# *Towards the Use of Emission Taxes in Canada*

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## Introduction

In this presentation I will cover three topics: the context (international and domestic) for environmental policy in Canada, the basic principles of pollution tax design, and the priority I would suggest for proceeding with this policy instrument.

## 1. The Context

Please refer to Appendix 1, where I have included a selection of international and domestic data to illustrate several points.

Figure 1 shows an example of the widely-noted phenomenon that emissions seem to grow with economic activity in *low-income* settings, but in high-income settings emissions tend to fall with rising incomes. From both graphs it appears that robust economic growth is not necessarily bad for the environment.

Figure 2 shows that in the US, economic growth since WWII has been largely decoupled from air pollution emissions. Comparable data for Canada over the same interval are not available, but would not likely be dissimilar.

I have not included $CO_2$ in Figure 2 because it is not a pollutant under EPA rules, nor is it a health hazard.

Figure 3 shows that some common air contaminants in Toronto have declined markedly over the past few decades, while progress has been modest or nonexistent on others. Also, bear in mind the fact that economic activity in Toronto more than doubled between 1971 and 1996.

Figure 4 shows vehicle-related air pollution emissions remained constant from 1985-1997 despite the rise in the total amount of driving that took place.

Some conclusions pertinent to your work are:

- Canada has been successful in controlling pollution levels in recent decades.

- This has been accomplished using unsophisticated, inefficient command-and-control policies. Policies like these will be less and less effective in the future and will accelerate the economic costs of environmental protection. If further progress is to be made economic instruments should be applied.

- While pollution in Canada is a *challenge* it is not a *crisis*. You can motivate economic instruments on the basis that it will allow us to accomplish future goals more cheaply. But the public (rightly) does not perceive a crisis and claims to this effect will only generate skepticism about your motives.

## 2. Some Basic Principles of Environmental Taxation

The theory of optimal environmental taxation was worked out by Agnar Sandmo in an article in the Swedish Journal of Economics in 1975. Some points that have emerged from Sandmo's work are the following. (Detailed explanations are in Appendix 2).

*There is an "optimal" level of taxation on commodities, including those which generate pollution.*

- The optimal level of taxation is determined by the government's overall revenue needs, the market characteristics of each commodity, and the externalities generated by the commodity. The observation that a commodity generates pollution only justifies an additional "green" tax if the current tax rate is below the optimum.

*The optimal tax rate is the sum of the revenue-raising portion and an extra charge associated with Marginal Damages.*

- "Marginal Damages" represents the total amount that people who are fully-informed about the effects of the pollution would be willing to pay to reduce emissions by one unit, if they had the option to go into a market and buy such emission reductions.

*Pollution taxes should be considered primarily for their environmental effects, not for their revenue potential.*

- The need to raise revenue does not, on its own, justify introducing "green taxes", nor would the need to reduce the overall tax burden justify a reduction in green taxes.

*Pollution tax rates interact with the overall burden of the tax system in a paradoxical way.*

- The heavier the economic burden of the general tax system, the lower pollution taxes should be. Likewise, the less the overall burden of the tax system, the greater the rate at which pollution should be taxed.

*The key step in implementing emission charges in a systematic way is to obtain estimates of Marginal Damages.*

- Without these you are merely playing guessing games with environmental policy. Marginal damages estimation is common in the US, and some of the leading experts in the field in North America are Canadians.

# 3. A Suggested Policy

## *Motor Vehicle Emissions Pricing*

Our urban areas have continuing air quality issues due to the rapid rise in motor vehicle use and the preference for larger SUV-type vehicles. Some commonly-heard suggestions are not useful in this regard.

- Ontario's "Drive-Clean" emission testing program ("Air Care" in BC) costs a lot and has no measurable benefits. Few vehicles are affected, the tune-ups are minimal and have temporary effect, the program does not affect one's choice of vehicle at the time of purchase nor does it influence the propensity to drive rather than walk or take public transit.
- Taxes on new "gas guzzlers" do not induce a shift in buyer preference towards new compact cars. They induce a shift towards *used* gas guzzlers.
- Costly emission technology requirements on new vehicles reduce the relative cost of used vehicles and encourage people to keep older vehicles on the road longer. Since older vehicles are "dirtier" these effects undermine the intent of the policy.

