

# DRAFT STRATEGY FOR TRANSPORT IN CANADA FOR THE POST-KYOTO PERIOD<sup>†</sup>

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## TABLE OF CONTENTS

1. Introduction.....	1
2. Beyond the turn-around decade.....	2
3. Sustainable transportation is not only about climate change.....	3
4. Other considerations for the development of the <i>Strategy</i> .....	4
5. Rationing transport fuel by tradable permits, a key element of the <i>Strategy</i> .....	5
6. Attitude change: an equally important element.....	8
7. Land use change: an important complementary element.....	8
8. Public transit enhancement: another key complementary element.....	9
9. A few words about sustainable freight transport and inter-city transport, .....	10
10. Implications for the present decade.....	10
11. Concluding remarks and questions for the workshop.....	11
End Notes.....	13

## 1. Introduction

**This document and a companion document**—entitled *Background Paper for a post-Kyoto Transport Strategy* (the *Background Paper*)—have been prepared for a workshop being held by the Centre for Sustainable Transportation in Halifax on September 9, 2002. Details about the workshop and its purposes are in the *Background Paper*. Reference to the *Background Paper* may be required for understanding of some of the points made in the present document.

The present document—the *Strategy*—focuses on the actions required to move transportation in Canada towards sustainability<sup>‡</sup> during the period 2010-2025. These actions are set out and discussed in Sections 5-9. They are directed towards attainment of a target for 2025 for reduction in greenhouse gas (GHG) emissions from transportation proposed in the *Background Paper*. They assume achievement of one or another of the three scenarios for 2010 also explained in detail in the *Background Paper*. The sections on required actions for 2010-2025 are followed by consideration of their implications for the present decade (Section 10).

The next section—Section 2—reinforces the importance of the years until 2010 in moving towards sustainable transportation, and briefly reviews the scenarios for 2010 developed in the *Background Paper*. Section 3 expands on the discussion in the *Background Paper* to the effect that sustainability is not only about climate change. Section 4 recapitulates some of the key points made in the *Background Paper* that have implications for transportation in Canada during the period 2010-2025.

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<sup>†</sup> This document is an updated version of a paper prepared for workshops held by the Centre for Sustainable Transportation in Vancouver (Feb. 6, 2001), Brampton (Jun. 27, 2001), and Montreal (Nov. 8, 2001) with support from Environment Canada. The views and analyses presented here are those of the author and not necessarily those of Environment Canada or the Centre.

<sup>‡</sup> Superscript numbers refer to endnotes beginning on Page 13. The endnotes provide sources for many of the statements made here and supplementary material. The last endnote (#41) provides contact and other information about the author.

A final section—Section 11—provides some concluding remarks and also **several questions to be addressed at the November 8 workshop.**

## 2. Beyond the turn-around decade

**The present decade, until 2010, is turn-around time for sustainability.** For hundreds of years, human activity has increasingly imperiled all life on the surface of the only planet known to support life. The extent of the environmental degradation has become apparent only during the past few decades. Humans have altered large areas of the planet's surface, polluted watercourses and oceans, and changed the atmosphere and the climate. Through these actions, we have reduced biological diversity, the very fountainhead of life.<sup>2</sup> Transportation has been a major factor in this degradation.

The risk of further changes to the Earth's climate has impelled corrective action. Climate is perhaps the most important of the factors that determine which species—if any—can survive in a particular place. Almost all nations have ratified a framework convention that seeks to reduce this risk. Several nations have ratified a protocol—the **Kyoto Protocol**—that mandates specific actions to reduce production of the greenhouse gases (GHGs) that are changing the climate.<sup>3</sup>

**The Kyoto Protocol captures and provides implementation of the thought that things need to be turned around during the present decade.** The essence of the Kyoto Protocol is that the major producers of GHGs must act to return levels of GHG emissions to just below 1990 levels. If no action is taken, use of fossil fuels and emissions of GHGs in Canada and worldwide in 2010 will be more than 50% above 1990 levels.<sup>4</sup> Delay beyond 2010 could mean that the environmental impacts will be greater and the turn-around will be harder. (Other environmental aspects of sustainability, as well as social and economic aspects, are discussed here in Section 3.)

Assuming that the turn-around occurs during this decade—i.e., environmental unsustainability is halted and returned to near 1990 levels—then will come **the daunting task of achieving the dramatic reductions in transport emissions that appear to be required if the ability of future generations to meet their needs is not to be compromised.** For a country such as Canada, reductions in GHG emissions to 80 per cent below 1990 levels may be required, with perhaps even greater reductions in emissions of locally acting pollutants. The year 2030 has been set by both the Centre for Sustainable Transportation and the Organization for Economic Cooperation and Development (OECD) as an initial target date for the attainment of these reductions. This date may be optimistic, although delay—as always—could in many ways increase the challenges of attainment.<sup>5</sup>

**The present exercise is framed by the much more conservative target of reducing GHG emissions associated with transport to 30% below the 1990 level.** For the period in question, 2010-2025, this means reductions of 26% or 44% below the 2010 level according to which of three indicated scenarios applies for the period until 2010. These scenarios and the 2025 target are elaborated in Section 2 of the *Background Paper*.

In brief, **Scenario A** speaks to attainment of Canada's Kyoto Protocol commitment<sup>6</sup> for transportation through implementation of Canada's National Implementation Strategy (NIS), which involves use of as-yet-unspecified means of meeting the commitment. **Scenario B** speaks to partial effectiveness of the NIS and thus partial attainment of the Kyoto target as it may be applied to transport. **Scenario C** speaks to full attainment of the commitment, in part because of the effects of the NIS and in part because world production of oil peaks near 2005 and world oil prices rise dramatically soon after that date and continue to rise.

Section 8 of the *Background Paper* discusses how the NIS could unfold. Emphasis is placed on the implementation of substantially enhanced fuel-efficiency standards for new road vehicles, including freight vehicles, together with ancillary measures that help ensure effective application of the standards. **The key point in what is suggested is that reliance is placed on available technology**, together with some further improvements to all vehicles or considerable downsizing of personal vehicles on the road, or both.

