DEVELOPMENT OF OPTIONS FOR A VEHICLE FEEBATE IN CANADA

--Final Report--

Prepared for:

National Round Table on the Environment and the Economy

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EXECUTIVE SUMMARY

Background and Objectives

In the 2005 Federal Budget, the Government of Canada tasked the National Round Table on the Environment and the Economy (NRTEE) to develop options for a vehicle feebate for Canada. The options were to be revenue neutral, to apply to all light-duty vehicles, and to be flexible to adapt to changing circumstances. The Budget set out *A Framework for Evaluation of Environmental Tax Proposals* as the basis for evaluating this and future environmental proposals involving the tax system.

In response, the NRTEE commissioned this study, whose objectives are to: understand the nature of the motor vehicle market in Canada and trends, including the recent Memorandum of Understanding (MOU) between the industry and the Government on greenhouse gas (GHG) emissions; identify the key feebate options that meet the mandatory parameters identified by the Government; and, assess the options against the criteria established in the Budget 2005 Framework.

The Automotive Sector – Challenges and Opportunities

The Canadian Auto Sector is currently facing a number of difficult challenges, including low prices and poor profitability, both of which are linked to a problem of excess supply. Although these problems affect all manufacturers, import name plates have responded more successfully and, as a result, have gained significant market share. These manufacturers also represent an increasing share of Canadian manufacturing capacity.

In contrast with the US, Canadian vehicle ownership is low and relatively stable, and preferences are for smaller, more fuel-efficient vehicles. However, both Canadians and Americans purchase less fuel-efficient vehicles than those purchasers in other countries. Furthermore, there are significant regional differences in Canadian purchasing preferences. Transactions involving used vehicles represent more than 50 percent of the market. Consumer choice is driven primarily by purchase price, value, reliability and styling. In comparison, consumers rank 'fuel economy' and 'safety features' in the middle of the pack and they rank 'environmentally friendly' last of 21 factors in new-vehicle purchase.

Since 1990, the fuel consumption of Canadian vehicles has improved by approximately 5 percent, far less than it could have, were it not for offsetting changes in horsepower and weight, and for a shift from cars to trucks in the early 1990s. As far as GHG emissions are concerned, the improvements in vehicle fuel efficiency have been negated by the increasing number of vehicles and longer distances travelled. According to Natural Resources Canada (NRCan), the automotive sector represents almost 90 megatonnes (Mt), or more than 12 percent of Canada's total GHG emissions, and the sector's emissions have increased by more than 17 percent since 1990.

There are a number of technologies that are available to improve fuel economy. Some have already been widely adopted, some are now maturing and becoming cost-effective, and others are expected to remain expensive for some time to come. In addition to conventional technologies, diesel and hybrid technology are expected to play an increasing role.

Since most vehicles manufactured in Canada are exported (over 85 percent) and most vehicles sold in Canada are imported (over 75 percent), in theory the policy environment for vehicles should not affect manufacturing decisions. However, it is reasonable to assume that perceptions of market negativity could affect manufacturer investment decisions.

Key policies affecting the design and sales of vehicles include: safety regulations, air emission standards, and climate change. The key climate change initiative is the 2005 MOU between the Canadian Automotive Industry and the Government of Canada. This MOU voluntarily commits the industry to achieving a 5.3-Mt reduction in GHG emissions from the light duty vehicle sector in 2010. The MOU targets are aggressive and there is some uncertainty as to how the vehicle companies will achieve their commitments. Since the agreement is voluntary, the Government retains the right to regulate GHG emissions and the industry retains the right to terminate the MOU if regulations are implemented. The industry has not taken an official position on a feebate system relative to the MOU.

Options for a Feebate

A feebate is an economic instrument under which vehicles are subject to taxes or rebates in proportion to how much they exceed or fall below a specified reference factor (the pivot point). Typically this factor is the mean fuel consumption rating for the vehicle for a particular year. (So, in lay terms, a *feebate* refers to the combination of a *fee* on low-mileage vehicles and a *rebate* on fuel-efficient vehicles.)

There are an infinite number of design options, based on nine main variables:

- ***Rate Basis***. Fuel consumption expressed as litres (l) per 100 kilometres (km) is the most likely choice; this ensures that each litre saved has the same value
- ***Form of the Feebate Function***. Linear functions are possible; caps provide ways of avoiding excessive fees or rebates that contribute little to the effectiveness of the measure, and deadbands provide a way of avoiding large numbers of small transfers close to the pivot point.
- ***Rate***. Assuming a linear function, this refers to the slope of the line.
- ***Number of Classes***. The options include a single system, a two-tier system (cars and trucks), or multiple classes (by weight, or interior volume).
- ***Application and Exemptions***. Various classes of vehicles could be exempt.
- ***Manufacturer Feebate or Consumer Feebate***. This choice should make little difference as manufacturers will determine how to factor in the feebate when determining prices.
- ***Revenue Neutrality***. While preserving the principle of revenue neutrality, there are a variety of options on how to handle the uncertainty associated with having to predict the overall balance between fees and rebates.
- ***Phase-In Period***. Any length of time is possible.
- ***Paid at Purchase or Annually***. This refers to the possibility of an ongoing feebate implemented through the vehicle registration system.

Modeling of Feebate Options

In order to evaluate the different options, two separate models were used:

- ***Transport Canada Variant of Greene et al. Vehicle Purchase Model***. This is a spreadsheet-based, nested multinomial logit model that estimates the effect of feebates on consumer purchasing behaviour and manufacturer investment in fuel economy technologies. Transport Canada modified the model to use aggregated 2003 Canadian and US sales data and updated the technology cost curves based on a 2005 literature review.

- ***NRCan Vehicle Stock Model***. This is a simple representation of vehicle turnover and usage.

Like all modeling exercises, there are a number of limitations and simplifications that apply. In the real world, manufacturers and consumers make decisions based on a variety of factors that are not easily represented by simple parameters. This model assumes that manufacturers redesign their vehicles to maximize consumer surplus. The model does estimate changes in sales but does not address profits, since producers are assumed to be perfectly competitive.

Other key limitations include:

- ***Valuation of fuel savings***. A central assumption of the model is that consumers undervalue fuel savings. Although there is evidence to this effect, there is no information on the magnitude of the undervaluation. Sensitivity analysis is done to investigate the effect.

- ***Consumer elasticities***. These values determine the extent to which consumers respond to price signals. Since there is no data on Canadian elasticities, our approach has been to use the elasticities proposed by Greene et al. but to halve them, as a way of approximating long-run responses and to better represent assumed Canadian circumstances. We also undertake a sensitivity analysis.

- ***Hybrid and diesel technologies are not included***. As mentioned above, hybrids and diesels are expected to play a significant role in improving fuel economy. Unfortunately, the current version of the model lacks the information necessary to include these options. As a result, the effectiveness of feebates is underestimated.

- ***Effects on used vehicle markets are not modeled***. As mentioned above, the used vehicle market represents more than half of vehicle sales. However, the model assumes that consumers primarily respond by shifting purchases to other new vehicles. As a result, the effectiveness of feebates is overestimated.

A series of 12 scenarios are modeled, representing a selection of options and assumptions. The most significant findings are:

- Most scenarios result in significant fuel savings and GHG reductions.
- Most scenarios produce a net economic benefit, mostly in the form of unvalued fuel savings.
- Most scenarios produce a significant shift in sales but technology still accounts for more than two thirds of the improvement.
- GHG reductions and the shift in sales increase relatively linearly with an increasing feebate rate.
- Benefits are positive for all rates but level off between $500 and $1000.
- A cap removes incentives for highly inefficient vehicles to improve, since a fixed fee is paid on them.
- A deadband removes incentives to improve fuel economy for vehicles near the pivot point.
- If consumers are assumed to fully value fuel savings, the base case becomes more advantageous and the benefits of feebates are correspondingly reduced. Fuel economy still improves but there is a net cost per tonne of GHG emission reductions.
- Differentiating pivot points for cars and trucks means a lower fee or even a rebate as larger vehicles are assessed only against their cohorts. This discourages shifting to smaller vehicles (less change in market shares) and means less improvement in consumer surplus and fewer GHG reductions. Going to 11 classes has little additional effect.
- With North American implementation, all vehicles improve according to the full change in consumer willingness to pay. As a result, GHG reductions are larger and the change in Canadian surplus is larger.
- With Greene’s original elasticities, consumers are more sensitive to price changes. As a result, the sales mix changes more easily but policies are less costly, since consumers take greater advantage of the option to purchase other vehicle types. This doubles the size of the sales shifts and the GHG reductions.
- A higher fuel price means that there is more incentive for fuel economy present in the base case. Thus, the incremental of the feebate on fuel and GHG savings is reduced. On the other hand, the unvalued fuel savings are worth more, so the overall benefit is higher and the benefit per tonne is greater. The price of fuel has little impact on the sales mix.

The main value of the model is to assist in understanding the relationships between inputs and various indicators of environmental effectiveness, economic efficiency and other factors. Even though limitations and assumptions may affect individual results, there are a number of findings that are robust, including:

- Feebates will encourage additional investment in fuel-efficiency technology and shift the market towards more fuel-efficient vehicles (trucks to cars, large cars to small cars, more fuel-efficient cars in the same class).
- Over time, this will improve the fuel efficiency of the vehicle stock and will reduce GHG emissions.
- The investment in fuel-efficiency technology will raise the cost of individual vehicles and reduce consumer surplus accordingly.

- To the extent that consumers undervalue fuel savings, feebates will capture savings that would otherwise not have been realized. If the undervaluation is significant, over the life of the vehicle fuel savings are likely to exceed the added cost to vehicles, resulting in a net economic benefit to society.
- Higher prices will depress vehicles sales.
- The shift towards more fuel-efficient vehicles will also reduce overall revenues.
- In a single-class feebate, General Motors (GM), Ford, and DaimlerChrysler (DCX) will lose additional market share and bear a disproportionate share of the adjustment costs. This could be alleviated by adopting separate classes for trucks and cars, though doing so would reduce GHG savings and economic benefits.
- The extent of the shifts is determined by the elasticities of demand. If elasticities are greater than expected, the environmental and economic benefits will be greater but so will the adjustment costs. Conversely, if elasticities are less than expected, the environmental and economic benefits will be reduced, as will the burden on manufacturers.

Assessment of Feebate Options

The *Framework for Evaluation of Environmental Tax Proposals* includes five criteria:

- ***Environmental Effectiveness***. Feebates are less well-targeted than alternatives such as fuel taxes but the main concern, the rebound effect, is expected to be no more than 23 percent, and probably less. Consumers are expected to respond by switching from trucks to cars, from larger vehicles to smaller vehicles, and to more fuel-efficient vehicles within a given class. The car share of the vehicle market is expected to increase by 1–6 percent, depending on the rate. Manufacturers will respond primarily by investing in cost-effective technologies; however, some less fuel-efficient models may be dropped.

  The combination of technology improvements and shifts in purchasing is expected to yield fuel consumption improvements of 0.2 litres per 100 km to 0.8 litres per 100 km. Corresponding GHG reductions are expected to range from 1.5 Mt per year to 6.2 Mt per year, with 3.0 Mt per year for a $500 per litre per 100 km feebate. Adopting two or more separate classes would significantly lower the GHG reductions (because these are cumulative).

  The environmental effectiveness (as well as the revenue neutrality) of feebates could be compromised by the possibility of vehicle "arbitrage"—the import of relatively new large vehicles from the US and the export of relatively new smaller vehicles to the US.

- ***Fiscal Impact***. By definition, the measure will be revenue neutral. However, there will be administration costs and reductions in fuel taxes to consider. These could be recovered from the feebate, but this could be perceived as a tax increase. It will also be necessary to consider options on how to handle the uncertainty associated with having to predict the overall balance between fees and rebates.

- ***Economic Efficiency***. To the extent that consumers fail to value fuel savings correctly—this is supported by the market research in Canada, though the extent is unknown—feebates provide a means of correcting this perception. Feebates also provide an indirect means of giving value to GHG reductions. Feebates impose costs which rise as the rate increases, but the reduction in consumer surplus is more than compensated for by unvalued fuel savings that are realized. The benefits are positive for all rates up to $1000 but marginal costs begin to outweigh benefits between $500 and $1000. Adopting two or more classes reduces the benefits significantly while creating a relative subsidy for larger vehicles. Because of the unvalued fuel savings, feebates produce economic benefits as opposed to costs. These range from $40 per tonne for a $250 per litre per 100 km feebate, to $10 per tonne for a $1000 per litre per 100 km feebate. If it is assumed that consumers already fully value fuel savings, then there are no unvalued fuel savings and the costs are in the range of $10 per tonne. By selectively targeting fuel economy, feebates impose opportunity costs.

  Feebates will only affect vehicle sales in Canada, so there should be no impact on exports. Furthermore, feebates should have no impact on the environment for manufacturing. However, as noted previously, an environment interpreted as hostile to the product could affect investment decisions.

  Overall vehicle sales are expected to decline slightly (at most 6000 or approximately 0.5 percent of annual sales for a $1000 feebate). Of greater importance is the shift to less expensive models, which overall would reduce revenues by approximately $1.5 billion per year. (Note: these results are very sensitive to elasticity assumptions.) Although net sales may only decrease slightly, the employment impacts could be greater if imports are substantially increased. On the other hand, a large proportion of the North American adjustment may occur in the US. Given the overall economic benefit, the loss of jobs in this industry should be more than offset by job gains elsewhere in the economy.

- ***Fairness***. In terms of market share, the main impact is further loss in market share for GM/Ford/DCX. The shift increases as the rate increases, reaching 4 percent for a $1000 per litre per 100 km feebate. This shift can be significantly mitigated by segmenting the market into two classes. (Having 11 classes does not make much additional difference.) As far as profitability is concerned, the assumption is that all costs and savings are passed on, and so profits are unchanged. However, since there will be a shift to smaller vehicles, and historically these vehicles have had lower profit margins, it is reasonable to conclude that profits will be adversely affected. As far as parts suppliers and retailers are concerned, they will be affected in proportion to their exposure to GM/Ford/DCX.

  For individuals, the key issue is price. The price of each individual vehicle will rise to pay for new technology. However, consumers are expected to shift to lower priced models within classes and to lower priced classes overall, so average prices will decline. Certain consumers who are unable or unwilling to shift will bear a greater burden. For example, the estimated 50 percent of consumers who use trucks for commercial purposes may not be able to avoid the higher fees. Similarly, larger families may be restricted in shifting to smaller vehicles. Regions and areas that have a greater preference for larger vehicles (western Canada and rural areas, for example) will find that their traditional choices are more costly. Conversely, consumers who would have purchased fuel-efficient vehicles anyway will gain a windfall. Because lower income households tend to purchase smaller vehicles, the measure is progressive overall. (Feebates will eventually influence prices in the used car market as well as new cars.)

- ***Simplicity***. The size of the transfers will range from approximately $300 million per year to $1.1 billion per year, whereas the number of transactions will be equal to the number of new vehicle sales (1.5 million per year). A single class would clearly be the simplest approach, whereas 11 classes could be cumbersome to manage. Because definitions are unclear, anything more than one class creates the potential for gaming (artificially changing features to move vehicles into a different class). Similarly, the use of a cap, plateau or deadband would introduce added complexity and induce responses that would reduce the effectiveness of the measure.

  In terms of administrative practicality and costs, the measure could be similar to the Goods and Services Tax (GST). Retailers would need to collect the fees, pay the rebate, and submit the appropriate paperwork on a regular basis. Overall, given the experience of the GST, it would be anticipated that costs would be significant at first but would fall substantially after the initial implementation.

Conclusions

As noted previously, the modeling results are subject to significant limitations and assumptions, but some robust conclusions are possible:

- Feebates can be designed to be environmentally effective and economically efficient. Although other measures such as fuel taxes may be better targeted, feebates are a legitimate alternative should other measures not be feasible.

- The imposition of feebates will involve difficult adjustments for automobile manufacturers at a time when the industry is faced with the challenge of oversupply. GM, Ford and DCX will bear most of the burden.

- The measure is administratively feasible and can be designed to be fiscally neutral.

- There are significant uncertainties and risks that affect the magnitude of the benefits as well as the market shifts involved.

Overall, **a feebate of $1000 per litre per 100 km would appear to be most promising** since it delivers the greatest economic benefit, and avoids the large shifts in market share associated with higher rates. This option would produce GHG reductions of 3 Mt per year in 2010 rising to 6 Mt per year by 2018. (By comparison, the MOU target is 5.3 Mt per year in 2010.)

However, starting with a rate of $500 per litre per 100 km would be helpful in three ways:

- It would give greater weight to the fairness criterion, while still being reasonably environmentally effective and economically efficient.
- It would give firms time to adjust.
- It would contribute to a risk management strategy by providing the opportunity to: gather better information on factors such as elasticities and valuation; assess issues regarding, for example, the import of used cars; and, assess other implementation problems.

Depending on the results, the rate could eventually be increased to the optimal level justified by the information gained.

The key risks that affect the assessment are as follows:

- important limitations of modeling
- poor knowledge of Canadian elasticities
- poor knowledge of Canadian perceived value of fuel savings
- opportunity costs for consumers
- risk of vehicle arbitrage
- heavy adjustment costs for some manufacturers

As suggested above, a lower rate to begin (phase-in period) would help hedge against these risks and would provide an opportunity to gather real information on costs and benefits.

If the MOU and feebates were implemented simultaneously, many or most of the benefits of the feebate would be included in the reference case. In theory this could mean that the effects would be additive. However, the reaction of manufacturers is unknown and there is a risk that they would respond to a feebate by withdrawing from the MOU. This suggests that feebates might best be considered as an alternative policy to the voluntary MOU, or as a subsequent policy following the expiration of the MOU.

GLOSSARY

Cap	Maximum level of fee to be paid, regardless of fuel consumption rating.
Consumer Surplus	The difference between what is person is willing to pay for a commodity and the amount he/she actually is required to pay.
Deadband	Band of fuel consumption rating, where there is no fee or rebate.
Elasticity	In economic terms, elasticity is the ratio of the incremental percentage change in price with respect to an incremental percentage change in quantity demanded. Generally, elasticity is expressed with respect to a 1% increase in price and a corresponding decrease in quantity demanded.
Fuel Efficiency	The extent to which the various vehicle components maximize the conversion of fuel to kinetic energy. Can be expressed as fuel economy or fuel consumption, which are inversely related: *Fuel Consumption* – the amount of fuel needed to cover as specific distance (e.g. litres per 100km) – used by convention in Canada. *Fuel Economy* – the distance covered with a specific amount of fuel (e.g. miles per gallon) – used by convention in the U.S.
Gaming	Artificially changing behaviour to manipulate program rules so that some competitive advantage is gained (e.g. to move vehicles into a different class or to influence the selection of the pivot point).
Light-duty vehicle	Cars and light trucks.
Multinomial Logit Model	Type of mathematical model used to predict consumer choices that are independent. The model is based on logarithms of probabilities, expressed as the odds of a set of choices.
Pivot Point	The level of fuel consumption below which results in a rebate and above which results in a fee, and that in combination with other feebate design parameters, can be selected to achieve revenue-neutrality.
Plateau	Band of fuel consumption rating, where the fee or rebate remains unchanged.
Rebound Effect	The inducement to drive more because the cost of driving has come down due to fuel savings.
Revenue Neutrality	From a government revenue perspective, total fees equal total rebates and thus government revenue remains unchanged.
Vehicle Arbitrage	The import/export of vehicles to take advantage of different prices in different jurisdictions. In effect, price differentials in the markets will induce a movement in sales to the lower price market.

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1. INTRODUCTION[1]

A feebate is an economic instrument under which vehicles are subject to taxes or rebates in proportion to how much they exceed or fall below a specified reference factor. Typically this factor is the mean fuel consumption rating for the vehicle for a particular year.

For example, in Canada, the average fuel consumption rating for light-duty vehicles is approximately 9.0 litres per 100 km. A single-class feebate of $500 per litre per 100 km would mean:

- A fuel-efficient vehicle that achieved 5.0 litres per 100 km would receive a rebate of $2000.
- A vehicle with poor fuel efficiency that achieved 13.0 litres per 100 km would pay a fee of $2000.

Feebates could offer some of the fuel-efficiency advantages of regulation without mandating a specific fleet average fuel consumption rating and thus allowing the market to determine the available choice of vehicles.

1.1 BACKGROUND

The concept of feebates was first proposed in the late 1980s but has not been fully implemented in any jurisdiction.

- The Ontario Tax for Fuel Conservation is technically a feebate but most vehicles fall in the category of a maximum tax of $75 or a maximum rebate of $100. These amounts not large enough to influence consumer behaviour. Revenues collected are much larger than the rebates.[2]

- In June 2004, France announced the reform of their car registration tax into a feebate scheme.[3] Under this scheme, cars that emit over 180 g per km of CO_2 or diesels without a particulates filter will face a surcharge of €1,500 to €3,500, whereas cars that emit under 140 g per km of CO_2 and diesels with particulate filters will receive a rebate of €200 to €700. Cars emitting between 140 and 180 g per km of CO_2 will be liable to neither a surcharge nor rebate.

- Feebate variations also exist in Germany and Denmark (linked to annual registration), however the amounts are low and the incentives are minimal.[4]

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1 Please note that the findings and conclusions in this report are those of Marbek Resource Consultants and do not necessarily reflect the views of subcontractors to the study.

2 National Round Table on the Environment and the Economy. (1998). *Backgrounder: Greenhouse Gas Emissions from Urban Transportation.* p. 29.

3 Stephen Potter, Graham Parkhurst, Ben Lane. *European Perspectives on a New Fiscal Framework for Transport.* Policy Studies Institute, U.K. The available literature does not indicate when the system is to be implemented, p.3.

4 Ibid, p.5.

- In June 2005, the Governor of Connecticut signed a bill directing the Commissioner of Environmental Protection to develop a plan for the implementation of a feebate. The plan is to allow an increase or decrease of up to 3% in the state sales tax; based on GHG emissions. Preliminary indications are that the proposal may include a large “dead zone”, or band in which the feebate is zero, so that many vehicles would be unaffected.[5]

Feebates have also been studied extensively, but with conflicting results:

- The 1998 National Round Table on the Environment and the Economy (NRTEE) *Backgrounder: Greenhouse Gas Emissions from Urban Transportation* estimated a potential to improve fuel economy by 10 percent (Canada only) to 20 percent (Canada–US) with a feebate of $1400 per litre per 100 km.[6] This report provided no information on costs.

- The 1999 NRCan study entitled *Assessment of a Feebate Scheme for Canada* found feebates to be costly approach to GHG reductions ($100+ per tonne).[7] Our assessment is that this study overestimated the costs by double-counting the reduction in consumer surplus.

