WORKING GROUP REPORT

FINAL Report—Environment and Taxation

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December 14, 1992

The Honourable Floyd Laughren
Treasurer of Ontario and Minister of Economics
7th Floor Frost Building South
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Toronto, Ontario
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Dear Minister:

The Environment and Taxation Working Group of the Ontario Fair Tax Commission is pleased to submit its second and last report.

Since the middle of September, 1991, the group has done its best to fulfil its mandate of responding to the questions posed by yourself and the Commissioners. It has come to this report by carrying out research and consultation, and by sharing points of view in productive discussions.

The working group is proud to have participated in the discussion over the fairness of the tax system and values the opportunity to have made a contribution to the development of tax policy in the province.

Respectfully submitted,

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(Professor, Environmental Studies,
University of Toronto)

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Membership List

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Jack Gibbons	Senior Economic Adviser, Canadian Institute for Environmental Law And Policy (Participated on behalf of J. Ferretti at numerous full group and subgroup meetings.)

Past Members **(Resigned due to professional appointments during working group process)**

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The working group is deeply indebted to the contribution of Matthew Akman. As Research Coordinator at the Fair Tax Commission, he went far beyond the call of duty in serving the working group. The intelligence and rigour he brought to his administrative, research and writing work was exceptional and the group has benefitted from his outstanding dedication to its process and goals.

The opinions and judgements in the report are those of the working group members. However, the group received much factual support and input from employees of the Ontario Public Service, many of whom attended meetings on a regular basis.

Special thanks to:
Peter Burns, Ministry of Housing; Denise Dagenais, Ministry of Treasury and Economics; Janet Dawson, Ministry of Treasury and Economics; Peter Deschamps, Ministry of Revenue; Jack Donnan, Ministry of Environment; Sid Friesen, Ministry of Agriculture; Lori Hale; Premier's Council on Health Well Being and Social Justice; Russ Houldin, Ministry of Treasury and Economics; Alexander Kraas, Ministry of Environment; Bill Mclean, Ministry of Treasury and Economics; Al Nausedas, Ministry of Natural Resources; Jay Nuttall, Ministry of Transportation; Larry Poon, Ministry of Transportation; Kumara Rachamalla, Ministry of Revenue; Orna Salamon, Ministry of Environment; Ilan Salamon, Ministry of Energy; Almos Tassonyi, Ministry of Municipal Affairs; Duncan Taylor, Ministry of Energy; Joan vanKralingen, Ministry of Northern Development and Mines; Bunli Yang, Ministry of Energy.

The group would also like to thank Jeanne Jabanoski for her important contribution to its work on communications and consultation.

SUMMARY OF RECOMMENDATIONS

The working group believes that environmental tax instruments can help Ontario realize its environmental objectives. When environmental tax instruments are used as complements to direct regulations, they can provide an incentive to reduce environmental impacts below regulated levels and help accelerate achievement of environmental goals. Furthermore, particularly when revenues are earmarked or used as offsets to social and economic impacts through the tax and expenditure systems, environmental tax instruments can constitute fair and effective instruments of environmental policy while demonstrating a high level of sensitivity to the economy and financial position of various sectors.

Here is a summary of the working group's recommendations, both general and specific, as they appear in this report:

Recommendations On Principles Of Environmental Taxation

The working group has adopted the following principles which should serve as a guide in the design and implementation of environmental tax instruments:

> • ***The primary goal of environmental tax instruments should not be to raise revenue but to use tax incentives and disincentives to modify behaviour--to encourage environmentally sustainable practices and to discourage environmentally damaging ones.***
>
> • ***To achieve environmental objectives, environmental tax instruments should be imposed as closely as possible to the practices they seek to change.***

To ensure the effectiveness of environmental tax instruments, and to build public trust that these instruments will be used to advance a specific environmental objective, the working group has expanded its principles and strongly endorsed the following preconditions:

> • ***Revenues raised by environmental tax instruments should be earmarked to advance the environmental objective of the tax.***
>
> • ***Environmental tax instruments should act as a complement to direct regulations.***
>
> • ***Through the "polluter-pays principle", environmental tax instruments should be used to ensure that environmental costs are reflected in the price of goods and services.***

Recommendations on Environmental Tax Instruments

The group has made the following recommendations with respect to environmental tax instruments for Ontario:

• To help reduce harmful pollution in Ontario, and generate revenues for directly related environmental objectives, the group recommends a pollution tax. The tax could be based on the Ministry of Environment "Primary List" of substances for ban or phase-out. The tax could also be applied to the pollutants contained in the National Pollutant Release Inventory or to those on the Ministry of Environment "Secondary List". To demonstrate consistency with the multimedia approach, the tax should apply to discharge into water (including sewers), air and land. It should increase with the quantity of pollution and risks associated with the particular substance.

• Members do not recommend a deposit refund system on lead acid car batteries for Ontario. Further, in future consideration of deposit refund systems, the government should refrain from taking any action where market forces already create a mechanism for the safe recycle or reuse of potentially harmful products. Where markets fail to provide for such mechanisms, deposit refund systems merit further experimentation.

• Fees for Certificates of Approval issued by the Ministry of Environment should not be based on capital costs. Any fees for Certificates of Approval should be set so that charges directly reflect relative environmental impacts.

• To ensure that the Ontario Tire Tax is directed towards environmentally sustainable practices, the group recommends that the revenues be earmarked to help solve the tire problem. Tire Tax revenues might be directed towards programs that facilitate reuse and recycling of old tires.

• In its first report, the group recommended a vehicle scrappage program to improve the fuel efficiency of the fleet and stimulate the purchase of new vehicles as an aid to the economy. In keeping with the group's view on earmarking, taxes designed to address the vehicle fuel efficiency issue would properly be used to develop a scrap program. Since old tires would be scrapped with each vehicle, Tire Tax revenues could be used to help support the tire component of the program.

• The tax system should generally recognize environmental costs as legitimate expenses. The group has identified mine reclamation activities as examples of environmental expenditures that should qualify for tax deductions.

• When considering reductions in energy use and carbon dioxide emissions, the government should explore the use of economic instruments to facilitate this goal. Some of the options for environmental tax instruments include carbon and energy taxes, extension of the retail sales tax to energy, and related tax expenditures to provide an incentive for adoption of energy efficient equipment. The group cautions, however, that these environmental tax instruments must not become a mechanism for the government to raise money for the consolidated revenue fund. Such revenues should be used to help achieve the goal of increased energy efficiency and reductions in carbon dioxide emissions.

• In general, the tax burden on farmers should be shifted towards products and practices that tend to be environmentally harmful and away from other tax bases. Moreover, tax revenues derived from environmentally harmful farm activities should be recycled into programs that help farmers develop new, financially viable markets and facilitate the transition to more environmentally responsible practices. As an example, economic instruments can facilitate the development and greater use of environmentally desirable products such as ethanol, the relatively clean burning alternative fuel derived from corn, wood, or other biomass.

• For farmers, the group suggests a general direction towards net income stabilization and away from commodity-based stabilization. A more environmentally sound option that the group also endorses is to base financial support for individual farms on some measure of environmental stewardship. This type of stabilization might be based on many of the same criteria as the government's current Land Stewardship II program which provides grants for diversification, conservation practices, maintenance of crop cover, planting windbreaks, and pesticide storage.

Recommendations on Process For Consideration of Environmental Tax Instruments

The working group makes the following recommendations on future process for consideration of environmental taxes:

• In general, any further consultation should be initiated by the government when specific goals, environmental tax proposals and design principles have been established. Stakeholders should then be consulted over the detailed design issues of the tax and related offsets including tax reductions and expenditure policies.

• Tax instruments to address the environmental issues not examined in this report such as issues in forestry, solid waste and water conservation merit examination through a further process. The group would also encourage continued or new consultative and research activities on other economic instruments such as tradable permits schemes and deposit refunds.

• Following the model established by the working group, in addition to stakeholders outside of the government, all relevant government departments should be involved in developing and implementing government commitments resulting from this report. This involvement implies that any existing policies, programs, and legislation should be re-examined to ensure consistency with any new initiatives of this kind.

• Consultation on environmental tax instruments requires a substantial time and energy commitment. The working group believes that appropriate compensation should be provided to participants or their organizations in future consultation. There should also be sufficient funds to carry out the research necessary to develop specific design proposals.

• The group set out features of a pollution tax which should serve as a general guide in the design process. More detailed features of the tax could be established by a special task force guided by a specific mandate and set of working principles established by the government. Creation of such a task force should ensure that all interests are included or recognized in the specific design of the tax.

• Further research on energy and carbon tax instruments by the Fair Tax Commission, a different task force, or other jurisdictions should focus on the macroeconomic and distributional impacts of energy and carbon taxes that may be implemented in conjunction with other tax cuts or expenditures to help ease the transition to a more energy efficient less carbon dioxide emitting economy.

• Consultation on energy and carbon taxes should only be initiated by a government proposal for specific environmental tax instruments and involve stakeholders who are prepared to focus on the detailed design issues of the tax and related offsets including tax reductions and expenditure policies. To ensure a relevant and effective outcome, tax and expenditure analysis should be closely linked to a broader Ontario global warming strategy which encompasses a range of regulatory, education and economic policy initiatives.

1. INTRODUCTION

1.1 Mandate Of The Working Group

The Environment and Taxation Working Group is one of eight working groups that have been established by the Treasurer to answer specific questions regarding the fairness of the current tax system. The Treasurer's questions to this group read as follows:

- What role should environmental considerations play in a fair tax system?
- What is the role of taxes and/or tax expenditures in achieving the Government's environmental objectives?
- What environmental tax options could best improve the fairness of the tax system as it relates to environmental objectives?

The commissioners of the Fair Tax Commission asked the working group to address an additional set of questions. These can be found in Appendix A: "First Report Executive Summary".

The working group was asked to examine a range of economic instruments including taxes and tax expenditures. Environmental taxation may also involve other financial incentives such as rebates or refunds. In this report, the working group terms all such instruments as "environmental tax instruments".

This is the second and final report of the working group. In its first report, delivered in March of this year, the working group established a set of principles that provide a basis for action on environmental tax instruments as well as a set of criteria for the evaluation of specific tax initiatives. Explanations of these principles and criteria, as they appear in the first report, along with the working group's first specific recommendations can be found in Appendix A.

1.2 The Group's Process And Consultation

The Environment and Taxation Working Group is comprised of volunteer members that encompass a wide range of constituencies and perspectives. For the purposes of efficiency in its deliberations on specific environmental tax initiatives, the group divided itself into three subgroups. These subgroups are: Health/Freedom From Toxics; Energy/Transportation; and Natural Resources. (See Appendix A for further description of working group process.)

The working group model serves as a medium for consultation in itself. In addition to that, given the scope and nature of the issues at hand, the group recognized the value of broader consultation. Dialogue with interested parties enabled the group to incorporate a wider range of perspectives and information into its deliberations. The

group's consultation varied in form, and included informal conversations, written submissions, presentations to the full group or to specific subgroups, and workshops on environmental tax instruments. Members feel that continual, rigorous and comprehensive consultation on environmental tax instruments should continue after the life of the group. In the subsequent sections of this report, the group sets out some suggestions for further consultation on environmental tax instruments.

It is worth noting in particular that the workshops were an especially valuable means of consultation for the working group. In addition to working group members, these workshops involved representatives from the broader environmental community, the industrial sector, the labour movement, social equity groups, and government. Outside experts presented information on important issues in environmental taxation while participants shared ideas and concerns that were incorporated into the working group's analysis and report.

1.3 Description of Report

This introduction is the first of the report's six sections. Section 2, which responds to the Treasurer's first two questions, reinforces important principles that should provide the basis for action on environmental tax instruments in Ontario. Sections 3, 4, and 5, which respond to the Treasurer's third question, set out analysis of specific initiatives and recommendations as developed by the Health/Freedom From Toxics, Energy/Transportation, and Natural Resources Subgroups. Section 6 summarizes the recommendations and presents some guidelines on future process for action on environmental tax instruments.

The reader will notice that each of the subgroups took a slightly different approach to its analysis of environmental tax instruments. The various approaches were largely dictated by the existing body of knowledge and experience pertaining to the issues and policy initiatives as well as the degree of activity, government action and commitment on topics under consideration. Regardless of the differing approaches to study and analysis, the working group's principles of environmental taxation permeate all recommendations of the three subgroups.

The reader will also note that the group has not addressed all environmental issues in Ontario such as solid waste and certain energy related emissions. Moreover, the group has not explored the entire range of possible economic instruments such as tradable emissions schemes and some types of deposit refund systems. Omissions such as these are largely due to the group's time frame, its perception of government priorities, and members' particular areas of expertise and interest. Nevertheless, the group feels that a wider range of issues and instruments merit further attention.

2. PRINCIPLES

2.1 Significance and Description of Principles

In its first report, the working group established principles and criteria as a guide to action on environmental tax instruments. The principles, as set out below, reflect the conditions under which the group endorsed the use of environmental tax instruments. The criteria, which should be considered in the evaluation of any environmental tax initiative, include environmental effectiveness, economic efficiency and impacts, distributional effects (equity), transparency or visibility, administrative considerations, jurisdictional considerations, timing, fiscal impacts and coordination with other policy areas.

PRINCIPLE #1

> ***The primary goal of environmental tax instruments should not be to raise revenue but to use tax incentives and disincentives to modify behaviour--to encourage environmentally sustainable practices and to discourage environmentally damaging ones.***

When this principle is adhered to, environmental tax instruments do not constitute "tax-grabs" or "licenses to pollute". Rather, they are instruments which promote or hasten the achievement of environmental objectives.

PRINCIPLE #2

> ***To achieve environmental objectives, environmental tax instruments should be imposed as closely as possible to the practices they seek to change.***

This principle guards against unwarranted changes or distortions in behaviour due to the introduction of a tax. If the tax is not placed on the practice it seeks to change, the risk arises that it may constitute a financial penalty for behaviour that has no negative impact on the environment. This principle also implies that harmful practices should be clearly identifiable for the purposes of establishing a direct link to the purpose of any environmental tax instrument.

Next, the group expands on its original principles to reinforce their crucial role in the creation of sound public policy and public support for environmental tax instruments.

2.2 Interpretation of Principles

Earmarking

Previous Position on Earmarking

The group has already strongly endorsed dedicating revenues from environmental tax instruments to spending programs that hasten the achievement of the environmental goal the tax was designed to address. The first report sets out the general arguments for and against earmarking and cites examples of dedicated revenues in the United States and the province of British Columbia.[1] After further observation of government action on environmental tax instruments and public response to this action, it is useful to explain why the group continues to strongly support the idea of dedicating environmental tax revenues.

Earmarking As An Extension Of The Working Group's First Principle

In its first report, the group set out the principle that environmental tax instruments should be designed to help achieve environmental objectives. This end can be realized by using environmental tax instruments to provide a price signal to change behaviour which is strengthened or weakened with higher or lower tax rates. The establishment of high rates upon introduction of the environmental tax instrument, however, may give rise to socially and economically undesirable outcomes as companies and individuals adjust to new signals. Where social and economic factors constrain tax rates, the group's first principle can still be achieved by introducing a moderate environmental tax and earmarking the revenues for advancement of directly related environmental objectives and goals.

Attributes Of Earmarking And Examples Of Application

Dedication of environmental tax revenues to facilitate the achievement of a related environmental objective or goal can help the government on two difficult fronts: lack of public support for any new taxes, and the need for new and sustainable initiatives to protect the environment and generate revenues for environmental programs in depressed economic times. To illustrate this point, it is worthwhile to examine the activities of governments in other jurisdictions who face similar constraints and have, in part, overcome them by way of earmarking environmental tax revenues. The example used here is that of the federal and state governments in the United States.[2]

At the federal level, one noteworthy example of earmarking in the United States comes under the Intermodal Transportation Act of 1991. Under this act, revenues from the gas tax are dedicated to the Highway Trust Fund which is, in part, used for

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[1] Common arguments against earmarking include reduced flexibility over government spending patterns and prioritization of spending programs, elimination of regular program review for effectiveness and efficiency, and mismatching of revenues and expenditures for a particular program.

[2] Most information provided in this section found in Bureau of National Affairs, Inc., Washington, D.C. (1992). Special Report: States Turn to Dedicated Funding For Environmental Budgets. See also Teja, R. S. and Bracewell-Milnes, B. (1991). The Case For Earmarked Taxes: Government Spending and Public Choice. Institute of Economic Affairs, London.

road construction and repair. The fund is also structured to help achieve the environmental goals of fuel conservation and reduced auto emissions. Current legislation allows individual states to direct money from this fund to public transportation and bicycle infrastructure.

In addition to federal spending on the environment through the Highway Trust Fund, the recession has not prevented an increased commitment to environmental spending on the part of major U.S. states. In California, the proposed budget for this year reflects a seventeen percent increase in funding for the environment. In the last four years, Florida has more than doubled its annual spending on the environment and New Jersey has seen a steady increase in environmental budget initiatives over the same period even though state general revenues are generally not increasing. In all of these states, as well as in Illinois, New York, and Texas, the new funds are largely derived from environmental tax instruments and fees.

Environmental fees are normally linked with related spending initiatives on the environment and economy. For example, California links a point-source discharge fee with the activities of its Water Resources Control Board and Department of Toxic Substances Control. It directs a tax on oil to an Oil Recycling Fund and motor vehicle fees to air quality programs. In Florida, vehicle fees are directed to the Air Pollution Control Trust Fund while charges on petroleum storage tanks help pay for clean-up of leaking underground storage tanks. Along the lines of economic relief, Illinois directs environmental tax revenues to ease costs of compliance with the United States Clean Air Act.

While the above scenarios may seem unambiguously positive, some see disadvantages in the use of earmarked environmental tax instruments to help solve environmental problems. In most of the states referred to above, the proportion of environmental budget revenues derived from earmarked environmental tax instruments has increased steadily. One implication of abundant environmental tax revenues is that there are still sufficient polluting activities which can bear taxes; reduced pollution means less environmental tax revenue. It is suggested that "dependence" on environmental tax revenues may therefore ultimately conflict with environmental goals.

The group rejects the argument that environmental tax instruments increase our dependence on polluting activities through the need for revenues. In certain cases, such as the emission of harmful toxic discharge, revenues from environmental tax instruments will and should decline over time as emissions are phased-out. In these instances, the declining revenue for environmental spending is offset by accomplishing the primary toxic reduction and elimination goals. In other cases polluting activities, such as those associated with energy use, are likely to continue for a long time. In these instances, pollution taxes could generate funds for the continued promotion, development and facilitation of more environmentally and economically sustainable practices.

Conclusions On Earmarking

Suddenly imposing high environmental tax rates might severely shock the economy and prevent a smooth transition to more environmentally responsible practices. Therefore, to preserve environmental objectives, earmarking should accompany environmental tax instruments that are introduced at low levels and increase gradually over time. In this manner, environmental tax instruments can enhance rather than impede the transition to a more sustainable economy. The group cautions, however, that too gradual an increase in tax rates could result in the loss of environmental objectives and the onset of a new, steady source of revenue as the imperative.

Environmental tax Instruments As a Complement To Environmental Regulation

To achieve environmental objectives, environmental tax instruments should be designed to complement direct regulations; they should not simply become a substitute for regulations. One caveat to this position is that taxes should not constitute an add on to inadequate existing regulations, especially those that rely on "end-of-pipe" solutions. There are four main reasons for this conclusion:

- **Environmental regulations increase the certainty of some base level of environmental stewardship**. For localized environmental problems, specific regulated caps on emissions or other forms of contamination may prove critical. Regulated caps are often established to ensure that contamination does not exceed some threshold, beyond which environmental hazards such as severe human health effects or impacts on enclosed water bodies are likely to arise. Since the effects of prices on behaviour are sometimes unpredictable, it may be difficult to achieve a specific level of environmental protection through a charge or tax alone. Moreover, where a zero discharge threshold exists, taxes will be inappropriate as substitutes for regulation.
- **Environmental tax instruments provide a financial incentive to reduce environmental impacts below regulated levels.** While regulations might only provide the incentive to meet regulated levels, environmental tax instruments provide an added incentive to reduce below these levels since there are financial benefits to reduction of all units of pollution. Reductions below regulated levels will depend, in part, on the current state of substitution or reduction technology on the part of the polluter. Technologies are not static, however, and tax incentives may speed the development and adoption of new technologies.
- **Environmental tax instruments can help accelerate achievement of environmental goals.** Regulations may involve provisions for gradual phase out of a harmful substance or activity. Where complementary environmental tax instruments apply to the targetted substance or activity, companies that possess the technical and financial means may accelerate phase out to avoid current costs. Careful attention must be given, however, to those unable to adjust to potential social and economic impacts. Where such situations clearly exist,

the appropriate environmental tax instrument might be a tax expenditure which provides a financial reward for reducing below regulated limits.

- **Certainty in environmental regulations and taxes improves efficiency in private sector decisions.** Regulations can specify timelines for phase-downs of pollution or the use of a substance. As a complement to regulations, taxes can be phased in with gradual but certain increases. Together, these types of taxes and regulations moving in the same direction give businesses a clear incentive and indication of future and current costs. In turn, cost certainty enhances efficiency in private spending and investment decisions.

There are many ways to design complementary environmental tax instruments and regulations. The working group, in the Health/Freedom From Toxics section, develops a particular design option to complement regulations of toxic pollution in Ontario. Another design option worthy of consideration that was not expanded in other sections of this report involves the use of administrative penalties for non-compliance.

Currently, the government follows a legal approach to non-compliance with standards and limits. Where industries are out of compliance with most emissions, the Ministry of Environment normally develops an action plan which will enable the company to attain compliance.[3] If this approach fails, it will be backed up by some form of legal enforcement and, in certain instances, a penalty of some kind. This process can result in penalties that provide little incentive for change, and long periods where entities remain out of compliance.

As a solution to the inefficiencies in the legal, regulatory process, administrative fees could apply automatically upon non-compliance. These fees would be imposed outside of the traditional legal process and would vary with the degree of environmental harm and duration of non-compliance.[4] Fees could theoretically apply to a range of environmental problems that arise in regulated areas. It is worth noting that Alberta, in the Environmental Protection and Enhancement Act (1992), set out the authority to impose administrative fees. Alberta is currently developing regulations to detail their operation.

The idea of using environmental tax instruments to complement direct regulations has been put into practice in both Canada and the United States. British Columbia's "waste discharge permit fees" constitute an example of environmental tax instruments currently used to enhance regulations in Canada. This scheme is described in

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[3] See Ontario Ministry of Environment (1991). Report on the 1989 Industrial Direct Discharges In Ontario.

[4] A proposal of this sort was made by Jack Donnan and Peter Victor in a 1976 paper "Alternative Policies for Pollution Abatement: The Ontario Pulp and Paper Industry". Donnan and Victor termed the administrative penalty the "pollution control delay penalty" since it would automatically penalize companies that failed to remain on schedule with effluent reduction. "The size of the penalty would be directly related to the divergence in any year between the permitted discharge and the actual discharge". (p. 68).

further detail in section 4. The cases of lead and ozone depleting substances, as described below, serve as other illustrative examples of environmental tax instruments that have complemented regulated phase-downs.

Lead, specifically in gasoline, has been linked to human health problems through direct exposure and through increased auto emissions that arise from the use of leaded fuel.[5] In Canada, the production of leaded gasoline was eliminated in 1990. Beginning in 1985, governments at the federal and provincial levels levied special taxes to speed reductions in demand for leaded gasoline. Rates were set at anywhere from less than a cent to about two cents per litre. Where the rate of tax increased the price of leaded fuel above unleaded fuel, sales of leaded fuel fell more rapidly than in any other period.[6] This decline in sales seems to indicate that the tax was an effective complement to regulations on lead.

Like the Canadian taxes on lead in gasoline, the United States tax on ozone depleting substances complemented important regulations. The Vienna Convention in 1985 and the Montreal Protocol in 1987 resulted in international agreements on reductions of ozone depleting substances. The Montreal Protocol set out graduated, target reduction levels in the consumption of CFCs and Halon over a twelve year period. The United States imposed taxes on ozone depleting substances in 1990. Tax rates increase with the ozone depleting potential of the substance. Although it is too early for sufficient data to confirm the effectiveness of the tax in promoting further reductions in consumption, the financial incentive demonstrates consistency with the priorities set out in current regulations.

Global And Local Environmental Issues

The scope of environmental problems should affect the design of environmental tax instruments. Many environmental problems are global in scope while others are local. Global warming and ozone depletion serve as examples of the former and point source emissions to closed water bodies serve as an example of the latter.

Where policies are designed to address global environmental problems, the government should take a role in inter-jurisdictional negotiations and integrate policies when possible. When many jurisdictions act simultaneously, there is less opportunity for transfer of a specified environmentally harmful activity to areas with lower taxes. In the case of environmental problems that are generated and impact locally, other jurisdictions cannot be expected to pay for adjustments and the full responsibility for action rests at the local level.

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[5] Information on leaded gasoline taxes derived from Stone, Michael (1990). Environmental Excise Taxes: Options For British Columbia. Environmental Protection Division, B.C. Ministry of Environment. Also see Ernst and Young study for Ontario Ministry of Environment (1991). Options For Environmental Protection and Management In Ontario.

[6] Ernst and Young (1991). p. 86.

Special consideration for the design of environmental tax instruments that address global issues could require unilateral action on the part of Ontario. Such unilateral action by the province could have several consequences:

(i) adversely affect the province's competitiveness by raising costs in industries;

(ii) enhance the province's competitiveness by stimulating technology advancement and industry adjustments that improve efficiency;

(iii) neutral impact on the province's competitiveness

If the province should choose to take unilateral action on environmental tax instruments, the working group believes that the structure and administration of such taxes, and the way in which the revenues are distributed in society, will determine whether its effects are positive, negative or neutral.

Polluter-Pays Principle

Designing an environmental tax instrument raises the question of who pays the tax. As a general guide, the group endorses the "polluter-pays principle". As adopted by the Organization for Economic Cooperation and Development (OECD), this principle requires that "the polluter should bear the cost of measures to reduce pollution decided upon by public authorities to ensure that the environment is in an acceptable state".[7]

The primary importance of the polluter-pays principle is its suggestion that the polluter should provide the appropriate funds for environmental remediation and that environmental costs and damages should be incorporated into the price of goods and services. In practice, it may sometimes be difficult to identify the "polluter" and the "acceptable environmental state". However, these ambiguities are continually clarified through societal change and norms. Members believe that producers and consumers must share the responsibility of environmental stewardship. The group would caution, however, that in certain cases the producer and consumer might be viewed as "polluters" and in these cases the consumer may bear the burden of double taxation; first passed on in some proportion by the producer and then directly borne through further charges. This situation would be unfair and should be avoided where possible.

Illustration of Principles—The Ontario Tire Tax

To assist in communicating the group's principles, specific examples of their application are presented in the remaining sections of this report from the three subgroups. It is also useful to illustrate them here using the example of the Ontario Tire Tax.

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[7] Organization For Economic Cooperation and Development (1989). Economic Instruments For Environmental Protection, p. 27.

The Ontario Tire Tax, as currently designed, does not serve to hasten any particular environmental objective and therefore violates the group's first principle. The original purpose of the tax was to ensure safe storage of tires at dump sites and eventual reuse and recycling. Thus, the tax was supposed to hasten the achievement of an environmental objective. To accomplish this end, however, the tax revenues would have had to be earmarked for the specific purpose of safer tire storage, reuse and recycling.

Only if the tax were earmarked would it constitute an acceptable environmental tax instrument from the perspective of the working group. If earmarked, the eventual generator of the waste or "polluter" would be made to pay for reuse or recycling programs, and the environmental objective would be advanced. Under the current situation, it seems that the primary purpose of the tax is to raise revenue, which violates the working group's principles.

To ensure that the Ontario Tire Tax is directed towards environmentally sustainable practices, the group recommends that the revenues be earmarked to help solve the tire problem. Tire Tax revenues might be directed towards programs that facilitate reuse and recycling of old tires.