A better alternative would be an emissions tax on motor vehicles.

### Operation

Cars would be inspected at the time of license renewal and assigned an emissions class, say on a scale from 1 to 30, with 1 being the cleanest and 30 being the dirtiest per km. Call the emissions class *E*. Then the license renewal fee would be

$$Fee = E \times D \times L$$

where *D* is the total distance (in 1000 km) driven since the last license renewal
*L* is a coefficient reflecting the local marginal damages per 1000 km from a vehicle of class *E*.

### Examples:

Suppose you have driven 15,000 km in a vehicle rated $E = 20$ and your local marginal damages coefficient is $L = 0.6$.

Then $E = 20$
$D = 15$
$L = 0.6$

Your renewal fee would be $20 \times 15 \times 0.6 = \$180$.

Suppose you have driven the same amount, but you have a vehicle rated $E = 4$. Your renewal fee would be $4 \times 15 \times 0.6 = \$36$.

Knowing you will face these kinds of renewal fee, you have an incentive to drive less, get your car tuned up to a lower emissions class, or get a cleaner type of car if you have to drive that much.

### Effects

The incentives created by such a pricing scheme would be:

- Those who drive a lot will tend to buy low emission vehicles.

- High-emission vehicles would be allocated through the used car market into the hands of people who either live in low-damage areas (i.e. rural and remote areas that don't have air quality problems) or who drive very little.
- Mechanics would find growing demand from vehicle owners on maintenance options to keep vehicles in a lower emissions class.
- Automakers will be able to readily identify a target market for low emission vehicles and respond accordingly.
- Regardless of your vehicle emissions class, all vehicle owners would have a continuous incentive to economize on distance traveled. This may translate into increased ridership on public transit, and elimination of the most frivolous car trips.

An alternate to the above would be to have drivers pre-pay a distance allowance at the time of license renewal, then at the next license renewal either make up the outstanding amount or obtain a refund on an overpayment.

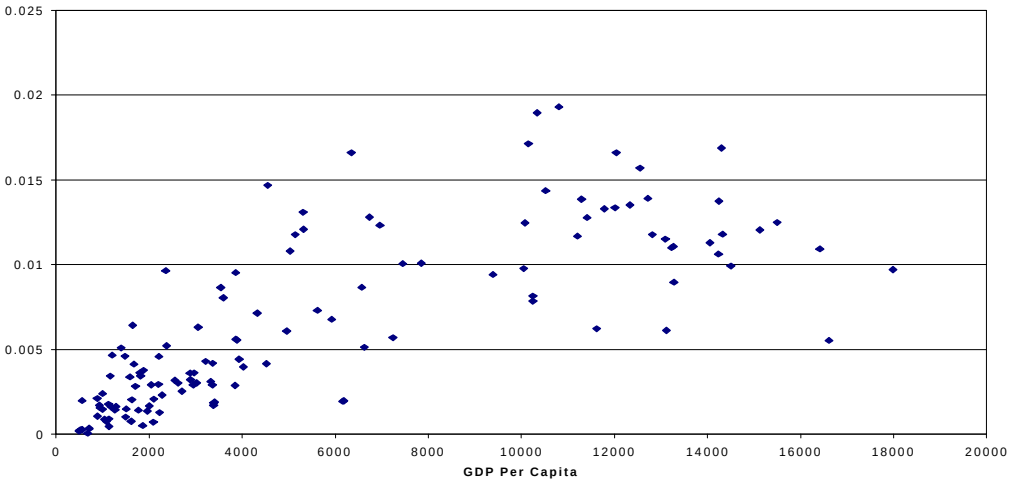
## Administrative Issues

Such a pricing scheme would have to be coordinated among Finance Canada, Transport Canada and the Provincial Governments. The pricing scheme outlined would supplant some current policies of the latter 2 groups.