**There appears to be no such ‘technological fix’ for the period beyond 2010.** Much is promised—specifically in relation to fuel cells—but the challenges are formidable and the results may not meet expectations.<sup>7</sup> Presently, the potential of new technology seems too uncertain to depend on it for attainment of the target set here for 2025. Accordingly, this *Strategy* places reliance on measures that could work whether or not the ‘pollution-less’ motor vehicle is developed. They are touched on briefly in Sections 5 to 9 below. In brief, the targets are to be achieved by reductions in transport activity aided by land-use changes, transit investments, and other measures. To the extent that technological improvements are achieved, in respect of both emissions control and resource use, there will be less need to curb transport activity.

At the core of any elaboration of prospects for transportation during the period 2010-2025 must be consideration of **energy availability**. Scenarios A and B for the period until 2010 speak to continued availability of oil more or less as we know it now. Scenario C takes into account the strong possibility that oil production will peak near 2005 and supply will thereafter fall short of demand, resulting in steep fuel price increases. These two kinds of projection are continued into the period 2010-2025. The question as to what exactly will happen with oil prices after 2010 for Scenarios A and B is left open.

### 3. Sustainable transportation is not only about climate change

Climate change is just one of several features of environmental unsustainability. It and many others are related to energy use, particularly fossil fuel use. **If fossil fuel consumption declines, because of efforts to improve energy efficiency or insufficient production, many but not all of the environmental aspects of unsustainability will be reduced to the extent of the decline.** Transport-related environmental impacts that could continue unabated are to do with the consumption of other materials and its impacts, changes in land surface and resulting effects on water quality, barriers to species migration posed by transport corridors, and noise.

**As far as environmental aspects are concerned, concerns about present and future needs seem to be mostly aligned.** The emphases are different. Present concerns focus more on local environmental conditions. Concerns about the future are more to do with global matters such as climate change, stratospheric ozone depletion, and the worldwide spread of persistent organic pollutants. As noted above, addressing global matters often results in local improvements, e.g., reducing greenhouse gas emissions usually results in reductions in local pollution.

**There also seems to be a good measure of alignment between present social conditions and the welfare of future generations.** Education is the most obvious example, but less definable matters such as the integrity and viability of cultural and political institutions can involve processes over decades or longer. Present physical and emotional health can be important for future generations; in part this is dependent on present environmental conditions.

Moreover, some work suggests that as motorized mobility increases beyond an optimum level there are **adverse social impacts of transport** including growing social disparity and alienation, and loss of independent mobility among the elderly and children.<sup>8</sup> These may all be incompatible with notions of social sustainability. Average mobility levels in rich countries could be beyond the optimum. Thus, **in Canada,**

**a lessening of overall mobility may be consistent with social sustainability.**<sup>9</sup> Notwithstanding this possibility, care must be taken to ensure that changes in transport availability do not have inadvertent adverse impacts on disadvantaged groups.

Present economic factors seem less important for the future, except as they involve investment in goods that will be realized far into the future, for example, investment in education, childcare, and some physical infrastructure. Indeed, what is economically good for the present often seems to limit the opportunities available to future generations, for example, high levels of resource use.

It almost goes without saying that the economic aspects of transportation are hugely important for the present, in at least two ways. **Good transportation facilitates—and is often essential to—most current economic activity. As important in many respects is the direct economic activity associated with transport.** The automotive industry is Canada's largest industrial sector and a major source of net exports. Oil—which is used mainly for transportation—is a major net export. Truck driving is the largest single occupational category of males in Canada. Canada is the least densely populated among the industrialized countries of the world and the most dependent on exports. **Without care, a reduction in transport activity could be a major source of unemployment and loss of economic activity.**<sup>10</sup>

Nonetheless, there is the large paradox that if businesses were able to function with less transport, other things being equal, they would be more efficient. This is because **transport is a cost to business.**

Thus, **the economic aspects of sustainability may be those that require the most careful attention,** especially in Canada. This becomes especially important if consideration for the future appears to be in conflict with present needs, as when it is argued that fossil fuel use cannot be reduced without endangering growth in material welfare. It may be a good sign that many prominent business leaders increasingly recognize that priority must be given to our environmental future, even if at first sight this appears to act against their own business interests.<sup>11</sup>

The strategies suggested for the period until 2010 (see Section 8 of the *Background Paper*) may have few adverse economic impacts and may even produce a positive result on account of the proposal for accelerated replacement of vehicles.<sup>12</sup> **For the period beyond 2010, diminution of many aspects of transportation industries seems unavoidable.**

Three things are required: (i) a strategy to ensure that business as a whole becomes less transport-dependent without becoming less efficient; (ii) a strategy to ensure that the much of the direct economic activity represented by transport is replaced elsewhere in Canada's overall economy; and (iii) care that in these respects Canada does not move seriously out of line with trading partners and competitors for investment, particularly the United States. Development of these requirements is beyond the scope of this paper. **What is proposed here assumes that appropriate action will be taken.** An alternative position, which is not to move towards sustainability in order to protect present interests, seems increasingly unacceptable.

**Continuing with 'business-as-usual' may in any case be more and more unbusinesslike.** Rising costs associated with environmental remediation and resource depletion could ensure that efforts to move less and use less constitute smart business decisions.