- A 2005 study by Greene et al. developed a detailed vehicle choice model for the US and found a significant potential to improve fuel economy at a net economic benefit (benefits exceed costs).[8] The study also found a modest decline in sales (with the vast majority of improvement coming from technology rather than shifts in sales). A key factor in these results was the assumption that consumers significantly undervalue fuel savings in purchasing decisions and that there are economic gains to be made by capturing these unvalued savings through the application of a feebate.

In recognition of the growing interest in feebates, the 2005 Federal Budget signalled the Government of Canada's intention to explore the concept further, both in vehicles and potentially in broader applications. The Budget tasked the NRTEE to develop options for Budget 2006. These options were to:

- Be revenue neutral for the Government (striving, over time, to balance revenues from the fees with expenditures on rebates)

- Apply to all cars and light trucks, including all vans, sport utility vehicles (SUVs) and pickup trucks

- Be sufficiently flexible in structure to adapt to changing circumstances—for example to allow for adjustments in fees and rebates over time in response to changes in vehicle models and technology

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[5] Langer, Therese. (September 2005). *Vehicle Efficiency Incentives: An Update on Feebates for States*. ACEEE Report Number T051, p.5.

[6] Based on United Nations Framework Convention on Climate Change (UNFCCC) and Organisation for Economic Co-operation and Development (OECD) research.

[7] HLB Decision Economics Inc. (June 25, 1999). *Assessment of a Feebate Scheme for Canada.*

[8] Greene et al. (2005). *Feebates, Rebates and Gas-Guzzler Taxes: A Study of Incentives for Increased Fuel Economy.* In Energy Policy 33 (2005), pp 757-775.

The Budget also set out a basis for assessing feebates and other fiscal instruments in *A Framework for Evaluation of Environmental Tax Proposals.*[9]

At the same time, Transport Canada has initiated its own study of feebates by developing a Canadian variant of the Greene model for use in assessing options, and by commissioning the development of updated technology cost curves.

1.2 OBJECTIVES

To support the NRTEE in its development of feebate options for Budget 2006, this study was commissioned. The study assesses the implications of feebates by:

- Describing the nature of the motor vehicle market in Canada, the key factors that influence both manufacturers and consumers, and the key trends (including the implications of the recent voluntary agreement on GHG emissions)
- Identifying the key feebate options that meet the mandatory parameters identified by the Government (revenue neutrality, broad application and flexibility)
- Assessing the options against the criteria established in the *Framework for Evaluation of Environmental Tax Proposals*

Further, the Transport Canada variant of the Greene et al. vehicle purchase model was mandated for the analysis.

[9] Department of Finance Canada. *The Budget Plan 2005*. Annex 4. See Appendix A.

2. MARKET AND SECTOR TRENDS

2.1 SECTOR TRENDS

The automotive sector is Canada's largest industrial trading sector, with a volume of over $160 billion in 2004. According to Statistics Canada, about 40,000 firms are involved with manufacturing, selling and repairing vehicles and the sector directly employs over 400,000 Canadians (not including aftermarket parts, repairs, or fuel stations), including:

- Vehicle manufacturing: 80,000
- Parts, accessories, body & trailer: 160,000
- Dealers, distribution and leasing: 180,000

Manufacturers produce 50 percent more vehicles in Canada than are sold here. Most of the vehicles produced in Canada are exported, and most of the vehicles purchased in Canada are imported. Overall, Canada's vehicle production has stabilized at 2.7 million units, down from the peak of 3.1 million units in 1999. Overall vehicle sales in North America are now reaching 20 million per year, with Canadian sales of approximately 1.5 million. See Figures 2.1 and 2.2.

The Canadian auto sector is currently facing a number of difficult challenges, including:

- ***Low Prices***. Statistics Canada's New Vehicle Price Index has been negative for the last five years; used vehicle prices are also falling, and the original equipment parts sector prices have been decreasing for most of the last decade. See Figure 2.3.

- ***Rising Costs***. Some prices and costs affecting the industry have been rising, including material and labour costs, taxes and fees.

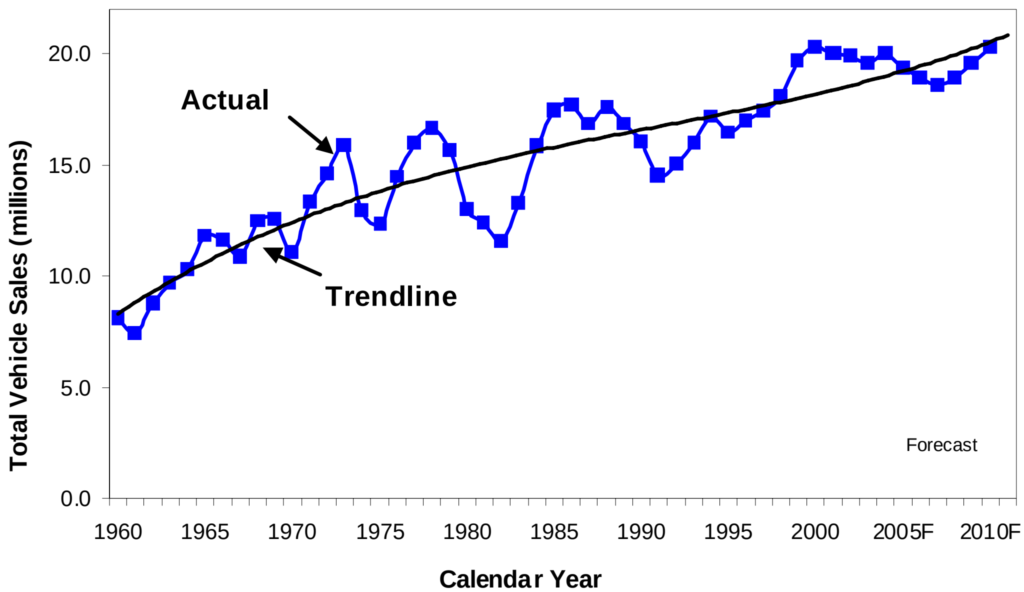
- ***Poor Profitability***. Price deflation is affecting profitability for suppliers, vehicle manufacturers, and dealers. The market has been artificially inflated with incentives; the ability of manufacturers to maintain these incentives is questionable given the profit margins. Although a 'soft' landing is possible, significant price increases could have a significant negative impact on demand.

- ***Excess Supply***. At the root of the problem is the excess supply of light-vehicle capacity in the global auto sector, especially in North America.

Given the political and socio-economic issues around reducing plant capacity, the problem of excess supply is likely to get worse before it gets better, and may not be resolved without significant restructuring. Lean pricing will be difficult to resolve in the short term and thus the profit outlook is very poor. That said, consumers benefit through continued low pricing.

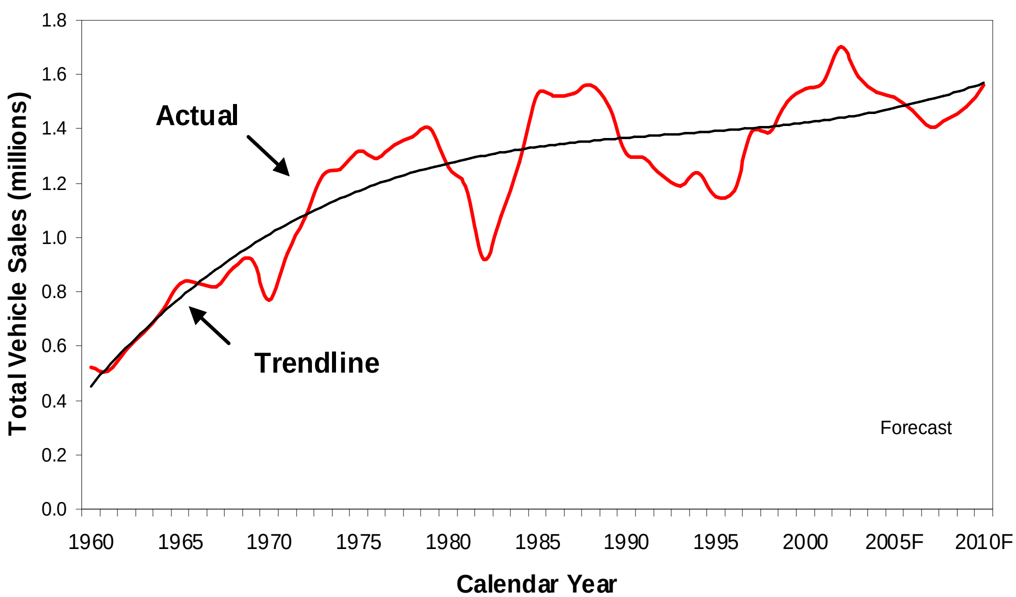
Although these problems affect all manufacturers, import name plates have responded more successfully and, as a result, have gained significant market share. These manufacturers also represent an increasing share of North American and Canadian manufacturing. Unfortunately, because import name plates use a smaller percentage of North American and Canadian parts, the overall impact is to reduce overall economic activity and employment.

Figure 2.1: Total North American Vehicle Sales, 1960 – 2010F



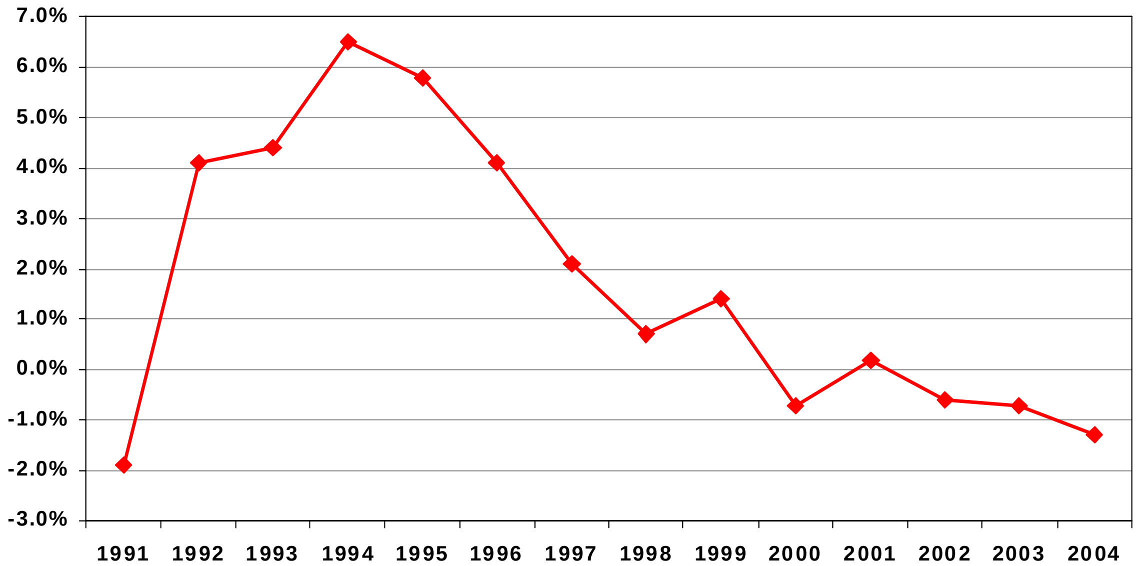
Source: DesRosiers Automotive Consultants, Ward's Automotive, CVMA, AIAMC

Figure 2.2: Total Canadian Vehicle Sales, 1960 – 2010F



Source: DesRosiers Automotive Consultants, Ward's Automotive, CVMA, AIAMC

Figure 2.3: Canadian Nominal Price Changes – Purchasing & Leasing of New Vehicles



Source: Statistics Canada

2.2 MARKET COMPARISONS AND TRENDS

The most relevant comparisons and trends that are relevant to this study are as follows.

- ***Ownership of vehicles is low and relatively stable***. Canadian vehicle ownership is one third lower than in the US and has not changed substantially in over 30 years**.** As a result, the primary driver of growth in vehicle sales is population growth.

- ***Canadians purchase more environmentally-friendly vehicles than Americans***. Although the distinction between vehicle segments is increasingly arbitrary, there are some significant observations to be made about Canadian preferences. (See Table 2.1.)

    - Trucks as a percentage of new vehicle sales increased substantially until 1995 but have shown no growth over the last decade.
    - The market is moving away from mid-sized family vehicles; the majority of consumers are moving downmarket although some are moving upmarket.
    - Smaller vehicles are much more popular in Canada than in the US.
    - Subcompact and compact light vehicles represent about 40 percent of the Canadian market but only 22 percent of the US market.
        - Fleet buyers are a major source of demand for larger vehicles.
        - Luxury vehicles and large/luxury/sport utility vehicles are much less popular in Canada.
    - Large/luxury/sport market share is less than half the size in Canada.
    - Canadian consumers are downsizing while US consumers are upsizing.
        - Diesel sales, although a small percentage of the market, are much more significant in the Canadian market than in the US market.
        - Hybrid share is a little lower in Canada, but is currently supply constrained and affected by higher diesel share.

Table 2.1: Light Vehicle Sales by Segment – 2004 Calendar Year

	UNITED STATES		CANADA	
	Units	**Share**	**Units**	**Share**
Passenger Cars				
Subcompact	255,671	1.5%	79,651	5.2%
Compact	1,932,530	11.5%	388,123	25.3%
Sport	385,503	2.3%	28,491	1.9%
Luxury	752,409	4.5%	54,933	3.6%
Intermediate	3,396,510	20.1%	240,317	15.7%
Luxury High	573,280	3.4%	20,380	1.3%
Luxury Sport	224,297	1.3%	8,204	0.5%
Total Passenger Car	7,520,200	44.6%	820,099	53.4%
Light Trucks				
Compact Sport Utility	1,098,420	6.5%	115,337	7.5%
Intermediate Sport Utility	1,777,889	10.5%	87,781	5.7%
Large Sport Utility	1,059,539	6.3%	18,930	1.2%
Luxury Sport Utility	787,152	4.7%	39,832	2.6%
Small Pickup	555,524	3.3%	26,511	1.7%
Large Pickup	2,604,271	15.4%	212,805	13.9%
Small Van	1,110,817	6.6%	184,614	12.0%
Large Van	346,761	2.1%	28,506	1.9%
Total Light Truck	9,340,373	55.4%	714,316	46.6%

Source: DesRosiers Automotive Consultants, Ward's Automotive, CVMA, AIAMC

- ***Both Canadians and Americans purchase less fuel-efficient vehicles than other countries***. Table 2.2 lists the average light-duty vehicle fuel consumption for selected countries.

Table 2.2: Comparison of Average Light-Duty Vehicle Fuel Consumption (2002)[10]

Country/Region	Average Fuel Consumption (l/100km)
United States	9.8
Canada	9.2
Australia	8.1
China	8.0
European Union	6.3
Japan	5.1

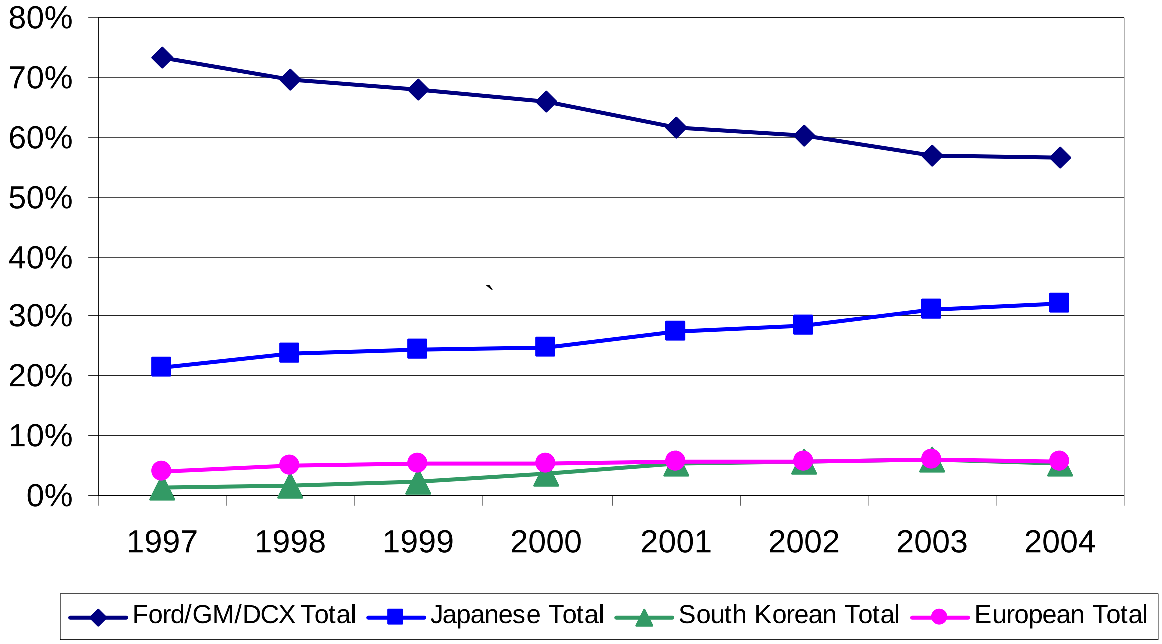
Source: Pew Center on Global Climate Change

[10] An, Feng, Amanda Sauer. (December 2004). *Comparison of Passenger Vehicle Fuel Economy and Greenhouse Gas Emission Standards Around The World.* Pew Center on Global Climate Change, p. 21.

- ***There are significant regional differences in Canadian purchasing preferences***. Some of the key differences are as follows.
  - Consumers in Quebec and the Atlantic provinces tend to buy smaller and cheaper vehicles.
  - Ontario has high family vehicle and large/luxury/sport segments.
  - The Prairies have the largest commercial use penetration.
    - Primarily pickup trucks
    - Twice the national average in Saskatchewan and Alberta
  - BC has a large high-end market and commercial-use market.
    - Largest penetration of large/luxury/sport vehicles

- ***Consumer demand is shifting towards the import name plates***. Since 1997, the three largest manufacturers—GM, Ford and DCX—have seen their market share decline from 73.2 percent to 56.5 percent. See Figure 2.4.

Figure 2.4: Manufacturer's Share of Canadian Light-Duty Vehicle Market



Source: DesRosiers Automotive Consultants

- ***Consumers expect and are getting vehicles with improved durability***. Improved durability means longer ownership. As a result, today's vehicles will last over 300,000 km versus 150,000 km in the 1960s. One of the consequences of this durability is that older and less environmentally friendly technology remains in the vehicle stock for a longer period, and that environmental performance has a longer time to degrade.

- ***Consumers shift readily between the new and used vehicle markets depending on pricing***. In 2004, 60 percent of the 3.8 million vehicles purchased were used vehicles. Although most of these originated in Canada, consumers also have access to the extremely large US market. The import/export of used vehicles depends on price differentials which vary by segment and are exchange-sensitive.

- ***Consumer choice is driven primarily by purchase price, value, reliability and styling***. Consumers consistently rank 'price/cost to buy' as the single most important reason for their choice of brand and 'value for money' near the top, by far outweighing all other market factors. (See Table 2.3.) When all purchase reasons are added together, reliability/dependability combined with styling rank at the top. In comparison, consumers rank 'fuel economy' and 'safety features' in the middle of the pack as reasons for purchasing their new vehicle, indicating they do not attach much value to fuel savings. Recent US studies also back this conclusion.[11] Furthermore, consumers rank 'environmentally friendly' last of 21 factors in new-vehicle purchase.

Table 2.3: Important Factors in Choice of New Vehicles – 2002[12]

#1 Most Important Reason For Choice		
1	Price/Cost to Buy	4,131
2	Reliability/Dependability	2,879
3	Exterior Styling	2,840
4	Value For The Money	2,564
5	Interior Comfort	2,461
6	No Answer	2,324
7	Manufacturer's Reputation	1,731
8	Fun To Drive	1,525
9	Storage & Cargo Capacity	1,311
10	Quality of Workmanship	1,275
11	Fuel Economy	1,237
12	Engine Performance	1,056
13	Safety Features	1,010
14	Road-holding/Handling capabilities	955
15	Ride Quality On Highway	699
16	Durability/Long Lasting	594
17	Future Trade-In Or Resale Value	483
18	Rebate/Incentive	415
19	Length of Warranty	244
20	Discount/Value Package	183
21	Environmentally Friendly Vehicle	37
Unweighted Sample Total Count		**29,954**

Source: Maritz Canada Inc.

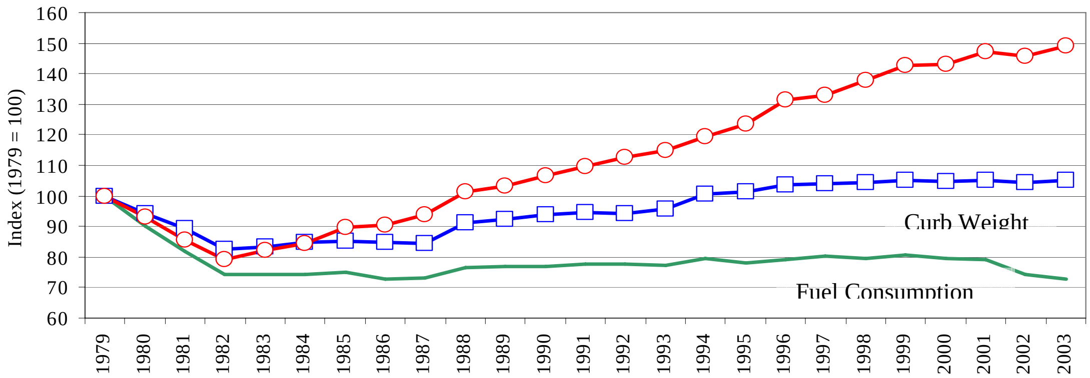
[11] Turrentine, T. and K. Kurani. (2005). *Automotive Fuel Economy in The Purchase Decisions of Households*, presented at the 84th Annual Meeting of the Transportation Research Board, January 9-13, 2005, Washington.

[12] Maritz Canada Inc. *The Maritz New Vehicle Customer Study 2002*.

2.3 ON-ROAD FUEL CONSUMPTION AND GHG EMISSIONS

Figure 2.5 shows the improvement in car fuel consumption over the period 1979–2003. Since 1990, consumption has improved by approximately 5 percent but, as shown in the chart, it would have improved substantially more if not for offsetting changes in horsepower and weight, and for a shift from cars to trucks in the early 1990s.