Such a program would automatically generate the information needed to assess its effectiveness, since license renewal information would tally up the distribution of vehicle types and their usage levels in each region.

# Appendix 1: Selected International and Domestic Pollution Data

Figure 1: International Comparisons
Organic Water Pollution Emissions per worker vs. Real Income per Capita for 65 countries, 1983 and 1994




Total Suspended Particulates in parts per million, 1995 average, vs. Real Income per Capita

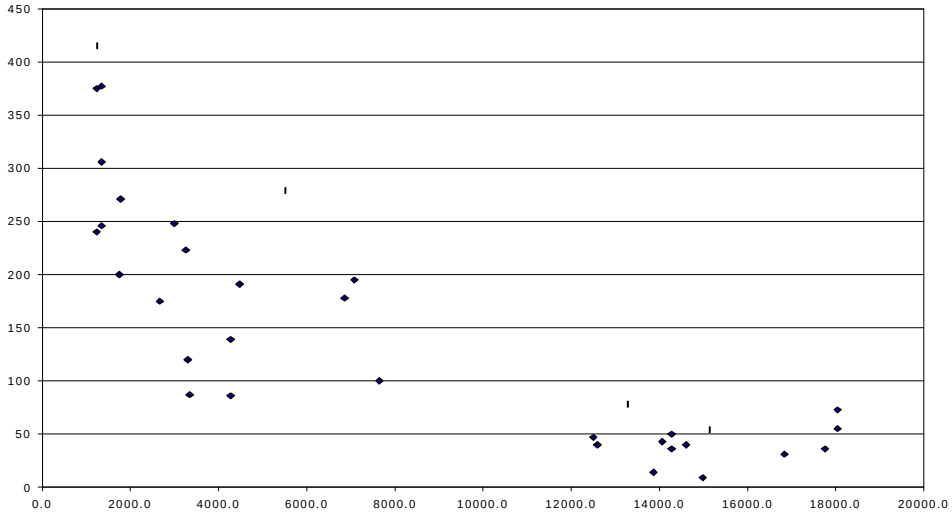


Figure 2: Comparison over Time
US Air Pollution Emissions versus Economic Growth, 1947-1997
All values indexed to start at 1947=100

