexibility mechanisms. Three principal flexibility mechanisms are permitted under the Kyoto Protocol: emissions trading, Joint Implementation (JI), and the Clean Development Mechanism (CDM). Emissions trading allows countries to purchase the rights to emissions reductions made by other Annex B parties to the Protocol, assuming that the selling country has a level of emissions below its

Assigned Amount. JI provides emissions credits for the implementation of a project that leads to emissions reductions in another developed (Annex A) country, while CDM offers credits for projects that reduce emissions in developing (non-Annex A) countries.

Penalties for non-compliance under the Kyoto Protocol lead to more stringent and more expensive compliance requirements in future commitment periods (i.e., after 2012). A common term used to describe non-compliance is the expected "Kyoto gap": the amount by which Canada's net emissions for 2008–2012 (total emissions, net of credits from emissions trading, and certified reductions from CDM and JI projects) exceed 2815 Mt. Under Decision 27/CMP.1, annex, part XV, paragraphs 5 and 6, a positive Kyoto gap would lead to a situation where Canada would be required to meet a more stringent cap in the second commitment period. In particular, Canada's allowable units (total emissions) in the second commitment period would be reduced by 130% of the first commitment period Kyoto gap. Further, Canada would lose access to emissions trading through the Kyoto Protocol, which would likely render future compliance with the protocol more expensive. It is not possible to provide details on the exact penalty, since the assigned amounts have yet to be negotiated for the second commitment period.

⁵ To avoid cumbersome notation, Mt is used in place of Mt CO₂-eq.

Table 6: Annual Allowable Units, Projected Emissions, and Implied Excess Emissions over the First Commitment Period (2008–2012) under the Kyoto Protocol⁶

Year	2008	2009	2010	2011	2012
Kyoto Target (2008–2012 avg) (Mt)	563	563	563	563	563
Commitment Period Total Allowable Emissions (Mt)	2815				
Emissions Projections (Mt)	766	786	742	746	736
Kyoto gap (Mt)	203	223	179	183	173
Commitment Period Projected Excess Emissions (Mt)	961				

4.2.2 Effectiveness of Measures and Regulations in Meeting Canada’s Kyoto Protocol Obligations

Statements and information contained in the government’s Plan indicate that it is not pursuing a policy objective of meeting the Kyoto Protocol emissions reductions targets. The Plan explicitly states that the government will not participate directly in the purchase of Certified Emissions Reductions (CERs), also known as international credits. Therefore, the stated emissions reductions set out in the Plan would not be sufficient for Canada to comply with the Kyoto Protocol as domestic emissions reductions alone are insufficient to achieve its Kyoto obligations. While statements in the Plan are correct—that non-compliance with the Kyoto Protocol can only be judged after the end of the commitment period in 2012—it is unlikely that the measures and regulations in the Plan will be sufficient to meet Canada’s Kyoto obligations.

As shown in Table 6, the projected emissions profile described in the Plan would leave Canada in non-compliance with the Kyoto Protocol. Canadian emissions would exceed their allowable units by 34%, with average excess emissions of 192.2 Mt/year.

5. Conclusions

In addition to the specific findings described above, the NRTEE would like to offer the following conclusions from this exercise:

- The policies and measures contained in the government’s Climate Change Plan and Statement will result in carbon emission reductions during the 2008–2012 period. There is a likelihood that the Statement overestimates the extent of emission reductions in the 2008–2012 period but we cannot definitively conclude at this time by how much. This stems from how some emission reductions are counted and estimated. With respect to the realization of Canada’s Kyoto commitments, we conclude that the Plan and Statement will likely not allow Canada to meet those commitments. As stated earlier, we are not in a position to comment on the impact of policies and measures beyond 2012 because of the way the government’s Statement is expressed and what the KPIA requires us to do.
- The NRTEE found that establishing “likelihood” of emission reductions in a definitive way from specific policy measures

⁶ This table was constructed by the NRTEE using the government’s numbers presented in the Plan.

is extremely challenging and subject to the sensitivity of projections and assumptions that are themselves very difficult to clearly establish. This is exacerbated by the specific challenges we faced in understanding and assessing the underlying assumptions of the government's Plan and Statement within the short time frame the KPIA gives us. We believe that going forward, certain methodological improvements can be made in both the development and presentation of reasonably expected emission reductions. This includes the following:

- Transparency and clarity, where key assumptions and methods are presented clearly and important sensitivities and uncertainties are made available and explained;
- Consistency, where common practices among departments is followed in areas such as accounting for emission reductions over the relevant time period; and
- Integration, where all programs are assessed in an integrated manner and the overall contribution accounts for positive and negative interactions between measures and regulations.

Throughout this report, suggestions for improved methodological and information-gathering practices are made for future Plans and Statements. We suggest that the government consider undertaking an analysis of international best practices in this area and applying relevant lessons to the Canadian context.

- Focusing on “likelihood” to determine emission reductions may not be the most useful framework through which to assess policies and measures to address climate change. Using this as the sole criterion affects the ability of policy makers to make

informed choices about the most appropriate and effective climate change policies because it does not consider other important factors, such as the costs of a given policy. As a result, it tends to favour a regulatory approach to policy making in order to equate a stated emission reduction outcome with a specific measure in a shorter-term time frame. In doing so, it ignores the positive contribution that market-based instruments and fiscal policy can make in sending effective, long-term carbon emission price signals throughout all aspects of the economy at a deeper level.

A related concern stems from the fact that an assessment of “likelihood” may not be sufficient to provide the information that Canadians need to properly evaluate the measures their elected representatives are either advocating for or implementing. This has an impact on the overall accountability of such measures and government action on this important issue.

- The necessity of addressing climate change as a long-term transformational issue cannot be overlooked. Focusing exclusively on the short-term Kyoto Protocol period alone—as we have had to do for this response—reinforces the NRTEE's established view that a longer-term national climate change policy framework is a more effective and necessary approach for the country. The nature and structure of Canada's energy system can only really be transformed through the sustained, consistent, and long-term application of appropriate policy. Accelerating the rate of infrastructure and capital investment decisions in the short term would lead to some emissions reductions, but also would come with considerable opportunity costs in terms of diverting limited economic and intellectual resources to a short-term target, instead of to the long view. This would affect Canada's collective ability to sustain the

necessary transformation of the economy over the medium and longer term and reap the substantial and sustained emissions reductions that would result and are needed. While there is a cost to addressing climate change, there are also opportunities—technological, economic, social, and environmental—that must be pursued and can only be achieved by establishing a long-term framework that includes clear medium- and long-term objectives and policy mechanisms that impose a price on carbon emissions. Focusing our national attention and energy on the achievement of these opportunities will benefit Canadians where they live, and ensure we all contribute positively to resolving this global problem.