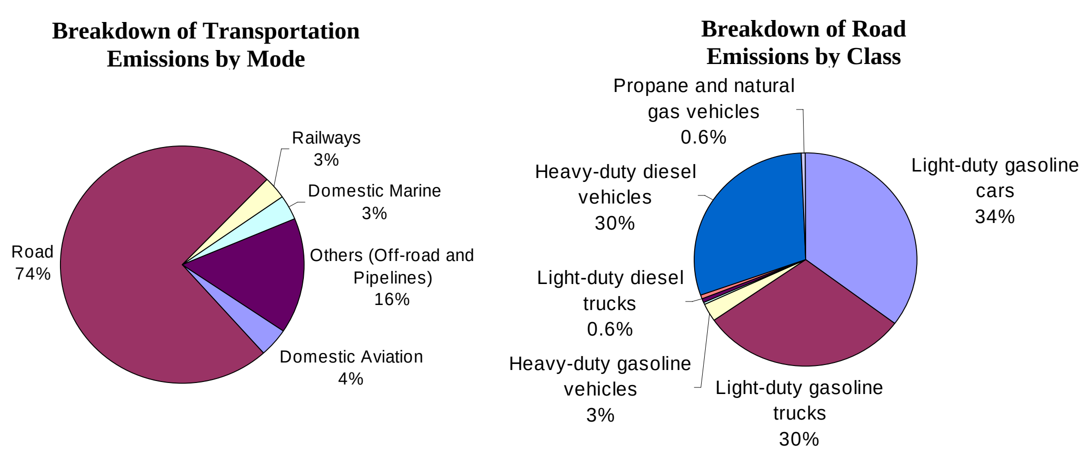
Figure 2.5: Performance of Light-Duty Vehicles



Source: Natural Resources Canada, Office of Energy Efficiency

As far as GHG emissions are concerned, the improvements in vehicle fuel efficiency have been negated by the increasing number of vehicles and longer distances travelled. According to NRCan, on-road emissions from the automotive sector represents almost 90 Mt, or more than 12 percent of Canada's total GHG emissions. Further, these emissions have increased by more than 17 percent since 1990, led by an increase of more than 50 percent from light trucks. Figure 2.6 provides a breakdown of Transportation Sector Emissions while Figure 2.7 indicates the trajectory of emissions.

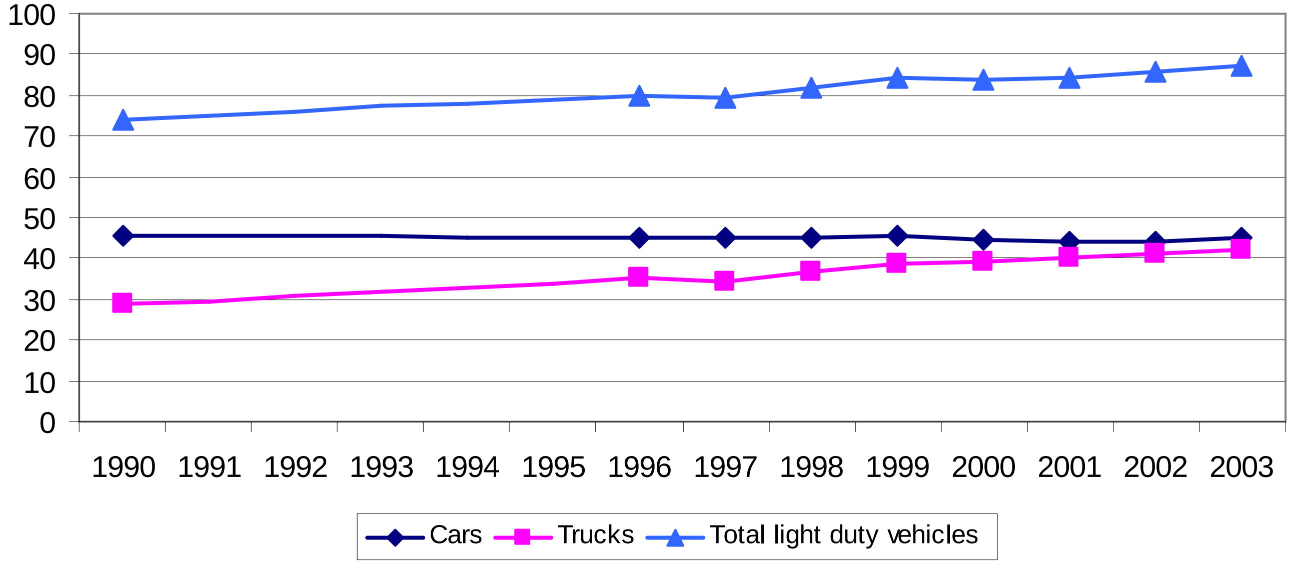
Figure 2.6: Automotive Share of Transportation GHG Emissions [13]



Source: Canada's 2003 GHG Inventory

[13] Environment Canada. (2005). *Canada's 2003 GHG Inventory*. May 2005, p.7.

Figure 2.7: GHG Emissions from Light-Duty Vehicles (Mt)[14]



Source: NRCan – Energy Use Data Handbook, June 2005

2.4 TECHNOLOGY OPPORTUNITIES

In the automotive sector, technology usually filters downwards through product lines, often starting with more expensive vehicles before becoming widely available on mass-production models. This can justify the production of low-volume, top-end models (with higher potential fuel consumption) which act as technological test beds for the industry. (An example is the Audi A8 and its use of aluminum spaceframe technology.) It can easily take seven to ten years for advanced technologies to become widely available across the new vehicle market, and some never become widely available. Thus, more elaborate/exotic fuel consumption reduction technologies such as gasoline direct injection, camless valve actuation, and full hybrid-electric systems may take many years to influence the fuel economy of the entire market. Table 2.4 provides a breakdown of the anticipated availability of key fuel consumption technologies.

[14] NRCan. (June 2005). *Energy Use Data Handbook 1990 and 1997 to 2003.* p. 99.

Table 2.4: Current and Future Fuel Economy Related Technology, Ranked by Availability

Currently Available	Limited Availability with Upside Potential	Low Availability, Cost Prohibitive
• Friction Reduction • 4Valve • Improved Accessories • 5W-20 Oil • Drag Reduction • Material Substitution • Improved Tires • Early Lock Up • Aggressive Shift Logic • Variable Valve Timing (VVT) • Electric Power Steering • Turbocharging • 6-Speed Automatic • Continuously Variable Transmission (CVT) • Mild Hybrid	• Cylinder Cut • VVT Dual • Variable Valve Lift (VVL) Continuous • Automated Manual • Direct Injection • Idle Cut	• VVL – Discrete • Camless Valve • 42V Electrical

Source for Ranking: DesRosiers Automotive Consultants

It should be noted that many cost-effective technologies have already been widely adopted to deliver fuel consumption benefits and that some of the most advanced technology on the horizon will be very expensive to implement and very difficult to service. Nevertheless, a range of lower-end technologies have good potential to deliver cost-effective improvements and some other technologies have the potential to become cost-effective with additional research and development (R&D).

A study commissioned by Transport Canada and conducted by Energy and Environmental Analysis Inc. (EEA) using various published studies has developed a list of technologies available in the short to medium term, and associated fuel consumption improvements and costs, for each car segment and for domestic and import vehicles. Table 2.5 provides an example for domestic small cars.

Table 2.5: Domestic Small Car Technology Cost Curve[15]

Technology Type	**Fuel Economy Improvement [%]**	**Cost [C$]**	**Cost Effectiveness [C$/FE%]**
4 VALVE	0.0	0	N/A
CYLINDER CUT	0.0	0	N/A
6-SPD AUTO	0.0	0	N/A
AUTOMATED MANUAL	2.0	3	1.6
EARLY LOCK UP	0.5	6	13.0
5W-20 OIL	1.0	16	15.6
AGG. SHIFT LOGIC	2.0	39	19.5
IMPROVED TIRES	2.0	52	26.0
CVT	3.9	110	28.2
ELEC POWER STRNG.	2.0	59	29.3
FRIC. REDUCTION I	1.5	46	30.3
VVT	2.0	65	32.5
VVL-DISCRETE	5.0	195	39.0
FRIC. REDUCTION II	1.5	59	39.0
VVL CONTINUOUS	3.0	124	41.2
MATERIAL SUB.	3.3	137	41.4
DIRECT INJECTION	3.5	163	46.4
DRAG REDUCTION	1.7	85	49.7
VVT DUAL	1.0	65	65.0
IMPROVED ACCESSORIES	1.0	73	72.8
TURBO	7.5	585	78.0
CAMLESS VALVE	3.0	306	101.8
42V w/idle cut	4.5	910	202.2
MILD HYBRID	3.0	650	216.7

Source: Energy and Environmental Analysis Inc.

The opportunities to introduce new technologies will depend not only on the availability of the technology, but also on the timing of vehicle redesigns, and whether or not the market is large enough to justify the investment.

Redesign of vehicle models is influenced by many external variables, including the market environment, political environment, and individual manufacturer direction, and is therefore subject to a lot of uncertainty. Notwithstanding this uncertainty, it is anticipated that 75 percent of vehicles will see a retrofit opportunity in the next 3 years, and that most remaining vehicles will see another opportunity within the next 10 years.

Redesign thresholds depend on the type and cost of the technology and the value of the vehicle. Typically, manufacturers would not consider significant technology investments solely for the Canadian market. Instead, manufacturers would typically search other markets for replacement vehicles, recognizing that some models may not be suitable. (For example, Japan has vehicles that have unsuitable engines and right-side drive.) Nevertheless, if the Canadian demand was large enough, some investments might be considered.

[15] Energy and Environmental Analysis Inc. *Automotive Technology Cost and Benefit Estimates*. Prepared for Transport Canada, March 2005. p. 47.

EEA has attempted to quantify the necessary sales demand for both domestic vehicles and imports that would trigger these new investments, and has proposed two sales thresholds:

- Imports - 2000 vehicles
- GM, Ford, DCX - 20,000 vehicles

The lower threshold for imports reflects the potential availability of suitable vehicles in other markets that would only need minor redesign in order to be certified for the Canadian market.

Beyond the conventional technologies listed in Table 2.4, two other technology options are important in terms of their impact on fuel consumption.

Diesel Technology

Diesel engines have to the potential to improve fuel economy by 25–30 percent. The technology is not new—there are currently more than 500,000 diesel light vehicles on the road in Canada—and has been proven to be profitable in Europe, but until recently the market penetration of diesels in Canada was limited by a number of barriers.

These recent developments have improved the outlook for diesels:

- Improved clean-diesel technology has addressed the noise and odour issues traditionally associated with diesel.
- Diesel fuel availability has increased significantly across Canada.
- Government-mandated ultra-low sulphur diesel fuel will enter the market in January 2006, allowing vehicles to meet the stringent Tier 2 emission standards mandated by US and Canadian regulations.

Although the ability to meet future emission standards and still be profitable is still somewhat uncertain, the penetration of diesel technology is expected to increase across all segments of the market. In the US, estimates of this penetration by 2012 range from 4–7 percent to 7.5 percent.[16, 17] Market penetration in Canada could be even higher since it is already three times greater than in the US and diesel technology has traditionally been more attractive to Canadian consumers.

Hybrid Technology

Hybrid engines have the potential to improve fuel economy by 35–40 percent. There are currently approximately 5000 hybrid vehicles on the road in Canada. However, hybrids are rapidly becoming more widely available (for example, Toyota Prius and Highlander; Lexus RX400h; Honda Civic, Accord, and Insight; Ford Escape Hybrid) with more models coming soon. At present, the cost–benefit ratio still very uncertain for consumers; however, as economies of scale increase, the costs of hybrid technology will be reduced, making these models more

[16] Greene, D.L., K.G. Duleep, W. McManus. (August 2004). *Future Potential of Hybrid and Diesel Powertrains in the U.S. Light-Duty Vehicle Market.* ORNL/TM-2004/181, Oak Ridge National Laboratory, Oak Ridge, Tennessee, p. xv.

[17] J.D. Power and Associates. *Report: Hybrid and Diesel Vehicles Expected to Represent 11 Percent of Market Share in Next Seven years*. Press Release 28 June 2005.

accessible. In the US, estimates of hybrid market penetration by 2012 range from 3.5 percent[18] to 10–15 percent.[19] For manufacturers the future profitability of hybrids is still unclear.

Availability of both hybrids and diesels has been an issue, but this constraint is likely to be overcome in the next few years as manufacturers invest heavily in new capacity.

2.5 POLICY ISSUES

Manufacturing

There is no explicit government automotive sector strategy for Canada. However, the Canadian Automotive Partnership Council (CAPC) involves governments in seeking to encourage investment. A key mandate of the CAPC is to maintain regulatory harmonization with the US.

Both the federal and Ontario governments have sought to attract additional investment in vehicle manufacturing, and have offered financial incentives on a case-by-case basis. The attractiveness of Canada is also based on productivity of the workforce, public health care and a variety of other factors.

Products

Since most vehicles manufactured in Canada are exported (over 85 percent) and most vehicles sold in Canada are imported (over 75 percent), in theory the policy environment for vehicles should not affect manufacturing decisions. However, it is reasonable to assume that perceptions of market negativity could affect manufacturer investment decisions.

Key policies affecting the design and sales of vehicles include: safety regulations, air emission standards, and the 2005 *MOU between the Canadian Automotive Industry and the Government of Canada Respecting Automobile GHG Emissions*. Because of its importance, the MOU is covered separately in Section 2.6.

- ***Safety***. A variety of regulations exists for safety. In some cases regulations in Canada are different from regulations in the US.

- ***Air Emissions***. Air emissions are governed by the *On-Road Vehicle and Engine Emission Regulations*. These regulations, which are aligned with the US Environmental Protection Agency (EPA) Tier 2 standards, came into force in 2003 and are being phased in over a number of years. The regulations will require reductions of approximately 90 percent in smog precursors (NOx, VOCs, particulates, and others). The same rules will apply to cars and trucks, as well as to gasoline and diesel vehicles.

[18] J.D. Power and Associates. *Report: Hybrid and Diesel Vehicles Expected to Represent 11 Percent of Market Share in Next Seven years*. Press Release 28 June 2005.

[19] Greene, D.L., K.G. Duleep, W. McManus. (August 2004). *Future Potential of Hybrid and Diesel Powertrains in the U.S. Light-Duty Vehicle Market.* ORNL/TM-2004/181, Oak Ridge National Laboratory, Oak Ridge, Tennessee, p. xv.

2.6 MOU RESPECTING AUTOMOBILE GHG EMISSIONS

The 2005 MOU between the Canadian automotive industry and the Government of Canada voluntarily commits the industry to achieving a 5.3 Mt reduction in GHG emissions from the light-duty vehicle sector in 2010 relative to the reference case.[20] The reference is to be adjusted for changes in vehicle sales and sales mix, scrappage of vehicles, and annual kilometres traveled.

The MOU targets are aggressive and there is a degree of uncertainty as to how the vehicle companies will achieve their commitments. The burden is alleviated somewhat by the potential to claim fuel consumption progress made beyond Company Average Fuel Consumption (CAFC) requirements since 2000. (Because of the cumulative nature of these gains, these will make a significant contribution.) The industry is expected to adopt a strategy that is approximately 75 percent based on technology and 25 percent based on shifts between market segments. Diesel, hybrid, and many ancillary technologies will probably be used in high-volume segments and additional vehicles from emissions-conscious overseas markets will be introduced—for example, Honda Fit. The industry is not relying on market shifts between companies, but there will likely be a move away from less fuel-efficient products designed for the traditionally less fuel-conscious US market and towards vehicles designed for more fuel-conscious global markets.

Since the agreement is voluntary, the Government retains the right to regulate GHG emissions and the industry retains the right to terminate the MOU if regulations are implemented. In this context, regulation was primarily meant to refer to fuel consumption standards, but a feebate system would require a new set of regulations, and these could be interpreted by industry as a regulatory measure. The industry has not taken an official position on a feebate system relative to the MOU.

[20] For comparison, the current estimated required reduction below business as usual for Canada to meet its Kyoto target is 280 Mt.

3. FEEBATE OPTIONS

There are a wide range of options to link feebates with other programs such as social marketing or R&D incentives. However, this study is focused exclusively on the use of the purchase price mechanism to influence the behaviour of consumers and manufacturers.

In this context there are still an infinite number of design options, based on nine main variables:

- ***Rate Basis***. This refers to the choice of indicator or metric for the calculation of the feebate. The options include:

    - Targeting fuel consumption (litres per 100 km) – this ensures that each litre saved has the same value
    - Targeting fuel economy (kilometres per litre or miles per gallon) – this would mean that there would be progressively fewer fuel savings per dollar of feebate as fuel efficiency improves; consequently, this choice would not lead to least-cost reductions
    - Targeting GHG emissions directly – this would be a more precise way of targeting their reduction (by including gases other than CO_2) and would provide a basis for dealing with alternative fuels, but it would be less intuitive for the public
    - Targeting specific technologies, such as advanced diesel or hybrid vehicles, as proposed by the Sierra Club[21]

- ***Form of the Feebate Function***. The function that applies the rate can be linear or non-linear (for example, plateaus, or deadbands where the feebate is not applied; changes in slope, meaning differential rates; and, caps where fees are limited or capped at an upper level). In theory, all of these are possible: caps provide ways of avoiding excessive fees or rebates that contribute little to the effectiveness of the measure; deadbands provide a way of avoiding large numbers of small transfers close to the pivot point (mean fuel consumption level). However, they create discontinuities in the incentive to reduce fuel consumption, affecting behaviour and reducing effectiveness.

- ***Rate***. Assuming a linear function, this refers to the slope of the line. Steeper slopes (higher rates) are more effective in promoting fuel-efficient technology investments but may be more disruptive as they would lead to greater shifts in purchasing, and greater costs.

- ***Number of Vehicle Classes***. The options are:

    - Single system (one pivot point for all vehicles) – the most efficient system
    - Two-tier system (cars and trucks, for example) – less efficient but better at mitigating the impact due to market shifts
    - Multiple classes (by weight, or interior volume) – least efficient, however multiple classes could reduce the burden on manufacturers more heavily reliant on larger vehicles (GM, Ford, DCX). That is, the pivot point would be differentiated by class, thereby limiting the impact of the feebate between classes.

[21] Sierra Club of Canada. (September 6, 2005). *1 Million Kyoto Cars*. Comments submitted to NRTEE on draft report on Development of Options for a Vehicle Feebate in Canada.

- ***Application and Exemptions***. In principle, feebates are meant to apply to all classes. However, a variety of small exceptions could be made for legal or administrative reasons without affecting the overall effectiveness of the measure**.** A more significant option would be to exempt commercial vehicles or vehicles built exclusively for cargo (though such an exemption would probably encourage various forms of gaming to manipulate the definition of "commercial" or "cargo").

- ***Manufacturer Feebate or Consumer Feebate***. Assuming that manufacturers pass on the fees or rebates fully, there should be no difference in the effect. In either case, the tax or rebate amount can be posted with fuel economy ratings, since consumers may value that information. Both options would also be comparable in terms of administrative complexity and, in any case, manufacturers would likely want the feebate to be transparent in the price.

- ***Revenue Neutrality***. In principle, the pivot point would be determined by the requirement for revenue neutrality and would change annually as vehicles became more efficient. However, the value would not be known with certainty until after the fact. Therefore, it would be necessary to operate with a proxy value so that vehicle transactions could take place with price certainty.

  One approach to achieve revenue neutrality is to model the expected changes in purchasing and set the pivot point ahead of time, then calculate the surplus or deficit at the end of the year and recalibrate in the following year(s) to distribute the excess or recover the deficit. This could involve large adjustments and possibly a risk of overcompensating. In addition, manufacturers with large market share may strategically respond by gaming in order to influence future pivot points.

  Another approach would be to continually recalibrate the modeling approach to improve the estimate of the pivot point but without seeking to explicitly compensate for any previous surplus or deficit. Over time, it might be hoped that surpluses and deficits would cancel each other out. In this option, the pivot point could be set several years in advance (for example, 3–5 years), improving planning, ensuring price certainty and minimizing the potential for gaming.

- ***Phase-In Period***. A phase-in period could help alleviate some concerns about fairness and market disruptions, but would also delay the benefits. If implemented, a phase-in should take into account the projected vehicle redesign schedule.

- ***Paid at Purchase or Annually***. An annual feebate would act as a continual incentive to replace less fuel-efficient vehicles but would incur additional administrative costs relative to a paid at purchase system. (Administration of an annual system would probably need to be through provincial vehicle registration.) In principle, this would apply equally to used cars, and therefore might be appealing as a way of mitigating the impact on manufacturers. This approach is more administratively complex

4. MODELING OF FEEBATE OPTIONS

4.1 DESCRIPTION OF MODELS

Two separate models were used in this analysis:

- ***Transport Canada Variant of Greene et al. Vehicle Purchase Model***. This is a spreadsheet-based, nested multinomial logit, consumer choice model that estimates the effect of feebates on consumer purchasing behaviour and manufacturer investment in fuel economy technologies. Each individual vehicle model is included (830 in total North American market), as well as its purchase price and fuel economy. The model solves for fuel economy changes that maximize consumer surplus given a defined feebate. Consumer surplus is maximized in response to the feebate "price" by:

  - shifting vehicle demand towards more fuel-efficient cars and reducing overall vehicle demand
  - inducing manufacturers to maintain or improve market share by improving fuel economy, and
  - providing fuel savings to the consumer through lower overall fuel consumption.

  The model produces aggregate national results for a single future year (15 years in the future), representing the new long-run equilibrium impact of the feebate.

  Transport Canada modified the US model to use aggregated 2003 Canadian and US sales data, updated the technology cost curves based on a 2005 literature review (necessary to track manufacturer responses to the feebate), and added redesign thresholds provided by EEA. (These EEA redesign thresholds are used to determine if sales are adequate in Canada to induce manufacturers to make manufacturing investments that produce fuel economy improvements.)

  A key assumption in the model is how consumers respond to the price signal introduced by the feebate. The model used the following elasticity assumptions to model the price response of consumers:

  - -10 @ market share of 15 percent within a class
  - -5 @ market share of 10 percent between classes
  - -1.0 for overall sales

  Some limitations of these assumptions are discussed below.

- ***NRCan Vehicle Stock Model***. This is a simple representation of vehicle turnover and usage over a 15-year period. The model also incorporates the technology redesign schedule provided by EEA for the US Energy Information Administration in order to estimate the timing of technology investments. Outputs include the path of annual fuel savings and GHG emission reductions leading up to the fifteenth year.

4.2 BASE CASE AND ASSUMPTIONS

To isolate the effect of the feebate, a base case is assessed. This case is generated by the model and based on allowing consumer and manufacturer behaviour to evolve naturally in response to the availability of cost saving-technology with no feebate. The base case has not been calibrated to NRCan's reference case and it does not incorporate macroeconomic or demographic factors. However, in evaluating the incremental impact of feebates, these are not major limitations.

The key assumptions that remain constant for all scenarios are:

- A single fuel-efficiency cost curve for each class (provided by EEA)
- 2000 minimum threshold for redesign of import vehicles
- 20,000 minimum threshold for redesign of domestic vehicles
- Vehicle life of 15 years
- Average yearly distance traveled of 23,500 km, declining 4 percent per year
- 15 percent adjustment of fuel consumption rating to approximate on-road conditions
- 23 percent rebound effect (where decreased fuel costs induce more driving, thus negating a portion of the feebate gains)
- 10 percent discount rate.

