Environmental and Economic Effects of Emissions Trading by the City of Toronto
Phase II Report

Report to Works and Emergency Services
City of Toronto
As part of the
Study of Emissions Trading
For Smog Precursors and Greenhouse Gases

Dewees Consulting Limited
Don Dewees
Peter Victor

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Table of Contents

List of Tables

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Executive Summary

This project is divided into two phases. Phase I examined the effects of emissions trading in general, including the environmental and financial effects of emissions trading, a review of existing emissions trading systems, and analysis of a set of simplified cases involving emission reduction projects that give rise to emissions trading opportunities. Phase I explored the difference between cap and trade (allowance) and emission reduction credit (ERC) trading systems. Appendix B contains the executive summary of the Phase I report.

This report completes Phase II of the project, looking at strategic policy options that the City might choose for directing its emissions trading activities. Since the City does not have capped sources, this report focuses on emission reduction credit opportunities. Four policy options are identified, defined and evaluated. In addition, a set of separate strategic issues raised by emissions trading opportunities are listed and examined, identifying both problems and possible solutions. The policy options thus developed are then applied to six specific cases representing opportunities for emissions trading for the City of Toronto. The environmental and financial implications of pursuing the selected projects are explored using principles developed in Phase I. Both the development of the policy options and the examination of the cases are conducted in the context of the City's existing voluntary commitment to reduce CO2 emissions to 20% below 1990 emissions by the year 2005. The interpretation of that commitment will have implications for the City's emissions trading policy. We suggest three alternative interpretations.

Emissions trading often presents conflicts between environmental and financial goals. Selling emission reduction credits that arise from emission reduction projects generates revenue that offsets their costs. However selling emission reduction credits gives up some or all of the environmental benefits from a project. Deciding when to sell credits requires deciding the relative importance of environmental and financial goals. We consider four policy options with alternative strategic goals: environmental protection is paramount; financial results are paramount; environmental and financial goals are balanced; the City will reject emissions trading.

1. If the environmental goal is paramount, the City will be prepared to spend relatively large amounts on emission reduction projects per tonne of emissions reduced, will create and register credits when possible, and will rarely sell those credits. Credits would only be sold when the proceeds from the sale will fully fund further environmental projects that will achieve even greater emission reductions.

2. If the financial goal is paramount, the City will be prepared to spend relatively small amounts on emission reduction projects per tonne of emissions reduced, will create and register credits when possible, and will usually sell those credits, so long as they are surplus to legal requirements and a narrow interpretation of the City's voluntary commitment.

3. If a balanced approach is taken to these goals, the City will be prepared to spend intermediate amounts on emission reduction projects per tonne of emissions reduced, will create and register credits when possible, will retire at least half of all credits created and will retire the other half except when the reductions are surplus to legal requirements and the voluntary CO2 commitment (broadly defined), and the proceeds will be earmarked for environmental projects and the buyer (if it is a local or regional pollutant) is downwind. This will present some, but limited selling opportunities.

4. Do not participate in trading. We recommend against this policy because whatever the City's goals, one of the other three policies will always give an equal or better combination of environmental and financial performance.

We also consider the analysis of projects whose main purpose is not environmental but which have the effect of reducing pollution emissions. The same logic used to develop the three main policies yields a variation on those policies for these projects. If there is no extra cost of the pollution reduction, then the analysis used is the same as for environmental projects. If there is an extra cost to achieve the emission reduction, policies 1 and 3 do not allow the sale of any credits (except in rare circumstances in policy 3). However policy 2 would allow the sale of the credits if the funds are needed to justify the project. Once again, credits would be sold only in limited circumstances, and only when the financial goal is paramount.

We recommend that the City develop an explicit policy for emission reduction credit creation and trading. The policy should include a statement of the relative importance of the City's environmental and financial objectives with respect to ERCs, as set out in policy options 1 and 3 above. To the extent that the chosen policy allows the sale of ERCs, it should provide for the allocation of revenues from that sale, as well as banking, purchase, sale, retirement, record keeping, budgeting, and approvals mechanisms. Responsibility for ensuring that the policy is implemented should be given to a high level committee that would vet all proposed ERC sales.

Ownership of ERCs arising from projects involving partners has been a difficult issue in the past. Any project that may create ERCs and that involves partners should include an agreement on the ownership of the ERCS as part of the contract or project agreement. The City should attempt to secure ownership of the ERCs, and can use its cost per tonne target to decide how much it is prepared to pay the partner for them. If the City cannot secure ownership at a reasonable price, it should try to ascertain how the partner that secures the ERCs will dispose of them. If they will be used in a way that is inconsistent with the City policy, the City should consider not participating in the project.

Since sulphur dioxide (SOx) and nitrogen oxides (NOx) are regional pollutants, trading in them should be regional. The Ontario emissions trading program (which began operation in 2002) allows the purchase in Ontario of credits created in 12 US states. From the City's point of view the important issue is distance and direction, not jurisdiction. Sales of credits would depend on the location of the buyer only under policy 3, (financial goal) and then the sale would occur only if the buyer were far away or downwind. The effects of greenhouse gases are worldwide, so whether the City is buying or selling it should look for the best price, regardless of location, except to the extent that other pollutants are emitted.

We recommend that in general the revenues from the sale of ERCs be placed into a reserve fund. The division of the City that created the ERCs should be given priority in applying for funds from this reserve fund. This provides a financial incentive for divisions to engage in projects that give rise to valuable ERCs, but it provides oversight for the use of the funds, to ensure that they are applied to high priority projects. In the rare case where the revenues from ERC sales can fully fund a project that will create even more emission reduction than the original project, the funds should be earmarked for the project creating greater emission reductions.

Many ERCs may be created by projects that would be undertaken under business as usual, without the incentive of emissions trading revenues. These may be called "anyway" reductions and credits. Selling "anyway" credits will increase air pollution, reducing the quality of the environment, compared to what would have happened in the absence of trading. If the City does not want emissions trading to make the environment worse than it would have been under business as usual, it should not sell credits if the project would have been done anyway, without the emissions trading program. However the City may have difficulty determining whether its own divisions would have undertaken a project anyway. This issue requires caution, not rigid rules.

The City may find that the cost of meeting its voluntary commitment can be reduced by purchasing CO2 ERCs to fulfill part of the commitment. Here, too, the City must decide whether to purchase ERCs from projects that would have been undertaken under business as usual without regard to the revenue from selling the ERCs.

We discuss the application of the principles discussed above to cases involving the creation or possible creation, and disposition, of emissions reduction credits by the City of Toronto. While we comment on the economics of the projects, our purpose in this analysis is to explore the emissions trading opportunities for these projects, not to pass judgement on whether the project should have been undertaken or not.

- The purchase of low-sulphur diesel fuel for City vehicles would likely be rejected under all policies because of the high cost per tonne of SO2 reduced. However, if the project went ahead for other reasons, the sale of credits would be allowed under some circumstances within all three policies. See Table 3.

- The purchase of biodiesel fuel for City vehicles would likely be rejected under all policies because of the high cost per tonne of CO2 reduction. As well, the biodiesel project reduces CO2 by 20%, which just meets with the City's CO2 reduction commitment. The City would have to meet that target City-wide under policies 1 (environmental) and 3 (balanced) before any sale would be allowed. Under policy 2 (financial), CO2 credits could only be sold to the extent that the reduction exceeds 20% reduction within this project. See Table 4.

- The Better Buildings Partnership project is a public-private partnership that promotes building renewal and energy-efficiency retrofits of industrial, commercial, institutional and multi-residential buildings. This project would qualify under policy 1 (environment) based on the cost of creating ERCs. The credits may not be sold except under policy 2 (financial) and a narrow interpretation of the City's CO2 commitment. See Table 5.

- The Waterfront Integrated Energy concept is part of a massive waterfront revitalization project. The integrated energy component of the project would consist of deep lake water cooling, anaerobic digestion, district and distributed energy systems, natural gas co-generation, high energy efficiency buildings, and some green energy systems (i.e. wind power, solar). This project is still in the conceptual stage, so there are few details. If the integrated energy component pays for itself, then any credits are anyway credits and would not be sold under policies 1 and 3. However under policy 2 (financial) the credits could all be sold.

- The Toronto Atmospheric Fund/Green$aver Home Rewards program offers cash rewards to homeowners for improvements that increase their home's energy efficiency. Participating homeowners sign a Carbon Credit Transfer Agreement that allows TAF to claim ownership of any greenhouse gas ERCs. Policies 1 and 3 would preclude selling ERCs from this program. Under policy 2 (finance), the City would register the credits and only sell those credits that were surplus to the city's limit or target, which would in turn depend on the interpretation of the CO2 commitment. However, the advertising of the program implies that the City would retire all the credits.

- The Keele Valley Landfill Methane Project involved using methane collected from the landfill to generate electricity. If the capture of these gases was required by the Ministry of the Environment, then the methane reduction is not surplus to legal requirements and could not create credits under most trading systems. The reduction of CO2, SO2 and NOx emissions arising from landfill electricity replacing coal-fired electricity is an environmental benefit of the project, but since it seems profitable it may have been done aside from consideration of ERC revenue, so it appears to be an "anyway" reduction, and any credits should not be sold. Moreover the City will need the credits to meet its voluntary CO2 commitment, prohibiting their sale under all but the narrowest interpretation of that commitment under our financial policy. See Table 6.

These cases illustrate the value of adopting a consistent set of policies for evaluating projects that reduce air pollution, of analysing projects in the light of those policies, and of adopting policies for emissions trading that are consistent with the City's air pollution control policies. They also illustrate the complexity of trying to understand the environmental effects of undertaking some projects and of trying to decide whether or not to create, register and sell resulting emission reduction credits.

1. Background and Purpose

In June, 2001, the City of Toronto issued a request for proposals for an emissions trading study. The stated purpose of the proposed study was:

> "To enable/facilitate the development of a corporate emissions trading policy that incorporates economic, environmental and financial considerations. This project will also inform ongoing efforts to influence and respond to the provincial trading program that is currently under development by the Ministry of the Environment."

Prior to this project City staff and others discussed how the City should deal with emerging opportunities for emissions trading. There was also a major report by the International Council for Local Environmental Initiatives prepared for the City and for the Toronto Atmospheric Fund, entitled "Design of a Carbon Emissions Pilot Trade for Toronto." (ICLEI, 1998.) On October 2, 2001, the Commissioner of works and Emergency Services sent to the Works Committee a status report on emissions trading that discussed actions taken and potential emission reduction projects.

This project is divided into two phases. Phase I examined the effects of emissions trading in general. It examined the environmental and financial effects of emissions trading, reviewed existing emissions trading systems that are relevant to the City, and explored a set of cases involving emission reduction projects that give rise to emissions trading opportunities. Finally, Phase I identified issues to be considered in Phase II. A draft report was discussed by City staff at a workshop prior to producing the final report on May 27, 2002. Appendix A1 contains the executive summary of the Phase I report.

Phase II of the project looks at strategic options that the City might choose for directing its emissions trading activities. Since city sources are not capped, the City's trading opportunities involve only creating or perhaps purchasing emission reduction credits (ERCs). Four options are identified, defined and evaluated. In addition, a set of separate strategic issues raised by emissions trading opportunities are listed and examined, identifying both problems and possible solutions. The general principles thus developed are then tested in the examination of six specific cases, representing examples of emissions trading opportunities for the City of Toronto. The environmental and financial implications of pursuing the selected projects will be explored using principles developed in Phase I. Both the development of the strategic options and the examination of the cases are conducted in the context of the City's existing commitment to reduce CO2 emissions to 20% below 1990 emissions by the year 2005. A draft report will be presented for discussion to the City at a workshop prior to final revision. The final report will be presented at a workshop to which a broad audience will be invited.

This report is written for City staff considering emissions trading as part of an overall air quality strategy well as City Councillors, staff of the City's agencies, boards and commissions and others in the City who share this interest. We have used environmental economics analysis as needed, but have tried to avoid economic jargon to the extent that the subject matter allows.

