Université de Montréal



# DETERMINING THE SOCIAL COST OF THE PROJECT PROPOSED BY THE RÉGIE INTERMUNICIPALE DE GESTION DES DÉCHETS SUR L'ÎLE DE MONTRÉAL

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## SUMMARY

The objective of this paper is to determine the social costs of the project proposed by the Régie Intermunicipale de Gestion des Déchets via social cost analysis. Social Cost analysis is a particular branch of cost-benefit analysis which consists in the transformation of a financial analysis in to a social analysis. The method of transforming financial costs into social costs, as applied in this paper, is based on a permutated version of the theoretical principles governing cost-benefit analyses; that is, those principles which have been adapted to suit social cost analysis.

Perhaps the most striking difference between a cost-benefit analysis and a social cost analysis is the definition of *benefits* accruing from a project. In cost-benefit analysis, social benefits are perceived if they increase the social welfare (via consumer surplus or rents from factors of production) of the society. However, in the case of social cost analysis presented in this paper, the benefits to society resulting from the project are used solely in the reduction of the social costs and as such we cannot discuss the change in social welfare from the point of view of consumer surplus.

Instead, we must focus on the applications of shadow prices to reveal a more accurate assessment of economic impacts on society resulting from the implementation of the project. These applications are demonstrated through the development of both the

social opportunity costs of labour and social opportunity costs of capital. The latter turns out to be the most salient (although briefly described) feature of this paper since it compels the social analysis to assume a greater dimension than previously revealed by the financial analysis. In fact, the primary catalyst for increasing the cost burden of the project on society is the result of the adoption of a specific social opportunity cost of capital discussed in this paper. Although there are bound to be steadfast objections to this rate of social opportunity cost of capital, we have chosen to use it here in order to alleviate the possiblity of underevaluating the economic impact of public borrowing from private lending institutions.

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# INTRODUCTION

The issue concerning effective waste disposal is predominant in many fields of academia. The prevailing issue, in economics, concerns the economic viability of alternative solutions to current methods practised for waste elimination. The central objective of this paper is to determine the economic cost of the waste disposal project proposed by the Régie Intermunicipale de Gestion des Déchets sur L'Île de Montréal. The question that must be borne in mind is: what is the social cost of implementing a new waste management system? To this question, the underlying issue for decision makers becomes: is it in the public interest for this project to be implemented? The methodology which will be applied to determine the general solution of these problems will be through the social cost analysis approach (that is, transforming the financial analysis into a social cost analysis).

This paper is subdivided into four chapters. Apart from the first chapter on the historics of the project, each of the remaining subsequent chapters contains an element essential to the final diagnosis.

The first chapter consists in the examination of the background situation of the project. This section will also describe who the different interveners are, where the data has originated, and how long the project is expected to last. It is designed for the reader to gain as much of a general insight as possible concerning the complexity of the project.

The second chapter reveals the results of the financial analysis. We will attempt to elucidate the differences between the original financial analysis performed by the Groupe SNC-Lavalin and

the one presented in this paper. In addition, detailed explanations of the factors concerned will be given in order to fully assess the revenues and costs related to the project. It should be noted that throughout this chapter references will be made to information contained in the ***Appendices***. This was done primarily to shed more light on the various calculations undertaken in the assessment of this project and to provide the reader with supplementary information.

The following two chapters concern the theoretical and analytical premises of cost-benefit analysis.

The third chapter outlines the basic theoretical context in which most economic cost analyses are performed. Special attention should be devoted to the development of the social opportunity cost of capital, as it will be one of the central components of the social analysis that will require rigorous interpretation.

The final chapter of the paper is dedicated to the transformation of the financial analysis into an economic analysis. The principal problem of the social analysis is the determination of the cost of capital. That is, those social costs borne by the Quebec society resulting from the private borrowing, through indirect use of public funds, for the financing of the project.

The paper concludes by highlighting the results of both the financial analysis and the social analysis. From these observations, it is hoped that Ministère de l'Environnement du Québec may best utilize this information to decide if in fact it is in the interest of society to permit the Régie to commence its plans for a new integrated waste management system.

# Chapter 1:

# HISTORICS OF PROJECT

**THE PROJECT**

The Régie Intermunicipale de Gestion des Déchets sur L'Île de Montréal (hereinafter the Régie or the promoter) is an intermunicipal government body comprised of 26 municipalities (for list of members see appendix 1). Its creation came as a result of the urgent situation presented by the closure of the Meloche quarry in 1984 and the impending closure of the Miron quarry slated for 1994. Since 1988, this government body has been responsible for the management of all solid waste produced on its territory (approximately 701 000 tons of waste annually). The Régie currently landfills its waste in the Miron quarry but its imminent closure has provoked the Régie to take action and adopt a new integrated waste management system.

The project proposed by the Régie begins this year and involves the implementation of three waste treatment centers and a transfer center. The treatment centers are an incinerator, a sorting center (both located in the town of Montreal East), and a composting center (located in the West Island). The part of the project concerning the proposed transfer center will not be included in this paper due to the lack of information disclosed to the public at this time. Therefore, all costs concerning transportation to the various centers will not be estimated. Only the transportation costs pertaining to recyclable materials delivered to companies which wholesale in those products will be included in the prices of those products.

The proposed project is considered to be both a public and a private project. It is considered to be a public project in view of its nature: that is, waste disposal is considered the responsibility of local authorities. The project is equally considered to be a private project from the standpoint of the type of financing to be obtained and the fact that the installations will be owned by a private company. Furthermore, in view of the nature of the project (municipal public service), the question of financial feasibility cannot be considered. However, what will be considered will be the social costs and benefits of the project, as derived primarily from the financial analysis of the project. From the results of this analysis, it will be up to the decisions makers (namely the Ministère de L'Environnement du Québec) to decide whether or not it is in the public interest to grant a permit to the Régie to proceed with its project.

**THE INTERVENERS IN THE PROJECT**

The Régie, as indicated above, is the actual promoter of the project. Its role in the project is twofold: 1) as promoter, it "is responsible for the co-ordination and supervision of all the preliminary and preparatory activities of the project" (Tecsult Inc.[1], chp.3 pg.32); and 2) as a public entity, its role is primary objective is to "adopt and implement different policies favouring the reduction of waste at the source" (Tecsult Inc.[1], chp.3 pg.33). In regards to the second statement, the Régie has undertaken to

comply with the objectives outlined in the National Protocol on Packaging and reduce its packaging waste by 50% by the year 2000.

"The Régie has created a filiate called the Société Intermunicipale de Gestion de Déchets, (hereinafter SIGED), to undertake the responsibility of the financing, the conceptualization, construction, and exploitation" of the centers involved in the project. (Tecsult Inc.[1], chp.3 pg.34) However, SIGED will not partake in the actual conception, construction, or exploitation of the centers as the expertise in those domains were yielded by the Régie to the conceptor-exploiter Foster Wheeler. The SIGED was created as a private non-profit organization, exempt from all corporate taxes, where all the shares are owned by the Régie (these shares were "purchased" with public funds). It was conceived to fulfill a dual purpose: 1) to permit a greater flexibility in obtaining financing on the financial market; and 2) to not implicate the credit lines of the member municipalities. It must be borne in mind that the SIGED and not the Régie is the owner of the waste treatment installations as all the costs and revenues procured from operating and exploiting the centers will be paid or received by the SIGED. In fact, the SIGED will appropriate all revenues to reduce the cost of waste treatment. Finally, the SIGED will bill the Régie who will in turn bill the member-municipalities in accordance with the tonnage of refuse received.

The subsidiary firm of the Foster Wheeler Power Systems Inc. (based in New Jersey) was retained, according to the impact study, to undertake the conception, construction, and exploitation of the three centers. This company will in turn be responsible for the

sub-contracting of the St.Laurent Construction company to construct the three waste treatment centers and also for the employment of all personnel required to operate the said installations.

**THE DATA**

Most of the data used in this project originates from two primary sources. The first source is the environmental impact study conducted by Tecsult. This study, performed in 1990, contains most of the information concerning the project in general, the economic and fiscal spinoffs, and environmental impacts. It has been used here to provide some additional background information on the project. The second source is the financial analysis performed in October 1992 by the group SNC-Lavalin. This document discloses most of the costs and revenues obtained by the SIGED. All other data used in the proceeding analysis was obtained directly from the primary sources (ie. municipal tax evaluation departments, Foster Wheeler, Statistics Canada catalogues, as well as individual interviews with certain analysts at SNC-Lavalin).

**THE HORIZON OF THE PROJECT**

The horizon of the project has been established at 25 years. The choice of this length of time is dependent upon two conditions. The first, and perhaps foremost, condition is that this length of time is dictated by the various contracts signed between the SIGED and Foster-Wheeler, the SIGED and Hydro-Québec, and the Régie and Foster-Wheeler. Eventhough a clause exists where the SIGED can opt

out of the contracts every 5 years (in absence of respect of certain conditions contained within the contracts), it has been widely implied that the duration of the project (construction plus exploitation) will be 25 years. The second condition is that the utility life of the equipment used in the project cannot be longer than 20 years. Therefore, given the combination of the two above conditions, we must accept the longer established length of 25 years for the project.

Both the financial analysis and the economic analysis in the following sections will project the costs and the revenues over this 25 year period.

# Chapter 2:

# FINANCIAL ANALYSIS

## FINANCIAL ANALYSIS

The financial analysis performed by the group SNC-Lavalin, hereinafter SNC, was designed to forecast an overall tipping fee cost for the three centers in question. As such, the analysis does not include general transportation costs from municipalities to the installations. The only transportation costs are those included in the quoted prices for recyclable products; that is, those transport costs incurred in delivering the recyclable materials to the buyers of those products. Also omitted from the analysis were the municipal taxes to be paid for the composting center located in the west of the island. However, the financial analysis remains well organized and detailed and most of its elements will be preserved for the current analysis.

The changes made to the SNC financial analysis, for the purposes of this paper, include a re-adjusted inflation rate, disaggregation of construction costs (labour from equipment etc), and the inclusion of municipal taxes for the composting center. Although these modifications may *appear* insignificant, due to the overall indifference of the values originally estimated, this *appearance* is illusory as the changes effectuated imply not only a **complete** overhauling of the original analysis but an exercise in the academic comprehension of financial analytical procedures.

The adjustment of the inflation rate retroacts on the prices, costs, and revenues. However, it is important to underline that the figures presented here below have been indexed (unless

otherwise stipulated) by either the consumer price index or by the industrial price index of various aggregates (listed appendix 2). Contrary to the original analysis, in the current analysis presented here, there is no constant rate of inflation (based on CPI) prior to 1996, therefore, forecasted variable rates have been used. The forecasted rates were obtained from Hydro-Québec's planification department and current inflation rates by Statistics Canada. Since Hydro-Québec is quasi-public organization (as its funds are predominantly public based) and projects similar characteristics as those existing between the Régie and SIGED, its forecasted rates were deemed more representational of the current situation than from other sources.

The current rate of inflation (CPI) for the region of Montreal is 2% (however, the rate used at the time of the current calculations was 1.9%). The variable rates of inflation as projected by H.Q. may be found in appendix 2 as being: for 1993- 2.3%, 1994- 2.7%, 1995-3% and 1996+ 3.5% per annum. However, the SNC analysis provides an constant inflation estimate for the industrial price aggregates at 2% per annum from 1992, which will be retained here.

As for the disaggregation of construction costs, the original analysis does not distinguish between costs of equipment & materials and labour. It is essential for the purposes of any economic analysis that the costs of employment be separate (or at least distinguishable) from other costs for the reason that job

creation (especially in high employment/recessionary situations) becomes a major social preoccupation-if not a political dilemma. The costs were disaggregated in the current financial analysis in order to avoid confusion in estimating the social opportunity costs of labour of the project in the social analysis.

In regards finally to the municipal taxes to be paid for the installations of the composting center, the exact fiscal amounts are unavailable as a definitive site for that center has not yet been established, and as such the taxes applicable cannot be accurately estimated. However, using the hypothesis that taxation rates on the island (given similar characteristics- a *ceteris paribus* assumption) will not substantially vary from one area to another, we will use a site in Montreal East as a proxy for estimating the magnitude of the applicable taxes.

Before proceeding with the details of the analysis, some general theoretical guidelines must be followed to insure that the financial analysis is performed correctly. These guidelines can be summarized as follows:

1) All calculations must be performed in current dollars (that is, all amounts concerned must be indexed every period-either yearly or quarterly depending on the situation);

2) The only amounts to be considered are the costs and revenues directly associated with the project (in order to avoid overquantified amounts or double counting);

3) All taxes and equipment amortisation must be held in consideration; and

4) The discount rate used must correspond to the financial opportunity cost of capital of the firm.

Of these guidelines above presented, the current analysis must undertake modifications to 3) and 4). In regards to modifying the third guideline, it must be noted that although the SIGED is a private non-profit company exempt of corporate taxes, it still has an obligation to pay for municipal taxes. Furthermore, eventhough equipment amortisation must be considered, we must avoid the error of double-counting. According to the Regie, the amortisation of the equipment has already been accounted for in the repayment schedules of the debt. In addition, there exists no residual value for the equipment used as its usefulness after 20 years is almost nil.