4.3 LIMITATIONS

Like all modeling exercises, the current one is a crude approximation of reality designed to provide policy guidance. While the model has limitations that we highlight below, it is our view that the model can be used to inform policy. Limitations include:

- ***Decision basis***. In the real world, manufacturers would redesign based on a number of complex considerations and consumers would be driven by a variety of considerations that are not easily represented by a simple elasticity function. In this simulation, the model assumes that manufacturers redesign their vehicles to maintain market share and not to maximize profits. Similarly, societal costs may be fairly represented by consumer surplus changes, but it is not possible to estimate the share of the burden that would fall on producers and not be passed on to consumers.

- ***Air quality benefits***. Important co-benefits from reduced fuel consumption like improved air quality, a reduction in adverse health outcomes and the monetary value of those outcomes are also not modeled.

- ***Valuation of fuel savings***. A central assumption of the model is that consumers undervalue fuel savings. A key limitation is that there is no data on the extent to which this is true of Canadian consumers. As a result, we use the same assumption as Greene et al. (three years undiscounted) and we undertake a sensitivity analysis by examining the effect of assuming that consumers already fully value fuel savings. To the extent that consumers do undervalue fuel savings, a feebate would be justified on efficiency grounds alone, with carbon mitigation benefits additive.

- ***Consumer elasticities***. These values determine the extent to which consumers respond to price signals. Greene et al. used short-run elasticities, which are assumed to vary with make/model market shares, but are not estimated by manufacturer or vehicle class. Given the function used, classes with larger market shares have smaller elasticities, whereas models with small market shares have high elasticities (in some cases, unrealistically high). Furthermore, cross-price elasticities are not differentiated by make/model or class. This means that consumers diverted from buying a large SUV are assumed to be equally likely to buy a subcompact as a minivan or mid-size SUV. It also means that cross-price elasticities are higher across the board for classes with large market shares; this issue matters more for Canada, since the market shares are less evenly distributed than in the US. Since there is no comparable data on Canadian elasticities, our approach has been to use the Greene et al. elasticities but to halve them, as a way of approximating long-run responses and to mitigate some of the effects described above. We also undertake a sensitivity analysis by examining the effects of assuming the full elasticities prescribed by Greene et al.

- ***Static designs***. The model uses a database of vehicles, which is based on 2003 models and assumes no changes in makes and models over the 15-year period. This is unrealistic but neutral in terms of costs. Furthermore the model uses a static technology cost curve that assumes no progress in available fuel economy technologies over the period—this assumption tends to overestimate costs. Finally, the model assumes that all technology investments are used to improve fuel economy and that weight and performance remain constant. (Given past experience, this tends to overestimate the fuel economy effectiveness of the investments.)

- ***Hybrid and diesel technologies are not included***. As discussed in Section 2, hybrids and diesels are expected to play a significant role in improving fuel economy. Unfortunately the current version of the model lacks the information necessary to include these options. (Our understanding is that Transport Canada is working to add them to the model soon.) As a result, the model overestimates costs and underestimates fuel economy gains.

- ***Effects on used vehicle markets are not modeled***. As discussed in Section 2, the used vehicle market represents more than half of vehicle sales. If the price of certain models rises because of feebates, it is likely that some of the demand will be filled from the used vehicle market. However, the model assumes that consumers primarily respond by shifting purchases to other new vehicles. As a result, the effectiveness of fuel economy gains is overestimated.

- ***Threshold approach to redesign***. The cost curve approach does not account for economies of scale beyond the pre-set threshold, as the thresholds are only set to limit the access to technology in a Canadian-only scenario.

- ***Spillover effects of unilateral Canadian policy***. The model assumes that unilateral Canadian policies have no effect on US policy. Thus any spillover effects that might occur are discounted. For example, should Canadian policies increase the potential for voluntary or mandatory fuel economy improvements in the US, the effect of this on the overall size of the market for redesign is not included. (As a result, costs are potentially overestimated and effectiveness is underestimated.)

- ***Rebound effect***. “Rebound” refers to the increase in distance travelled that accompanies reduced driving expenses (in this case, fuel savings). The model assumes a rebound effect of 23 percent—meaning 23 percent of fuel savings are lost to this effect—based on research of past experience in the US. The potential future rebound effect in Canada has not been studied, but 23 percent almost certainly overestimates the effect and therefore underestimates the GHG savings.

4.4 SCENARIOS

The primary purpose of the modeling is to explore the effects of various feebate options. In this respect, the model is primarily designed to examine the effects of varying rate designs as opposed to implementation options, such as approaches to revenue neutrality, phase-in periods, or annual feebates at vehicle registration. As well, the model is designed to use fuel consumption as the rate basis.

Thus, our scenarios are selected to include variations on the following options:

- Form of the function: Fully linear, $5,000 cap, or zero feebate within 1.0 litre per 100 km of pivot (deadband)
- Rate: $250, 500, or $1000 per litre per 100 km
- Number of classes: single, car and truck, or 11 classes.

A secondary purpose of the modeling is to examine the sensitivity of the results to differences in key assumptions. In this respect, the following alternatives are considered:

- ***Elasticities***
  - Base assumption – represents long-run elasticities (i.e. half of the values used by Greene et al. presented above)
    - -5 @ market share of 1.5 percent within a class
    - -2.5 @ market share of 10 percent between classes
    - -0.5 for overall sales
  - Sensitivity analysis for double these figures (i.e. the full values used by Greene et al.).

- ***Policy Scope***
  - Base assumption: feebates are implemented in Canada only
  - Sensitivity analysis for Canada–US policy.

- ***Consumer Perception of Value of Fuel Savings***
  - Base assumption: three years of undiscounted savings
  - Sensitivity analysis for fuel discounted valuation.

- ***Fuel Price***
  - Base assumption: C$0.90 per litre
  - Sensitivity analysis at C$1.20 per litre.

These alternative options and assumptions are grouped into 12 scenarios, as shown in Table 4.1.

Table 4.1: Specification of Scenarios

No.	Rate (C$/l/100km)	Classes	Caps or Plateaus	Elasticities	Jurisdictions	Valuation of Fuel Savings	Fuel Price $/l
1	Base Case	N/A	N/A	50% of Greene	Canada – US	3 years, undiscounted	0.90
2	$250	Single	No	50% of Greene	Canada only	3 years, undiscounted	0.90
3	$500	Single	No	50% of Greene	Canada only	3 years, undiscounted	0.90
4	$1,000	Single	No	50% of Greene	Canada only	3 years, undiscounted	0.90
5	$500	Single	No	50% of Greene	Canada – US	3 years, undiscounted	0.90
6	$500	Single	Cap at $5,000	50% of Greene	Canada only	3 years, undiscounted	0.90
7	$500	Single	Zero within 1.0l/100km of pivot	50% of Greene	Canada only	3 years, undiscounted	0.90
8	$500	Separate cars & trucks	No	50% of Greene	Canada only	3 years, undiscounted	0.90
9	$500	11 classes	No	50% of Greene	Canada only	3 years, undiscounted	0.90
10	$500	Single	No	50% of Greene	Canada only	Full	0.90
11	$500	Single	No	As per Greene	Canada only	3 years, undiscounted	0.90
12	$500	Single	No	50% of Greene	Canada only	3 years, undiscounted	1.20

4.5 RESULTS

Appendix B contains detailed result for each of the scenarios. Selected results are presented in Table 4.2. Note that Scenario 7 could not be modeled because of problems with the specification of the discontinuity.

Table 4.2: Scenario Results

Scenario			**Total Trans-fer ($M)**	**Fuel Economy (l/100km) 2018**		**Unval. Fuel Savings ($M)**	**GHG Emission Reduction (Mt)**		**Societal Cost ($M) *Benefit shown as neg.**			**Sales (2010)**						
#	**Policy Options**	**Assump-tions**	**2010**	**Cars**	**Trucks**	**2018**	**2018**	**2003-2018**	**2010**	**2018**	**2003-2018**	**Total Change (#veh.)**	**Big 3 (%)**	**Other (%)**	**Cars (%)**	**Trucks (%)**	**Avg. Car Price ($)**	**Avg. Truck Price ($)**
1	Base Case	First 3 yrs valuation Base Elasticities	0	7.1	9.8	0	0	0	0	0	0	0	62	38	56	44	24,600	32,600
2	$250/l/100km	Canada only First 3 yrs valuation Base Elasticities	290	6.9	9.7	180	1.5	13	(80)	(180)	(540)	(260)	61	39	58	42	24,200	32,500
3	$500/l/100km		570	6.8	9.5	370	3.0	26	(120)	(310)	(800)	(1,200)	60	40	59	41	23,800	32,400
4	$1000/l/100km		1,100	6.5	9.2	760	6.2	53	(90)	(460)	(460)	(6,300)	58	42	62	38	23,100	32,200
5	$500/l/100km	North America	550	6.4	8.8	730	6.0	42	(160)	(650)	(1340)	(1,800)	60	40	59	41	23,900	32,600
6	$500/l/100km Cap @ $5,000	Canada only First 3 yrs valuation Base Elasticities	570	6.8	9.5	370	3.0	26	(120)	(310)	(800)	(1,200)	60	40	59	41	23,800	32,400
8	$500/l/100km Sep. Cars & Trucks		450	6.8	9.5	250	2.1	16	(70)	(220)	(480)	(860)	61	39	56	44	23,800	31,400
9	$500/l/100km 11 Classes		280	6.8	9.6	200	1.6	12	(50)	(180)	(380)	(520)	61	39	56	44	23,900	32,400
10	$500/l/100km	Full Valuation	590	6.6	9.2	0	3.0	26	20	(20)	292	(470)	61	39	58	42	23,700	32,500
11	$500/l/100km	Double Elasticities	560	6.7	9.3	1,200	5.4	49	(540)	(1070)	(3540)	(5,700)	58	42	62	38	23,000	32,100
12	$500/l/100km	$1.20/l	580	6.7	9.4	400	2.4	21	(160)	(360)	(990)	(30)	60	40	59	41	23,700	32,400

4.6 OBSERVATIONS

The scenarios provide a basis for several observations:

- ***General Observations***. The most significant findings are:
    - Most scenarios result in significant fuel savings and GHG reductions.
    - Most scenarios produce a net benefit—meaning from a societal perspective the benefits are greater than the costs—mostly in the form of unvalued fuel savings.
    - In contrast with Greene's US experience, most scenarios produce a more significant shift in sales (although technology still accounts for more than two thirds of the improvement). As a result, the average cost of vehicles is slightly lower and combined with slightly lower sales; total revenues are reduced by approximately $1.5 billion per year (approximately 4 percent).
- ***Effect of Rate Change***. See Table 4.3. The key observations are:
    - Fuel economy improves and therefore GHG reductions increase relatively linearly with an increasing feebate rate.
    - The shift in sales also increases linearly.
    - Net benefits are positive for all rates but level off between $500 and $1000.

Table 4.3: Effect of Rate Change

Scenario	Change in GHG (Mt)	Total Societal Benefit ($M)	Change in Car Share
$250/l/100km	-13	540	1.6%
$500/l/100km	-26	790	3.1%
$1000/l/100km	-53	460	6.1%

- ***Cap & Deadband***. The key observations are:
    - A cap removes incentives for highly inefficient vehicles to improve, since they just pay a fixed fee. It also diminishes incentives to shift away from those vehicles.
        - A $5000 cap has no significant effect: only one vehicle (Ferrari Enzo) would be above this threshold.
        - Only one other (Chevrolet Silverado) would be above $4000.
        - Only 15 models out of 800 would be above $3000.
    - A deadband removes incentives to improve fuel economy for vehicles near the pivot point.
        - Thus, reductions are fewer, and shifting to more efficient vehicles is distorted.
        - Unfortunately, the model was unable to simulate this effect correctly.
- ***Consumer Valuation of Fuel Savings***. See Table 4.4. The key observations are:
    - At C$0.90 per litre the full discounted value of reducing fuel consumption by 1.0 per litre per 100 km would be $1700. If we assume that consumers only value three years, or $700, feebates provide a way to compensate for this. Thus, feebates up to $1000

per litre per 100 km should be cost-effective. Results are consistent with this expectation:

- The total surplus (net benefit) improves as the feebate rise.
- All scenarios up to $1000 have benefits instead of costs.
- For rates higher than $1000, the costs would outweigh the benefits on the margin.

• Full valuation means that the base case is more advantageous and that the benefits of feebates are correspondingly reduced. Fuel economy still improves but there is a net cost per tonne for GHGs.

Table 4.4: Effect of Consumer Valuation Assumption

	Baseline FC in 2018 (l/100km)	Average FC in 2018 (l/100km)	Change in Consumer Surplus ($M)	Unvalued Fuel Savings ($M)	Total Societal Benefit ($M)
$500/l/100km, 3yr valuation	8.3	7.9	-510	1300	790
$500/l/100km, full valuation	8.1	7.7	-290		-290

• ***Segmentation***. See Table 4.5. The key observations are:

• Differentiating pivot points means a lower fee or even a rebate as larger vehicles are assessed only against their cohorts. This discourages shifting to smaller vehicles (less change in market shares) and means less improvement in consumer surplus and fewer GHG reductions. Results are consistent with this expectation.

- Segmentation of cars and trucks reduces fuel economy, GHG reductions and benefits, while virtually eliminating the shift between cars and trucks (and reducing the shift between manufacturers).
- Going to 11 classes has little additional effect.

Table 4.5: Effect of Segmentation

Scenario	Change in GHG (Mt)	Total Societal Benefit ($M)	Change in Car Share
$500/l/100km, 1 pivot	-26	790	3.11%
$500/l/100km, 2 pivots	-16	480	0.02%
$500/l/100km, 11 pivots	-12	380	0.00%

• ***Policy Integration with US***. See Table 4.6. The key observations are:

• With a unilateral policy, not all makes/models meet the threshold for retooling. Fuel economy is then determined by the average North American willingness to pay (WTP) and a Canadian feebate raises this WTP according to the Canadian market share.

• With North American implementation, all vehicles improve according to the full change in consumer willingness to pay. As a result, GHG reductions are larger and the change in Canadian surplus is larger. An integrated North American feebate doubles the GHG reductions and benefits for the same shift in sales.

Table 4.6: Effect of Policy Integration with the U.S.

Scenario	Change in GHG (Mt)	Total Societal Benefit ($M)	Change in Car Share
$500/l/100km, Canada	-26	790	2.76%
$500/l/100km, North America	-42	1,340	2.48%

- ***Elasticities***. See Table 4.7. The key observations are:
  - Elasticities determine the effects on total sales and shift in the fleet mix. Greene’s original elasticities represented short-run responses; to better reflect the available information on long-run responses, we halved them to get our baseline elasticities. As a result, the baseline elasticities yield more conservative estimates of the benefits to consumers, but also predict smaller sales shifts.
  - With Greene’s original elasticities, consumers are more sensitive to price changes. As a result, the sales mix changes more easily but policies are less costly, since consumers take greater advantage of the option to purchase other vehicle types. This doubles the size of the sales shifts and the GHG reductions. At the same time, the change in surplus is five times greater.

Table 4.7: Effect of Elasticity Assumptions

Scenario	Change in GHG (Mt)	Change in Consumer Surplus ($M)	Unvalued Fuel Savings ($M)	Total Societal Benefit ($M)	Change in Car Share, 2018	Change in Sales, 2018
$500/l/100km Baseline Elasticities	-26	-510	1,300	790	2.8%	-0.1%
$500/l/100km Double Elasticities	-49	-680	4,580	3,900	5.7%	-0.4%

- ***Price of Fuel***. See Table 4.8. The key observations are:
  - A higher fuel price means that there is more incentive for fuel economy present in the base case. Thus, the incremental of the feebate on fuel and GHG savings is reduced (by about 20 percent).
  - On the other hand, the unvalued fuel savings are worth more so the overall benefit is higher and the benefit per tonne is greater (almost $50 per tonne).
  - The price of fuel has little impact on the sales mix.

Table 4.8: Effect of Fuel Price

Scenario	Change in GHG (Mt)	Change in Consumer Surplus ($M)	Unvalued Fuel Savings ($M)	Total Societal Benefit ($M)	Change in Car Share, 2018
$500/l/100km Fuel @ $0.90/litre	-26	-510	1,300	790	2.8%
$500/l/100km Fuel @ $1.20/litre	-49	-680	4,580	3,900	2.9%

4.7 IMPLICATIONS

- ***Model results are subject to the limitations and assumptions described above***. The main value of the model is to assist in understanding the relationships between inputs and various indicators of environmental effectiveness, economic efficiency, etc. Thus, although the results are considered directionally valid, individual values should be treated with caution.

- ***Some implications are clear and relatively robust***. Notwithstanding modeling limitations and assumptions, there are a number of findings derived from a logical understanding of the mechanisms at work and, therefore, not likely to be in doubt. These findings are:

  - Feebates will encourage additional investment in fuel-efficiency technology and shift the market towards more fuel-efficient vehicles (trucks to cars, large cars to small cars, more fuel-efficient cars in the same class).

  - Over time, this will improve the fuel efficiency of the vehicle stock and will reduce GHG emissions.

  - The investment in fuel-efficiency technology will raise the cost of individual vehicles and reduce consumer surplus accordingly.

  - To the extent that consumers undervalue fuel savings, feebates will capture savings that would otherwise not have been realized. If the undervaluation is significant, over the life of the vehicle fuel savings are likely to exceed the added cost to vehicles, resulting in a net economic benefit to society.

  - Higher prices will depress vehicles sales.

  - The shift towards more fuel-efficient vehicles will also reduce overall revenues.

  - In a single-class feebate, GM, Ford, and DCX will lose additional market share and will bear a disproportionate share of the adjustment costs. This could be alleviated by adopting separate classes for trucks and cars, though this would reduce GHG savings and economic benefits.

  - The extent of the shifts is determined by the elasticities of demand. If elasticities are greater than expected, the environmental and economic benefits will be greater but so will the adjustment costs. Conversely, if elasticities are less than expected, the environmental and economic benefits will be reduced, as will the burden on manufacturers.

5. ASSESSMENT OF FEEBATE OPTIONS

The *Framework for Evaluation of Environmental Tax Proposals* is reproduced in Appendix A. Its objectives are:

- to set out the context for use of the tax system for environmental purposes, and
- to guide the analytical evaluation of options in order to contribute to the policy debate, and to facilitate dialogue with other governments and stakeholders who are concerned with the integration of economic and environmental factors.

The main criteria are:

- Environmental Effectiveness
- Fiscal Impact
- Economic Efficiency
- Fairness
- Simplicity

5.1 ENVIRONMENTAL EFFECTIVENESS

Environmental effectiveness refers to whether, and to what extent, the proposal will contribute to achieving the environmental goal. In general, an environmental tax measure will be effective if it induces a change in producer or consumer behaviour that achieves the goal. This presupposes that the measure can be targeted effectively and that it will alter behaviour such that environmental objectives will be met.

Thus, we divide the discussion into four parts:

- Targeting
- Consumer Response
- Manufacturer Response
- Environmental Benefits and Side Effects.

Targeting

An important limitation is that, contrary to a fuel tax, feebates do not directly target fuel consumption. By affecting the vehicle purchase decision, a feebate will have a major impact on fuel consumption, but some of the fuel savings may be lost if drivers convert the savings into more distance travelled—this is referred to as the rebound effect.

As described in Section 3, this is accounted for in the model, which uses a figure of 23 percent based on past experience in the US. In fact, this figure likely overestimates future rebound in the Canadian context: anecdotal evidence suggests that distances traveled are not generally constrained by the cost of fuel, but are more likely to be constrained by other factors, such as availability of time. If the rebound is in fact overestimated, the effect is to underestimate the GHG reductions that can be achieved from a feebate.

Consumer Response

Consumers will respond to feebates in several ways. They may ignore them (accepting whatever fee or rebate they receive without modifying their choice of vehicle); they may shift their purchase (from trucks to cars, or from less fuel-efficient vehicles to more fuel-efficient vehicles); they may purchase a vehicle for the first time if the rebate on cheaper vehicles provides enough inducement; they may hold on to less fuel-efficient vehicles for a longer period to avoid the fee on a replacement; or, they may seek to purchase a used vehicle that meets their needs. The model attempts to predict the response by assuming that consumers will shift their purchases as determined by cost and the elasticities described in Section 4.

- ***Shifts in purchases***. The incentive to switch depends primarily on the feebate rate. Although partially offset by technology improvements, there will likely be a significant shift from trucks to cars, from larger vehicles to smaller vehicles, and from less fuel-efficient vehicles to more fuel-efficient vehicles within a given class. In a single-class feebate, the increase in car share ranges from 1–6 percent, with a 3-percent shift for $500 per litre per 100 km feebate. With separate classes for cars and trucks, the shift is reduced to less than 0.1 percent.

- ***Modal shift from transit to small cars***. Lower prices for fuel-efficient cars might tempt some people who would not otherwise have done so to purchase a car. This effect increases as the rate rises and is included in the overall estimate of demand for smaller vehicles.

- ***Scrappage***. Higher new car prices for larger vehicles means longer retention of existing cars in these classes. In the worst case scenario, approximately 6000 fewer vehicles would be sold, out of total market of 3.8 million (approximately 0.1 percent). Assuming that vehicle ownership remains the same, this would mean that an equivalent number of older vehicles would stay on the road longer.

- ***Used Vehicles***. If feebates are high enough, purchasers seeking less fuel-efficient vehicles could look to the used car market for supply. Similarly, purchasers of more fuel-efficient vehicles will be more likely to buy new vehicles. Eventually, Canadian used car prices will reflect the value of the feebates that applied to them when they were originally sold, however this could take several years. To some extent this effect is included in the overall calculation of vehicle sales and is reflected in the figure of 6000 fewer vehicles sold. However, what is not included is the possibility that feebates will lead to increased imports of larger (relatively new) used vehicles from the US or increased exports of smaller (relatively new) used vehicles to the US. If significant, either or both effects (vehicle arbitrage) would undermine revenue neutrality and could significantly reduce the effectiveness of the measure.

Manufacturer Response

Manufacturers will respond to feebates either by ignoring them and accepting that consumers will shift demand to other vehicles or by investing in new technologies to improve fuel efficiency. Depending on demand, manufacturers may also respond by making individual models more or less available to the Canadian market. The model seeks to predict this response by assuming that manufactures will cater as much as possible to consumer demand by investing in technology to the extent that the combination of increased purchase price and valued fuel savings are most advantageous to the consumer.