Appendix A: Analysis and Assessment of Individual Measures in the Statement¹

1. Regulatory Framework for GHG Emissions

Summary of the Initiative and Emissions Projections

The Regulatory Framework for GHG Emissions (Canada, 2007b) imposes emissions reductions on Large Final Emitters (LFE), forcing affected firms to achieve an 18% reduction in GHG intensity from 2006 levels beginning in 2010, with a further 2% improvement required in each year thereafter. Affected firms may comply with the regulations either through internal abatement, through contributions to a climate change technology fund (at an initial rate of \$15/tonne), by purchasing the right to claim emissions reductions made by other domestic

firms through the emissions trading and offset systems, or by purchasing emissions reductions credits through the CDM mechanism defined under the Kyoto Protocol. Firms may also claim a one-time credit for GHG reductions between 1992 and 2006.²

Methodological Approach

The estimated emission reductions are based on output from Environment Canada's E3MC model, which provides an integrated view of the effects of the proposed regulations. Actual industrial emission levels depend on the compliance options chosen by regulated firms, for which Environment Canada provided preliminary estimates. For the reported emissions reductions, the breakdown by compliance mechanism is shown in Figure 1.

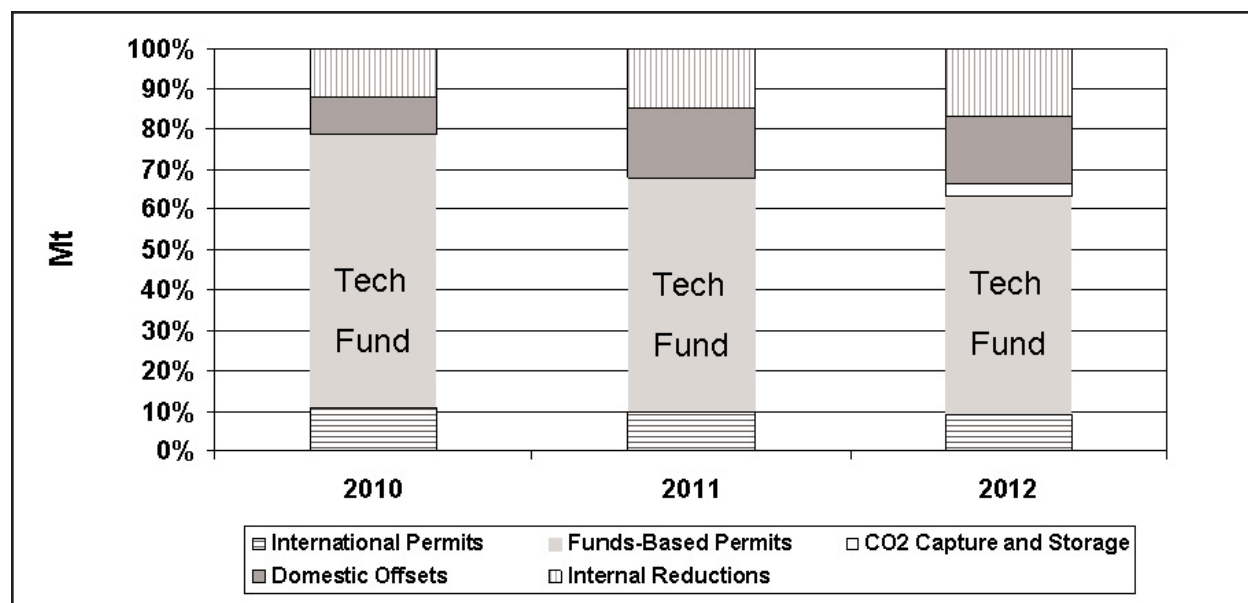
Table 1: Emissions Reductions Attributed to the Regulatory Framework for GHG Emissions

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
Regulatory Framework for GHG Emissions	0	0	49	53	58	<ul style="list-style-type: none"> • relative contribution of internal emissions reductions and Technology Fund contributions • accounting for Technology Fund contributions 	Likely overestimate

1 Annex 1, Statement of Measures and Expected Emission Reductions 2002–2012, A Climate Change Plan for the Purposes of the *Kyoto Protocol Implementation Act* 2007.

2 With respect to the particular mandate of this study, the provision for early-action means that firms can receive credit for emissions reductions already undertaken prior to 2006. It is important to note here that, while these reductions would be credited under the Regulatory Framework against 2010–2012 emissions, they hold no standing with regards to the Kyoto Protocol.

Figure 1 – Allocation of emissions reductions across compliance mechanisms*



* This table was constructed by the NRTEE using the government's numbers presented in the Plan and the Reference Case.

Analysis

Intensity targets regulate the quantity of emissions allowable per unit of output or value-added, and therefore add a degree of uncertainty with regard to the eventual emissions profile as compared with an emissions cap. In order to properly estimate the eventual emissions reductions, reliable estimates should be available for each of the following:

- the evolution of emissions intensity and economic activity absent the policy,
- economic activity under the policy, and
- compliance behaviour and use of flexibility/compliance mechanisms under the policy.

In order to understand how these emissions trends will evolve under the Regulatory Framework for GHG Emissions, use of an integrated model is particularly important. The policy affects some of the largest sectors of the Canadian economy, and thus will have

important spillover or secondary effects. Also, the response of other markets will determine the availability of domestic offsets to supplement internal emissions reductions and the purchase of international permits as a means of complying with the policy. While many of the details of the policy have yet to be finalized, the key driver of the results will be the marginal cost of emissions faced by affected firms, and this will be determined in the early years of the policy largely by the fixed rate of contribution to the Technology Fund, and to a greater degree in later years by the domestic and international offset markets.

Estimates in the Plan treat contributions to the Technology Fund as being equivalent to emissions reductions realized in the time period in which the contributions are made. However, these contributions will be used to finance emissions reductions programs that will result in an undetermined number of future emissions reductions; conceivably, these reductions could be more, or less, than 1 tonne of realized

reductions per \$15 invested. This represents an important inconsistency in accounting for emissions reductions.

While the Plan appears to overestimate realized reductions in the 2010–2012 period, the lack of realized reductions for the 2008–2009 period is also inconsistent with other modelling outcomes. As firms engage in early action to reduce their eventual compliance costs, some reductions relative to the Reference Case are likely to occur in the two initial years of the commitment period.

Conclusions

The above evidence suggests that significant emissions reductions and contributions to future emissions reductions will result from the Regulatory Framework for GHG Emissions, but that an immediate accounting of expected emissions reductions accruing as a result of contributions to the Technology Fund leads to a likely overestimation of the emissions reductions realized. Regardless of the eventual emissions reductions that occur as a result of the Fund, it is inconsistent to treat investment in potential emissions reductions as being equivalent to realized present-day emissions reductions.

2. Regulating Energy Efficiency

Summary of the Initiative and Emissions Projections

As part of the Regulatory Framework for Air Emissions, the government proposes to update existing standards for 12 product categories, and introduce new energy efficiency standards for 20 more between 2007 and 2010, as well as introduce a ban on incandescent light bulbs that would begin in 2012.

Methodological Approach

The emissions reductions provided in the Plan were calculated assuming that, in the case of appliance replacement, the energy savings resulting from the regulations would be proportional to the difference in energy consumption between a benchmark regulated unit and the least efficient product currently sold in Canada. According to information provided to the NRTEE by Natural Resources Canada (NRCan), no consideration was explicitly given to the *rebound effect*. No specific methodology was provided for the calculation of projected emissions reductions from the ban on incandescent bulbs.