The fourth guideline is perhaps the key to understanding the difference between the financial analysis and the eventual social analysis. For the financial analysis, there is no direct rate of discount in this project. That is, since there exists no apparent alternative solution to the proposed project, and since we already know that from the nature project it is impossible for the project to be financially feasible, then no NPV (**N**et **P**resent **V**alue) can be calculated from the cash-flow (which will be represented in this analysis by waste treatment costs). However, the rate of interest used to repay the longterm loan is based on the longterm net borrowing costs (in %) of the municipalities belonging to the Régie, thus reflecting both the financial opportunity cost of capital for SIGED and the financial opportunity cost of capital of

the Régie, as guarantor of the loan. At this point the reader should note that the rate of interest of 10.5% **(current terms)** for the longterm loan can change between now and the financial closing date in August of 1993 (however, upon the date of financial closure the rate of interest applicable to all loans will be fixed for the duration of the project- 25 years). Moreover, the same principles governing the longterm loan equally apply to the short-term loan. That is, the rate of interest used to reimburse the short term loan is also based on the prevailing net borrowing costs of the member-municipalities. As a final remark on this subject, let it be known that these rates of interest do not reflect ( in any way) the social opportunity cost of capital (this will be discussed in the following chapter of the paper).

**FINANCIAL SUMMARY**

The table entitled "Financial Summary", contains a synopsis of the costs and revenues involved in the project are presented. Each element in this table is based on particular hypotheses or projections calculated in the appendix of tables. However, to better comprehend the origins of this data, a brief line by line description will be provided as well as the implicit hypotheses.

**EXPENDITURES DURING CONSTRUCTION**

Under this heading, the costs listed in this section may be retraced to the table entitled "Capital Costs". Construction costs have been subdivided into three groups: materials and equipment for

both the incinerator and the sorting center, labour or manpower for the same above centers, and the composting center (which already includes labour, equipment and materials). These costs are indexed only up to the financial closure in 1993.3 at a rate of 1.3% from 1991 to 1992 and 2% from 1992 to 1993. Because of the *clés en mains* contract signed between the Régie and Foster Wheeler, the costs of construction and/or other capital costs **cannot** fluctuate (even by inflation) after the financial closure. These costs follow a payment schedule outlined in the "Capital Cost" table. It is important to mention that during the construction period a total of 300 people will be employed to construct the actual sorting center and incinerator installations and additional personnel will be hired throughout the construction period for technical purposes. However, neither the promoter nor Foster Wheeler could not give more detailed information. In addition, it is **not** known at this time how many people will be employed to construct the composting center as plans for this center are undergoing modifications.

The "costs of development and financing" are detailed in the table of "Capital Costs". This section encompasses the addition of two major subgroups in the aforementioned table: 1) Fees & Costs of Development and 2) Financial Costs and Fees. The first subgroup refers to those costs incurred (or in the process of being incurred) in the development of the project (ie. the impact study performed by Tecsult, cost of public hearings, engineering and judicial costs etc). These costs were submitted in current 1992 dollars, and therefore were not indexed when the SNC group

submitted its analysis in October of 1992. However, due to delays in the public process these costs have not yet been completely incurred and thus an indexation of 1.9% (CPI) was applied in the current analysis.

The second subgroup is somewhat of a more complicated nature due to the formulas needed to calculate the amounts and the fairly lengthy list elements contained therein. In particular, the calculations of the longterm financial commitment and the credit establishment fee are somewhat complex. The formulas required for these calculations are listed in appendix 3. The "lending agency's fee" of 50 000 1992 dollars is paid yearly at rates varying to the CPI. Also of note are the last three elements of this subgroup: "lender's insurance adviser", "U.B.S. financial consultant fees", and "other" costs. These costs are definitive and are therefore not subject to indexation. Therefore, the costs of development and financing encompass all of the above mentioned elements and their respective indexation rates.

The information concerning the "other construction costs" also involve some detailed background information. In the contract "Achat d'Électricité" signed between SIGED and Hydro-Québec, details of payments schedules for electrical-power system integration to the incinerator are outlined these costs are not indexed as the costs outlined in the contract are definitive and final. As for the "General and Administrative costs" incurred during the construction period, approximately 4.3 million 1992 dollars has been allocated for engineering and other costs to be

paid out over this period. These costs have been indexed by the varying CPI rates (as mentioned previously) and follow a payment schedule outlined in the "Capital Costs" table.

The "reserve-debt service" refers to the portion of the debt placed in reserve and the end of the construction period. This amount corresponds to  of the total annual debt. The Union des Banques Suisses (U.B.S.) has established that an amount equivalent to one semestrial debt payment should constitute the debt service reserve fund. This implies that half of the semestrial payment be held in reserve and the other half be "covered by a Cash Deficiency Agreement with the Regie in order to minimize the negative arbitrage in the debt reserve fund." (SNC-Lavalin, Oct.1992 pg.14). In other words, the amount held in reserve will provide an interest revenue during the exploitational life of the project (as is mentioned under the "revenues of exploitation-return on interest").

The "cash-reserves" during the construction period refers to the first 45 days (or half of the first quarter) of the exploitation period where accounts receivable are subtracted from the accounts payable (the formula is again provided in appendix 3). This amount is paid in the last period of construction and is equally financed by the long term debt. The reader should note that this figure has already been implicitly indexed via the revenues and costs during the first period of exploitation.

In order to determine the "unforeseen costs" during the construction period, we must make use of the construction costs presented on the second line ("construction costs"). The

calculation of the unforeseen costs constitutes 4% of the construction costs (this percentage was established by the Regie). It is not indexed as the construction costs were already indexed.

The final element to be explained is the "interest during construction" or (IDC). This corresponds to the interest accrued during the construction period based on the short term loan contracted by the SIGED at 7.5% per annum. In order to calculate this amount, the cumulative total and sub-total is needed from each construction period. The IDC "is established through the hypothesis that the total disbursement during any period occurs in the middle of that period. (That is,) the interest on the required funds (or sub-total) during the middle of that period, plus the interest on the cumulative total corresponding to the previous period." (SNC-Lavalin, Oct.1992 pg.15). To understand the full nature of this concept it is necessary to consult the formula given in appendix 3. Once more it is unnecessary to index these amounts as implicit indexation is contained in both the sub-total and cumulative total.

**DEMOGRAPHIC TENDENCIES**

Prior to proceeding to the next stage regarding the revenues of exploitation, it is important to mention that a demographic hypothesis for the evolution of waste has been applied. Although the rate used is small, there remains a difference between the hypothesis chosen by the Régie's environmental impact study of zero population growth and the hypothesis chosen by the SNC group of

positive but small population growth. For the purposes of this paper, the hypothesis retained by the group SNC will be applied to the present calculations. This option was chosen for two reasons: 1) it would seem more plausible that Québec, despite many socio-political and economic problems, would experience at least some degree of population growth over the next 20 years; and 2) in order to facilitate the calculations involved in determining the revenues and costs of this project it is simpler to use the figures already calculated by SNC concerning waste production. The demographic hypothesis used by SNC is the same scenario used by the Bureau de Statistiques du Québec (B.S.Q.). The most plausible demographic scenario for Québec, as projected by the B.S.Q., is 1.5 children per female with an annual immigration rate of 9500. According to the B.S.Q., the demographic tendency is not promising as the generational replacement threshold will not be maintained.

Thus, the production of waste generated on the territory of the Régie will be slightly modified over the zero growth projection, and will result in the adequate dimensionning of the incinerator during the exploitational life of the incinerator (therefore achieving optimal revenues for electrical generation) instead of an under-dimensionned during the first two years of the exploitation of the incinerator as the impact study would suggest.

**MARKET TENDENCIES OF RECYCLABLE AND COMPOSTABLE PRODUCTS**

According to various organizations, the markets for recyclable and compostable materials has tended to increase with the education

and participation of the citizenry. However, despite these encouraging signs, "these markets have been subjected to large fluctuations in accordance with supply and demand. Many factors influence these markets, (among these are): the availability of quantity and quality recyclable products; (participation rates in grassroots collective recycling); the evolution of tendencies and policies in Canada and (abroad) concerning minimum quantities of recycled fiber in (packaging etc.); and the variation in price of various basic materials -aluminium, pulp and paper,etc." (SNC-Lavalin, Oct.1992 pg.2-3).

**REVENUES DURING EXPLOITATION**

The "revenues of exploitation" serve to reduce the waste treatment cost burden on the SIGED and indirectly (due to billing procedures) on the member-municipalities of the Régie. These revenues are generated primarily from the sale of electricity, recyclable products, and compostable products. It is obvious that the costs involved in treating the waste far outweigh the financial benefits procured. However, the revenues generated by the exploitation of the various centers represents a new era in waste management and environmental consciousness as for the first time on a large scale these municipalities will be actually making money off the "stuff" that citizens throw away and at the same time making the environment a little cleaner.

The revenues generated by the "sale of electricity" are based on the amount of combustible refuse incinerated (these amounts are

found in the table labelled "Worksheet of Materials-Ton"). The conditions applied to the sale and purchase of electricity are spelled out in the contract signed between SIGED and Hydro-Québec. The contract stipulates that the revenues will be derived from two sources: "1) the power furnished to Hydro-Québec during the winter months (December 1 to March 31) will be sold at a prime rate of *96.48$/kW for the contractual year of 1996 after which time it will be indexed (at a rate of *3.5% per annum); 2) the totality of energy produced furnished to Hydro-Québec sold at a rate of (*3.9/kWh) for the contractual year after which time it will be indexed at a rate of (*3.5% per annum)." (SNC-Lavalin, Oct.1992, pg.1-2). These "*" amounts differ from the rates specified in the original financial analysis of 99.47$/kW, 0.0402$/kWh, and 3% per annum inflation as the contract between SIGED and Hydro was not completed at that stage. Of important notice are the first two entries of the "sale of electricity", these two entries are based on the amount of combustible refuse used to produce energy at a rate of only 0.03$/kWh as occasional energy since full exploitational capacity of the incinerator is not possible. These quoted prices (and their indexed values) are found in the table "Unit Prices".

In order to determine exactly what the revenue from electricity would be we need to determine the quantity of energy or power actually produced from the combustion of refuse. Making use of the "Worksheet of Energy" table and the "Worksheet of Materials-Ton" table, the amount (or quantity) of electricity and power produced

both on an annual and seasonal (winter) basis can be calculated. For example, the "electrical energy produced by waste (kWh)" in the "Worksheet of Energy" table is calculated by taking the amount of combustible refuse ("Worksheet of Materials-Ton") and multiplying it by the "forecasted production amount" of 719kWh/T and dividing that product by a factor of 1000 (if this was not done then the amount would be in MWh instead of kWh- although we use the MWh in the annual assessment of the amount of energy produced). As the reader will note, the procedure for calculating the revenues from electricity involves using each of the elements in the "Worksheet of Energy" table which in turn involves other lengthy calculations. Therefore, a calculation, description, and example of the necessary elements in the "Energy" table will be provided in appendix 3.

The determination of the revenues concerning the "sale of recyclable products" is calculated by taking each amount of every recyclable product (ie. newspaper) in the "Worksheet of Materials-Ton" table and multiplying it by the appropriate unit price ("Unit Price" table), recall that these prices also contain the transportation costs in delivering the recyclable material to the buyer. These prices have been indexed at a rate equivalent to 33% of the CPI (as quoted from Hydro-Québec) from 1992 to 1996 and then rounded off to 1% per annum for the rest of the project. This factor of 33% of the CPI was used in the original financial analysis to reflect the "high cyclical tendencies" of recyclable (and compostable) products (as previously mentioned). The SNC group "established this rate following a review of industrial prices

indices for comparable products between 1984 and 1991. (The result was that there existed) a long term tendency approximately equivalent to 33% to 50% of the CPI. Consequently, (they) chose to index the prices of compost and of recyclable materials at a rate of 1% per annum." (SNC-Lavalin,Oct.1992 pg.22). Therefore, for the purposes of this paper, the indexation rate of 1% per annum will be equally maintained for the calculations of the revenues of recyclable materials and compostable materials.

Proceeding to the "sale of compost", the revenues of this category are defined by the amount of compost produced and the price for which it is sold. It is important to note that the price for the compostable material does not include a cost for transportation from the composting center to the buyer. In the analysis by SNC it was explained that the establishment of a transport cost was difficult because the location of the center was not chosen. However, they maintained the buyers would have to be located at a short distance since the compost would be delivered in bulk. "In the region of Montréal the supply price is 10$/ton, without counting the transportation costs. Therefore, it is not recommended to use a higher price." (SNC-Lavalin, Oct.1992 pg.6). The amount of compost produced as indicated in the "Worksheet of Materials-Tons" table is equivalent to 50% of the initial amount received by the composting center. Only this amount can be retrieved as most of the initial tonnage is lost to aerobic activity and the removal of plastics and metals found in the

compost. The price used for calculating the revenues of compost are indexed at a rate of 1% per annum (as aforementioned).