2. Strategic Options for Emissions Trading by the City of Toronto and its ABCs

To date, the City and its agencies, boards and commissions (ABCs) have made decisions about pollution reduction projects and trading of emission reduction credits that may be created by those projects on an ad hoc basis. The problem with continuing on this piecemeal basis is that the decisions may be inconsistent with each other and may ultimately be wasteful. For example, a City department could decide to expend funds on a project to reduce emissions, but if a partner in the project registers some emission reduction credits from the project and sells them, the environmental benefits of the project may be lost. To avoid such situations, it is necessary for the City to decide on the relative importance of its goals and to adopt a strategic policy that will pursue those goals efficiently.

Because environmental protection projects are usually costly, emissions trading often presents conflicts between environmental and financial goals. Selling emission reduction credits that arise from such projects generates revenue that offsets their costs. However selling emission reduction credits gives up some or all of the environmental benefits from a project. To sell the credits arising from an environmental project advances the financial goal; to do a project without selling any credits advances the environmental goal. To sell some, but not all of the credits may advance both goals.

We consider four alternative strategic policy options reflecting different goals: environmental protection is paramount; financial results are paramount; environmental and financial goals are balanced; the City will reject emissions trading. We define what each of these policies implies about choosing what air pollution reduction projects to undertake, and about creating, selling and even buying emission reduction credits. We set out the rules to implement the policy, and discuss the implications of the policy. In doing so, we touch in some cases on other policy issues that are discussed more fully in Section 3 below.

The City will face decisions about projects in two contexts. First, there will be projects whose primary purpose is to reduce air pollution. These projects will be evaluated primarily with respect to their performance in pollution reduction and the effect of emissions trading on that reduction. These projects are discussed in sections 2.2, 2.3 and 2.4 below. Second, there will be projects whose primary purpose is something other than reducing air pollution, but that will reduce pollution as a side effect. These projects are discussed in section 2.5 below. In addition to the text discussion of these policies, we present a set of flow charts, for those that prefer a graphical approach, in Figures 1A, 1B, and 2.

The discussion that follows focuses on projects that have only one effect: to reduce a single pollutant. But many projects will reduce several pollutants at once. In such cases, the costs of the project may be apportioned among the several pollutants in proportion to their importance. The analysis below can then be thought of as the analysis of the portion of the costs of the project that are attributable to the pollutant in question. The analysis may be applied to any pollutant but the examples used below generally involve CO2 reductions.

2.1 The City of Toronto Voluntary 20% CO2 Commitment

The City of Toronto has made a commitment to a 20% reduction in CO2 emissions below 1990 emissions, discussed in section 7 of the Phase I report. We have been unable to find a clear unambiguous statement of the meaning of that commitment, leaving the possibility of different interpretations. Ultimately the meaning of that commitment will have to be decided by Council. We suggest here three interpretations that might coincide with the goals of the alternative policies discussed below although those policies could be chosen independently of the definitions.

> If the environmental goal is paramount the City will presumably interpret its CO2 commitment broadly. For example: the City has committed to reducing total CO2 emissions from all sources within the City limits, whether owned by the City and its ABCs or not, to 20% less than that total for 1990. Emissions should fall steadily toward the goal in the years leading up to 2005. If this is the City's commitment, it must undertake sufficient projects, or purchase sufficient ERCs, to achieve that goal.
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> If the finance goal is paramount, the City will presumably interpret its CO2 goal narrowly. For example: the 20% reduction applies only to sources under the direct control of the City and its ABCs; until the overall 20% reduction below 1990 is achieved for these sources, only ERCs for emission reductions beyond 20% for any project could be sold. Thus any source that reduced its emissions by more than 20% could sell any excess ERCs beyond 20% even though the City goal was not reached. Since some City sources will make no reductions, some will increase, and those that make reductions will sell all but 20%, this policy would fail to achieve the 20% reduction for all City sources unless the City also purchases emission reductions from other sources.
>
> If the environmental and the financial goals are both considered, the interpretation will be balanced. For example: the 20% reduction applies only to sources under the direct control of the City and its ABCs. No CO2 credits may be sold until total emissions by these sources have been reduced to 20% less than that total for 1990. Emissions should reach this goal in the year 2005 and should be held at that level thereafter. The City must undertake sufficient projects and purchase sufficient ERCs to achieve that goal.

Whatever the definition of the commitment, the City should not sell CO2 ERCs until the commitment has been met. The Phase I report concluded that selling ERCs from a project eliminates the environmental benefit from that project when the buyer uses the credits to increase its emissions. If an environmental commitment has been made, it would be inconsistent with that commitment to sell ERCs from any project until the commitment has been met.

It is possible that emission reduction projects will not be sufficient for the City to achieve its 20% CO2 emission reduction goal, especially if the policy makes financial goals paramount. The only other way to reach the goal would be to purchase CO2 emission reduction credits from other sources. Any ERCs that the City purchases should be retired without using them, to ensure that their purchase reduces emissions. If the City concludes that it will have difficulty in meeting the CO2 commitment on time, it should seriously consider purchasing CO2 reductions elsewhere, by purchasing CO2 credits, as a legitimate means of meeting its commitment. Any such purchase should involve a test to ensure that the project creating the credits is not "anyway", as discussed in section 3.6 below.

2.2 Option 1: Environmental Goal is Paramount

If environmental protection is paramount then the reduction of air pollution is assumed to be more important than generating revenue. However this cannot mean that the City is prepared to spend unlimited amounts of money on any available pollution reduction, no matter how small, because the City could not afford such a policy. A more reasonable interpretation would be that the City is prepared to pay a substantial price for air pollution reduction. While the City has not declared how much it is prepared to spend, it will get the most environmental improvement for a given expenditure if it chooses, for each pollutant, a target cost per tonne and undertakes all projects, but only those projects, costing less than this amount. (See Field and Olewiler, 2002, ch. 9.) Making the environmental goal paramount would mean choosing a high target cost per tonne which we will refer to as V_1* for pollutant *. In the case of greenhouse gas emissions, for example, the City might decide that it was prepared to spend $20 per tonne of CO2 reduced. $20 is far above the current price of emission reduction credits, so it could be regarded as setting a high priority on the environmental goal; making it paramount. When a project reduces more than one pollutant, the cost could be allocated among all the pollutants for purposes of this evaluation. Projects with a forecast cost higher than the target V_1* (e.g. $20) would not generally be undertaken. Figure 1A in Appendix A shows the project decision process depending on this cost per tonne.

How would the City choose the target V_1*? It should be the amount that a jurisdiction would spend, per tonne reduced, if it is very concerned about the environment. Presumably this would be above the average cost of pollution reductions to comply with regulations, assuming that the regulations impose a moderate control cost. Since emissions trading reveals the cost of pollution reduction, V_1 would be above the average price of emission allowances or credits.

The details of the policies that would support this strategy are summarised in words below and in a flow chart in Figures 1A and 1B.

1. For each air pollutant (CO2, SOx, NOx, others) determine a target cost per tonne V_1* reflecting the City's willingness to pay to reduce emissions of that pollutant. Undertake all projects costing less than V_1*, excluding possible ERC revenues.

2. Create and register emission reduction credits arising from a project whenever they are recognised by a trading system. See Figure 1A. Registering the credits will verify the emission reduction that has been achieved and ensure that no other party can register and sell them.

3. Retire all credits without using them. See Figure 1B, Policy #1. Selling them would allow the buyer to increase its emissions, thereby negating the environmental goal. If this means that the City will not sell regional pollutants (like SOx and NOx) to downwind purchasers, it implies that the City's environmental goal applies not just to air quality in Toronto, but to air quality elsewhere as well.

4. An exception would allow the sale of half of the ERCs from projects that are not needed to meet any mandated or voluntary target if the resulting revenue could be earmarked for additional projects that would be fully financed by those revenues and that would cause greater emissions reductions than the quantity of ERCs sold. Figure 1B, Policy #1. (See the discussion of earmarking below in section 3.5.) We suggest selling only half of the credits because the emission reduction of the additional project will not occur for some time and one can never be sure that it will be as great as expected; retiring half of the credits guarantees half of the project's environmental benefits right away.

Applying this policy to the selection of pollution control projects would help the City to achieve its CO2 commitment at least cost and to exceed that commitment or to achieve other air pollution goals at least cost to the City. Refusing to sell ERCs unless their sale finances even greater reductions ensures that the environmental benefits of any pollution control project are preserved. Purchasing ERCs from others when they cost less than City projects maximises the likelihood that all low-cost projects for reducing the relevant pollutants are pursued. Note that this policy does not exclude emissions trading, but it limits that trading primarily to the purchase of credits from others.

2.3 Option 2: Financial Goal is Paramount

If the financial goal is paramount, then generating revenue is assumed to be more important than reducing air pollution. However this cannot mean that the City would spend nothing on pollution control projects unless they generated enough revenue or cost savings to more than cover their costs; this would be inconsistent with the City's environmental policies over many years,. Under a slightly less strict interpretation the City would engage in projects the cost of which was less than some low cost per tonne which we will refer to as V_2* for pollutant *. In the case of CO2, the target cost might be $2 per tonne, which is in the range of recent prices for CO2 credits in North America's emerging CO2 markets.. In addition, the City would undertake such projects as are necessary to meet a narrow interpretation of the City's 20% CO2 commitment.

In considering the financial effects of the project, the City would still not consider any revenues that would be generated from selling emission reduction credits created by the project. Since the purpose of the project is pollution reduction, selling credits defeats the purpose of the project. However if the project creates credits that exceed any regulation or voluntary commitment, the City would be allowed to sell those excess credits, as shown in Figure 1B, Policy #2. In the case of greenhouse gas emissions, for example, selling emission reduction credits beyond 20% for this project would allow the buyer of the credits to discharge that much pollution so this policy would achieve environmental benefits only to the extent of the 20% reduction. When a project reduces more than one pollutant, the cost could be allocated among all the pollutants for purposes of this evaluation. Projects with a forecast cost higher than the target V_2*(e.g. $2) would not be undertaken.

V_2* should be the amount that a jurisdiction would spend, per tonne reduced, if it is not very concerned about the environment. Presumably this would be below the average cost of meeting pollution regulations, assuming that the regulations impose a moderate control cost. Since emissions trading reveals the current cost of pollution reduction, V_2 would be well below the average price of emission credits.

The details of the policy that would support this strategy are summarised in words below and in a flow chart in Figures 1A and 1B.

1. For each air pollutant (CO2, SOx, NOx, others) determine a target cost per tonne V_2*reflecting the City's willingness to pay to reduce emissions of that pollutant. Undertake only projects costing less than V_2*, excluding possible ERC revenues. See Figure 1A.

2. Create and register emission reduction credits arising from a project whenever they are recognised by a trading system. See Figure 1A.

3. Sell the credits from a project to maximise the revenue from their sale. This could mean selling them as soon as they are created or holding them in anticipation of future increases in the price of credits. Selling them will allow the buyer to increase its emissions, thereby negating the environmental gains of the project, but earning revenue for the City. In the case of the voluntary CO2 commitment, only sell credits representing a reduction below 20% of 1990 emissions from the source being reduced. See Figure 1B, Policy #2.

4. When projects that may create ERCs involve partners (or suppliers), negotiate ownership of the ERCs for the City only if the value of the ERCs exceeds any increase in the cost of the contract with the partner.

Applying this policy to the selection of pollution control projects would help the City to maximise its net revenues associated with pollution control. It would also probably mean that the City would make little progress in reducing pollution except as required by law or its 20% CO2 commitment. Following these rules the City is unlikely to reach even the narrow interpretation of its CO2 target without purchasing credits from other sources.

2.4 Option 3: Environmental and Financial Goals Both Important.

If the environmental goal and financial goal are both important, then there is a moderate target for how much the City will spend to achieve those air pollution reductions. This expenditure target must be less than under policy #1 where the environmental goal was paramount, but more than under policy #2.

In our examples above, the target V_1* was $20 per tonne of CO2 when the environmental goal was paramount and V_2* was $2 per tonne when the financial goal was paramount. If both goals are important, the limit, which we call V_3* might be, for example, $10 per tonne for CO2. When a project reduces more than one pollutant, the cost could be allocated among all the pollutants for purposes of this evaluation. Projects with a forecast cost higher than the target V_3 (e.g. $10) would not be undertaken. Possible revenue from ERC sales would again not be considered in deciding whether to undertake a project, since the ERCs will usually not be sold.