Table 2: Emission Reductions Attributed to Energy Efficiency for Household Goods

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
Regulating Energy Efficiency	.61	.96	1.3	1.4	7.1	<ul style="list-style-type: none"> • <i>rebound effect</i> • policies are compared to the lowest efficiency case • pace of benefits from light bulb ban 	Likely overestimate

Analysis

Reducing emissions by improving efficiency standards poses similar challenges to those presented by intensity targets. When the energy consumption of a particular device is regulated, and attempts are made to translate this regulation into a reduction in total energy consumed and/or emissions levels, several ancillary assumptions must be made. The only ways in which the decrease in energy use from the device will correspond directly to the percentage increase in energy efficiency, as is assumed in the calculations in the Plan, is if replacement rates remain the same, the use of old appliances is discontinued, and the intensity of use does not change. There are three principal reasons that estimates based on such assumptions will lead to an overestimate of the impact of efficiency standards. First, people may continue to use an older unit as a secondary device (the “*beer fridge effect*”), they may purchase a larger but more efficient replacement unit, or they may use the new appliance more intensively (the *rebound effect*). The occurrence of any of these effects implies that the reduction in total energy use will be less than the increase in energy efficiency. Also, efficiency gains mean that appliances are less costly to operate and so people who otherwise would not have purchased one may choose to do so, and the total number of appliances in use would therefore increase, which also negates some of the emissions reductions.

Empirical evidence suggests that the *rebound effect* is important to consider when regulating appliance efficiency, but that these changes in behaviour are unlikely to negate all the gains from energy efficiency. Nadel (1993) examined more than 40 studies of energy efficiency programs and found evidence of *rebound effects* only for compact fluorescent lamps and air conditioners (Nadel refers to the *rebound effect* as a “*snapback effect*”). A recent study by Davis (2007) provides strong evidence of the increased use of higher-efficiency household appliances. He

shows that when randomly chosen homeowners are given washers that are on average 48% more energy efficient, they wash 5.6% more clothes. And so the total resulting energy (and emissions) reduction is just 42.4% rather than 48%. Additional studies by Hausman (1979); Dubin and McFadden (1984); Dubin (1985); and Dubin, Miedema, and Chandran (1986) show similar patterns of increased usage intensity after the acquisition of more efficient appliances.

The data do provide strong support for the role of regulation in driving incremental changes in efficiency, and therefore reductions in energy use. Between 1972 and 2001, average electricity consumption of central air conditioners and refrigerators decreased by 44% and 56% respectively, and this was representative of gains among other products (Davis, 2007). Strong evidence for the role of regulation in affecting this trend is also provided in Nadel (2002) who shows that, for refrigerators, the efficiency improvements are not smooth, but rather follow almost exactly the stringency of efficiency standards. Nadel states that in years in which market forces prevailed, and there were no new standards, there were also few efficiency improvements. As a result, treating the set of appliances currently available for sale as the no-policy benchmark may not be inconsistent for the short-term. However, assuming that the same replacement decision would have been made and each would have chosen the least-efficient model available represents a best-case scenario and so is too strong an assumption. In the absence of the policy, some replacements would certainly be undertaken with appliances other than the least-efficient model.

Empirical evidence for Canada does support the Plan’s contention that some emissions reductions will be induced by tighter emissions standards. Jaccard and Rivers (2007) discuss the likely consequences of a set of improved standards for energy-using products in Canada based on the historic relationship between energy demand and

regulation, and find that likely emissions from their chosen standards are in the order of 1.5 Mt in 2010. It is not possible to directly compare the projections in the Plan to the results of Jaccard and Rivers (2007) since they are not based on the same standards as those used to compute the emissions projections specified in the Plan.

In addition to the concerns expressed above with respect to the estimation of the impact of the policies, a potential issue of *additionality* exists with the manner in which these results are treated. Since the impacts are expressed as reductions relative to the Reference Case, there should be careful consideration of which efficiency improvements have been already taken account of in the Reference Case projections. Specifically, consider that the Reference Case accounts for some new equipment regulations and standards that will require new gas furnace efficiency to be 90% in 2009 and new gas boilers to be 85% efficient by 2010. Since specific details of the standards used to calculate the stated reductions in the Plan are not given, it is not possible to say whether these are the same as some or all of those already included in the Reference Case, although information provided suggests that *additionality* of these emissions reductions has been assured.³

In the Plan, particular attention is given to an effective ban on incandescent light bulbs as a source of increased energy efficiency. While it is true that compact fluorescent light bulbs convert electricity to light at a much more efficient rate than incandescent lights, several caveats must be considered before accepting the claim that

moving from a 60-watt incandescent bulb to a 15-watt compact fluorescent will lead to 75% reductions in energy use. Jaccard et al. (2006) discusses how previous projections of the market acceptability of energy-efficient substitutes for incandescent bulbs greatly over-estimated their uptake. Greater up-front costs, high premature failure rates, unfamiliar light quality, and incompatibility with household fixtures and switches led to greater financial risk and a product that was not as “cheap” as a watt-for-watt or lumen-for-lumen comparison would suggest. In this measure, the regulation of the technology will likely result in further innovation, improved quality, and—eventually—lowered cost and increased uptake.

This being said, the forecasted emissions reductions seem likely to be overestimated. Estimates produced by the Ontario Ministry of Energy state that replacing all incandescent light bulbs in Ontario would reduce electricity consumption by 6 TW-h, or just over 4% of total electricity consumption.⁴ If we extrapolate this to Canadian electricity sales, this would imply a savings of 20TW-h per year. At current emissions intensities, 20TW-h of generation produces 4.1 Mt of carbon emissions. This corresponds exactly with the Plan’s estimate of the savings in 2012.⁵ But since the Canada-wide ban is only slated to take effect in 2012, realized emissions reductions should be lower in the initial years as some incandescent bulbs remain in use. For example, in Australia, a ban imposed in 2008 is not expected to reach peak emissions reductions until 2015.⁶

3 Information provided by Natural Resources Canada (NRCan): “The savings cited in the KPIA for equipment standards is incremental to those incorporated within Canada’s Energy Outlook: The Reference Case 2006.”

4 http://www.energy.gov.on.ca/index.cfm?fuseaction=english.news&body=yes&news_id=148 .

5 Based on an average emissions intensity of 0.207Mt/TW-h in 2006. Intensity was derived based on 115 Mt of emissions from power generation in 2006, over production of 554.7 TW-h.

6 <http://www.environment.gov.au/minister/env/2007/pubs/mr20feb07.pdf>

Conclusions

Given the fact that the estimates provided do not explicitly account for the *rebound effect* of increased intensity of use or increased total appliance stock, and given that the estimates have assumed the best-case scenario that all replacements would have chosen the least energy efficient model available absent the policy, it may be concluded that the gains from improved standards are likely overestimated. However, since the exact standards are not defined, it is not possible to compare the Plan's projections to estimates that correct the above assumptions in order to assess the magnitude of any overestimation. This lack of specific detail also makes it difficult to evaluate the degree to which stated emissions reductions should be understood to be *additional* to those attributed to more stringent efficiency standards already accounted for in the Reference Case. While this policy to ban incandescent light bulbs will undoubtedly result in emissions reductions, the 2012 number is a reasonable estimate of the eventual reductions once all incandescent bulbs are removed from use, but is not an accurate measurement of the reductions accruing in the first year of the ban. It is expected to take several years for this measure to reach its full potential.