The debt service reserve will earn interest during the exploitational life of the project and generate an additional source of revenue. This situation combined with the number of cumulative debt repayments made is reflected in the "return on interest". The rate chosen of 4.5% was determined by U.B.S. (Union Bank of Switzerland) as the rate which the SIGED could obtain if it were to place the debt service reserve in savings at the time the original analysis was performed (in October 1992). The details of exactly how this percentage was arrived at was not explained in the original financial analysis. However, the Régie and SNC maintain that a thorough conservative financial market evaluation was done in order to obtain this rate. Hence, relying on the expertise of those in the domain of financial investments, the same rate is applied to the present calculations.

Finally, the "debt reserve reimbursement" is simply the principal amount of the debt service (amount equivalent to the debt-service reserve that was paid at the end of the construction period) to be reimbursed in the final year of exploitation.

**COSTS DURING EXPLOITATION**

Under the "expenditures of exploitation" we find those costs directly associated with the exploitation of the project.

The "debt servicing" is the amount of debt repayment of the long term loan contracted between SIGED and a group of financial

institutions. The rate applied to this loan, as previously explained, is based on the capability of SIGED to obtain financing from the financial institutions (for list see appendix 4) for the project and having the member-municipalities of the Régie being the guarantors of the loan. As indicated in the table labelled "Capital Costs", the "data on loan" is based on 40 semestrial repayments of 19 064 000 current dollars each during the exploitation of the project. The formula used in obtaining the semestrial repayments was calculated directly by the software (Lotus 123), however, a formula will be provided in appendix 3.

As during the construction period, there is a "lending agency's fee" equally applicable during the exploitation of the project. This fee prior to indexation is equivalent to 50 000 1992 dollars per year. This fee is indexed in the same manner as the lending fee during the construction period. Therefore, the rates of CPI inflation used are those projected by Hydro-Quebec (as mentioned previously).

The "service costs" involved during the exploitation of the centers is best summarized in the table "Annual Expenditures". In that table the service costs constitute the sum of the "operating costs" and "compensatory costs". As equally indicated in this table different indexation rates are applied. For example, the "operating and maintenance costs" have been indexed along the industrial price indices for similar services. As the reader will note, the rate has dropped from 4.3% in 1992 to an estimated longterm average of 2% per annum. Similarly, the "compensatory costs" have been indexed

following the projections of the CPI inflation rates. The most salient element in the "operating costs" are the "labour (+other)". This constitutes all those who will be employed by each of the centers (42 incinerator, upto 38 for sorting center, and 6 for composting center) and personnel who will be hired sporadically during exploitation to make repairs or assessments. These labour costs will be important for the discussion of the social costs of labour of the project. In addition, the credits of exploitation for each of the centers are also included under the "compensatory costs". These credits are deemed on a percentage basis everytime the capacity of each center exceeds a certain tonnage. These limits are outlined in the service contract signed between SIGED and Foster Wheeler. The conditions for these credits are given in appendix 3. For example, if the composting center exceeds an annual capacity of 50 000 tons but does not exceed 59 000 tons then the credit applicable to Foster-Wheeler (being the exploiter of the center) will receive 5% of the annual revenues. Finally, the surcharges on the annual quantities of the three centers and of electrical generation are obtained by taking the excess capacity amounts for each center (350 000 tons incinerator, 118 000 tons sorting center, and 50 000 tons composting center) and multiplying it by a factor of 14.95$/T (or 13$/T indexed at the industrial price index of 4.3% in 1992 and 2% thereafter) and indexed by the industrial price index of 2% annually. All of the above factors are implicit in the calculation of the service costs.

The "other annual expenditures" as indicated in this table are comprised of the municipal taxes to be paid for each of the installations in Montreal East and in the West Island and the amortised purchase and expropriation for the land in Montreal East. The municipal taxes for Montreal East are based on the location, territorial area, and vacancy of land in addition to business taxes, surtaxes on vacant lots and municipal development taxes (ie. those taxes which pay for street lighting, waterways, and other municipal activities). The taxes concerning the Composting center have been evaluated by using a similar territory in Montreal East as a **proxy** since the site for the center (see appendix 3), although it has been narrowed down to the three most likely sites, is still being discussed. The evaluation was not obtainable from either of the three sites due to inexpedient bureaucratic red tape involved. The amortised purchase and expropriation can be found in the table of "Annual Expenditures". The sum originally given by the Régie to SNC was 8.8 million 1992 dollars to be paid through amortisation at a rate of 11% per annum by the SIGED over a period of 20 years (this figure is presumably definitive and not subject to indexation). This value was to include the amount to be paid for compensation of expropriation for the auto recycling firm Auto Berpa located on one of the lots where the installations of the incinerator and sorting center are to be built. However, the exact figure of the compensation of expropriation was never given to SNC and the Régie has not revised it global figure of 6 million dollars for the package of purchasing the proposed land and expropriating

Auto Berpa. Therefore, when determining the social cost of the expropriation and leasing the land, the figures provided in this will not be used. However, the global figure given by the Régie will be used and subjected to a social opportunity cost rate (equally in current terms).

The final element of expenditure during exploitation refers to the "increased cash reserves". Similar in procedure to the cash reserve during construction, the increased cash reserve is determined by the "subtracting the additional amounts required for the cash reserve, the initial cash reserve and all other preceding increases in the cash reserve." (SNC-Lavalin, Oct.1992 pg.11). This amount is defined by the total costs during exploitation minus the total revenues during exploitation plus the revenues obtained from electricity, recyclable products, and compost all subtracted by the service costs and other annual costs this sum multiplied by a factor of 0.125 the resulting product subtracting the cash reserve in the last period of construction less the sum of the cumulative increased cash reserve. The 0.125 factor is not explained in the text of the original financial analysis, however, speculation of this factor would suggest that it would represent the 45 days during each period (year); that is the ratio of 45 days in one year would be approximately equivalent to a 0.125 factor. The formula for calculating the increased cash reserve will be provided in appendix 3.

**WASTE COST TREATMENT**

The "waste cost treatment" indicates the net cost amount paid by SIGED to be billed to the Régie who will in turn bill its member-municipalities on the basis of tonnage. To obtain this amount, we need only take the total costs during exploitation and subtract them from the total revenues during exploitation. It is interesting to note that in the last period (2016) the waste cost treatment is much lower than in any other period. This is attributed to the large negative figure contained in the "increased cash reserve". This is due primarily to the calculatory procedure used in determining the increased cash reserve. This will have an impact on the tariff per ton subsequently explained.

**TARIFF**

The "tariff per ton" indicates how much each ton of waste produced in each period will cost. These amounts are defined as the ratio of waste treatment costs to annual tonnage of all waste produced. This gives each municipality an approximation how much they must budget for waste management. The more refuse (per ton) a municipality produces the higher the cost of waste treatment. Therefore, the tariff per ton acts as an incentive to optimize waste control. The large negative figure in the last period of the "increased cash reserves" has an impact on the tariff per ton being much lower than in previous periods. However, if plans are undertaken to renew each of the centers after the 20 year period, it will be unlikely that this low tariff will persist for the

reason that the calculatory procedure involved will effectuate transformations in the figures presented in such a manner that the tariff per ton would increase instead of decrease.

**NET FINANCIAL COST**

In final note, the net cost of the project over a 20 year period was calculated to simply indicate the grandeur of the project. The reader will remark that the overall figure is large enough to produce economic spinoffs. Although these potential spinoffs are not mentioned in the financial summary, as they would represent neither a direct cost nor a direct revenue for the SIGED, this subject matter will be discussed in the following chapter regarding the social costs of the proposed project.

Chapter 3:

# PRINCIPLES OF SOCIAL ANALYSIS

## PRINCIPLES OF SOCIAL COST ANALYSIS

If it were possible to determine economic viability of a project by ex-post observations then our work as economists would be far more easier. However, we rarely, if ever, have the opportunity to make crucial ex-post decisions concerning the implementation of a project. Once the decision is made to go ahead with a project it is very difficult (and sometimes very costly) to retract the decision. In the case of the project under study, the cost of not going ahead with the project is 2.5 million dollars to be paid to Foster-Wheeler as compensation. The question decision makers must decide upon is whether it is in the social interest, regardless of contractual penalties, to grant a permit for the realisation of this project.

Therefore, before making any decisions, we need to draw upon a set of guidelines delineating how to analyze economically the implementation of a project in order to insure that we do not overcompensate or underevaluate the costs and revenues concerned and at the same time make an assessment of the potential impacts borne by the society. These general guidelines can be summarized as follows:

1) the "Potential Pareto Improvement (PPI)" (second best) must form the basis for the social analysis;

2) the social analysis must be performed from a monetary perspective and with the use of current dollars-in this particular case- instead of constant dollars (as in the usual case of cost-benefit analysis);

3) the analysis must be a partial equilibrium analysis

4) the data must be corrected and recalculated in terms of the shadow prices of elements such as labour, equipment, and land in order to reflect the distortions in the economy (ie. unions, unemployment, inflation etc.);

5) the externalities, both positive and negative, must be accounted for in the calculation of the social analysis; and

6) the discount rate applied must be a social discount rate (that is one that takes account of the opportunity cost of using public funds and may be performed in constant or current terms depending on the analytical situation-in this case a current social discount rate will be used).

A brief theoretical background is necessary to understand the importance of each of these guidelines.

**POTENTIAL PARETO IMPROVEMENT**

Within the social welfare theory, there are a number of different schools of thought of which the Potential Pareto Improvement Approach (PPI) is a one branch. This approach, although widely criticized because of its neglect of redistributional income effects, is the basis for performing economic cost-benefit analyses. The PPI is based on the Pareto Optimum Condition, which states that " an allocation is efficient if it is not possible to make one person better off without making some other person worse off." (Binger and Hoffman, 3rd.ed. chp.7 pg.181). However, this optimum, as is, is hardly useful in the real world as it requires that society only pursue one objective (chiefly efficiency), and that the society accept the reallocation of resources even when this reorganization could be less than "socially acceptable".

In addition, the Pareto criteria does not establish a total "pre-ordering of preferences based on the possible states of the economy," which is necessary to be able to communicate the interest of the society. (Martin,F., Évaluation des Projets,.chp2.pg.2-3). Succinctly stated, the PPI approach encompasses (among other things) the pre-ordering of preferences, which allows individual utilities to be preserved, and a derivation of a societal utility function (which does not aggregate all utilities in to one total).

The "second best" is the situation resulting from the corrections of the distortions existing in the economy in order re-establish an operational optimum for the society. Therefore, the PPI approach (constructed from the "second best" situation) is a practical instrument for cost-benefit analysis. In other words, this amalgamated theory permits both the "correction of distortions in the current situation and a way to potentially compensate the injured parties of the project without using the redistributional mechanisms of revenue."
(Martin, F., Évaluation des Projets..chp.2 pg.15-16).

**MONETARY ANALYSIS**

For the purposes of this paper, it is important to effectuate the social analysis in monetary (current dollar) terms and not in terms of utilities or constant dollars. This is done for two reasons: 1) utilities to do not give an indication as to whether the project in question is beneficial for the society or not; and 2) if we desire to compare the project with the financial analysis

then we need a common reference (current dollars) which encompasses the distortions present in the economy. In the context of the present social analysis, we must still use the shadow prices to determine the opportunity costs involved (see "shadow pricing" for further details).

**PARTIAL EQUILIBRIUM ANALYSIS**

In evaluating a project in partial equilibrium, we concern ourselves only with those costs and benefits directly concerned with the project. Mishan suggests that in this manner "a project will have more chances of being accepted as there would be little or no externalities and little or no cross elasticities." (Martin,F., Évaluation des Projets, .chp.2 pg.15). And, as Henderson and Quandt (1971) maintain, partial equilibrium analysis can be justified in regards to small projects because the impact that "the locomotive industry has on the bubble gum industry" is negligible. (Op.cit. chp.2 pg.17). Therefore, in partial equilibrium analysis, we can justify the omittance of the distribution of revenue in the PPI approach and at the same time make the task of analyzing projects a great deal easier.

**SHADOW PRICING**

Generally, the social benefits of a project can be determined from two sources: by using the consumer surplus and/or by the rents of factors (depending on the nature of the project). However, since we are determining only the social costs of the project we will not

make use of either of these elements in their explicit form. Nevertheless, the importance of these elements rests in their application of shadow prices to accurately reflect the benefits of a project to society. This notion of shadow pricing will be equally used to estimate the actual social costs of the project to society.

Given that the market prices of goods and services in the economy do not accurately reflect the value of the goods or services to the consumer; that is, the market price does not emulate the consumer's "willingness to pay" (or shadow price- the difference between what is willing to pay and the nominal market price or the price it is worth in an alternative use and equivalently the prices necessary to attain a second-best optimum), the use of shadow prices or opportunity costs becomes an important concept when conditions of less than full employment exist. For example, "in a less than fully employed economy, the opportunity cost of the labour of an unemployed worker is..equal to the value that the worker attaches to his..non-market activities." (Mishan, E.J,.chp.11 pg.67). In the project currently under consideration, the use of this type of shadow pricing will be used to evaluate the social cost of lost labour, the social opportunity cost of new labour, and the social cost of capital.