V_3* should be the amount that a jurisdiction would spend, per tonne reduced, if it is moderately concerned about the environment. This might be the average cost of pollution reductions under current regulations. Since emissions trading may reveal the cost of the most expensive pollution reductions needed to meet these regulations, V_3* would be about the average price of emission credits, assuming that current regulations impose a moderate control cost.

The details of the policy that would support this strategy are summarised in words below and in a flow chart in Figures 1A and 1B in Appendix A.

1. Create and register emission reduction credits arising from a project whenever possible. See Figure 1A. When projects that create ERCs involve partners or suppliers negotiate ownership of the ERCs for the City unless the added cost of ownership exceeds the target cost per tonne.

2. Retire (without using them) half of all ERCs when created. See Figure 1B, Policy #3.

3. Sell the remaining half of ERCs created if and only if the following conditions are met, otherwise retire without using them:

    - the project is not needed to meet a voluntary commitment or legal obligation; and

    - the revenues from the sale of the ERCs will be earmarked for environmental projects; and

    - in the case of regional ERCs, sell only to downwind buyers to preserve environmental benefits for Toronto. See Figure 1B, Policy #3.

The ban on selling credits if the project is needed to meet a voluntary commitment simply insists that the credits be genuinely surplus. The earmarking requirement ensures that while half of the pollution reduction benefits of this project are lost because of the sale of half the ERCs, some environmental benefit will be created by the follow-up project; the 50% was picked arbitrarily as an example. The limitation on sales to downstream buyers ensures that air quality in Toronto is not degraded by the sale. If all trades are directly between two polluters, and there are no resales, this tracking should be easy. As the market matures and trading takes place on exchanges, it may be more difficult to determine the true source of credits, and if there is a chain of transactions the true location of the emission increase may be impossible to trace. This requirement may therefore only be enforceable in the early days of the market.

Applying this policy to the selection of pollution control projects would help the City to achieve its CO2 commitment at least cost and perhaps to exceed that commitment or to achieve other air pollution goals at least cost to the City. By choosing a moderate target cost per tonne, the City ensures a moderate level of pollution control and a moderate cost, respecting both the environmental and financial goals. This policy allows for some limited emissions trading.

2.5 Option 4: Do Not Participate in Emissions Trading.

Some may argue that the City should not be involved in emissions trading at all and should simply reject this mechanism. This would mean not registering ERCs when City projects create them, and not buying or selling ERCs at any time. Such a policy is most likely to be suggested by those who are concerned about the environment and who believe that emissions trading will be detrimental to the achievement of environmental goals. These are people for whom the environmental goal is paramount. However we believe that if the environmental goal is paramount, policy option #1 is superior to completely rejecting emissions trading.

If the City rejects emissions trading, it runs the risk that partners or suppliers will register and sell ERCs created by City projects in which they are involved. Yet the sale of these ERCs will undo the environmental advantages of the project, as discussed under policy option #2 above. If the City wants to protect the environment, then it is a mistake to reject emissions trading. It is essential to register and claim ownership of all ERCs created by projects with which the City is involved, so that the City can retire them and prevent others from using them to increase their emissions.

We can think of no goals or circumstances under which this policy would be superior to the preceding policies. While "do nothing" seems like a simple solution, it actually creates the risk that others will undo the environmental benefits of City projects. Rejecting emissions trading completely does not meet standards of due diligence with regard to environmental protection by the City. It opens the City to risks of environmentally harmful trading activities by others. Regardless of one's position on emissions trading in general, the existence of emissions trading possibilities means that the City must be involved in emissions trading, at least to the extent of creating and registering credits when they arise from City projects, and negotiating ownership of credits when projects are undertaken with partners or suppliers.

2.6 Projects Whose Main Purpose is Not Environmental

The discussion above has considered projects whose main purpose is assumed to be the improvement of air quality. The City also will face some projects, however, that have some other main purpose with a side effect of reducing air pollution, such as energy conservation projects. In such cases, we suggest the following supplemental decision rules. These are illustrated in Figures 2A and 2B. The rules differ from those for environmental projects only if there are no added costs for the emission reductions, so the decision trees branch into Figure 1A otherwise.

If some added expenditure on the project is necessary in order to reduce air pollution, that added expenditure is considered as a separate project and the City can apply the decision rules that arise from whichever of the above policies has been chosen, shown in Figure 1A.

If the project will reduce air pollution without added expenditure, in most cases the value of any ERCs that might be created and sold under the above policies will be small relative to the overall cost of the project, so consideration of these revenues will not alter the decision to do the project. In this case, it is an "anyway" project. The City will do it, if at all, without regard to ERC revenue. The project decision will then be made on the City's usual criteria. The credits should not be sold, because they are "anyway" under policies #1 and #3. See Figure 2A. However if the City chooses policy #2 in which finance is paramount and if the revenue from ERC sales is needed to justify the project, then the project is not an anyway project, so the expected ERC revenue may be used to justify the project and the actual revenue should be so used. See Figure 2B.

3. Strategic Trading Issues

This section describes and analyses a set of additional strategic issues related to emissions trading.

3.1 Management of ERCs Within Many Toronto Divisions and ABCs

3.1.1 Management Issues

The City of Toronto is a large and complex organisation. It has annual revenues of approximately $6.5 billion, employs 45,000 people and delivers more than 40 major services through six departments (Works and Emergency Services, Finance, Urban Development Services, Community and Neighbourhood Services, Corporate Services and Economic Development Culture and Tourism). Each department consists of several divisions, many of which have the potential to create ERCs largely through projects which have direct and indirect impacts on energy use. The most obvious ones are solid waste management services, transportation services, water and wastewater services, fleet management, urban planning, building, economic development, parks and recreation and shelter housing and support.

Given the likelihood that ERCs can and will be created by divisions across the corporation, (and the City's agencies, boards and commissions) the question of how the ERCs are to be managed arises. This question is especially important at this time since ERCs are new to many members of Council, most members of staff and citizens, and are generally not yet widely understood. The systems that allow their creation are either recently established and evolving (e.g. MOERT) or still under development (e.g. arising out of the Kyoto Protocol.) The rules for creating, banking, trading and retiring ERCs are still evolving. This situation lends itself to confusion, misunderstanding and even contradictory behaviour especially in an organisation the size and complexity of the City of Toronto. Consequently the management of ERC's by the City is important not just for the efficient execution of the City's responsibilities, but also so that the citizens of Toronto have confidence that the system is beneficial, not problematic or controversial.

In approaching the City's management of its ERCs, several questions arise.

1. What is the balance between the City's environmental and financial objectives?

Many details of the City's ERC management system will flow from the desired balance between the City's environmental and financial objectives, discussed in section 2 above.

2. What aspects of ERCs require management?

Each system that provides for ERCs (e.g. MOERT and CACI) has its own rules for the creation, registering, banking, purchase, sale and use of ERCs. It follows that the City requires a management system that addresses each of these aspects for each system. In addition the City's management system should include provisions for the disposition of funds arising from the sale of ERCs. (This issue is taken up in section 3.5 below on Earmarking of ERC Revenues.)

3. ERCs are assets of the City of Toronto. Should their ownership and disposition and the use of any revenues be governed by the same principles that apply to other assets or are there reasons for introducing different principles?

ERCs are not like other assets in that their sale has environmental effects on everyone in the City. The sale of ERCs allows the buyer to increase its emissions, increasing air pollution. So long as the City chooses a policy that accords some weight to environmental quality, the City has an interest in controlling the sale of ERCs, employing principles that are unique to ERCs. This argues for some central control over their sale. Even if ERCs were not different from other assets, divisions would still not be completely free to dispose of them at their discretion. City departments do not generally have the right to buy or sell City property unless it has been approved by the Chief Administrative Officer or his delegate and is consistent with Council policy. There appears to be no reason why ERCs should be freed from this requirement.

4. Some ERCs will be created by City projects, programs and possibly by-laws, that would not otherwise have been undertaken in the absence of such a system. Others have been and will be created by activities that would have been undertaken anyway. Some will create credits that are surplus, while others will create credits that are not. Should this make a difference to how the ERCs are managed?

The policies discussed in section 2 above suggest that decisions may require information as to whether the project was done only because of the opportunity to create and sell ERCs or whether it would have been done without this opportunity; whether the reductions are surplus to legal requirements and the City's commitments or not; whether the reductions are real. This suggests that the City's management system for ERCs will have to keep track of this information for all of the ERCs that it creates and perhaps for any that it purchases.

5. Is there a trade-off between the requirement for centralized management of ERCs by the City to ensure that a consistent policy is implemented and the incentive at the divisional level or below to create ERCs?

Market driven behaviour is generally more flexible and responsive when decisions are decentralised. When decision-making authority is concentrated and/or local decisions are subject to various levels of review and approval, decision-making tends to be slow and cautious. With regard to the City's ERCs, a more decentralized approach may yield more activity at the departmental level and below, but it may also lead to decisions and actions that, especially at the outset, may not be in the best interests of the City or its citizens. This suggests a management approach with some form of central oversight and approval for the creation and disposition of ERCs.

3.1.2 A Suggested Approach to Management

Based on the above, the following approach to the management of ERCs by the City is suggested:

- An ERC Policy should be developed by the City that covers all aspects of ERCs. The Policy objectives should include a statement of the relative importance of the City's environmental and financial objectives with respect to ERCs, as set out in section 2 above. To the extent that the chosen policy allows the sale of ERCs, it should provide for the allocation of revenues from that sale. As well as objectives, the Policy should cover creation, banking, purchase, sale, retirement, record keeping, budgeting and disposition of funds, and approvals mechanisms.

- Responsibility for ensuring that the Policy is implemented should be given to a high level committee. A key function of this committee would be to vet all proposed sales of ERCs in a timely manner.

- Given the uncertainty about the revenues that ERC sales will generate, especially in the formative stage of the market in ERCs, it would not be wise to include these revenues as a source of finance for proposed projects or to support operating budgets. It would be preferable for these revenues to be placed in a reserve fund for future use. (See section 3.5 on Earmarking of ERC Revenues.) However ERCs will usually be created by projects that generally emanate from divisions. If divisions are to have an incentive to create ERCs they will have to share in the proceeds from any sales. To preserve the incentive to create ERCs, divisions that generate ERC revenues for the reserve fund should have some priority in securing funds from that reserve for investment in further environmental projects.

3.2 Shared ownership, non-ownership of partnered ERCs.

The City of Toronto may be involved with other partners or participants in projects that reduce pollution discharge and could therefore generate emission reduction credits. In such cases the ownership of any ERCs will usually be an important issue. As markets develop for ERCs, they become valuable assets. Any time multiple parties create valuable assets, any of the parties may want to claim ownership of those assets. The City may wish to sell the ERCs to generate revenue, or it may want to retire the ERCs without using them to ensure that the environmental benefits of the project are preserved. Partners may either want to sell the ERCs for revenue purposes or to use

them to meet their own ERC needs, thereby increasing total emissions. If the City has chosen a policy that accords some weight to the environment, it will want to prevent the use of ERCs by those partners, if possible at a reasonable price.

The discussion of policies in section 2 above noted different dispositions that the City might make of its ERCs when a project creates them. However the City can only dispose of ERCs if it owns them. Therefore any project that may create ERCs and that involves partners should include an agreement on the ownership of the ERCS. The ownership issue can be settled in the contract that structures the project. Since the ERCs are valuable, presumably the City will have to pay a higher price if it owns the ERCs than if the partner owns them. If in the absence of contract language the City owns the credits by default, no premium should arise from clarifying that in the contract. As we note in the policy discussion, the City can use its cost per tonne target to decide how much it is prepared to pay the partner for the ERCs.

For example if the City purchases low-sulphur fuel, its contract of purchase can specify that the City will own any ERCs or that the supplier will own the ERCs. Thus far, the City's low-sulphur fuel project has not secured ERC ownership for the City, raising the possibility that the partner may be creating and using or selling them, thus eliminating the environmental benefit that the City created with the project in the first place.