- ***Investment in Technology***. Feebates would induce significant investment in technology. In fact, the model suggests that most improvements in fuel efficiency will likely flow from technology improvements as opposed to shifts in purchasing. However, because manufacturers respond to overall North American demand for fuel economy, technology investment is smaller with unilateral Canadian policies (approximately 80 percent for Canada-only versus 85 percent for an integrated North American feebate of $500 per litre per km).

  It is important to note that, although not included in the model, the availability of hybrid and diesel technologies will enhance the technology contribution and that excluding hybrids and diesels tends to underestimate effectiveness of feebates and overestimate costs.

- ***Availability***. Constraints on the availability of diesels and hybrids are expected to be overcome in the medium term. The availability of models incorporating conventional technologies is governed by the assumed design modification thresholds—lower production run models may not be available.
  - In contrast with fuel consumption standards, feebates should not directly restrict the availability of less efficient models.
  - High-volume manufacturers have the ability to continue to offer a wide choice of product offerings, but some less fuel-efficient models will probably be dropped.

Environmental Benefits and Side Effects

The main concerns are: fuel savings and GHG emissions; other air emissions; congestion and noise; and, safety.

- ***Fuel Savings and GHG Emissions***. The combination of technology improvements and shifts in purchasing is expected to yield fuel consumption improvements of 0.2 litres per 100 km to 0.8 litres per 100 km, with an improvement of 0.4 litres per 100 km for a $500 per litre per 100 km feebate (equal to 1.2 billion litres per year). Corresponding GHG reductions are expected to range from 1.5 Mt per year to 6.2 Mt per year, with 3.0 Mt per year for a $500 per litre per 100 km feebate. Adopting two or more separate classes would slightly reduce the fuel economy improvement and would significantly reduce the GHG reductions (because these are cumulative).

- ***Criteria Air Contaminant (CAC) Emissions***. Some fuel-economy technologies will increase CAC emissions, but overall, the reduction in fuel consumed should result in significant decreases. To some extent, manufacturers may take advantage of this to reduce their investment in emission controls to meet the *On-Road Vehicle and Engine Emission Regulations*, but generally emissions per kilometre should be substantially lower. However, because of the rebound effect, distance travelled may increase and total CAC emissions could rise accordingly. Emissions may also increase due to reduced vehicle scrappage, but, as noted earlier, the number of vehicles affected would be relatively small. Overall emissions of CACs should be lower.

- ***Congestion and Noise***. Both congestion and noise may increase slightly due to the rebound effect. Noise could also increase because of the use of diesel technology which is slightly noisier, but the use of hybrids would decrease noise.

- ***Safety***. There will be an increase in exposure due to the larger distances traveled (rebound effect). As far as risk is concerned, larger and heavier vehicles are safer for their occupants but less safe for others. Overall, there no consensus on the impact of a smaller fleet on safety risks.

5.2 FISCAL IMPACT

Fiscal impact refers to how the proposal will affect government expenditures or revenues.

In this case, the federal government has mandated that the options under consideration should be revenue neutral. However, there are still a number of relevant considerations, including:

- Size of the Transfer
- Public Perception and Trust
- Administration Costs
- Effect on Other Revenues
- Annual Surplus or Deficit.

- ***Size of the Transfer***. Although all options are revenue neutral, they vary in terms of the amount of fees collected and rebates paid. The total transfer varies from approximately $300 million per year (for a $250 feebate, or a $500 feebate with 11 classes) to over $1.1 billion per year for a $1000 feebate.

- ***Public Perception and Trust***. Because there is little experience in Canada with revenue-neutral government programs, many people are sceptical of the Government's short-term and long-term intentions and will need significant ongoing reassurance that this is not primarily a tax increase.

- ***Administration Costs***. The cost of administration of the program is discussed in Subsection 5.5. What is relevant here is that this cost has not been considered in the calculation of revenue neutrality. In principle, the pivot point could be adjusted to raise additional revenues in order to account for these costs, but again, this could be perceived as a tax increase.

- ***Effect on Other Revenues***. Because fewer cars will be sold and those cars that are sold will be smaller and cheaper, there will be an overall reduction in revenues for retailers and manufacturers. Reduced revenues for vehicle purchases also means less GST collected. However, it is expected that the loss of these GST revenues will be compensated for by additional GST revenues elsewhere in the economy. Overall no net effect on GST revenues is forecast.

However, the same is not true for fuel taxes. Because of the greater fuel economy of vehicles, less fuel will be sold and governments will collect fewer fuel taxes. The loss is expected to range from $200 million per year (for a $250 feebate) to $900 million per year for a $1000 feebate (including both federal and provincial taxes). Again, the pivot point could be adjusted to raise additional revenues to account for these lost revenues, but this could be perceived as a tax increase.

- ***Annual Surplus or Deficit***. As discussed in Section 3, it should be possible to achieve revenue neutrality over time, but it will not be possible to do so with certainty in any given year while providing the price certainty necessary for transactions to proceed. Thus, it will be necessary to consider the practicality of different options regarding adjustments for compensation, as well as different options regarding bias. For example, in the early years, it may be important to demonstrate that Government is not retaining excess revenue, and therefore, a pivot point could be selected to provide a degree of certainty that fees will not exceed rebates. All of the options will involve trade-offs between the certainty of revenue neutrality and the need for price certainty for market effectiveness.

5.3 ECONOMIC EFFICIENCY

Economic efficiency refers to how the proposal will affect the allocation of resources in the economy and Canada's global competitiveness. There are three key considerations:

- Internal Efficiency
- Competitiveness
- Adjustment Costs

- ***Internal Efficiency***. In assessing internal efficiency, we are concerned with the extent to which feebates help compensate for market failures and their cost-effectiveness in doing so. Specifically, we are concerned with two types of market failure:

  - ***Undervaluation of Fuel Savings***. To the extent that consumers fail to value fuel savings correctly—this is supported by the market research in Canada, though the extent is unknown—feebates provide a means of correcting this tendency.[22] The optimal feebate for this market failure is the difference between the social valuation of the fuel savings and the consumer valuation. As discussed in Section 4, on this basis, a feebate of approximately $1000 would be appropriate. This calculation is particularly sensitive to the choice of discount rate, and so using a rate of 10 percent means that the undervaluation is conservatively estimated.

  - ***Externalities***. Feebates also provide an indirect means of giving value to GHG reductions. They can help internalize the costs of GHG emissions in decisions to purchase new vehicles, but not in decisions to drive and consume fuel directly. Thus, they help improve economic efficiency when GHG emissions are otherwise underpriced in the cost of fuel. As discussed above in the section on targeting, other options could address externalities more directly, including, for example, fuel taxes, a GHG charge and congestion pricing.

[22] See Table 2.3. According to research conducted by Marketing Canada Inc., fuel economy ranks 11th out of 21 factors.

- ***Cost-Effectiveness***. A calculation of cost-effectiveness needs to consider the change in consumer surplus, overall societal costs and any changes in opportunity costs. Assuming GHG reductions are the key objective, cost-effectiveness is the ratio of costs per tonne of emissions reduced.

  - ***Change in Consumer Surplus***. Feebates impose costs which rise as the rate increases
    - $7 million per year for $250
    - $60 million per year for $500
    - $300 million per year for $1000.

  - ***Overall Societal Costs***. The reduction in consumer surplus is more than compensated for by unvalued fuel savings that are realized. The benefits are positive for all rates up to $1000 but marginal costs begin to outweigh benefits between $500 and $1000. Adopting two or more classes reduces the benefits significantly while creating a relative subsidy for larger vehicles.

  - ***Costs per Tonne GHG Reductions***. Because of the unvalued fuel savings, feebates produce economic benefits as opposed to costs. These range from $40 per tonne for a $250 per litre per 100 km feebate, to $10 per tonne for a $1000 per litre per 100 km feebate. If it is assumed that consumers already fully value fuel savings, then there are no unvalued fuel savings and the costs are in the range of $10 per tonne.

  - ***Opportunity Costs***. By selectively targeting fuel economy, feebates impose opportunity costs. Consumers who might otherwise have chosen other features such as power, weight or options will have their choices reduced. This effect is not modeled and there is no way to estimate how significant these costs may be in this context.

- ***Competitiveness***. The key considerations are effects on exports and effects on investment:

  - ***Exports***. Feebates will only affect vehicle sales in Canada, so there should be no impact on exports.

  - ***Investment***. In theory, feebates should have no impact on the environment for manufacturing. However, as noted previously, an environment interpreted as hostile to the product could affect investment decisions.

- ***Adjustment Costs***. The key consideration will be the effect on vehicle sales and revenues, and how this will affect employment in the sector.

  - ***Vehicle Sales***. Overall vehicle sales are expected to decline slightly (at most 6000 or approximately 0.5 percent of annual sales for a $1000 feebate). Of greater importance is the shift to less expensive models, which overall would reduce revenues by approximately $1.5 billion per year. (Note: these results are very sensitive to elasticity assumptions.)

- ***Employment***. There are a number of factors that will affect employment.

  - Although net sales may only decrease slightly, the employment impacts could be greater if imports are substantially increased.
  - On the other hand, a large proportion of the North American adjustment may occur in the US.
  - Some losses will be offset by new employment associated with technology investments.
  - For illustrative purposes, using 15 jobs per 100 vehicles would imply a worst-case net loss of approximately 1000 jobs worldwide; this result may mask greater or lesser adjustments in Canada.
  - Given the overall economic benefit, the loss of jobs in this industry should be more than offset by job gains elsewhere in the economy.

- ***Fuel Sales***. In addition to a reduction in vehicle sales, there will also be a reduction in fuel sales that will affect refiners and their retail networks. The reduction in revenues would range from $300 million per year (for a $250 feebate) to $1.4 billion per year for a $1000 feebate (not including fuel taxes) and would involve associated employment changes. Once again, these losses should be more than offset by gains elsewhere in the economy.

5.4 FAIRNESS

Fairness refers to how the impacts of the proposal are distributed across sectors of the economy, or groups within sectors, as well as regions or groups within the population.

In this case we are concerned with the distribution of impacts for different groups within the automotive sector and individuals.

- ***Automotive Sector***. In terms of market share, the main impact is further loss in market share for GM/Ford/DCX. The shift increases as the rate increases, reaching 4 percent for a $1000 per litre per 100 km feebate. This shift can be significantly mitigated by segmenting the market into two classes. (Having 11 classes makes little additional difference.) As far as profitability is concerned, the assumption is that all costs and savings are passed on, and so profits are unchanged. However, since there will be a shift to smaller vehicles, and historically these vehicles have had lower profit margins, it is reasonable to conclude that profits will be adversely affected. As far as parts suppliers and retailers are concerned, they will be affected in proportion to their exposure to GM/Ford/DCX.

- ***Individuals***. For individuals, the key issue is price. The price of each individual vehicle will rise in order to pay for new technology. However, consumers are expected to shift to lower-priced models within classes and to lower priced classes overall, so average prices will decline. Certain consumers who are unable or unwilling to shift will bear a greater burden. For example, the estimated 50 percent of consumers who use trucks for commercial purposes may not be able to avoid the higher fees. Similarly, larger families may be restricted in shifting to smaller vehicles. Regions and areas that have a greater preference for larger vehicles (western Canada and rural areas, for example) will find that their traditional choices are more costly. Conversely, consumers who would have purchased fuel-efficient vehicles anyway will gain a windfall. Because lower income households tend to purchase smaller vehicles, the measure is progressive overall. (Feebates will eventually influence prices in the used car market as well as new cars.)

5.5 SIMPLICITY

Simplicity refers to how governments will administer the proposal and how affected individuals or parties will comply—and at what cost. While a detailed study of administration and transaction costs is beyond the scope of this report and not part of the modeling exercise, some findings are possible. The key issues are:

- Volume of Transactions
- Overall Complexity
- Administrative Cost and Practicality.

- ***Volume of Transactions***. As noted earlier, the size of the transfers will range from approximately $300 million per year to $1.1 billion per year, whereas the number of transactions will be equal to the number of new vehicle sales (1.5 million per year). The number of transactions could be reduced by adopting a deadband but the level of effort probably would not be substantially reduced, since there would still be an administrative procedure required to assert that the vehicle was not subject to a feebate.

- ***Overall Complexity***. Overall complexity is a function of the number of classes and the number of rules. A single class would clearly be the simplest approach, whereas 11 classes could be cumbersome to manage. Because definitions are unclear, anything more than one class creates the potential for gaming (artificially changing features to move vehicles into a different class). Similarly, the use of a cap, plateau or deadband would introduce added complexity and induce responses that would reduce the effectiveness of the measure.

- ***Administrative Cost and Practicality***. In terms of administrative practicality and costs, the measure could be similar to the GST in that retailers would need to collect the fees, pay the rebate, and submit the appropriate paperwork on a regular basis. Overall, given the experience of the GST, it would be anticipated that costs would be significant at first but would fall substantially after the initial implementation. Some of the considerations are as follows:
  - Because of year-round model introduction, feebates would probably need to be administered on a calendar-year basis.
  - It would be necessary to publish the rate and pivot point ahead of time and calculate the fees and rebates accordingly. This could be done through NRCan's Fuel Consumption Guide. (The timing of industry submissions and publication might need to be adjusted.)
  - Cash-flow impacts on retailers would need to be assessed and mitigated so there is no incentive to sell more inefficient vehicles in order to collect more fees.
  - The application of feebates leasing requires additional study, but should not present major impediments as the fee or rebate can be passed on by the leasing agent.

- The annual feebate option could be implemented through vehicle licensing but would require the participation of provinces and would be much more complex to administer.
- The application of feebates to alternative-fuel vehicles requires additional study but could be implemented via a GHG conversion factor.

6. CONCLUSIONS

As discussed in Section 4, the modeling results are subject to limitations and assumptions but some robust policy conclusions are possible.

- Feebates can be designed to be environmentally effective and economically efficient. Although other measures such as fuel taxes may be better targeted, feebates are a legitimate alternative should other measures not be feasible.
- The imposition of feebates may involve difficult adjustments for automobile manufacturers at a time when the industry is faced with the challenge of oversupply. GM, Ford and DCX will bear most of the burden.
- The measure is administratively feasible and can be designed to be fiscally neutral.
- There are significant uncertainties and risks that affect the magnitude of the benefits as well as the market shifts involved.

Assessment of the Options

- ***Environmental Effectiveness***. The higher the feebate rate, the greater the GHG reductions. However, it would be necessary to compare cost per tonne with other measures. Assuming $15 per tonne (and extrapolating from our highest scenario of $1000) a feebate of $1500–$2000 per litre per 100 km would be appropriate.
- ***Economic Efficiency***. The best choice would be the feebate option that produces the greatest marginal economic benefit to society. Based on current assumptions concerning valuation and elasticities, this would involve a rate of approximately $1000 per litre per 100 km.
- ***Fairness***. The best choice would be the feebate option that produces the least amount of shift between manufacturers and between classes. A feebate with separate classes for cars and trucks would mitigate most of the fairness concerns, but at the expense of economic efficiency, environmental effectiveness and simplicity.
- ***Fiscal Neutrality and Simplicity***. Apart from the two-class option, there are no significant differences between the options.

Overall, **a feebate of $1000 per litre per 100 km would appear to be most promising** since it delivers the greatest economic benefit, and avoids the large shifts in market share associated with higher rates. This option would produce GHG reductions of 3 Mt per year in 2010 rising to 6 Mt per year by 2018. (By comparison, the MOU target is 5.3 Mt per year in 2010.)

However, starting with a rate of $500 per litre per 100 km would be helpful in three ways:

- It would give greater weight to the fairness criterion, while still being reasonably environmentally effective and economically efficient.
- It would give firms time to adjust.

- It would contribute to a risk management strategy by providing the opportunity to: gather better information on factors such as elasticities and valuation; assess issues regarding the import of used cars, etc.; and, assess other implementation problems.
- Depending on the results, the rate could eventually be increased to the optimal level justified by the information gained.

Risks

The key risks that affect the assessment are as follows.

- ***Modeling has Important Limitations***. These limitations do not affect the main conclusions, which are based on broader evidence, but they do affect the magnitude of changes and the choice of the most promising option. In order to mitigate their effect, the study has used conservative assumptions and has involved sensitivity analysis. The key concerns are:

  - ***Poor Knowledge of Canadian Elasticities***. Elasticities have a very significant impact on the calculation of environmental benefits, economic benefits and adjustment costs. To the extent that they are underestimated, it means that the actual environmental and economic benefits would even greater, but so would the adjustment costs and impacts on manufacturers.

  - ***Poor Knowledge of Canadian Perceived Value of Fuel Savings***. The extent of unvalued fuel savings determines the economic benefit and affects the choice of optimal rate. While there is ample evidence of some level of undervaluation, there is very little information on the magnitude of it.

- ***Opportunity Costs for Consumers***. As discussed in Section 5, these costs have not been assessed (although they have been described in general terms).

- ***Imports of Used Vehicles from the U.S.*** As discussed in Section 5, there is little information on the extent of the potential problem, yet it has the potential to undermine the entire initiative. If consumers were to import US vehicles in large numbers, this would significantly reduce the environmental effectiveness of feebates and make it very difficult to achieve revenue neutrality.

- ***Adjustments for Manufacturers***. The reduction in net vehicle sales would probably be minimal but the reduction in overall revenues could be substantial (in the range of 4 percent). Most of the response should come in the form of economically justified investments in conventional fuel economy, hybrids and diesels, but there will be significant shifts in market share (2–4 percent). Given the fragile state of some manufacturers, this could be difficult.

As suggested above, a lower rate to begin (phase-in period) would help hedge against these risks and would provide an opportunity to gather real information on costs and benefits.

Interaction with the MOU on GHG Emissions

If the MOU and feebates were implemented simultaneously, many or most of the benefits of the feebate would be included in the reference case. In theory this could mean that the effects would be additive. However, the reaction of manufacturers is unknown and there is a risk that they would respond to a feebate by withdrawing from the MOU.

This suggests that feebates might best be considered as an alternative policy to the voluntary MOU, or as a subsequent policy following the expiration of the MOU.

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APPENDIX A

- **Finance Canada: Framework for Evaluation of Environmental Tax Proposals**

Annex 4

A Framework for Evaluation of Environmental Tax Proposals

Introduction

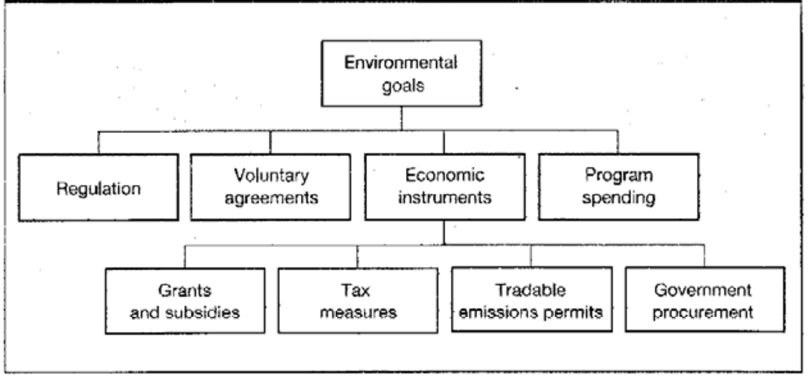
The Government of Canada strives to develop and implement policies that enhance productivity, competitiveness, growth and jobs while ensuring the sustainability of our resource base and the quality of our natural heritage. Strong, sustainable growth provides the resources to meet Canada's social needs, to foster innovation, and to enhance standards of living and quality of life for this and future generations. The pursuit of sustainable growth requires that economic and environmental considerations be integrated into all aspects of decision making. In the best of cases, this will ensure that economic and environmental goals are advanced together. In others, it will entail trade-offs among these goals, but with informed decision making and choices that reflect careful deliberation.

The integration of economic and environmental considerations is how Canada will best achieve reductions in greenhouse gas emissions in order to combat climate change. It is also how Canada will assure clean air and clean water, protect species at risk, and manage the Great Lakes.

A strategy for a productive, growing economy and a sustainable environment requires that the Government deploy the full range of available policy instruments to maximize its leverage. In the pursuit of environmental goals, this will include regulatory instruments whereby government sets the rules, and markets—producers and consumers—are asked to adapt accordingly. It will encompass voluntary agreements and public expenditure, such as investment in innovation. Importantly, it will also include "economic instruments"—such as targeted grants and subsidies, and tax measures—that are intended to leverage market forces and to induce efficient, environment-friendly market outcomes (see box below).

In Canada, and internationally, organizations have underscored the potential contribution of economic instruments for achieving environmental goals in an efficient manner. At home, the National Round Table on the Environment and the Economy (NRTEE) and the Green Budget Coalition, among others, have proposed wide-ranging policy changes under such themes as "green budgeting" or "ecological fiscal reform." Internationally, the Organisation for Economic Co-operation and Development (OECD) has commented that Canada could usefully enhance its reliance on economic instruments to achieve its environmental policy goals while maintaining sustained economic growth.

Instruments for Pursuit of Environmental Goals



Economic instruments, in turn, comprise a set of tools, one of which is the tax system. The basic role of the tax system is to generate revenue to fund public goods and services. Tax policy aims to ensure that this is achieved in a manner that is economically efficient, fair, and as simple as possible for compliance and administration. In some circumstances, the tax system may also be used to pursue other government policy objectives. Because of its breadth and reach, the tax system may impact a wide range of economic decisions. Accordingly, it has the potential to make an important contribution to the Government's sustainable growth agenda.

The use of the tax system to advance environmental goals—or any other objective of public policy—must be judicious. For any particular goal, use of the tax system must be assessed relative to other instruments of policy, including other economic instruments such as subsidies or emissions trading systems. Principles of sound public policy require that the Government identify the set of instruments, including taxation, that will make the best contribution to its environmental goals, at the lowest cost (or with the greatest net benefit) for government and the economy, and in the fairest and simplest manner. Initiatives must also be pursued within the context of a commitment to balanced budgets and sound fiscal management.

The Government of Canada has put in place a range of economic instruments, including tax measures, that play an important role in advancing sustainable growth. This budget proposes several such measures, including a Clean Fund, expansion of the Wind Power Production Incentive and EnerGuide for Houses Retrofit Incentive programs, as well as the acceleration of capital cost allowances for a broadened range of efficient and renewable energy generation equipment. The Government intends to go further, and will do so in successive budgets.

This annex sets out the context and criteria that may guide the analytical evaluation of options to use the tax system to pursue environmental goals. As a framework, it is intended to contribute to the public policy debate and to facilitate dialogue with other levels of government, organizations and individuals who are concerned with the integration of economic and environmental factors in policy making and the pursuit of sustainable growth.

Market Forces, Market Failures, and the Case for Government Intervention

Under perfect conditions, market forces ensure that producers and consumers of goods and services integrate all costs and benefits of production and consumption into their decision making. Market prices are then established at levels that reflect all of these costs and benefits, and no government intervention is required to achieve an efficient allocation of resources in the economy.