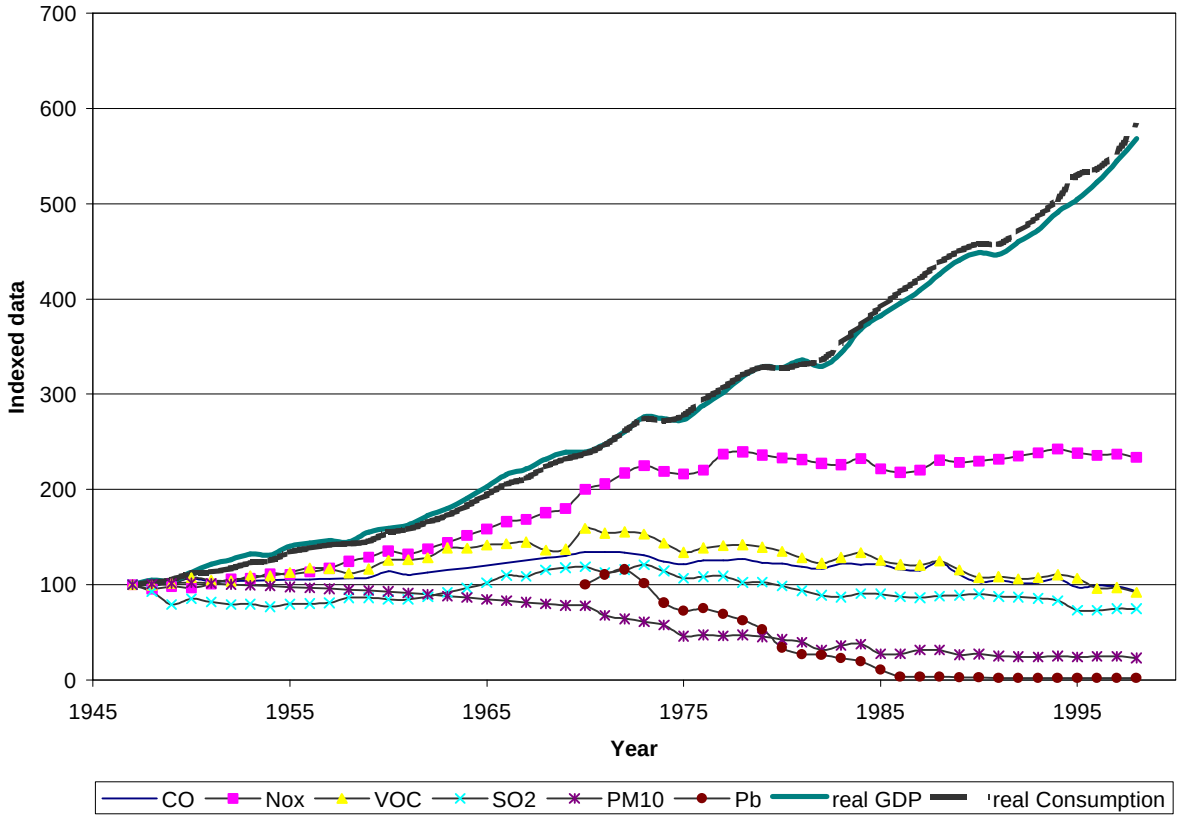
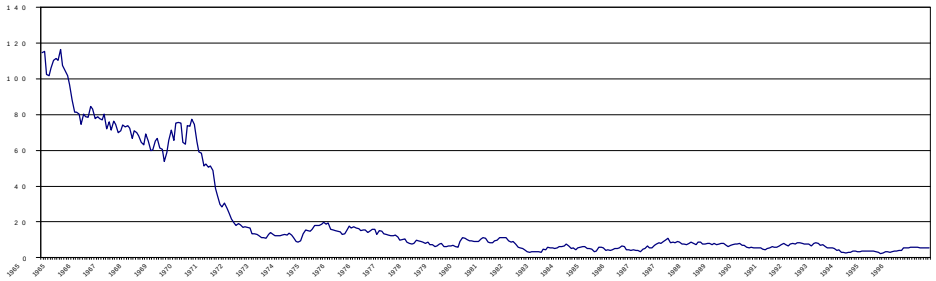


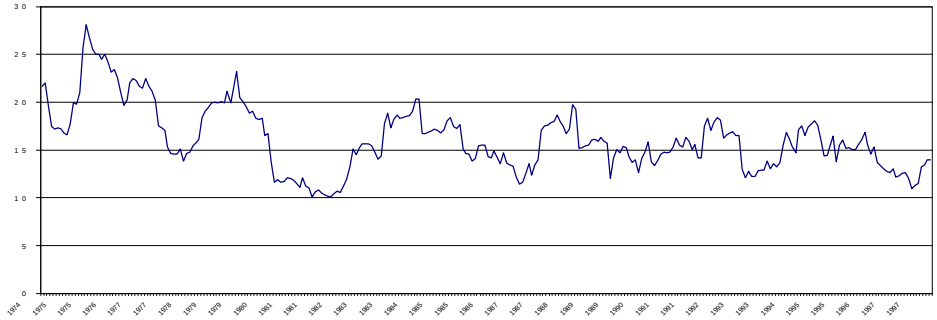
Figure 3: Air Pollution Concentrations over Time, Toronto (12 Month Moving Averages)