As another example, the Better Buildings Partnership Project has involved the City and several other entities. While ownership of ERCs arising from past projects may be in doubt, any future projects should be subject to some agreement among the parties regarding the ERCs and their ownership. The case studies discussed in section 4 below identify participants and thus the need to sort out ownership issues.

Should the City always insist on retaining ERC ownership? In section 2 we suggested that this would not be a wise policy. When negotiating ownership the City should be prepared to pay up to its target price for the ERCs, and to let them go if the partners refuse the City's price. But the City should also try to ascertain how the partner that secures the ERCs will dispose of them, and if they will be used in a way that the City does not approve, the City should consider not participating in the project or indicating to the partner that they will contest ownership, which will make it difficult for the partner to sell them.

3.3 International implications of ERC trading.

The international implications of ERC trading were discussed in the Phase I report, section 5.3 and section 8. We treat smog precursors such as NOx and VOC differently from greenhouse gases since the former are local pollutants while the latter are global.

Photochemical smog in general and ozone in particular are the result of regional emissions of nitrogen oxides and hydrocarbons (volatile organic compounds or VOCs) which react chemically in warm air in the presence of sunlight over a period of hours. Photochemical smog occurs in Toronto predominantly in the summer months. Studies have shown that on average roughly half of the photochemical smog precursors in Southern Ontario are blown in from the Midwest and northeast US while the other half originate in Ontario. The smog in Toronto is only partly caused by Toronto emissions, while the smog in Buffalo or Detroit or Peterborough or London is also partly caused by Toronto emissions.

While MOERT allows capped sources to purchase ERCs from sources in 12 US states, Toronto is not a capped source, so it has no need to purchase NOx ERCs. We are not aware of any US emissions trading program that would allow Toronto to sell NOX reductions to US buyers. Since Ontario electricity generators are likely to be net buyers of NOx credits, Toronto could probably sell NOx credits domestically. It would only be advantageous to sell them in the US if the price was higher there or if the buyer was in a location such that it appeared unlikely that the resulting emissions would degrade Toronto's air quality. But if trading programs are designed to match the trading to the airshed, such opportunities would be limited. We do not see much relevance of international NOx trading for the City in the near future.

Since greenhouse gases (GHG) have a global effect, trading systems are typically not limited geographically. The Kyoto protocol specifically provides for Annex I parties to trade emissions reduction units with each other, to trade their assigned amount with each other, and to invest in emission reduction projects in non-Annex I countries (CDM). Several of the options discussed in the May, 2002 Federal discussion paper (Canada, 2002) assume that the federal government or private parties will purchase GHG credits in the international market. Thus it would be perfectly reasonable for the City to purchase international credits or permits to meet its 2005 CO2 commitment.

How could this be done? There are brokers in the business of matching buyers and sellers of GHG credits. Ontario Hydro, and its successor Ontario Power Generation also have a commitment to limiting CO2 emissions, and have purchased a number of CO2 ERCs over the years, providing some experience in how this is done. Their purchases were originally made using PERT, in which the City was a participant since 1998, to certify and approve the credits and may now be made through CleanAir or some other certifying organization. Since the City's CO2 commitment is voluntary, there are no rules as to what body must approve and register any credits that the City purchases – this is a matter for decision by the City itself.

3.4 Local Air Quality Implications of ERC Trading.

When does emissions trading affect local air quality, and what strategy could the City adopt to deal with such effects? As noted above, the effects of greenhouse gases are global, so there are no local air quality effects of buying or selling GHG credits. However greenhouse gas emissions are often associated with the emissions of other pollutants, so that changes in the emissions of the GHG cause proportional changes in the emissions of other pollutants. For example, a reduction in coal burning reduces CO2 emissions and emissions of the other pollutants associated with coal, including SOx, NOx, particulate matter and toxic materials. The effect of the other pollutants diminishes with distance from the source.

The implications of these facts can be explored using variations on a simple example. Suppose that source A in the City proposes to undertake an energy conservation project that will reduce CO2 emissions by 100 tonnes and NOx emissions by 50 tonnes. A proposes to sell the resulting ERCs to a capped source B, C, or D which will then increase its emissions in the same amount. Source B is located in Toronto close to source A. Source C is located 100 kilometres away but still within the Toronto airshed. Source D is located 1000 kilometres away, virtually out of the Toronto airshed. If B, C, or D did not purchase the ERCs, they would have high costs to keep their emissions at the current level, while A's cost of emission reduction is much less. The project and trade therefore reduce total pollution control costs and keep total emissions of the traded pollutant for the trading partners constant. But what is the effect of this project and trade on air quality in Toronto? The answer depends on whether the pollutant is a greenhouse gas or a regional pollutant, and on what associated pollutants are emitted by source A and by the buyer. We consider two types of buyer: a coal-fired electricity generator, emitting CO2, SOx, NOx, PM and air toxics or a gas-fired electricity generator emitting CO2 and NOx.

CO2 is a global pollutant so location is irrelevant and A's reduction is just offset by any buyer's increase; Toronto air pollution is unchanged. NOx is a regional pollutant, so A's reduction is just offset by the buyer's increase if the buyer is in Toronto (B). If the buyer is further away (C or D), the project and ERC sale reduce air pollution in Toronto and increase it near the buyer's location. There are no other emissions if the buyer burns gas, but if the buyer burns coal there will be increases in the concentration of other local pollutants that were not emitted by A in the first place (such as particulates and sulphur dioxide). The changes in Toronto air quality are shown in Table 1.

Table 1
Toronto Air Pollution Effect of Emission Reduction Project with ERC Sale

		ERC Purchaser		
Pollutants	Fuel burned by purchaser	**B** (In Toronto)	**C** (100 km)	**D** (1000 km)
Toronto CO2		Unchanged	Unchanged	Unchanged
Toronto ozone (from NOx)		Unchanged	Down some	Down fully
Toronto other air pollutants	Coal Natural gas	Up Up little	Up some Up very little	Unchanged Unchanged

The project reduces natural gas burning, reducing emissions of CO2 and NOx.

This analysis reveals two principles:

- Doing an air pollution control project in Toronto and selling ERCs from that project improves air quality in Toronto if the pollutant is not a global pollutant like CO2 and if the buyer of the ERCs is sufficiently far from Toronto that only a fraction of its pollution reaches the City.

- Air quality in the City may actually become worse if the buyer is located nearby and if the buyer will be able to increase its discharge of other pollutants as a result of its purchase of ERCs. For example if a coal-fired generator purchases CO2 credits and may therefore burn more coal, it will increase the discharge of SOx, NOx, PM, and air toxics.

With respect to emissions trading strategies, the implications of this analysis depend on the City's goals, discussed below. If the environmental goal is paramount, and if the City's main concern is air quality in Toronto, then the City should only sell ERCs for local or regional pollutants to distant buyers so that the sale of the ERCs does not reduce the benefits for Toronto of the pollution reduction project. If the environment is paramount but Toronto cares as much about air quality elsewhere as in Toronto, it should not sell credits to distant buyers if it would not sell them to local buyers. If the financial goal is paramount, the City should sell ERCs to the highest bidder, regardless of location.

3.5 Earmarking ERC Revenue for Further Emission Reduction Projects.

Despite the tradition in public finance that the revenue and expenditure decisions of government should be kept separate, there is an obvious attraction to using the revenues from the sale of ERCs to pay for further environmental projects and programs. There are two main reasons for earmarking ERC revenues in this way:

- To compensate for the increase in emissions by the purchaser of the credits by using the funds to protect the environment through other means.

- To allay any suspicion by the public that the City is compromising its commitment to environmental protection for financial gain by selling 'licenses to pollute'.

However, there are dangers in earmarking revenues especially if the revenues become substantial. First of all, the revenues may not be used in the highest and best way if the earmarking is too restrictive (e.g. if the earmarked funds are all retained by the division that generated them regardless of the availability of additional valid, cost-effective projects sufficient to absorb the revenues.) This argues for placing the revenues in an environmental reserve fund to which all divisions and departments can apply, recognising that this may dilute somewhat the incentive for the creation of ERCs.

Second, earmarking prevents the City from using the funds to pay for other much needed services even if it is widely agreed that they should take precedence over environmental objectives. This is unlikely to be a serious problem in the short term because the revenue from the sale of ERCs will probably not be substantial. However, faced with a tight budget and the prospect of much larger revenues if and when the sale of greenhouse gas ERCs takes off, this is a problem that the City should anticipate. One solution is to earmark only a portion of the revenues or to adopt at the outset a sliding scale such that the first $x million is all earmarked for environmental purposes, with a declining percentage from revenues in excess of $x million. Another option is to send all ERC revenues from the sale of all anyway credits to general revenue and only earmark revenues that come from the sale of ERCs that represent genuine reductions in emissions.

Third, earmarking can create confusion as to the overall environmental and financial effects of a project or a set of projects. It is sometimes said that earmarking allows the City to achieve even greater benefits from its environmental expenditures, yet that is true only under certain assumptions.

We can explore this third issue with a simple example. Suppose that the City has a menu of CO2 reduction projects that can reduce CO2, for a cost of $4 per tonne. Suppose further that the budget only includes $100 so only one project can be completed. If the City does the project and creates and registers the ERCs but does not sell them, it has spent $100 and removed 25 tonnes of CO2 from the atmosphere. Suppose further that the market price of CO2 ERCs is $5 per tonne. If the City sells the ERCs, it will earn $125 in revenue from the first project. By selling the ERCs to a buyer who will use them, the City has completely eliminated any environmental benefit from the project. If the ERC revenue is reinvested, however, a second project can be done costing $125 and reducing 31.25 tonnes. By selling the ERCs and reinvesting the proceeds, the City can continue to reduce the net cost per tonne of CO2 removed. However there will be no net environmental benefit unless the ERCs arising from the last project are retired rather than sold. The top section of Table 2 shows the result of doing four such projects and selling the ERCs from the first three. The overall reduction from four projects is 48.8 tonnes, the overall cost is $100, so the cost/tonne is just over $2/tonne. In this case, where the price of ERCs exceeds the cost per tonne of the projects, reinvestment of the proceeds of ERC sales can reduce the cost per tonne of the ultimate reduction in emissions, assuming that the final ERCs are retired, not sold. If the final set of ERCs is sold, the scheme has no environmental benefits, but generates profits for the City.

Table 2 Reinvestment of Proceeds of ERC Sales					
Project	**Cost ($)**	**Emission Reduction (t)**	**ERC Revenue ($)**	**Net Cost ($)**	**Net Reduction (t)**
ERC Revenue Exceeds Project Cost (Cost = 4, ERC Price = 5)					
1	100	25	125	-25	0
2	125	31.25	156.25	-31.25	0
3	156.25	39.06	195.31	-39.06	0
4	195.31	48.8	No sale	195.31	48.8
Total	577		477	100	48.8
Project Cost Exceeds ERC Revenue (Cost = 4, ERC Price = 3)					
1	100	25	75	25	0
2	75	18.75	56.25	18.75	0
3	56.25	14.06	42.19	14.06	0
4	42.19	10.55	No sale	42.19	10.55
Total	400		173.44	100	10.55

Another example, however, produces a different result. Suppose that the City has the same menu of CO2 reduction projects available at $4 per tonne of CO2 reduced, but the market price of CO2 ERCs is only $3 per tonne. Now the revenue from the sale of ERCs from the first project is only $75. If the ERCs from the first project are sold and the proceeds reinvested, a project only ¾ as large can be completed, removing 18.75 tonnes of CO2. Sale of these ERCs will yield only $56.25. Continuing to sell the ERCs and reinvesting the proceeds in more similar projects will ultimately dissipate all of the funds and leave no environmental benefit. If four projects are completed and the ERCs from the last project are not sold, the net cost is $100 and the net reduction is 10.55 tonnes, for a cost of almost $10 per tonne. See the bottom half of Table 2. In this case, where the price of ERCs is less than the cost per tonne of a project, reinvestment of the proceeds is a losing strategy, giving up environmental results without financial gain. The City would be better off not to do the projects at all, or to do the first project and retire the ERCs, but there is no gain, either financial or environmental, from selling the ERCs and reinvesting the proceeds.