**EXTERNALITIES**

The importance of including all pertinent externalities in the project is to avoid social inefficiency (or non-optimality) and to maintain a "second best" optimum. The most pertinent problem

created by the existence of externalities is that they circumvent most market mechanisms. That is, because externalities are generally unintentional changes in economic welfare, they have no price and as such mislead market functioning. An externality exists if one of the two following situations (or conditions) is present:

> 1) "there is externality every time that..a firm, through its welfare or its profits, is affected by an economic change and where the firm has not taken part in the decision to bring about this change. And, 2) there are no transactions between the affected agents and no compensation. Inversely, given that there is a price and a transaction on the externality, we say that this externality is internalized." (Martin, F., Évaluation des Projets,chp.5 pg.2)

The externalities identified in the current project are environmentally based. Eventhough these externalities, resulting from the operation of the facilities, effectuate a change in the economic welfare of the SIGED, they are internalized through the implementation of equipment (anti-pollution equipment) designed to attenuate them (externalities). Therefore most of the negative impacts such as air pollution (which occurs as a result of combusting refuse) are diminished (but not entirely expunged) by the installation of anti-pollution mechanisms. The positive externalities of the project are not readily recognizable.

**MULTIPLIER EFFECTS- A "SUB" EXTERNALITY**

The promoter of the project is under the impression that the project will generate numerous economic and fiscal benefits in the Montreal region as the amount that will be invested into the construction and the operation of the installations will bring

about these spinoffs. However, we must keep in mind that under full employment (with inflation) the multiplier effect becomes primarily a pecuniary effect. Yet, when we are capable of identifying a multiplier effect in the labour force, we must include it in the calculation of the social analysis as a positive externality of the project. The case for under-employment reveals that the multiplier has an effect where

> "certain resources become utilized when previously there was no way (no alternative project) to incorporate them in the production process. Consequently, we can use a part of the multiplier if it (can be shown) that the monetary and fiscal policies, present and future, are incapable of preventing the unemployment of resources and if we can retrace its effects on the factors of production precisely identified." (Martin,F., Évaluation des Projets, chp.4 pg.61).

In regards to the project proposed, it could be justified that a multiplier effect exists, since the unemployment rate for construction workers, general labourers, and other qualified personnel (as used in the project) is particularly high and is not characteristic of full employment. However, it has not been identified by the impact study which sectors will perceive this effect nor has the magnitude of this effect been established. Although intuitive speculation would lead us to conclude that the effect would be small, given the existing inflationary pressures and the size of the Montreal region, we cannot provide an accurate hypothesis for this effect. In fact, the assumption made in the impact study that, with the inception of the project, many new industries will want to locate their businesses (and create even more employment) in proximity to the waste treatment installations, is entirely speculatory not supported by any concrete evidence.

**SOCIAL COST OF CAPITAL**

Generally, we examine the need for a social rate of the cost of capital to yield an indication of the social opportunity cost of capital where public funds are concerned. The general premise for the Harberger model, for instance, is based on the hypothesis that the "equilibrium rate of return (after tax) on private investment is to be equal to the rate of interest on government bonds." (Martin,F., Évaluation des Projets,chp.9 pg.17). The model accounts for both the "various sources of funds for government borrowing.. (and)..the sensitivity of these sources to variations in the interest rate on the financial market." (Op.cit. chp.9 pg.21). The formula developed to find the opportunity cost of borrowing (see appendix 5) indicates that the social discount rate is greater than the market interest rate. Since firms pay taxes, they must be compensated for the loss of investment due to the latter. Hence, "the public sector must be penalized in order for a second best optimum to be re-established." (Martin, F., Évaluation des Projets..chp.9 pg.22). Jenkins has modified the Harberger model to adapt it to the "Canadian" experience. According to his findings "the opportunity cost of government funds consists in the weighted sum of..alternative returns which different sources would have produced from these funds. In 1977, in constant terms the rate of social discount was evaluated at 10.022 % ." (Op,cit...chp.9 pg.37).

Thus, for this case-study, we must make an adjustment to the sixth guideline. Eventhough in this case the SIGED is not using

public funds directly (recall the Régie, as the sole shareholder in the company, is only the guarantor of the private loan), if something were to go "wrong" with the project the municipalities would be held liable for the damages. Therefore, we must apply a social opportunity cost rate to this project which reflects the social opportunity cost of municipal borrowing with public funds. Why? Because, the utility function addressed in this paper is from the point of view of the Québécois society, we must assess the impact of public borrowing upon private borrowing with public money.

Jenkins, in his article entitled "Public-Utility Finance and Economic Waste" (C.J.E. pgs.484-497), argues that the constitution of public electric utilities in Canada are

> "a common form of organization..where the government owns the equity of the utility while allowing it to operate in a manner similar to that of a private business- (which emulates the current case) allows two special concessions not given to private enterprises: 1)..exemption from federal income taxes..and 2) when they borrow in the capital markets their loans are guaranteed by the provincial governments enabling them to borrow more cheaply because they do not have to compensate the lender's for risk of default. The implicit..government guarantee of the debt against default greatly reduces the utility's financial need for equity funds....This puts the government owned public utilities in a special position. It enables them to compete for scarce capital and allows them to engage in more risky and low-return projects." (pg.485)

The same analogous can be applied to any organization (like the SIGED) which uses public funds either directly or indirectly since these types of organizations will equally benefit from their unbalanced competitive edge on the financial borrowing markets. Hence, we must use a social rate that takes into account the social

discount rate obtained by Jenkins (1977) augmented by a ratio of municipal borrowing rates and federal government borrowing rates (through Canada Savings Bonds) and the inflation rate (to place the rate in current terms and not in constant terms), see appendix 5. This rate quantifies the not only the additional risk undertaken by various levels of government but also the cost of productivity of capital involved in the project. This social opportunity rate will compensate for the distortion between what the SIGED (under the auspice of the Régie) will borrow at and the "economic opportunity cost of borrowed funds" (Jenkins,G., "Public Utility Finance..", pg.486). Such a rate takes into account the repercussions felt in the economy through a "crowding out" effect of lost investment via private investors excluded from borrowing on the capital market because of public borrowing.

Finally, since the financial feasibility question is not the key issue in this case, the only question which can be addressed is whether it is socially feasible to approve this project. Once the above-mentioned social cost of capital rate has been applied to the amount borrowed by the SIGED and the assessment of the other social costs and benefits of this project has been made, then the decision makers must rely on their own discretion, whether to grant a permit to the Régie to commence its project.

Given the specifications of the above guidelines and their adaptability to the project at hand, we can proceed to the results obtained from the social analysis found in the following chapter.

# Chapter 4:

# SOCIAL ANALYSIS

## SOCIAL ANALYSIS

There exists no prior economic analysis of this project. Therefore, prior to venturing into *uncharted territory* (with regards to addressing the economic costs of the project), we must keep in mind that the utility function concerned is from the point of view of society. At this juncture, the attention is focused not on the financial impacts (in terms of how much the project will cost-in monetary terms-to the citizens) but on the economic impacts on society (particularly via the social opportunity cost of capital). The social costs of this project are summarized in the table entitled "Social Analysis". The reader should note that the *benefits during construction* and the *benefits during exploitation* are not benefits to society per se, but, instead benefits resulting from the project which serve to reduce the overall social cost of the project. All the costs presented in this table are in current dollars in order to achieve comparability between the financial analysis and the social analysis. In an attempt to maintain the continuity of this paper, a brief line by line description will be given with the appropriate implicit hypotheses (where necessary).

### COSTS DURING CONSTRUCTION

This involves a regroupment of all social costs incurred as a result of the inception of the project. These costs have been subdivided into two sections, each treating different aspects of social costs. Although, the most crucial social costs, in this phase of the project, would seem to originate from the

environmental costs, the current methods in attempting to accurately quantify these costs are still too recent in economics (and in particular, social cost analysis) to be accepted so readily by most sceptics in the field. However, we will devote some time in examining the social impacts of some of the most quantifiable environmental costs via the use of sensitivity parameters. For the academic purposes of this paper, under this category, particular attention will be focused on the social cost of labour.

**SOCIAL COST OF LABOUR:**

As stated in the impact study, the Régie will need to expropriate additional land in Montreal East. As a result, two causal events will take place: 1) a firm (Auto Berpa) will have to cease all of its operations and vacate the area and 2) approximately 10 jobs lost will be lost. The amount displayed in the table represents the social cost of lost labour. These figures were calculated in detail in the appendix of calculating the social cost of labour with the aid of the formulas in appendix 5. The calculations will not be described here as they are sufficiently detailed in the aforementioned appendices. What will be discussed are the reasons why the Jenkins/Montmarquette probit model was used and why these costs figure for only 2.5 years instead on the whole 25 years of the project.

According to Jenkins and Montmarquette ("The Social Opportunity Cost of Displaced Workers"-1979) in order to determine the duration of unemployment, we need "to measure both the workers' private

income after lay-off, and the social value of the income they generate, (thus)..two key parameters need to be estimated." (Ibid., pg.346). The first parameter was to determine those factors which influence the probability of being re-employed (see vector of characteristics in appendix of calculating the social cost of labour). The second parameter "is the determinants of the estimated hourly wage rate received by the displaced workers prior to layoff and after finding alternative employment." (Op.cit., pg.346). Hence, the model (based on probit estimations) provides a framework for estimating the social cost of *displaced* labour and the probability that the displaced workers will be re-employed.

For Jenkins and Montmarquette (see above reference), the current situation can be considered as an analogous to the "factory closing" case scenario. The motive for this labelling stems from the fact that as soon as the expropriation occurs and the firm ceases its operations, the workers employed by the firm will be immediately unemployed and their opportunity cost of employment will fall to their leisure values (see appendix 5 under **L**). However, as Jenkins and Montmarquette point out, with the passage of time, "the social cost increases as the passage of time permits other alternatives -other than personal activities- to be present." (Martin,F., Évaluation des Projets, chp.7 pg.11). These workers will be re-absorbed either into the labour market or will take the opportunity for early retirement. The passage of time will allow for the social opportunity cost of the unemployed to ascend to the same level of nominal salary as prior to their lay-off.

A study conducted by Luc Girard (1990), used the results of Jenkins and Montmarquette in order to determine the value of the social cost of labour. In the appendix of calculating social costs, the reader will note that we have adapted these two studies (Jenkins & Montmarquette, and Girard) to construct vectors of characteristics similar to those in the above-mentioned studies. A different vector was assigned to each *type* of worker laid-off as a result of the expropriation. These characteristics, along with the Jenkins/Montmarquette Probit model table, were used to determine the probability that each type of worker would be eventually re-employed at the same wages/salaries as prior to their lay-off. It is clear from the results, that given the prevailing economic conditions in the Montreal area, the probability that all of these workers will eventually be reabsorbed would appear to quite low. In fact, on the average, none of the workers still left unemployed after 2 years will be placed, according to these results. Hence, the social cost of lost labour can only be imputed for that period. Although some may question these results (those who are optimistic about the current and future economic conditions), there is little alternative but to accept these findings as there exists no more recent probit model estimation on displaced workers.

It should be noted at this point that the nominal and competitive salaries are the same (in terms of weekly salaries) as Auto Berpa was unwilling to disclose the real amounts for workers' salaries. Consequently, the **B** factor in the calculation of the value of leisure is equal to 1. However, since it is believed that

there is no union for Auto Berpa workers, this will not seriously affect the outcome of determining the social opportunity cost of labour.

**ENVIRONMENTAL COSTS AND INTERNALIZED EXTERNALITIES:**

The term *environmental cost* is used rather loosely in this case as the costs mentioned under this category do not reflect the true environmental costs to society but merely simplistic approximations. In economics, it is very difficult (and at times impossible) to quantify monetarily the effects on the environment from a social point of view. However, it was judged necessary in this case to at least attempt to economically quantify at least two environmental costs namely: site development costs and territorial restructuring costs. The reader should recall from the previous section on principles of social analysis the discussion on how externalities are determined. These two environmental costs are not externalities as they do not arise inadvertently. They are deliberate and imperative for the installation of the waste treatment centers (*only of sorting center and incinerator).

The site development costs are those costs used in the construction of access ways on the site, removal of debris and vegetation, and the plantation of trees and shrubs for the centers in Montreal East. In the table of Capital Costs, the site development costs were included (and indexed) along with all the other costs to form the aggregated construction costs. And, they are paid out (presumably) along the same payment schedules as the

sorting center and incinerator. In the current social analysis these costs are portioned according to the percentages of the payment schedule. Although these amounts are more than likely to be inaccurate, there does not seem to be a precedent to this type of calculation. The only other method would be through a hedonic pricing method which would require more details about the land characteristics. But, even that method would not seem to accurately reflect the social cost of the site development.

The costs of territorial restructuring are similar in nature to those of the site development costs only the pertain more predominantly to land excavation. The same procedure was followed in calculating these amounts as for the site development costs. Consequently, it too does not accurately reflect the social environmental cost of changing the landscape.

In this category, the internalized externalities during construction are outlined. These externalities arise as a result of the SIGED's desire to attenuate various environmental impacts such as air pollution. Since air pollution is probably the largest preoccupation of residents in the area and to environmental groups, the SIGED has taken upon itself to implement air pollution reduction mechanisms in the construction of the incinerator and in its equipment (notably the anti-pollution equipment and the chimney stack modifications). Theoretically, if these air pollution reduction mechanisms could completely counteract the impact of air pollution then the environmental externality costs of implementing this type of equipment could be completely internalized by the

SIGED, and the result on society would be neither a cost nor a benefit. However, we cannot reasonably believe that there could exist, given our current level of technology, any such mechanisms that would 100% attenuate the impact of air pollution. Therefore, we must *penalize* the implementation of such mechanisms by an appropriate factor in order to reflect the cost to society of this environmental impact. Two arbitrary factors were chosen here to reflect a measure of sensitivity evaluated at 5% and 10% of the (1993) costs applicable to the air pollution mechanisms. Again, these figures are unlikely to accurately forecast the impact on society as there does not seem to be any information available on this type of forecasting.