3. Motor Vehicle Fuel Efficiency Memorandum of Understanding (MoU)

Summary of the Initiative and Emissions Projections

A Memorandum of Understanding (MoU) between the Government of Canada and automakers aims to reduce GHG emissions from motor vehicles on the road by 5.3 Mt/year by 2010. The 5.3 Mt/year target is measured from a benchmark level of emissions from the vehicle fleet in absence of any action.

Methodological Approach

The MoU was signed before the development of the Reference Case, and is explicitly included in the emissions projections contained therein (see Canada 2006c, Annex II). As a result, the estimation of the reductions is not relevant for the present study.

Analysis

Measures enacted under the *Motor Vehicle Fuel Consumption Standards Act* will impose more stringent fuel-efficiency ratings for Canadian vehicles, however the Plan clearly states that the estimates of emissions reductions accruing from these fuel-efficiency changes are preliminary, and as such are not included since they are based on unknown standards. The stated emissions reductions thus include only those accruing as a

Table 3: Emission Reductions Attributed to Vehicle Fuel Efficiency Standards

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
Vehicle Fuel Efficiency Standards	3.0	3.9	5.3	5.3	5.3	• <i>additionality</i> of reductions	Reliable, but should not be included

result of the MoU. This poses a significant problem of *additionality*, since the MoU is already included in the Reference Case. As a result, counting these emissions as part of reductions relative to the Reference Case implies counting the same reductions twice.

Conclusions

Given the *additionality* concerns expressed above, emissions accruing as a result of the MoU should not be counted as reductions against the Reference Case. Any emissions reductions attributed to the MoU in the context of the Plan would constitute an overestimate.

4. Regulating Renewable Fuels Content Standards

Summary of Initiative and Emissions Projections

Regulations detailed in the Plan will require 5% renewable fuel content by volume for gasoline from 2010 and 2% by volume for diesel fuel and heating oil by no later than 2012.

Methodological Approach

The estimates are derived by estimating aggregate volumes of biodiesel and ethanol produced, and calculating emission reductions using conversion factors that specify the percentage by which total GHG emissions are reduced when gasoline and diesel are produced from biomass rather than from petroleum. The emission reduction factors for Regulating Renewable Fuels Content are 1.25 Mt of GHG emissions reduced per 1 billion litres of ethanol and 2.2 Mt per billion litres for biodiesel. The former corresponds to GHG reductions of 33.1% relative to gasoline produced from petroleum sources, while the latter represents a 66.5% reduction relative to the conventional production of diesel.⁷

Analysis

Renewable fuels content standards do not directly regulate GHG emissions, but rather seek to indirectly regulate the inputs to gasoline and other fuel production. In order for a renewable fuels content standard to reduce GHG emissions, two conditions must be verifiable:

1. The renewable fuels content requirement does not lead to increases in production of gasoline and diesel fuels in general.

Table 4: Emission Reductions Attributed to Regulating Renewable Fuels Content Standards

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
Regulating Renewable Fuels Content Standards	1.3	1.3	2.9	2.9	4.1	<ul style="list-style-type: none"> • full cost accounting of renewable fuels' induced emissions • <i>additionality</i> uncertainty not considered 	Likely overestimate

⁷ Based on gasoline energy content of 36MJ/L, and diesel energy content of 40.9MJ/L and emissions from diesel of 82.3G/MJ and emissions from conventional gasoline of 96.9G/MJ.

2. Based on a full-cost accounting, the production of the renewable fuel has lower GHG emissions than comparable petroleum-based production.

Optimal business management suggests that the first of these conditions is likely to be satisfied. It would be implausible for a regulation to reduce the costs of providing fuel by requiring a change in input mix, at least in the short term. Simply put, if it were cheaper to provide a renewable content at or above 5%, companies would be doing so now.

Empirical estimates show that the second of these conditions is likely true, but the magnitude of the emissions reduction factor may be lower than that chosen in the Plan. Farrell et al. (2006) show that production of gasoline using ethanol reduces petroleum use on average by about 95% relative to conventional refining, but that GHG reductions are only reduced by about 13% relative to conventional gasoline production. In fact, Farrell et al. argue that “the impact of a switch from gasoline to ethanol has an ambiguous effect on GHG emissions, with the reported values ranging from a 20% increase to a decrease of 32%.” Updated estimates published as a correction to the Ferrell et al. article suggest a point estimate of net GHG for corn ethanol of 18% below conventional gasoline, but with a possible range of 36% fewer emissions to 29% more emissions.⁸ Hill et al. (2006) find similar results for gasoline, and find that GHG emissions are reduced by 41% for biodiesel relative to the fossil fuels they displace. Further, they note that “these estimates assume these biofuels are derived from crops (corn) harvested from land already in production; converting intact ecosystems to production would result in reduced GHG savings or even net GHG release from biofuel production.”

A further issue with regard to *additionality* arises when considering the quantities used to calculate emissions displacement. Figures presented are based on the expansion of ethanol production to 2.2 billion litres after 2010, and the expansion of biodiesel production to 600 million litres in 2012. For ethanol production, this represents an increase of 900 million litres over the Reference Case for 2010. Using the conversions from the Plan, this would only account for an additional 1.125 Mt of reductions in 2010, rather than the figure of 2.9 Mt stated in the Plan, which corresponds to more than the predicted emissions displaced by all ethanol produced, including units already counted in the Reference Case.⁹

Conclusion

The evidence above suggests that two factors contributed to the likely overestimation of the emissions reductions resulting from the renewable fuel content standard. First, the emissions reduction factors used are higher than those cited in the current scientific literature. Second emissions reductions already included in the Reference Case are counted a second time.

5. ecoENERGY for Renewable Power

Summary of Initiative and Emissions Projections

According to the Plan, the ecoENERGY for Renewable Power program will invest \$1.5 billion dollars to provide incentives to increase Canada’s supply of clean electricity. The goal of the program is to encourage the production of 14.3 terawatt hours (TW-h) of new electricity

⁸ <http://www.sciencemag.org/cgi/content/full/312/5781/1748b>

⁹ In order to obtain a reduction of 2.9 Mt, the conversion factor of 1.25 Mt per billion litres suggests that the estimates are based on over 2.2 billion litres of production, the total amount of ethanol production for 2010.

Table 5: Emission Reductions Attributed to ecoENERGY for Renewable Power

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
ecoENERGY for Renewable Power	2.2	3.7	5.5	6.7	6.7	<ul style="list-style-type: none"> • actual displacement of existing capacity • nature of displaced alternative • <i>additionality</i> • <i>free ridership</i> 	Likely Overestimate

from renewable energy sources, which is enough electricity to power about one million homes.¹⁰ The program provides an incentive of one cent per kilowatt hour for up to ten years, which will reduce the cost gap between new technologies and traditional sources of electricity.