In its first report, the group recommended a vehicle scrappage program to improve the fuel efficiency of the fleet and stimulate the purchase of new vehicles as an aid to the economy. In keeping with the group's view on earmarking, taxes designed to address the vehicle fuel efficiency issue would properly be used to develop a scrap program. Since old tires would be scrapped with each vehicle, Tire Tax revenues could be used to help support the tire component of the program.

Through the working group's consultation, members found much public distrust that an environmental tax instrument would be used to help achieve an environmental goal. The Tire Tax was the primary example cited by the public to illustrate the reason for their distrust. Therefore, the group believes that earmarking the Tire Tax is a critical first step towards building public trust in the use of environmental tax instruments to assist in the achievement of a directly related environmental goal.

3. HEALTH/FREEDOM FROM TOXICS SUBGROUP

3.1 Introduction

The reduction and/or elimination of emissions of certain toxic substances has been identified as one of the government's high priorities. The group believes that carefully designed economic instruments within the tax system can hasten the achievement of such goals and ameliorate some of the economic impacts that may result. With this in mind, the Health/Freedom From Toxics subgroup studied two types of environmental charges. The first type of charge falls on harmful discharges into the air, water or land ("pollution taxes"). The second type of charge would be based on harmful products used as inputs to the production process ("input taxes"). The subgroup also examined the idea of deposit refunds and explored the possible application of this instrument to lead acid batteries.

3.2 Charges on Toxic Pollution

Nature Of The Problem

When toxic pollution results in unacceptable harm to the environment, it gives rise to a range of societal costs. Costs of toxic contamination may be associated with the provision of health care services, reductions in human mental and physical well-being, threats to traditional ways of life for aboriginal groups, provision of water treatment facilities, reductions in recreational and other economic activities, and threats to wildlife. Although the dollar value of these costs is not easily measured, there is the risk that costs are intolerably high. For this reason, toxic contamination merits careful attention and has been the subject of much study, particularly in the area of health. Also, many toxic substances are subject to existing regulation limits and in some cases bans or phase-outs.

A healthy ecosystem is intrinsically linked with the health of humans and other species. It has been found that wildlife species in the Great Lakes basin have experienced reproductive and other problems such as birth defects attributable to chemical contaminants.[8] There is also some evidence that humans face increased risk of cancer and harm to the nervous system and internal organs with exposure to toxic pollution.[9] Moreover, exposure poses relatively greater risk for certain populations such as nursing children, the fetus and the elderly.

Exposure to toxics in Ontario depends critically on contamination from a range of sources. Aside from natural sources, toxic contamination arises from direct dis-

[8] Health and Welfare, Department of Fisheries and Oceans, and Environment Canada (1991). Toxic Chemicals in the Great Lakes and Associated Effects.

[9] Health and Welfare Canada (1992). A Vital Link: Health and the Environment In Canada.

charge at point sources, slow leaching from toxic waste sites, atmospheric transport of toxics to local air and water, the transfer of contaminants by tributaries to local water bodies, and remobilization of toxic chemicals from contaminated bottom sediments. Exposure, in turn, occurs upon physical contact with toxics, ingestion of contaminated food and water, and inhalation of contaminated air.[10]

Pollution Prevention Paradigm

Approaches to the problem of toxic pollution have tended to consist of pollution control strategies. Control strategies generally differ for air and water-borne discharges. Control is maintained through the regulation of toxic discharges from specific points of emission. Most of the existing standards and guidelines which apply under current regulations are based on environmental effects and apparent thresholds.

Difficulties in the attainment of toxic reduction goals under pollution control may be fundamental to the nature of the approach. Solutions geared towards single source end-of-the-pipe emissions tend to lack a comprehensive vision of chemical contamination. They may overlook important factors such as society's goals for protecting or improving the overall environment, and the combined impact of discharges from other polluters.[11]

Rather than pollution control, the working group recommends moving towards a pollution prevention approach. As opposed to pollution reduction which targets single points of emission such as an industrial stack or pipe, prevention amounts to simultaneous consideration of all emissions from a source. The prevention approach does not imply the elimination of all toxic substances in the environment. Rather, it means that pollution is eliminated before it is created, thus increasing the possibility for an overall reduction of toxic discharge into the environment.

Along the lines of pollution prevention, The Government of Ontario has endorsed the "multimedia" approach to regulation, or simultaneous consideration and regulation of pollution to air, land and water.[12] Consideration of all sources mitigates the transfer of pollutants from one media such as land to another such as water. The multimedia, preventative approach provides an important part of the group's framework for analysis of taxes or special charges on toxic inputs and pollution.

Rationale, Benefits and General Principles For Taxes On Toxic Inputs Or Pollution

The rationale for taxes on toxic inputs or pollution is to reduce pollution or facilitate the prevention of toxic contamination. If the prices of harmful substances are in-

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[10] ibid. pp. 9-26.

[11] International Joint Commission , Report of the Program For Zero Discharge (1991). A Prescription For Healthy Great Lakes.

[12] Ministry of the Environment, Hazardous Contaminants Branch (1992). "The Multimedia Approach To Regulating Environmental Contaminants".

creased by way of a special tax, producers will presumably use less of the targetted substances as inputs in the production process. Likewise, if it becomes more costly to discharge harmful substances into air, water or land, producers will find ways to reduce harmful discharges. These behaviour changes would come about as producers substitute away to less harmful inputs where possible, as the price or cost of continuing to pollute exceeds the cost of changing production methods, or employing new technologies.

If the goal of pollution reduction is achieved through some form of toxics tax, other added benefits may arise. As described below, these benefits include the generation of funds for environmental protection and rehabilitation of damage caused by past emission of the toxic substances, and the institution of the "polluter-pays principle":

- **Funds for reduction of environmental and economic impacts**—Depending on the substances that are taxed and the tax rates that are established, input and pollution taxes can be designed to generate funds for environmental protection and rehabilitation. If the goal of behaviour modification is achieved, these funds would tend to decline over time. Funds can be recycled back into environmental protection programs, used to decrease potentially damaging taxes, or employed as offsets to the economic impacts of an environmental tax instrument.
- **Institute "polluter-pays principle"**—Environmental tax instruments can be designed so that the polluter pays for the environmental harm associated with the use or discharge of a substance. In the case of taxes on toxics, beneficiaries of the damage done to the environment from the use or discharge of toxics are made to pay. If the polluter does not pay for the use or consumption of environmental goods, principles of fairness are violated since the costs of environmental clean-up, protection, and decline in quality and availability of competing uses for the environment will be distributed in some random fashion to society at large or to future generations.

It is not enough to state the rationale and benefits of a toxics tax since rationales add minimal information on implementation and design. To provide further direction, it is useful to reinforce principles that constitute a type of "roadmap" to the use of toxics taxes. The group believes that environmental tax instruments will hasten the achievement of environmental goals and demonstrate consistency with the pollution prevention or multimedia approach to toxic reduction if designed in accordance with the suggested principles.

One of the principles relates to the rationale of behaviour modification. In order to change behaviour, taxes on toxic inputs or pollution should not replace regulation. Rather, they should be used in conjunction with current and emerging regulation. In this manner, the tax will not constitute a limitless "license to pollute". On the contrary, while regulations set limits on emissions, complementary taxes send the signal that <u>any</u> level of emissions should be discouraged. Taxes provide an incentive

to reduce use and emissions of toxics below levels required by current regulations. As a cautionary note, however, taxes should not promote excessive administrative efforts and should therefore not introduce rigidities into the system that prevent the removal of obsolete regulations or the replacement of old regulations with improved ones.

A second principle relates to revenues. Environmental tax instruments should not be used solely to increase general revenue. Rather, environmental tax instruments should be tied to the achievement of specific, quantified environmental goals.

These and other principles are made more explicit in the sections under headings "Implementation Issues" and "Design and Recommendations".

Tax Base

The rigorous, scientific development of a list of substances that should bear a pollution tax is beyond the capacity of this group. Recent analysis and prioritization in the federal and provincial governments, however, has resulted in lists of substances that the group considered as possible tax bases. The Ontario Ministry of Environment recently published a list of candidate substances for ban, phase out, or use/release reductions.[13] In the Ministry of Environment report, two tiers of substances are identified. The first tier or "Primary List" consists of twenty-one substances of highest priority for ban or phase-out. These substances are present in, or currently discharged into Ontario surface waters. The second tier or "Secondary List" is comprised of forty-six substances that are to be considered for ban, reduction or phase-out subsequent to the consideration of the substances on the Primary List (See Appendix C "Substances For Ban or Phase Out").

The Ministry's Primary List consists of those substances which pose the greatest hazard to the environment. This hazard is usually due to the severity or duration of impact on the environment. Substances found on the list are all noted for their toxic or poisonous nature, their persistence or tendency to impact on the environment for long durations, and their bioaccumulative nature or ability to increase in concentration as they move up the food chain. Due to the severity of impacts associated with the substances on the Government's Primary List of toxics, the working group recommends that unless they are banned immediately, these substances represent a priority base for the application of environmental tax instruments during the phase-out period.

In addition to toxic substances identified in the recent Ministry of Environment publication, there are other pollutants that could form the base for an environmental charge. Some of these will be included in the "National Pollutant Release Inventory" (NPRI), an inventory of releases from fixed sources to all media of a

[13] Ontario, Ministry of Environment (1992). Candidate Substances List For Bans Or Phase-Outs.

selected number of substances which are of health and/or environmental concern.[14] This inventory is currently being developed by a multi-stakeholder advisory committee as part of a federal government commitment in the Green Plan, and overlaps to a certain extent with the Ministry of Environment lists. (See Appendix D, "Proposed Substances For Inclusion In National Pollutant Release Inventory".)

Finally, other substances already forming the base for municipal sewer charges could also bear direct discharge taxes. These pollutants include suspended solids, oil and grease, phenolics and biological oxygen demand. Various jurisdictions have already imposed special taxes on the discharge of such substances with varying degrees of success in changing behaviour.[15]

The group recommends the implementation of taxes on particularly harmful pollutants that comprise the Ministry of Environment "Primary List". Other near term options for the tax base include the Ministry of Environment "Secondary List" and the National Pollution Release Inventory list.[16] The NPRI list may have practical advantages over other bases since creation of the inventory necessitates reliable, regular monitoring of substances released. (For further information, see section on monitoring, p. 19.)

Input Taxes vs. Pollution Taxes–Analysis And Environmental Incentives

In the application of environmental tax instruments to toxic pollution, two major options stand out. Taxes might be applied to substances as inputs or as discharge. One of the issues that arises in the consideration and analysis of the two tax options is the difference in incentives they provide. In particular, the group emphasised the importance of consistency with the pollution prevention philosophy and the multimedia approach. The section below outlines the logic that brought the group to the conclusion that taxes on polluting discharge into air, land and water can demonstrate an environmental incentive compatible with the pollution prevention approach.

- *Nature of the goal—achieve environmental objectives:*

According to the group's first principle,[17] environmental outcomes of the group's recommendations are the ultimate concern. The group's goal is to provide the best

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[14] Information derived from "Towards A National Pollutant Release Inventory", The Interim Report of the NPRI Multi-Stakeholder Advisory Committee, October, 1992.

[15] For information on effluent charges in European jurisdictions, see Ernst and Young study for Ontario Ministry of Environment (1991). "Options For Environmental Protection and Management in Ontario" or Peat Marwick and Partners study for Ontario Ministry of Environment (1988). "Design Factors and Data Requirements For Water Withdrawal Pricing and Effluent Charges" or Organization For Economic Cooperation and Development (1989). "Economic Instruments For Environmental Protection."

[16] The choice of tax base may depend in part on the ability to monitor discharge and to enforce and administer the tax.

[17] The group's first principle is presented and explained in Section 2.

incentive to achieve environmental objectives.[18] The idea of providing strong incentives is directly linked to the group's second principle that "environmental tax instruments should be imposed as closely as possible to the practices they seek to change". Where the tax is imposed on the undesired consequences of a certain behaviour, the clear incentive is to modify that behaviour. With respect to the Health/Freedom From Toxics subgroup, the practice to change is that of polluting the air, water and land with toxics. A tax on toxic pollution is not just close to the practice, it is on the practice and directly fulfils the group's second principle.

The group recognizes that there is a distinction between provision of incentives, and dictation of how to achieve an environmental goal. Government initiatives should not focus on how private decision makers achieve established environmental objectives since private decision makers have the best information on how to minimize their costs. That is, incentives should be created by the public sector with decisions on to how to reduce environmental impacts left in the hands of the private sector.

• *Incentives provided by the different tax measures—they both send a positive environmental signal, but input taxes can also send the wrong signal resulting in unintended negative impacts:*

A pollution tax and a tax on toxic inputs can be designed to provide the same incentive for pollution reduction. In both cases, the tax increases the cost of polluting and alters behaviour away from environmentally harmful activities.

Unfortunately, an input tax may not always be justified on environmental grounds. In certain cases, depending on technologies and industrial processes, the use of toxic inputs may result in minimal or no environmental harm at the end of the pipe. Harmful inputs may be reduced or converted to more environmentally benign output in the production process. In these cases, a special tax on the toxic inputs (input tax) sends the "wrong" signal by unjustifiably increasing the price of an input. An input tax will only send the "correct" signal in all cases if the use of a given amount of toxic products always results in comparable levels of environmental harm.

• *Flexibility in private sector decision making—pollution taxes may provide more flexibility than input taxes:*

A charge on pollution does not bias decision making towards any particular means of pollution reduction or prevention (including "end of pipe" solutions). If a charge on environmentally harmful effluent imposes high costs on certain private sector entities, these costs can be reduced by any number of actions. Producers can reduce costs by changing technology, adopting new processes, substituting inputs, etc.

[18] In its first report, the group outlined a set of criteria that all proposals would be subject to. These criteria included environmental effectiveness, economic efficiency, equity, administrative considerations, jurisdictional considerations, visibility and timing.

Pollution taxes allow full flexibility in private decision making for the minimisation of costs to achieve an environmental goal.

Taxes on toxic inputs (input taxes) force producers to reduce pollution by reducing their use of particular inputs. This reduction might be accomplished through technology or process changes but, in any case, the input must be reduced to offset the costs of the tax. Thus, these measures may leave private sector decision makers with less flexibility than pollution taxes with respect to their choice of meeting a particular environmental objective. Input taxes are therefore capable of imposing unwarranted costs on business and may violate the group's second principle of placing the tax as close as possible to the practice it wishes to change. In turn input taxes may undermine the criterion of economic efficiency.

In light of this possible drawback to input taxes, and the one described above as the potential for input taxes to provide the wrong signal, the group supports the general principle that pollution charges constitute the preferred option. Only in certain cases will other factors such as ease of administration or enforcement of an input tax override this general principle.

• *Problem with single-media pollution taxes—pollution will be transferred to other media:*

Pollution charges are often associated with discharge into water only. This single-media approach can seriously undermine the environmental objective of the tax. If toxics contained solely in water effluent are taxed, then the pollution could profitably be converted to airborn or solid form. This transfer of contamination would, of course, defeat the goal of toxics reduction and should be prevented by a multimedia approach in which toxic emissions to the air, water, and solid or sediment waste are taxed at a similar rate.

• *Multimedia charges should capture discharge into sewers or should be accompanied by extra-strength sewer surcharges:*

A pollution tax should account for discharge into the sewer system. If the price of direct discharge into bodies of water rises due to a special charge on pollution that does not encompass sewer discharge, producers may turn to the relatively cheap sewers for disposal. Currently, sufficient incentive to prevent producers from shifting contamination to sewers is not in place, as sewer charges are only loosely and infrequently based on the nature of pollution, its volume or concentration.[19]

In order to prevent the shift from direct discharge of pollution towards greater volumes of pollution into the sewer system, the charge should ideally encompass re-

[19] For information on current Ontario practice with respect to special sewer charges, see Ecologistics Ltd. and Canviro Consulting study for the Ontario Ministry of Environment (1988). "The Extra-Strength Sewer Surcharge To Regulate Industrial Sanitary Sewer Users".

leases into the sewer system. As a second best solution, where pollution taxes do not cover sewer discharge, special sewer surcharges that are designed to reflect the nature, concentration and volume of pollutants should be implemented in conjunction with the tax. Several municipalities already have these surcharges in place but they vary substantially in scope and degree. Certainly their current scope and magnitude is not sufficient to complement comprehensive regulation of toxics. Therefore, in order to prevent a shifting of pollution from bodies of water to the sewer system, extra-strength sewer surcharges would have to be expanded to apply to more substances on a province-wide basis.

Input Taxes vs. Pollution Taxes—Implementation Issues (Administration, Monitoring & Enforcement, Available Data, Jurisdictional)

- *Administration*

While input taxes have the potential to unjustifiably penalize certain substances, pollution taxes may "miss" certain harmful substances due to administrative constraints. The difficulty in accounting for the "pollution" contained in household waste serves as a specific example of this type of administrative complication. Substances contained in products that come into contact with human beings and threaten their health, or those that have the potential to contaminate air, water and soil from landfill, may not be diverted from the solid waste stream or separated out for the purposes of the tax. Certain household products, for example, contain toxics that are potentially harmful to human health and the environment, yet these products and the substances contained in them may not fall within the scope of the tax. Car batteries that contain lead and household batteries that contain mercury and cadmium pollute ground water and soil in the landfill, yet it is practically impossible to impose a pollution tax on these as well. Therefore, without taxes on substances as inputs, or taxes on products in the market, we may not be able to fully achieve the desired environmental objective.

Input taxes give rise to their own set of administrative complexities. Through the Province of British Columbia's experience with input taxes on toxic products, the subgroup has learned that the administration of such a tax at the provincial level may be extremely complicated.[20] Many of the problems with a provincial input tax arise from the fact that there is currently no tax mechanism in place that could easily be built on. In Ontario, although administration through the provincial sales tax might be possible, this base does not currently cover certain products and substances that are transported across the border or most consumable business inputs. The imposition of a special excise tax may also prove difficult since targetted toxic substances often flow across borders as embedded ingredients in other products.

[20] British Columbia announced a "Hazardous Products Levy" in the 1990 budget. On September 25 of that same year, they announced that the levy would be replaced by an output tax scheme that involves revisions to their waste discharge permit scheme.

In an attempt to circumvent some of the administrative difficulties described above, the subgroup has examined how input and pollution taxes might be administered through the existing regulatory framework. Along these lines, legal staff from the Ministry of Environment familiarized the group with certain aspects of the Transportation of Dangerous Goods Act and the Environmental Protection and Ontario Water Resources Act.

The Transportation of Dangerous Goods Act, which was designed to ensure that shipping containers and methods of shipment for various substances are recorded and that safety standards are applied, was reviewed as a possible mechanism for an input tax. The Act has no provisions for the levy of charges, however, and has only a rough schedule which is classified under very general categories such as compressed gases, pesticides, organic chemicals, and flammable liquids.

The subgroup has also studied the possible administration of a pollution tax through current approvals granted under the Environmental Protection and Ontario Water Resources Acts. Approvals are required by all producers whose operations will impact on the environment through air emissions, waste water discharge, or waste management. The group has noted that fees for Certificates of Approval will be introduced this year.[21] These fees are scheduled to be set at two percent of capital costs for most projects.

The group feels that Certificates of Approval may not constitute the best vehicle for a pollution tax. Further, the current scheme, which would base charges on capital costs, provides a disincentive to invest in new capital which may promote energy efficiency and pollution abatement. *The group recommends that any fees for Certificates of Approval should be set so that charges directly reflect relative environmental impacts.*[22]

- *Monitoring and Enforcement*

Currently, monitoring and enforcement of both input and pollution taxes will present difficulties for the government. In the case of input taxes, problems largely stem from the fact that taxes would have to apply to all targetted substances used in that province regardless of origin. In the case of British Columbia, persons would have had to self-assess upon transportation of toxic products into the province. Ontario would likely be faced with the same system and the enforcement problems that accompany it.

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[21] May 12, 1992 news release from Ontario Ministry of Environment

[22] British Columbia will levy a form of output tax through their waste discharge permit fees. Currently, fees are levied on permits for discharge into air, land and water. The B.C. Government will adjust fee levels to reflect environmental hazards and impacts. For more information, see British Columbia Government, Environmental Protection Division, Ministry of Environment, Lands and Parks (1992). Revising British Columbia's Waste Discharge Permit Fee System: A Discussion Paper.

In the case of pollution taxes, ease of monitoring and enforcement will come with improvements in existing monitoring programs and data. Further development of the National Pollutant Release Inventory will eventually lead to annual reports from facilities on the release of a range of substances. Under the Municipal Industrial Strategy For Abatement, emissions monitoring regulations have been imposed on direct dischargers in Ontario. Under a charge on certain types of pollution, companies would have to be monitored to measure discharge on a regular basis. Although some monitoring is already performed under the regulations by the Ministry of Environment or the private sector, monitoring activities should eventually increase in scope and frequency under a special pollution charge.

• *Available Data*

Monitoring gives rise to a set of emissions data that provide the basis for a charge. In studying the possible constraints to the creation of a multimedia pollution tax, the group investigated the currently available data on emissions into water, air and land. In sum, the group found rather comprehensive data on water emissions and very poor data on air and land emissions.

For water emissions, the Municipal Industrial Strategy For Abatement already monitors most of the twenty-one substances sited in the Ministry of Environment's "Primary List" for ban, phase-out, or reduction.[23] Much of the data are compiled in the Industrial Monitoring Information System (IMIS) which provides information on potentially harmful industrial discharge into Ontario surface water and the Utility Monitoring Information System (UMIS) which contains data on all public water treatment and sewage treatment plants in Ontario.

The data on annual loadings of toxics in industrial sector effluents help demonstrate the magnitude of toxic water effluent and its sources. The sectors monitored under the Municipal Industrial Strategy For Abatement include organic chemicals manufacturing, iron and steel, inorganic chemicals, petroleum refining, pulp and paper, metal mining and refining, metal casting, industrial minerals, and electric power generation. Table 1 in Appendix E, "Emissions Data", contains data on all but the last two sectors. There is nothing worth noting in particular about the data itself except that all sectors discharge at least some quantity of the substances identified as top priority for bans or phase-outs.[24]

Data on municipal sector toxic emissions are perhaps not as comprehensive or current as those for industrial sector emissions.[25] Above, the group discussed the incen-

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[23] Candidate Substances List For Bans Or Phase-Outs pp. 40-42.

[24] The data is based on a six month average but much of the monitoring is done on a daily, weekly, biweekly or triweekly basis. Therefore, it seems that monitoring may be performed with adequate frequency for the purposes of calculating fees.

[25] See Candidate Substances List For Bans Or Phase-Outs p. 42. Examples of 1987 data for toxic loadings of a few substances from 37 Municipal Water Pollution Control Plants are provided.

tives that would be provided by a pollution charge levied on the municipal and industrial sectors. The group suggested that a pollution tax should cover discharge into municipal sewers or be accompanied by an extra-strength sewer surcharge. To better understand the scope and magnitude of industrial discharge of toxics in municipal sewers, the group accessed data on toxic emissions into sewers as compiled through Ministry of Environment pilot monitoring projects.

Tables 2, 3 and 4 in Appendix D contain data from Ministry of Environment demonstration projects in five municipalities. The numbers from these municipalities show that certain metals and other toxic substances identified by the Ministry of Environment for eventual ban or phase-out are discharged into municipal sewers by a wide range of industrial sectors. No more can be said about the tables at this point, since the data do not include sewer discharge statistics for all Ontario municipalities.

Data on toxic emissions into air and land are scant. There is no comprehensive database on these emissions for Ontario although, for air, some useful studies have compiled preliminary inventories of toxic compound emissions.[26] Some advancement in attribution of emissions to specific sources and monitoring frequency would facilitate administration of a pollution charge.

In light of insufficient monitoring and data constraints, the group recommends improved monitoring and regular compilation of emissions data in the future. In the short term, while monitoring and data constraints persist, a multimedia pollution charge should be subject to self-assessment. Under this system, companies would have to monitor and report their own discharge and, based on rates set by the government, assess their own tax liability. Also there should be an effective system of spot checks and substantial fines for non compliance.

- *Jurisdictional*

Provinces are restricted by the constitution in their authority over certain types of taxes. The federal government has sole jurisdiction over "indirect" taxes or those that are passed on in a recognizable form.[27] Whether a charge on pollution would constitute an indirect or direct tax is not certain and would depend, in part, on the design of the charge.

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[26] See, e.g. Ortech International (Draft, 1990). "Toxic Chemical Emission Inventory For Ontario and Eastern North America." This study provides estimates of industrial, stationary fuel combustion, waste incineration, and mobile transportation source emissions. It also discusses gaps in the data and current data limitations. It is worth noting that a study of air emissions in the Windsor area (Ministry of Environment "Windsor '91 Air Quality Study") is scheduled to be released in 1993. This study will contain data generated from ambient monitoring as well as mobile monitoring of point sources.

[27] This definition is not necessarily concerned with who eventually bears the economic burden of the tax. In other words, it differs from economic rather than legal conceptions of tax incidence.

There is likely little question that a pollution tax would be considered direct and within the constitutional jurisdiction of the province. An input tax, on the other hand, may be subject to jurisdictional constraints. The subgroup turned to the British Columbia experience in an attempt to understand the likelihood that an input tax would be called into question on constitutional grounds. It found that an indirect tax is one that is generally passed on in a recognizable form. Under this guideline, lawyers have suggested that a tax on a component or material (such as a toxic substance) incorporated in the manufacturing process into a manufactured item is likely to be viewed as a direct tax.[28] Therefore, Ontario may possess the option of implementing either an input tax or a pollution tax on toxics. However, the input tax is more likely than a pollution tax to raise questions on jurisdictional grounds.

Design and Recommendations

The group feels that environmental and human health risks associated with harmful pollution in Ontario can be addressed, in part, through the use of environmental tax instruments. The group noted that other jurisdictions have employed tax instruments as part of a broader strategy towards pollution prevention. Minnesota, for example, introduced a "Pollution Prevention Fee" in 1991. Under this initiative, companies are required to report releases of toxic chemicals and remit fees that increase with the number and volume of substances released into the environment. Revenues generated through the fee scheme are directed to assist companies in the reduction or elimination of hazardous waste and the release of toxic chemicals.[29]

To help reduce harmful pollution in Ontario, and generate revenues for directly related environmental objectives, the group recommends a pollution tax. The tax could be based on the Ministry of Environment "Primary List" of substances for ban or phase-out. The tax could also be applied to the pollutants contained in the National Pollutant Release Inventory or to those on the Ministry of Environment "Secondary List". To demonstrate consistency with the multimedia approach, the tax should apply to discharge into water (including sewers), air and land. It should increase with the quantity of pollution and risks associated with the particular substance.

The group also considered other general features of the tax. These features, as outlined below, should serve as a general guide in the design process. More detailed features of the tax could be established by a special task force with a specific mandate and set of principles as communicated by the government. Creation of such a task force should ensure that all interests are included or recognized in the specific design of the tax.

- **The tax should complement direct regulations**—The group has considered the Ministry of Environment recommendation for eventual ban or phase-out

[28] Correspondence between legal and Treasury Board Staff, British Columbia Ministry of Finances and Corporate Relations.