The implication of these examples is clear. If the City has a limited budget for emission reduction projects and if it has a set of projects that can create ERCs that are worth more than the cost of the projects, it can pursue either environmental or financial goals, or both, by performing one or more projects, selling the ERCs, and reinvesting the proceeds in additional projects. Whether the overall effect is environmental benefit or financial benefit depends on the proportion of the ERCs from the final project that are retired without being sold. The implication of this conclusion is that in these circumstances the original budget is smaller than would be appropriate to achieve the City's objectives.

Finally, as far as possible, the disposition of funds from the sale of ERCs should be consistent with the City's overall revenue allocation policy guidelines, a draft of which was submitted to the Policy and Finance Committee in April 2002.[1] Among the recommended principles in this draft policy most relevant to ERCs are:

- Revenue streams that are either temporary in nature or volatile should be applied against the capital program or to reserve/reserve funds.

- There should not be cross subsidization between programs. Revenues should be first applied to the expenditures that generated them.

We recommend that in general the revenues from the sale of ERCs be placed into a reserve fund. The division of the City that created the ERCs should be given priority in applying for funds from this reserve fund. This provides a financial incentive for divisions to engage in projects that give rise to valuable ERCs, but it provides oversight for the use of the funds, to ensure that they are applied to high priority projects. In the rare case where the revenues from ERC sales are so great that they can fully fund a project that will create even more emission reduction than the original project, the funds should be earmarked for the project creating greater emission reductions.

In the case where two or more programs co-operate to generate revenue for the City, the funds should go into a corporate revenue account (non-program). Where the expenditures are material, the programs should receive an interdepartmental revenue transfer equal to the level of expenditure require to generate the revenues.

3.6 Trading Reductions that Would Take Place Without the Program.

Suppose that an air pollution source intends for purely financial reasons to convert its boiler from burning coal to natural gas. If an emissions trading program is in place, can the owner sell allowances or ERCs representing the emission reduction arising from that conversion? If so, then the buyer can increase its emissions to offset the seller's reduction, and the environmental benefit of that conversion is lost. This is an emission reduction that would take place "anyway" regardless of the emission trading program, so allowing the source to sell allowances or ERCs

[1] "Revenue Allocation Policy Guidelines," April 24, 2002; staff report submitted by the Chief Financial Officer and Treasurer to the Policy and Finance Committee.

representing the reduction makes the environment worse than it would have been in the business as usual case without trading. However it would be difficult and costly to independently verify whether a reduction would have happened in the absence of the emissions trading program, so this is rarely attempted. Most emissions trading programs do not test whether the reduction would occur "anyway". Usually if a source makes a reduction, it can sell it.

'Anyway' credits, arising from anyway projects, is really an issue of the baseline against which emissions trading is to be measured. Do we compare emissions under an emissions trading program with historic emissions, do we try to forecast what emissions would have been in the future under a business-as-usual assumption without emissions trading, or do we just compare emissions with this project and without this project? Any of these is legitimate, but they yield different environmental and financial results. If the City decides always to sell credits, whether they would have been created without the trading program or not, then it will increase air pollution, reducing the quality of the environment, compared to what would have happened in the absence of trading, any time it sells "anyway" ERCs. If the City is intent on not making the environment worse than it would have been in the absence of emissions trading, it should not sell credits unless their creation depended on the emissions trading program.

One other type of "anyway" credits may also be important. Some projects completed before the emissions trading program was in operation could not have been motivated by the program since they could not be certain to qualify. They are part of a "business as usual" scenario without emissions trading. To allow the creator to sell credits from past projects will certainly increase emissions above what would have arisen under business as usual without trading. Other projects, however, may have been done in anticipation of the program, often called "early reduction" projects. MOERT specifically allows credits created after January 1, 2000, a full two years before MOERT came into operation. MOERT also allows credits created between July 1, 1998 and January 1, 2000, so long as the credits were submitted to PERT by January 1, 2001, apparently because the Ministry encouraged sources to engage in early reductions at that time.

Second, there are projects that are needed to meet a voluntary commitment. If we assume that the entity that made the commitment intends to fulfill it, then until it is fulfilled all projects that contribute to that goal are "anyway" projects. Credits created by the project should not be sold because to do so would allow other sources to increase their emissions, thereby negating the environmental benefits of the commitment. If the purpose of the commitment is to improve the environment, then the entity should not be allowed to sell credits from any project needed to meet the commitment. MOERT disallows credits that are not surplus to regulatory requirements or enforceable agreements, but seems to allow credits that are needed to meet voluntary commitments.

If the City were to adopt a policy that was more permissive than policies #1 and #3 in section 2 above, and if it intends to improve the environment, it should consider adding a limitation that credits will not be sold unless the reduction was not an "anyway" reduction. Note that the balanced policy, #3, provides that the City should only purchase ERCs when it is confident that the reduction that gave rise to the ERCs would not have been undertaken in the absence of the ERC program.

In policy #1, in which the environment is paramount, the City would never sell ERCs (unless they can reinvest the funds in a project that will yield even greater emission reductions), but it could purchase ERCs if they are not "anyway". In policy #2, in which finance is paramount, the City would readily sell ERCs, whether "anyway" or not.

Clearly the "anyway" issue is important. To protect the environment, the City may wish to impose limits on its ERC purchases and sales that are more strict than those imposed by existing trading programs. As well, it will be difficult for the City to determine whether credits that it may purchase would have been created in the absence of the opportunity for selling ERCs, unless it enters into a contract with a partner to create the ERCs and it is clear that the project depends on the ERC revenue. Indeed, the City may have difficulty determining whether its own divisions would have undertaken a project anyway. Thus implementation this portion of our recommendations will not be without difficulty.

4. Illustration of Strategic Implications in Six Case Studies

The principles discussed above can be applied to actual cases involving the creation or possible creation of emissions reduction credits by the City of Toronto and the disposition of those credits. We discussed the selection of case studies with City staff, based on a list of possible cases for which data seemed to be available. The criteria suggested for choosing cases included: illustrating general principles; data availability; credits might be eligible for trading under MOERT or CleanAir; projects representing a variety of City divisions, agencies, boards and commissions. In the end, the following six cases were selected by City staff:

Low sulphur fuel purchase
Biodiesel fuel purchase
Better Buildings Partnership
Waterfront Integrated Energy Concept
TAF/Green$aver Home Rewards Residential Program
Keele Valley Landfill Methane Control

We discuss the emission reductions (real or speculative), available financial data, potential markets, ownership issues, and other considerations. We also discuss whether the credits would be anyway credits if they arose at the present time and whether they are surplus to the City's voluntary 20% CO2 reduction commitment. For a discussion of anyway credits see section 3.6 above. For the purposes of these case studies, projects that the city was legally required to complete or was under a voluntary commitment to complete will not produce surplus credits. While we have gathered the best available data for the case studies, our purpose here is to show how the policies discussed in section 2 can suggest strategies for dealing with emissions trading in various situations. We do not intend to judge whether individual projects should or should not have been undertaken.

4.1 Target Environmental Values for Case Studies

Evaluation of the cases requires the use of target values for the control of each of the pollutants. As discussed in section 2 above, these are the values that the City uses to decide whether a project is worth doing or not. We suggested that the target values would be relatively high if the environmental goal is paramount, relatively low if the financial goal is paramount, and similar to regulatory costs if both goals are considered. At the present time the City has not declared, nor carefully considered, what those values should be. For purposes of our analysis, we have chosen reasonable target values to use as examples, looking to emissions trading markets to see the price at which those emissions have been traded, and looking at the literature to see the cost of controlling those pollutants. We emphasise, however, that these values are examples only and the actual values must be chosen by the City based on its priorities and its belief about the benefits of reducing these pollutants.

For sulphur dioxide, the Chicago Board of Trade has recorded SO2 trades from 1994 through 1999. These trades reflect the marginal cost of controlling SO2 during this period when the US Title IV SOx trading program was in its infancy and the supply of allowances was substantial. Converting those prices from US to Canadian dollars, and converting from US tons (short tons) to metric tonnes yields a low price of $117/tonne, an average price of $239/tonne, and a high price of $360/tonne. Analysts expect that prices will rise from these levels during the next few years as the excess supply of allowances is used up by the more stringent standards that came into force in the year 2000. Studies of the cost of controlling SO2 from various industrial processes yield costs ranging from hundreds to thousands of dollars per tonne. Studies of the harm caused by SO2 range up to US $4,000 per short ton. (Leonardo, 2001b.) We will assume values of CDN $200/tonne if finance is paramount, $1,000/tonne if environment is paramount, and $500/tonne for the balanced goal.

For nitrogen oxides, it is reported that Ontario Power Generation has paid $743 per tonne for NO credits. In California, NOx trades at US $2,000 to $4,000 per short ton during the smog season. Studies have revealed a wide range of control costs. It is more difficult to estimate harm per tonne because it depends on local conditions for converting NOx into ozone. We will assume values of $300/tonne if finance is paramount, $1,500/tonne if environment is paramount, and $750/tonne for the balanced goal.

For CO2, control costs can vary from very low values in projects that save energy and operating costs to very high values if expensive cleaner fuels must be used. Actual trades in CO2 have been at prices ranging up to $10 per tonne (Leonardo, 2001a), but these trades have been in support of voluntary commitments, like the City of Toronto commitment or early trades in pursuit of Kyoto goals. Future prices will depend on the fate of Kyoto and whether Canada ratifies the protocol and undertakes vigorous compliance activities. A recent federal government study pointed to $10/tonne as a reasonable price for CO2 if Canada ratifies and the US does not. (Canada, 2002.) Benefits of CO2 control are very difficult to quantify when general agreement that CO2 causes global warming is a relatively recent phenomenon. We will assume values of $2 per tonne if finance is paramount, $20 per tonne if environment is paramount, and $10 per tonne for the balanced goal.

We stress that the values we use here are examples only, chosen to illustrate the method of using target values in environmental decisions. The City of Toronto will have to decide what are its goals and what price it is willing to pay to pursue those goals.

4.2 Low-Sulphur Fuel Purchase

Project Description

In 1998, in response to a Federal proposal to reduce sulphur levels in fuel, the Toronto Public Health Board requested that the City examine the possibility of purchasing lower sulphur

gasoline, on-road diesel and off-road diesel for the City's corporate usage.[2]

The City releases its tender for potential bidders mid-year. City staff from the Health Promotion & Environmental Protection Office, Purchasing and Environmental Services have consistently offered two recommendations to the Administrative Committee:

a) A purchase recommendation based on price alone.
b) A purchase recommendation based on price and sulphur content.

In each of the last three purchasing years, council has chosen the lower sulphur fuel option.

"Low-sulphur" represents approximately 210 ppm for gasoline, 390 ppm for diesel, and 390 ppm for coloured diesel. This is in comparison to 480 ppm, 390 ppm and 2380 ppm respectively for the lowest cost options of the same fuel without regard to sulphur.

Emissions

POLLUTANT: Sulphur Dioxide (SO2)

Year	Regular Fuel (kg/yr)	Low Sulphur Fuel (kg/yr)	Net Change (kg/yr)	Possible ERCs (tonnes/yr)
2001	21,900	10,600	-11,300	-11.3
2002	17,100	7,600	-9,500	-9.5

Note: 1 tonne = 1000 kg

Finance

Fuel Cost

Year	Without Project $	With Project $	Net Cost $
2001	$ 8,670,477	$ 8,744,432	$ 73,955
2002	$ 7,495,516	$ 7,575,397	$ 79,881

Note: These data are based on tender contracts.

Cost / Tonne Reduction: SO2

= [$73954.94+$79881.38] / [11.3+9.5]
= $ 7,396 / tonne

Anyway, Surplus Credits?

The lower sulphur fuel purchase involves an increased cost to City. If the City was deciding whether to do the project today, credits obtained from the emissions reductions would not be considered anyway credits. There is no legal or voluntary commitment to SO2 reduction from vehicles, so these reductions are surplus to any requirements.

[2] Some information about this project was provided in a meeting with Sarah Gingrich, Research Consultant, Public Health, City of Toronto on June 18th, 2002.

Ownership

Since the start of the initiative, the City has tried to acquire the rights to any credits from the fuel companies, however they have not been successful. It is not clear whether the supplier has claimed ERCs and used them or not.