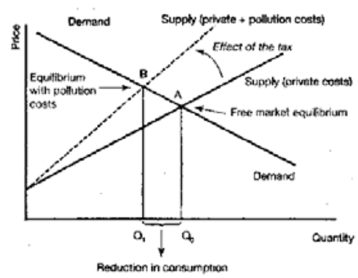
In practice, perfect market conditions do not always hold. In some cases, the supplier does not bear all of the costs of production: other costs, called "negative externalities," are borne by other parts of society. Market prices then understate actual costs, and production and consumption levels are too high from the perspective of society. In other cases, producers or consumers may not capture all of the benefits of certain goods or services and "positive externalities" may accrue to other producers or consumers, or to future generations. Market prices are then above socially optimal levels, and production or consumption levels correspondingly are too low.

The presence of externalities, or other "market failures" such as lack of information in the hands of decision makers, generally underpins the case for government intervention. Under certain conditions, government may be able to correct for such market failures by implementing financial incentives or disincentives that establish improved price signals. Supply and demand may then respond in a manner that satisfies both private and broader public interests. If well designed, the intervention leverages the capacity of the marketplace to adjust, to innovate, and to minimize the cost of achieving defined public policy goals (see box below).

Environmental Costs, Market Prices and Taxes

When markets are functioning properly, prices are a reliable guide to the cost of producing goods and services. This allows society to make the best use of its resources. But when producing or consuming a good imposes environmental costs not faced by producers or consumers individually, these additional costs are not factored into market prices. As a result, market prices for certain goods are too low, and more of these goods are produced or consumed than would be the case if decision makers took into account the environmental costs that have to be borne by society at large.

For illustrative purposes, the case of an industrial process that causes pollution (e.g. release of toxic substances) is depicted, in simplified form, in the adjacent chart. If firms decide how much to supply (based on demand and the cost of labour, materials and capital) and do not consider environmental costs that they do not have to bear, the free market equilibrium (A) is not optimal. Assuming each unit of production creates the same amount of pollution, the supply curve that would apply if the producer had to bear the environmental costs is an upward rotation of the market supply curve, indicating a lower level of production at all prices.



One approach to improving the market outcome is to impose a tax on production. If the Government sets the tax at the right level, the new equilibrium will occur at a point (B), where prices reflect the private costs of production as well as the environmental costs. The quantity produced and consumed is then reduced from Q_0 to Q_1. Resources (labour and capital) not used may then be deployed more efficiently to other uses.

Whether such an illustrative example may be applied in practice depends, case-by-case, on a broader range of factors such as those set out in the framework described in this annex.

Economic instruments encompass a range of tools that have been used in specific circumstances, both in Canada and internationally, to advance environmental goals. Some of these tools are broad-based, affecting transactions across a range of products, technologies, or sectors of the economy. Others are more targeted. In addition to the tax system, the tools include tradable permits, grants and subsidies, and government procurement policy (see box below).

Economic Instruments for the Pursuit of Environmental Goals—Examples

Tax measures can be structured as either incentives or disincentives to induce a change of behaviour on the part of producers or consumers in favour of more environment-friendly goods, services, or activities. Federal environmental tax measures implemented in recent years include accelerated capital cost allowance for energy efficient and renewable energy generation equipment (Class 43.1), which is enhanced in Budget 2005, excise tax relief for alternative fuels, and a reduced inclusion rate on capital gains for donations of ecologically sensitive land.

A system of **tradable permits** may be used to limit the amount of pollution emitted by firms. After an initial allocation, these permits can be purchased and sold by firms. Firms with relatively low pollution abatement costs have an incentive to reduce their emissions and sell excess permits to firms that have higher abatement costs. As a result, only the most efficient methods of abatement are used, minimizing the cost of achieving the mandated reduction. In January 2005, the European Union Greenhouse Gas Emission Trading Scheme (EU ETS) commenced operation as the largest multi-country, multi-sector greenhouse gas emission trading scheme, worldwide.

Grants and subsidies are payments designed to encourage the recipients to undertake specific environment-friendly activities. For example, Natural Resources Canada, through its EnerGuide for Houses Retrofit Incentive program, provides grants to Canadian homeowners who make retrofit improvements that increase the energy efficiency of their homes. The grants lower the cost of the retrofit and stimulate market demand for home insulation production and services. This program is expanded in Budget 2005.

Procurement policies, such as the Government's "Green Procurement" initiative, involve the practice of acquiring goods and services that minimize the use of natural resources, the use and production of toxic materials, and/or emissions of greenhouse gas and other air pollutants. The Federal House in Order (FHIO) initiative is the federal government's plan for reducing greenhouse gas emissions (GHGs) within its own operations. Through this initiative, the 11 departments and agencies that account for 95 per cent of the Government's GHG emissions have agreed to meet collectively a target of reducing greenhouse gases within their operations by 31 per cent, from 1990 levels, by 2010.

Against this background, the use of the tax system covers two key types of interventions:

- The imposition of specific taxes to ensure that environmental costs—the negative externalities—are factored into the price of goods produced and consumed, consistent with the "polluter-pays principle" (see box below). This may be advocated, for example to discourage the production and use of toxic substances that need not be banned altogether.
- The implementation of tax incentives to "price-in" positive externalities and to encourage the adoption by producers or consumers of more environment-friendly technology, goods or services.

What is the Polluter-Pays Principle?

The "Polluter-Pays Principle" is a concept that addresses the allocation of the costs of pollution prevention, control and remediation measures in a manner that encourages a rational use of scarce environmental resources. As a policy principle, it means that the polluter should bear the costs of activities that directly or indirectly damage the environment. This cost, in turn, is then factored into market prices.

There are limits to the judicious use of the tax system to advance economic growth and a sustainable environment. It is not sufficient that a market failure be identified. In some cases, there may not be a specific measure that could be implemented effectively to correct for the market failure. Further, government intervention has its costs. It may give rise to unintended and/or undesirable consequences. It may generate other economic distortions, or be unfair to certain producers or consumers.

It is important that all such considerations be factored into the analysis of environmental tax proposals. Where a clear goal is established, proposed tax measures must be assessed against a set of criteria that must also guide the evaluation of alternative forms of intervention—including regulation, spending, and other economic instruments.

Evaluating Environmental Tax Proposals

The basic role of the tax system is to raise revenue to fund government expenditures and to do so in a manner that is economically efficient, fair, and as simple as possible for compliance by taxpayers and administration by the government. The management of the tax system entails not only establishing the overall level of taxation in the economy, but also the structure of the tax system. This includes, for example, addressing how tax bases are defined, and how the tax burden will be shared among taxpayers.

Proposals for new environmental taxes may be assessed on a case-by-case basis, taking into account the following criteria.

Environmental effectiveness: whether, and to what extent, the proposal will contribute to achieving the environmental goal.

Fiscal impact: how the proposal will affect government expenditures or revenues.

Economic efficiency: how the proposal will affect the allocation of resources in the economy and Canada's global competitiveness.

Fairness: how the impacts of the proposal are distributed across sectors of the economy, regions or groups within the population.

Simplicity: how governments will administer the proposal and how affected individuals or parties will comply—and at what cost.

Of course, there may be trade-offs among these different criteria that will require a decision, by government, on the relative weight to be applied to each criterion in making choices and establishing priorities.

Environmental Effectiveness

As a general proposition, an environmental tax measure will be effective if it induces a change in producer or consumer behaviour that achieves the environmental goal. This presupposes that two key conditions can be met.

- The environmental tax measure can be targeted effectively.
- It is likely to alter consumer or producer behaviour and generate an improved environmental outcome.

Effective Targeting

Effective targeting means that the measure can be designed to affect the transactions in the marketplace—and then, to the extent possible, only those transactions—that are germane to the pursuit of the environmental goal.

For a tax measure, this requires that clear and objective parameters can be established in law to ensure that the tax incentive or disincentive will apply where it is most likely to make a difference.

In this regard, the tax system has some limitations. First, key parts of the tax system impact various segments of the marketplace differently. Specifically, income tax measures such as deductions or credits will generally affect only individuals or corporations that are, or may become, taxable. They will not affect entities like governments, Crown corporations, or non-profit organizations that do not pay income taxes. Similarly, corporations that do not have taxable income will tend to discount deductions or credits that have no immediate impact on their tax liability. Correspondingly, income tax measures may have a different value for different firms. This is in contrast to grants or subsidies that may be paid equally to all recipients. For example, whereas the Wind Production Power Incentive may be paid in the same amount to all producers, the value of accelerated capital cost allowance for the related capital investment will depend on whether the producer is in a taxable position today, or likely to be in the future. In contrast to income tax measures, excise tax measures (e.g. fuel excise tax relief for renewable fuels) may apply more evenly across market segments.

Second, the tax system is a relatively blunt instrument. The conditions of application of a tax measure are set in law, taxpayers are required to comply, and the Canada Revenue Agency administers the measure on that basis. As a general proposition, tax measures are not easily targeted to a very narrow segment of the market, or made to adapt to diverse circumstances or conditions. An expenditure program may be designed and administered in a manner that allows more discretionary application and narrow targeting to achieve a specific goal.

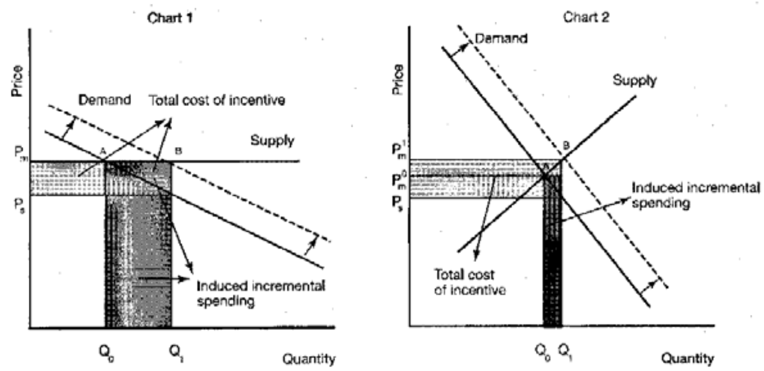
Consumer and Producer Responsiveness to Tax Measures

The effectiveness of an environmental tax measure depends on the sensitivity of demand and supply to changes in prices (see box for an illustration of this concept).

If a tax incentive is applied to a product for which demand is relatively insensitive to price changes, it will create "windfall" effects: the environmental benefit will be small and most of the fiscal cost will represent a transfer from taxpayers to purchasers of the subsidized product. In other words, a proposed tax measure that does not alter measurably the behaviour of producers or consumers will not be effective. An effective measure is one that will not simply reward good behaviour—although that may be considered appropriate in its own right—but one that will also induce a positive change in consumer or producer behaviour.

Financial Incentives, Price Responsiveness and Environmental Effectiveness

The ability of a financial incentive, as may be provided by a tax measure, to affect consumer or business spending depends on the sensitivity of both demand and supply to changes in prices. For example, if consumer spending on home insulation is relatively sensitive to prices *and* there are no substantial supply constraints, a financial incentive can generate an increase in consumer spending on home insulation that will justify the fiscal cost. This situation is shown in Chart 1.



Initially the market is at the point A, with a price P_m and a quantity Q_0. A financial incentive is introduced that increases demand from Q_0 to Q_1 at the market price, P_m, since the net price to consumers, P_s, is reduced. This is illustrated by the rightward shift of the demand curve, which moves the market equilibrium point from A to B. The rise in spending depends only on the sensitivity of demand to price since additional supply is assumed to be available at prevailing prices. The fiscal cost of the incentive is determined by the total quantity consumed (Q_1) multiplied by the subsidy rate (P_m- P_s). That is, all purchasers of home insulation benefit from the incentive, including those who would have made a purchase without it.

If demand is less sensitive to price, or if the market price rises along with demand due to supply constraints, incentives become less effective. In particular, if market supply is highly constrained, producers will absorb most of the benefits of the incentive through higher prices, with only a small change in the quantity consumed. This situation is illustrated in Chart 2, which shows the market price rising from P_m^0 to P_m^1 along with a small change in demand from Q_0 to Q_1.

The prospective effectiveness of the subsidy, as determined by the sensitivity of both demand and supply to price, is an important consideration in evaluating a proposed incentive. Comparing the cost of the subsidy to the induced change in spending gives a preliminary indication of cost-effectiveness. Everything else being equal, the greater the "leverage" of an incentive (i.e. the increase in spending relative to the fiscal cost) the greater will be its cost-effectiveness. In Chart 1, the increase in spending exceeds the cost of the incentive, while the opposite situation is depicted in Chart 2.

Fiscal Impact

Environmental tax measures will generally have an impact on tax revenues and the Government's overall fiscal framework. For this reason, they must be assessed in the broader context of a commitment to balanced budgets, sound fiscal management and an efficient tax system.

Tax Incentives

A tax incentive represents foregone government revenue. In other words, it imposes a cost that, in a balanced budget context, must be offset by higher taxes, or reduced spending, elsewhere. The cost of a tax incentive may be difficult to estimate precisely because it depends on the degree of taxpayer take-up. This is in contrast to an expenditure program to which a defined amount of money may be allocated.

In comparing and ranking alternative proposals, it may be useful to evaluate the projected fiscal cost against the expected environmental benefits. For example, measures may be ranked by how many tonnes of greenhouse gas emissions reductions they produce per dollar of foregone tax revenue. Such comparisons may be carried out across tax and non-tax measures to help identify the most cost-effective environmental policy measures.

Tax Disincentives

A tax disincentive may, alternatively, raise additional government revenue. This revenue will generally be deposited in the Government's Consolidated Revenue Fund and be used to reduce other taxes, or to fund public spending.

Tax measures can be revenue neutral if they are structured in such a manner as to raise the level of tax paid by some taxpayers, while at the same time lowering the level of tax paid by others. Such an approach could be developed in respect of a set of measures that collectively would contribute to advancing environmental objectives while being neutral from a fiscal standpoint. While the result in terms of the total level of taxation could be neutral, it could be positive in terms of both environmental and economic efficiency outcomes (see "Economic Efficiency" below).

In some instances, there may be a case for directing some of the revenues of an environmental tax to a specific use—a concept generally referred to as "revenue earmarking." The rationale often cited by proponents of this approach is that the willingness of taxpayers to pay will be higher if there is a direct and transparent link between the incidence of the tax and the subsequent use of its proceeds (e.g. a tire tax to fund tire disposal costs).

From the Government's perspective, however, in some circumstances earmarking may reduce fiscal flexibility and result in some programs being over-funded, and other priorities being under-funded.

Other Considerations

Some proposed environmental tax measures—i.e. measures that affect the income tax base or the goods and services tax (GST) base—could have financial implications for provinces that share the same tax bases under agreements with the federal government.

In all cases, because of their fiscal dimension, proposals for federal environmental tax measures will generally be assessed in the broader context of developing fiscal priorities for the annual budget.

Economic Efficiency

Aside from the fiscal cost or revenue, economic costs or benefits of a tax measure must also be assessed and related to environmental benefits. There are three key considerations: internal efficiency, competitiveness, and adjustment costs.

Internal Efficiency

A key thrust of a policy to integrate environmental and economic factors into decision making is to identify environmental solutions that also contribute to improved economic performance. Where market failures can be identified, a well-targeted tax measure may provide improved price signals, contribute to a more productive use of resources, stimulate technological innovation, and hence improve the efficiency of the economy. Careful analysis is required to assess the market failure and to determine whether a tax measure can properly deliver the intended adjustment to prices. This will inform how the tax measure may affect the allocation of resources in the economy and productivity. The benefits of correcting an environmental market failure, however, may not always be captured in economic performance, as conventionally measured. In these instances, the loss in measured economic output must be compared to the benefits of a better environment, evaluated more subjectively.

An important, related consideration is how environmental tax measures may affect the structure of the tax system. Within a revenue-neutral framework, tax incentives would be offset by higher taxes elsewhere. Conversely, environmental taxes that generate revenue would allow reductions in other taxes. Analysis shows that different taxes impose different costs on the economy.[1] For example, taxes on consumption tend to impose lower economic costs than taxes on investment or saving. Correspondingly, environmental tax measures may generate added benefits or costs depending on whether their effect is to improve, or to lessen, the overall efficiency of the tax system.

Competitiveness

Consideration must also be given to the impact—positive or negative—of a proposed measure on international competitiveness. This will include assessing the effect on both the overall level of taxation and the incidence of taxes on those sectors of the economy engaged in competition, at home or abroad.

Adjustment Costs

By changing the behaviour of economic agents, tax measures will cause adjustments in the marketplace that may entail some costs. For example, tax measures that would reduce demand for a particular good will affect the producers of that good. The producers may respond by investing in new technology, or alternatively, by lowering production or shutting down their facilities. It is important that such scenarios be reviewed and that corresponding economic or social costs be identified.

Fairness

The fairness of a proposed tax measure relates to the distribution of the burden of the tax, or of the benefit of the tax incentive.

Generally speaking, it is considered fair that polluters pay a tax, and that firms and consumers willing to adopt environment-friendly behaviour benefit from a tax incentive. Nonetheless, the application of tax measures may, in some circumstances, be perceived to affect or benefit disproportionately particular individuals, regions, or sectors of the economy. The assessment of distributional impacts is an important part of the evaluation that poses particular difficulties as it may bring trade-offs into play.

[1] "Taxation and Economic Efficiency: Results From a General Equilibrium Model," *Tax Expenditures and Evaluations*, Department of Finance, 2004.

Simplicity

Tax measures will work best if they are relatively simple and can be easily understood by affected taxpayers.

Compared with spending programs or regulation, tax measures will tend to work best where the intention is to leave more of the decision making and responsiveness in the hands of producers and consumers. Through the use of a tax measure, the Government affects a price or another economic parameter, and it lets economic agents respond accordingly. In the best of cases, this minimizes bureaucratic involvement and promotes flexible, cost-effective responses by taxpayers.

However, if the targeting of the measure or its adjustment over time requires a complex set of rules, this benefit may be lost and the tax system—its design, administration and compliance—may become unwieldy. Costs for the Government to administer and monitor, and taxpayers to comply with a measure, may become prohibitive.

Summary

The pursuit of a productive, growing and sustainable economy requires that both environmental and economic considerations be integrated into decision making.

In this context, the case for government intervention in pursuit of environmental goals is founded in large measure on the need and opportunity to correct market failures. Where market failures exist, well-designed government intervention can foster a more rational use of resources and enhance both environmental and economic outcomes.

The Government has a range of policy instruments at its disposal. Important among these are economic instruments—including tax measures—that aim to leverage the capacity of the marketplace to respond to price signals, to innovate, and to contribute to the achievement of policy goals at the lowest cost.

Environmental tax proposals may be evaluated against five criteria: environmental effectiveness, fiscal impact, economic efficiency, fairness, and simplicity. With the benefit of a detailed evaluation, a tax measure may be shown, in some circumstances, to be the most appropriate policy instrument for addressing an environmental problem. In others, it may not be the instrument of choice.

For any environmental goal, it is important that consideration be given to all of the available policy instruments and that solutions be identified that produce the best results for the environment, at the lowest cost for taxpayers and the economy, and in the fairest and simplest manner. Sound fiscal management and the pursuit of an efficient tax structure will require that consideration be given to both tax incentives and tax disincentives.

Opportunities to use the tax system to advance environmental goals will continue to be actively considered. For this purpose, it will be necessary to engage stakeholders, non-governmental organizations and interested Canadians on the best means to promote sustainable growth. The framework set out in this annex is intended to facilitate this dialogue and to foster a shared understanding of policy considerations that may be taken into account as proposals are developed, assessed and implemented.