Methodological Approach

The estimates above are calculated on the basis of renewable energy supplies of 4.7 TW-h in 2008, 8.0 TW-h in 2009, 11.7 TW-h in 2010, and 14.3 TW-h for 2011 and 2012. The estimates of emissions reductions are derived using a conversion factor of 0.4564 Mt/TW-h.

Analysis

As with all subsidy programs, it is difficult to establish the incremental impact of the ecoENERGY for Renewable Power program. Program designers have recognized this problem, and according to NRCAN, “where a renewable electricity generation project is developed at a site where no previous electrical generation existed, it would clearly be considered ‘incremental’.”¹¹ This does not, however, constitute incremental generation for the purposes of evaluating policy-induced emissions reduction. In order for emissions reductions to be clearly attributed to

increased renewable generation under the RPPI, one of two factors must be demonstrable:

1. The production facility would not have been built without the subsidy, and the new facility replaces an existing one with a higher rate of emissions; or
2. The production facility would have been added without the subsidy, but the facility would have been more emissions intensive.

In either of these cases, the new capacity would represent emissions reductions as a result of displacing a more emissions-intensive alternative. Statements in the Plan suggest that all new renewable energy production eligible for financing under the RPPI would be considered as contributing to emissions reductions, thereby ignoring the potential for policy free riders, who benefit from receiving the subsidy for projects which would have been built irrespective of it.

A second important source of *additionality* concern arises because the original Wind Power Production Initiative (WPPI) subsidy is included in the Reference Case. Any emissions savings resulting from projects financed under this initiative (as opposed to those financed under the expanded WPPI from the 2005 Budget) would be double-counted if included in the Plan. As of 2007 Canada has seen significant growth in wind

¹⁰ <http://www.ecoaction.gc.ca/ecoenergy-ecoenergie/power-electricite/index-eng.cfm>

¹¹ http://www2.nrcan.gc.ca/es/erb/CMFiles/RPPI_Discussion_Paper_August_3173MJT-01092005-8155.pdf.

Table 6: Use of Information Provided for the RPPI*

Year	2005	2008	2009	2010	2011	2012
Reference Case Wind Production¹² (*=interpolated)	1.8	4.76*	6.58*	9.1	10.6*	12.5*
Provided Generation Total Numbers		4.7	8.0	11.7	14.3	14.3
Total Emissions Reductions (multiply total generation by a factor of 0.4564 Mt/TW-h)		2.2	3.7	5.3	6.5	6.5
Stated Emissions Reductions from the Plan		2.2	3.7	5.5	6.7	6.7
Incremental Emissions Reductions (multiply difference between Reference Case and Provided Generation by a factor of 0.4564 Mt/TW-h)		0	0.6	1.2	1.7	1.7

* This table was constructed by the NRTEE using numbers provided by Natural Resources Canada.

power generation, and a continuation of this pattern is part of the Reference Case: wind generation is expected to increase from 1 TW-h in 2004 to 9 TW-h by 2010 and to 24 TW-h by 2020. This represents a Reference Case for growth in wind power of 17% per year.

Figures provided by NRCan suggest that emissions reductions are in fact stated for all renewable generation, or at least all generation that would be eligible for RPPI or WPPI financing. Table 6 above shows the figures provided, the Reference Case for wind power (other renewables are taken to be negligible and biomass is not included), and the calculations that led to the stated reductions.

To interpret the table, consider that in 2010, Reference Case generation is to be 9.1TW-h from wind, while figures the NRTEE was provided implied 11.7 TW-h of total production from renewables, for which stated emissions

reductions are 5.5 Mt, with the ratio between the two being exactly equal to the provided conversion factor (up to rounding errors). Consider also that the implied incremental production from renewables in 2010 is 2.7 TW-h (the difference between the Reference Case of 9 TW-h and the production forecast of 11.7 TW-h provided by NRCan). Based on the conversion factors provided, rather than achieving the 5.45 Mt of stated reductions, this incremental production would be equivalent to emissions reductions of 1.2 Mt. The key assumptions used above are that the provided figures do not correspond to an estimate of incremental generation. This would imply that total generation from wind and other renewables would increase two-fold under the policy, to a total of 21.8 TW-h per year. While this would negate the discussion of *additionality* above, such an assumption would seem unrealistic and so would be subject to a different set of critiques.

¹² Reference case emissions are smoothed between years by assuming constant emissions growth rates between 2006 and 2010, and again between 2010 and 2015.

Conclusions

The evidence reported above suggests that the figures in the Statement do not represent incremental reductions in GHG emissions that will occur relative to those already accounted for in the Reference Case. The projections are a reflection of the aggregate displacement of GHG emissions associated with projects financed under the existing WPPI and the enhanced RPPI, and so would represent a double-counting of some reductions. The forecasts suggest some incremental production as a result of the RPPI that is not accounted for in the Reference Case, and emissions reduction numbers would be more accurately based on this incremental production only.

6. ecoAUTO Incentives

Summary of Initiative and Emissions Projections

The Plan describes the ecoAUTO new-vehicle-purchase incentive program, which offers rebates or charges additional fees to new vehicles based on their relative fuel economy. Under the program, purchasers may be eligible for rebates on fuel-efficient vehicles of up to \$2000, or be charged fees of up to \$4000 on new fuel-inefficient vehicles.

Methodological Approach

The estimates provided in the Plan are derived from a multi-step estimation procedure. First, an estimate of the fuel consumption per kilometre for vehicles being replaced by the rebate vehicles is based on lifetime on-road fuel consumption estimates for either the conventional engine equivalent of a hybrid vehicle (when available), or an average vehicle in one of two classes (cars or light trucks). This rate is then used to compute total consumption of fuel with and without the rebate program, accounting for a 15% *rebound effect* on kilometres travelled. These total fuel savings are converted to emissions reductions attributable to replacement vehicles. The estimate also accounts for the *free rider* problem by assuming that 60% of forecast increases in efficient vehicle sales cannot be directly attributed to the rebates.

Analysis

The analysis of the ecoAUTO incentives is very thorough. As specified above, the analysis clearly accounts for estimated *rebound* and *free rider* effects.

The data supports the magnitude of the corrections used for the *rebound* and *free rider* effects, as estimates both above and below the value of 15% used in the Plan can be found. Kleit (2002) examines the role of fuel- (as opposed to emissions-) efficiency standards in promoting gasoline conservation in the United States. He finds that people use efficient cars

Table 7: Emission Reductions Attributed to EcoAUTO Rebate Program

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
EcoAUTO Rebate Program	0.1	0.2	0.2	0.2	0.3	• accounting for cumulative rather than year-over-year reductions	Likely overestimate

more intensively, which negates a significant proportion of the aggregate fuel savings. Specifically, Kleit finds that under a proposal to tighten Corporate Average Fuel Economy (CAFE) standards by 50%, fuel consumption would decrease by only 22% as a result of increased driving, increased congestion, and other factors. Fischer, Parry, and Harrington (2007) examine the welfare basis for tightening vehicle fuel-efficiency standards. They find that a 13% reduction in gasoline consumption can be achieved by a 15% tightening of the CAFE standards. This suggests that the *rebound effect* may be stronger for higher fuel economy. The *rebound effect* for vehicles ensuing from tightened fuel-economy standards was also studied by Greene et al. (1999), who found that the *rebound effect* leads to a long-run take back of about 20% of potential energy savings. The correction for the *free rider* problem is also consistent with estimates compiled for the NRTEE (NRTEE, 2005).