$SO_2$ Concentrations, 1965-1997

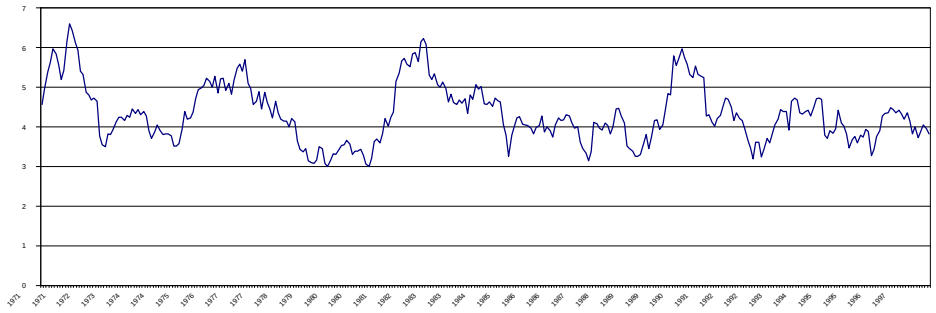


Total Suspended Particulates, 1962-1997

Ozone Levels, 1974-1997



Coefficient of Haze, 1971-1997



NOx Concentrations, 1974-1997

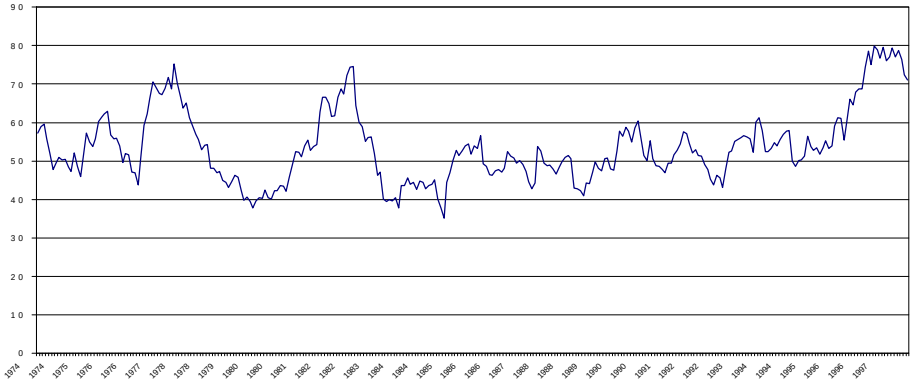
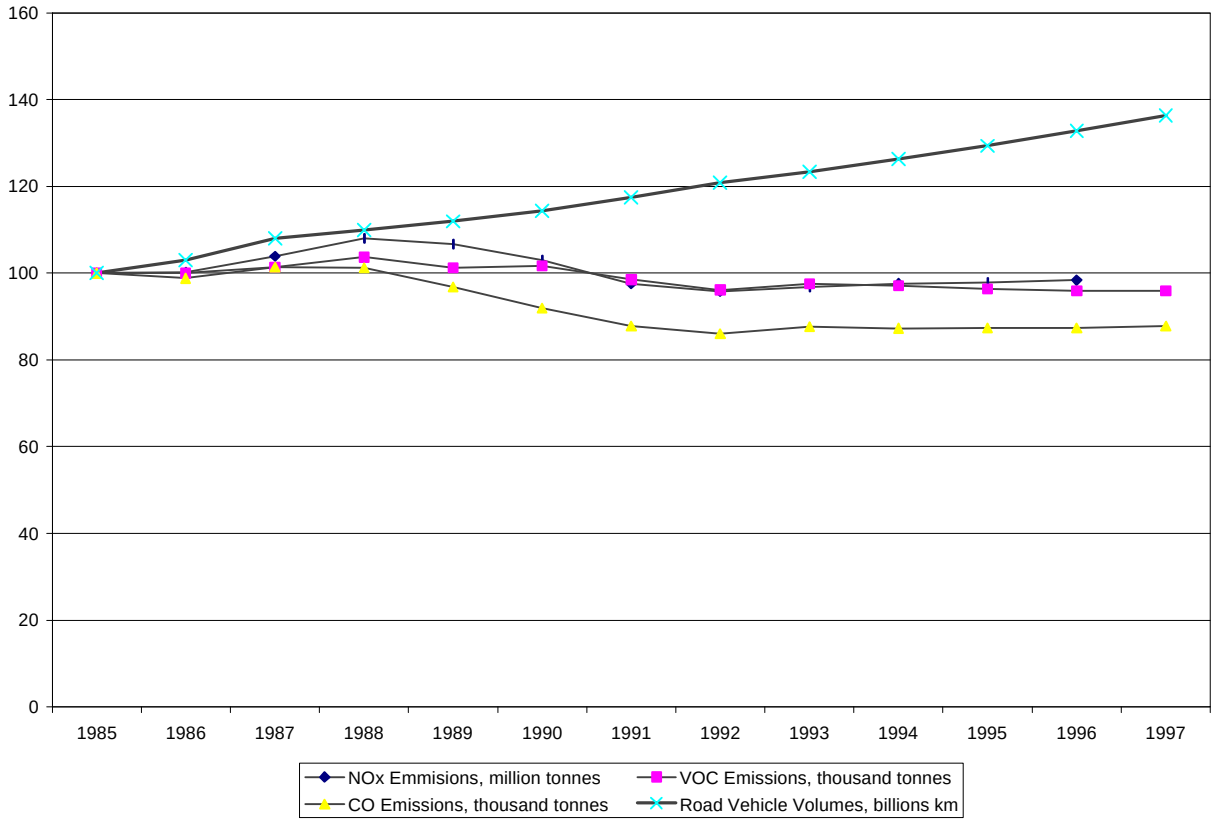