#### **4. Other considerations for the development of the Strategy**

Several additional matters elaborated in the *Background Paper*—beyond the specifics of the three scenarios and their attainment—are relevant to how things unfold during the period 2010-2025, as follows:

- Increases in real transport fuel prices are proposed by 2010, relatively small for Scenarios A and B (12% and 6%) but large for Scenario C (86%). Transport fuel use seems relatively insensitive to price in the short term, but more sensitive in the longer term.<sup>13</sup> Thus, price increases implemented before 2010 may have a continuing and even stronger effect after 2010.
- Road diesel fuel use appears to be less sensitive to price than road gasoline use.<sup>14</sup> A pricing regime applied to both could thus have different effects.
- Increases in new vehicle prices are expected before 2010 as a consequence of the enhanced fuel-efficiency standards that would be imposed (25% for Scenario A and half that for Scenarios B and C). The nature of the responses to such price increases appears to be the opposite of that for fuel prices: i.e., initially purchasers are highly sensitive but in the longer term the higher prices are accepted and purchases are made.<sup>15</sup> Thus, a higher demand for new vehicles could be expected after 2010 as a consequence of higher prices before 2010.
- Use of personal motor vehicles seems to be strongly driven by ownership.<sup>16</sup> Measures to reduce automobile use should thus include measures that make automobile ownership less necessary.
- The movement of freight by water in Canada may be declining, unlike other countries.<sup>17</sup> There could be scope for increased use of this fuel-efficient mode, perhaps moderated by low lake water levels.
- The sprawl of urban areas—resulting at least as much from low-density commercial/industrial development as low-density residential development—appears to be an important factor in the growth of transport activity.<sup>18</sup>
- Disproportionate amounts of the growth in personal vehicle use are for shopping and other ‘discretionary’ purposes rather than for work-related purposes.<sup>19</sup> A refashioning of transport activity should provide for the growing variety of destinations that such a trend appears to entail.
- Aviation poses special challenges on account of its rate of growth, the damage it appears to cause, and its present exemption from constraints by national governments.<sup>20</sup> Steps need to be taken to bring air travel with a national framework of action that applies across all modes.<sup>21</sup>

Each of these matters should be taken into account in fashioning strategies for the period 2010-2025.

## **5. Rationing transport fuel by tradable permits, a key element of the Strategy**

*For the present exercise*, the basic challenge for transport in Canada for the post-Kyoto period of 2010-2025 is to reduce overall emissions of GHGs from transport activity to 30% below the 1990 level (i.e., about 45% below the 2000 level, 55% below the ‘business-as-usual’ 2010 level, 26% below the 2010 level if Scenarios A or C apply, and 44% below the 2010 level if Scenario B applies<sup>22</sup>). In effect, this would mean equivalent reductions in fossil fuel use for transport because fossil fuel use and GHG emissions are closely correlated. Some of the reductions required by 2025 can be achieved with presently available technology. However, without major technological advances, which cannot be guaranteed, other means will have to be deployed to ensure that the whole of the challenge for the post-Kyoto period is met.

To avoid further climate change and local environmental impacts, fossil fuel use for transport will have to be considered as a scarce resource. If Scenario C unfolds, it *will* be a scarce resource, although it may not be scarce enough to ensure attainment of the 2025 reduction target. For Scenarios A and B, the scarcity could be artificial, at least for some of the period 2010-2025, in that it will be induced by governments in order to restrain use.

**In times of scarcity, the fairest approach is to ration access to what is scarce.** Economists and others often object to rationing as a violation of market principles, specifically because allocation does not occur according to need as expressed in willingness to pay. Supporters of rationing argue that the alternative is to ration by price, which could mean in the case of transport that the rich may be able to travel much as before and the poor may be able to travel very little, if at all.

**One form of rationing is nevertheless finding widespread favour: emissions trading.** Indeed, a version of emissions trading is permitted under the Kyoto Protocol. If a country exceeds its commitment, it may sell credit for the difference to another country, which acquires a correspondingly reduced commitment. In a more usual form, entitlements to emit pollution are sold or awarded by governments to individual businesses, who may trade them. The theory, and possibly the practice, is that such a scheme helps ensure that reductions in pollution are achieved at the lowest cost.<sup>23</sup> Such a scheme is a form of rationing to the extent that a limit on the total of entitlements is set and maintained. Emissions trading schemes are seen as fair to the extent that needs are met without undue hardship. Unlike a fixed-allowance rationing scheme, such schemes are flexible in that no individual or company is specifically restricted, as long as there are entitlements to be purchased.

A system involving moving sources of pollution (i.e., motorized vehicles) has not yet been implemented, but many are being discussed—within, for example, the Australian, Netherlands, Swiss, and U.S. governments.<sup>24</sup> In Canada, such a scheme was considered at the National Forum on Climate Change, organized by the National Round Table on the Environment and the Economy in 1998.<sup>25</sup>

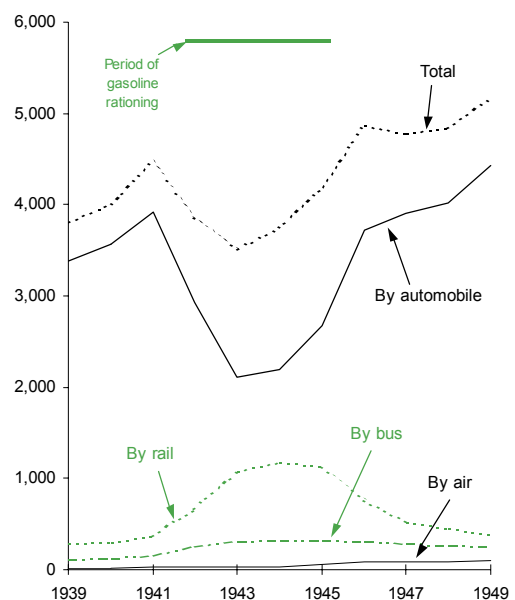
Simple rationing of vehicle fuel has been effective. Figure 1 shows that the period of wartime fuel rationing in the United States was associated with a sharp decline in inter-city automobile use and less than compensating increases in such travel by other motorized modes.<sup>26</sup> There is reason to suppose that a sophisticated, market-based system of rationing could be a fair and effective way of helping Canadians achieve the large reductions in emissions that would be required to achieve the proposed 2025 GHG emissions target.