One issue with these estimates with respect to the current mandate is the way in which emissions reductions are attributed to the subsidy program. The estimates in the Plan represent a reliable estimate of the difference in total lifetime (15 year) emissions attributable to cars purchased under the subsidy program. In other words, for a car purchased in 2010, all emissions reductions—from 2010 through 2025—that will be realized as a result of that purchase are

accounted for in 2010. Since these emissions reductions occur incrementally over those 15 years, accounting for them in this way likely overestimates the realized emissions reductions in the early years of the subsidy, which is our period of interest.

Conclusions

The estimates are reliable in terms of the lifetime impact of sales of vehicles in the years 2008–2012; however, they do not accurately reflect realized emissions reductions over that period. Given the way in which reductions are generally defined in the Plan, results for this policy should state the year-by-year realized emissions reductions for the subsidy program.

7. ecoENERGY Retrofit Initiative

Summary of Initiative and Emissions Projections

The ecoENERGY Retrofit Initiative offers subsidies to owners of homes and small- to medium-sized businesses upon completion of retrofits that verifiably improve the energy-efficiency rating of the building. The Plan projects reductions of 440 kt in 2008 up to 1 Mt in 2012, or roughly 250kt per cumulative-program-year of emissions savings.

Table 8: Emission Reductions Attributed to ecoENERGY Retrofit Program

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
ecoENERGY Retrofit	0.4	0.7	0.9	1	1	<ul style="list-style-type: none"> • <i>rebound effect</i> • conversion of predicted energy savings to realized emissions reductions • treatment of <i>free ridership</i> 	Likely overestimate

Methodological Approach

Reductions are calculated based on differences between the forecasted energy consumption with and without the increased energy efficiency associated with NRCan program activities. Forecasted energy savings are then converted to emissions savings using emissions factors. Details on grants provided and realized emissions savings per grant were not provided.

Analysis

As with other programs in the Plan, the ecoENERGY Retrofit Initiative targets energy efficiency rather than energy consumption, and the results of the program are presented in terms of emissions reductions. It is highly likely that in most cases, utility and government retrofit programs have overestimated the impact of their investments on realized energy demand, largely as a result of directly translating potential gains in efficiency to estimated reductions in energy use, ignoring *rebound effects*, and/or as a result of treating all realized energy use reductions as incremental results of the subsidy programs, ignoring the *free rider effect*. Each of these is expanded upon below.

The projected reductions in the Plan summarize potential gains in energy efficiency realized through grants. As with any subsidy program, the *free rider effect* drives a wedge between the number of subsidies paid out and the incremental benefits of the policies relative to the Reference Case. For homeowners obtaining subsidies, there is no way to reward only those who are acting as a result of the program (for homeowners who would have retrofitted their homes regardless, the subsidy represents a windfall) and so only some of the dollars spent under the program actually alter retrofit behaviour. The data suggest that the level of *free ridership* in the case of retrofit subsidies may be substantial. In Carpenter and Chester (1984), results show that over 90% of homeowners

receiving a conservation tax credit for home retrofits would have made the changes without the tax credit. In NRTEE (2005), estimates are reported for *free ridership* of between 40% and 80% of subsidy recipients. Overall, the academic literature suggests that there is a weak, positive relationship between fiscal incentives and retrofits, but that each dollar remitted through these programs equates to far less than one dollar of new investment. It appears that evaluations of benefits accruing from the EcoENERGY programs include the reductions resulting from all investments for which grants were received, which would overestimate the incremental effects of these programs.

Retrofit subsidies reward retrofits, they do not reward diminished total energy consumption. They provide no disincentive to invest the savings in other energy consuming goods after the grant has been received, and they may provide an incentive to increase the intensity of use or the total number of certain energy durables (the *rebound effect*). The role of consumer behaviour is very important in determining energy savings from energy efficiency improvements. A more energy efficient home costs the homeowner less per year to keep the furnace at a higher temperature, just as a high-efficiency washer makes it cheaper to wash clothes as discussed above. As with results from Davis (2007) cited above for appliances, results reported by Dubin, Miedema, and Chandran (1986) for a pilot project undertaken by the Florida Power and Light Company in 1981 constitute a relevant example here. The goal of the study was to evaluate how usage patterns changed upon the installation of one of three technology combinations: (1) upgraded attic insulation, (2) upgraded insulation and a high-efficiency air conditioner with a traditional furnace, and (3) upgraded insulation and a high-efficiency heat pump. The key distinguishing characteristic of this study is the ability to monitor changes after random assignment of

technologies, and to compare these changes to a control group. The key results of the study show that usage increases substantially after the installation of new technologies. In particular, they find that actual energy gains from new cooling technologies would be as much as 13% below engineering estimates on average, but only 1%–2% below for peak summer cooling (where the air conditioner is used all the time). For heating, energy savings 8%–12% below engineering estimates were found. Studies undertaken by Hausman (1979), Dubin and McFadden (1984), and Bernard, Bolduc, and Belanger (1996) provide similar results.

In contrast to the evidence above, the estimates in the Plan directly translate forecast energy efficiency gains into emissions reductions, without explicitly accounting for *rebound effects*. The resulting emissions reductions will therefore likely be overestimated.

Evidence from similar programs in Canada supports these conclusions. Over the period 1998–2006 under the similar EnerGuide for Houses program, 270,000 audits were performed, with approximately 180,000 of these performed after retrofit grants were introduced in 2003. In 2005, 37% of homeowners receiving initial audits received a grant, and among those, the predicted emissions savings resulting from renovations was 4 tonnes, similar to projected energy savings for the EcoENERGY Retrofit. However, these estimates were based on the homeowners undertaking all recommendations.¹³ In fact homeowners undertook fewer and smaller changes than recommended by the audits, and thus saved less energy than the amount predicted by the second audit. For homeowners receiving the first sets of energy audits under the EnerGuide for Houses program, the average realized emissions savings

was found to be 1.4 tons per household, or less than half of the predicted savings at the time.¹⁴

Conclusions

Given the historical evidence of overestimation of these types of programs, the evident lack of accounting for *free ridership* and *rebound effects* and the historical rates of grants-per-budget-dollar and emissions-saving-per-grant, this would likely result in an overestimate of stated emissions reductions from the eventual realized reductions.

8. Encouraging Canadians to Use Transit (EcoMOBILITY Program)

Summary of Initiative and Emissions Projections

Under this policy, persons purchasing monthly transit passes may claim a 15.5% income tax credit for the amount of the pass.