[29] Information derived from Minnesota Office of Waste Management "Fact Sheet", November, 1990.

of the most harmful toxic substances. The pollution tax would complement the current process for the implementation of these regulations. It would do so through the provision of an immediate incentive for reductions in these emissions, and the promotion of more sound, comprehensive monitoring. *The tax should in no circumstance be seen as a substitute for important regulations, or a reason to delay implementation of regulations.*

- **The tax design should incorporate an incentive for reliable monitoring**—The group suggested the possibility of a "two-tiered" tax where companies complying with a specified monitoring system giving relatively precise, accurate data pay a relatively low rate of tax. Those companies failing to monitor pollution discharge should pay a pre-established, relatively high tax rate for each substance expected to be emitted at estimated levels.
- **Producers should self-monitor within a carefully designed system of government spot checks**—Since monitoring of toxic emissions and data are currently incomplete, companies should self-monitor for pollution, and calculate tax liability based on rates established by the government. The fact that toxic emissions originate from a broad range of sources may hamper the government's ability to serve as an effective back-up to industry monitoring and increase audit costs to unwarranted levels. Therefore, the group recommends that the government set priorities as to how the tax is implemented to achieve the most cost effective environmental impacts. Those sources found to intentionally violate monitoring legislation would be subject to significant penalties.
- **Tax rates should rise over time**—In recognition of the need for transition time to more sustainable practices, tax rates should be set at "low" levels at the outset and increase gradually over time. Thus, the economic impacts of the tax will be minimized while a constant, increasing incentive will ensure continued improvements in environmental protection as the price of continued discharge becomes economically intolerable. It should be re-emphasized that the objective is to achieve the environmental goal, not to create another undesirable tax revenue program. Indeed, environmental success would be defined by declining tax revenues and ultimately by none at all.
- **Tax revenues should be earmarked for "green" initiatives, job preservation and creation programs, and offsets to cushion the economic impacts of the tax**—Revenues generated by the tax should be compiled into a trust fund for directly related qualifying "green initiatives". Projects would win grants based on sound, practical proposals that help create jobs and provide for environmental remediation or the development and application of new technology to assist in the elimination or reduction of emissions below agreed limits. The amount of the trust fund should be determined by the task force of stakeholders, with any additional revenues used for other short term environmental initiatives or offsets as outlined below. As an example of a specific project, alternative systems for wastewater treatment could improve ground

and surface water quality and address an important rural environmental issue. Construction of new treatment facilities funded through environmental tax revenues could also create jobs for Ontarians. In no case should the revenues be used to fund other government operating expenses. These should continue to be subject to normal budgetary review and approval.

The group is concerned that pollution taxes could create an unfair advantage for producers located outside of Ontario. Moreover, if companies locate polluting operations in other jurisdictions, Ontario may begin to import products that are generated from the same polluting activities discouraged at home. Therefore, tax revenues should be used, in part, to cushion impacts on various economic sectors. As examples of economically and environmentally sound use of tax revenues, funds might be targetted towards reductions in other business taxes or research and investment in technologies that help reduce toxic emissions.

- **Revenues could be directed back to communities where pollution occurs**—The group is concerned with the impacts of environmental tax instruments on communities that rely on local industries for economic stability. To offset the possible regional nature of economic impacts, and to hasten the achievement of environmental objectives in the affected community, tax revenues could be directed back to communities where the pollution occurred.
- **The government should maximize cooperation and coordination with other jurisdictions**—To ensure the success of any new program, and to minimize unforeseen consequences, the provincial government should seek out opportunities to lever on the experience and programs of other jurisdictions.
- **Consideration should be given to the use of product charges and deposit refunds to enhance the tax**—As noted above, it may be administratively difficult to place a tax on emissions from consumer products. To strengthen the effectiveness of the tax in achieving reductions in toxic emissions, consideration should be given to product charges and deposit refunds for products that are known to contain substantial amounts of the targetted substances.[30]

3.3 Deposit Refund Systems

Deposit refund systems are economic instruments which can help achieve reductions in solid waste and toxic contamination. These instruments are designed to provide an incentive for purchasers to return used products or their containers for reuse or recycling. In Ontario, deposit refund systems have applied to a range of beverage containers and currently apply to certain beer and soft drink containers. Other jurisdictions have applied deposit refunds to a wider range of products including car and household batteries, and car hulks. As other possibilities, the

[30] The application of product taxes and deposit refunds may serve as a case where economic instruments are only distantly linked to environmental regulations such as those pertaining to reductions in solid waste and toxic emissions. The type of connection between economic instruments and regulations will vary on a case by case basis.

Environmental Protection Agency in the United States cites deposit refunds on pesticide containers, used oil, and chlorinated solvents.[31]

Apart from beverage containers, deposit refunds have most commonly been applied to lead acid car batteries. In the United States alone, Rhode Island, Maine, Minnesota and Wisconsin are among the jurisdictions that have implemented such systems. Given the government's identification of lead as a particularly harmful toxic substance,[32] the proliferation of deposit refunds on lead acid batteries, and the fact that Canadian jurisdictions have also experimented with economic instruments on these products,[33] the working group decided to investigate the desirability of a deposit refund on lead acid batteries for Ontario.

A deposit refund on lead acid batteries would presumably be designed to reduce toxic contamination in the environment resulting from the disposal of lead in landfill sites. This economic instrument would provide a financial incentive to return batteries for extraction and recycle of lead contents. The best evidence that the group examined, however, indicates that in Ontario nearly all lead contained in lead acid batteries is already recycled. Estimates based on calculations by Energy, Mines and Resources Canada suggest that recycling rates for lead acid batteries in Ontario fall in the range of 95%-98%.[34] Moreover, the group found that a deposit refund mechanism may serve to reduce recycling rates by providing an administrative deterrent to battery distributors and scrap metal dealers who act as intermediaries between customers and recyclers.

In light of the group's findings, *members do not recommend a deposit refund system on lead acid car batteries for Ontario. Further, in future consideration of deposit refund systems, the government should refrain from taking any action where market forces already create a mechanism for the safe recycle or reuse of potentially harmful products. Where markets fail to provide for such mechanisms, deposit refund systems merit further experimentation.*

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[31] United States Environmental Protection Agency Economic Incentives Task Force (1991). "Economic Incentives: Options For Environmental Protection".

[32] Lead appears on the Ministry of Environment "Secondary List" of substances for possible ban or phase-out.

[33] British Columbia applies an excise tax to lead acid batteries with revenues directed to the the Sustainable Environment Fund.

[34] Information obtained through communication and studies conducted by officials from Energy Mines and Resources, Canada and consulting engineers for Tonolli Canada Ltd., one of Ontario's primary recyclers of lead acid batteries.

4. ENERGY SUBGROUP

4.1 Energy Use In Ontario

Current Energy Use In Ontario

Canada uses more energy per dollar of output than any other industrialized country (except Luxembourg). This reliance on energy is due to a number of factors. These include Canada's resource oriented economy, which uses large quantities of energy to convert raw resources into commodities for market; relatively low energy prices, especially in the past when facilitated by federal and provincial pricing policies; and urban land use sprawl. In addition, Canada is one of the few industrialized nations that is totally self-sufficient in energy. This fortunate natural endowment may have bred some federal and provincial complacency towards energy use.[35]

Canada's high energy intensity is often attributed to the country's Northern climate. This may be difficult to substantiate for most sectors. Space heating in Ontario, for instance, accounts for less than 20 per cent of total end use consumption. If the Province's building stock were as energy efficient as buildings in the cold European climates of Scandinavia, overall energy intensity would still be a great deal higher than in those countries.

Ontario's share of Canadian energy consumption approximates its share of Canadian output as measured by gross national product, however its mix of energy derived from different sources is unique. Provinces differ widely from each other, and Ontario is one of two provinces with a high reliance on nuclear power which generates approximately 50 per cent of its electricity.

In 1989, Ontario's industrial sector accounted for approximately 35 per cent of end use consumption followed by transportation at 24 per cent, residential (19 per cent) and commercial (14 per cent).[36] Energy use by sector and by fuel type is presented in Appendix F, Table 1. Sectoral energy expenditures do not follow the same ranking as energy use. Due to energy pricing and current taxes on retail pump sales, the transportation sector spent the most in 1989, followed by the residential, industrial and then commercial sectors. Energy expenditures by sector and fuel type are presented in Appendix F, Table 2.

Possible Directions In Ontario Energy Use[37]

The profile of energy use in Ontario is dynamic. In order to achieve energy efficiency and emissions reductions, adjustments are likely to be necessary in the level of en-

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[35] Some of the information in this section is derived from The Ontario Round Table On Environment and Economy's Energy and Minerals Sectoral Task Force Report, October, 1991.

[36] Energy and Minerals Sectoral Task Force Report, Appendix A, p. 1.

[37] Much of the information in this section derived from The Ontario Global Warming Coalition's "Degrees of Change: Steps Towards and Ontario Global Warming Strategy" (1991).

ergy consumed and the composition of energy inputs.[38] Competitive and environmental forces will provide impetus for changes in residential, commercial, transportation and industrial energy use. These changes will be directed towards efficiency increases and emissions reductions. The speed with which any changes take place will depend on a range of factors including current and future government and market incentives, the availability of funds for investment in new capital, and the general health of the economy and sectors most effected.

There is some evidence that significant technical and economic potential exists for energy efficiency in Ontario. A recent study of the electricity sector by Marbek Resource Consultants for the City of Toronto, for example, identified economic electricity savings on the order of 40-to-46 per cent at current electricity prices. Under this scenario, if all of the economic potential of electricity end use efficiency were achieved in Toronto, the City would experience a significant decline in demand in this sector over the next 15 years. The analysis for Toronto is probably fairly typical for urban areas throughout Southern Ontario.

In the residential and commercial sectors, there is potential for reductions in energy intensity through improved insulation, and high efficiency furnaces, water heaters, windows, furnace fans, and lighting. Assuming coal is used to produce the marginal unit of electricity, residential units and commercial buildings could move off electric resistance heating furnaces and water heaters to natural gas furnaces and water heaters as well as solar water heaters to reduce emissions.[39] Commercial buildings could save additional energy through the use of occupancy sensors and dimming systems for lighting.

Future directions in the transportation sector could include increased fleet average fuel efficiency and use of alternative fuels such as natural gas and ethanol. Shifts from private motor vehicles towards public transportation, rail, bicycles and walking would also reduce energy use.

Many of the potential changes for improved energy efficiency in the residential and commercial sectors such as improved lighting and insulation also apply to the industrial sector. More importantly, where funds are available, the adoption of other high efficiency equipment such as motors and pumps could add to efficiency gains. Also of potentially greater significance for energy use and emissions is the potential for industries with heating requirements to use waste heat recycling and adopt

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[38] The Ontario Round Table On Environment and Economy called for increased energy efficiency and emissions reductions in all major sectors. See Ontario Round Table on Environment and Economy (1992). Restructuring For Sustainability. pp. 52-59. Throughout this section of the report, the working group continues to draw on several sources of information to broaden its perspective on the topic. The group does not claim to have performed sufficient research to objectively judge the conclusions drawn by other groups or researchers.

[39] Changes in emission levels will depend in large part on the marginal source of energy used to generate electricity. If coal is used at the margin, these measures are much more likely to result in reduced emissions than if nuclear energy is used.

"cogeneration" which is the simultaneous production of heat and electricity generally from natural gas.

4.2 Environmental Issues In Energy Production And Consumption

Some of the barriers to movement towards energy efficiency options described above include lack of capital for new investment in equipment and availability of technology broadly suitable for businesses in Ontario. Another is that energy users may not currently pay the full cost of energy production and use.[40] Depending on the energy source, energy production and use can give rise to a range of environmental externalities related to air and water pollution, disposal of used-up nuclear fuel, conservation of resources, and preservation of wildlife and ecosystems.

Energy related air emissions have generated concern due to the nature and scope of their global and local environmental impacts. On the global scale, energy emissions can contribute to global warming.[41] The combustion of fossil fuels results in emissions of "greenhouse gases" such as carbon dioxide, methane, and nitrous oxide which may lead to increases in the global, annual-mean surface air temperature. In turn, academic studies have suggested this global warming phenomenon can have implications for coastal flooding, energy use, forest growth patterns and productivity, availability of agricultural land and soil quality, and abundance and quality of water resources.

The local impacts of energy emissions are associated with specific substances. Sulphur dioxide emissions, for example, give rise to acid rain which harms water bodies, forests and plant life. Nitrogen oxide and volatile organic compound emissions are the precursors to ground level ozone which creates human health problems and crop damage. Various persistent toxic substances emitted through energy use and production such as benzo(a)pyrene, perylene, phenanthrene, and anthracene have been cited by the Ministry of Environment as candidates for ban or phase-out.[42] The levels and circumstances under which these contaminants are emitted largely determine the magnitude and nature of their environmental and health impacts.

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[40] It is recognized that a complete definition of full cost is far from settled or understood.

[41] Studies have suggested that nitrous oxide and methane are carriers of molecules that enhance ozone depletion which has in turn been linked to increased skin cancers and eye diseases, decreased effectiveness in human immune systems, and decreases in agricultural yields. Information on global warming and ozone depletion largely derived from Environment Canada (1991). Climate Change Digest, "Climate Change And Canadian Impacts: The Scientific Perspective", Ministry of Supply and Services, Canada. and Environment Canada (1991). A State of The Environment Report, "Understanding Atmospheric Change: A Survey of the Background Science and Implications of Climate Change and Ozone Depletion", Ministry of Supply and Services, Canada.

[42] These persistent toxics are emitted through stationary fuel combustion, mobile transportation, industrial processes, or some combination of these.

4.3 Attention Devoted To Greenhouse Gas Emissions

Greenhouse gas emissions have received a great deal of attention in Canada and abroad. At the 1992 Environmental Summit in Brazil, Canada was one of the more than 150 signatories to a "Framework Convention on Climate Change" which provides a common framework for countries to pursue domestic policies to limit emissions of greenhouse gases and establishes a commitment by signatories to prepare inventories and take specific actions for greenhouse gas reductions.[43] Prior to this agreement, Canada's "Green Plan" proposed the goal of stabilizing national greenhouse gas emissions at 1990 levels by the year 2000.[44] In addition to this target, the Ontario Round Table on Environment and Economy recommended an 80 per cent reduction in global emissions of fossil-based fuels by the year 2030 and a 20 per cent reduction in carbon dioxide emissions by the year 2005.[45] Through a multi-stakeholder process, the Ontario Minister of Energy is currently developing an action plan that "has specific initiatives, programs, and targets to take Ontario as quickly as possible to stabilizing greenhouse gas emissions, then to a 20 per cent reduction and beyond".[46]

Much of the discussion on greenhouse gas reductions has focused on reductions in carbon dioxide emissions. It is estimated that carbon dioxide accounts for about 56 per cent of the past decade's increase in global warming potential.[47] Moreover, over 90 per cent of carbon dioxide emissions in Canada are energy related.[48] As a result, many environmental policy ideas have been geared towards energy conservation and efficiency in general, and carbon dioxide reductions in particular.

4.4 Background On Energy Taxes

The broad interest in the achievement of energy efficiency, conservation and emission reduction goals for environmental and economic purposes has led to much discussion and analysis of the role for economic instruments in the facilitation of these goals. Tax and other instruments have been identified as options in the correction of environmental externalities through reductions in energy use or individual energy related emissions. Along these lines, the working group focused on general energy taxes as well as specific energy related emissions taxes. Given current government interest in greenhouse gas reductions, the group analyzed a "carbon tax" which might be designed to hasten reductions in energy related carbon dioxide emissions. However, much of the group's analysis of carbon taxes could be extended to taxes on other emissions such as sulphur dioxide and nitrous oxide.

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[43] Energy, Mines and Resources, Canada. Global Warming Report, Volume 1, Number 1, August, 1992.
[44] Environment Canada (1990).Canada's Green Plan For A Healthy Economy, Supply and Services Canada.
[45] These targets were not tested against economic impacts, benefits or other environmental priorities. See Ontario Round Table on Environment and Economy (1992). Restructuring For Sustainability.
[46] June 22, 1992 correspondence from Honourable Brian Charlton to Ontario Global Warming Coalition. This letter also indicates the support of these targets and goals by the Ontario Cabinet.
[47] State of the Environment Report, p. 30.
[48] Energy and Minerals Sectoral Task Force Report, Appendix A, p. 5.

A carbon tax, as one of many possible forms of energy tax, has been studied in great detail. A carbon tax is levied on fossil fuel energy inputs according to their carbon content. Under this scheme, fossil fuels with a relatively high carbon content per unit energy content such as coal bear higher taxes than those with a relatively low carbon content per energy content such as natural gas. Under certain circumstances, the tax may encourage energy conservation and substitution of relatively low carbon fuels for high carbon fuels.

Carbon tax studies have tended to focus on the implications of a particular tax for economic growth (usually in terms of gross product), emissions, and revenues in a particular country, block of countries or the world.[49] Other studies have emphasised the design and coordination issues associated with a carbon tax[50] or the effects of a carbon tax on economic efficiency.[51] The results of all these studies, and the studies referenced below, vary widely and depend, in large part, on the assumptions used by the researcher in the development and application of the economic model.

In Canada, carbon tax studies have been performed by the government, the non-profit sector,[52] and the private sector. In a recent discussion paper on economic instruments, the Federal Government presented results which demonstrated that a carbon tax designed to stabilize carbon dioxide emissions at 1990 levels by the year 2000 would result in an approximately 0.2 per cent decline in real income and that a carbon tax would be the most cost-effective instrument for the achievement of the stabilization goal.[53] This paper also indicated that a carbon tax would result in reductions of nitrogen oxides, volatile organic compounds, sulphur oxides and methane by approximately 11, 6, 7 and 5 per cent respectively.[54] Unfortunately, the details of this study have not been published and the assumptions underlying its conclusions are unknown.

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[49] For a good summary of these studies, see Organization For Economic Cooperation and Development (1992). "New Issues, New Results: The OECD's Second Survey of The Macroeconomic Costs of Reducing CO2 Emissions", Economics Department Working Papers No. 123.

[50] See, e.g., Poterba, J.M. (1991). "Tax Policy To Combat Global Warming: On Designing a Carbon Tax" in Global Warming Economic Policy Responses, Rudiger Dornbusch and James Poterba editors, The MIT Press, Cambridge, Mass. or Cnossen, S. and Vollebergh, H. (1992). "Toward A Global Excise on Carbon", National Tax Journal, Vol. XLV. pp. 23-35.

[51] See, e.g., Goulder, L.H. (1992). "Do The Costs of a Carbon Tax Vanish When Interactions With Other Taxes Are Accounted For?", Working Paper No. 4061, National Bureau of Economic Research, United States or Jorgenson, D. and Wilcoxen, P. et. al. (1991). "The Efficiency Value of Carbon Tax Revenues" United States Environmental Protection Agency, Washington , D.C.

[52] See Gibbons, J. and Valiante, M. (1991). "Carbon Taxes and Tradeable Carbon Quotas: A Least Cost Strategy to Reduce Ontario's Carbon Dioxide Emissions", Canadian Institute For Environmental Law and Policy.

[53] Government of Canada Discussion Paper (1992). "Economic Instruments For Environmental Protection", pp. 16 and 58.

[54] ibid. p. 18.

Another theoretical study of carbon tax options for Canada, performed through use of economic analysis, theory and models, was carried out for Imperial Oil, Ltd.[55] This study demonstrates that a $50/tonne carbon tax would result in an approximately 350 million tonne total reduction in carbon dioxide emissions over the period 1990-2005 and a corresponding 1.8 per cent reduction in aggregate output over the same period.[56] It also demonstrates the relative cost effectiveness of carbon taxes over gas guzzler taxes, motor fuel taxes and sales taxes in the achievement of carbon dioxide reductions. However, the authors indicate that carbon taxes can lead to losses in industrial competitiveness, dislocation in energy intensive sectors, and inflationary pressures.

Activities related to carbon taxes have extended beyond study to action in some jurisdictions. Sweden imposed a carbon tax in 1990 replacing a lower level of energy tax and some income tax revenues. It was initially established at the relatively high rate of $50 U.S. per tonne of carbon and exempted the major emitters of carbon dioxide in the industrial sector including cement and iron and steel. Recent changes to the Swedish tax to address competitiveness impacts and equality across industrial sectors have included substantial reductions in the tax rate to $16 U.S. per tonne and broadening the base to include previously exempted industries. Finland and The Netherlands introduced carbon taxes in 1990.[57] These taxes were introduced at lower levels than the Swedish tax but applied to all sectors. To date, there is no available empirical evidence as to the effectiveness of these taxes in reducing carbon dioxide emissions.

4.5 Consultation And Research Findings

Process For Working Group Examination Of Energy Taxes

At the outset of its deliberations in the fall of 1991, the working group found a gap in the existing literature on energy and carbon taxes that would constrain its analysis of these options for Ontario. There had been relatively little detailed empirical study on the implications of these taxes for Ontario's economy, or environment.[58] To obtain a better understanding of energy taxes and their potential impacts, the group established a process of broader consultation and a research agenda.

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[55] Osten, J.A. and Vasic, G. and West, D. (1991). "Carbon Dioxide Emissions and Federal Energy Policy: A Discussion of the Economic Consequences of Alternative Taxes", prepared for Imperial Oil Limited by DRI/McGraw-Hill.

[56] According to this study, total 1990 emissions of carbon dioxide in Canada were about 500 million tonnes.

[57] It is also worth noting that the European Community has considered carbon and energy tax options and the state legislature of Minnesota has recently considered a carbon tax proposal. The Minnesota proposal is called the "Sustainable Energy Transition Act of 1992". It involves a carbon tax with revenues generated to be directed towards a fund for the promotion of energy conservation and efficiency. Spending initiatives would include investments in locally available renewable energy supplies, energy efficiency, conservation, utility and transportation infrastructure, waste minimisation and recycling.

[58] For an overview of the implications of a carbon tax for Ontario, see Gibbons and Valiante (1991). pp. 44-57.

The working group's consultation consisted of two major workshops involving industry representatives, environmentalists, small business, labour representatives, social equity groups, academics and government. At the first of these two events, participants heard from a panel of experts and identified important issues for the working group's research. The second workshop featured some results from this research and provided the working group with an opportunity to obtain further feedback on the desirability of energy taxes for Ontario and the conditions under which they might or might not be desirable or acceptable.

Research On Energy Tax Options For Ontario

The research results possess both a quantitative and qualitative nature.[59] Calculations were performed to derive the cost impacts of energy and carbon tax options on various Ontario industries, and the potential for these taxes to promote energy conservation and reduce carbon dioxide emissions. In addition, a questionnaire was distributed to companies with operations in the province to elicit further information on the impacts of energy taxes for investment and location decisions.

In the quantification of carbon tax impacts, it is crucial to know the carbon content of fuels used by the various sectors and sub-sectors.[60] As indicated in Table 3 of Appendix F, the total fuel used in the industrial sector contains more carbon than that used in any of the transportation, commercial and residential sectors although the transportation and industrial sectors are nearly equal when electricity inputs are excluded.[61] Table 4 (Appendix F) shows the carbon content of fuels/energy used by various industrial and transportation sub-sectors. Within the industrial sector, the carbon content of total energy inputs to manufacturing far exceeds the carbon content of total energy used by other sub-sectors, whereas in the transportation sector, retail pump sales contain the bulk of carbon.[62]

The research study examined the impacts of three different tax options, each of which would generate approximately one billion dollars in revenue.[63] These options were an energy tax based on the energy content of all energy inputs, a carbon tax based on the carbon content of fossil fuels, and an ad valorem or sales tax based

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[59] Research study by Fred Lazar of York University Business School to be published by Fair Tax Commission at a later date.

[60] The total carbon content of the fuels used in electricity generation by Ontario Hydro was prorated over the primary electricity used by the four main sectors. The implicit carbon content for electricity consumed in Ontario was taken to be 17.51 tonnes per terajoule or 63.04 tonnes per GwH of electricity.

[61] All figures are from 1989.

[62] These sub-sectors also account for the bulk of energy expenditures, however, so it should not be taken that they necessarily use the most carbon intense fuels.

[63] The billion dollar revenue target was selected at random for its ease in calculation and because it would translate into a carbon tax of $24.68 per tonne carbon—in the range of magnitude of carbon tax considered in various studies and by the European Community. Also, the Greenprint For Canada proposal by a coalition of environmental groups suggested a carbon tax of approximately $22/tonne carbon.

on the retail price of energy inputs. The cost implications for the industrial, transportation, residential and commercial sectors varies substantially across the three tax options, although the implications for the carbon and energy tax options are similar. As demonstrated in Appendix F, Tables 5, 6, and 7, the energy and carbon taxes impact most heavily on the industrial and transportation sectors followed by the residential and commercial sectors while the ad valorem tax impacts most heavily on the transportation sector followed by the residential, industrial and commercial sectors.

Deeper analysis of the impacts of various tax options generated estimates of cost increases for the various industrial sub-sectors[64] (see Appendix F, Table 8). Again, the carbon and energy tax options would give rise to similar outcomes. Under either option, costs would generally increase by less than one half of one per cent for any given industrial sub-sector.[65] Exceptions to this pattern included some of the primary metals operations which fell in the 1-2 per cent cost increase range and the cement industry which fell in the 7 per cent cost increase range.[66] For the ad valorem tax, total cost increases for almost all of the sub-sectors fell in the range of 0.2 per cent or less. It is recognized that relatively small per cent changes in total cost such as these during a period of severe economic distress similar to today can have a significantly negative economic impact on certain sectors of the economy.

Some of the benefits to the application of energy taxes would be derived from increased energy conservation and decreased emissions. To understand the possible magnitude of these effects, the short-term and long-term (15 years) impacts of energy tax options on energy use and carbon dioxide emissions were generated through the use of previously calculated relationships between energy demand and energy prices.[67] In sum, it was found that the energy tax was the most effective instrument in the reduction of energy use and the carbon tax was the most effective in the reduction of carbon dioxide emissions (see Appendix F, Tables 10, 11 and 12). Under the billion dollar tax options, an energy tax could reduce energy use by about 7.4 per cent in the industrial sector, 3.5 per cent in the commercial sector, 1.7 per cent in the transportation sector, and 0.7 per cent in the residential sector in the long term

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[64] Cost calculations performed through the use of industrial input-output tables.

[65] These cost estimates reflect the impacts of taxes where effects on the prices of intermediate inputs such as materials and supplies are not accounted for. See Appendix F, Table 9 for estimates of costs where input price changes are factored into calculations. In general, accounting for price changes in intermediate inputs will increase estimates of total costs.

[66] These numbers were derived under the assumption that the revenues were in no way recycled back into the economy to offset the sectoral economic impacts of the tax. These impacts also assume carbon tax based on use of coal as energy input as opposed to feedstock by primary steel and cement industries. See Appendix F, Tables 8 and 9 for cost implications where coal treated as feedstock in these sub-sectors.

[67] Mr. Mahmoud Elkhafif, an economist with Ontario Hydro, had previously calculated short-term, long-term, own and cross-price elasticities of demand for the residential, commercial and industrial sectors in Ontario for electricity, natural gas, oil and coal. He had also estimated short and long-term price elasticities of demand for motor gasoline by the transportation sector.

whereas a carbon tax could reduce carbon dioxide emissions in total by about 6350 kilotonnes[68] in the long term.[69]

Carbon taxes are generally considered to accelerate reductions in carbon dioxide emissions by encouraging the substitution of low carbon fuels for high carbon fuels where it is technologically feasible and economically practical. Substitution in this direction generally arises from higher price increases in high carbon fuels relative to low carbon fuels. Due to pre-tax prices of fuels and energy in Ontario, however, a carbon tax may increase natural gas prices relative to light fuel oil and electricity prices even though electricity and oil are more carbon intensive.[70] As indicated in Table 13 a carbon tax would increase natural gas prices by anywhere from 6 to 12 per cent, depending on the sector. By contrast, the price of light fuel oil would increase by about 6 per cent and electricity by 2 to 4 per cent depending on the sector. It should be noted that the prices of the most carbon intensive fuels, coal and heavy fuel oil, would increase many times more than the price of natural gas. An energy tax would have similar impacts on the relative price of these fuels.[71]

The above results constitute a summary of the quantitative research results. It is also worth briefly noting some of the qualitative findings as elicited through the industry questionnaire. Interestingly, respondents indicated that a billion dollar energy tax taken in isolation from other policies may not promote significant changes in corporate strategy and decision-making. The cumulative effect of the tax and other policies, however, may lead to changes in investment and location decisions which could have a substantial impact on the Ontario economy. Another interesting finding was that an energy tax, combined with Ontario Hydro rate increases, could promote the adoption of cogeneration technologies to produce electricity by companies whose production processes consume sufficient quantities of heat. This change could lead to substantial increases in industrial energy efficiency.

4.6 Recommendations, Guidelines And Analysis Of Energy Taxes And Other Options

After research, consultation and discussion, the group recommends that when considering reductions in energy use and carbon dioxide emissions, the government

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[68] This amounts to approximately 4.3 per cent of the aggregate 1989 level of emissions by the four sectors.

[69] These numbers were derived under the assumption that the revenues were in no way recycled back into the economy to enhance the goal of energy efficiency.

[70] This result arises from the relatively low retail price of natural gas compared to electricity and fuel oil.