**Here is the emissions trading scheme proposed by the Netherlands government** for an OECD study concerned with securing very large reductions in GHG and other emissions by 2030 (80% in the case of GHGs):<sup>27</sup>

Each resident would have an emissions budget for personal travel of 160 kg of carbon dioxide per year. (This was estimated to be the amount that could be permitted if total emissions from personal travel of CO<sub>2</sub>—the main GHG—were to be reduced by 80%.) The total of 160 kg would allow roughly 1,400 passenger-kilometres (pkm) of use of a 1998 automobile, 7,100 pkm in a car of the kind expected to be available in 2030, and 46,700 pkm of travel by the kind of rail service expected in 2030. The initial allocation of CO<sub>2</sub> permits in the amount of 160 kg to each person would be without charge. Individuals could buy or sell their allowances in formal or informal permit markets.

The Netherlands' proposal also included an emissions trading or tradable permit scheme for freight transport. In this, all permits to emit CO<sub>2</sub> for freight transport purposes would have to be purchased from a pool provided by gov-

**Figure 1. Per-capita inter-city travel in the U.S. 1939-1949 (passenger-kilometres per person)**



ernment. The permits could be traded after purchase. An alternative mechanism for freight transport—not proposed by the Netherlands but proposed below—would give individuals larger allowances and require deliverers of freight transport services to purchase entitlements from individuals, presumably through an organized market.

**What is proposed here is that such a scheme of tradable entitlements to emit transport GHGs be introduced in Canada early in the period 2010 to 2025, say in 2011.** It could concern GHG emissions directly, or CO<sub>2</sub>—as in the case of the Netherlands scheme—or use of fossil fuels for transport expressed in terms of GHG emissions. For the purposes of the present exercise, the scheme concerns use of fossil fuels, weighted for full life-cycle GHG emissions.<sup>28</sup>

**A limit on the total amount of fossil fuels that could be emitted by Canadians for transport purposes would be set for each year.** Each person would have his or her equal share—i.e., about one 30-millionth of the total—allocated electronically in the form of tradable permits through whatever means will be appropriate and convenient (say a multi-purpose smart card). Permits would be required for the purchase of direct transport services and of fossil fuel for transport use.

**Businesses would receive no allocation but would buy permits through brokers who purchased them from individuals.** Initially the total of available permits would be set at the respective 2010 targets, according to which of Scenario A, B or C had been achieved. The entitlement each individual would receive through the permits would decline each year both as the total was reduced to ensure progress towards the 2025 target and as the population grew.

This sketchiest of accounts of such a tradable permit scheme already raises **numerous warning flags.** On the face of it, the scheme would be complex, could require a large bureaucracy, and could be wide open to fraud. It could impose severe restrictions on the ability of businesses to function. If rationing of GHG emissions were confined to transportation, there could be severe distortion of the economy and particular unfairness for transport and transport-related industries and their main customers.

**In response, it could be said that only a rationing scheme has a high certainty of working, if it is well implemented.** A scheme allowing trading would involve much less bureaucracy and economic inefficiency than one that did not. Transportation appears to be an especially intransigent sector in terms of securing needed reductions in activity or improvements in energy efficiency. Special treatment is justified. Businesses could nevertheless be severely disadvantaged until the emergence of a well-functioning market for the tradable permits. There would have to be a transition period. However, a system that allocated permits to business on the basis of estimated need—such as the Netherlands' scheme indicated above—would not have the discipline and flexibility of a permit market. In the long run it could be more disadvantageous to business.

**In a well-working tradable permits scheme people would have choice.** One person might travel little and secure additional income from selling his or her permit allocation. Another person could use the year's allowance for a couple of journeys by air (if there is much aviation after 2010). Yet another person could maximize distance travelled within his or her allowance by heavy use of trains. A fourth person could travel extensively by car and purchase the many permits that would be required to do this.

The implementation of a tradable permit scheme would provide a huge boost to the development and use of transport modes that did not require permits. A city's transit system would become a favourite mode if its vehicles were electrically powered in ways that resulted in few or no GHG emissions. The permit scheme could become increasingly irrelevant to everyday travel and freight movement as sustainable alternatives were developed, but might have to be retained to avoid relapse into fossil fuel use for transport.

## 6. Attitude change: an equally important element

If a government today were to try to introduce such a scheme it would be voted out or otherwise thrown out of office. **Rationing is accepted only when there is extreme scarcity or other emergency, such as war, and then only with great difficulty.** Major tasks of government in the period before introduction of such a scheme would be to demonstrate first the need for scarcity, and second the fairness and flexibility of the tradable permit scheme compared with alternative strategies. In the case of Scenario C, the scarcity would be evident but much education and persuasion could still be needed to secure acceptance of a tradable permit scheme.

Governments can act firmly with greater ease *when* crisis occurs, but not before. The temptation to wait until things begin to go wrong is thus strong and understandable, but delay in the face of the inevitable can be profoundly counterproductive. For these reasons, if Scenario C were to happen the educational responsibilities of governments would be easier to assume.

Once a well-administered tradable permit scheme were in place it would serve as a powerful educational tool. People and businesses would be reminded daily of the need for change in transport matters, and of some of the reasons for the change.