Methodological Approach

The estimates in the Plan are calculated on the basis of assumptions that using transit brings about an average emission savings of 2.8 kilograms per 10-kilometre trip, and that the tax credit is expected to increase urban transit ridership by an average of 5%. This 5% increase translated to 80 million additional public transit rides, which, with the expected average savings, is equated to an emissions reduction of 0.224 Mt.

Analysis

The success of this policy in terms of incremental transit ridership and the success in terms of displacing vehicle trips must be separated.

¹³ <http://oee.nrcan.gc.ca/residential/personal/retrofit-homes/grants-residential.cfm?attr=4#experts>

¹⁴ See http://www2cm.nrcan.gc.ca/nrcan/index_e.aspx?DetailID=57 and <http://www2.nrcan.gc.ca/dmo/aeb/english/ReportDetail.asp?x=135&type=rpt>

Table 9: Emissions Reductions Attributed to EcoMOBILITY Program

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
EcoMOBILITY Program	0.2	0.2	0.2	0.2	0.2	<ul style="list-style-type: none"> displacement of vehicle trips is equal to increase in transit use energy savings per trip 	Likely over estimate

Emissions reductions will be determined by three factors:

- The cross-price elasticity of automobile use to transit price, or the number of additional riders that will be attracted away from cars by a decrease in the effective price of a pass;
- The relative difference between the emissions per person kilometre on transit; and
- The inter-relationship between the results of this program and the effects of other programs that implicitly reduce the cost and impact of driving.

It is important to consider the cross-price elasticity between personal vehicles and transit as a measure of potential policy effectiveness. We are not as interested in increases in aggregate ridership since each transit ride does not necessarily offset a vehicle trip. Estimates of vehicle-for-transit substitution rates in Elgar and Kennedy (2005) suggest that the 15.5% decrease in the price of transit should be expected to yield a 0.4% decrease in the use of automobiles. However, we must also consider the inverse problem. Voith (1991) estimates a 10% decrease in the fixed cost of auto ownership will decrease transit ridership by 11.3%, while a 10% decrease in the variable cost of an auto trip will decrease transit ridership by 26.9%. These interrelationships are important since the transit pass subsidy, the ecoAUTO rebate program, and the renewable fuels content standards are likely to induce changes in both the costs of transit and the fixed and variable costs of auto trips.

Estimates of the incremental impact of the public transit tax credit in Jaccard and Rivers (2007) find decreases of emissions of 0.15 Mt per year. The fact that this estimate is slightly smaller than that calculated in the Plan is likely a result of the assumption that all new transit trips result in emissions reductions. It may also reflect the fact that, given the other measures imposed in the Plan, vehicles also become slightly cheaper to drive. In both cases the predicted impact of the policy in terms of emissions reduction is very small.

Conclusions

Because of the Plan's assumption that all new transit trips result in emissions reductions, the Plan's projected emissions reduction will be slightly overestimated.

9. Information Programs

Information-based programs described in the Plan account for 3.4 Mt per year of emissions reductions. Gillingham et al. (2006) analyze some past empirical evidence on information programs designed to induce investment in energy efficiency, and show that these can appear to be powerful tools. Likely the best-known labelling program is EnergyStar, and the US Environmental Protection Agency credits the use of EnergyStar appliances with savings of up to 80 TW-h of electricity in 2001. Loughran and Kulick (2004) point out that, in some cases, knowledge may present a significant barrier to

technology adoption and so “...programs that collect and disseminate information on the costs and benefits of particular energy efficiency investment, demonstrate to firms how they can benefit from energy efficiency investments may be more successful (than financial incentives)” (Loughran and Kulick, 2004, page 39).

However, with few exceptions, little evidence exists through which one can evaluate the incremental effect of information-provision programs for emissions control or energy conservation. With the example of the Energy Star appliances given above, it is difficult to identify the incremental role of the label in driving these decisions. While we can observe peoples’ actions after receiving information, we do not know what information they had before, what they would have acquired through other channels, and what their decisions would have been absent the programs.

In the case of the information-dissemination programs discussed in the Plan, the majority of the individual programs provide few details and the stated emissions reductions are small relative to margins of error that would exist for estimates from past or similar programs. As such, the section below discusses in turn the various measures proposed and suggests means by which their emissions reductions might be validated after the fact.

9.1 *ecoENERGY for personal vehicles and ecoENERGY for fleets*

In addition to the incentive and regulatory programs discussed above, the Plan attributes small emissions reductions to these education programs for vehicle owners and fleets. It will be difficult to assess the incremental impact of this approach, particularly given that other relatively large programs also raise awareness of fuel-economy concerns. Given the small emissions savings reported, the major concern with this

program will be the ability to tie results to spending, since it will be difficult to observe the small projected changes in behaviour in aggregate data.

9.2 *ecoENERGY for buildings and houses*

The ecoENERGY for buildings and houses program is investing \$60 million over four years to encourage the construction of more energy-efficient homes and buildings using ratings, labelling, and training. Programs similar to this have proven very successful in the United States, with a prime example being the US Department of Energy’s Rebuild America program. Estimates show that for each dollar investment in Rebuild America, there were energy savings valued at \$18.43 (Gillingham et al., 2006). However, these estimates do not identify the incremental impact of the program. Details on the ecoENERGY for buildings and houses are limited, and so it is not possible to make a direct comparison between these programs.

9.3 *ecoENERGY for Industries*

The ecoENERGY for Industries program is designed to facilitate information sharing and best practices for energy use. In order to provide a reliable estimate, the analysis must specify the best practices that it hopes to disseminate and the timelines over which these best practices alter behaviour and lead to energy savings. Realizations can then eventually be benchmarked against adoption of particular practices. In the absence of this, it will be difficult to directly and confidently separate program impacts from market forces.

9.4 *ecoTECHNOLOGY for Vehicles*

The ecoTECHNOLOGY for Vehicles program is investing \$15 million over four years to test the safety and performance of more energy-efficient, light-duty vehicles in the Canadian

context. What is not clear in this program is the degree to which these measures lie outside traditional government mandates, and to what extent they can be considered incremental. As regulatory requirements for more efficient vehicles become reality, smaller and more efficient vehicles will be introduced into the marketplace. It is not clear from the program exactly which barriers currently exist and in what ways investment will lower these barriers.

Ideally, for this program to be properly evaluated a set of benchmarks against which to measure success should be specified. Market-share projections for particular technologies should be adopted before the program is launched, and these should be compared at regular intervals to realized adoptions. Secondly, a comparison should be made between adoption rates in other jurisdictions with similar conditions and no government promotion of the same technologies.

9.5 ecoMOBILITY

Another program aimed at changing the decision-making process of Canadians is the ecoMOBILITY initiative: a \$10 million program to help develop products and services that make it easier for Canadians to change their behaviour. Again, there are few specifics provided on the nature of this program, or how it integrates with other initiatives discussed above. In order to be able to properly assess this program, it is necessary to provide clear results that include information on the following:

- Regions affected by the programs,
- Previous predictions of ridership, kilometres driven, or other benchmarks against which to evaluate the program, and
- Realized changes in ridership in municipalities/regions covering regions that benefited from investment under the program and regions that did not.