**BENEFITS DURING CONSTRUCTION:**

In this category we note that the only benefits from construction are those pertaining to the employment of labour. The impact study indicates that approximately 300 construction workers will be employed in the construction of the sorting center and the incinerator. However, it is not mentioned the number that will be employed in constructing the composting center. It can be speculated, however, that the number that will be employed to construct the composting center will not be very large. Since figures nor percentages could be appropriated by the Régie regarding the latter (as the plans for the center are undergoing current modifications), the social opportunity cost of labour resulting from those employed in the construction of the composting

center was not calculated. Therefore, we must keep in mind that the figure presented under the "benefit during construction" is slightly underevaluated.

The social opportunity cost of labour of the 300 plus construction workers employed for the construction of the two waste treatment centers in Montreal East were calculated in the appendix of calculating social costs of labour. It is important to draw the reader's attention to two facts: 1) there is a large number of different categories of construction (approximately 26 categories) and 2) Foster-Wheeler cannot or will not furbish more detailed information regarding the number of each type of construction worker to be employed. Therefore, a figure based on the average of salaries earned by each of these individuals and used by the C.S.S.T. (Commission de la Santé et Sécurité du Travail) was used in determining the approximate value of the social cost of labour.

**NET SOCIAL COST DURING CONSTRUCTION:**

In this final section all the costs and benefits accruing in each period have been taken. These figures represent the net social cost to society during each construction period.

**COSTS DURING EXPLOITATION:**

This involves a regroupment of all social costs incurred as a result of the exploitation of the project. These costs contain two central elements: waste treatment costs and debt reimbursement. Of these two costs, the most crucial element is the debt

reimbursement. Its salience is not only attributed to its large figures but to the overall social cost implication. Consequently, a significant portion of this section will be dedicated to this discussion.

**EXTERNALITIES DURING EXPLOITATION:**

The externalities created during this phase of the project are largely attenuated by measures that have been installed during the construction period (ie. type of equipment installed and the planting of vegetation).

**WASTE TREATMENT COST**

These costs are similar in explanation as those found in the financial analysis chapter. However, there are two important distinctions: 1) the waste treatment costs are net of the reimbursements of debt; and 2) the waste treatment costs are net of taxes and the expropriation and leasage of the land in Montreal East. Firstly, the debt reimbursements had to be eliminated to **avoid** double-counting in the next section. Secondly, the taxes and expropriation and leasage had to be equally eliminated for the reasons (taxes constitute a type of benefit for society, expropriation and leasage -due to the inseparability of the figure given by the Régie- will be counted as a cost to the society). The waste treatment cost represents a *cost* to society because these funds could be appropriated elsewhere.

**DEBT REIMBURSEMENT**

In the financial analysis the SIGED's debt reimbursement was evaluated at 10.5% per annum (over 20 years) reflecting the **current** financial cost of capital of the member-municipalities of the Régie. However, this cost of capital used in the financial analysis cannot reflect the social cost of capital since it does not accurately reflect the risk of the project and the productivity of capital in the project. As stated in the principles of social analysis, the fact that so-called government backed private enterprises can borrow at low rates implies that other enterprises seeking to borrow on the financial markets are met with unbalanced competition. This constitutes a **social cost** as the *crowding out* syndrome of private investment impacts on the economy. Therefore, in order to restore this *underevaluation* we must apply a rate that encompasses the social opportunity cost of public funds (Jenkins 1977 rate of 10.022%) augmented by both the ratio of municipal borrowing and national borrowing (which reflects the additional risk that various levels of government undertake in projects) **and** the inflation rate (CPI 1996+). This enables us to produce a social opportunity rate in current dollars rather than a social opportunity rate in constant terms. This procedure was undetaken in order to be facilitate a comparison between the financial analysis debt reimbursement and the social analysis debt reimbursement. Hence, the rate calculated was 14.95% which was applied to the amount the SIGED needed to borrow for the construction of the installations (found in Capital Cost table under last period of

"cumulative total") and annuitized over 20 years (see appendix 5 for formula). As a result of penalizing the social opportunity cost of capital by the inflation rate, we obtain a figure substantially greater than that projected in the financial analysis. Thus, this amount must be imputed on the entire exploitational life of the project.

**EXPROPRIATION OF AUTO BERPA AND LEASAGE OF LAND**

If the reader will recall, in the financial analysis a global amount of 8.8 million dollars (1992) was appropriated by the Régie (to be amortized over 20 years by the SIGED) for the expropriation and leasage of the said land. In order to determine the social cost of the expropriation and the leasage of land, we must make use of the same global figure given by the Régie but apply a social opportunity cost rate when determining the annual payments. The rate used to determine the annual payments in the financial analysis was expressed in current terms. Therefore, for the social analysis the rate applicable to this amortization is the same one which was applied to the debt reimbursement. As previously this was done to achieve comparability between the rates used in the financial analysis and those used for the social analysis.

**BENEFITS DURING EXPLOITATION:**

The social cost-minimizing benefits in this category arise from only two sources: municipal taxes and employed labour. Generally, in cost-benefit analysis (and/or social cost analysis), taxes are

generally considered to be just transfer payments. However, in this case, the municipal taxes generated are the direct result of the implementation of the project. These taxes are a form of benefit to society since in the ex-ante situation these amounts do not exist. If the municipalities could not collect taxes from the installations involved in the project then the overall social cost of the project would be far greater than it is estimated in this table. Recall that an economic rule of 50% is applied to these taxes as not 100% of this amount can be perceived as a benefit.

The labour employed during the exploitation of the project encompasses all of the centers. These amounts have been calculated in the appendix of calculating social costs. Three important remarks must be made: 1) only approximate nominal salaries (based on independent undocumented investigations and hypotheses) for all employees in all of the centers could be obtained; 2) the number of "workers" in the sorting center increases by 3 persons every year from 1997 to 2000; and 3) the estimates of salaries given by Stats.Can., used in calculating the social opportunity cost of labour ($W_1$), do not accurately reflect the type of occupation/earning held by the persons employed in this project. In the first regard, as Foster-Wheeler could not disclose this type information, proxies from similar industries were used. As a result, the estimates for the social opportunity cost of labour are only *ball park* approximations. Secondly, based on the assumption that the recycling programs implemented by the Régie will have a positive effect, the impact study has suggested that the sorting

will require additional employees up to a total of 38 employees by the year 2000. Finally, Statistics Canada does not extensively disaggregate the type of occupation and earnings held by persons in positions of management or assistant management positions (ie. no evaluations exist for administrators of industrial plants etc.), and, as a result, the forecasted earnings of these persons do not accurately reflect the actual situation. Thus, we attempted to associate these persons with the most similar occupational/earning available in the Stats.Can. catalogue on **Earning and Employment.**

**NET SOCIAL COST DURING EXPLOITATION:**

Similar to the situation presented during the construction period, the net social cost during exploitation is the social cost to society (costs-benefits) during every exploitation period.

**TOTAL NET SOCIAL COST OF THE PROJECT:**

This refers to the aggregated net social costs during both phases of the project. It was calculated here for the purpose of giving the decision maker a global view of the magnitude of the social costs that will be incurred by the project on the society over the twenty-five year period of the project.

These results show that the implementation of the project will definitely have an important impact on society. It is up to the decision makers to put forth the final decision on whether it is truly in the public interest to grant the permit to the Régie allowing the project to begin this year.

## CONCLUSION

In this paper, we have attempted to answer the fundamental question of what is the social cost of the project proposed by the Regie.

Via the financial analysis, the social costs of the project were isolated and quantified. The results of the social analysis indicate that the most hard felt costs extend from the waste treatment cost and the social opportunity cost of capital. However, from a practical viewpoint, the social opportunity cost of capital constitutes the greatest *evaluation* in the social analysis as the effects of so-called private borrowing with public money produces an competitive imbalance on the financial markets and a real *crowding out* effect of private investment in the economy. Given the current recessionary state of the economy, this effect is even more exaggerated as financial institutions are unwilling to engage in such high risk projects as the one proposed in this study.

Based on the results obtained in the social analysis, it is up to the decision maker (Ministère de L'Environnement du Québec) to decide the fate of the proposed project. In view of the fact that the project is neither financially nor socially feasible, if the decision is to permit this project to be undertaken then the justification must be made on grounds other than those presented in this paper.

# APPENDICES

# APPENDIX 1

## LIST OF MEMBER-MUNICIPALITIES OF THE RÉGIE

Ville d'Anjou
Ville Baie-d'Urfé
Ville de Beaconsfield
Ville de Côte-St-Luc
Ville de Dollard-des-Ormeaux
Ville de Dorval
Ville de Hampstead
Ville de Kirkland
Ville de Lachine
Ville de LaSalle
Ville de Montréal-Est
Ville de Montréal-Nord*
Ville de Montréal-Ouest
Ville de Mont-Royal
Ville de Outremount
Ville de Pierrefonds
Ville de Pointe Claire
Ville de Roxboro
Ville de Senneville
Ville de Ste-Anne-de-Bellevue
Ville de Ste-Genviève
Ville de St-Laurent
Ville de St-Léonard
Ville de St-Pierre
Ville St-Raphael-de-i'île-Bizard
Ville de Verdun
Ville de Westmount

* The Ville de Montréal-Nord will join the "group" after the Régie has received its permit from the Ministère de L'Environnement du Québec.

# APPENDIX 2

## LIST OF INDEX RATES APPLIED

HYDRO-QUÉBEC CPI RATES[1]:

1992: 2.0%
1993: 2.3%
1994: 2.7%
1995: 3.0%
1996+: 3.5%

SNC-LAVALIN INDUSTRIAL PRICE INDICES[2]:

| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|
| Montreal CPI | 4.5 | 4.9 | 4.5 | 3.8 | 4.4 | 4.2 | 7.5 |
| Plastic Products | 2.0 | 4.3 | 3.7 | 10.5 | 3.5 | -1.3 | -1.7 |
| Paper Pulp | -13.4 | 10.9 | 23.8 | 16.1 | 11.1 | -4.7 | -27.7 |
| Primary Steel Prods. | 2.0 | 1.2 | 1.3 | 6.1 | 2.4 | -2.0 | -2.9 |
| Aluminium Prods. | -12.4 | 11.1 | 10.3 | 29.5 | -9.0 | -18.9 | -14.9 |
| Glass & Glass Prods. | 2.4 | 4.9 | 4.3 | 7.0 | 1.2 | -0.8 | -0.9 |
| Fabricated Metal Prods. | 3.1 | 3.1 | 3.1 | 4.5 | 3.2 | 0.9 | -0.2 |
| Machinery & Equipment | 3.5 | 2.4 | 2.4 | 3.6 | 4.8 | 2.2 | 1.4 |
| Elect.& Comm.Equipment | 2.6 | 3.0 | 2.6 | 4.2 | 3.6 | 0.2 | -0.5 |
| Non-Metallic Min.Prod. | 3.4 | 5.3 | 3.8 | 5.0 | 1.6 | 1.1 | -0.8 |
| Primary Steel Indust. | 2.0 | 1.0 | 1.3 | 6.1 | 2.3 | -1.7 | -2.9 |
| Average Hourly Wages including O.T.-Québec | | 4.2 | -0.5 | 7.5 | 7.3 | 4.5 | 3.5 |

1. Source: Hydro-Quebec produced June 1,1992

2. Source: SNC-Lavalin (Analyse Financiere Oct.1992 table 9)

# APPENDIX 3

## FORMULAE FOR FINANCIAL ANALYSIS

FORMULA 1: Longterm Financial Commitment

$L.F.C. = [C.T._N - C.T.]*0.00375/4$

where; $C.T._N$ cumulative total in the last construction period

C.T. cumulative total in the construction period in question

0.00375 factor applied to the undisbursed amount

4 refers to the quarterly periods during construction

FORMULA 2: Credit Establishment Fee

$C.E.F.= [C.T._N *1.25\%]$

where; $C.T._N$ cumulative total in the last construction period

1.25% refers to the percentage found in "Capital Costs" table

FORMULA 3: Cash Reserve (during last construction period)

$$CR=[TC_1-TR_1+REG_1+RR_1+RC_1-SC_1-OAC_1]*0.5$$

where; $TC_1$ total cost in first period of exploitation

$TR_1$ total revenue in first period of exploitation

$REG_1$ revenue from electricity in first period

$RR_1$ revenue from recyclable products in first period

$RC_1$ revenue from compostable products in first period

$SC_1$ service costs in first period of exploitation

$OAC_1$ other annual costs in first period of exploitation

0.5 refers to the 45 day period or half of first period

FORMULA 4: Interest During Construction

$IDC_N = ST_N*[(1+AR/100)0.25 - 1]/2 + CT_{N-1}*[(1+AR/100)0.25 - 1]$

where; IDC interest during construction

ST sub-total of all capital costs before IDC

AR annual rate of interest (%)

CT cumulative total

N period in time

FORMULA 5: Calculation of Revenue from Electricity

RE = [AE*ETF]

where; AE annual energy = [ACR*FP]

ACR annual combustible refuse (Worksheet of Materials)

FP forecasted production in (kWh/T)

ETF energy tariff as stipulated in "Achat d'Électricite" contract

FORMULA 6: Calculation of Revenue from Electrical Power

REP = [PTF*CEP*WDCC]

where; PTF power tariff established in contract (same as above)

CEP contacted electrical-power (also in contract)

WDCC winter delivery contacted coefficient (in contract)

FORMULA 7: Total Revenue from Electrical Generation

REG = [RE+REP]

where; RE and REP are explained above

FORMULA 8: Semestrial Loan Repayment

$$S.L.R. = \frac{T.A.B.}{[1-(1+i)^{-N}]/i}$$

where; S.L.R. semestrial loan repayment
T.A.B. total amount borrowed during construction period (last period cumulative total-"Capital Costs")

i annual interest rate divided in half to reflect semestrial payment

N number of repayment periods, in this case 40.