## 7. Land use change: an important complementary element

Compact urban form reduces the need for travel and makes travel by fuel-efficient means—public transit, walking, and bicycling—more feasible. Reversal of decades of urban sprawl will be a matter of further decades.<sup>29</sup> An early start would be advantageous. Waiting until restraints on transport impel higher densities could leave millions of residents and thousands of businesses in progressively disadvantageous positions, increasingly unserved by adequate transportation. **Present and recent land-use planning systems do not seem up to the task of remedying sprawl. New tools are needed, including fiscal measures that encourage more compact urban form.**

Today's land taxation systems encourage sprawl by taxing *uses* rather than land itself. **If all property taxes fell on land rather than on the uses of land, and if all land in an urban region were taxed at the same rate, there would be a strong incentive to engage in more intensive development and redevelopment.** Land values would still be higher near the core of the region, but the present large centre-periphery differences that encourage sprawling development would be dramatically reduced.<sup>30</sup>

An early wholesale shift to such a more rational property-tax regime is inconceivable. It would be enormously disruptive and bring unmanageable hardship to owners and users of sparsely occupied peripheral land. What could possibly be countenanced—with appropriate education—would be a gradual progressive change over some decades to a fiscal regime that encouraged compact urban form. The new fiscal regime would reflect the principle that urban land is a scarce resource. Such a change would have to be applied in concert with **strict limits on the extent of the urban region.**

As well as the imposition of urban boundaries, land-use planning principles would need supplementation, particularly as they relate to ownership of automobiles. Section 7 of the *Background Paper* suggests there are few more important contributing factors to automobile use than automobile ownership. An effective **new principle of land-use planning** could be to move towards **ensuring that in each part of an urban region it is as advantageous to live without owning a vehicle as to live with owning a vehicle.** This would require detailed examination of the parts of urban regions where a majority chooses not to have a car, and—to the extent possible—applying the critical features of these parts to other areas.<sup>31</sup>

**The application of such a principle would require careful assessment of exactly what cars are used for, how they could be replaced, and what it would take to replace them.** For example, if shopping were the main reason found for car ownership, there could be a strong emphasis on encouraging local stores and also delivery services. If weekend trips were the main reason, a neighbourhood car rental outlet could be the answer. If a range of infrequent but necessary short journeys carrying items to a variety of destinations were what impelled car ownership, support could be given to establishing car-sharing services.

Such a planning principle is not coercive in the usual sense of the word. It depends not so much on telling people what to do as on creating a milieu in which people are increasingly inclined to do what is needed in the public interest.

Other devices can be employed to rationalize the use of land towards reducing transport activity. Many are caught under the rubric of “smart growth”, which refers to attributes of land development and redevelopment consistent with lower-than-average rates of automobile use.<sup>32</sup> These include project location (e.g. downtown or periphery), variety of uses within buildings, orientation to pedestrian network, and many others. They also include supporting measures such as location efficient mortgages, which take account of the higher disposable incomes of households in areas served by transit (because car ownership is less necessary).

## **8. Public transit enhancement: another key complementary element**

Compact urban form makes public transit more feasible, but so do more passengers. In the early 1990s, exercises of the imagination by urban planners and others in the Toronto and Vancouver regions resulted in a report on how the two regions could possibly function in the event private automobiles were banned or otherwise removed from the scene.<sup>33</sup> An important insight emerged during work on the project, one that is obvious when you think about it but did not seem so at the time. It is that **comprehensive public transit could be viable at much lower densities than at present if there were no (or less) competition from personal automobiles.** Accordingly, the imperative to achieve dense urban regions was not felt to be so strong at the end as at the beginning of work on the project, although good reasons remained for intensification (e.g., to increase accessibility generally, and to enhance the textures of communities).

The corollary of this insight is that **as travel by personal automobile becomes restrained by the tradable permits scheme, travel by public transit could flourish, at least to the extent it were available and associated with lower emissions of GHGs per person kilometre travelled.** From the perspective of sustainability, the strongest advantage of public transit could be its ability to use electric power from rails and wires, and ultimately from renewable sources (wind, solar, biomass combustion, etc.).

Over the last forty years, urban public transit in Canada has changed from being a profitable business to one that requires capital subsidies (from the 1960s) and operating subsidies (from the 1970s), chiefly the result of growth in the amount of automobile use. Subsidies have been forthcoming, but with diminished enthusiasm and perhaps with more regard for transit’s potential contribution to the avoidance of congestion than for the vital role it could play in progress towards sustainability.<sup>34</sup>

For restraints on travel to be accepted and effective, **alternative, more sustainable modes of travel will have to be available,** notably public transit. Otherwise there could be substantial impoverishment of life for very large numbers of people. The challenge is to find early funding that will allow timely investments to be made, particularly in rail-based and wire-based systems but also in less conventional systems for lower-density areas such as dial-a-bus.

Perhaps the most promising strategy for diverting funds to public transit was one that appears to have been almost adopted by Stockholm City Council in the late 1980s.<sup>35</sup> The scheme involved **requiring each vehicle moving in the city to show evidence of purchase of a valid transit pass**, for the day, week or month. The result could have been a vast infusion of funds into the transit system from users of other vehicles. It would not have been a simple tax, because vehicle users would acquire an instrument of value that could be used by household members or sold to third parties.

Such a large infusion of funds is required to ensure present transit investments that will allow necessary systems to be in place a decade from now. Moreover, if levies on the use of other vehicles are the source of the funds that use will be further restrained, thus serving to make the investments in transit more productive in terms of higher ridership levels and higher modal shares for transit.<sup>36</sup>

## 9. A few words about sustainable freight transport and inter-city transport,

Both the *Background Paper* and the above discussions have focused perhaps unduly on the movement of people, on travel by automobile, and on travel within urban regions. A higher proportion of the movement of freight—as opposed to the movement of people—appears to be between rather than within urban regions, although perhaps about a quarter of the motorized movement of people is also outside of urban areas.<sup>37</sup> As noted here in Section 3, freight transport is vital for Canada's economy.

**The challenges in moving Canada's freight more sustainably, while retaining economic prosperity, seem overwhelming.** An important opportunity may lie in moving more freight by water. Global warming could make this more feasible, especially if passages are not made unnavigable by drought conditions.

On land, as for urban transit, **movement by rail could present the most sustainable options if massive electrification occurs.** Such investments could also serve the inter-city movement of people.<sup>38</sup>

The possible demise of commercial aviation could be a strong spur to major investment in rail. **Emerging evidence points to strong global impacts of high-altitude emissions, far in excess of those from ground transportation.** In the unlikely event current worldwide trends were to continue, aviation could be making a larger contribution to climate change than either trucks or automobiles after 2010.<sup>39</sup>

## 10. Implications for the present decade

Much of what may have to be done during the post-Kyoto period requires preparation during the present decade. Above all, attitudes must begin to change; mechanisms must be put in place that will begin to reverse trends in land use; and transport investment must begin to be redirected away from movement by road and air towards potentially more sustainable modes.