These recommendations for future reporting echo the recommendations of Transport Canada (2005).¹⁵

9.6 Marine Shore Power Program

The Marine Shore Power Program will invest up to \$6 million to demonstrate the use of shore-based power for vessels in Canadian Ports. The goal is to demonstrate how vessels can reduce emissions by adopting shore-based power. However, the eventual adoption outside the demonstration program depends on key assumptions being satisfied:

- It must be cheaper for vessels to power using on-shore power than by idling engines.
- Infrastructure must be present for sufficient power to be provided for on-shore powering of vessels.
- Current lack of use of on-shore power must be due to a lack of information about its applicability.

In the absence of these conditions, it must be the case that vessel owners are currently ignoring a means of reducing fuel costs, which seems unlikely. Since the policy provides no additional incentive in terms of fines, penalties, or rewards, it must be shown that a lack of information or infrastructure exists that the program will provide.

9.7 Synopsis and Reasons for Lack of Evaluation

In general, information programs are very hard to evaluate. It is very difficult to collect data on what people or companies do not know. Further, it is difficult to identify the source of information used to make a purchase or investment decision, since information has significant spillover across markets. As such, we are less likely to be able to draw conclusions only

¹⁵ <http://www.tc.gc.ca/programs/environment/policy/docs/Summary.pdf>

Table 10: Summary of information-based emissions reduction programs

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
ecoENERGY for Personal Vehicles	0	0.1	0.1	0.1	0.1	<ul style="list-style-type: none"> • consumers are not fully aware of the consequences of their driving behaviour 	Insufficient information to reach a conclusion
ecoENERGY for Buildings and Houses	0.6	0.9	1.2	1.3	1.3	<ul style="list-style-type: none"> • lack of regulatory backstop in building codes • unclear whether existing practices would be adopted 	Insufficient information to reach a conclusion
ecoENERGY for Commercial and Industrial Buildings	0.2	0.3	0.4	0.4	0.4	<ul style="list-style-type: none"> • percentage of free ridership 	Insufficient information to reach a conclusion
EcoTECHNOLOGY for Vehicles	0.2	0.4	0.5	0.7	0.9	<ul style="list-style-type: none"> • lack of information versus lack of fiscal incentives explains some of current driving behaviour 	Insufficient information to reach a conclusion
ecoENERGY for Fleets	0.2	0.3	0.5	0.5	0.5	<ul style="list-style-type: none"> • managers are now aware of the cost of energy and the ways to incite cost-reducing behaviour among employees 	Insufficient information to reach a conclusion
EcoFREIGHT	0.4	0.7	1.2	1.2	1.3	<ul style="list-style-type: none"> • separation of program-induced benefits from natural improvements in energy efficiency 	Insufficient information to reach a conclusion
EcoMOBILITY	0.9	1.2	1.6	1.7	1.7	<ul style="list-style-type: none"> • current barriers exist and can be reduced through information rather than fiscal or regulatory incentives 	Insufficient information to reach a conclusion
Marine Shore Power Program	Less than 0.1 Mt total					<ul style="list-style-type: none"> • infrastructure costs will be paid back in savings at market energy prices • potential cost savings exist but there is a lack of information about these savings 	Insufficient information to reach a conclusion
Eco-AGRICULTURE	No Specific Commitment						Insufficient information to reach a conclusion
Total	1.7	2.7	3.9	4.2	4.5		

based on differences between areas benefiting and not benefiting from the programs. Further, since information is changing, it is difficult to predict which sources of information will be used in future programs and how these will benefit Canadians and lead to emissions reductions. Even if such information were to be available, it is difficult to assess how the adopted technologies would have evolved in the absence of the information programs, or how non-adopted technologies would fare in the presence of more aggressive information programs.

10. Clean Air and Climate Change Trust Fund

Summary of Initiative and Emissions Projections

Under the \$1.5 billion Clean Air and Climate Change Trust Fund, a series of third-party trusts have been established to directly support provincial and territorial efforts to reduce emissions.

Methodological Approach

Annual emissions reductions of 16 Mt were attributed to the \$1.519 billion Clean Air and Climate Change Trust Fund. Although information provided to the NRTEE by Environment Canada suggests that these were estimated on the basis of stated emissions

reductions from the Province of Quebec, specific details were not available to us. However, the NRTEE notes that details of all provincial activities to be undertaken as a result of the Fund have yet to be determined. The Government of Quebec's June 2006 climate change plan indicated that federal funding of \$328 million would generate additional emissions reduction of 3.8 Mt per year, on average, for the years 2008–2012. An extrapolation of these numbers to the total budgeted amount would yield an estimated annual total reduction of 17.5 Mt, so a direct extrapolation was not used. Specific details on the method of accounting for provincial emissions reductions realized as a result of federal programs were not provided.

Analysis

Details are not provided on the relative contribution of specific measures to the 16 Mt total, as a result only limited analysis is possible.

The investment of \$1.519 billion is credited in the Plan with generating 80 Mt of total emissions reductions, assuming that none of the programs have results beyond 2012. If this assumption holds, the rate at which emissions reductions are achieved averages \$19 per tonne. If some policies have longer-term results, the average dollars per tonne will be less than \$19. Modelling completed by the NRTEE in the context of the present study suggests that the total emissions reductions from Canadian industry, households, and the transportation

Table 11: Emission Reductions Attributed to the Clean Air and Climate Change Trust Fund

Program	Projected Emissions Reductions in Mt					Key Determinants of Results	Predictive Accuracy
	2008	2009	2010	2011	2012		
Clean Air and Climate Change Trust Fund	16	16	16	16	16	• <i>additionality</i> of provincial reductions	Insufficient information to reach a conclusion

sector would be 16–20 Mt if an emissions price of \$19 per tonne were imposed. This figure represents, arguably, the most cost-effective way of achieving a comparable number of emissions reductions. However, it represents all reductions available.

While this is not a perfect proxy for the role of the Clean Air and Climate Change Trust Fund, it suggests only two eventualities. First, the incremental emissions reductions stated for provincial programs are likely overestimated, or second, the reductions counted for the Clean Air and Climate Change Trust Fund include reductions that occur as a result of all programs, federal and provincial. In this case, the stated 16 Mt would not be additional to other reductions estimated in the Plan.

Conclusions

The nature of some of the provincial programs suggests that issues of *additionality* exist. For example, the Quebec plan (as communicated to the NRTEE by Environment Canada) includes reductions in GHG emissions due to projects funded under the WPPI and due to the 5% ethanol content standard. It also sets targets for Quebec industries that will already be affected under the Regulatory Framework for GHG Emissions. Without a fully integrated model that includes these transfers to the provinces, the federal policies, and the provincial policies, it is difficult if not impossible for the NRTEE to attribute incremental emissions reductions to each separately and therefore insufficient information is available to conclude the likelihood of emissions reductions at this time.

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Appendix B:
Kyoto Protocol Implementation Act (C-288)