[71] Gibbons and Valiante (1991) write that "Since Ontario Hydro's generation mix is 75 per cent non-fossil and since electricity supply is more capital intensive than natural gas supply, a system of carbon taxes or tradeable carbon quotas would have a much greater impact on the prices of natural gas, oil and coal than on the price of electricity. For example, a carbon tax which will double the price of natural gas will only raise the price of electricity by 18 per cent." pp. 37-38. The authors then take the position that electricity should be priced at its social marginal cost to encourage switching to natural gas and other lower carbon options.

should explore the use of economic instruments to facilitate this goal. As described below, some of the options for environmental tax instruments include carbon and energy taxes, extension of the retail sales tax to energy, and related tax expenditures to provide an incentive for adoption of energy efficient and emission reducing processes and equipment. The group cautions, however, that these tax instruments should not become a mechanism for the government to raise money for the consolidated revenue fund. Such revenues should be used to help promote the objectives of increased energy efficiency and reductions in carbon dioxide emissions.

Guidelines For Energy Taxes In Ontario

Many important design and implementation issues must be addressed in a complete analysis of energy and carbon taxes. Some of the main issues arise out of considerations for tax administration and "constitutionality" or the constitutional right of the provinces to levy certain taxes. The working group has not addressed all of the important issues, but has focused on some guidelines for energy taxes in Ontario with respect to their economic and environmental impacts.

For environmental and economic purposes, the group agrees that when energy/carbon taxes are being considered, it is preferable to implement them in conjunction with other jurisdictions. The guidelines outlined below would apply to a case where, for whatever reason, Ontario chooses to act unilaterally.

- **Energy/carbon taxes should not be used as the sole mechanism for achievements in energy efficiency and carbon dioxide emissions reductions**—Many of the recent carbon tax studies have examined tax levels designed to achieve a particular goal for stabilization or reduction of carbon dioxide emissions. Tax instruments should be used in conjunction with regulatory instruments, education, and public investments through direct expenditures, special grants or tax expenditures. Furthermore, the mandate of Ontario's natural gas utilities should be expanded to include the promotion of energy efficiency and conservation. In short, taxes should not be designed to achieve established emissions reductions targets on their own.
- **Energy/carbon tax designs should reflect considerations for sectoral economic impacts through low tax rates, special provisions for the most energy/carbon intensive industries, and the use of revenues to offset other taxes**—Recent research used by the group indicates that the impacts of energy and carbon taxes on certain economic sectors and sub-sectors could become substantial. It is recognized that the severity of the impact of such a tax on sectors of the economy and their ability to respond with minimum economic hardship will vary substantially. A high tax to change behaviour and achieve established emissions targets would create substantial cost increases across many industrial sub-sectors. A lower tax in the range of a billion dollars, however, was found to generate modest increases in total cost and would therefore be preferable to the high tax from an economic stand-point.

In light of the current economic recession which has already impacted heavily on many energy intensive industries, the global market in which many companies operate, and the imbalance in impacts of a carbon tax, certain sub-sectors may merit special provisions such as lower rates and exemptions. These sub-sectors might include, for example, those in the primary metals and paper products industries.[72] In addition to these provisions, tax revenues should be used to offset other business taxes. Measures such as these would help cushion the economic impacts of the tax.

- **Energy/carbon tax designs should reflect considerations for the advancement of energy efficiency gains and reductions in emissions**—Research shows that low level energy and carbon taxes will not substantially advance energy efficiency and carbon dioxide emissions reductions if the revenues are not recycled to enhance these specific goals. Therefore, in the provision of offsets for economic impacts, revenues should be directed to grants, subsidies or tax expenditures which promote the adoption of new energy efficient capital equipment, manufacturing processes and distribution technologies, and the use of low carbon content fuels.
- **Energy/carbon tax designs and related program designs should reflect considerations for regional disparities and income disparities**—The impacts of energy and carbon taxes may be more concentrated in particular communities and regions than in others. Communities that rely on energy intensive industries for employment and economic activity, for example, or small towns that require energy due to lack of public transportation or land use may bear a relatively large proportion of the tax burden. To address these potential impacts, tax revenues might be redirected to the community of origin for the purposes of job creation or for investment in energy efficient industrial activities, public transportation and energy distribution and monitoring technologies.

  Low income households generally spend a relatively large proportion of their disposable income on energy. Energy taxes are therefore likely to have regressive impacts unless programs are implemented to offset increased energy costs. Tax assistance to low income households could be delivered in the form of special rates, subsidies, or tax credits, any of which could reduce energy costs and/or provide an incentive to improve home energy efficiency.

Future Process On Energy Taxes For Ontario

The group believes that taxes can be used to help achieve environmental objectives related to energy use. Moreover, through examination of research results, the group has learned that energy and carbon taxes may be one of the most effective, cost-efficient instruments in the reduction of carbon dioxide emissions. However, the

[72] The working group's research did not study the cost impacts on the various transportation sub-sectors, however calculations of energy tax costs by sub-sector demonstrate that retail pump sales would bear the largest proportion of the tax. Within the industrial sector, the steel industry might be exempted from a carbon tax without special provisions since there is some question as to whether coal and coke are used as feedstocks in this sector.

group has also learned that under certain circumstances, the impacts of an energy or carbon may be minimal for the environment and detrimental for some industrial sub-sectors. These impacts will depend critically on the tax design, use of revenues, and broader energy and environmental policy framework.

To improve our understanding of these design and policy coordination issues, any further investigation of energy taxes in Ontario should be conducted through research as well as consultation. Further research by the Fair Tax Commission, a different task force, or other jurisdictions should focus on the macroeconomic and distributional impacts of energy and carbon taxes that may be implemented in conjunction with other tax cuts or expenditures to help ease the transition to a more energy efficient, less carbon dioxide emitting economy. Consultation should only be initiated by government when environmental goals and tax instruments have been established. Involvement by stakeholders would be focussed on the detailed design issues of the tax and related offsets including tax reductions and expenditure policies. To ensure a relevant and effective outcome, tax and expenditure analysis should be closely linked to a broader Ontario global warming strategy which encompasses a range of regulatory, education and economic policy initiatives.

Sales Tax On Energy

Through its adoption of the "polluter-pays principle", the working group has, under certain circumstances, advocated the application of special environmental tax instruments to internalise environmental externalities. Where economic and other factors constrain the implementation of such taxes, a modified approach whereby the elimination of current tax expenditures and other subsidies that provide an environmentally undesirable signal might be pursued. The Natural Resources Subgroup took this approach in its analysis of the impacts of tax measures and subsidies in the natural resource sectors.

One of the tax expenditures in the current tax system is the exemption of energy sales from the Provincial Retail Sales Tax.[73] While this exemption may facilitate the achievement of certain economic and social policy goals, it may undermine the goal of full-cost pricing for energy[74] and the internalisation of energy related environmental externalities as outlined in the group's adoption of the polluter-pays principle. The group believes that it may not be necessary to make this trade off between environmental and other policy goals. Through taxation of energy sales and efficient, immediate use of the revenues to offset some of the impacts or to reduce the overall rate of the Provincial Retail Sales Tax, other policy objectives of the tax system could be maintained with added incentives for energy efficiency.

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[73] It is not certain that the extension of retail sales tax would apply to industrial energy inputs. The RST currently applies to certain inputs but not others. The GST currently applies to energy inputs but is offset by a corresponding input tax credit.

[74] Full costs are not readily known or measurable.

The issues raised by a sales tax on energy and a carbon tax are similar. They include environmental benefits, economic impacts, equity, administration and simplicity. A sales tax may be a better option than a carbon tax, at least in the short term, for the following reasons:

- **Extension of the Retail Sales Tax to energy could prove less administratively costly than a carbon tax**—Since the Retail Sales Tax is already in place, a sales tax on energy could be administered through the current government structure whereas a carbon tax would likely require new administrative structures. Based on this difference, the group believes that the administrative costs are likely to be higher for a carbon tax than a sales tax on energy.
- **A Retail Sales Tax on energy could prove simpler in compliance than a carbon tax**—Private sector energy consumers already understand and comply with sales taxes but have no direct experience or familiarity in complying with a carbon tax. For this reason, compliance with the carbon tax may be more complex, particularly in the initial stages of application.
- **A Retail Sales Tax on energy could raise fewer jurisdictional issues than a carbon tax**—The Province is prohibited by the constitution to levy "indirect" taxes. A retail sales tax on energy is a "direct" tax that is within the Province's jurisdiction. A carbon tax may also be within the Province's jurisdiction, depending on the design. If challenged on the basis of constitutionality, however, there is no certainty that a carbon tax would be ruled permissible by the courts.[75]

Regardless of these possible advantages, the group cautions that **from an environmental point of view, extension of the Retail Sales Tax to energy may not be the best option.** In particular, it could be argued that a sales tax on energy would not promote the same degree of fuel switching and hence carbon dioxide reductions as a carbon tax. While this argument may hold in reference to substitution away from coal and heavy fuel oil, it is unlikely to hold for substitutions between electricity, light fuel oil and natural gas. As pointed out above, under current retail pricing of energy inputs, a carbon tax would raise the price of natural gas relative to electricity and light fuel oil. A sales tax on energy, on the other hand, would lead to proportional price increases in all energy inputs. Therefore, the advantages in carbon dioxide reductions of a carbon tax over a retail sales tax on energy may not be as great in practice as might have been predicted on the basis of standard theory.

The guidelines to application of a carbon tax set out by the working group would generally apply to a retail sales tax on energy. If the tax were applied to industrial energy inputs, some companies may be able to avoid cost increases through investments in new energy efficient equipment or through upgrades of old equipment while others may not. To facilitate such actions, and to enhance the incentive for improved energy efficiency, tax revenues could be directed towards some form of

[75] For a more detailed discussion on the constitutionality of a carbon tax, see Gibbons and Valiante (1991).

subsidy (direct or tax) for the adoption of new energy efficient equipment. One such example would be to extend the current Ontario Current Cost Adjustment, which applies narrowly to pollution control equipment, to cogeneration equipment. In addition, research and development credits could be expanded for the pursuit of more energy efficient technologies.

Like a carbon tax, a sales tax on energy gives rise to equity concerns with respect to low income households and rural regions of the Province. As demonstrated in Charts 1 and 2, Appendix F, energy taxes are regressive; they impact on low income households relatively more than high income households.[76] To offset the impacts on low income households and Northern or rural regions of the Province that require relatively high energy consumption, a retail sales tax on energy could be accompanied by a reduction in the overall sales tax rate so as not to generate further revenues through the application of a regressive tax.

Alternatively, the tax could be introduced in conjunction with other programs such as energy saving weatherization programs and insulation subsidies for low income households, increased rental subsidies for low income households who may not benefit from weatherization programs, and Retail Sales Tax exemptions for high efficiency furnaces, windows and lights. Moreover, to ensure that tenants possess a wide range of energy saving options, the introduction of sales taxes on energy for the residential sector may require investments in energy use meters for rental units. Otherwise, in the current situation, rising energy costs may be paid by landlords and passed on to tenants who may have no control over energy consumption and costs.

Voluntary Approach To Emissions Reductions

As a complement to the use of economic and regulatory instruments, a process of voluntary negotiations could help accelerate emissions reductions. Under this scheme, industries might develop emissions reduction plans with the government on a sectoral basis. Plans would establish measurable commitments which would be enforceable through regulatory penalties and fines. The advantages of the voluntary approach include increased flexibility for different sectors in the timing and speed with which reductions take place to account for their unique financial and structural positions.[77] Such a program could be initiated by the government as part of a broader global warming strategy. If such mechanisms fully achieve the objective of government emissions reductions policy then environmental tax instruments would not be needed.

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[76] These charts reflect the "actual" and "relative" incidence of retail sales taxes on energy. The actual incidence is based on actual energy expenditures and does not account for the fact that more is spent on one form of energy or another. The relative incidence is a weighted analysis that distributes household expenditures evenly across energy sources.

[77] This option is similar in nature to tradable carbon quotas which the group did not investigate. For a good description of a tradable carbon quota system, see Gibbons and Valiante (1991).

5. NATURAL RESOURCES SUBGROUP

5.1 Agriculture

Background

Farmers have a significant role as protectors of the environment because of their unique use of land and the earth's natural resources. Farming activities are often associated with uncompensated environmental benefits. The preservation of undeveloped agricultural lands provides environmental benefits to the greater public. In addition, there is an opportunity cost borne by farmers in the maintenance of certain lands out of production such as woodlands and wetlands. If farmers are made to pay for the negative environmental impacts of agricultural activities, they should also be compensated for the related environmental benefits.

Farming practices have environmental consequences by their nature. Some of the potential negative impacts on the environment that result from agricultural practices include soil contamination, erosion and degradation, ground and surface water contamination, wetland and woodland reduction, waste disposal, high-energy use, and greenhouse gas emissions. While governments have implemented certain programs that are designed to promote more sustainable farming practices in Ontario, and the Ontario farming community has a self-imposed direction towards environmentally responsible farming, farmers have not yet achieved all their goals for the reduction of negative impacts on the environment.

Framework For Analysis

The Treasurer asked the working group what role environmental considerations should play in a fair tax system. The working group takes the tax system to include both the collection of revenues and the provision of subsidies and transfers. Particularly in the area of agriculture, where government transfers in recent years have represented anywhere from three to nearly eight percent of farm receipts (See Appendix B "Agricultural Data" Table 1, Chart 1), the way farmers are taxed, and the basis on which their incomes are stabilized both affect farm practices through financial incentives. In turn, many farm practices will have strong implications for the environment.

For environmental and other reasons, the group recognizes the importance of maintaining a stable agricultural base in the Province of Ontario.[78] Although area

[78] In addition to environmental benefits, there are social benefits to the maintenance of a strong agricultural base in Ontario. The skills involved in the production of food, and the special Ontario farming culture serve as examples. These issues, however, should be addressed outside of the working group.

farmed has only declined by approximately four percent over the past ten years, the number of census farms in Ontario has declined by approximately seventeen percent, and net farm incomes have declined by nearly twenty eight percent. (Appendix B, Tables 2,3,4 and Charts 2,3,4). There are many possible environmental advantages to stabilizing or reversing these trends in agricultural activity and promoting local food production. Some of the advantages concern energy conservation and environmental preservation in other jurisdictions. The transportation of food over long distances, for example, is associated with high energy use and greenhouse gas emissions. In addition, pesticides regulated in Canada are not necessarily restricted to the same degree in other jurisdictions. The environmental costs of these activities are generally not reflected in the price of imported food.

The group feels that the best way to maintain the existence of an environmentally sustainable agricultural sector in Ontario is to ensure its economic viability together with environmental protection. Economic instruments can enhance this strategy through the promotion of agriculturally based industries or improved agricultural practices that also reduce farm costs. As an example of the former approach, economic instruments can facilitate the development of environmentally desirable products such as ethanol, the relatively clean burning alternative fuel derived from corn, wood, or other biomass.[79] As an example of the latter approach, Germany has implemented a tax on all water use with revenues earmarked for farmers who lose income in the short run as a result of switching to more environmentally sustainable practices.

Tax Reduction And Incentive Programs

Tax Reduction—General

Many tax policies affecting the agricultural sector bear directly on environmental issues. The group examined tax reduction programs that are designed to ensure consistency with the broader tax system or to reduce the overall tax burden on farmers. Exemptions and refunds are provided for some inputs that may be harmful to the environment, especially when misused. Diesel and gasoline fuel are subject to tax exemptions or refunds, and farm inputs such as nitrogen fertilizers and chemical pesticides are exempt from sales tax. In addition, farmers get a retail sales tax exemption on drainage systems which, when applied to certain wetlands, have negative environmental consequences.

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[79] According to the Ontario Corn Producers' Association, the development of markets for ethanol, the alcohol-based fuel derived from corn, wood or other biomass, could increase annual demand for grain by approximately 8 million tonnes, approximately 1/3 of Canada's annual average grain exports. Increased use of ethanol would also tend to reduce transportation based carbon monoxide and nitrogen oxide emissions. Carbon dioxide emissions could be reduced substantially depending on the production method. For further information on ethanol, see eg. Gordon, Deborah (1991). Steering A New Course: Transportation, Energy, and the Environment, Cambridge, Massachussetts. or U.S. Department of Energy, Center for Transportation Research Argonne National Laboratory (1992). Emissions of Greenhouse Gases From the Use of Transportation Fuels and Electricity, Vol. 1: Main Text.

Tax exemptions for farmers are sometimes analogous to exemptions for other businesses which pay no sales tax on certain inputs such as raw materials. Although there might be some environmental benefit to the application of retail sales tax on farm inputs, a bias against farmers may result from such action. Applying the retail sales tax to farm inputs while leaving other business inputs untaxed would be unfair.

While it may not be fair or appropriate to include farm inputs in the retail sales tax base, taxes on specific farm inputs may be justified as a means of pricing environmental impacts. If special taxes are applied to inputs that are deemed to be particularly harmful, financial compensation should be provided to offset amounts lost on products that would normally obtain standard retail sales tax exemptions. This compensation could be directed towards programs that expand environmentally sustainable farm practices.

Pesticides and Fertilizers

Agricultural pesticides and fertilizers can represent a threat to human health and the environment. Chemical pesticides, particularly if not property applied, can contaminate food, soil, ground water, and surface water. Misuse of fertilizers can lead to water contamination problems. In addition, the manufacture and transportation of fertilizer materials demands considerable energy.[80]

Although many of the general impacts of pesticides and fertilizers on the natural environment have been identified, information on the specific impacts of pesticides and fertilizers, and the relative magnitudes of the environmental problems is limited. Studies have identified and explored, for example, the movement of pesticides from soil to surface and ground water in Ontario,[81] the persistence of particular substances in the soil,[82] and pesticide residues on food for human consumption.[83] In all cases, researchers have found evidence that these impacts are worthy of concern. Unfortunately, measurements of the magnitude of environmental hazards are largely unavailable.[84] In light of these information gaps, the group recommends that

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[80] Ontario Federation of Agriculture (1992). Our Farm Environmental Agenda. p. 19..

[81] See for example Frank, Richard (1986). "Rural Water Quality and Pesticides", Highlights Vol. 9, No. 3 or Frank, R. and Braun, H.E. (1982). "Agriculture and Water Quality in the Canadian Great Lakes Basin", Journal of Environmental Quality, Vol. 11, No.3.

[82] See for example Frank, R. and Clegg, B.S. and Patni, N.K. (1990). "Dissipation of Atrazine, Cyanazine and Metolachlor From a Loam Soil Including Movement to Tile Drains", Agricultural Laboratory Services Branch, Ontario Ministry of Agriculture and Food or Patni, N.K. and Frank, R. and Clegg, S. (1987). "Pesticide Persistence and Movement Under Farm Conditions", Agricultural Laboratory Services, Ontario Ministry of Agriculture and Food.

[83] See for example Frank, R. and Ripley, B.D. (1990). "Food Residues From Pesticides and Environmental Pollutants In Ontario", Agricultural Laboratory Services Branch, Ontario Ministry of Agriculture and Food or Labonte, R. N. (1989). "Pesticides and Healthy Public Policy", Canadian Journal of Public Health, Vol. 80.

[84] Some of the main barriers to impact estimation are outlined in Day, D.E. (1991) "Assessment of the Environmental Hazards of Pesticides to Aquatic Biota," Environment Canada. Barriers cited in that paper include lack of knowledge on the effects of low-dose, extended toxicities, uncertainties around the

further research be done to prioritize environmental issues in the agricultural sector through measurement and assessment of damages and risks associated with farm activities. Further, this need for research on environmental impacts is not unique to the agricultural sector. The same applies to all natural resource sectors.

Given the environmental impacts associated with the application of pesticides and fertilizers, and the uncertainty surrounding the scope and magnitude of the impacts, many programs and policies have been implemented in Ontario and other jurisdictions to reduce the use of pesticides and fertilizers in agricultural production. As for economic instruments, Norway and Sweden both have taxes on pesticide and fertilizer products.[85] In Norway, the tax revenues are dedicated to environmental programmes in the agricultural sector. In Ontario, rather than taxing these products, the government has used education to encourage reduced application of agricultural pesticides. The Ministry of Agriculture and Food's "Food Systems 2002" has a stated goal of reducing agricultural pesticide use by 50 per cent by the year 2002.

Due to the recent implementation of the "Food Systems 2002" program and therefore lack of data, there is no clear evidence as to the effectiveness of this program to date. Pesticides application by active ingredient shows an overall increase over the 1978 to 1988 period with fluctuations on an annual basis. Likewise, application per unit area of land farmed increased over this period. (Appendix B, Table 5, Charts 5a and 5b). While real pesticides expenditures also demonstrate an upward trend in the 1980s, expenditures over the 1989-1991 period demonstrate a slight downward trend.[86] (Appendix B, Table 6, Chart 6). The precise impetus for this decline is unclear, however possible contributing factors include improved management practices and reductions in acreage.

Gasoline and Fuel Tax Refund Program

Combustion of fossil fuels leads to emissions of atmospheric greenhouse gases. The social costs associated with this environmental damage are not accounted for in the price of the fuel. The group believes, in general, that the tax system should not overlook products such as fossil fuels that are harmful to the environment. On the other hand, the group believes that all sectors should be treated equally with respect to the taxation of the carbon content of fossil fuels. Therefore, it is unfair to tax fossil fuels in agricultural production without equivalent tax treatment across all sectors.

Drainage of Agricultural Lands

Drainage of agricultural lands helps raise the productivity and quality of certain acreage and is therefore an important component of agricultural activities. Drainage of agricultural lands, however, also raises environmental concerns about the avail-

effect of mixtures of chemicals and the synergistic effects of combined chemical exposure, uncertainties around the effects of degradation and/or transformation products of a parent compound.

[85] Organization For Economic Cooperation and Development, (1989) Economic Instruments For Environmental Protection. p. 60-61

[86] Pesticides are defined to include insecticides, herbicides, fungicides, nematocides and growth regulators.

ability and state of wetlands, woodlands and streams. Two types of drainage policies which reduce the effective cost of drainage to farmers have been identified: tax reduction programs and subsidization programs. Examples include the sales tax exemption on drainage systems, and loans on favourable terms to farmers installing tile drainage.

The Ontario Drainage Program is perhaps the most notable of the drainage policies. This program, which is delivered under the Ontario Drainage Act, provides grants to agricultural regions for drainage construction and maintenance. The grant rate is one third of the project costs in a county or regional municipality, two thirds in a territorial district or provisional county, and up to eighty percent in an unorganized township. Grant amounts have been substantial for both capital construction and maintenance. For capital construction, grants seem to have peaked in the mid 1980s at about seven million dollars, but were less than two million dollars in 1991-92. For maintenance costs, over the period 1981-1992, grants generally fell between one and two million per annum. (Appendix B, Table 7).

The Drainage Program is not inherently designed for thorough assessment of environmental impacts related to drainage projects. For the construction or reconstruction of a municipal drain, a new engineer's report is required which may or may not explore environmental issues. The Ministry of Natural Resources and the local Conservation Authority are involved in this procedure and may request a special "Environmental Appraisal", but an appraisal is rarely requested since it must be funded by the party making the request. The Drainage Act is subject to other legislation, however, such as the Lakes and Rivers Improvement Act, The Fisheries Act and the Wetlands Policy. In addition, drainage projects are supervised by approved drainage superintendents educated by the government on environmental and other relevant issues.

Like other farming activities, the environmental impacts of drainage in Ontario have not been assessed with precision. In terms of negative impacts, studies have focused broadly on the environmental impacts of agricultural drainage[87] or more narrowly on the benefits to wetland preservation.[88] On the positive side, some authors suggest that tile drainage provides environmental benefits through prevention of soil damage. Although certain studies have demonstrated impacts, the effects of any given drainage project will vary with a range of factors such as wildlife inhabitation and soil quality and consistency.

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[87] See for example Found, W.C. and Hill A. R. and Spence, E.S. (January, 1976). "Economic and Environmental Impacts of Agricultural Land Drainage In Ontario", Journal of Soil and Water Conservation or Serrano, S. E. and Whitley, H.R. and Irwin, R.W. (1985). "Effects of Agricultural Drainage on Streamflow in the Middle Thames River, Ontario, 1949-1980", Canadian Journal Civil Engineering, Vol. 12.

[88] See for example Roy, Pierre and van Vuuren, Willem (1990). "Social and Private Returns From Wetland Preservation", American Water Resources Association.

Members of the group are concerned with the potential environmental impacts of drainage programs. They are aware, however, that drainage can, in some instances, constitute a way for farmers to increase production on less than ideal lands at relatively low environmental costs. Moreover, the group acknowledges that there is an opportunity cost to farmers who forego drainage and leave marginal lands out of production. The group tends to believe compensation should be paid for the protection of these lands.

Conclusions on Tax Reduction And Incentive Programs

In general, the tax burden on farmers should be shifted towards products that tend to be environmentally harmful and away from other tax bases. Moreover, tax revenues derived from environmentally harmful farm activities should be recycled into programs that help farmers develop new, financially viable markets and facilitate the transition to more sustainable practices. The group's approach to subsidies mirrors its approach to taxes. Where possible, subsidies should be shifted towards neutral income stabilization or environmentally benign or renewal activities and away from potentially harmful activities.

As an illustration of the group's principles on tax reduction and incentive programs, it is worth pointing out that materials for the construction of manure storage facilities, which tend to prevent pollution of soil and waterways, currently attract sales taxes. From an environmental stand-point, rather than taxing products that help protect the environment, it makes more sense to generate revenues on the sale of inputs which are potentially harmful to the environment and to subsidize the purchase of storage facilities and other environmentally beneficial items.

Farm Income Protection Programs

General Description

The group studied the various income protection programs for Ontario farmers and their environmental implications. In particular, the group focused on the relative environmental merits of net income stabilization versus commodity based stabilization. In Ontario, the Net Income Stabilization Account provides farmers with financial assistance in years when their net income (sales revenue minus costs of inputs) falls below their five year average net income. By contrast, the Crop Insurance/Market Revenue Program insures farmers based on individual crop yields and annual average farm commodity prices. For Crop Insurance/Market Revenue, in years where a farmer's yield for a particular crop falls a certain percentage below their average farm yield of that crop, a claim is paid on the difference.

Income Protection And Farm Input Use

The group has been advised that farmers strive to use as few inputs as possible in the production of crops to contain immediate financial costs and limit environmental impacts. The group explored the relative incentive to employ farm inputs provided by the Net Income Stabilization Account versus Crop Insurance/Market Revenue. Members believe that stabilization based on commodities tends to pro-

mote higher input use, including energy-based inputs, pesticides, herbicides and fertilizers, than net income stabilization. The reasoning behind this statement is as follows. While net income stabilization is neutral with respect to output, compensation under Crop Insurance/Market Revenue tends to increase more directly with output of a particular crop. Therefore, insofar as increased use of inputs boosts gross output, financial protection under Crop Insurance/Market Revenue increases over time with increased use of inputs.

For similar reasons, the group believes that net income stabilization tends to provide more reliable support to farmers who shift to lower input-based production than protection based on crop yields. The transition to lower input farming may be associated with relatively low outputs and less coverage under crop yield-based protection.

Income Stabilization And Farm Specialization

The group explored the possibility that insurance schemes based on commodities encourage crop specialization relative to net income stabilization. Crop specialization can lead to soil deterioration due to nutrient loss and compaction. The growth of certain row crops such as corn and soybeans often causes over-exposure of the soil, and requires relatively high applications of fertilizer and pesticide.[89] (Appendix B, Table 8, Charts 8a-8h). By contrast, the rotation of "soil-building" crops such as cereals and forages is environmentally beneficial.

Although certain crops such as triticale, lentils and cover crops are not currently insured under crop insurance, the group understands that these crops will soon be included in the crop insurance scheme. The group encourages the immediate eligibility of these crops for insurance purposes. Once all crops are eligible for insurance, the Crop Insurance/Market Revenue program will be neutral with respect to incentives for farm specialization.