Two matters in the news in 2001 offer **hope that these changes will be considered.** One is what appears to be the start—in California—of the crumbling of North America's present energy system. Above all this appears the result of high natural gas prices, although other factors are evident. The high prices are caused by unanticipated shortfalls in supply coupled with greatly increased use of natural gas for generating electric power and for other purposes.<sup>40</sup> What is happening in California has many lessons for the next few decades about fossil fuel pricing, fuel supply and demand, and the need for change.

The other promising matter is the reports of huge returns being generated by Canadian oil and gas companies. A natural inclination will be for much of these gains to be invested in further exploration. If the analysis associated with Scenario C is valid—see Section 4 of the *Background Paper*—such investment will not be as productive as it has been in the past. Alternative investments—into renewable energy

sources, rail electrification, urban public transit, and so on—could be more attractive, especially with the right kind of incentives by government.

What happens post-Kyoto will be much influenced by which one of the scenarios set out in the *Background Paper*, if any, applies during the present decade. Scenario C will induce many more relevant preparations for the post-Kyoto challenges. Scenario A—which speaks to an effective national climate change strategy—will imply early attitudinal changes that will auger well for the post-Kyoto period. Scenario B—in which the Kyoto commitment applied to transportation will not be met—or something even less effective, may not prepare Canadians well for the challenges ahead. Moreover, the reduced accomplishments before 2010 will make the post-Kyoto tasks that much more difficult. Perhaps the only positive thing that can be said about Scenario B is that it could imply less reliance on purely technological solutions than Scenario A. Thus, Canadians may be more ready to accept strategies such as the proposed tradable permit scheme when it becomes necessary.

## 11. Concluding remarks and questions for the workshop

The main aim of this *Strategy* and the companion *Background Document* is to **provoke discussion about transport strategies for the post-Kyoto period**—from 2010 to 2025—at the workshop to be held on November 8, 2001.

The challenges appear huge, beyond those that are ordinarily contemplated in thinking about transport futures. There is a disposition in our society to minimize such challenges, or **not to engage in long-term planning at all**. Present concerns are compelling and exciting, and things have more or less worked out well so far. But there is a strong possibility that the tide of human good fortune is about to turn. Careful consideration of potential options can help avoid severe adverse effects, and may point the way to even better transport systems than we have now.

**Meeting the challenges will require resolute effective action of a kind encountered only in war and disaster.** Achieving sustainable transportation will require tough measures such as fuel rationing and new taxes on land. It will not be achieved with speed bumps and carpooling (although these could help).

**Here are questions that could be addressed at the November 8 workshop:**

### *Morning breakout sessions on policy options for the shorter term (until about 2010):*

1. Are the three scenarios for 2010 set out in the *Background Paper* reasonable?
2. What other scenarios for 2010 should be considered?
3. Is the *Background Paper* correct to focus on new-vehicle fuel-efficiency improvements as the main means of reaching emissions targets for 2010?
4. Are the complementary measures proposed in the *Background Paper* appropriate (i.e., fuel-price increases, incentives for vehicle replacement, and improvements to existing transit services)?
5. Are the measures proposed in the present *Strategy* document for the present decade in preparation for achieving results during the period 2010-2025 appropriate (i.e., changing public attitudes, reversing trends in land use, and redirecting transport investment)?
6. What else should be done before 2010?

***Afternoon breakout sessions on policy options for the longer term (2010-2025):***

7. Is the target for 2025 reasonable?
8. What other targets should be considered?
9. Is the *Strategy* correct to focus on market-based fuel rationing as the main means of achieving the effects required during 2010-2025?
10. Are the complementary focuses in the *Strategy* appropriate (i.e., changing public attitudes, reversing trends in land use, and redirecting transport investment)?
11. What else should be considered for 2010-2025?
12. Is the proposed strategy of *not* relying on unproven technology for the period after 2010 useful?

***Question for both the morning and the afternoon sessions:***

13. How can more concern about the future of transportation be stimulated; and how can relevant information be best disseminated?

## End Notes

References to endnotes in this paper are in the form 'Note 1'.

Reference to endnotes in the companion *Background Paper* are in the form 'BPN 1'.