FORMULA 9: Credits of Exploitation

| | THOUSANDS OF TONS | | |
|---|---|---|---|
| Percentage of revenues | Incinerator | Sorting Ctr. | Composting Ctr. |
| 5% | >350 T. | >100 T. | >50 T. |
| 25% | 350 to 413 T. | 100 to 118 T. | 50 to 59 T. |
| 50% | over 413 T. | over 118 T. | over 59 T. |

example 1, for composting center year 1997: tonnage=25013
revenue=261400

solution = 261400*0.05=13070 or 13.1 (thousand dollars)
this solution is in "Annual Expenditures" table

example 2, for incinerator year 1997: tonnage=375774 (combustible)
revenue=11278200 (net)

```
solution = (350000/375774)*0.05*11278200
                          +
           (375774-350000)*0.25*11278200
         =718.6 (thousand dollars) this solution is also found in
                                   the above-mentioned table
```

FORMULA 10: Surcharges of Service Costs

Example: Incinerator (from year 1997 onward):
(375774-350000)*(13/1000)*(1.043)*(1.02)^1997-1991.25

where; 375774-350000 implies excess quantities

13/1000 transportation costs for extra tonnage ($ 1991)

1.043 indexation rate from 1991 to 1992
(see table "Annual Expenditures")

1.02^ 1997-1991.25 indexation from 1992 til end of project (see above-mentioned table)

FORMULA 11: Increased Cash Reserves

$$ICR=[[(TC_N-TR_N+REG_N+RR_N+RC_N-SC_N-OAC_N)*0.125]-CR-\sum(ICR_0..ICR_M)]$$

where; ICR increased cash reserve

$TC_N$ total cost during period N

$TR_N$ total revenue during period N

$REG_N$ revenue from electrical generation period N

$RR_N$ revenue from recyclable products period N

$RC_N$ revenue from compost period N

$SC_N$ service cost period N

$OAC_N$ other annual costs period N

$ICR_M$ increased cash reserve equivalent to N-1

0.125 refers to 45 days of accounts payable and receivable during any period N

SUM(*) refers to previous cumulative calculated ICR

TAXES OF COMPOSTING CENTER: Characteristics of sites chosen

SITE 1*: Ste-Marie (north of Chemin Ste-Marie)
Town of Ste-Anne-de-Bellevue

Zoning: Industrial (approx. 100 000 sq. meters available) currently vacant and available public services

Owner: Groupe Belcourt 1

(* indicates most probable site selection for composting center)

SITE 2: Macdonald (north of Chemin Ste-Marie)
Town of Ste-Anne-de-Bellevue

Zoning: Rural (approx. 75 000 sq.meters available) currently vacant, no availability of public services, high ecological value of land

Owner: Macdonald College

SITE 3: Nord du Parc (boul. Senneville and L'Anse-à-l'Orme)
town of Senneville

Zoning: Rural/agricultural (approx. 75 000 sq.meters available) currently vacant, no available public services, future site of agricultural parc currently in planification by the M.U.C.

Owner: M.U.C.

Characteristics of site in Montreal East: Industrial Park of Mtl.E.

Zoning: Industrial (approx. 100 000+ sq. meters available) currently vacant and availability of public services

Owner: City of Montréal East

EVALUATION OF MUNICIPAL TAXES FOR COMPOSTING CTR.:
(Based primarily on characteristics of Site 1* with characteristics of Montréal E.).

-land zoned for industry

-vacancy and availability of public services

-area of at least 70 000 sq. meters

Approximated calculation given by Montreal E. = $199 578

# APPENDIX 4

## LIST OF FINANCIAL INSTITUTIONS

Bank of Montreal
Caisse Centrale Desjardins
Caisse de Depots
Canadian Life
Canadian Imperial Bank of Commerce
Citibank
Confederation Life
Credit Lyonnais
Credit Suisse
Gordon Capital
Metropolitain Life
National Bank of Canada
Royal Bank of Canada
Scotia Bank
Sun Life
Toronto Dominion Bank

# APPENDIX 5

## FORMULAE FOR SOCIAL ANALYSIS

FORMULA 1: Social Cost of Labour[1] (*based on Jenkins and Kuo-1978):

S.C.L.= $PW_T$ + (1-P)L or similarly S.C.L.= $PW_T$ + (52-P)L

where; P cumulative probability that an employee finds a new employment or in the other case the proportion of time in weeks that a worker hopes to be employed. Both of these scenarios are equivalent and will be used in the calculation of the social cost of labour.

$W_T$ annual brut salary including social benefits both public and private multiplied by a coefficient of 1.14 to account for the private marginal benefits and the taxes for the marginal public benefits paid to the governments by the employers. This information is obtained in Stats.Can.# 72-619, 1978. Unfortunately this publication is no longer in print and agents at Stats.Can. insist that this type of information is no longer available.

L leisure value of the employee

To determine the leisure value (L), we must calculate the following

$$L=\frac{W_1(1-T)-B[fU(1-t)+gA(1-t_m)]}{B}$$

where; $W_1$ weekly salary earned for a similar employment to the one occupied by the employee in question. This information is obtained in the Statistics Canada catalogue #72-002. This amount must be multiplied by a factor of 1.09 to account for the private marginal benefits received by the employees. This factor was obtained in Stats.Can.# 72-619. However, as explained above this information is not available in any new catalogue.

T combined (Federal and Provincial) marginal tax rate. This rate was obtained from Revenu Québec and Revenue Canada for the 1992 taxation year.

B correction factor which allows for the elimination of sur-remuneration due to unions and other institutional barriers. This factor represents the ratio of nominal(current) salary/competitive market salary.

f proportion of the unemployment period during which the employee receives the benefits from U.I.C.

U weekly U.I.C. benefits. This information can be obtained from the Statistics Canada catalogue #73-001. For 1993, this amount corresponds to 57% of the weekly salary (gross) upto an insurable maximum of 425$ per week. A marginal tax rate is equally applicable on this amount. It must be remembered that UIC payments are not a **cost** for society but merely a transfer payment between members of society. However, a reduction in UIC payments can mean a benefit for society in as far as the funds could be appropriated elsewhere (there are alternative uses for public money). Hence, we must include **U** in our determination of leisure value.

t marginal tax rate applicable on U.I.C. calculated by Canada Unemployment and Immigration Department based on the current taxation indices of Revenue Canada and Revenue Quebec.

g proportion of time unemployed where the employee has exhausted the U.I.C. benefits and have recourse to social assistance.

A weekly payments of social assistance.

$t_m$ marginal tax rate applicable to social assistance based on predominant taxation rates as established by Revenue Canada and Revenue Quebec.

In the case where people associate a positive psychological value to their leisure, the opportunity cost of labour must be greater than zero. The psychological value associated to leisure represents the minimal opportunity cost of labour. Even in the case of general unemployment, the economic cost of labour for a new project does not consist in the salary, but in the value that the involuntarily unemployed associate with their leisure and other non-remunerative activities. (Adapted from Martin, F., Evaluation des Projets, chp7.pg.3).

FORMULA 2: Social Benefit of Labour[2]

S.B.L.= S.N.- S.C.L.

where; S.N. nominal salary including social benefits

S.C.L. same as defined above

FORMULA 3: Opportunity Cost of Borrowing[3]

$$W=\frac{r(\mu S/\mu i)-p(\mu I/\mu i)}{(\mu S/\mu i)-(\mu I/\mu i)}$$

where: $\mu$ is the sign of a partial derivative

W is the social opportunity cost of the amount borrowed by government

r is the net return after tax on individual savings= the weighted average of these returns in different categories of revenue of individuals.

p is the marginal productivity (%) of capital before taxes in the private sector = the average weighted return on capital in different industrial sectors.

$\mu S/\mu i$ change in individual savings due to an increase in the interest rate. (positive change)

$\mu I/\mu i$ change in the amount invested in the private sector due to an increase in the interest rate. (negative change)

FORMULA 4: Social Cost of Capital[4] (S.C.C.)

$$S.C.C. = (10.022) * \frac{A.R.B_{LT}}{G.C.B._{LT}} * 1.035$$

where; 10.022 Jenkins (1977) social opportunity rate

$A.R.B._{LT}$ average on 5 years of long-term rate of borrowing by the municipalities of the Régie as determined from the net borrowing costs obtained by the Ministère des Affaires Municipales du Québec.

$G.C.B._{LT}$ average over 5 years on long-term rate of borrowing by the Government of Canada (as obtained from the Bank of Canada Review-table-F1).

1.035 inflation rate after 1996 is 3.5% this is done to change the social rate from constant terms to current terms to achieve comparability.

Source 1: Martin,F. Recueil de Cas ECN 6890, Cas 10 pg. 30-34

Source 2: IBID., pg.36

Source 3: Martin, F., Évaluation des Projets Privés et Publics, pg.19-22.

Source 4: Adapted from notes given by F.Martin, also contained in Jacques,G. and Miller,A., "Analyse Avantages-Coûts du Nouveau Système de Perception de la Société de Transport de Laval," étude de session, pg.19

Appendix of:

# CALCULATING SOCIAL COSTS OF LABOUR

# CALCULATING THE SOCIAL COST OF LABOUR

## PART 1: Auto Berpa

Approximate Vector Characteristics of (1) Administrator:

| | |
|---|---|
| Age | 50 |
| Seniority | 520 weeks (= 10 yrs.) |
| Education | 15 yrs. |
| Training* | 5 |
| Unemployment Rate | 13.9% |

Approximate Vector Characteristics of (both) Auto Mechanic Recyclers:

| | |
|---|---|
| Age | 35 |
| Seniority | 260 weeks (= 5 yrs.) |
| Education | 13 yrs. |
| Training* | 3 |
| Unemployment Rate | 13.9% |

Approximate Vector Characteristics of (4) Office Workers:

| | |
|---|---|
| Age | 30 |
| Seniority | 156 weeks (= 3 yrs.) |
| Education | 12 yrs. |
| Training* | 4 |
| Unemployment Rate | 13.9% |

* Classification Canadienne Descriptive des Professions, Tome 1, Canada Employment and Immigration, 1971.

| | |
|---|---|
| Administrator (Proprietor) | code 5730-118, training = 5 |
| Auto mechanics (recyclers) | code 8581-182, training = 3 |
| Office Workers (secretaries etc.) | code 4197-114, training = 4 |

"training" implies the level of rational evaluation either mathematically or organizationally.

PROBABILITIES OF EMPLOYMENT

PART 2: Auto Berpa

Administrator:

| Nbr. of days after Lay-Off | Calculation | Probability | Cumulative Probability |
|---|---|---|---|
| 30 | -2.04 | 2% | 2% |
| 31-90 | -1.66 | 5% | 7% |
| 1 yr. | -4.44 | 0% | 7% |
| 2 yrs. | -4.40 | 0% | 0% |

Auto Mechanic Recyclers:

| Nbr. of days after Lay-Off | Calculation | Probability | Cumulative Probability |
|---|---|---|---|
| 30 | -1.83 | 3% | 3% |
| 31-90 | -1.26 | 10% | 13% |
| 1 yr. | -3.95 | 0% | 13% |
| 2 yrs. | -3.90 | 0% | 13% |

Office Workers:

| Nbr. of days after Lay-Off | Calculation | Probability | Cumulative Probability |
|---|---|---|---|
| 30 | -1.74 | 4% | 4% |
| 31-90 | -1.10 | 14% | 17% |
| 1 yr. | -3.75 | 0% | 17% |
| 2 yrs. | -3.71 | 0% | 17% |

The vector sets of characteristics are determined in order to isolate the factors affecting the probability of re-employment. The cumulative probabilities of each type of worker indicates the probability of each group to find employment within prescribed time intervals. As can be noted, the estimates for these groups are not very high thus indicating that re-employment in the labour force (given the current unemployment rate) does not look very promising.