Potential Markets

The "low-sulphur" fuel purchase program creates SO2 credits. These could be bought and sold under the current Provincial emissions trading program MOERT.

Other Considerations

- On January 1st, 2005 proposed Federal government legislation is scheduled to mandate low-sulphur levels in gasoline of less than 30 ppm. At that point this "low-sulphur" initiative, in regards to gasoline purchase, would be superseded by the legislation.

- The "low-sulphur" fuel purchase was a health-initiated project. The cost/tonne analysis also does not reflect any health benefits that may have been achieved through the initiative (although if the fuel company claimed and used the credits these benefits will have been reversed).

- The sale of SO2 credits by the city or supplier could eliminate the environmental or health benefit sought from the project. Furthermore, cancellation of the project without implementation of a substitute SO2 reduction project would also have detrimental consequences on Toronto air quality and health unless the supplier has been selling the credits, in which case cancellation would have no effect.

- One of the aims of the initiative was to help create a market for "low-sulphur" and to show the City as a corporate leader in environmental sustainability issues. These intangible aspects are not reflected in the cost/tonne analysis.

Summary Assessment of Low Sulphur Fuel Project

Applying each of the three policy options and the example target values of pollution control to this project yields the following assessment of the project and of the feasibility and desirability of creating and selling emission reduction credits.

Table 3

Summary Assessment: Low-Sulphur Fuel
(SO2)

POLICY OPTION →		ENVIRONMENT	BALANCED	FINANCE
Example Target Values ($/tonne)		V1* = $1000	V3* = $500	V2* = $200
Trading System		MOERT	MOERT	MOERT
ERC status		Surplus	Surplus	Surplus
Sale Allowed		Yes, 50% (unlikely)	Yes, 50%	Yes, all
Use of Revenues		Projects with greater reductions (unlikely)	Environmental projects	Unrestricted
Impact on SO2 levels in Toronto depending on where credits are used	Toronto	100% reduction, or more – unlikely	100% reduction	Unchanged
	100 km	100% reduction, or still more	100% reduction	Some reduction
	1000 km	100% to 150% reduction	100% reduction	Up to 100% reduction

Project cost = $ 7,396/tonne SO2
Key: □ = Accepted Project
■ = Disqualifying Criteria
□ = Rejected Project

Analysis

Based on currently available data the "Low-Sulphur" fuel project would likely be rejected because of the high cost per tonne of SO2 reduction. However, if the project went ahead for other reasons, or if the City's value of reducing SO2 emissions were higher than assumed in our target values, the project might then be eligible under one or more of the decision criteria. The sale of any SO2 credits would have varying air quality impacts depending on whether the proceeds can be invested in a project that yields even greater reductions, where SO2 is subsequently emitted and the buyer's proximity to the Toronto airshed.

In light of the high cost of SO2 emission reductions from purchasing low-sulphur fuel the City may also want to consider the purchase of SO2 ERCs in the Toronto airshed as an alternate means to reduce SO2. This could stimulate other SO2 reduction projects in the Toronto airshed that would reduce a similar or greater amount of SO2 emissions at a lower cost per tonne.

4.3 Biodiesel Fuel Purchase

Project Description

The fleet development division within Corporate Services has been exploring various initiatives including low-emissions vehicles, fleet rightsizing, fleet rerouting and alternative fuel purchases. Among the most promising alternative fuels is biodiesel, a renewable plant or animal based fuel that can run in diesel vehicles without requiring modification to the engines.[3]

Currently the City has one test truck running on 100% soybean-based biodiesel. The test fleet is to be expanded to ten trucks in 2003.

There are two main types of biodiesel: B100, a 100% biodiesel that cannot be used in cold temperatures and would only be useful in the summer months; and B20, a 20% biodiesel, 80% "low-sulphur" diesel mix. We report two analyses; one based on B20 year round , and one based on B20 for 9 months and B100 for 3 months. We assume that all diesel fuel purchased by the City is replaced by B20 or B100.

Emissions

POLLUTANTS: Carbon Monoxide (CO), Volatile Organic Compounds (VOC), Particulate Matter (PM10), Nitrogen Oxides (NOx), Sulphur Dioxide (SO2), and Carbon Dioxide (CO2)

[3] Fuel data supplied by Effie Ginzberg, Manager Amalgamation & Fleet Development, Corporate Services at the City of Toronto. June 19, 2002.

Annual Emissions: Diesel; B20 12 months; B20 9 mo./B100 3 mo.			
Regular Diesel	**CO**	**VOC**	**PM10**
Diesel Emissions (tonnes)	110.31	19.86	9.60
Biodiesel B20			
% reduction from diesel	- 12.6%	- 11.0%	- 18.0%
Biodiesel Emissions (tonnes)	96.4	17.67	7.87
Biodiesel B100			
% reduction from diesel	- 43.2%	- 56.3%	- 55.4%
Biodiesel Emissions (tonnes)	62.7	8.68	4.28
B20 Net Change (tonnes)	**- 22.1**	**- 2.18**	**- 1.73**
B20 & B100 Net Change (tonnes)	**- 28.5**	**- 4.4**	**- 2.6**
Regular Diesel	**NOx**	**SO2**	**CO2**
Diesel Emissions (tonnes)	66.19	2.78	17508
Biodiesel B20			
% reduction from diesel	2%	-20.0%	- 20.0%
Biodiesel Emissions (tonnes)	67.51	2.23	14006
Biodiesel B100			
% reduction from diesel	5.8%	-100%	-100%
Biodiesel Emissions (tonnes)	70.0	0	0
B20 Net Change (tonnes)	**1.32**	**-0.55**	**-3501.56**
B20 & B100 Net Change (tonnes)	**2.0**	**- 1.1**	**- 7003**

Notes:

- Biodiesel particle matter reduction assumed to be PM10
- Biodiesel reduction for hydrocarbons applied to VOCs
- Biodiesel contains no sulphur; therefore 20% reduction reflects the 20% biodiesel in the 20/80 mix.
- Combustion of biodiesel releases CO2, however, since the biodiesel is made from plants that just recently captured CO2, the releases are balanced by CO2 uptake from plant growth. (US DOE, 2002a)

Finance

Financial Analysis: Biodiesel			
	Without Biodiesel		
	Litres	Cost / Litre	Cost
Clear "Low-Sulphur" Diesel	5,963,400	$0.53	$ 3,178,530
Coloured "Low-Sulphur" Diesel	50,476	$0.41	$ 20,540
Total "Low-Sulphur" Diesel	6,013,877	$0.53	$ 3,199,069
	With B20		
	Litres	Cost / Litre	Cost
Biodiesel (80:20 mix)	6,013,877	$0.67	$4,023,238
Total Biodiesel	6,013,877	$0.67	$4,023,283
Biodiesel Added Cost (BAC)			**$ 824,214**
	With B20 9 months, B100 3 months		
	Litres	Cost / Litre	Cost
Biodiesel (80:20 mix) 9 months	4,473,853	$ 0.669	$ 3,127,223
Biodiesel (100%) 3 months	1,540,027	$ 0.859	$1,322,883
Total Biodiesel			$ 4,450,106
Biodiesel Added Cost (BAC)			**$ 1,251,037**

Notes:

- Data based on 2001 actuals.
- The best alternative in clear diesel purchase is the "low-sulphur" purchase. With respect to coloured diesel versus "low-sulphur" coloured diesel, the cost difference is $0.53/litre in comparison to $0.67/litre. However, the US diesel emissions factors are probably similar to medium sulphur content or 'low-sulphur" fuel in Canada. Therefore, the US coefficients are valid for comparison with Canadian "low-sulphur" coloured diesel.
- At the time of this writing Federal taxes on biodiesel were expected to decrease and this could alter the fuel cost to the city.

Value of ERCs

We have calculated the value of emission reduction credits that could be earned by using biodiesel fuel in the volumes discussed above. Whether we use recent market prices or our target values, the value of CO2 credits is at least ten times as great as the value of credits for NOx or SOx. If we value CO2 at $10 per tonne, the value of credits from using B20 year round is about $35,000, while the value of B20/B100 is about $70,000. These credit values in turn are a small fraction of the cost of the program.

Cost/Tonne CO2

- Although there is a small impact on NOx and SO2 emissions most of the impact is on CO2 emissions. Therefore, the decision tree analysis will be done in regards to the CO2 ERCs.

Biodiesel B20
= [$ 824,214] / [3500 tonnes]
= $235/tonne[4]

Biodiesel B20 9 months, B100 3 months
= [$ 1,251,037] / [7003 tonnes]
= $ 179/tonne

Anyway, Surplus Credits?

By far the greatest tradable reduction created would be CO2 ERCs. If the program was considered today, the credits would not be considered "anyway" credits since the program is uneconomic without considering credit value (or even if the credit value is added). However any credits created would fall under the City's 20% CO2 reduction commitment and would therefore be considered not surplus to that commitment until it is met.

Ownership

Ownership will be a difficult issue. There are three possible claims to the ownership of any ERCs. The US company supplying the diesel has put in a lot of research money into the creation of a viable B20 mix and would have a claim. Big K fuels, the only Ontario provider may also have a claim. Finally the City or any other large corporate purchaser may have a claim in the ERCs. Securing any possible ERCs will be an important task and also essential if the environmental benefits of the purchase are to be maintained.

Potential Markets

a) SO2 credits can currently be bought and sold under MOERT.
b) NOx levels increase with biodiesel, therefore there would be no sale of credits. However, NOx credits could be purchased under MOERT to compensate for the increase.
c) CO2 credits could be sold to OPG or other firms with a voluntary commitment or perhaps to countries that have ratified the Kyoto protocol.
d) CH4 (methane) has been traded under GERT and may be included in future trading systems.
e) CO credits, in very limited numbers, had been registered but not traded through PERT.
f) VOC credits, in very limited numbers, had been registered through PERT. VOC credits on the market in the Illinois Emissions Reduction Market System, had an average price of US $76/ton in the year 2000. (Illinois EPA, 2001).

[4] Information provided by Effie Ginzberg, Manager Amalgamation & Fleet Development, Corporate Services, City of Toronto, suggests that the additional costs of B20 is $774,000/year (including tax savings) which corresponds to a cost of $221/tonne of CO2.

g) PM10 credits, in very limited numbers, have been registered with the Michigan Air Emissions Trading System.

Other Considerations

- Biodiesel proponents list a number of other benefits including more employment in the agricultural sector; a product that can be manufactured in Canada; a renewable resource that is biodegradable and less harmful to humans. These possible benefits have not been factored into the cost/tonne analysis.

- An offsetting consideration is fuel efficiency. The lower energy content of 100% biodiesel results in engine performance that is 8% to 15% less than regular diesel (US DOE, 2002a). The extra biodiesel needed to compensate for lower energy efficiency may counteract the reduced emissions. However, with B20 engine performance is said to be virtually the same (US DOE, 2002b).

- The following analysis only considers CO2 reductions . Some reduced emissions, such as PM10, are currently not tradable in an available Toronto market. However, reduction in PM10 has marked air quality significance not accounted for the in the cost/tonne analysis.

Summary Assessment of Biodiesel Fuel Project

Applying each of the three policy options and the example target values of pollution control to this project yields the following assessment of the project and of the feasibility and desirability of creating and selling emission reduction credits.

Table 4

Summary Assessment: Biodiesel Fuel
(CO2)

Policy Option →	ENVIRONMENT	BALANCED	FINANCE
Example Target Value $/tonne	V1* = $20	V3* = $10	V2* = $2
Trading System	OPG	OPG	OPG
Anyway Credit?	No	No	No
ERC Status	Not surplus	Not surplus	80% surplus
Sale Allowed	No, until surplus	No, until surplus	Yes, 80%.
Use of Revenues	Projects with greater emission reduction	Environmental projects	Any
Impact on CO2 levels (location irrelevant)	Slight reduction	Slight reduction	Slight reduction

B20 YEAR ROUND - COST = $ 235 per tonne of CO2 reduced
B20 9 months / B100 3 months - COST = $ 179 per tonne of CO2 reduced
Key: □ = Accepted Project
■ = Disqualifying Criteria
□ = Rejected Project

Analysis

Based on the currently available data, both versions of the biodiesel project would likely be rejected under any of the policies because of the high cost per tonne of CO2 reductions. However, a reduction in price or further tax incentives, improvement in fuel efficiency or further emission reductions, and a broader spectrum of emissions qualifying for trade on the market would affect the desirability of this project. Intangible and other benefits may influence the decision whether or not to proceed with this project.