- <sup>1</sup> 'Sustainability' can be defined as a condition in which the needs of the present are met in ways that do not compromise the ability of future generations to meet their needs. This is derived from the definition of 'sustainable development' set out in the report of the UN's World Commission on Environment and Development, which popularized the notion of sustainability (*Our Common Future*, Oxford University Press, 1987, p. 41—also known as the Brundtland report after the Commission's chair, the then Norwegian prime minister Gro Harlem Brundtland). Prescriptions for sustainability include, "Leave the world better than you found it, take no more than you need, try not to harm life or the environment, make amends if you do." (Paul Hawken, *The Ecology of Commerce*, Harper-Business, 1994). A definition of 'sustainable transportation' appears in Section 3 of the *Background Paper*.
- <sup>2</sup> A useful review of the extent of degradation of the planet's surface by human activity is United Nations Environment Program, *Global Environment Outlook 2000*, EarthScan Publications, London (UK), 1999. A corresponding source for Canada is *Human Activity and the Environment 2000*, Statistics Canada, Ottawa, 2000.
- <sup>3</sup> See BPN 1 for information about the Kyoto Protocol. Note particularly that the year 2010 is used as a shorthand form for the *Kyoto commitment period* of 2008-2012.
- <sup>4</sup> See BPN 6 for Canada's projected energy and emissions growth and the International Energy Agency for world growth (at <www.iea.org>).
- <sup>5</sup> For a note on the scale of the required reductions and the target date of 2030, see BPN 9. See also BPN 5 for a note on transport's role.
- <sup>6</sup> "Commitment" is used here loosely. As noted more fully in BPN 1, Canada, in common with almost all other OECD countries, has signed but not ratified the Kyoto Protocol, which is thus not yet in effect.
- <sup>7</sup> Fuel cells and the electric motors they drive are proven technology that is far from ready for market. In one sense they antedate the internal combustion engine. (Welsh scientist and lawyer William Grove is credited with demonstrating the fuel-cell principle in 1839, although it was nearly 100 years before the first useful devices were produced. See "What is a Fuel Cell? Fuel Cell Commercialization Group, at <www.ttcorp.com/fccg/fc\_what1.htm>.) However, notwithstanding claims by major automotive firms that mass production of fuel-cell vehicles will begin in 2004 (Denis DesRosiers, "Fuel Cell Technology", *Maclean's*, October 30, 2000; Andrew English, "Coming Clean", *Daily Telegraph* (London, UK), July 8, 2000), the prospect of relief through this technology seems distant. The production challenges seem huge (see Crosse J, "A whole new business", *Automotive World*, November 2000, pp. 38-43). There is little indication as to expected costs, but it is hard to believe they would not be several times those of the power trains of conventional vehicles (and thus make the project unfeasible). As well as the production challenges, there is the critical matter of fuel. Fuel cells require hydrogen, but ready distribution of this fuel seems decades away, if ever feasible, on account of the technical challenges of distribution and storage and the *energy costs* of production of hydrogen. A recent assessment of these energy costs suggests they would be higher than for conventional engines (Keller M, Zbinden R, *'EST-Alpine': Feasibility of the technological Challenges*, INFRAS, Zurich, Switzerland, 2000). Thus, unless renewable energies are used, which may take many decades to develop to the level required for replacement of present, non-renewable energy, production of hydrogen as a fuel seems impracticable. For such reasons, automotive manufacturers are focusing on in-vehicle production of hydrogen: from gasoline in the case of General Motors, and from methanol in the case of DaimlerChrysler (see Crosse, this note). Gasoline has the advantage of being readily available, but it is relatively difficult to produce hydrogen from, and the overall reduction in emissions is relatively small. Natural gas is another option, but does not seem to be being embraced by a major manufacturer. These processes, especially for gasoline, require bulky and expensive on-board reforming equipment (described as the equivalent of a small oil refinery in each car). An alternative process is fuel-station production of hydrogen, but in-vehicle storage then become a major challenge. The future of fuel cells may well be bright, but perhaps not within the 2010-2025 time frame of the present exercise. This matter is discussed more fully in Issue No. 5 of the *Sustainable Transportation Monitor* (Centre for Sustainable Transportation, November 2001; available at <www.cstctd.org>).
- <sup>8</sup> See the OECD's EST project, referenced in BPN 9.
- <sup>9</sup> In poorer countries, lack of adequate transport is often a barrier to healthy living. There, overall increases in mobility may be consistent with sustainability. See, for example, *Transport*, Draft Report of the UN Secretary-General to the Ninth Session of the Commission on Sustainable Development, April 2001 (available at <www.un.org/esa/sustdev/csd.htm>).
- <sup>10</sup> The Centre for Sustainable Transportation is planning work on the key issue of workforce transition in automotive industries in response potential declines in transport activity.
- <sup>11</sup> For a remarkable example of this see the speech made to a Greenpeace meeting in London, England, by the chairman of the Ford Motor Company on October 5, 2000. Bill Ford said that the automobile has had a serious negative impact on the environment, and that his industry had wrongly played down the threat from global warming ... [that] the Kyoto Protocol would not provide deep enough cuts to halt global warming ... that the day will come when the whole notion of car owner-

ship is antiquated ... people will not want to own cars, but merely have access to mobility. (report by Michael McCarthy in *The Independent* (UK) newspaper, October 6, 2000). Another recent remarkable speech was made by Toyota president, Fujio Cho, at the North American International Auto Show in Detroit on January 8, 2001. Mr. Cho said, "The automobile industry is running out of time. ... automobile pollution has made some cities almost unliveable ... The industry must limit the car's impact on our Earth." (Greg Keenan, "Clean up, car makers told," *Globe & Mail*, January 9, 2001).