APPENDIX B

- **Scenario Results**

Base Case

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Environmental Effectiveness																
Avg. fuel economy of new vehicles	9.0	8.8	8.6	8.5	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.2771
Change in overall GHG emissions (MT)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Change in overall fuel use (million litres of gasoline)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fiscal Impact																
Total rebate and total fees ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Change in fuel tax revenue to government ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Economic Efficiency																
Change in Consumer Surplus ($millions)	$0.00	$91.85	$176.77	$208.99	$291.75	$320.90	$320.90	$320.90	$320.90	$320.90	$321.02	$321.02	$321.02	$321.02	$321.02	$321.02
Change in Total Fuel Cost (net of fuel tax) ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Overall societal costs	$0	$92	$177	$209	$292	$321	$321	$321	$321	$321	$321	$321	$321	$321	$321	$321
Cost per tonne of GHG reduction																
Fairness																
Change in Total Sales (numbers of vehicles)	0	1,971	3,788	4,476	6,241	6,862	6,862	6,862	6,862	6,862	6,865	6,865	6,865	6,865	6,865	6,865
Change in Revenue ($ billions)	$0.00	$0.14	$0.25	$0.30	$0.36	$0.44	$0.44	$0.44	$0.44	$0.44	$0.44	$0.44	$0.44	$0.44	$0.44	$0.44
Big Three	$0.00	$0.16	$0.25	$0.23	$0.32	$0.37	$0.37	$0.37	$0.37	$0.37	$0.37	$0.37	$0.37	$0.37	$0.37	$0.37
Others	$0.00	-$0.02	$0.00	$0.06	$0.04	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07
Total Market Share																
Big Three	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62.4%
Others	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%
Total Market Share																
Cars	57%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%
Trucks	43%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%
Average price of new vehicles	$27,929	$27,987	$28,029	$28,045	$28,054	$28,093	$28,093	$28,093	$28,093	$28,093	$28,094	$28,094	$28,094	$28,094	$28,094	$28,094

Scenario 2

$250 Feebate, One Pivot Point, Revenue Neutral

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Environmental Effectiveness																	
Avg. fuel economy of new vehicles	9.0	8.6	8.4	8.4	8.2	8.2	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.0857	
Change in overall GHG emissions (MT)	(0.04)	(0.07)	(0.35)	(0.38)	(0.56)	(0.56)	(0.60)	(0.69)	(0.88)	(1.01)	(1.07)	(1.20)	(1.31)	(1.39)	(1.42)	(1.49)	(13.02)
Change in overall fuel use (million litres of gasoline)	0	(56)	(112)	(157)	(193)	(224)	(263)	(310)	(359)	(409)	(450)	(489)	(524)	(554)	(583)	(607)	
Fiscal Impact																	
Total rebate and total fees ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Change in fuel tax revenue to government ($millions)	$0	-$20	-$39	-$55	-$68	-$79	-$92	-$109	-$126	-$144	-$158	-$172	-$184	-$194	-$205	-$213	
Economic Efficiency																	
Change in Consumer Surplus ($millions)	$0.00	$73.12	$157.54	$189.91	$272.76	$303.09	$307.29	$308.92	$311.93	$313.02	$314.11	$314.11	$314.11	$314.11	$314.11	$314.11	$1,904
Incr. Change in Consumer Surplus ($millions)	$0.00	-$18.73	-$19.23	-$19.07	-$19.00	-$17.81	-$13.61	-$11.98	-$8.97	-$7.88	-$6.91	-$6.91	-$6.91	-$6.91	-$6.91	-$6.91	-$105
Change in Total Fuel Cost (net of fuel tax) ($millions)	$0	$17	$34	$47	$58	$68	$79	$93	$108	$123	$136	$148	$158	$167	$176	$183	$649
Overall societal costs	$0	-$2	$14	$28	$39	$50	$66	$82	$99	$115	$129	$141	$151	$160	$169	$176	$544
Cost per tonne of GHG reduction (Discounted to 2003)																	-$42
Fairness																	
Change Total Sales (numbers of vehicles)	0	1,569	3,377	4,069	5,837	6,483	6,572	6,607	6,671	6,694	6,718	6,718	6,718	6,718	6,718	6,718	
Incr. Change in Sales	0	-401	-411	-407	-405	-379	-290	-255	-191	-168	-147	-147	-147	-147	-147	-147	
Change in Revenue ($ billions)	$0.00	-$0.51	-$0.40	-$0.35	-$0.33	-$0.23	-$0.21	-$0.19	-$0.20	-$0.19	-$0.19	-$0.19	-$0.19	-$0.19	-$0.19	-$0.19	
Big Three	$0.00	-$0.67	-$0.57	-$0.61	-$0.52	-$0.47	-$0.45	-$0.43	-$0.43	-$0.43	-$0.42	-$0.42	-$0.42	-$0.42	-$0.42	-$0.42	
Others	$0.00	$0.16	$0.17	$0.25	$0.19	$0.24	$0.23	$0.23	$0.24	$0.24	$0.24	$0.24	$0.24	$0.24	$0.24	$0.24	
Total Market Share																	
Big Three	62%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61.2%	
Others	38%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	
Total Market Share																	
Cars	57%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	
Trucks	43%	42%	42%	42%	42%	42%	42%	42%	42%	42%	42%	42%	42%	42%	42%	42%	
Average price of new vehicles	$27,929	$27,554	$27,596	$27,614	$27,598	$27,651	$27,663	$27,674	$27,672	$27,674	$27,678	$27,678	$27,678	$27,678	$27,678	$27,678	
Transfers																	
Rebates (millions)	-	- 299.09	- 292.47	- 290.26	- 294.18	- 284.70	- 286.70	- 288.23	- 290.34	- 289.81	- 289.26	- 289.26	- 289.26	- 289.26	- 289.26	- 289.26	
Fees (millions)	-	299.09	292.47	290.26	294.19	284.70	286.69	288.22	290.33	289.81	289.26	289.26	289.26	289.26	289.26	289.26	

Scenario 3

500 Feebate, One Pivot Point, Revenue Neutral

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Environmental Effectiveness																	
Avg. fuel economy of new vehicles	9.0	8.5	8.3	8.3	8.1	8.1	8.0	8.0	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8972	
cars	7.6	7.3	7.2	7.1	7.0	6.9	6.9	6.9	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8051	
Trucks	10.7	10.3	10.0	9.9	9.8	9.7	9.6	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.4876	
Change in overall GHG emissions (MT)	(0.0)	(0.2)	(0.6)	(0.8)	(1.0)	(1.1)	(1.3)	(1.5)	(1.8)	(2.0)	(2.2)	(2.4)	(2.6)	(2.8)	(2.9)	(3.0077)	(26.17)
Change in overall fuel use (million litres of gasoline)	0.0	(111.4)	(223.5)	(314.9)	(387.5)	(450.5)	(529.3)	(623.6)	(724.6)	(825.3)	(908.9)	(988.0)	(1,058.5)	(1,119.2)	(1,179.1)	(1,227.9765)	
Fiscal Impact																	
Total rebate and total fees ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Change in fuel tax revenue to government ($millions)	$0	-$39	-$78	-$111	-$136	-$158	-$186	-$219	-$254	-$290	-$319	-$347	-$372	-$393	-$414	-$431	
Economic Efficiency																	
Change in Consumer Surplus ($millions)	$0.00	$18.36	$101.57	$134.60	$217.66	$251.23	$255.10	$255.32	$258.02	$260.23	$262.40	$262.40	$262.40	$262.40	$262.40	$262.40	$1,497
Incr. Change in Consumer Surplus ($millions)	$0.00	-$73.48	-$75.20	-$74.38	-$74.10	-$69.67	-$65.80	-$65.58	-$62.88	-$60.66	-$58.62	-$58.62	-$58.62	-$58.62	-$58.62	-$58.62	-$513
Change in Total Fuel Cost (net of fuel tax) ($millions)	$0	$34	$67	$95	$117	$136	$160	$188	$218	$249	$274	$298	$319	$337	$356	$370	$1,307
Overall societal costs	$0	-$40	-$8	$21	$43	$66	$94	$122	$156	$188	$215	$239	$261	$279	$297	$312	$795
Cost per tonne of GHG reduction (Discounted to 2003))																	-$30
Fairness																	
Change Total Sales (numbers of vehicles)	0	394	2,179	2,886	4,661	5,378	5,460	5,465	5,522	5,570	5,616	5,616	5,616	5,616	5,616	5,616	
Incr. Change in Sales	0	-1,576	-1,609	-1,590	-1,580	-1,484	-1,402	-1,397	-1,340	-1,292	-1,249	-1,249	-1,249	-1,249	-1,249	-1,249	
Change in Revenue ($ billions)	$0.00	-$1.16	-$1.05	-$1.00	-$1.01	-$0.89	-$0.86	-$0.82	-$0.84	-$0.83	-$0.82	-$0.82	-$0.82	-$0.82	-$0.82	-$0.82	
Big Three	$0.00	-$1.50	-$1.39	-$1.44	-$1.36	-$1.30	-$1.25	-$1.21	-$1.24	-$1.22	-$1.21	-$1.21	-$1.21	-$1.21	-$1.21	-$1.21	
Others	$0.00	$0.34	$0.34	$0.45	$0.35	$0.41	$0.40	$0.39	$0.40	$0.39	$0.40	$0.40	$0.40	$0.40	$0.40	$0.40	
Total Market Share																	
Big Three	62%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60.0%	
Others	38%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
Total Market Share																	
Cars	57%	60%	60%	60%	60%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	
Trucks	43%	40%	40%	40%	40%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	
Average price of new vehicles	$27,929	$27,138	$27,181	$27,202	$27,160	$27,227	$27,251	$27,275	$27,261	$27,267	$27,274	$27,274	$27,274	$27,274	$27,274	$27,274	
cars	24522.29	23753.34	23784.39	23815.59	23698.18	23737.3	23762.14	23772.97	23756.41	23756.79	23761.1	23761.1	23761.103	23761.103	23761.103	23761.103	
Trucks	32358.49	32179.49	32171.14	32176.78	32254.08	32313.29	32339.86	32370.35	32373.49	32381.83	32389.38	32389.38	32389.3843	32389.3843	32389.3843	32389.38433	
Transfers																	
Rebates (millions)	-	- 587.28	- 570.37	- 564.37	- 573.79	- 556.56	- 565.01	- 570.47	- 579.65	- 577.93	- 576.16	- 576.16	- 576.16	- 576.16	- 576.16	- 576.16	
Fees (millions)	-	587.28	570.38	564.37	573.79	556.56	565.00	570.47	579.66	577.94	576.16	576.16	576.16	576.16	576.16	576.16	

Scenario 4

$1000 Feebate, One Pivot Point, Revenue Neutral

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
Environmental Effectiveness																	
Avg. fuel economy of new vehicles	9.0	8.3	8.1	8.0	7.9	7.8	7.7	7.6	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5269	
Change in overall GHG emissions (MT)	(0.04)	(0.48)	(1.18)	(1.54)	(1.99)	(2.22)	(2.57)	(3.02)	(3.59)	(4.11)	(4.49)	(4.92)	(5.31)	(5.63)	(5.88)	(6.15)	(53.12)
Change in overall fuel use (million litres of gasoline)	0	(224)	(449)	(632)	(778)	(905)	(1,069)	(1,260)	(1,471)	(1,679)	(1,852)	(2,014)	(2,161)	(2,287)	(2,411)	(2,512)	
Fiscal Impact																	
Total rebate and total fees ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Change in fuel tax revenue to government ($millions)	$0	-$79	-$158	-$222	-$273	-$318	-$375	-$442	-$516	-$589	-$650	-$707	-$758	-$803	-$846	-$882	
Economic Efficiency																	
Change in Consumer Surplus ($millions)	$0.00	-$190.45	-$110.19	-$73.45	$10.38	$54.70	$38.57	$28.82	$14.72	$19.90	$25.10	$25.10	$25.10	$25.10	$25.10	$25.10	-$180.09
Incr. Change in Consumer Surplus ($millions)	$0.00	-$282.30	-$286.95	-$282.44	-$281.38	-$266.19	-$282.32	-$292.08	-$306.18	-$300.99	-$295.91	-$295.91	-$295.91	-$295.91	-$295.91	-$295.91	-$2,189.76
Change in Total Fuel Cost (net of fuel tax) ($millions)	$0	$67	$135	$191	$234	$273	$322	$380	$443	$506	$558	$607	$652	$690	$727	$757	$2,652.57
Overall societal costs	$0	-$215	-$152	-$92	-$47	$7	$40	$88	$137	$205	$262	$311	$356	$394	$431	$462	$462.82
Cost per tonne of GHG reduction (discounted to 2003)																	-$9
Fairness																	
Change Total Sales (numbers of vehicles)	0	-4,103	-2,371	-1,580	223	1,174	828	619	316	427	539	539	539	539	539	539	
Incr. Change in Total Sales	0	-6,073	-6,159	-6,056	-6,019	-5,688	-6,034	-6,243	-6,546	-6,435	-6,325	-6,325	-6,325	-6,325	-6,325	-6,325	
Change in Revenue ($ billions)	$0.00	-$2.44	-$2.33	-$2.26	-$2.35	-$2.20	-$2.13	-$2.05	-$2.15	-$2.12	-$2.10	-$2.10	-$2.10	-$2.10	-$2.10	-$2.10	
Big Three	$0.00	-$3.15	-$3.02	-$3.09	-$3.02	-$2.96	-$2.84	-$2.73	-$2.83	-$2.81	-$2.80	-$2.80	-$2.80	-$2.80	-$2.80	-$2.80	
Others	$0.00	$0.71	$0.70	$0.83	$0.67	$0.76	$0.71	$0.68	$0.69	$0.68	$0.70	$0.70	$0.70	$0.70	$0.70	$0.70	
Total Market Share																	
Big Three	62%	57%	57%	57%	57%	57%	58%	58%	58%	58%	58%	58%	58%	58%	58%	57.6%	
Others	38%	43%	43%	43%	43%	43%	42%	42%	42%	42%	42%	42%	42%	42%	42%	42%	
Total Market Share																	
Cars	57%	63%	63%	63%	63%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	
Trucks	43%	37%	37%	37%	37%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	
Average price of new vehicles	$27,929	$26,352	$26,399	$26,429	$26,336	$26,423	$26,477	$26,534	$26,472	$26,486	$26,501	$26,501	$26,501	$26,501	$26,501	$26,501	
Transfers																	
Rebates (millions)	0	-1128.561	-1082.628	-1063.481	-1093.836	-1069.127	-1113.216	-1114.561	-1153.438	-1148.862	-1143.236	-1143.236	-1143.236	-1143.236	-1143.236	-1143.236	
Fees (millions)	0	1128.5934	1082.6037	1063.4686	1093.8205	1069.0983	1113.1891	1114.5472	1153.3665	1148.7938	1143.1829	1143.1829	1143.1829	1143.1829	1143.1829	1143.1829	

Scenario 5

North American 500 Feebate, One Pivot Point, Revenue Neutral

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Environmental Effectiveness																	
Avg. fuel economy of new vehicles	9.0	8.5	8.3	8.3	8.1	8.1	7.8	7.7	7.5	7.4	7.4	7.4	7.4	7.4	7.4	7.3996	
Change in overall GHG emissions (MT)	(0.04)	(0.20)	(0.63)	(0.76)	(1.04)	(1.11)	(1.41)	(1.87)	(2.51)	(3.13)	(3.65)	(4.22)	(4.73)	(5.18)	(5.56)	(5.95)	(41.99)
Change in overall fuel use (million litres of gasoline)	0	(111)	(223)	(315)	(387)	(450)	(594)	(792)	(1,029)	(1,275)	(1,507)	(1,724)	(1,923)	(2,104)	(2,280)	(2,433)	
Fiscal Impact																	
Total rebate and total fees ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Change in fuel tax revenue to government ($millions)	$0	-$39	-$78	-$111	-$136	-$158	-$208	-$278	-$361	-$447	-$529	-$605	-$675	-$739	-$800	-$854	
Economic Efficiency																	
Change in Consumer Surplus ($millions)	$0.00	$18.36	$101.57	$134.60	$217.66	$251.23	$241.36	$237.56	$229.89	$235.10	$239.78	$239.78	$239.78	$239.78	$239.78	$239.78	$1,414
Incr. Change in Consumer Surplus ($millions)	$0.00	-$73.48	-$75.20	-$74.38	-$74.10	-$69.67	-$79.54	-$83.34	-$91.01	-$85.80	-$81.23	-$81.23	-$81.23	-$81.23	-$81.23	-$81.23	-$595
Change in Total Fuel Cost (net of fuel tax) ($millions)	$0	$34	$67	$95	$117	$136	$179	$239	$310	$384	$454	$520	$580	$634	$687	$734	$1,936
Overall societal costs	$0	-$40	-$8	$21	$43	$66	$99	$156	$219	$299	$373	$439	$499	$553	$606	$652	$1,340
Cost per tonne of GHG reduction (discounted to 2003)																	-$32
Fairness																	
Change Total Sales (numbers of vehicles)	0	394	2,179	2,886	4,661	5,378	5,167	5,086	4,922	5,034	5,133	5,133	5,133	5,133	5,133	5,133	
Incr. Change in sales	0	-1,576	-1,609	-1,590	-1,580	-1,484	-1,695	-1,776	-1,940	-1,829	-1,731	-1,731	-1,731	-1,731	-1,731	-1,731	
Change in Revenue ($ billions)	$0.00	-$1.16	-$1.05	-$1.00	-$1.01	-$0.89	-$0.69	-$0.52	-$0.49	-$0.39	-$0.29	-$0.29	-$0.29	-$0.29	-$0.29	-$0.29	
Big Three	$0.00	-$1.50	-$1.39	-$1.44	-$1.36	-$1.30	-$1.14	-$1.01	-$1.07	-$0.93	-$0.87	-$0.87	-$0.87	-$0.87	-$0.87	-$0.87	
Others	$0.00	$0.34	$0.34	$0.45	$0.35	$0.41	$0.45	$0.49	$0.58	$0.55	$0.59	$0.59	$0.59	$0.59	$0.59	$0.59	
Total Market Share																	
Big Three	62%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60.1%	
Others	38%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
Total Market Share																	
Cars	57%	60%	60%	60%	60%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	
Trucks	43%	40%	40%	40%	40%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	
Average price of new vehicles	$27,929	$27,138	$27,181	$27,202	$27,160	$27,227	$27,366	$27,485	$27,509	$27,575	$27,639	$27,639	$27,639	$27,639	$27,639	$27,639	
Transfers																	
Rebates (millions)	0	-587.276	-570.371	-564.368	-573.792	-556.556	-572.846	-561.685	-586.607	-566.399	-548.574	-548.574	-548.574	-548.574	-548.574	-548.574	
Fees (millions)	0	587.2753	570.3812	564.3654	573.7885	556.5568	572.8652	561.685	586.5997	566.3985	548.5824	548.5824	548.5824	548.5824	548.5824	548.5824	

Scenario 6

500 Feebate, One Pivot Point, Revenue Neutral

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Environmental Effectiveness																	
Avg. fuel economy of new vehicles	9.0	8.5	8.3	8.3	8.1	8.1	8.0	8.0	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8972	
cars	7.6	7.3	7.2	7.1	7.0	6.9	6.9	6.9	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8051	
Trucks	10.7	10.3	10.0	9.9	9.8	9.7	9.6	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.4876	
Change in overall GHG emissions (MT)	(0.0)	(0.2)	(0.6)	(0.8)	(1.0)	(1.1)	(1.3)	(1.5)	(1.8)	(2.0)	(2.2)	(2.4)	(2.6)	(2.8)	(2.9)	(3.0077)	(26.17)
Change in overall fuel use (million litres of gasoline)	0.0	(111.4)	(223.5)	(314.9)	(387.5)	(450.5)	(529.3)	(623.6)	(724.6)	(825.3)	(908.9)	(988.0)	(1,058.5)	(1,119.2)	(1,179.1)	(1,227.9765)	
Fiscal Impact																	
Total rebate and total fees ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Change in fuel tax revenue to government ($millions)	$0	-$39	-$78	-$111	-$136	-$158	-$186	-$219	-$254	-$290	-$319	-$347	-$372	-$393	-$414	-$431	
Economic Efficiency																	
Change in Consumer Surplus ($millions)	$0.00	$18.36	$101.57	$134.60	$217.66	$251.23	$255.10	$255.32	$258.02	$260.23	$262.40	$262.40	$262.40	$262.40	$262.40	$262.40	$1,497
Incr. Change in Consumer Surplus ($millions)	$0.00	-$73.48	-$75.20	-$74.38	-$74.10	-$69.67	-$65.80	-$65.58	-$62.88	-$60.66	-$58.62	-$58.62	-$58.62	-$58.62	-$58.62	-$58.62	-$513
Change in Total Fuel Cost (net of fuel tax) ($millions)	$0	$34	$67	$95	$117	$136	$160	$188	$218	$249	$274	$298	$319	$337	$356	$370	$1,307
Overall societal costs	$0	-$40	-$8	$21	$43	$66	$94	$122	$156	$188	$215	$239	$261	$279	$297	$312	$795
Cost per tonne of GHG reduction (Discounted to 2003))																	-$30
Fairness																	
Change Total Sales (numbers of vehicles)	0	394	2,179	2,886	4,661	5,378	5,460	5,465	5,522	5,570	5,616	5,616	5,616	5,616	5,616	5,616	
Incr. Change in Sales	0	-1,576	-1,609	-1,590	-1,580	-1,484	-1,402	-1,397	-1,340	-1,292	-1,249	-1,249	-1,249	-1,249	-1,249	-1,249	
Change in Revenue ($ billions)	$0.00	-$1.16	-$1.05	-$1.00	-$1.01	-$0.89	-$0.86	-$0.82	-$0.84	-$0.83	-$0.82	-$0.82	-$0.82	-$0.82	-$0.82	-$0.82	
Big Three	$0.00	-$1.50	-$1.39	-$1.44	-$1.36	-$1.30	-$1.25	-$1.21	-$1.24	-$1.22	-$1.21	-$1.21	-$1.21	-$1.21	-$1.21	-$1.21	
Others	$0.00	$0.34	$0.34	$0.45	$0.35	$0.41	$0.40	$0.39	$0.40	$0.39	$0.40	$0.40	$0.40	$0.40	$0.40	$0.40	
Total Market Share																	
Big Three	62%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60.0%	
Others	38%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
Total Market Share																	
Cars	57%	60%	60%	60%	60%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	
Trucks	43%	40%	40%	40%	40%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	
Average price of new vehicles	$27,929	$27,138	$27,181	$27,202	$27,160	$27,227	$27,251	$27,275	$27,261	$27,267	$27,274	$27,274	$27,274	$27,274	$27,274	$27,274	
cars	24522.29	23753.34	23784.39	23815.59	23698.18	23737.3	23762.14	23772.97	23756.41	23756.79	23761.1	23761.1	23761.103	23761.103	23761.103	23761.103	
Trucks	32358.49	32179.49	32171.14	32176.78	32254.08	32313.29	32339.86	32370.35	32373.49	32381.83	32389.38	32389.38	32389.3843	32389.3843	32389.3843	32389.38433	
Transfers																	
Rebates (millions)	-	- 587.28	- 570.37	- 564.37	- 573.79	- 556.56	- 565.01	- 570.47	- 579.65	- 577.93	- 576.16	- 576.16	- 576.16	- 576.16	- 576.16	- 576.16	
Fees (millions)	-	587.28	570.38	564.37	573.79	556.56	565.00	570.47	579.66	577.94	576.16	576.16	576.16	576.16	576.16	576.16	

Scenario 8

FB $500, 2 pivot points - cars and trucks, revenue Neutral

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Environmental Effectiveness																	
Avg. fuel economy of new vehicles	9.0	8.6	8.4	8.4	8.2	8.1	8.1	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.9799	
Cars	7.6	7.3	7.2	7.1	7.0	6.9	6.9	6.9	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8051	
Trucks	10.7	10.3	10.0	9.9	9.8	9.7	9.6	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.4876	
Change in overall GHG emissions (MT)	(0.04)	(0.05)	(0.35)	(0.38)	(0.58)	(0.59)	(0.66)	(0.81)	(1.06)	(1.26)	(1.38)	(1.57)	(1.73)	(1.87)	(1.94)	(2.05)	(16.32)
Change in overall fuel use (million litres of gasoline)	0	(52)	(109)	(158)	(200)	(235)	(289)	(358)	(434)	(511)	(577)	(641)	(697)	(747)	(797)	(838)	
Fiscal Impact																	
Total rebate and total fees ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Change in fuel tax revenue to government ($millions)	$0	-$18	-$38	-$55	-$70	-$83	-$102	-$126	-$152	-$179	-$203	-$225	-$245	-$262	-$280	-$294	
Economic Efficiency																	
Change in Consumer Surplus ($millions)	$0.00	$48.99	$128.62	$161.54	$245.56	$277.31	$281.62	$280.53	$284.19	$286.08	$288.01	$288.01	$288.01	$288.01	$288.01	$288.01	$1,701
Incr. Change in Consumer Surplus ($millions)	$0.00	-$42.86	-$48.15	-$47.45	-$46.19	-$43.59	-$39.28	-$40.36	-$36.71	-$34.82	-$33.00	-$33.00	-$33.00	-$33.00	-$33.00	-$33.00	-$309
Change in Total Fuel Cost (net of fuel tax) ($millions)	$0	$16	$33	$48	$60	$71	$87	$108	$131	$154	$174	$193	$210	$225	$240	$253	$784
Overall societal costs	$0	-$27	-$15	$0	$14	$27	$48	$68	$94	$119	$141	$160	$177	$192	$207	$220	$475
Cost per tonne of GHG reduction (discounted to 2003)																	-$29
Fairness																	
Change Total Sales (numbers of vehicles)	0	1,052	2,758	3,462	5,257	5,934	6,025	6,002	6,080	6,121	6,162	6,162	6,162	6,162	6,162	6,162	
Incr. Change in sales	0	-919	-1,030	-1,014	-985	-928	-837	-860	-782	-742	-703	-703	-703	-703	-703	-703	
Change in Revenue ($ billions)	$0.00	-$0.72	-$0.64	-$0.59	-$0.59	-$0.48	-$0.44	-$0.42	-$0.43	-$0.42	-$0.41	-$0.41	-$0.41	-$0.41	-$0.41	-$0.41	
Big Three	$0.00	-$0.86	-$0.80	-$0.85	-$0.75	-$0.72	-$0.66	-$0.63	-$0.65	-$0.64	-$0.63	-$0.63	-$0.63	-$0.63	-$0.63	-$0.63	
Others	$0.00	$0.14	$0.16	$0.26	$0.16	$0.23	$0.22	$0.22	$0.22	$0.22	$0.23	$0.23	$0.23	$0.23	$0.23	$0.23	
Total Market Share																	
Big Three	62%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	60.9%	
Others	38%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	
Total Market Share																	
Cars	57%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	
Trucks	43%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	
Average price of new vehicles	$27,929	$27,423	$27,447	$27,466	$27,435	$27,493	$27,519	$27,537	$27,528	$27,533	$27,539	$27,539	$27,539	$27,539	$27,539	$27,539	
Cars	24522.29	23753.91	23784.59	23816.07	23697.08	23737.07	23761.29	23771.43	23754.82	23755.22	23759.32	23759.32	23759.32	23759.32	23759.32	23759.32	
Trucks	32358.49	32179.55	32171.18	32176.72	32254.27	32313.32	32339.85	32370.25	32373.42	32381.91	32389.38	32389.38	32389.38	32389.38	32389.38	32389.38	
Transfers																	
Rebates (millions)	0	-418.135	-453.783	-442.791	-439.861	-428.853	-438.573	-445.888	-454.939	-454.062	-453.063	-453.063	-453.063	-453.063	-453.063	-453.063	
Fees (millions)	0	418.1379	453.7849	442.8006	439.8559	428.8598	438.5772	445.8731	454.9216	454.039	453.0265	453.0265	453.0265	453.0265	453.0265	453.0265	