How calculations were done:

Ex.1 Administrator:

STEP 1:

using the coefficients in the Probit Table for the corresponding period intervals and multiplying by the vector of characteristics we obtain the value contained in the "calculation".

row vector (1,50,520,15,5,13.9)
multiplied(*)
column vector (.8730,-.0202,-.000189,.0536,.0165,-.1937)

= -2.04

STEP 2:

-using the standardized normal distribution table, we locate the above value (-2.04) and determine the probability. Since the distribution is symmetrical, negative values are equal to positive values. Thus, we note that the probability for the above example is equivalent to 0.5-.4793=.0207 or 2%.

STEP 3:

-the cumulative probability is obtained by taking the probability in the table and multiplying it by the number of workers still unemployed.

**example**: if we obtained 2% in the first period, then the second period will have 98% unemployment. Thus, we take the probability found in the second period and multiply it 98%, in this example, this is equal to 98%*5%=4.9% or 5%. We take this calculation and add it to the previous cumulative probability (in this case 2%) thereby obtaining 7% as a cumulative probability.

## ESTIMATING THE SOCIAL COST OF LABOUR

### PART 3: Auto Berpa

Administrator:

$W_1$ = $ 745.74 weekly salary (from Stats.Can. # 72-002 SIC 771-779) multiplied by a factor of 1.09 to take account of the private marginal benefits. This is necessary as Stats.Can. does not take into account these benefits when estimating the weekly salaries.

T = 35% (provincial= 21%, federal= 14%)

B = 1 (nominal salary=competitive salary)
*special case as Auto Berpa did not want to divulge salaries therefore salaries contained in Stats.Can. #72-002 had to be used as proxies in order to determine the "L".

f = 0.5 this is justified by the probability that a claimant, with the above characteristics, will not be eligible for the full portion of time allotted for receiving benefits. His previous salary and experience would indicate that he disposes of certain capabilities to avoid using U.I.C. as a longterm recourse for economic stability.

U = $425 represents maximum weekly salary allowable. The claimant in this case should be eligible for 50 weeks of U.I.C. benefits at 57% of gross weekly salary or to a maximum of $425.

t = 29% (provincial= 19%, federal= 10%) applicable taxes on U.I.C. benefits received by claimant

**"g & A" are not applicable in this case, as it is difficult to conceive that a person earning this sum per annum (and most likely a great deal more) would not be eligible for social assistance.

Calculating L:

$$L=\frac{W_1(1-T)-B[fU(1-t)+gA(1-t_m)]}{B}$$

We obtain a value of L = 333.84$/week

Thus, the social cost of labour (S.C.L.), as obtained through the formula in appendix 5 and the probability of finding new employment,

$$S.C.L.=PW_T+(1-P)L$$

We obtain a value of S.C.L. = 3160.69$/yr.

Auto Recyclers: using the same procedure as above but replacing the values by the following:

$W_1$ = \$598.09 weekly salary as obtained in Stats.Can.# 72-002 SIC 591-599 multiplied by factor 1.09 (see above).

T = 32% (provincial= 20%, federal= 12%)

B = 1 (same reasoning as above)

f = 0.9 (same as above)

U = \$340.91 weekly U.I.C. benefit calculated as 57% of weekly gross salary

t = 27% (provincial= 18%, federal= 9%) these are the applicable taxes on the amount of U.I.C. received by the claimant.

g = 5% justified by the amount of unemployment in the region and the unemployment in the sector.

A = \$473 this is the monthly base amount for a single person of no dependents who is eligible for social assistance. This is equivalent to \$118.25/week.

$t_m$ = 16% (provincial= 16%, federal= 0%).

Therefore, calculating L:

We obtain a value of L = \$177.75/week

Hence, the social cost of labour (from equation 2 and using the corresponding probabilities) is estimated at:

S.C.L. = \$ 3041.41/auto recycler/yr. (recall there are two auto recyclers)

Office Workers:

$W_1$ = \$418.11 weekly salary as found in Stats.Can.# 72-002 SIC 771 (for Canada) multiplied by 1.09.

T = 30% (provincial= 19%, federal= 11%)

B = 1 see above explanation

f = 0.9 see above explanation

U = \$238.32 weekly U.I.C. benefits constituting 57% of gross weekly salary.The claimant is eligible for 50 weeks worth of this benefit.

t = 24% (provincial= 17%, federal= 7%) these are the taxes applicable to the U.I.C. benefits.

g = 5% justified by the high unemployment rate in the sector and the economy.

A = \$473 base amount of monthly social assistance for single person eligible for social assistance. This amount is equivalent to 118.25\$/week.

$t_m$ = 16% see above for details

Thus, calculating L:

We obtain L = \$129.67/week

Hence, the social opportunity cost of labour:

S.C.L. = \$2824.27/office worker/yr.

Conclusion: Aggregate Social Opportunity Cost of Labour (A.S.O.C.L.)

We must take the SCL's calculated for each group of employees and multiply them by the number of employees in each group and

aggregate the sum of each group. From this, we will obtain the aggregated social opportunity cost of labour resulting from the closure of the firm.

A.S.O.C.L. = 3160.69 + 6082.82 + 11297.08 = $20540.59/yr.

## CALCULATING THE SOCIAL OPPORTUNITY COST OF LABOUR

### PART 4: CONSTRUCTION & EXPLOITATION

Construction:

Using a similar procedure as the one presented above, we will estimate the social benefit of labour of construction based on the formula presented in appendix 5 (S.B.L.).

STEP 1:

300 construction workers @ $44 500/yr. or $855.79/week in

1992 dollars (this was established by the C.S.S.T. based on a 52 week period at 40 hr./week)

Therefore, establishing the social opportunity cost of labour we must make use of the following data:

P = 26 — average number of weeks construction workers (all fields) are employed during a given year. This was obtained by Commission de Construction du Quebec based on 1992 data.

$W_T$ = $975.57 — weekly average salary as obtained by the Commission de Construction du Québec and the Commission de Sécurité et Santé du Travail based on a 40hr. work week, 52 weeks per annum, yielding an average of 44 500 (including social benefits). To this amount we have adjusted by a factor of 1.14 for marginal public benefits (in form of taxes) paid to the governments by the employers.

$W_1$ = \$726.91 weekly average salary as obtained in Stats.Can. #72-002 SIC 401-402, 411-417, 421-429. This average was multiplied by a factor of 1.09 (same as previous reasoning).

T = 34% (provincial= 20%, federal= 14%)

B = 1.34 This factor represents the ratio between the nominal salary and the competitive salary. This factor is used to correct for distortions presented in the data due to unionization of labourers in this sector.

f = 0.8 due to the unemployment in this sector (30.3% as indicated in Stats.Can.#71-001-construction sector), and the general number of weeks that construction workers are employed during a usual year, this factor still remains quite high to reflect these distortions.

U = \$425 weekly U.I.C. benefits representing the maximum insurable amount, which is <u>less than</u> 57% of weekly gross salary. The claimants in this case should be entitled to approximately 48 weeks of benefits.

t = 29% (provincial= 19%, federal= 10%).

g = 0.05 justified by the long period without work which, may in certain cases exhaust the U.I.C. benefits.[1]

A = \$473 (see above comments) or \$118.25/week

$t_m$ = 16% (provincial= 16%, federal= 0%).

Thus, L = \$111.66/week and S.C.L. = \$28 267.98/worker/year

Therefore, the social benefit of employment consists in using the formula: S.B.L. = S.N. - S.C.L.

S.B.L. = 50 730 - 28 267.98 = \$22462.02/worker/year

For approximately 300 construction workers, the annual social benefit is $6 738 606/year.

It is important to mention that due to the lack of accurate information pertaining to the number of employees in each period of construction, we have little choice but to impute the entire above amount for each year of construction.

EXPLOITATION:

Incinerator: total employees= 42 listed as follows:

| | *$W_T$ ($/yr.) | SIC | *$W_1$ ($/week) |
|---|---|---|---|
| 1 director (adm.) | 91 200 | 812-837 | 767.79 |
| 3 shift supervisors | 53 800 | 338 | 815.37 |
| 1 maint. foreman | 45 600 | 338 | 815.37 |
| 3 control room optrs | 45 000 | 338 | 815.37 |
| 3 machine mechanics | 43 320 | 311-319 | 751.95 |
| 7 tech. operators | 39 900 | 301-309 | 646.42 |
| 2 welders | 39 900 | 422 | 651.14 |
| 2 plumbers | 39 900 | 424 | 651.14 |
| 10 plumbing mechanics | 38 760 | 425 | 651.14 |
| 10 workers | 37 620 | 832-837 | 689.50 |

* these amounts have been modified by the corrective factors of 1.14 and 1.09 for $W_T$ and $W_1$ respectively.

The social opportunity cost of labour for each group is calculated below as follows:

Administrator:

P = 50 number of weeks that individual expects to work

$W_1$ = \$767.78 modified by factor 1.09

T = 36% (provincial= 21%, federal= 15%)

B = 2 ratio of nominal salary to competitive salary, it is important to note that the comparative salary in Stats.Can. is far from being accurate in this case as there exists no general listing of remuneration for administrators. This problem will undoubtedly persist in subsequent evaluations involving the other employees' salaries.

f = 0.5 (see explanation for Auto Berpa administrator)

U = \$425 The claimant in this situation has recourse to full benefit for all the prescribed insurable weeks. However, as mentioned earlier, it is not likely that he/she will take full advantage of U.I.C. benefits.

t = 29% (see previous calculation of tax rate)

g & A are not applicable for the same reasons stated in the Auto Berpa administrator case.

We obtain L= \$94.81/week; S.C.L. = \$87 881.93/yr; S.B.L.= 3318.07

The rest of the calculations will not be shown due to the lengthiness of the process. However, if special circumstances apply they will be duly noted.

| Incinerator (cont'd) | Per Employee | | |
|---|---|---|---|
| | L($/week) | S.C.L.($/yr.) | S.B.L.($/yr.) |
| 3 shift supervisors | 260.34 | 52 251.18 | 1548.8 |
| 1 maint.foreman | 334.55 | 44 515.10 | 1084.90 |
| 3 control room optrs | 340.95 | 43 950.90 | 1049.10 |
| 3 machine mechanics | 239.72 | 42 133.29 | 1186.71 |
| 7 tech. operators | 137.31 | 38 640.12 | 1259.88 |
| 2 welders* | 161.73 | 38 688.84 | 1211.16 |
| 2 plumbers* | 161.73 | 38 688.84 | 1211.16 |
| 10 plumbing mechanics* | 171.92 | 37 612.84 | 1147.16 |
| 10 workers* | 182.75 | 36 538.50 | 1081.50 |

* implies these people are entitled to social assistance

Total S.B.L. for all employed for the incinerator = $51 814.16/yr.

Sorting Center: total employees= 29 (1996.3) to 38 (2000)

| | *$W_T$($/yr.) | SIC | *$W_1$($/week) |
|---|---|---|---|
| 1 director (adm) | 77 520 | 812-837 | 767.79 |
| 1 assit. director | 54 500 | 812-837 | 767.79 |
| 1 maint. supervisor | 43 600 | 338 | 815.37 |
| 3 mechanics | 39 240 | 311-319 | 751.95 |
| 23 to 32 sorters | 34 200 | 181-183 | 577.74 |

| Sorting center (cont'd) | Per Employee | | |
|---|---|---|---|
| | L($/week) | S.C.L.($/yr.) | S.B.L.($/yr.) |
| 1 director | 102.42 | 74 743.34 | 2776.66 |
| 1 assit. director | 209.11 | 52 822.22 | 1677.78 |
| 1 maint.supervisor | 356.91 | 42 636.82 | 963.18 |
| 3 mechanics | 283.76 | 38 298.52 | 941.48 |
| 23 to 32 sorters* | 150.38 | 33 185.26 | 1014.74 |

* implies this group is eligible for social assistance

Total S.B.L. for all employed by Sorting Center:

Sorting Ctr. with 23 sorters = $31 581.08/yr.

Sorting Ctr. with 26 sorters = $35 328.34/yr.

Sorting Ctr. with 29 sorters = $37 669.52/yr.

Sorting Ctr. with 32 sorters = $40 713.74/yr.

Composting Ctr.: total employed= 6 (based on the following hypothetical criteria)

| | *$W_T$($/yr.) | SIC | *$W_1$($/week) |
|---|---|---|---|
| 1 administrator | 68 400 | 812-837 | 767.79 |
| 1 supervisor | 53 580 | 812-837 | 767.79 |
| 4 workers | 34 200 | 181-183 | 577.74 |

* implies figures already adjusted by 1.14 for $W_T$ and 1.09 for $W_1$.

| Composting center (cont'd) | | Per Employee | |
|---|---|---|---|
| | L($/week) | S.C.L.($/yr.) | S.B.L.($/yr.) |
| 1 administrator | 135.98 | 66 040.96 | 2359.04 |
| 1 supervisor | 215.28 | 51 949.56 | 1630.44 |
| 4 workers* | 150.38 | 33 185.26 | 1014.74 |

* implies this group eligible for social assistance
Total S.B.L. for Composting Ctr.: = $8 048.44/yr.

## TOTAL S.B.L. ALL CENTERS

$Total^1$ = { 8 048.44 + 51 814.16 + 31 581.08 } = $91 443.68/yr.

$Total^2$ = { 8 048.44 + 51 814.16 + 35 328.34 } = $95 190.94/yr.