Income Stabilization And The Use Of Marginal Land

One of the environmental impacts of agriculture is the reduction of wetlands and woodlands. These "marginal" lands provide wildlife habitat and, in some cases, guard against soil erosion. As discussed above, crop insurance may provide more of an incentive to maximize gross output than net income stabilization. Therefore, the group believes that insurance based on crop yield may provide more of an incentive to bring marginal lands into production than net income stabilization.[90]

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[89] As demonstrated in Table 8, for a given area of production, herbicide application to corn and soybeans has usually been six to eight times greater than application to grains. In addition, insecticide application to grains is nearly insignificant compared to corn.

[90] For a more lengthy discussion on this and other income stabilization issues, see Girt, John (1992). "The Environmental Impact of Farm Support Policies in Ontario", Report to the Policy Committee, Ontario Round Table on Environment and Economy.

Conclusions On Farm Income Stabilization Programs

The group could not find any reason to suggest that net income stabilization provides environmentally harmful incentives. Stabilization based on individual commodities might encourage higher input use, provide relatively low support to farmers who move to lower-input production, encourage farm specialization in crops that are relatively harmful to the environment, and promote the use of marginal lands.

The group suggests a general direction towards net income stabilization and away from commodity-based stabilization. A more environmentally sound option that the group also endorses is to base financial support for individual farms on some measure of environmental stewardship. This type of stabilization might be based on many of the same criteria as the government's current Land Stewardship II program which provides grants for diversification, conservation practices, maintenance of crop cover, planting windbreaks, and pesticide storage. The group recognizes that more work in this area is needed before further recommendations can be made, but views this type of strategy as the most environmentally conscientious way for the government to financially support the farming community.

5.2 Mining

Framework and Background

The group identified a range of environmental issues associated with mining. These include acid mine drainage, mine reclamation, abandoned mines, harmful emissions, conservation/extraction rates, and solid waste. Some of the issues, such as toxic emissions, are addressed by the other subgroups, while others do not easily lend themselves to tax solutions. The Natural Resources Subgroup focussed on the range of environmental incentives, both positive and negative, provided by the current tax system. Its primary focus was on the specific incentives with respect to conservation, extraction rates, and mine reclamation.

In its review of current environmental tax incentives, the subgroup examined provisions in the Ontario Mining Tax Act. Under the Act's current provisions, pollution abatement capital equipment qualifies for depreciation and processing allowances.[91] To lay the foundation for subsequent commentary on the tax treatment of reclamation costs, these provisions are described below.

The upgrading of smelters and refineries by mining companies to meet new emission control standards set by the government often entails large capital outlays. Those types of outlays qualifying for depreciation allowances and processing al-

[91] For further information on this topic, see Rachamalla, K. S. (1992). "Comparison of the Federal Income Tax Act With The Ontario Corporations Tax Act and the Ontario Mining Tax Act" paper presented at the Revenue Canada Taxation National Coordinating meeting, June, 1992.

lowances under the Mining Tax Act include the construction of tailings dams and effluent purification systems.

Specifically, capital outlays on pollution abatement equipment would qualify under the Mining Tax Act for:

(i) a depreciation allowance at 15% per annum of the original capital cost of the processing asset;

and

(ii) an annual processing allowance of up to 20% of the original capital cost of the processing asset for as long as the asset remains in use.

To illustrate these tax incentives, an investment of $10 million in emission control processing equipment by the taxpayer would qualify for:

(i) an annual depreciation allowance on the processing assets of 15% or $1.5 million per year deductible from profits, until the full cost is written off for mining tax purposes;

and

(ii) an annual processing allowance on the processing assets of up to 20% or $2 million per year deductible from profits for as long as the asset remains in use.

This example illustrates that the processing allowance is not limited to a tax deduction up to the original cost of the asset as in the case of the depreciation allowance. It is available on the processing asset as long as the asset remains in active use.

Conservation/Extraction Rates And Taxes

Natural resource conservation is central to the maintenance of equity between generations. The degree to which the tax system encourages or discourages conservation is therefore an important tax fairness question. One of the difficulties with this question, however, is that resource extraction is directly linked to the general economic well-being of Ontario as well as that of several small communities. Given the uncertainties surrounding the availability of resources into the future, it is difficult to establish a "fair" rate of mineral extraction that ensures equity between present and future generations.[92]

Historically, there have been incentives built into the tax system which may encourage extraction of minerals. *Depletion allowances* have traditionally been a common feature of the federal and provincial tax systems. Recently, however, both

[92] For an analysis of economic issues in resource conservation, see, e.g., Anders, G. and Gramm, W. P. and Maurice, S. C. (1978). "Does Resource Conservation Pay?", International Institute For Economic Research, Paper 14.

levels of government have begun to phase out direct tax concessions for resource depletion. This phase out will be complete by 1994.

The phase in of a *resource allowance* at the provincial level coincides with the elimination of the depletion allowance. The resource allowance provides for 25 per cent of resource profits to be deductible from taxable income. This measure is designed to compensate for the fact that taxes paid under the Mining Tax Act are not deductible from corporate income tax.

Resource profits based tax deductions such as the resource allowance, tend to provide an incentive for exploitation and development of mineral resources. Under the resource allowance, each dollar of profits generated from the extraction of resources is worth more than it would be in the absence of the allowance.[93] The added financial incentive will tend to increase mineral extraction in the province, but the extraction effects on a global basis are uncertain.[94]

While tax deductions for extraction activities can undermine conservation goals at least within a particular region, taxes that approximate levies on virgin materials can increase the price of these materials relative to reused or recycled materials and may provide an incentive for conservation. Royalty taxes, or taxes computed on the gross proceeds or sale of the mineral output, can serve as a proxy for a virgin materials tax. The group noted that certain jurisdictions in Canada already have a "first-tier" royalty tax in addition to "second-tier" profits based resource tax.[95] The subgroup came to no conclusions on the desirability of a royalty tax for Ontario, since the effects of such a tax on the speed of extraction are uncertain in the first place.[96] The subgroup did not explore the possibility for any other form of virgin materials tax.

Even if royalties are found to provide an incentive for conservation, they may be deemed undesirable on other environmental grounds. Economic literature offers the conclusion that royalties result in "high grading" where deposits of a certain grade, which would be extracted in the absence of taxes, are left in the ground.[97] The

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[93] Each dollar of profit is worth 25 cents times the marginal income tax rate of the firm more than it would be in the absence of the tax.

[94] It may be worth noting that the Resource Allowance also promotes exploration and development since related exploration and development costs are not deducted from the profit base that is used for calculation of the allowance. Operating costs and depreciation are deducted from the profit base before the amount of allowance is determined.

[95] For further description see, e.g., Caragata, Patrick (1991). "An Analysis of the Cost Effectiveness of the Profits Based Royalty Regimes in Ten Canadian Jurisdictions and Australia's Northern Territory", Energy and Resources Division, Ministry of Commerce, Wellington, New Zealand.

[96] The economic literature on resource taxation would suggest that the effects of a royalty tax on the speed of extraction depend on the growth in the price of the resource and interest rates. Under certain assumptions, if the price of the resource is increasing faster than the interest rate, the firm will accelerate extraction since the present value of the tax is increasing over time.

[97] See McKenzie, K.J. The Taxation Of Nonrenewable Resources: An Overview Of The Literature. (Prepared for the Ontario Fair Tax Commission.)

high grading scenario may seem favourable from a conservation perspective if firms were to reduce overall extraction rates, but high grading can also result in substantial economic and resource waste.

Conclusions on Resource Conservation

In the first section of this report, the group discusses the difficulties in finding local solutions to global environmental issues. Since resource conservation is a global environmental issue, the environmental effects of any local policy, including specific tax concessions for resource conservation, are not entirely clear. The benefits to resource conservation on a provincial level may be relatively small due to mobility of mining activities and the global nature of mineral markets. At the same time, the local economic impacts of decreasing extraction rates may be severe.

The difficulty in arriving at a provincial solution to resource extraction rates and the use of virgin materials does not suggest that the province should ignore the issues. Instead, it suggests that isolated, local tax measures are unlikely to solve the global issue of resource conservation without substantial regional dislocation. At this time, therefore, the group recommends that changes to the tax system to facilitate resource conservation should only be considered within the broader context of other environmental and economic policies. In the long term, as the broader policy framework and economic instruments provide the incentive to use fewer virgin materials, the tax system should not continue to bias decisions towards extraction of virgin materials.

Tax Treatment Of Reclamation Costs

Under the financial assurance provisions of the Ontario Mining Act, firms must set aside funds to cover future costs of mine reclamation.[98] This policy was introduced to address the problem of abandoned sites which leave governments responsible for environmental clean-up. The tax treatment of funds deposited for future site reclamation is not entirely clear in the Income Tax Act and is not specifically addressed by the Ontario Mining Tax Act. There is no clear provision in either Act for the deductibility of reclamation costs from taxable income.[99] Under the current system, mining companies that may incur substantial reclamation costs can not be certain as to the deductibility of any financial outlays.

The subgroup believes that the deductibility of reclamation costs gives rise to a tax fairness issue.[100] *Members believe that the tax system should generally recognize*

[98] More specifically, firms must establish financial security satisfactory to the Director of Mine Rehabilitation funds to cover specific reclamation costs which are contained in a decommissioning plan.
[99] The Income Tax Act uses three criteria to judge whether reclamation costs are deductible: Is the liability an expense? If so, is it incurred for the purpose of gaining or producing income? Is the expense on account of capital (non-deductible)?
[100] The issue of matching current income with future expenses for the purposes of decommissioning has been addressed by Robin J. MacKnight in "Square Pegs And Round Holes: Environmental Cost Under The Income Tax Act." March, 1991. In that paper, the author argues that Canada should adopt a modified

environmental costs as legitimate expenses. In certain cases, the tax system already contains provisions for the deduction of environmental expenditures. The tax treatment of investments in pollution control equipment as described above serves as an example. This type of treatment stands in contrast to that provided for reclamation expenditures.

Given the complexity of the design issues for deductibility of rehabilitation costs, and the uncertainties surrounding the revenue implications of any changes, the subgroup feels that it would be inappropriate to recommend any specific changes in this area. Rather, the group recommends that guidelines and design of this provision be developed in consultation with the mining industry.

5.3 Forestry

The Natural Resource Subgroup regrets it was unable to devote to the forest products sector the same attention it devoted to mining and agriculture. Nevertheless it wishes to offer a few comments to guide further discussion in this area.

The basic issues in the forest products sector are the same as in mining and agriculture. Two questions should be asked. First, does the tax and tax expenditures system actively discriminate against sound environmental practices? Secondly, are there specific areas in which taxes or charges are the preferred economic instrument for promoting improved environmental practices?

Important environmental issues related to forestry include the following:

• **Allocation of Forest Land**—Should forest land be managed for a single use (e.g. timber only or recreation only) or for multiple uses (e.g. integrated timber, recreational and preservation uses as in Algonquin Park)?

• **Harvesting Techniques**—Should cutting proceed by large scale clear cutting or by smaller scale strip cutting and selection methods? Are harvesting methods unnecessarily harmful to the forest soil and reproductive ability? Does large area clear cut-

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version of the United States model. In the United States, firms can deduct the estimated current costs of reclamation. Site-specific, tax exempt sinking funds are established so that when decommissioning activities do take place, amounts paid are not deductible except for the excess over the site reclamation sinking fund since deductions have been made previously. In the United States, MacKnight argues, there is a problem with this system since there is no assurance that funds for reclamation will actually be available even though deductions have been made in previous years. With effective financial assurance in place, Ontario would not experience this problem. In a separate paper, "Mining and Environment Taxes", by Richard A. Westin prepared for the German Foundation For International Development, the author argues that there is another danger in allowing current deduction of future reclamation costs. Westin suggests that taxpayers may be able to manipulate the system by creating liabilities that will not call for payment until far in the future and result in substantial tax revenue losses.

ting harm certain wildlife populations and lead to unfavourable changes in erosion and drainage?

• **Reforestation Techniques**—Should cut-over areas be reforested using seeds and seedlings, or should there be greater reliance on natural regeneration? Should new growth be vigorously tended by spraying and thinning? Should steps be taken to reduce monoculture in regenerated areas?

• **Sustainability**—How rapidly should the remaining timber in Ontario be harvested? Should harvest be constrained to sustained yield levels?

• **Continuity and Employment in Northern Communities**—Many communities in Northern Ontario rely heavily on employment in the forest product industries. If the standing timber is harvested before replacement growth becomes available for harvest, some communities may contract rapidly with consequent social disruption. Should steps be taken to extend the harvest period to promote community stability? This is closely related to the issue of sustainability.

• **Air and Water Pollution**—Historically, effluent from pulp and paper mills has been an important element of air and water pollution. Would a system of effluent charges or administrative penalties encourage firms to meet reduction targets more rapidly?

It is clear that the use of forest land for timber production, recreation, or wilderness preservation imposes costs on third parties that may not be reflected in the decisions of forest companies, recreationists, or environmentalists. Yet it is difficult to determine the magnitude of these costs, and harder still to design a tax system which would cause resource prices to adequately reflect them. In some instances, command and control regulation, tradable permit plans, or administrative penalties for non-compliance may be preferred to a general tax.

6. SUMMARY OF RECOMMENDATIONS AND FUTURE PROCESS ON ENVIRONMENTAL TAX INSTRUMENTS

6.1 Summary of Recommendations

The Environment and Taxation Working Group has been meeting on a regular basis as a full group and in subgroups for fourteen months. During this time the group has consulted on environmental tax instruments with a broad range of stakeholders. It has produced two reports to the Treasurer of Ontario which set out important principles of environmental taxation and recommend specific policy initiatives.

For working group members, the importance of abiding by the group's principles of environmental taxation can not be overstated. Unless environmental tax instruments are designed to achieve environmental objectives they will be viewed as "unfair" and will fail to receive wide support. To ensure that environmental tax instruments achieve the intended objective with minimum unintended consequences, it will be important to draw upon design features and provisions such as using environmental tax instruments to complement regulations, earmarking environmental tax revenues to advance the goal or objective of the tax, and reducing other taxes to offset sectoral impacts and increase economic efficiency.

Here is a summary of the group's recommendations, both general and specific, as they appear in this report:

Recommendations On Principles Of Environmental Taxation

The group has adopted the following principles which should serve as a guide in the design and implementation of environmental tax instruments:

- ***The primary goal of environmental tax instruments should not be to raise revenue but to use tax incentives and disincentives to modify behaviour—to encourage environmentally sustainable practices and to discourage environmentally damaging ones.***

- ***To achieve environmental objectives, environmental tax instruments should be imposed as closely as possible to the practices they seek to change.***

To ensure the effectiveness of environmental tax instruments, the group has expanded these principles and strongly endorsed the following preconditions:

- ***Revenues raised by environmental tax instruments should be earmarked to advance the environmental objective of the tax.***

• Environmental tax instruments should act as a complement to direct regulations.

• Through the "polluter-pays principle", environmental tax instruments should be used to ensure that environmental costs are reflected in the price of goods and services.

Recommendations on Environmental Tax Instruments

The group has made the following recommendations with respect to environmental tax instruments for Ontario:

• To help reduce harmful pollution in Ontario, and generate revenues for directly related environmental objectives, the group recommends a pollution tax. The tax could be based on the Ministry of Environment "Primary List" of substances for ban or phase-out. The tax could also be applied to the pollutants contained in the National Pollutant Release Inventory or to those on the Ministry of Environment "Secondary List". To demonstrate consistency with the multimedia approach, the tax should apply to discharge into water (including sewers), air and land. It should increase with the quantity of pollution and risks associated with the particular substance.

• Members do not recommend a deposit refund system on lead acid car batteries for Ontario. Further, in future consideration of deposit refund systems, the government should refrain from taking any action where market forces already create a mechanism for the safe recycle or reuse of potentially harmful products. Where markets fail to provide for such mechanisms, deposit refund systems merit further experimentation.

• Fees for Certificates of Approval issued by the Ministry of Environment should not be based on capital costs. Any fees for Certificates of Approval should be set so that charges directly reflect relative environmental impacts.

• To ensure that the Ontario Tire Tax is directed towards environmentally sustainable practices, the group recommends that the revenues be earmarked to help solve the tire problem. Tire Tax revenues might be directed towards programs that facilitate reuse and recycling of old tires.

• In its first report, the group recommended a vehicle scrappage program to improve the fuel efficiency of the fleet and stimulate the purchase of new vehicles as an aid to the economy. In keeping with the group's view on earmarking, taxes designed to address the vehicle fuel efficiency issue would properly be used to develop a scrap program. Since old tires

would be scrapped with each vehicle, Tire Tax revenues could be used to help support the tire component of the program.

• The tax system should generally recognize environmental costs as legitimate expenses. The group has identified mine reclamation activities as examples of environmental expenditures that should qualify for tax deductions.

• When considering reductions in energy use and carbon dioxide emissions, the government should explore the use of economic instruments to facilitate this goal. Some of the options for environmental tax instruments include carbon and energy taxes, extension of the retail sales tax to energy, and related tax expenditures to provide an incentive for adoption of energy efficient equipment. The group cautions, however, that these environmental tax instruments must not become a mechanism for the government to raise money for the consolidated revenue fund. Such revenues should be used to help achieve the goal of increased energy efficiency and reductions in carbon dioxide emissions.

• In general, the tax burden on farmers should be shifted towards products and practices that tend to be environmentally harmful and away from other tax bases. Moreover, tax revenues derived from environmentally harmful farm activities should be recycled into programs that help farmers develop new, financially viable markets and facilitate the transition to more environmentally responsible practices. As an example, economic instruments can facilitate the development and greater use of environmentally desirable products such as ethanol, the relatively clean burning alternative fuel derived from corn, wood, or other biomass.

• For farmers, the group suggests a general direction towards net income stabilization and away from commodity-based stabilization. A more environmentally sound option that the group also endorses is to base financial support for individual farms on some measure of environmental stewardship. This type of stabilization might be based on many of the same criteria as the government's current Land Stewardship II program which provides grants for diversification, conservation practices, maintenance of crop cover, planting windbreaks, and pesticide storage.

Recommendations on Process For Consideration of Environmental Tax Instruments

The group makes the following recommendations on future process for consideration of environmental taxes:

• In general, any further consultation should be initiated by the government when specific goals, environmental tax proposals and design principles have been established. Stakeholders should then be consulted over the detailed design issues of the tax and related offsets including tax reductions and expenditure policies.

• Tax instruments to address the environmental issues not examined in this report such as issues in forestry, solid waste and water conservation merit examination through a further process. The group would also encourage continued or new consultative and research activities on other economic instruments such as tradable permits schemes and deposit refunds.

• Following the model established by the working group, in addition to stakeholders outside of the government, all relevant government departments should be involved in developing and implementing government commitments resulting from this report. This involvement implies that any existing policies, programs, and legislation should be re-examined to ensure consistency with any new initiatives of this kind.

• Consultation on environmental tax instruments requires a substantial time and energy commitment. The working group believes that appropriate compensation should be provided to participants or their organizations in future consultation. There should also be sufficient funds to carry out the research necessary to develop specific design proposals.

• The group set out features of a pollution tax which should serve as a general guide in the design process. More detailed features of the tax could be established by a special task force guided by a specific mandate and set of working principles established by the government. Creation of such a task force would ensure that all interests are included or recognized in the specific design of the tax.

• Further research on energy and carbon tax instruments by the Fair Tax Commission, a different task force, or other jurisdictions should focus on the macroeconomic and distributional impacts of energy and carbon taxes that may be implemented in conjunction with other tax cuts or expenditures to help ease the transition to a more energy efficient, less carbon dioxide-emitting economy.

• Consultation on energy and carbon taxes should only be initiated by a government proposal for specific environmental tax instruments and involve stakeholders who are prepared to focus on the detailed design issues of the tax and related offsets including tax reductions and expenditure policies. To ensure a relevant and effective outcome, tax and expenditure analysis should be closely linked to a broader Ontario global warming strategy which encompasses a range of regulatory, education and economic policy initiatives.

Appendix A:

Executive Summary from First Report

(Presented to Treasurer March, 1992)

FIRST REPORT

Executive Summary

1. INTRODUCTION

i. Mandate Of The Working Group

The Environment And Taxation Working Group is one of eight working groups that has been established by the Treasurer to answer specific questions regarding the fairness of the current tax system. The Treasurer's questions to this group read as follows:

> *What role should environmental considerations play in a fair tax system? What is the role of taxes and/or tax expenditures in achieving the Government's environmental objectives? What environmental tax options could best improve the fairness of the tax system as it relates to environmental objectives?*

In addition, the commissioners of the Fair Tax Commission asked the working group to address the following questions:

> *How do current income taxes, capital taxes, and tax expenditures affect firms' behaviour towards the environment? How can these taxes and charges be adjusted in order to provide firms with the incentive to use more environmentally sound processes and procedures? What are the implications of environmental taxes for the economy?*
>
> *How can product taxes be used to augment the price of environmentally damaging products? How can charges be implemented in order to decrease the abuse of environmental goods? Are there other mechanisms available to government which might more efficiently achieve the stated social policy objectives of the tax/charge?*

The working group was given the opportunity to report in two stages with responses to these questions. This is the group's first report; the second will be submitted in September, 1992.

ii. The Process

The Environment and Taxation Working Group is comprised of volunteer members that encompass a wide range of constituencies and perspectives. Consultation with interested parties enables the group to incorporate a wider range of perspectives into its deliberations.

The working group has divided itself into three subgroups for the purposes of considering specific initiatives. These subgroups are: Health/Freedom From Toxics, Energy/Transportation, and Natural Resources.

iii. Description of Report

The report is divided into five sections. Section 2 outlines the group's principles and criteria for evaluating environmental taxes. Section 3 summarizes the group's discussions and position on "earmarking" or dedicating environmental tax revenues to environmental programs. Section 4 presents the group's recommendations for specific initiatives for the 1992 budget and section 5 summarizes and concludes the report.

2. PRINCIPLES AND CRITERIA FOR THE EVALUATION OF ENVIRONMENTAL TAXES

i. Principles

The group favours the use of environmental taxes as instruments of environmental policy making under certain conditions. The group has adopted a set of principles that define these conditions as follows:

PRINCIPLE #1

> The primary goal of environmental taxes should be to use tax incentives and penalties to modify behaviour—to encourage environmentally sustainable practices and to discourage environmentally damaging ones. By contrast, the primary goal of environmental taxes should not be to raise revenue.

PRINCIPLE #2

> To achieve environmental objectives, environmental taxes should be imposed as closely as possible to the practices they seek to change.

PRINCIPLE #3

> Environmental taxes should be tied to specific examples of the changes they are designed to achieve.

ii. Criteria

When specific initiatives have been derived from principles of environmental taxation, they will need to be evaluated against a broad set of criteria. For the purposes of this working group, the criteria act as a guideline to consideration of policy measures.

The group has set out nine criteria, each of which are considered in the evaluation of policies. Environmental effectiveness, economic efficiency and impacts, distribu-

tional effects (equity), transparency (or visibility), administrative considerations, jurisdictional considerations, timing, fiscal impacts, and coordination with other policy areas are among those issues considered.

3. EARMARKING

The group discussed the differences between notional earmarking and dedicated earmarking as well as the pros and cons of earmarking. After examining this evidence, as well as models of earmarking in British Columbia and the United States, the group maintains the following position on earmarking:

- The group is strongly in favour of some form of earmarking.
- As a model for consideration, British Columbia's Sustainable Environment Fund provides a good direction.
- Earmarking can accelerate the process of environmental protection.
- Earmarking can help maintain and improve economic prosperity.
- Earmarking can improve public support for environmental taxes.

4. SPECIFIC INITIATIVES

i. Energy/Transportation

The group has developed a policy direction that will promote increased energy efficiency and conservation through price incentives, consumer information, and spending. Within this energy-related proposal, substantial consideration is given to the economy, and fairness issues. The proposal is in keeping with the group's recommendations with respect to earmarking since it involves expanded revenue generation and dedication of new funds to environmentally and economically sound programs.

The following provides the basis for the group's consensus proposal on the current Tax For Fuel Conservation:

- Expansion of the tax/credit scheme to vans and trucks in 1993 for 1994 model years.
- Creation of new credit categories for fuel-efficient vehicles in the tax/credit scheme.
- Expansion of the fee-credit differential over time.
- Labelling of vehicles to improve consumer information and education.
- Spending new revenues on a vehicle scrappage program, bicycle infrastructure, and research into energy efficiency and conservation.

ii. Health/Freedom From Toxics

The group examined the specific question of how product taxes could reduce the use of toxic products and encourage the use of more environmentally friendly products. Their focus was on the use of pesticides in urban areas. Their findings can be highlighted as follows:

- It is difficult to identify a specific range of toxic products (difficult to define a tax base) for purposes of a toxics tax on products at the retail level.
- A tax on urban pesticides at the retail level would be administratively complex and costly for government.
- A special product tax on toxics at the retail level would be unfair and costly for retailers.
- The use of pesticides in urban areas should be controlled by stricter regulation, not by a product tax.

iii. Natural Resources

The Natural Resources subgroup will not make any specific recommendations for this report. The group will continue its deliberations on the tax system and environmental considerations in agriculture, forestry, mining, and water. Deliberations and recommendations of the group on all resource issues will be reflected in the working group's final report.

5. SUMMARY AND CONCLUSIONS

The group believes that environmental taxes will only be effective and receive wide support if they are designed to meet the group's principles. The group's first principle, that the primary purpose of environmental taxes should be to achieve environmental goals and not to raise revenue, is paramount. In order to enhance the effect of environmental taxes, revenues should be dedicated to spending programs that promote environmental goals.

The Environment and Taxation Working Group expects to finish its second report by the end of September, 1992. Until that time, the group will carry out research and consultation on specific initiatives to improve the fairness of the tax system as it relates to environmental objectives.