Scenario 9

FB $1000, 11 pivot points by Class, Revenue Neutral

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Environmental Effectiveness																	
Avg. fuel economy of new vehicles	9.0	8.7	8.5	8.4	8.2	8.2	8.1	8.1	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0330	
Change in overall GHG emissions (MT)	(0.04)	(0.01)	(0.25)	(0.24)	(0.41)	(0.38)	(0.43)	(0.55)	(0.77)	(0.94)	(1.03)	(1.20)	(1.34)	(1.46)	(1.52)	(1.63)	(12.22)
Change in overall fuel use (million litres of gasoline)	0	(35)	(71)	(102)	(128)	(153)	(195)	(251)	(315)	(379)	(436)	(490)	(539)	(583)	(626)	(663)	
Fiscal Impact																	
Total rebate and total fees ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Change in fuel tax revenue to government ($millions)	$0	-$12	-$25	-$36	-$45	-$54	-$68	-$88	-$110	-$133	-$153	-$172	-$189	-$205	-$220	-$233	
Economic Efficiency																	
Change in Consumer Surplus ($millions)	$0.00	$62.91	$145.97	$177.70	$261.89	$291.82	$296.75	$296.59	$300.49	$302.40	$304.10	$304.10	$304.10	$304.10	$304.10	$304.10	$1,821
Incr. Change in consumer Surplus ($millions)	$0.00	-$28.93	-$30.79	-$31.29	-$29.87	-$29.08	-$24.15	-$24.30	-$20.41	-$18.50	-$16.91	-$16.91	-$16.91	-$16.91	-$16.91	-$16.91	-$188
Change in Total Fuel Cost (net of fuel tax) ($millions)	$0	$10	$21	$31	$39	$46	$59	$76	$95	$114	$131	$148	$162	$176	$189	$200	$573
Overall societal costs	$0	-$19	-$9	-$1	$9	$17	$35	$51	$74	$96	$114	$131	$146	$159	$172	$183	$384
Cost per tonne of GHG reduction (discounted to 2003)																	-$31
Fairness																	
Change Total Sales (numbers of vehicles)	0	1,350	3,129	3,808	5,605	6,243	6,348	6,345	6,428	6,468	6,504	6,504	6,504	6,504	6,504	6,504	
Incr. Change in sales	0	-620	-658	-669	-637	-619	-514	-517	-435	-394	-360	-360	-360	-360	-360	-360	
Change in Revenue ($ billions)	$0.00	-$0.53	-$0.44	-$0.40	-$0.39	-$0.30	-$0.25	-$0.23	-$0.24	-$0.23	-$0.22	-$0.22	-$0.22	-$0.22	-$0.22	-$0.22	
Big Three	$0.00	-$0.63	-$0.57	-$0.63	-$0.49	-$0.47	-$0.41	-$0.39	-$0.40	-$0.38	-$0.38	-$0.38	-$0.38	-$0.38	-$0.38	-$0.38	
Others	$0.00	$0.10	$0.13	$0.23	$0.10	$0.17	$0.16	$0.16	$0.16	$0.15	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	
Total Market Share																	
Big Three	62%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61.3%	
Others	38%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	
Total Market Share																	
Cars	57%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	
Trucks	43%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	
Average price of new vehicles	$27,929	$27,548	$27,575	$27,585	$27,558	$27,609	$27,639	$27,656	$27,649	$27,654	$27,660	$27,660	$27,660	$27,660	$27,660	$27,660	
Transfers																	
Rebates (millions)	0	-271.511	-282.904	-286.532	-276.69	-271.163	-272.891	-280.256	-285.319	-285.063	-285.012	-285.012	-285.012	-285.012	-285.012	-285.012	
Fees (millions)	0	272	283	287	277	271	273	280	285	285	285	285	285	285	285	285	

Scenario 10 Base Case

FB 0, Full valuation fuel savings, revenue neutral

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Environmental Effectiveness																
Avg. fuel economy of new vehicles	8.959	8.676	8.407	8.327	8.107	8.061	8.061	8.061	8.061	8.061	8.061	8.061	8.061	8.061	8.061	8.061
Change in overall GHG emissions (MT)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Change in overall fuel use (million litres of gasoline)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fiscal Impact																
Total rebate and total fees ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Change in fuel tax revenue to government ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Economic Efficiency																
Change in Consumer Surplus ($millions)	$0.00	$356.46	$675.64	$786.22	$1,082.52	$1,178.76	$1,178.62	$1,178.62	$1,178.62	$1,178.62	$1,178.96	$1,178.96	$1,178.96	$1,178.96	$1,178.96	$1,178.96
Change in Total Fuel Cost (net of fuel tax) ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Overall societal costs	$0	$356	$676	$786	$1,083	$1,179	$1,179	$1,179	$1,179	$1,179	$1,179	$1,179	$1,179	$1,179	$1,179	$1,179
Cost per tonne of GHG reduction																
Fairness																
Change Total Sales (numbers of vehicles)	0	7,619	14,375	16,702	22,902	24,904	24,901	24,901	24,901	24,901	24,909	24,909	24,909	24,909	24,909	24,909
Change in Revenue ($ billions)	$0.00	$0.41	$0.69	$0.79	$0.85	$1.06	$1.06	$1.06	$1.06	$1.06	$1.06	$1.06	$1.06	$1.06	$1.06	$1.06
Big Three	$0.00	$0.57	$0.81	$0.73	$0.92	$1.04	$1.04	$1.04	$1.04	$1.04	$1.05	$1.05	$1.05	$1.05	$1.05	$1.05
Others	$0.00	-$0.17	-$0.12	$0.06	-$0.07	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01
Total Market Share																
Big Three	62%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63.1%
Others	38%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%
Total Market Share																
Cars	57%	56%	56%	56%	56%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%
Trucks	43%	44%	44%	44%	44%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
Average price of new vehicles	$27,929	$28,060	$28,120	$28,144	$28,067	$28,169	$28,169	$28,169	$28,169	$28,169	$28,172	$28,172	$28,172	$28,172	$28,172	$28,172
Transfers																
Rebates (millions)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fees (millions)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario 10

FB 500, Full valuation fuel savings, revenue neutral, 1pp

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Environmental Effectiveness																	
Avg. fuel economy of new vehicles	9.0	8.4	8.2	8.1	7.9	7.8	7.8	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.6895	
Change in overall GHG emissions (MT)	-	(0.27)	(0.56)	(0.79)	(0.98)	(1.14)	(1.33)	(1.55)	(1.79)	(2.03)	(2.22)	(2.40)	(2.57)	(2.71)	(2.85)	(2.96)	(26.15)
Change in overall fuel use (million litres of gasoline)	-	(113)	(229)	(323)	(400)	(466)	(545)	(636)	(733)	(829)	(909)	(984)	(1,052)	(1,109)	(1,165)	(1,211)	
Fiscal Impact																	
Total rebate and total fees ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Change in fuel tax revenue to government ($millions)	$0	-$39	-$80	-$113	-$140	-$164	-$191	-$223	-$257	-$291	-$319	-$345	-$369	-$389	-$409	-$425	
Economic Efficiency																	
Change in Consumer Surplus ($millions)	$0.00	$280.85	$596.06	$707.98	$1,004.10	$1,105.21	$1,139.26	$1,156.00	$1,177.56	$1,186.55	$1,195.86	$1,195.86	$1,195.86	$1,195.86	$1,195.86	$1,195.86	$7,150
Incr. Change in CS	$0.00	-$75.61	-$79.58	-$78.24	-$78.43	-$73.56	-$39.37	-$22.62	-$1.07	$7.92	$16.89	$16.89	$16.89	$16.89	$16.89	$16.89	-$292
Change in Total Fuel Cost (net of fuel tax) ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Overall societal costs	$0	-$76	-$80	-$78	-$78	-$74	-$39	-$23	-$1	$8	$17	$17	$17	$17	$17	$17	-$292
Cost per tonne of GHG reduction (discounted to 2003)																	$11
Fairness																	
Change Total Sales (numbers of vehicles)	0	6,009	12,696	15,056	21,266	23,374	24,083	24,431	24,879	25,066	25,260	25,260	25,260	25,260	25,260	25,260	
Incr Change in Sales	0	-1,609	-1,679	-1,646	-1,636	-1,530	-819	-470	-22	165	351	351	351	351	351	351	
Change in Revenue ($ billions)	$0.00	-$0.86	-$0.59	-$0.48	-$0.54	-$0.29	-$0.22	-$0.16	-$0.18	-$0.16	-$0.13	-$0.13	-$0.13	-$0.13	-$0.13	-$0.13	
Big Three	$0.00	-$0.97	-$0.73	-$0.83	-$0.69	-$0.56	-$0.48	-$0.42	-$0.46	-$0.43	-$0.42	-$0.42	-$0.42	-$0.42	-$0.42	-$0.42	
Others	$0.00	$0.11	$0.14	$0.35	$0.15	$0.27	$0.26	$0.26	$0.28	$0.27	$0.28	$0.28	$0.28	$0.28	$0.28	$0.28	
Total Market Share																	
Big Three	62%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	60.9%	
Others	38%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	
Total Market Share																	
Cars	57%	60%	59%	59%	59%	59%	58%	58%	59%	58%	58%	58%	58%	58%	58%	58%	
Trucks	43%	40%	41%	41%	41%	41%	42%	42%	41%	42%	42%	42%	42%	42%	42%	42%	
Average price of new vehicles	$27,929	$27,238	$27,295	$27,328	$27,176	$27,301	$27,336	$27,372	$27,347	$27,358	$27,372	$27,372	$27,372	$27,372	$27,372	$27,372	
Transfers																	
Rebates (millions)	$0.0	-$593.7	-$586.7	-$577.6	-$595.9	-$579.7	-$586.1	-$589.4	-$597.6	-$595.7	-$593.5	-$593.5	-$593.5	-$593.5	-$593.5	-$593.5	
Fees (millions)	$0.0	$593.7	$586.7	$577.6	$595.9	$579.7	$586.0	$589.4	$597.6	$595.7	$593.5	$593.5	$593.5	$593.5	$593.5	$593.5	

Scenario 11 Base Case

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Environmental Effectiveness																
Avg. fuel economy of new vehicles	9.0	8.8	8.6	8.5	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.2813
Change in overall GHG emissions (MT)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Change in overall fuel use (million litres of gasoline)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fiscal Impact																
Total rebate and total fees ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Change in fuel tax revenue to government ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Economic Efficiency																
Change in Consumer Surplus ($millions)	$0.00	$94.58	$180.67	$213.22	$296.31	$325.62	$325.62	$325.62	$325.62	$325.62	$325.75	$325.75	$325.75	$325.75	$325.75	$325.75
Change in Total Fuel Cost (net of fuel tax) ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Overall societal costs	$0	$95	$181	$213	$296	$326	$326	$326	$326	$326	$326	$326	$326	$326	$326	$326
Cost per tonne of GHG reduction																
Fairness																
Change in Total Sales (numbers of vehicles)	0	4,053	7,722	9,105	12,623	13,861	13,861	13,861	13,861	13,861	13,866	13,866	13,866	13,866	13,866	13,866
Change in Revenue ($ billions)	$0.00	$0.22	$0.39	$0.46	$0.52	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66
Big Three	$0.00	$0.28	$0.42	$0.38	$0.52	$0.60	$0.60	$0.60	$0.60	$0.60	$0.60	$0.60	$0.60	$0.60	$0.60	$0.60
Others	$0.00	-$0.06	-$0.03	$0.08	$0.00	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06
Total Market Share																
Big Three	62%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	62.7%
Others	38%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%
Total Market Share																
Cars	57%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%
Trucks	43%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%
Average price of new vehicles	$27,929	$28,003	$28,046	$28,064	$28,044	$28,112	$28,112	$28,112	$28,112	$28,112	$28,115	$28,115	$28,115	$28,115	$28,115	$28,115

Scenario 11

500 Feebate, One Pivot Point, Revenue Neutral, Double Elasticities

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	total
Environmental Effectiveness																	
Avg. fuel economy of new vehicles	9.0	8.3	8.1	8.0	7.9	7.8	7.8	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.6677	
Change in overall GHG emissions (MT)	-	(0.56)	(1.13)	(1.59)	(1.96)	(2.28)	(2.63)	(3.02)	(3.43)	(3.83)	(4.15)	(4.46)	(4.73)	(4.95)	(5.17)	(5.35)	(49.25)
Change in overall fuel use (million litres of gasoline)	-	(231)	(463)	(651)	(801)	(933)	(1,077)	(1,237)	(1,404)	(1,568)	(1,700)	(1,824)	(1,935)	(2,027)	(2,117)	(2,189)	
Fiscal Impact																	
Total rebate and total fees ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Change in fuel tax revenue to government ($millions)	$0	-$81	-$163	-$228	-$281	-$327	-$378	-$434	-$493	-$550	-$597	-$640	-$679	-$711	-$743	-$768	
Economic Efficiency																	
Change in Consumer Surplus ($millions)	$0.00	-$50.82	$33.25	$68.43	$151.71	$188.25	$190.62	$190.90	$191.38	$194.01	$196.57	$196.57	$196.57	$196.57	$196.57	$196.57	$993
Incr. Change in consumer surplus ($millions)	$0.00	-$145.40	-$147.42	-$144.79	-$144.60	-$137.37	-$135.00	-$134.72	-$134.24	-$131.61	-$129.17	-$129.17	-$129.17	-$129.17	-$129.17	-$129.17	-$1,049
Change in Total Fuel Cost (net of fuel tax) ($millions)	$0	$127	$254	$357	$440	$512	$591	$679	$771	$861	$934	$1,001	$1,062	$1,113	$1,162	$1,202	$4,584
Overall societal costs	$0	-$19	$107	$212	$295	$375	$456	$544	$637	$729	$804	$872	$933	$984	$1,033	$1,073	$3,535
Cost per tonne of GHG reduction (discounted to 2003)																	-$72
Fairness																	
Change Total Sales (numbers of vehicles)	0	-2,187	1,427	2,934	6,490	8,045	8,145	8,157	8,178	8,289	8,398	8,398	8,398	8,398	8,398	8,398	
Incr. Change in sales	0	-6,239	-6,295	-6,171	-6,134	-5,816	-5,716	-5,703	-5,683	-5,571	-5,468	-5,468	-5,468	-5,468	-5,468	-5,468	
Change in Revenue ($ billions)	$0.00	-$2.42	-$2.25	-$2.15	-$2.25	-$2.04	-$2.00	-$1.96	-$2.02	-$2.01	-$1.99	-$1.99	-$1.99	-$1.99	-$1.99	-$1.99	
Big Three	$0.00	-$3.11	-$2.93	-$3.00	-$2.91	-$2.82	-$2.74	-$2.68	-$2.74	-$2.72	-$2.71	-$2.71	-$2.71	-$2.71	-$2.71	-$2.71	
Others	$0.00	$0.69	$0.68	$0.85	$0.66	$0.78	$0.74	$0.72	$0.72	$0.71	$0.72	$0.72	$0.72	$0.72	$0.72	$0.72	
Total Market Share																	
Big Three	62%	57%	58%	57%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	57.7%	
Others	38%	43%	42%	43%	42%	42%	42%	42%	42%	42%	42%	42%	42%	42%	42%	42%	
Total Market Share																	
Cars	57%	63%	63%	63%	63%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	
Trucks	43%	37%	37%	37%	37%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	
Average price of new vehicles	$27,929	$26,330	$26,384	$26,422	$26,297	$26,408	$26,432	$26,461	$26,416	$26,425	$26,436	$26,436	$26,436	$26,436	$26,436	$26,436	
Transfers																	
Rebates (millions)	0	-561.5682	-537.8804	-527.7823	-544.9576	-534.4311	-544.563	-543.4621	-554.4396	-553.2103	-551.7506	-551.7506	-551.7506	-551.7506	-551.7506	-551.7506	
Fees (millions)	0	561.5658	537.8586	527.8116	544.9501	534.4094	544.5633	543.4527	554.4252	553.2001	551.737	551.737	551.737	551.737	551.737	551.737	

Scenario 12

$1.2 -- 500 Feebate, One Pivot Point, Revenue Neutral

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Environmental Effectiveness																	
Avg. fuel economy of new vehicles	9.0	8.5	8.3	8.2	8.0	8.0	7.9	7.9	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8387	
cars	7.6	7.3	7.2	7.1	6.9	6.9	6.8	6.8	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7472	
Trucks	10.7	10.3	9.9	9.8	9.7	9.6	9.5	9.5	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4152	
Change in overall GHG emissions (MT)	-	(0.2)	(0.5)	(0.7)	(0.8)	(0.9)	(1.1)	(1.3)	(1.5)	(1.7)	(1.8)	(2.0)	(2.1)	(2.2)	(2.3)	(2.4361)	(21.50)
Change in overall fuel use (million litres of gasoline)	-	(94.2)	(189.6)	(266.9)	(328.2)	(381.3)	(445.7)	(520.8)	(601.6)	(681.2)	(747.4)	(808.9)	(865.0)	(912.6)	(959.0)	(997.1361)	
Fiscal Impact																	
Total rebate and total fees ($millions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Change in fuel tax revenue to government ($millions)	$0	-$44	-$89	-$125	-$154	-$178	-$209	-$244	-$282	-$319	-$350	-$379	-$405	-$427	-$449	-$467	
Economic Efficiency																	
Change in Consumer Surplus ($millions)	$0.00	$76.97	$213.60	$265.60	$399.30	$449.40	$461.73	$466.65	$475.16	$478.88	$482.33	$482.33	$482.33	$482.33	$482.33	$482.33	$2,814
Incr. Change in Consumer Surplus ($millions)	$0.00	-$73.93	-$76.30	-$75.37	-$75.34	-$70.77	-$58.44	-$53.52	-$45.01	-$41.29	-$38.02	-$38.02	-$38.02	-$38.02	-$38.02	-$38.02	-$451
Change in Total Fuel Cost (net of fuel tax) ($millions)	$0	$38	$76	$107	$132	$153	$179	$209	$242	$274	$300	$325	$348	$367	$385	$401	$1,445
Overall societal costs	$0	-$36	$0	$32	$57	$83	$121	$156	$197	$233	$262	$287	$310	$329	$347	$363	$994
Cost per tonne of GHG reduction (Discounted to 2003))																	-$46
Fairness																	
Change Total Sales (numbers of vehicles)	0	1,956	5,202	6,355	9,384	10,424	10,669	10,741	10,924	10,999	11,066	11,066	11,066	11,066	11,066	11,066	
Incr. Change in Sales	0	-1,279	-1,000	-934	-744	-668	-423	-350	-168	-93	-29	-29	-29	-29	-29	-29	
Change in Revenue ($ billions)	$0.00	-$1.09	-$0.94	-$0.88	-$0.90	-$0.75	-$0.71	-$0.66	-$0.69	-$0.67	-$0.66	-$0.66	-$0.66	-$0.66	-$0.66	-$0.66	
Big Three	$0.00	-$1.38	-$1.24	-$1.30	-$1.21	-$1.13	-$1.07	-$1.03	-$1.06	-$1.04	-$1.03	-$1.03	-$1.03	-$1.03	-$1.03	-$1.03	
Others	$0.00	$0.29	$0.30	$0.43	$0.30	$0.38	$0.37	$0.36	$0.37	$0.37	$0.38	$0.38	$0.38	$0.38	$0.38	$0.38	
Total Market Share																	
Big Three	62%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60.2%	
Others	38%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
Total Market Share																	
Cars	57%	60%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	
Trucks	43%	40%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	
Average price of new vehicles	$27,929	$27,160	$27,207	$27,231	$27,163	$27,244	$27,270	$27,297	$27,279	$27,286	$27,294	$27,294	$27,294	$27,294	$27,294	$27,294	
cars	$24,522	$23,763	$23,797	$23,834	$23,666	$23,713	$23,740	$23,752	$23,731	$23,731	$23,736	$23,736	$23,736	$23,736	$23,736	$23,736	
Trucks	$32,358	$32,207	$32,182	$32,187	$32,278	$32,349	$32,378	$32,413	$32,416	$32,425	$32,433	$32,433	$32,433	$32,433	$32,433	$32,433	
Transfers																	
Rebates (millions)	-	- 589.13	- 575.18	- 568.64	- 580.72	- 563.57	- 572.31	- 577.06	- 586.29	- 584.68	- 582.99	- 582.99	- 582.99	- 582.99	- 582.99	- 582.99	
Fees (millions)	-	589.10	575.18	568.65	580.73	563.57	572.31	577.06	586.30	584.70	582.99	582.99	582.99	582.99	582.99	582.99	