- <sup>12</sup> Such a result was found in the Swedish contribution to the OECD's EST project (see BPN 9 for a source containing information about this project).
- <sup>13</sup> For shorter- and longer-term elasticities, see BPN 25.
- <sup>14</sup> For the relative insensitivity of diesel fuel to price changes, see BPN 19 and BPN 25.
- <sup>15</sup> For responses to vehicle price increases, see BPN 63.
- <sup>16</sup> For the role of ownership in vehicle use, see Figure 15 in the *Background Paper* and associated text.
- <sup>17</sup> For information on marine freight, see Figure 8 in the *Background Paper*.
- <sup>18</sup> See the sources detail in BPN 51 and 55.
- <sup>19</sup> For purposes of travel, see Figure 13 in the *Background Paper* and associated text.
- <sup>20</sup> See Issue No. 3 of the *Sustainable Transportation Monitor* (available at <[www.cstctd.org](http://www.cstctd.org)>).
- <sup>21</sup> International marine activity is similarly exempt, and requires similar accommodation within national strategies. However, the global environmental issues related to marine activity may be less acute.
- <sup>22</sup> These percentages are based on information in Table 2 of the *Background Paper*.
- <sup>23</sup> If it costs Company A \$10,000 a tonne to reduce sulphur dioxide emissions into the atmosphere, and it costs Company B \$50,000 a tonne, both companies benefit if Company A sells SO<sub>2</sub> emission entitlements to Company B for \$30,000. There is no adverse effect on the environment (only the same amount of SO<sub>2</sub> is emitted), and both companies are better off.
- <sup>24</sup> For a proposal by the Australian government's Bureau of Agricultural and Resource Economics for tradable GHG emission permits for Australian businesses, see the *Sydney Morning Herald*, March 20, 1998. For the suspicions of the American Petroleum Institute that the U.S. government is thinking about fuel rationing, see the Institute's August 1996 press release. For work on rationing done for the Netherlands government see the later part of this section. For the Swiss government's proposal to ration air travel see the 1997 publication of the Swiss Agency for the Environment, Forests and Landscape, *Climate in Danger: Facts and Implications of the Greenhouse Effect*.
- <sup>25</sup> From McMaster University's *Energy Studies Review*, June 1998.
- <sup>26</sup> The data in Figure 1 are from Rosalyn A. Wilson, *Transportation in America: Historical Compendium 1939-1995*, Eno Foundation, 1997, p. 20.
- <sup>27</sup> See the source for the OECD's EST project in BPN 9.
- <sup>28</sup> The weighting would take into account the type of the fuel, e.g., electricity from coal would count much more than electricity from natural gas, and gasoline would count more than natural gas. It would also take into account the GHG-emissions associated with production of the fuel.
- <sup>29</sup> For an illustration of sprawl see Figure 14 of the *Background Paper* and the associated sources.
- <sup>30</sup> See the Web site of the Geonomy Society for examples where taxes on land rather than the uses of land have been applied with apparently positive results (at <[www.progress.org/geonomy/geono05.htm](http://www.progress.org/geonomy/geono05.htm)>).
- <sup>31</sup> This principle is spelled out in Gilbert R, Reducing automobile use in urban areas by reducing automobile ownership: the EANO principle. In Andan O et al. (eds.) *L'avenir des Déplacements en Ville/The Future of Urban Travel*, proceedings of the 11th Entretiens Jacques Cartier, Laboratoire d'Economie des Transports, Lyon, France, December 1998. An earlier version of this paper was published as Gilbert R, Reduced car ownership as a route to clean transport, *World Transport Policy & Practice*, vol. 4(3), 1998. EANO stands for Equal Advantage for Non-Ownership.
- <sup>32</sup> For a recent account of smart growth see Chen DDT, The Science of Smart Growth. *Scientific American*, December 2000, pp. 84-91.
- <sup>33</sup> *Cities without Cars: An exploration of how two of Canada's largest urban regions might cope with the disappearance of the private automobile in the early part of the 21st century*. Canadian Urban Institute, Toronto, 1994.
- <sup>34</sup> The following points are not made strongly, for lack of good evidence, particularly from North America, but it may be nevertheless worth noting that transit subsidies *alone* may not be effective in inducing people to switch from car use to public transit use. Subsidies can be used to reduce fares or improve service, or both. Regarding fare reductions, a major assessment of experience in Europe concluded, "The use of subsidy to lower public transport fares is not generally effective for achieving a change in public transport relative to cars" (*Effectiveness of measures influencing the levels of public transport use in urban areas*, European Commission, Luxembourg, 1996, p.46). Improving service levels has more effect, but the main increases in transit use come from existing rather than new transit users. Moreover, increasing transit capacity (e.g., by adding more buses) can have the perverse effect of reducing environmental performance (i.e., emissions per person-kilometre) if there is not a commensurate increase in ridership. The European study concluded, "... direct policy instruments on their own have little impact on modal shift to public transport. The most successful implementations are likely to be those which combine direct and indirect measures, through a combination of physical, flow control, and relative pricing measures" (p. 45). This can be taken to mean that in order to increase transit use it is necessary to do both of improving transit service *and* restraining automobile use. This conclusion

is supported by work on the separate EU-funded TransPrice project, which concluded that "... a package of measures based around charges (parking or road pricing) coupled with improvements to public transport or park and ride services produce the best results" (see <palace.york.ac.uk/transprice/papers/ptrc98.html>). This conclusion is complemented by the conclusion reached at a workshop held by the European Conference of Minister of Transport in Athens in June 1999 that "... the effectiveness of [transit improvement plans] was compromised by lack of or inadequate complementary measures" (see <www.oecd.org/cem/UrbTrav/Workshops/PublicTr/index.htm>).

- <sup>35</sup> There seems to be no documentation in English about this proposal, which remains to be verified beyond anecdotal accounts. However, the strategy remains worthy of consideration.
- <sup>36</sup> See Note 34 for a discussion of the potential importance of restraining other vehicle use to achieve high levels of effectiveness of investments in transit.
- <sup>37</sup> Work by the IBI Group for the Government of Canada's participation in the OECD's EST project (for a source on the project see BPN 9) estimated that in the Quebec-Windsor corridor, 70-75% of the motorized movement of people—i.e., person-kilometres moved—in 1990 occurred within urban areas

(see Exhibit 6.5 of Canada's report on its Phase 2 work, March 1998). No such estimate could be developed for freight movement.

- <sup>38</sup> Several of these points concerning freight transport are elaborated in *Sustainable Transportation Monitor*, No. 4, Centre for Sustainable Transportation, April 2001 (at <www.cstctd.org>).
- <sup>39</sup> For elaboration of the points concerning aviation, see *Sustainable Transportation Monitor*, No. 3, Centre for Sustainable Transportation, March 2000. During the last year, the evidence concerning aviation's global impacts appears to have become stronger (see, for example, Sausen R; Schumann U, Estimates of the climate response to aircraft CO<sub>2</sub> and NO<sub>x</sub> emission scenarios, *Climatic Change*, vol. 44, 2000).
- <sup>40</sup> For comments on natural gas supply, see Woronuk in BPN 20.
- <sup>41</sup> Richard Gilbert, the author of this paper, is an independent consultant in urban issues who focuses on transportation, waste management, energy systems, and urban governance, with clients in the public and private sectors in North America and Europe. He serves as transport consultant to the Environment Directorate of the Paris-based Organization for Economic Cooperation and Development (OECD) and as part-time research director of the Toronto-based Centre for Sustainable Transportation. He can be reached at 15 Borden Street, Toronto, Ontario M5S 2M8; tel. 416 923 8839; e-mail: richardgilbert1@csi.com.