Appendix B:

Agricultural Data

Table 1

Farm Cash Receipts By Source

	Five Year Average (1981-1985)	1986	1987	1988	1989	1990	1991
			Year				
			$'000				
Total Crops	$1,671,558	$1,883,012	$1,737,409	$1,947,214	$1,959,391	$2,060,995	$1,920,296
Total Livestock And Products	$3,139,713	$3,372,998	$3,396,571	$3,296,966	$3,275,018	$3,302,030	$3,184,162
Total Govt. Payments	$171,539	$139,879	$323,599	$409,191	$422,694	$190,863	$299,608
CPI (1986=$1)	$0.89	$1.00	$1.04	$1.09	$1.14	$1.20	$1.26
Real Govt. Payments	**$193,829**	**$139,879**	**$309,961**	**$376,787**	**$370,784**	**$159,718**	**$237,407**
Total Receipts	$4,982,810	$5,395,889	$5,457,579	$5,653,371	$5,657,103	$5,553,888	$5,404,039
CPI (1986=$1)	$0.89	$1.00	$1.04	$1.09	$1.14	$1.20	$1.26
Real Total Receipts	**$5,630,294**	**$5,395,889**	**$5,227,566**	**$5,205,682**	**$4,962,371**	**$4,647,605**	**$4,282,123**
Govt. Payments As % Total Receipts	**3.44%**	**2.59%**	**5.93%**	**7.24%**	**7.47%**	**3.44%**	**5.54%**

Sources: 1990 Agricultural Statistics For Ontario, Ontario Ministry of Agriculture and Food and Bank of Canada Review, Feb., 1992

Chart 1

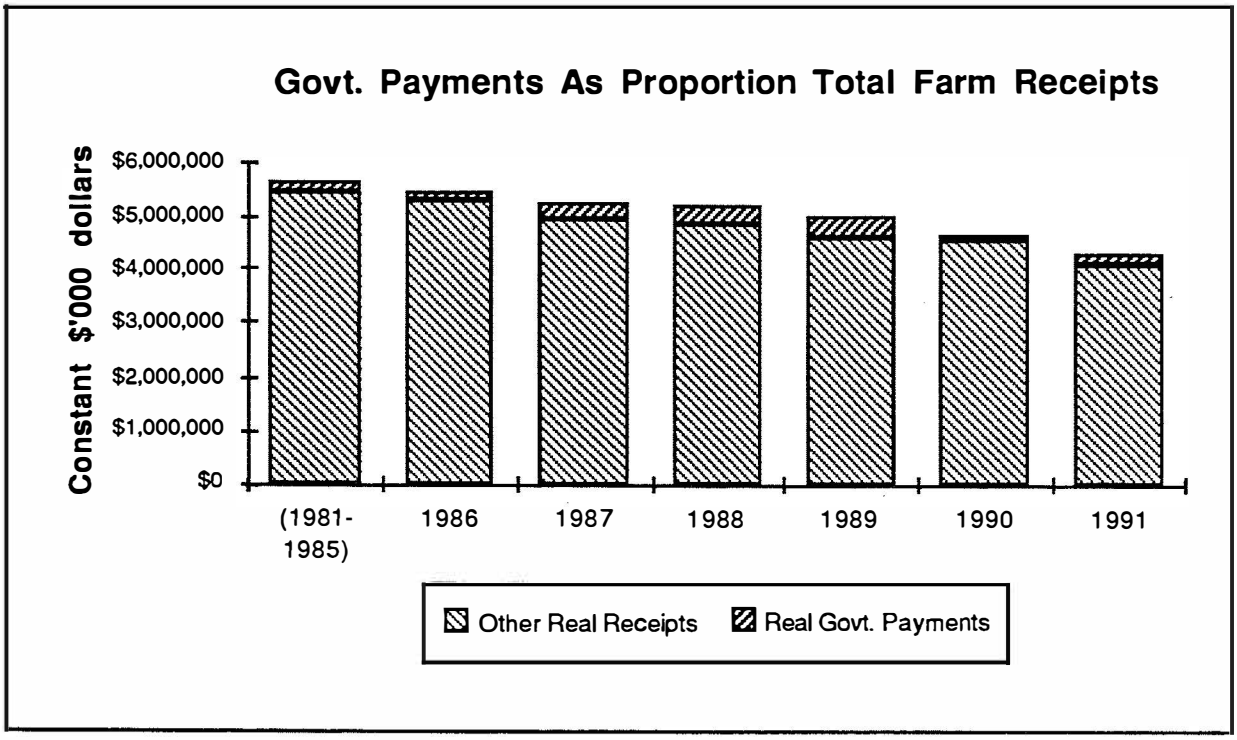


Table 2

Farm Activity

	1976	1981	1986	1991
Total Number of Census Farm	**88,801**	**82,448**	**72,713**	**68,633**

Source: 1990 Agricultural Statistics For Ontario, Ontario Ministry of Agriculture and Food

Chart 2

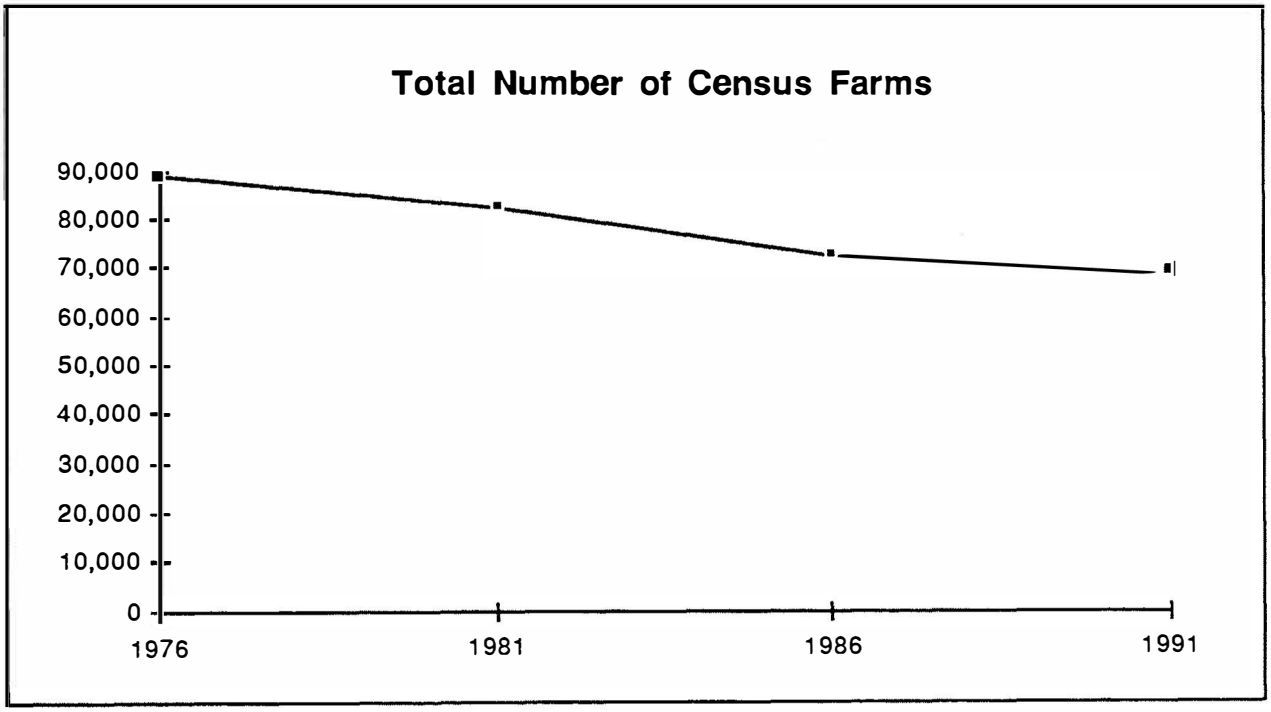


Table 3

Income of Farm Operators From Farming Operations

	(1981-1985)	1986	1987	1988	1989	1990	1991
Total Net Farm Income							
$'000	$717,838	$755,188	$1,128,341	$1,003,413	$1,106,471	$853,711	$736,580
CPI (1986=$1)	$0.89	$1.00	$1.04	$1.09	$1.14	$1.20	$1.26
Total Net Farm Income in Real '86 $'000	**$811,116**	**$755,188**	**$1,080,786**	**$923,953**	**$970,589**	**$714,403**	**$583,661**

Sources: 1990 Agricultural Statistics For Ontario,
Ontario Ministry of Agriculture and Food and Bank of Canada Review, February, 1992

Chart 3

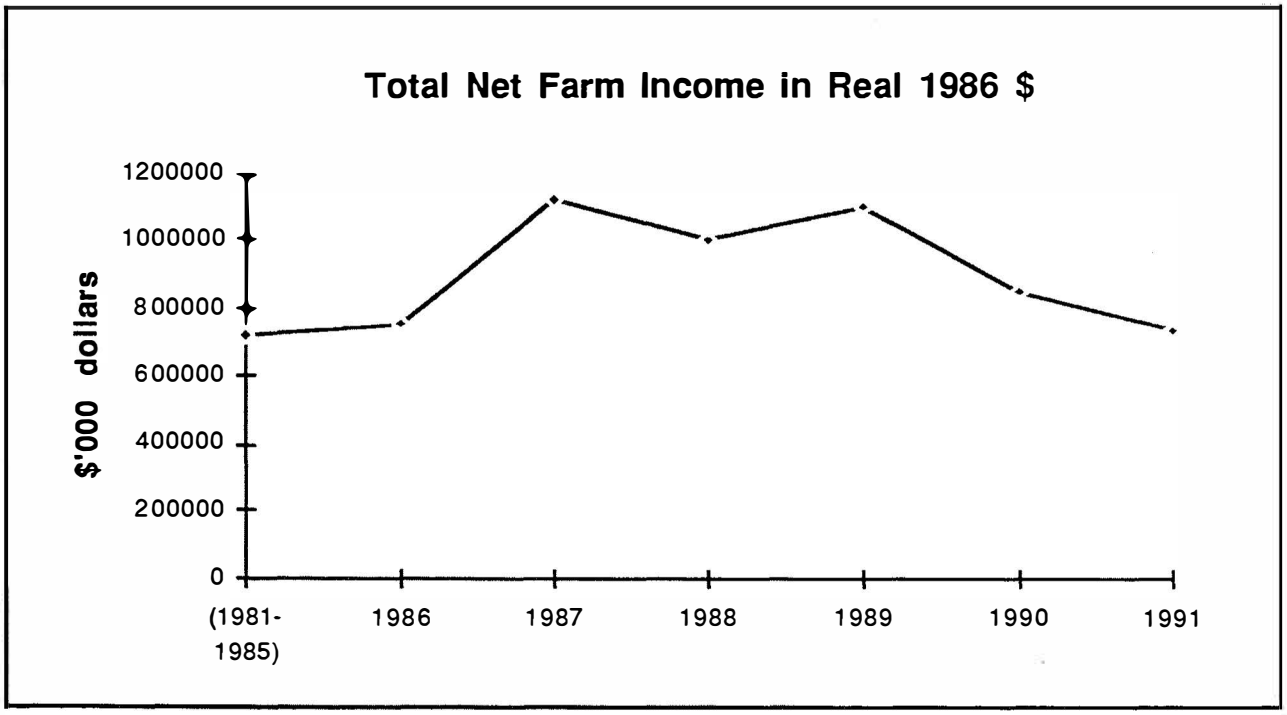


Table 6

Pesticides Expenditures

	(1981-1985)	1986	1987	1988	1989	1990	1991
Pesticide Expenditures (Current $000)	132,539	135,000	137,284	140,000	145,226	142,013	140,593
Real Pesticide Expenditures (1986 $000)		135,000	133,156	138,203	141,822	141,909	129,415

Source: 1990 Agricultural Statistics For Ontario, Ontario Ministry of Agriculture and Food

Chart 6

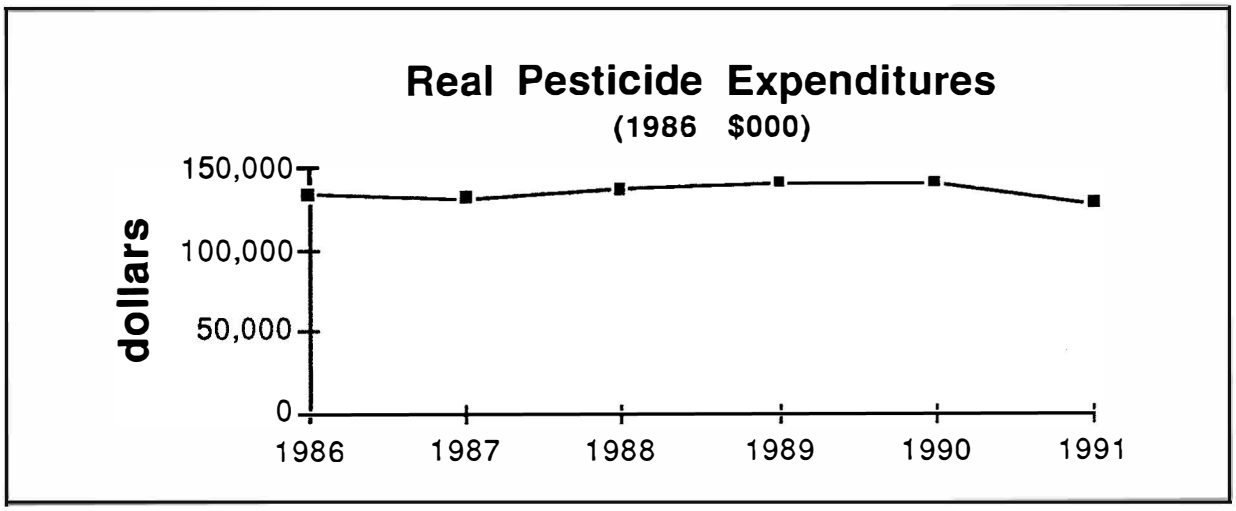


Table 7

DRAINAGE ACT						
	CAPITAL CONSTRUCTION			MAINTENANCE		
FISCAL YEAR	# PROJECTS	TOTAL COST $	GRANT $	# PROJECTS	TOTAL COST $	GRANT $
1964-65		2,148,573	664,995			
65-66		1,709,635	567,405			
66-67		2,000,000	673,940			
67-68		3,850,000	1,299,434			
68-69	895	8,780,514	2,390,984			
69-70	1172	13,369,674	3,442,997			
70-71	998	12,329,535	3,478,963			
71-72	972	13,545,548	3,757,086			
72-73	512	6,613,737	1,882,185			
73-74	567	8,061,634	2,299,983			
74-75	545	11,097,713	2,899,998			
75-76	703	14,867,149	3,768,712			
76-77	652	13,578,958	3,749,632			
77-78	763	19,725,886	5,206,700			
78-79	743	20,937,254	5,796,834			
79-80	713	17,274,899	4,765,665			
80-81	657	16,680,816	4,666,606			
81-82	675	21,562,864	5,992,522	591	1,507,023	507,023
82-83	745	23,960,083	6,900,600	1286	3,093,917	1,094,475
83-84	568	19,365,099	5,710,396	1633	3,526,011	1,239,263
84-85	578	21,580,632	6,100,163	1633	3,781,599	1,345,914
85-86	541	22,467,976	7,037,673	1924	4,278,709	1,497,844
86-87	406	20,910,848	5,081,954	2754	4,251,559	1,522,073
87-88	383	17,065,113	4,246,557	2032	4,687,091	1,655,197
88-89	275	8,656,522	2,048,338	1746	4,557,373	1,678,216
89-90	273	13,496,099	3,167,184	1713	5,016,464	1,889,490
90-91	271	11,190,208	2,671,450	2181	6,135,374	2,153,178
91-92	194	7,702,980	1,683,296	2081	5,072,458	1,761,103

Source: Ministry of Agriculture and Food

Table 8

Herbicide And Insecticide (Active Ingredient) Application By Crop Type

	1978	1983	1988
Total Herbicides Applied To Corn (kg)	3,090,980	3,653,310	2,491,370
Total Herbicides Applied To Soybeans (kg)	521,220	1,281,880	1,694,770
Total Herbicides Applied To Grain (kg)	269,630	376,140	491,320
Total Insecticides Applied To Corn (kg)	61,090	145,150	93,800
Total Insecticides Applied To Soybeans (kg)	4,590	-	3,430
Total Insecticides Applied To Grain (kg)	170	40	-
Total Corn Area (acres)	2,640,000	2,580,000	2,120,000
Total Soybean Area (acres)	705,000	900,000	1,280,000
Total Grain Area (acres)	1,950,000	2,105,000	1,990,000
	1978	**1983**	**1988**
Total Herbicides Per Acre Corn	1.17	1.42	1.18
Total Herbicides Per Acre Soybeans	0.74	1.42	1.32
Total Herbicides Per Acre Grain	0.14	0.18	0.25
	1978	**1983**	**1988**
Total Insecticides Per Acre Corn	0.02314	0.05626	0.04425
Total Insecticides Per Acre Soybeans	0.00651	0.00000	0.00268
Total Insecticides Per Acre Grain	0.00009	0.00002	0.00000

Note: Grain production defined as total area allocated to wheat, oats, barley, and "mixed grains".

Sources: Survey of Pesticide Usage In Ontario, Ontario Ministry of Agriculture & Food, 1978, '83 & '88; 1990, 1986, 1982 Agricultural Statistics For Ontario, Ontario Ministry of Agriculture and Food

Chart 8a

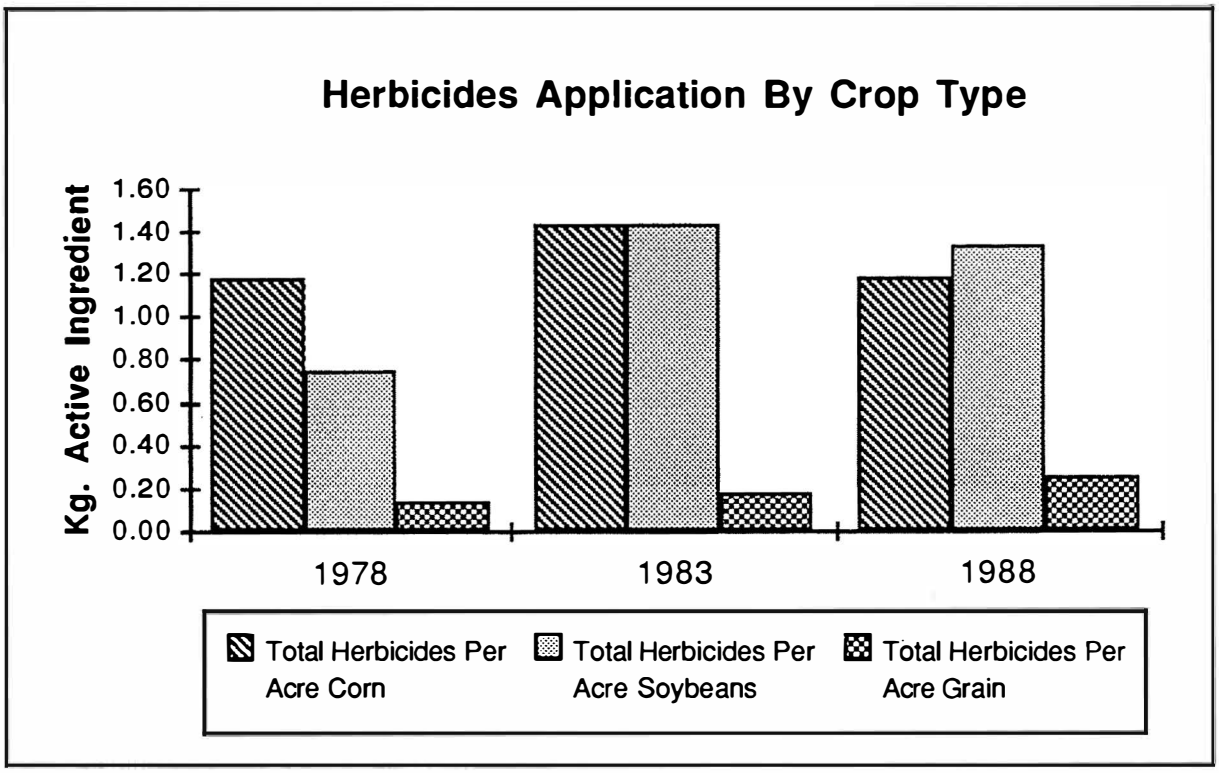
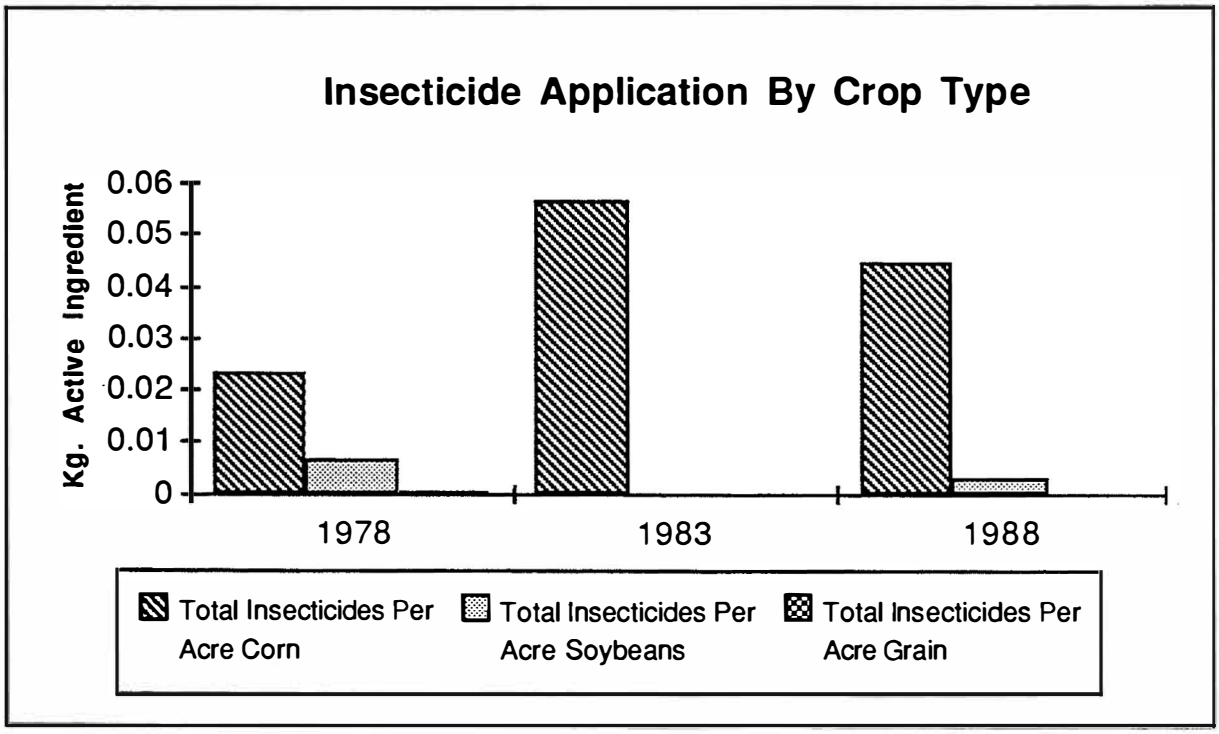


Chart 8b



Sources: Survey of Pesticide Usage In Ontario, Ontario Ministry of Agriculture and Food, 1978, '83 & '88; 1990, 1986, 1982 Agricultural Statistics For Ontario, Ontario Ministry of Agriculture and Food [See Table 8]

Chart 8c

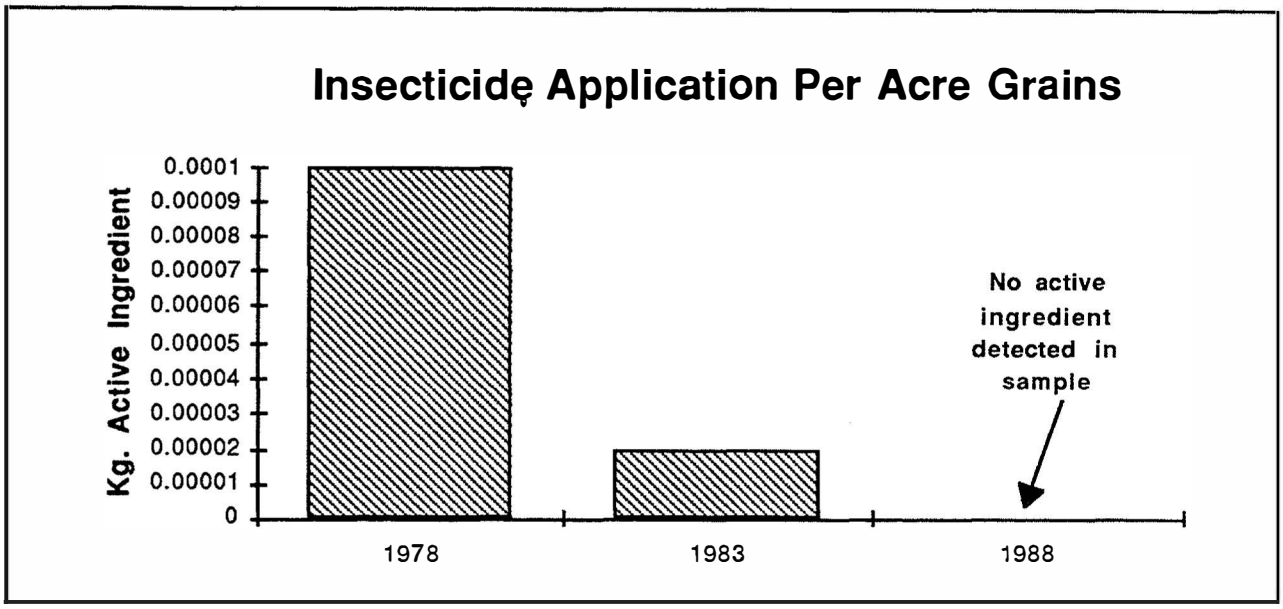
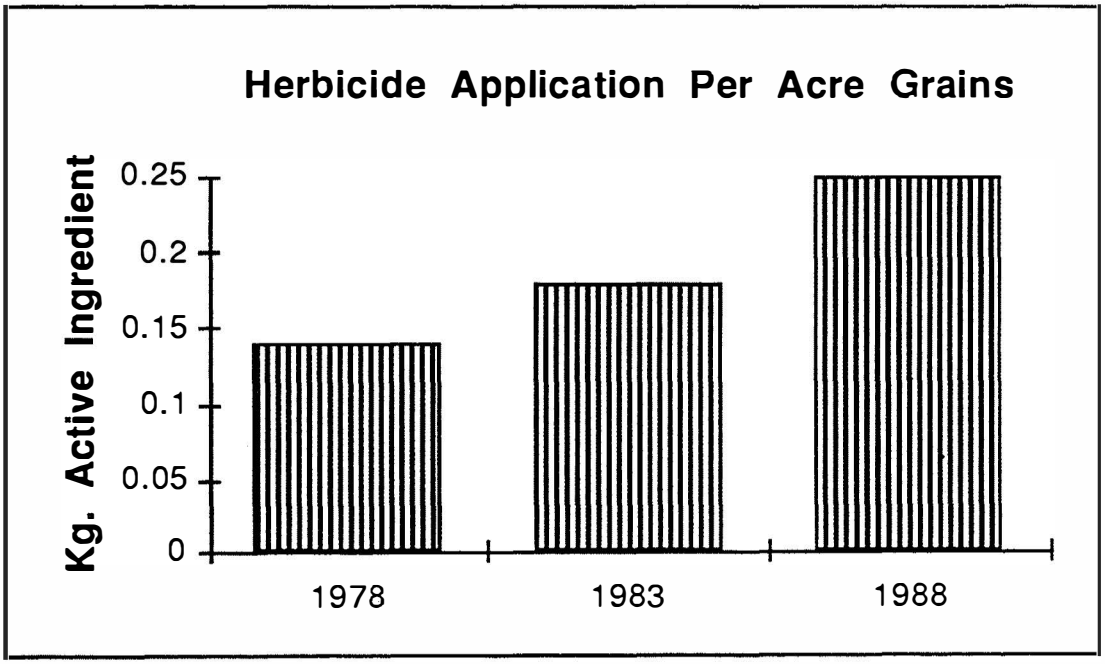


Chart 8d



Sources: Survey of Pesticide Usage In Ontario, Ontario Ministry of Agriculture and Food, 1978, '83 & '88; 1990, 1986, 1982 Agricultural Statistics For Ontario, Ontario Ministry of Agriculture and Food [See Table 8]