Figure 4: Canada: Motor Vehicle Use and Emissions, 1985-1997




data scaled to 1985=100

# Appendix 2: Some Technical Details Concerning Green Tax Design

The basic theory of optimal environmental taxation was worked out by Agnar Sandmo in an article in the Swedish Journal of Economics in 1975. Some points that have emerged from Sandmo's work are the following.

There is an "optimal" level of taxation on commodities, including those which generate pollution. The optimal level of taxation is determined by the government's overall revenue needs, the market characteristics of each commodity, and the externalities generated by the commodity.

The basic Sandmo formula is:

$$\text{Optimal Tax (\%)} = (1-a)\times[\text{Revenue Portion}] + a \times[\text{Marginal Damages}]$$

You can see that there are 2 parts to the tax, the "Revenue Portion" and "Marginal Damages." The first portion is determined strictly by the need to raise revenue, and the second is determined strictly by environmental considerations. The two parts should be considered separately.

Each part is weighted by a parameter $a$ .

$a$ is the inverse of something called the "Marginal Cost of Public Funds."

- This is the amount of economic activity lost when the government increases its tax take from the economy by $1.
- It is usually assumed to be about 1.25–1.40, based on empirical work done in the 1980's. This means that the economy loses about $1.25 in economic activity for every $1 additional revenue taken by the government.
- Thus $a$ would equal $1/1.25 = 0.8$

As the government's total revenue requirement goes UP, the marginal cost of public funds rises and therefore $a$ FALLS. Thus, *the heavier the economic burden of the general tax system, the less the rationale for green taxes. Also, the less the overall burden of the tax system, the greater the rationale for green taxes.*

"Marginal Damages" represents the total amount that people who are fully-informed about the effects of the pollution would be willing to pay to reduce emissions by one unit, if they had the option to go into a market and buy such emission reductions. If a particular pollutant is hardly noticeable or has little effect, people won't be willing to pay to avoid exposure to it. If a pollutant is quite irritating or hazardous people might collectively be willing to give up a great deal of their economic welfare to reduce exposure. The "economic" approach to pollution control recognizes that markets which would allow people to express their preference for cleaner air, water etc. are very incomplete. Green taxes should simulate the prices that would emerge in a proper competitive market.

Example: Suppose Environment Canada estimates that the Marginal Damages of $NO_x$ emissions in southern Ontario are $150 per ton. The above formula would imply that sources of $NO_x$ ought to be charged $a \times \$150 = \$120$ per ton (assuming $a = 0.8$).