While the city may be able to register ERCs from this project the CO2 emissions would be needed to meet the City's CO2 reduction commitment. The City would have to meet that target City-wide under the Environmental and Balanced policies before any CO2 ERC sale would be allowed. Under the Financial policy CO2 credits could be sold beyond the 20% reduction within this project, which would qualify 80% of the CO2 ERCs created from the use of B100.

4.4 Better Buildings Partnership

Project Description

The Better Buildings Partnership project is a public-private partnership that "promotes building renewal and energy-efficiency retrofits of industrial, commercial, institutional and multi-residential buildings." (City of Toronto, 2002a.)

The goals of the program are to improve indoor air quality, reduce energy costs and operating costs, promote emissions improvements including greenhouse gas reductions and smog level reductions. The methods are sealing windows and improved insulation; heating, ventilation and A/C retrofits; implementing the use of alternative fuels and energy systems; improving water efficiency including heating and plumbing; and lighting upgrades.

The following analysis is the combined result of 15 completed building retrofits.[5]

Emissions & Finance

Emissions And Finance: Better Buildings Partnership			
Year	Cost	Savings (not discounted)	Change in CO2 Emissions (tonnes)
1	$ 61,659,977		
2-10		$ 7,222,770	- 71,052
Total	$ 61,659,977	$ 65,004,930	- 639,468

Cost / Tonne Reduction: CO2

The table above presents the total cost and total savings over the ten year assumed life of the project without discounting. The net present value of the initial cost and the stream of savings, discounting future costs and savings at 5% per year, is a cost of $9,830,301. Dividing this cost by the reduction in CO2 emissions of 639,468 tonnes yields a cost of $15.37 per tonne of CO2 reduced.

Anyway Credits?

Since the projects were done generally for multiple purposes including reducing energy costs, promoting fuel efficiency, and reducing greenhouse gas emissions, the emissions reductions resulting from the retrofits might be considered "anyway" credits. However applying our

[5] Information received from Richard Morris, Managing Partner, City of Toronto Better Buildings Project. June 24, 2002.

definition from section 3.6 above, they are not "anyway" since the project is uneconomic. In any event, the credits created would fall under the City's 20% CO2 reduction target and would be considered not surplus to that commitment until it is met.

Ownership

Ownership of credits has been a complex issue for the BBP projects. In the past, due to the credit ownership debate between the BBP and a company which supplied an operational grant, PERT would not approve the sale of ERCs from the Better Buildings Partnership.[6]

Potential Markets

a) CO2 was previously traded under PERT (now called Clean Air Canada Inc.). OPG is also currently buying CO2 credits directly.
b) Countries that have ratified Kyoto or have a similar emissions trading program in place.

Other Considerations

- CO2 has a global impact and therefore sale to another organization anywhere in the world will have the same impact.

Summary Assessment of Better Buildings Partnership Project

Applying each of the three policy options and the example target values of pollution control to this project yields the following assessment of the project and of the feasibility and desirability of creating and selling emission reduction credits.

[6] Information from Drew Shintani, August 14, 2002.

Table 5

Summary Assessment: Better Buildings Partnership
(CO2)

Policy Option →	ENVIRONMENT	BALANCED	FINANCE
Example Target Value $/tonne	V1* = $20	V3* = $10	V2* = $2
Trading System	OPG	OPG	OPG
Anyway Credit?	No	No	No
ERC Status	Not surplus	Not surplus	80% surplus
Sale Allowed	No, until surplus.	No, until surplus.	Yes, 80%
Impact on CO2 levels (location irrelevant)	Slight reduction	Slight reduction	Very slight reduction

Note: non-emissions reduction project
PROJECT COST = $ 15.37/tonne CO2 reduced.
Key: □ = Accepted Project
■ = Disqualifying Criteria
□ = Rejected Project

Analysis

Based on currently available data, this project would not qualify under the Balanced or Finance policies, because of cost of reducing CO2 is higher than the assumed CO2 target values. It would qualify under the environmental policy. It would be more attractive if the retrofits were to create even greater CO2 savings, if energy costs were to increase (creating larger savings), or if more years of savings were taken into account. However, the sale of credits also depends upon the City's interpretation of its CO2 commitment. There is likely to be a surplus only under the financial goal, if that involves a narrow interpretation of the commitment (see section 2.1 above). Under the other two goals, any credits would not be surplus and should not be sold. Finally, if this project were considered today, any credits would not be regarded as "anyway" credits, since the project is not economic without the sale of credits.

4.5 Waterfront Integrated Energy Concept

Project Description

The Waterfront Integrated Energy Concept is part of a massive waterfront revitalization project. There are currently 800 hectares of vacant and underutilized land in the area that would be redeveloped into a new urban setting. The project would create "new residences, parks, commercial space, transportation and transit infrastructure, light industry, utilities and the remediation of contaminated lands." (City of Toronto, 2002b, p.2.)

The integrated energy component of the project would consist of deep lake water cooling, anaerobic digestion, district and distributed energy systems, natural gas co-generation, high energy efficiency buildings, and a variety of green energy systems (i.e. wind power, solar).

This project is still in the conceptual stage and the analysis in this report is based on information from a draft report.

Emissions

Key Assumptions (City of Toronto, 2002b, p.15):

1. The population of Toronto will increase, whether or not the waterfront is revitalized.
2. Populations associated with the revitalized waterfront are assumed to substitute for population increases that would otherwise occur in the rest of Toronto.
3. Except for special energy-efficiency features of the City, the environmental impact of a person living or working in the waterfront is assumed to be equal to that of someone living elsewhere in Toronto – called the "Toronto Reference Community" (TRC).
4. All direct and indirect impacts associated with the construction and operation of new waterfront developments will be attributable to the new development, regardless of whether they occur in the waterfront.
5. The difference between environmental impacts of a population in Toronto and an equivalent population living in new waterfront developments represents the net change in environmental impact that is attributable to waterfront revitalization.

Scenarios:

Low, Medium, And High Development Scenarios For The Revitalized Waterfront.

	SCENARIO 1	SCENARIO 2	SCENARIO 3
Housing units	20,000	40,000	60,000
Population (1.7 persons/unit)	34,000	68,000	102,000
New Employment	17,500	35,000	52,500
New Commercial space (m2)	600,000	1,200,000	1,800,000

(City of Toronto, 2002b, p.16)

Note: This emission trading analysis will be based on scenario 2.

Analysis year:

It is assumed that each of the three development scenarios would be fully achieved by 2021. (City of Toronto, 2002b, p.16)

Comparison to Grid or Coal:

It is assumed that to the extent that this project displaces electricity consumed from the grid, that electricity would be generated by a mix of hydro, natural gas, nuclear and coal. (City of Toronto, 2002b, p.23). However, a comparison with the displacement of coal-fired electricity is also included.

Trends in Energy Consumption:

> "In the absence of Toronto-specific data, Natural Resources Canada's comprehensive estimates of historic and forecasted energy use in Ontario have been used. The estimates were adjusted if appropriate scaling factors were available."
> (City of Toronto, 2002b, p.21)

Change in Emissions: Project Compared to TRC (tonnes/year)			
	NOx	SO2	CO2
Assuming Displacement of Grid Electricity	- 13	- 2,890	265,000
Assuming Displacement of Coal-Fired Electricity	- 3,400	- 14,600	- 2,170,000

The table shows that if the displaced electricity represents an average of the grid sources, the project causes a substantial increase in CO2 emissions with small reductions in NOx and SO2. If the displaced electricity would have come entirely from coal-fired plants, the project causes a large reduction in CO2.

Finance

There are as yet no data that could be used for estimating the financial viability of the project. A detailed feasibility study would be required to generate the necessary data.

Estimated Value of ERCs

If we calculate the value of ERCs potentially created by this project from the above emission changes, using recent ERC prices (Leonardo, 2001a) we get the values in the table below. Since our assumed example target values per tonne are significantly greater for SOx and CO2, using those target values would increase these ERC values by more than 50%. These calculations yield two insights: displacing coal electricity is beneficial while displacing the average grid electricity is not; and CO2 seems to dominate the value of displacing coal electricity.

Value of ERCs at Recent Market Prices			
	NOx	**SO2**	**CO2**
Emission Reduction Credits (Tonnes) (displacement of grid electricity)	13	2,890	- 265,000
Recent Credit Price $ / tonne	743	239	6
Total Value of ERCs ($)	9660	691,000	-1,590,000
Total Combined Value ($)			**- 889,000**
Emission Reduction Credits (Tonnes) (displacement of coal-fired electricity)	3,400	14,600	2,170,000
Recent Credit Price $ / tonne	743	239	6
Total Value of ERCs ($)	2,530,000	3,490,000	13,020,000
Total Combined Value ($)			**19,040,000**

Anyway Credits?

In the absence of a financial analysis of the project it is not possible to determine whether the emissions reductions should be deemed real or anyway credits. However, the CO2 ERCs would also fall under the City's 20% reduction commitment and likely be considered not surplus to the voluntary commitment.

Ownership

Ownership of any recognized credits will be at issue, as the project involves funding fom all three levels of government as well as the private sector.

Potential Markets

a) Currently, as there is no energy project on the waterfront, there are no emissions. Therefore, the baseline for comparison is either zero or, as was assumed in this report, emissions for the same population in the rest of Toronto (TRC). Depending on how the Ministry of the Environment interprets the baseline, there may or may not be recognizable credits (if zero is taken as baseline) for this project. (Ontario Emissions Trading Code, section 5.5.3).
b) Depending on the scenario NOx ERCs can be bought or sold through MOERT.
c) SO2 credits may be sold through MOERT.
d) CO2 credits may be bought from countries that have ratified Kyoto or have a similar green house gas emissions trading program in place. Any CO2 credits that can be sold after the city has surpassed its 20% reduction commitment may be sold to CO2 ERC purchasers such as OPG or countries that have ratified Kyoto or have a similar green house gas emissions trading program in place.

Other Considerations

- Between now and the analysis year, 2021, there are countless changes, such as new federal legislation, and innovations in technology, which may greatly affect the emissions and emissions trading analysis of this project.

- The large difference between emissions from grid electricity and from coal-fired electricity will have to be resolved to fully evaluate this project.

Decision Tree Table

A decision tree cannot be completed without more information on the financial cost of the project.

4.6 TAF/Green$aver Home Rewards Residential Program

Project Description

The Toronto Atmospheric Fund/Green$aver Home Rewards program offers cash rewards to homeowners for making improvements that increase their home's energy efficiency. Rewards, funded by the Toronto Atmospheric Fund (TAF) range from $136 to $3,933. The program is operated by Green$aver and the Green Communities Association, not-for-profit organizations dedicated to reducing CO2 emissions in Toronto and to environmental improvement respectively. (Green$aver, 2002)

The Toronto Atmosphere Fund, a City of Toronto agency, and Enbridge Consumers Gas funded this pilot project which started in June 2001. Natural Resources Canada also pays part of the cost of the rating inspection.

When a household requests the program, a member of Green$aver walks through the home to discover where heating and cooling is escaping as well as investigating the condition of the furnace and taps etc. Subsequent analysis yields recommendations for energy efficiency choices and ways to reduce costs as well as calculating projected savings. Once the homeowner completes their retrofits, they are subject to another household audit which analysis the energy efficiency savings.

At the start of the program the homeowner signs a Carbon Credit Transfer Agreement with TAF that allows TAF to claim ownership of any green house gas ERCs.

Ownership and Contractual Language

The contractual language clearly indicates that TAF is the sole proprietor of any greenhouse gas ERCs produced by the Home Rewards Program. Signing the contract at the start of the program prevents ERC ownership disputes later on.

The contract treats ERCs as valuable assets and clearly indicates that the credits are bought by TAF in exchange for homeowner funding as part of the Home Rewards Program. Therefore the contract is an ERC ‘purchase’.

ERC Sale?