Chart 8e

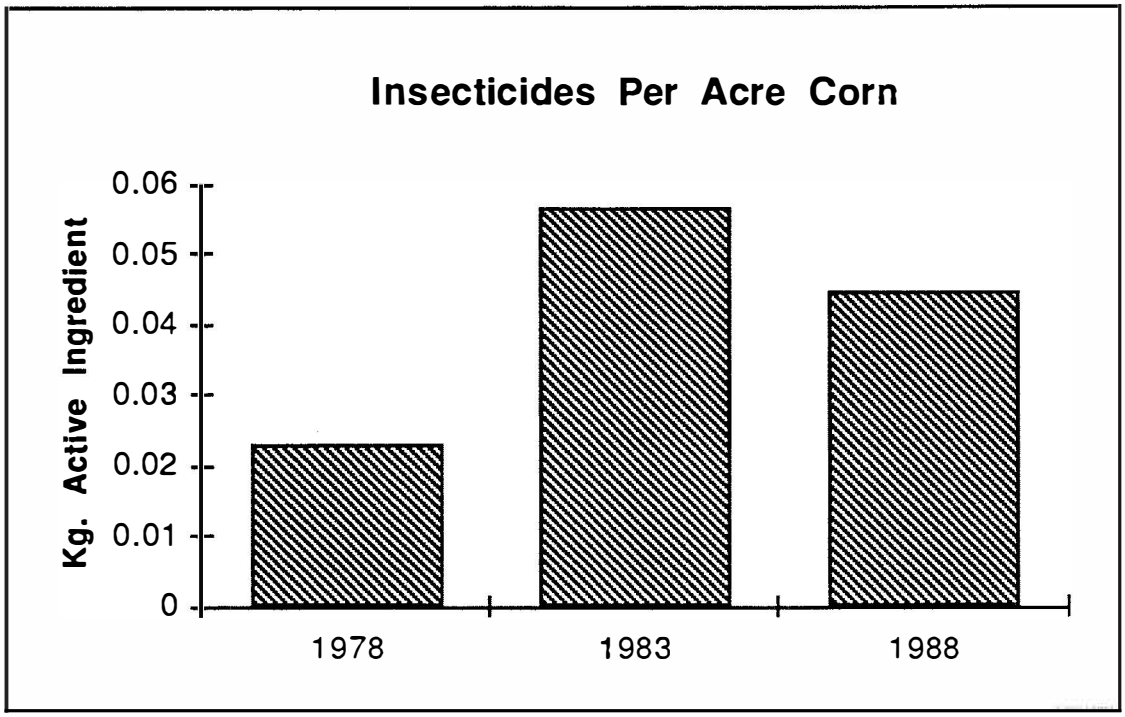
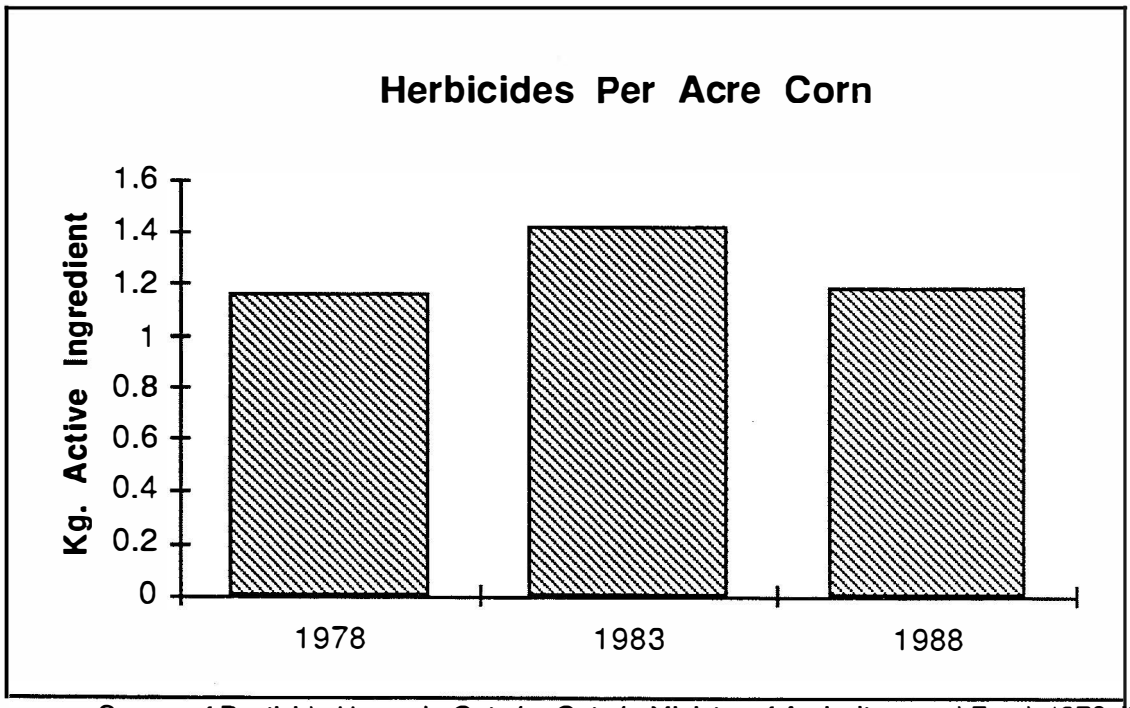


Chart 8f



Sources: Survey of Pesticide Usage In Ontario, Ontario Ministry of Agriculture and Food, 1978, '83 & '88; 1990, 1986, 1982 Agricultural Statistics For Ontario, Ontario Ministry of Agriculture and Food [See Table 8]

Chart 8g

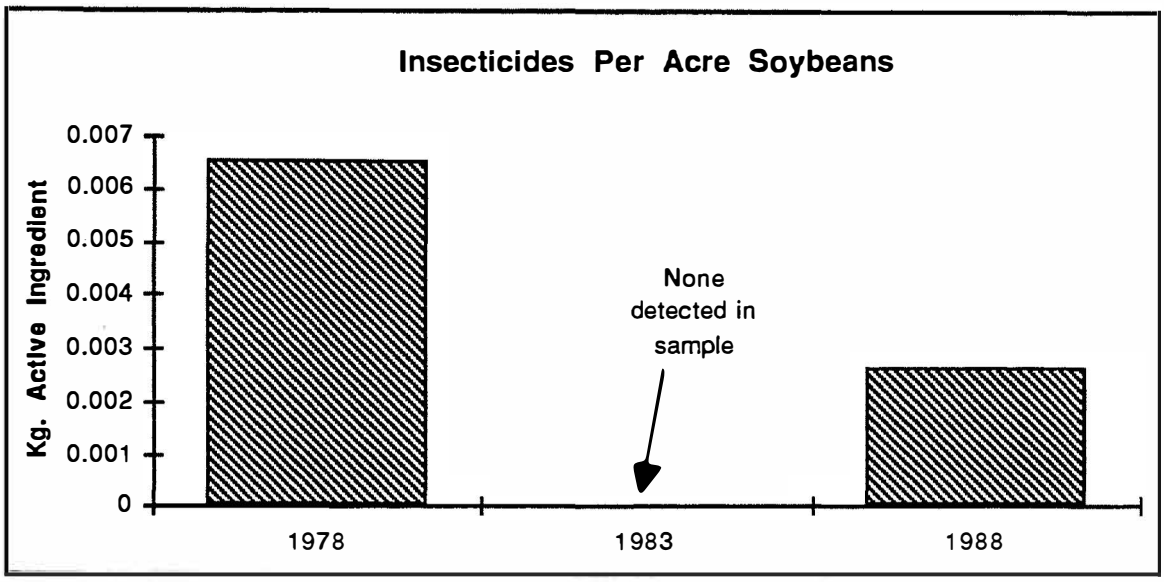
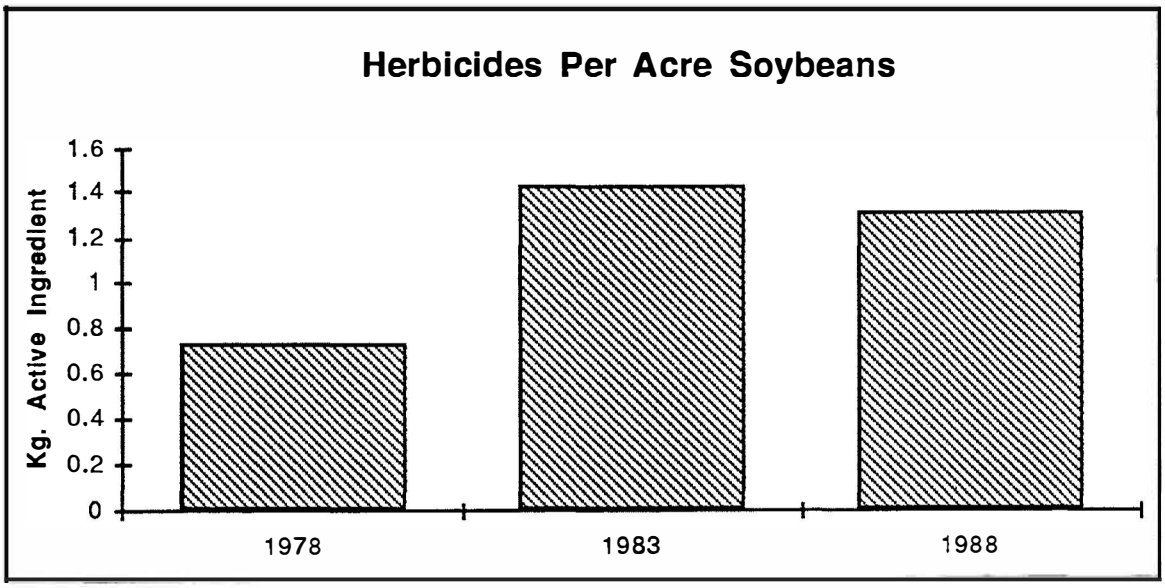


Chart 8h



Sources: Survey of Pesticide Usage In Ontario, Ontario Ministry of Agriculture and Food, 1978, '83 & '88; 1990, 1986, 1982 Agricultural Statistics For Ontario, Ontario Ministry of Agriculture and Food [See Table 8]

Appendix C:

Substances for Ban or Phase-Out

Table 1
Primary List of Candidate Substances for Bans or Phase-Outs

CAS Number	Substance Name
120-12-7	anthracene
7440-38-2	arsenic
50-32-8	benzo[*a*]pyrene
191-24-2	benzo[*ghi*]perylene
56-55-3	benz[*a*]anthracene
50-29-3*	DDT (+ DDD & DDE)
106-46-7	1,4-dichlorobenzene (paradichlorobenzene)
91-94-1	3,3'-dichlorobenzidine
60-57-1	dieldrin
118-74-1	hexachlorobenzene
319-84-6	α-1,2,3,4,5,6-hexachlorocyclohexane
58-89-9	γ-1,2,3,4,5,6-hexachlorocyclohexane
7439-97-6	mercury
2385-85-5	mirex
87-86-5	pentachlorophenol
198-55-0	perylene
85-01-8	phenanthrene
n/a	polychlorinated biphenyls
n/a	polychlorinated dibenzo-p-dioxins and -furans
8001-35-2	toxaphene
688-73-3	tributyl tin

Source: Ministry of Environment, Candidate Substances List for Bans or Phase-Outs, page 15

Table 2
Secondary List of Candidate Substances for Bans or Phase-Outs

Group A

CAS Number	Substance Name
205-99-2	benzo(*b*)fluoranthene
192-97-2	benzo(*e*)pyrene
205-82-3	benzo(*j*)fluoranthene
207-08-9	benzo(*k*)fluoranthene
7440-41-7	beryllium
117-81-7	bis(2-ethylhexyl)phthalate
7440-43-9	cadmium
67-66-3	chloroform
7440-47-3	chromium (Cr^{+6})
218-01-9	chrysene
7440-50-8	copper
189-55-9	dibenzo(*a,i*)pyrene
194-59-2	7H-dibenzo(*c,g*)carbazole
226-36-8	dibenz(*a,h*)acridine
224-42-0	dibenz(*a,j*)acridine
57-97-6	7,12-dimethylbenz(*a*)anthracene
42397-65-9	1,8-dinitropyrene
123-91-1	1,4-dioxane
122-66-7	1,2-diphenylhydrazine
106-93-4	ethylene dibromide
77-47-4	hexachlorocyclopentadiene
193-39-5	indeno(1,2,3-*cd*)pyrene
7439-92-1	lead
129-00-0	pyrene
7440-22-4	silver (free ion)
100-42-5	styrene
58-90-2	2,3,4,6-tetrachlorophenol
78-00-2	tetraethyllead
62-56-6	thiourea
7440-61-1	uranium
7440-66-6	zinc

Group B

CAS Number	Substance Name
7429-90-5	aluminum
108-90-7	chlorobenzene
87-68-3	hexachlorobutadiene
67-72-1	hexachloroethane
608-93-5	pentachlorobenzene
95-95-4	2,4,5-trichlorophenol
115-86-6	triphenyl phosphate

Group C

CAS Number	Substance Name
7005-72-3	4-chlorophenyl phenyl ether (1-chloro-4-phenoxybenzene)
1945-53-5	palustric acid
7782-49-2	selenium
634-90-2	1,2,3,5-tetrachlorobenzene
2539-17-5	tetrachloroguaiacol
4901-51-3	2,3,4,5-tetrachlorophenol
87-61-6	1,2,3-trichlorobenzene
25155-23-1	trixylyl phosphate

Source: Ministry of Environment, Candidate Substances List for Bans or Phase-Outs, page 17

Appendix D:

Proposed Substances For Inclusion In National Pollutant Release Inventory

Proposed NPRI List*
(Alphabetical listing)

Entry	Name	CASRN
1	Acetaldehyde	75-07-0
2	Acetone	67-64-1
3	Acetonitrile	75-05-8
4	Acrylamide	79-06-1
5	Acrylic acid	79-10-7
6	Acrylonitrile	107-13-1
7	Allyl alcohol	107-18-6
8	Allyl chloride	107-05-1
9	Aluminum (fume or dust)	7429-90-5
10	Aluminum oxide (fibrous forms)	1344-28-1
11	Ammonia	7664-41-7
12	Ammonium nitrate (solution)	6484-52-2
13	Ammonium sulfate (solution)	7783-20-2
14	Aniline	62-53-3
15	Anthracene	120-12-7
16	Antimony (and its Compounds)	N.A.
17	Arsenic (and its Compounds)	N.A.
18	Asbestos	1332-21-4
19	Benzene	71-43-2
20	Benzoyl chloride	98-88-4
21	Benzoyl peroxide	94-36-0
22	Benzyl chloride	100-44-7
23	Biphenyl	92-52-4
24	Bis(2-ethylhexyl) adipate	103-23-1
25	Bromomethane	74-83-9
26	1,3-Butadiene	106-99-0
27	Butyl acrylate	141-32-2
28	n-Butyl alcohol	71-36-3
29	sec-Butyl alcohol	78-92-2
30	tert-Butyl alcohol	75-65-0
31	Butyl benzyl phthalate	85-68-7
32	1,2-Butylene oxide	106-88-7
33	Butyraldehyde	123-72-8
34	C.I. Acid Green 3	4680-78-8
35	C.I. Basic Green 4	569-64-2
36	C.I. Basic Red 1	989-38-8
37	C.I. Disperse Yellow 3	2832-40-8
38	C.I. Food Red 15	81-88-9
39	C.I. Solvent Orange 7	3118-97-6
40	C.I. Solvent Yellow 14	842-07-9
41	Cadmium (and its Compounds)	N.A.
42	Calcium cyanamide	156-62-7
43	Carbon disulfide	75-15-0
44	Carbon tetrachloride	56-23-5
45	Catechol	120-80-9
46	Chlorine	7782-50-5
47	Chlorine dioxide	10049-04-4

*Source: "Towards A National Pollutant Release Inventory," *The Interim Report of the NPRI Multi-Stakeholder Advisory Committee*, October, 1992.

Proposed NPRI List
(Alphabetical listing)

Entry	Name	CASRN
48	Chloroacetic acid	79-11-8
49	Chlorobenzene	108-90-7
50	Chloroethane	75-00-3
51	Chloroform	67-66-3
52	Chloromethane	74-87-3
53	Chloromethyl methyl ether	107-30-2
54	Chromium (and its Compounds)	N.A.
55	Cobalt (and its Compounds)	N.A.
56	Copper (and its Compounds)	N.A.
57	Cresol (mixed isomers)	1319-77-3
58	m-Cresol	108-39-4
59	o-Cresol	95-48-7
60	p-Cresol	106-44-5
61	Cumene	98-82-8
62	Cumene hydroperoxide	80-15-9
63	Cyclohexane	110-82-7
64	Decabromodiphenyl oxide	1163-19-5
65	2,4-Diaminotoluene	95-80-7
66	Dibutyl phthalate	84-74-2
67	1,2-Dichlorobenzene	95-50-1
68	1,4-Dichlorobenzene	106-46-7
69	1,2-Dichloroethane	107-06-2
70	Dichloromethane	75-09-2
71	2,4-Dichlorophenol	120-83-2
72	1,2-Dichloropropane	78-87-5
73	Diethanolamine	111-42-2
74	Di-(2-ethylhexyl) phthalate	117-81-7
75	Diethyl phthalate	84-66-2
76	Diethyl sulfate	64-67-5
77	Dimethyl phthalate	131-11-3
78	Dimethyl sulfate	77-78-1
79	4,6-Dinitro-o-cresol	534-52-1
80	2,4-Dinitrotoluene	121-14-2
81	2,6-Dinitrotoluene	606-20-2
82	Dinitrotoluene (mixed isomers)	25321-14-6
83	n-Dioctyl phthalate	117-84-0
84	1,4-Dioxane	123-91-1
85	Epichlorohydrin	106-89-8
86	2-Ethoxyethanol	110-80-5
87	Ethyl acrylate	140-88-5
88	Ethylbenzene	100-41-4
89	Ethyl chloroformate	541-41-3
90	Ethylene	74-85-1
91	Ethylene glycol	107-21-1
92	Ethylene oxide	75-21-8
93	Ethylene thiourea	96-45-7
94	Formaldehyde	50-00-0

Proposed NPRI List
(Alphabetical listing)

Entry	Name	CASRN
95	Hexachlorocyclopentadiene	77-47-4
96	Hexachloroethane	67-72-1
97	Hydrazine	302-01-2
98	Hydrochloric acid	7647-01-0
99	Hydrogen cyanide	74-90-8
100	Hydrogen fluoride	7664-39-3
101	Hydroquinone	123-31-9
102	isoButyraldehyde	78-84-2
103	isoPropyl alcohol (manuf by str acid process)	67-63-0
104	4,4-isoPropylidenediphenol	80-05-7
105	Isosafrole	120-58-1
106	Lead (and its Compounds)	N.A.
107	Maleic anhydride	108-31-6
108	Manganese (and its Compounds)	N.A.
109	Mercury (and its Compounds) *	N.A.
110	Methanol	67-56-1
111	2-Methoxyethanol	109-86-4
112	Methyl acrylate	96-33-3
113	Methyl tert-butyl ether	1634-04-4
114	4,4'-Methylenebis(2-chloroaniline)	101-14-4
115	Methylenebis(phenylisocyanate)	101-68-8
116	4,4'-Methylenedianiline	101-77-9
117	Methyl ethyl ketone	78-93-3
118	Methyl iodide	74-88-4
119	Methyl isobutyl ketone	108-10-1
120	Methyl methacrylate	80-62-6
121	Michler's ketone	90-94-8
122	Molybdenum trioxide	1313-27-5
123	Naphthalene	91-20-3
124	Nickel (and its Compounds)	N.A.
125	Nitric Acid	7697-37-2
126	Nitrilotriacetic acid	139-13-9
127	Nitrobenzene	98-95-3
128	Nitroglycerin	55-63-0
129	4-Nitrophenol	100-02-7
130	2-Nitropropane	79-46-9
131	N,N-Dimethylaniline	121-69-7
132	N-Nitrosodiphenylamine	86-30-6
133	Peracetic Acid	79-21-0
134	Phenol	108-95-2
135	p-Phenylenediamine	106-50-3
136	2-Phenylphenol	90-43-7
137	Phosgene	75-44-5
138	Phosphoric acid	7664-38-2
139	Phosphorus (yellow or white)	7723-14-0
140	Phthalic anhydride	85-44-9
141	Propionaldehyde	123-38-6

Proposed NPRI List
(Alphabetical listing)

Entry	Name	CASRN
142	Propylene	115-07-1
143	Propylene oxide	75-56-9
144	Pyridine	110-86-1
145	Quinoline	91-22-5
146	p-Quinone	106-51-4
147	Saccharin (manufacture only)	81-07-2
148	Safrole	94-59-7
149	Selenium (and its Compounds)	N.A.
150	Silver (and its Compounds)	N.A.
151	Styrene	100-42-5
152	Styrene oxide	96-09-3
153	Sulfuric acid	7664-93-9
154	1,1,2,2-Tetrachloroethane	79-34-5
155	Tetrachloroethylene	127-18-4
156	Thiourea	62-56-6
157	Thorium dioxide	1314-20-1
158	Titanium tetrachloride	7550-45-0
159	Toluene	108-88-3
160	Toluene-2,4-diisocyanate	584-84-9
161	Toluene-2,6-diisocyanate	91-08-7
162	Toluenediisocyanate (mixed isomers)	26471-62-5
163	1,2,4-Trichlorobenzene	120-82-1
164	1,1,2-Trichloroethane	79-00-5
165	Trichloroethylene	79-01-6
166	1,2,4-Trimethylbenzene	95-63-6
167	Vanadium (fume or dust)	7440-62-2
168	Vinyl acetate	108-05-4
169	Vinyl chloride **	75-01-4
170	Vinylidene chloride	75-35-4
171	Xylene (mixed isomers)	1330-20-7
172	m-Xylene	108-38-3
173	o-Xylene	95-47-6
174	p-Xylene	106-42-3
175	Zinc (and its Compounds)	N.A.
176	Zinc (fume or dust)	7440-66-6

Appendix E:

Emissions Data

Table 1[1]
Annual Loadings Of Primary List Chemicals Found In MISA Industrial Sector Effluents (kg/year)*

PARAMETER	OCM ***	IRON & STEEL	INORGANIC **	PETROLEUM	PULP & PAPER	MINING	METAL CASTING	TOTAL
ARSENIC	15	301	109	185	-	12728	26	13364
1,4-DICHLOROBENZENE	177		2	-	-	-	-	179
HEXACHLOROBENZENE	3	2	0.2	-	-	2	-	7
MERCURY	105	7	34	0.8	15	33	6	200
PENTACHLOROPHENOL	-	-	-	-	32	-	-	32
PCB (TOTAL)	0.04	-	0.09	-	-	-	3.650	4
PCDD-F/ 2,3,7,8-TCDD	0.0009	-	-	-	0.002	-	-	0.003
PCDD-F/ TOTAL TCDD	0.0009	-	0.00002	-	0.01	-	-	0.01
PCDD-F/ TOTAL TCDF	0.002	-	0.02	0.003	0.03	-	-	0.06
PCDD-F/ TOTAL P5CDD	0.003	-	0.003	-	0.002	-	-	0.01
PCDD-F/ TOTAL P5CDF	0.005	-	0.01	0.003	0.005	-	-	0.02
PCDD-F/ TOTAL H6CDD	0.0010	-	0.003	-	0.003	-	-	0.007
PCDD-F/ TOTAL H6CDF	0.008	-	0.005	-	0.0030	-	-	0.02
PCDD-F/ TOTAL H7CDD	0.005	-	0.003	0.003	0.009	-	-	0.02
PCDD-F/ TOTAL H7CDF	0.007	-	0.00005	-	0.008	-	-	0.02
PCDD-F/ TOTAL O8CDD	0.01	0.002	0.02	0.008	0.028	-	-	0.07
PCDD-F/ TOTAL O8CDF	0.01	0.0004	0.0002	-	0.006	-	-	0.02
PAH/ ANTHRACENE	-	4	-	-	-	-	-	4
PAH/ BENZO(G,H,I)PERYLENE	-	44	-	-	-	-	-	44
PAH/ BENZO[A]PYRENE	-	79	-	-	-	-	-	79
PAH/ BENZ[A]ANTHRACENE	-	89	-	-	-	-	-	89
PAH/ PERYLENE	-	12	-	-	-	-	-	12
PAH/ PHENANTHRENE	-	21	46	-	562	-	35	665

LEGEND: * - THESE YEARLY LOADINGS REPRESENT THE UPPER BOUNDARY

** - SOURCE OF CHLORINATED DIBENZO-P-DIOXINS AND FURANS IN THE INORGANIC CHEMICALS SECTOR ARE UNKNOWN

*** - LOADINGS OF CHLORINATED DIBENZO-P-DIOXINS AND FURANS FOR ORGANIC CHEMICAL MANUFACTURING SECTOR INCLUDE ONLY THOSE FOR DOW CHEMICAL. DATA FROM OTHER PLANTS ARE INSUFFICIENT TO CALCULATE LOADINGS.

[1] Source: Ministry of Environment, Candidate Substances List for Bans or Phase-Outs

Table 2*
Summary Of Industries Inspected/Sampled in MISA Demos

		DEMONSTRATION PROJECTS																
		HAMILTON			THUNDER BAY			COBOURG			INGERSOLL			GANANOQUE			TOTALS		
#	MISA SECTOR	WSR	INS	SAM	WSR	INS	SAM	WSR	INS	SAM	WSR	INS	SAM	WSR	INS	SAM	WSR	INS	SAM
1	FABRIC. METAL PROD	51	17	15	1	1	1	1	1	1	2	2	1	5	5	5	60	26	23
2	ORGANIC CHEMICALS	14	5	5	2	3	2							1	1	1	17	9	8
3	WASTE TREATM.& RECYCL	20	10	4	1	1	1	1	1	1							22	12	6
4	PRIMARY METAL IND.	15	8	7							1	1	1				16	9	8
5	NON–FERROUS METALS	9	3	3				3	3	2							12	6	5
6	INORGANIC CHEMICALS	5	2	2	1			1	1	1	1	1					8	4	3
7	ELECTR. EQUIP. MANUF.	15	3	2	1	1		4	1								20	5	2
8	PULP & PAPER	3	2	1	1			1	1	1	3	3	1				8	6	3
9	PETROLEUM REFINING	4	2	0													4	2	0
10	TEXTILES	7	5	5							1	1					8	6	5
11	LEATHER	11	0	0				1	1	1							12	1	1
12	TIMBER PRODUCTS	5	2	0	2	2	1	2	1								9	5	1
13	INDUSTRIAL LAUNDRIES	26	6	3	3	1	1							1	1		30	8	4
14	RUBBER & M. PLASTIC	9	3	3	3	3		4	3	2	1			1	1	1	18	10	6
15	HOSPITALS	28	6	0	10	7	2				1	1	1				39	14	3
16	FOOD PROCESSING	61	13	8	10	11	5	3	3	3	4	3	3				78	30	19
17	TRANSPORTATION EQUIP	7	1	1							3	3	2				10	4	3
18	MACHINERY MANUF.& RE	33	5	5	6	4	2	2			2	2					43	11	7
19	STONE GLASS CL Y CEM	16	4	3	2	1		2	2	1	1						21	7	4
20	SERVICE INDUSTRIES	24	12	1	5	4	1				10	1					39	17	2
21	PRINTING & PUBLICAT.	18	3	3	7	5		1	1	1	2	2		3	3	3	31	14	7
22	TRANSPORTATION SERVICES	18	4	4	2	1								1	1		21	6	4
23	MISCELLANEOUS	123	94	14				2	1					2	2		127	97	14
	TOTALS	522	210	89	57	45	16	28	20	14	32	20	9	14	14	10	653	309	138

Note: Numbers in table are numbers of industries

KEY:
"WSR" = Approved waste survey report
"INS" = Industries inspected
"SAM" = Industries sampled

*Source: Ministry of Environment, Water Resources Branch

Table 3*
Summary of Metals On Bans/Phase-Outs List Found in MISA Demos (91/92)

PARAMETER	NUMBER OF INDUSTRIES DETECTED AT / NUMBER OF SECTORS FOUND IN		DISCHARGER CONC.n mg/L	DISCHARGER LOADING Kg/year	SECTOR LOADING Kg/year
Aluminum	INDUSTRIES = 98	AVG	1.08	142.86	TOTAL
	SECTORS = 22	MAX	13.00	2610.23	LOADING
		MIN	0.01	0.04	14000.45
Arsenic	INDUSTRIES = 84	AVG	0.02	1.55	TOTAL
	SECTORS = 19	MAX	1.00	47.52	LOADING
		MIN	0.00	0.00	129.93
Beryllium	INDUSTRIES = 79	AVG	0.03	3.99	TOTAL
	SECTORS = 21	MAX	1.00	74.46	LOADING
		MIN	0.00	0.00	315.30
Cadmium	INDUSTRIES = 94	AVG	0.17	8.56	TOTAL
	SECTORS = 21	MAX	13.75	652.46	LOADING
		MIN	0.00	0.00	804.84
Chromium	INDUSTRIES = 89	AVG	0.73	63.59	TOTAL
	SECTORS = 21	MAX	46.00	3425.16	LOADING
		MIN	0.00	0.00	5535.84
Copper	INDUSTRIES = 101	AVG	1.47	52.46	TOTAL
	SECTORS = 22	MAX	91.43	2187.81	LOADING
		MIN	0.01	0.01	5298.31
Lead	INDUSTRIES = 96	AVG	0.21	16.60	TOTAL
	SECTORS = 21	MAX	4.84	225.61	LOADING
		MIN	0.00	0.01	1560.37
Mercury	INDUSTRIES = 65	AVG	0.01	5.19	TOTAL
	SECTORS = 17	MAX	0.10	166.53	LOADING
		MIN	0.00	0.00	334.91
Selenium	INDUSTRIES = 81	AVG	0.04	19.49	TOTAL
	SECTORS = 19	MAX	2.00	1446.17	LOADING
		MIN	0.00	0.00	1579.05
Silver	INDUSTRIES = 92	AVG	0.07	5.93	TOTAL
	SECTORS = 20	MAX	2.07	98.08	LOADING
		MIN	0.00	0.00	545.43
Uranium	INDUSTRIES = 2	AVG	0.00	2.70	TOTAL
	SECTORS = 2	MAX	0.00	2.72	LOADING
		MIN	0.00	2.68	5.39
Zinc	INDUSTRIES = 104	AVG	3.40	126.66	TOTAL
	SECTORS = 22	MAX	114.30	4642.80	LOADING
		MIN	0.00	0.01	12921.08

*Source: Ministry of Environment, Water Resources Branch

Table 4*

Summary of Organic Parameters On Bans/Phas-Outs List Found in MISA Demos (91/92)

PARAMETER	NUMBER OF INDUSTRIES DETECTED AT / NUMBER OF SECTORS FOUND IN		DISCHARGER CONC.n ug/L	DISCHARGER LOADING kg/year	SECTOR LOADING kg/year
1,4–Dichlorobenzene	INDUSTRIES = 19	AVG	300.04	15.07	TOTAL
	SECTORS = 13	MAX	3200.00	235.68	LOADING
		MIN	0.83	0.03	286.38
Benzo(a)pyrene	INDUSTRIES = 2	AVG	13.00	0.55	TOTAL
	SECTORS = 2	MAX	17.00	0.70	LOADING
		MIN	9.00	0.40	1.10
Benzo(b)fluoranthene	INDUSTRIES = 1	AVG	14.00	0.58	TOTAL
	SECTORS = 1	MAX	14.00	0.58	LOADING
		MIN	14.00	0.58	0.58
Benzo(k)fluoranthene	INDUSTRIES = 1	AVG	19.00	0.78	TOTAL
	SECTORS = 1	MAX	19.00	0.78	LOADING
		MIN	19.00	0.78	0.78
Bis(2–ethylhexyl)phthalate	INDUSTRIES = 11	AVG	128.45	21.45	TOTAL
	SECTORS = 9	MAX	1000.00	120.07	LOADING
		MIN	0.00	0.00	235.92
Chlorobenzene	INDUSTRIES = 2	AVG	122.50	22.71	TOTAL
	SECTORS = 2	MAX	240.00	22.71	LOADING
		MIN	5.00	0.00	22.72
Chloroform	INDUSTRIES = 12	AVG	53.50	8.78	TOTAL
	SECTORS = 7	MAX	200.00	33.85	LOADING
		MIN	0.00	0.27	105.38
Ethylene dibromide	INDUSTRIES = 1	AVG	230.00	21.77	TOTAL
	SECTORS = 1	MAX	230.00	21.77	LOADING
		MIN	230.00	21.77	21.77
Perylene	INDUSTRIES = 2	AVG	14.00	0.60	TOTAL
	SECTORS = 2	MAX	15.00	0.62	LOADING
		MIN	13.00	0.58	1.20
Phenanthrene	INDUSTRIES = 2	AVG	1003.00	76.78	TOTAL
	SECTORS = 2	MAX	2000.00	153.30	LOADING
		MIN	6.00	0.27	153.57
Pyrene	INDUSTRIES = 2	AVG	765.00	57.63	TOTAL
	SECTORS = 2	MAX	1500.00	114.98	LOADING
		MIN	30.00	0.29	115.27
Styrene	INDUSTRIES = 10	AVG	41.63	48.95	TOTAL
	SECTORS = 8	MAX	140.00	467.63	LOADING
		MIN	0.01	0.00	489.46

*Source: Ministry of Environment, Water Resources Branch

Appendix F:

Energy Data

Table 1
Fuel/Energy Used By Sector (TJ), Ontario, 1989

FUELS/ENERGY	RES.[1]	COMM.[2]	IND'L[3]	TRANS.[4]	TOTAL
Solid Fuels					
Canadian Bituminous			25.9		25.9
U.S. Bituminous			164.5		164.5
Lignite					
Gaseous Fuels					
Natural Gas	269.5	163	380.1	0.5	813.3
Liquid Fuels					
Motor Gasoline		17.1	9.8	424.1	451.0
Kerosene	3.7	1.3	0.6		5.6
Aviation Gasoline		1.1		0.2	1.3
Aviation Turbo		5.9		51.8	57.7
Diesel Oil		25.8	32.5	114.9	173.2
Light Fuel Oil	56.6	15.3	4.7		76.6
Heavy Fuel Oil	0.1	3.1	42.1	13.9	59.2
Petroleum Coke			13.3		
Propane	3.9	7.5	14.7	11.1	37.2
Electricity	161.9	145.2	178.9	1.3	487.3
TOTAL	495.7	385.3	867.2	617.8	2366.0

Source: Statistics Canada, Quarterly report on energy supply-demand in Canada, 1989-IV, August 1990 (Catalogue 57-003, Vol. 14, No. 4), Tables 8B and 8D.

Notes: 1. RES - Residential.
2. COMM - Commercial.
3. IND'L - Industrial. The industrial sector includes agriculture, construction, mining, forestry and manufacturing. Included in the totals for liquid fuels and natural gas for the industrial sector are the quantities used to generate electricity for own use.
4. TRANS - Transportation.

Table 2
Expenditures On Fuels/Energy By Sector ($ Millions), Ontario, 1989

FUELS/ENERGY	RES.	COMM.	IND'L	TRANS.	TOTAL
Solid Fuels					
Canadian. Bituminous			27.1		27.1
US Bituminous			312.7		312.7
Lignite					
Gaseous Fuels					
Natural Gas	1401.3	672.5	1075.6	1.3	3150.7
Liquid Fuels					
Motor Gasoline		246.8	141.4	6138.6	6526.8
Kerosene	38.1	13.2	5.9		57.2
Aviation Gasoline		9.3		2.1	11.4
Aviation Turbo		49.0		427.6	476.6
Diesel Oil		325.4	410.0	1449.7	2185.1
Light Fuel Oil	463.5	125.3	38.6		627.4
Heavy Fuel Oil	0.4	8.4	114.1	37.6	160.5
Petroleum Coke			43.6		43.6
Propane	56.0	89.7	76.6	157.7	380.0
Electricity	2711.3	2173.2	2008.0	20.2	6912.7
TOTAL	4670.6	3712.8	4253.5	8234.9	20,871.8

Sources: Table1 and Ontario Ministry of Energy.

Table 3
Carbon Content of Fuels/Energy Used By Sector (Kilotonnes), Ontario, 1989

FUELS/ENERGY	RES.	COMM.	IND'L	TRANS.
Solid Fuels				
Canadian Bituminous			588.07	
U.S. Bituminous			3858.06	
Lignite				
Gaseous Fuels				
Natural Gas	3655.33	2214.02	5156.29	6.35
Liquid Fuels				
Motor Gasoline		316.16	181.16	7862.62
Kerosene	68.60	23.73	10.55	
Aviation Gasoline		19.90		4.56
Aviation Turbo		114.63		1000.16
Diesel Oil		497.23	626.48	2215.43
Light Fuel Oil	1127.73	304.88	93.82	
Heavy Fuel Oil	2.99	62.22	850.43	280.14
Petroleum Coke			246.47	
Propane	64.45	121.67	240.20	181.63
Electricity	2834.27	2541.61	3133.06	23.60
TOTAL(ex. ELECT.)	4919.10	3674.44	11,851.53	11,550.89
TOTAL (incl. ELECT.)	7753.37	6216.05	14,984.59	11,574.49

Sources: Table 1; A. P. Jacques, "Canada's Greenhouse Gas Emissions Estimates for 1990", Environment Canada, April 1992.

Table 4
Carbon Content of Fuels/Energy Used By Industrial and Transportation Sub-Sectors, Ontario, 1989

SUB-SECTORS	KT[1]	% of Total[2]
Industrial		
Agriculture	743	1.8
Construction	238	0.6
Mining	639	1.6
Forestry	34	0.1
Manufacturing	13442	33.2
Chemicals	1186	2.9
Iron & steel	5281	13.0
Smelting & refining	245	0.6
Cement	656	1.6
Pulp, paper & sawmills	1287	3.2
Transportation		
Rail	537	1.3
Domestic airlines	807	2.0
Foreign airlines	198	0.5
Domestic marine	228	0.6
Foreign marine	211	0.5
Truck & urban transit	1169	2.9
Retail pump sales	8425	20.8

Sources: Table 1; A. P. Jacques, "Canada's Greenhouse Gas Emissions Estimates for 1990", Environment Canada, April 1992.

Notes: 1. Kilotonnes of carbon content in all fuels/energy used.
2. Proportion of total carbon content reported in Table 3.

Table 5
Carbon Tax Costs By Industrial and Transportation Sub-Sectors, Residential and Commercial Sectors, Ontario, 1989

SECTORS AND SUB-SECTORS	$(mill.)[1]	% of Total
Industrial		
Agriculture	18.3	1.8
Construction	5.9	0.6
Mining	15.8	1.6
Forestry	0.8	0.1
Manufacturing	331.7	33.2
Chemicals	29.3	2.9
Iron & steel	130.3	13.0
Smelting & refining	6.0	0.6
Cement	16.2	1.6
Pulp, paper & sawmills	31.8	3.2
Total Industrial	369.8	37.0
Transportation		
Rail	13.2	1.3
Domestic airlines	19.9	2.0
Foreign airlines	4.9	0.5
Domestic marine	5.6	0.6
Foreign marine	5.2	0.5
Truck & urban transit	28.8	2.9
Retail Pump Sales	207.9	20.8
Total Transportation	285.7	28.6
Residential	191.3	19.1
Commercial	153.4	15.3

Sources: Table 1. Calculations by authors

Notes: 1.Millions of dollars.

Table 6
Energy Tax Costs By Industrial and Transportation Sub-Sectors, Residential and Commercial Sectors, Ontario, 1989

SECTORS AND SUB-SECTORS	$(mill.)[1]	% of Total
Industrial		
Agriculture	18.0	1.8
Construction	5.3	0.5
Mining	16.3	1.6
Forestry	0.7	0.1
Manufacturing	327.5	32.8
Chemicals	31.8	3.2
Iron & steel	107.3	10.7
Smelting & refining	6.9	0.7
Cement	13.5	1.4
Pulp, paper & sawmills	34.6	3.5
Total Industrial	366.5	36.7
Transportation		
Rail	11.8	1.2
Domestic airlines	17.6	1.8
Foreign airlines	4.3	0.4
Domestic marine	4.8	0.5
Foreign marine	4.5	0.4
Truck & urban transit	26.6	2.7
Retail Pump Sales	191.4	19.1

Sources: Table 1. Calculations by authors.

Notes: 1. Millions of dollars.

Table 7
Ad Valorem Costs By Industrial and Transportation Sub-Sectors, Residential and Commercial Sectors, Ontario, 1989

SECTORS AND SUB-SECTORS	$(mill.)[1]	% of Total
Industrial		
Agriculture	20.2	2.0
Construction	6.8	0.7
Mining	14.9	1.5
Forestry	1.0	0.1
Manufacturing	168.1	16.8
Chemicals	19.8	2.0
Iron & steel	36.5	3.7
Smelting & refining	3.7	0.4
Cement	4.2	0.4
Pulp, paper & sawmills	23.8	2.4
Total Industrial	203.7	20.4
Transportation		
Rail	8.5	0.9
Domestic airlines	16.5	1.7
Foreign airlines	4.0	0.4
Domestic marine	3.2	0.3
Foreign marine	3.6	0.4
Truck & urban transit	40.0	4.0
Retail Pump Sales	310.3	31.0
Total Transportation	394.4	39.4

Sources: Table 2. Calculations by authors.

Notes: 1. Millions of dollars.

Table 8

Direct, First Round[1] Impacts of Carbon, Energy and Ad Valorem Taxes on Total Costs, By Industry, Ontario, 1989 (% Increase in Total Costs)

INDUSTRY	CARBON[2] TAX	ENERGY TAX	AD VALOREM TAX	CARBON[3] TAX
		(%)		
Food	0.13	0.15	0.08	0.14
Beverages	0.16	0.19	0.09	0.18
Rubber	0.15	0.17	0.09	0.17
Plastic	0.12	0.13	0.10	0.13
Leather	0.09	0.11	0.06	0.10
Primary Textiles	0.37	0.45	0.21	0.42
Textile Products	0.16	0.19	0.09	0.18
Clothing	0.05	0.06	0.04	0.06
Wood	0.16	0.18	0.12	0.18
Furniture, Fixtures	0.10	0.11	0.06	0.11
Paper Products	0.64	0.68	0.30	0.72
Printing, Publishing	0.06	0.06	0.04	0.06
Primary Metals	0.54	0.56	0.25	0.53
Primary Steel	0.96	0.79	0.26	0.53
Steel Pipe & Tubes	0.12	0.14	0.07	0.14
Non-Ferrous Smelting	1.78	1.90	0.94	1.99
Aluminum	0.19	0.22	0.10	0.22
Other Metal Rolling	0.27	0.33	0.14	0.31
Fabricated Metal Products	0.13	0.15	0.08	0.15
Machinery, Equipment	0.08	0.09	0.05	0.09
Transportation Equipment	0.05	0.05	0.03	0.05
Electrical, Electronic Products	0.06	0.08	0.04	0.07
Non-Metallic Minerals	1.05	1.05	0.39	0.68
Cement	7.43	6.01	1.36	1.44
Refined Petroleum	0.20	0.25	0.11	0.23
Chemicals	0.34	0.39	0.16	0.38
Other Manufacturing	0.09	0.11	0.06	0.10
Mining	0.42	0.45	0.41	0.46

Source: Statistics Canada, Manufacturing industries of Canada: national and provincial areas, 1988 (Catalogue 31-203); Statistics Canada, General review of the mineral industries, 1989 (Catalogue 26-201); Statistics Canada, Consumption of purchased fuel and electricity, 1984 (Catalogue 57-208).

Notes: 1. Direct impacts do not factor the effects of the various taxes on the prices of intermediate inputs (materials, supplies) used by these industries. The relative impacts of the taxes are measured as the proportionate increases in the total costs (excluding capital costs) for each industry.

2. Carbon tax based on use of coal as energy input by primary steel and cement industries.

3. Carbon tax based on use of coal as feedstock by primary steel and cement industries. .

Table 9
Quasi-Equilibrium[1] Impacts of Carbon, Energy and Ad Valorem Taxes on Total Costs, By Industry, Ontario, 1990 (% Increase in Total Costs)

INDUSTRY	CARBON[2] TAX	ENERGY TAX	AD VALOREM TAX	CARBON[3] TAX
		(%)		
Food	0.37	0.41	0.30	0.40
Beverages	0.43	0.48	0.30	0.41
Rubber	0.41	0.46	0.30	0.45
Plastic	0.47	0.52	0.34	0.52
Leather	0.31	0.35	0.23	0.34
Primary Textiles	0.58[4]	0.67	0.37	0.64
Textile Products				
Clothing	0.31	0.36	0.22	0.34
Wood	0.47	0.50	0.45	0.51
Furniture, Fixtures	0.37	0.41	0.28	0.39
Paper Products	0.98	1.03	0.58	1.08
Printing, Publishing	0.37	0.40	0.28	0.41
Primary Metals	1.42	1.41	0.62	0.94
Fabricated Metal Products	0.50	0.55	0.35	0.52
Machinery, Equipment	0.35	0.39	0.26	0.36
Transportation Equipment	0.36	0.40	0.28	0.37
Electrical, Electronic Products	0.32	0.36	0.24	0.33
Non-Metallic Minerals	1.39	1.40	0.63	0.89
Refined Petroleum	0.33	0.38	0.22	0.36
Chemicals	0.62	0.70	0.39	0.69
Other Manufacturing	0.34	0.38	0.27	0.37
Mining	053	057	052	058

Sources: Statistics Canada, Manufacturing industries of Canada: national and provincial areas, 1988 (Catalogue 31-203); Statistics Canada, General review of the mineral industries, 1989 (Catalogue 26-201); Statistics Canada, Consumption of purchased fuel and electricity, 1984 (Catalogue 57-208); and Statistics Canada, The Input-Output Structure of the Canadian Economy, 1988 (Catalogue 15-501)

Notes: 1. The quasi equilibrium impacts factor the effects of the various taxes on the prices of intermediate inputs (materials, supplies) used by these industries. The relative impacts of the taxes are measured as the proportionate increases in the total costs (excluding capital costs) for each industry.

2. Carbon tax based on use of coal as energy input by primary steel and cement industries.

3. Carbon tax based on use of coal as feedstock by primary steel and cement industries. .

4. Input-output data available for the aggregate textiles industry which combines primary textiles and textile products.

Table 10
Short-Term Effects of Carbon, Energy and Ad Valorem Taxes on Energy Use By Fuel, By Sector, Ontario, 1989

SECTOR	CARBON TAX	ENERGY TAX	AD VALOREM TAX
		(%)[1]	
Residential			
Electricity	-0.64	-0.50	-1.68
Natural Gas	-0.90	-1.81	-0.24
Oil Products	-2.71	-1.94	-2.25
TOTAL	-1.04	-1.40	-0.95
Commercial			
Electricity	0.55	1.02	-1.25
Natural Gas	-3.12	-4.21	-1.25
Oil Products	-0.50	0.28	-1.25
TOTAL	-1.26	-1.43	-1.25
Industrial			
Electricity	-4.09	-1.70	-0.23
Natural Gas	0.40	-2.49	-0.23
Oil Products	5.10	2.68	-0.23
Coal	-4.61	-0.92	-0.23
TOTAL	-1.07	-1.37	-0.23
Transportation			
Oil Products	-0.73	-0.67	-1.01
		(TJ)[2]	
Residential			
Electricity	(1040)	(815)	(2714)
Natural Gas	(2457)	(4949)	(655)
Oil Products	(1637)	(1171)	(1360)
TOTAL	(5134)	(6935)	(4729)
Commercial			
Electricity	801	1485	(1808)
Natural Gas	(5331)	(7191)	(2126)
Oil Products	(344)	197	(865)
TOTAL	(4874)	(5509)	(4799)
Industrial			
Electricity	(7316)	(3047)	(420)
Natural Gas	1594	(9848)	(908)
Oil Products	5248	2755	(242)
Coal	(8777)	(1758)	(438)
TOTAL	(9251)	(11898)	(2008)
Transportation			
Oil Products	(4420)	(4027)	(6085)
TOTAL	(23679)	(28369)	(17621)
	(-1.01%)	(-1.21%)	(-0.75%)

Sources: The short-term price elasticities were provided by Mahmoud Elkhafif of Ontario Hydro. Calculations by authors.

Notes: 1. Percentage change in energy use.
2. Change in energy use measured in terajoules.

Table 11

Long-Term Effects (15 Years) of Carbon, Energy and Ad Valorem Taxes on Energy Use By Fuel, By Sector, Ontario, 1989

SECTOR	CARBON TAX	ENERGY TAX	AD VALOREM TAX
		(%)	
Residential			
Electricity	-1.07	-0.78	-3.02
Natural Gas	2.15	0.54	2.68
Oil Products	-7.96	-6.06	-6.56
TOTAL	-0.13	-0.69	-0.31
Commercial			
Electricity	-1.02	-0.67	-2.97
Natural Gas	-5.44	-6.97	-2.97
Oil Products	-2.28	-0.94	-2.88
TOTAL	-3.21	-3.51	-2.95
Industrial			
Electricity	-5.45	-2.83	-2.68
Natural Gas	-4.91	-9.13	-2.69
Oil Products	2.34	0.52	-2.69
Coal	-20.49	-12.22	-2.67
TOTAL	-7.58	-7.36	-2.68
Transportation			
Oil Products	-1.88	-1.71	-2.59
		(TJ)	
Residential			
Electricity	(1728)	(1256)	(4885)
Natural Gas	5880	1478	7334
Oil Products	(4807)	(3664)	(3965)
TOTAL	(655)	(3442)	(1516)
Commercial			
Electricity	(1477)	(968)	(4311)
Natural Gas	(9285)	(11888)	(5069)
Oil Products	(1585)	(654)	(1997)
TOTAL	(12347)	(13510)	(11377)
Industrial			
Electricity	(9746)	(5071)	(4800)
Natural Gas	(19405)	(36030)	(10610)
Oil Products	2407	533	(2766)
Coal	(39027)	(23269)	(5090)
TOTAL	(65771)	(63837)	(23266)
Transportation			
Oil Products	(11367)	(10354)	(15646)
TOTAL	(90140)	(91143)	(51805)
	(-3.83%)	(-3.87%)	(-2.20%)

Sources: The short-term price elasticities were provided by Mahmoud Elkhafif who is with Ontario Hydro. See Table 9.

Table 12
Long-Term Effects of Carbon, Energy and Ad Valorem Taxes on Carbon Dioxide Emissions By Sector, Ontario, 1989 (Kilotonnes)

SECTOR	CARBON TAX	ENERGY TAX	AD VALOREM TAX
Residential	(167)	(273)	(240)
Commercial	(677)	(707)	(684)
Industrial	(4723)	(4062)	(1479)
Transportation	(783)	(713)	(1078)
TOTAL	(6350)	(5755)	(3481)
		(%)	
Residential	-0.59	-0.96	-0.85
Commercial	-2.92	-3.05	-2.95
Industrial	-8.56	-7.36	-2.68
Transportation	-1.88	-1.71	-2.59
TOTAL	-4.28	-3.88	-2.35

Sources: Table 10; A. P. Jacques, "Canada's Greenhouse Gas Emissions Estimates for 1990", Environment Canada, April 1992.

Table 13
Relative Impacts on Fuel/Energy Prices of Carbon, Energy and Ad Valorem Taxes to Generate $1 Billion in Revenues, Ontario, 1989[1]

FUELS/ENERGY	CARBON %	ENERGY %	AD VALOREM %
Solid Fuels: Coal			
Canadian Bituminous	53.6	40.4	4.8
U.S. Bituminous	30.4	22.2	4.8
Lignite	108.7	68.6	4.8
Gaseous Fuels			
Natural Gas			
Residential	6.4	8.1	4.8
Commercial	8.1	10.3	4.8
Industrial/Transportation	11.8	14.9	4.8
Liquid Fuels: Refined Petroleum Products			
Motor Gasoline	3.2	2.9	4.8
Kerosene	4.4	4.1	4.8
Aviation Gasoline	5.3	4.8	4.8
Aviation Turbo	5.8	5.1	4.8
Diesel Oil	3.8	3.4	4.8
Light Fuel Oil	6.0	5.2	4.8
Heavy Fuel Oil	18.4	15.6	4.8
Petroleum Coke	14.0	12.9	4.8
Propane			
Residential/Transportation	2.8	3.0	4.8
Commercial	3.4	3.5	4.8
Industrial	7.7	8.1	4.8
Electricity			
Residential	2.6	2.5	4.8
Commercial	2.9	2.8	4.8
Industrial	3.8	3.8	4.8

Sources: Ontario Ministry of Energy. Calculations by authors.

Note: 1. Percentage increases in retail prices resulting from the imposition of a carbon, energy or ad valorem tax.

Chart 1

Actual Incidence of Ad Valorem Energy Tax On Ontario Households

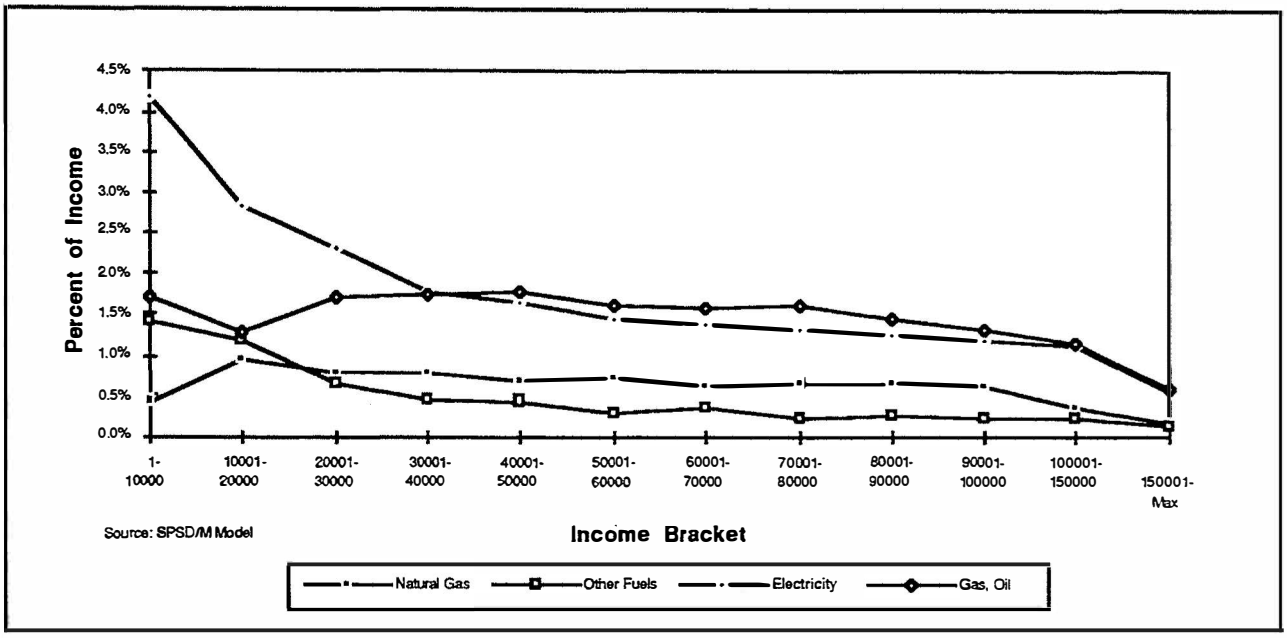
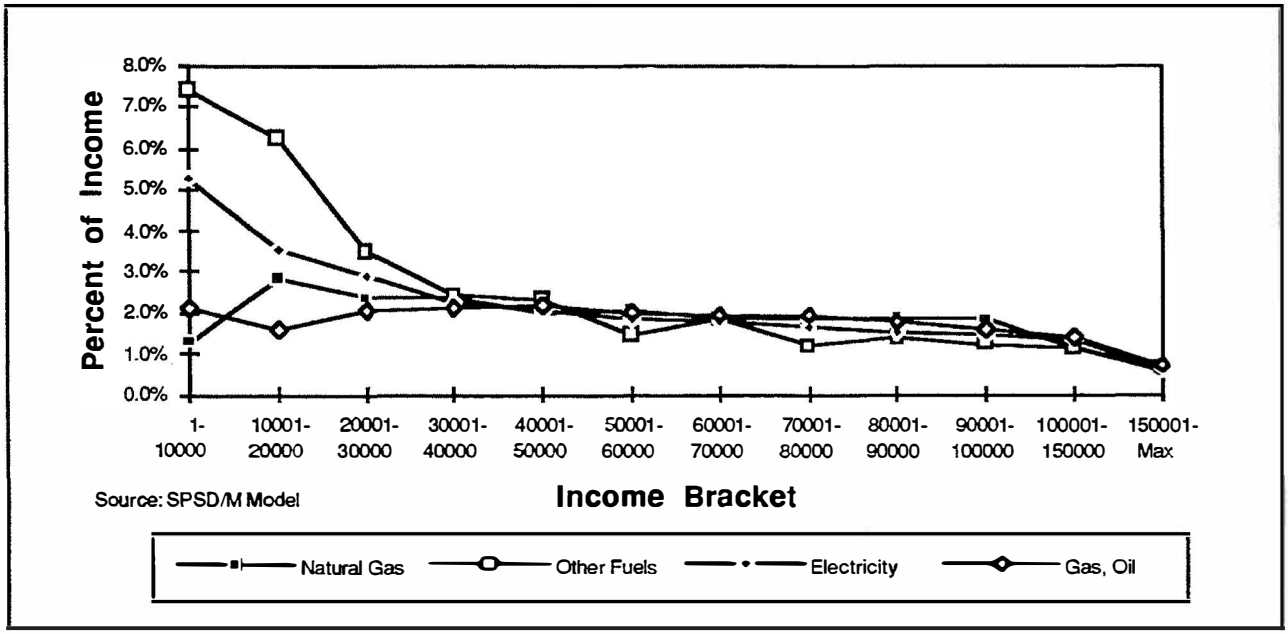


Chart 2

Relative Incidence of Ad Valorem Energy Tax On Ontario Households



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