The contract does not require the City to retire the credits. However, we believe that ethically the City of Toronto is bound to retire them because of claims made in the advertising of the program.

The Home Rewards Program is billed as both an energy efficiency program and a greenhouse gas reduction program. TAF states that one of its primary goals is "global climate stabilisation through the reduction of greenhouse gas emissions such as CO2". (City of Toronto, 2002c.) Green$aver states it is "a not-for-profit organization dedicated to reducing CO2 emissions in Toronto." (Green$aver, 2002.) These claims together imply that the program should reduce net CO2 emissions. Since use of the credits would cancel out the environmental benefits of the program, participants would expect the City to retire credits to comply with the program advertising.

Furthermore, when this program is analysed using the decision trees, under the Environment policy, sale of the credits would not be allowed. Under the Balanced policy 50% sale would be allowed of surplus credits and only if the revenue were earmarked for other environmental projects. Under the Finance policy only surplus credits would be available to sell.

If the Finance policy were applied to this case, the city would be required to register the credits and it could only sell those credits that were above the city's target. However, any sale of ERCs would be inconsistent with the advertising of the program and with reasonable homeowner expectations.

4.7 Keele Valley Landfill Electricity Generation

Project Description

The Keele Valley landfill has been in use for years and is due to be closed in late 2002. As is common, the organic material deposited in the landfill decomposes over time, releasing CO2 and methane, the principal component in natural gas. The release of these gases can begin soon after the landfill begins receiving waste material and can continue for decades after it has been closed. Emissions usually cease when the organic material has completely decomposed or the decomposition is halted for other reasons. In 1988 the landfill was mandated to collect and flare methane gas. The project analysed here is the construction and operation of a generating plant that began using the methane to generate electricity in 1995.[7] Since the methane was already being burned, electricity generation did not affect greenhouse gas emissions from the landfill directly. However injecting the electricity into the Ontario electrical system presumably reduced the amount of electricity generated by Ontario Hydro, now Ontario Power Generation, reducing coal burning by OPG.

[7] Keele Valley Landfill data supplied by Andrew Heit, Solid Waste Management, WES at the City of Toronto. October 18, 2002.

Emissions

The pollutants discharged from the landfill are methane and CO2, both greenhouse gases. To the extent that the project displaces fossil-fuelled electricity generation, there should be reductions in the emissions of CO2 and of nitrogen oxides, sulphur oxides and perhaps particulate matter as well.

Equivalent CO2 emissions were on the order of 250,000 tonnes per year in 1990. By 1998, they had been reduced to about 50,000 tonnes per year because of methane capture.[8] We assume that these figures include the net effects of: direct emissions from the landfill, emissions from the generating units operating at the landfill, and estimated emission reduction arising from displacing grid electricity with electricity from this project. In projects like this, because methane is 20 times as powerful a greenhouse gas as CO2, the emission reduction arising from electricity displacement is generally 5% or less of the emission reduction arising from not emitting the methane in the first place. We have no estimates of the amount of nitrogen oxides, sulphur oxides or particulate matter discharge that may be reduced by the displacement of fossil electricity. The effects of the project on emissions should continue so long as the landfill continues to emit substantial amounts of methane that are captured by the project.

Finance

Since the City has no operational costs in regards to the electricity generation we will assume that the reduction in CO2 emissions costs the City nothing. The City does receive electricity sale royalties ranging from $1,000,000 and $1,400,000 from the operator of the power plant.

Cost/Tonne = $ 0.00

Anyway Credits?

The reduction in CO2, SOx, and NOx emissions arising from the displacement of coal-fired generation would be regarded as an anyway reduction by our definition, since the electricity generation is costless to the City and would be done without consideration of creating credits. Furthermore, any reductions in CO2 emissions are necessary to meet the City's 20% CO2 reduction commitment, so the reduction should not be treated as surplus except in part under the financial goal. We note, however, the rules of CleanAir would not preclude registering and selling CO2 credits arising from coal displacement, since they do not disallow reductions to meet voluntary commitments.

The federal government has announced recently that methane control projects at landfills will be allowed to create credits that would count toward Canada's Kyoto target even if those projects were required by law.[9] This means that if a federal greenhouse gas emissions trading

[8] *Ibid*.
[9] Personal conversation, Drew Shintani, August 14, 2002.

regime emerges to implement Kyoto it might allow the creation, registration and sale of these credits. While the owner could then sell the credits, this would not alter the fact that they are not surplus to legal requirements, if that is indeed the case, and that their sale would increase Canadian emissions beyond those that would occur under business as usual without the sale.

Ownership

The Keele Valley methane project involved the City of Toronto, private firms and Toronto Hydro. It appears that the project contracts do not settle the ownership of any emission reduction credits created by the project. Since ownership is disputed, it is unlikely that any partner to the project can register the credits, since most registries will demand proof of ownership. Only a settlement of the dispute, resulting in an agreement assigning ownership to one of the partners (presumably in exchange for payment to other partners) will allow credits to be registered. In the future, it would be desirable to settle ownership of the credits as part of the agreement on the project itself.

Potential Markets

CO2 ERCs can be sold to Ontario Power Generation because of its commitment to keep its net CO2 emissions at 1990 levels, 26 million tonnes. Other buyers today would include other organisations that have made similar voluntary commitments. If Canada ratifies the Kyoto protocol there may be many buyers, in Canada and elsewhere, representing sources that need credits to achieve their Kyoto targets. Credits could be registered through CleanAir, or other registries. The SO2 and NOx reductions might quality as credits under Ontario's emissions trading regulation and could then be sold to Ontario Power Generation to meet its emissions cap.

Other Considerations

The estimation of the effect of this electricity generation on the emissions from other generators is not easy. It involves assumptions or calculations of how the electricity market is working and whether Ontario thermal generation will be reduced or exports to the US increased. If exports are increased, will this reduce US air emissions? Serious analysis would be required to resolve these issues.

Summary Assessment of Keele Valley Landfill Project

Applying each of the three policy options and the example target values of pollution control to this project yields the following assessment of the project and of the feasibility and desirability of creating and selling emission reduction credits.

Table 6

Summary Assessment: Keele Valley Landfill

(CO2, SO2, NOx)

Policy Option →	ENVIRONMENT	BALANCED	FINANCE
Example Target Value $/tonne	V1* = $20 (CO2)	V3* = $10 (CO2)	V2* = $2 (CO2)
Trading System	Clean Air/MOERT	Clean Air/MOERT	Clean Air/ MOERT
Anyway Credit?	Yes	Yes	Yes
ERC Status	CO2 Not surplus, SO2, NOx surplus	CO2 Not surplus, SO2, NOx surplus	CO2 80% surplus, SO2, NOx surplus
Sale Allowed	Only surplus.	Only surplus.	Yes, any surplus
Use of Revenues	Projects with greater emission reduction	Environmental projects	Any
Impact on CO2 levels (location irrelevant). SO2, NOx are as in Table 3 above.	Slight reduction	Slight reduction	Increase (if used)

Cost = nil

Key: □ = Accepted Project

■ = Disqualifying Criteria

□ = Rejected Project

Analysis

While the capture and flaring of methane from the landfill has greatly reduced greenhouse gas emissions, the 1995 project, involving burning the methane gas for power production had little effect on greenhouse gas emissions except to the extent of reducing CO2 emissions by displacing coal-fired generation elsewhere. Until ownership of the credits is settled, the City is unlikely to be able to sell them. In addition, the City's CO2 commitment may mean that the CO2 reduction is not "surplus" except under the narrow definition used in the Finance policy. Moreover, the methane control itself is mandated by the Ontario Ministry of the Environment, so the reduction in methane is not surplus to a legal requirement. Despite this, the Federal Government has indicated that it will recognise such reductions in the interest of fostering Kyoto compliance. Finally, even if the ERCs could be registered and sold, the electricity generation costs the City nothing so the reduction is an "anyway" reduction. If the City intends to improve the environment beyond what would have occurred under business as usual, it should not sell these "anyway" credits. (See section 3.6 above.)

4.8 Case Studies Summary

Table 7

Case Studies Summary

	LOW-SULPHUR FUEL	BIODIESEL FUEL	BETTER BUILDINGS	WATER-FRONT	HOME REWARDS	KEELE V. LANDFILL
POLLUTANTS AFFECTED						
Nox				✓		
SO2	✓			✓		
CO2		✓	✓	✓	✓	✓
CURRENT COST/TONNE						
Nox	-	-	-	-	-	-
SO2	$ 7400	-	-	-	-	-
CO2	-	$ 235 / $179	$ 15.37	-	Free	Free
CREDIT MARKET?						
Nox	-	Y	-	Y	-	-
SO2	Y	Y	-	Y	-	-
CO2	-	Y	Y	Y	Y	Y
ANYWAY CREDITS?	N	N	N	Unknown	Y	Y
SURPLUS CREDITS?	Y	Y/Y/ N (CO2)	N	Y/Y/ N (CO2)	N	Y/Y/ N (CO2)
SELL CREDITS UNDER BALANCED CRITERIA?	50%, if revenue earmarked for environ-mental projects	Not until CO2 target reached: Then sell 50% of surplus	Not until CO2 target reached: Then sell 50% of surplus	Not enough data to assess	No. Not consistent with contracts.	Not until CO2 target reached: Maybe not even then.

* = with restrictions

5. Conclusions

Choosing the weight to give to environmental and financial goals has a significant effect on the choice of projects for air quality improvement in the City of Toronto. If the environment is a high priority and finance is a low priority, the City should be prepared to spend more, per tonne of pollution reduced, while if the priorities are reversed, the City should be prepared to spend less per tonne on such projects. More projects will be undertaken if the environmental goal is dominant than if the financial goal is dominant. If the priority attached to both goals is balanced, an intermediate number of projects will be pursued.

Choosing the weight to give to environmental and financial goals will also affect whether the City should sell emission reduction credits that it creates or retire them without selling. If the environmental goal is paramount the City will rarely sell emission reduction credits created by emission reduction projects. If the financial goal is paramount all credits that are surplus to regulatory requirements and voluntary commitments may be sold. A balanced approach will mean that the City may sometimes sell some of the credits that it creates. No matter which policy it adopts, the City will have to decide whether to sell or purchase credits that would have been created in the absence of an emissions trading opportunity, whether the location of a purchaser or seller in relation to the city matters, whether revenues should be earmarked for environmental projects and if so, how.

If it is to make consistent decisions with regard to choosing projects and selling credits, the City will have to develop a policy and instruct staff accordingly. The policy should deal with the issues confronted in the three policies developed in section 2 of this report. Because emission reduction projects are performed by many different divisions of the City, implementing a policy consistently will require careful management. We recommend that the City formally adopt a policy regarding the choice of projects and the rules for emissions trading. To the extent that the chosen policy allows the sale of ERCs, it should provide for the disposition of revenues from that sale, record keeping, approvals mechanisms, and administration.

The policies and decision criteria discussed in sections 2 and 3 of this report provide a framework for analysing the cases explored in section 4. Some of the cases appear to involve high costs per tonne of pollution reduced. The City may benefit from a routine analysis of cost per tonne before embarking on such projects in the future. The cases illustrate the importance of securing title to credits that may be created to avoid having a partner sell those credits and thereby undo the environmental benefits of the project. The cases show that the City will rarely choose to sell credits that it creates, so long as it chooses the Environment or Balanced policy. Only under the Finance policy are sales likely to be common.

The cases show that the City's commitment to a 20% reduction in CO2 emissions by 2005 may seriously limit its ability to sell credits for CO2. The extent of that constraint will depend heavily on how the City interprets its commitment. That interpretation, in turn, should be consistent with the relative weight that the City places on environment and finance in setting its trading policy. The City may not often be a seller of credits, so long as it accords to the environment at least as much importance as it accords to financial goals.

If meeting the 20% CO2 commitment presents a difficult challenge, the City may find that paying others to reduce CO2, by purchasing CO2 credits, is the most economical, and perhaps the only feasible, means of fulfilling that commitment. This is a second example of how emissions trading may be an important means of reducing the costs of controlling air pollution emissions.

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Appendix A

Decision Tree Figures

Appendix B

Executive Summary from Phase I Report

Appendix C

Questions and Answers from September 17 Workshop