$Total^3$ = { 8 048.44 + 51 814.16 + 37 669.52 } = $97 532.12/yr.

$Total^4$ = { 8 048.44 + 51 814.16 + 40 713.74 } = $100 576.34/yr.

*****above indices refer to different amounts of personnel for Sorting Ctr.******

## BIBLIOGRAPHICAL REFERENCES


Association des Entrepreneurs en Construction du Québec, "Coût Horaire- de la Main d'Oeuvre dans l'industrie de la Construction selon le Décret et les Lois", L'A.E.C.Q., January 1993, 48 pgs.

Bank of Canada, Bank of Canada Review- table F1, Bank of Canada, Ottawa, May 1988- December 1992.

Bell-Canada, "Annual Report- 1992", Bell-Canada, Montréal, March 1993.

Binger,A., and Hoffman,E., 3rd.ed., Microeconomics with Calculus, Harper-Collins Publishing, U.S.A., 1988.

Foster-Wheeler, "Les Coûts de Main-D'Oeuvre Directs", Foster-Wheeler, Montréal, March 1993, 1 page.

Hydro-Québec, "Prévisions des Taux D'Inflation, Canada et États-Unis", Dept. de Planification Hydro-Québec, Montréal, March 1993, 1pg.

Hydro-Québec, SIGED, "Contrat D'Achat D'Électricité", Hydro-Québec et SIGED, Montréal, December 1992.

Girard, L., "Évaluation Économique d'un Projet Public- Étude Avantages-Coûts d'un Projet D'Abolition du Péage sur le Pont Champlain", Dept.Sc.Économiques, Université de Montréal, 1990.

Jacques,G., et Miller, A. "Analyse Avantages-Coûts du Nouveau Système de Perception de la Société de Transport de la Ville de Laval", case-study presented in course ECN 6890, Dept.Sc.Économiques, Université de Montréal May 1992, 29pgs.

Jenkins, G.P.,"Public Utility Finance and Economic Waste", Canadian Journal of economics, August 1985, pg.484-498.

Jenkins, G.P.,"Public Utility Finance and Pricing: A Reply", Canadian Journal Of Economics, February 1987, pg.172-176.

Jenkins, G.P. et Kuo, C.Y., "On Measuring the Social Opportunity Cost of Permanent and Temporary Employment," Canadian Journal of Economics, May 1978 pg 221-239.

Jenkins, G.P. et Montmarquette,C. "The Social Cost of Displaced Workers", Review of Economics and Statistics, September 1975, pg.342-353.

Martin, F., Évaluation des Projets Privés et Publics, recueil de notes de cours ECN 6811, Dept. Sc.Économiques, Université de Montréal, La Librairie de l'Université de Montréal, 1991.

Martin, F., Recueil de Cas ECN 6890, Dept.Sc.Économiques, Université de Montréal, La Librairie de L'Université de Montréal, 1990-1991.

Ministère des Affaires Municipales, "Coûts Nets D'Emprunt", Ministère des Affaires Municipales, Québec City, March 1993, 13 pgs.

Mishan, E.J., 4 ed., Cost-Benefit Analysis, an Informal Introduction, Unwin-Hyman Ltd., London, U.K., 1988.

Page,J. La Décision D'investissement en Contexte Canadien-Condition de Certitude, Université de Sherbrooke, 1987.

Page,J. et Lavallée, M., Le Facteur D'Intérêt dans la Prise de Décision Financière, Université de Sherbrooke, 1987.

Recyc-Québec, "Bilan des Résidus et des Déchets solides au Québec en 1992", Recy-Québec, March 1993, 5pgs.

Régie, et Foster-Wheeler,"Guarantee Contract", Régie and Foster-Wheeler, Montréal, December 1992.

Revenue Canada, "General tax Guide and Returns Federal Income Tax-1992 Tax Guide", Minister of Revenue and Taxation Canada, 1993.

Revenu Québec, "1992 Income Tax Return", Ministère du Revenu du Québec, 1993.

SIGED,et Foster-Wheeler, "Contrat de Conception et Construction", SIGED and Foster-Wheeler, Montréal, December 1992.

SNC-Lavalin, Analyse Économique-Révision 1, Groupe SNC-Lavalin, Montréal, October 1992

Spiro, P.S., "Public Utility Finance and the Cost of Capital: Comments on Jenkins", Canadian Journal of Economics, February 1987, pg.164-171.

Statistics Canada, Catalogue # 62-010 - Consumer Price Index, October to December 1992.

Statistics Canada, Catalogue # 71-001 - Labour Force Statistics, March 1993.

Statistics Canada, Catalogue # 72-002- Employment, Earnings, and Hours, January 1993.

Statistics Canada, Catalogue # 73-001- Unemployment Insurance Statistics, January 1993.

Tecsult Inc.[1], Projet de Valorisation des Déchets de la Régie Intermunicipale de Gestion des Déchets sur lîle de Montréal:Étude D'Impact sur L'environnement Déposée au Ministère de L'Environnement du Québec, Tecsult, Montréal,1990.

Tecsult Inc.[2], Projet de Valorisation des Déchets de la Régie Intermunicipale de Gestion des Déchets sur l'île de Montréal: Étude D'Impact sur L'environnement Déposée au Ministère de L'Environnment du Québec -Addenda 1 Supplémentaire:Étude D'Impact sur L'environnement, Tecsult, Montréal, May 1992.

Tecsult Inc.[3], Projet de Valorisation des Déchets de la Régie Intermunicipale de Gestion des Déchets sur l'île de Montréal: Étude D'Impact Déposée au Ministère de L'Environnement du Québec-Addenda 2 Mise à jour de l'étude d'impact, Tecsult, Montréal, March 1993.

Tecsult Inc.[4], Projet de Valorisation des Déchets de la Régie Intermunicipale de Gestion des Déchets sur l'île de Montréal: Étude D'Impact sur L'environnment Déposée au Ministère de L'Environnement de Québec- Préliminaire d'échancier sur Centre de Compostage, Tecsult, Montréal, April 1993.

Union Bank of Switzerland, "Project Review for the Executive Committee of the Régie", U.B.S., Montréal, July 30, 1992, 6 pages.

**Interviews:**

Mr.P.Lundhal Director of Environment Groupe SNC-Lavalin.

Ms.J.Méthot Assistant Director Régie Intermunicipale de Gestion des Déchets sur L'île de Montréal.

Mr.C.Schneeberger Co-ordinator of Impact Study-Tecsult Inc.

Ville de Montréal Est Dept.de Taxation et Évaluation

**Other:**

Public-Hearings of BAPE (Bureau des Audiences Publiques) March 22-April 2, 1993.

Commission de Construction du Québec: Annual Earnings of Construction workers (all 26 categories)

# LIST OF TABLES

TABLE: FINANCIAL SUMMARY

T1

FINANCIAL SUMMARY (CURRENT '000$)

| | | 1993.3* | 1993.4 | 1994.1 | 1994.2 | 1994.3 | 1994.4 | 1995.1 | 1995.2 | 1995.3 | 1995.4 | 1996.1 | 1996.2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EXPENDITURES DURING CONSTRUCTION: | | 33491.9 | 22156.9 | 31980.4 | 18463.6 | 7668.1 | 28170.3 | 71947.5 | 30400.8 | 15325 | 16576.8 | 14427.3 | 25016.9 |
| CONSTRUCTION COSTS: | | 16415.1 | 19873 | 28553.2 | 15532.9 | 4797 | 24213.1 | 64416 | 24670 | 10322.4 | 11007.7 | 8723.4 | 4154.9 |
| -Materials & equipment etc. | | 12147.6 | 15097.7 | 21692.1 | 11800.5 | 3644.3 | 18394.9 | 48937.3 | 18742 | 7115 | 7635.6 | 5900.2 | 2429.5 |
| -Manpower | | 3842.2 | 4775.3 | 6861.1 | 3732.4 | 1152.7 | 5818.2 | 15478.7 | 5928 | 2250.4 | 2415.1 | 1866.2 | 768.4 |
| -Compost ctr.(incl.labour) | | 425.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 957 | 957 | 957 | 957 |
| COSTS OF DEVELOPMENT & FINANCING | | 15647.7 | 296.1 | 266.7 | 249.8 | 295.9 | 190.1 | 123.1 | 94.8 | 135.1 | 64.7 | 51.9 | 267.5 |
| OTHER CONSTRUCTION COSTS: | | 469.7 | 387.1 | 723.2 | 308.4 | 395.9 | 487.2 | 1615.3 | 507.5 | 494.1 | 209.8 | 168.6 | 685.1 |
| -Line to H.Q. | | 160 | 0 | 160 | 0 | 300 | 0 | 300 | 0 | 300 | 0 | 0 | 616 |
| -Gen.& Admin.costs | | 309.7 | 387.1 | 563.2 | 308.4 | 95.9 | 487.2 | 1315.3 | 507.5 | 194.1 | 209.8 | 168.6 | 69.1 |
| RESERVE DEBT SERVICE | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9532 |
| CASH RESERVES | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4719.7 |
| UNFORESSEN COSTS | | 656.6 | 794.9 | 1142.1 | 621.3 | 191.9 | 968.5 | 2576.6 | 986.8 | 412.9 | 440.3 | 348.9 | 166.2 |
| I.D.C. | | 302.8 | 805.8 | 1295.2 | 1751.2 | 1987.4 | 2311.4 | 3216.5 | 4141.7 | 4560.5 | 4854.3 | 5134.5 | 5491.5 |
| SUM TOTAL CONSTRUCTION COSTS | 316224.6 | | | | | | | | | | | | |

| | 1996.3** | 1996.4 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REVENUES OF EXPLOITATION: | 2706.5 | 2689.5 | 17582.5 | 19394.5 | 19736.1 | 20236.6 | 20822 | 21418.7 | 22048.9 | 22675.6 | 23343.9 | 24037.5 | 24738.8 | 25477.4 | 26214.4 | 26989 | 27785.5 | 28585 | 29453.9 | 30326 | 31234.4 | 41487.6 |
| SALE OF ELECTRICITY | 1870.4 | 1870.4 | 13481.4 | 14341.5 | 14107.8 | 14337.5 | 14865 | 15396.7 | 15962 | 16528.8 | 17132.1 | 17762.4 | 18400.4 | 19069.5 | 19742.8 | 20453.8 | 21183.2 | 21920.2 | 22721.5 | 23526.1 | 24366.5 | 25213.1 |
| SALE OF RECYC.PRODUCTS | 664.2 | 647.1 | 3410.8 | 4359.4 | 4931.7 | 5199.5 | 5254.7 | 5316 | 5377.7 | 5434.4 | 5496.1 | 5556.3 | 5616.1 | 5682.2 | 5742.7 | 5802.9 | 5866.7 | 5925.9 | 5990.2 | 6054.3 | 6118.8 | 6204.3 |
| SALE OF COMPOST | 64.7 | 64.8 | 261.4 | 264.7 | 267.7 | 270.7 | 273.4 | 277.1 | 280.3 | 283.5 | 286.8 | 289.9 | 293.4 | 296.8 | 300 | 303.4 | 306.7 | 310 | 313.3 | 316.7 | 320.2 | 323.6 |
| RETURN ON INTEREST (4.5% per annum) | 107.2 | 107.2 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 | 214.5 |
| DEBT RESERVE REIMBURSEMENT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9532.1 |

T2

| | 1996.3** | 1996.4 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EXPENDITURES OF EXPLOITATION: | 17925.5 | 17980.3 | 73524.2 | 75665.2 | 76589.3 | 77470.9 | 78463.8 | 79489.5 | 80560.9 | 81594.3 | 82717.7 | 83834.1 | 84968.8 | 86172.2 | 87400.8 | 88660.6 | 89931.9 | 91240.1 | 92601.6 | 93978.2 | 95418.9 | 96938.9 |
| DEBT SERVICING | 9532 | 9532 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 | 38128 |
| LENDING AGENCY'S FEE | 14.5 | 14.6 | 59.9 | 62 | 64.2 | 66.4 | 68.7 | 71.1 | 73.6 | 76.2 | 78.9 | 81.6 | 84.5 | 87.4 | 90.5 | 93.7 | 97 | 100.3 | 103.9 | 107.5 | 111.3 | 115.2 |
| SERVICE COSTS | 7589.6 | 7639.8 | 32124.8 | 34191.2 | 35036.8 | 35837.7 | 36745.9 | 37686.9 | 38667.2 | 39607.6 | 40633.9 | 41651.2 | 42684.3 | 43780.4 | 44899.1 | 46045.4 | 47196.7 | 48383.1 | 49618.4 | 50864.7 | 52169 | 53529.5 |
| OTHER ANNUAL EXPENDITURES: | 789.4 | 793.8 | 3211.3 | 3283.7 | 3360.1 | 3438.5 | 3520.9 | 3603.2 | 3691.8 | 3782.1 | 3876.6 | 3973 | 4071.6 | 4176.1 | 4282.7 | 4393.2 | 4509.7 | 4628.3 | 4750.9 | 4877.5 | 5010.2 | 4590.4 |
| -Tot.municip. taxes (Mtl.E.& W.Is.) | 511.1 | 515.5 | 2098.3 | 2170.7 | 2247.1 | 2325.5 | 2407.9 | 2490.2 | 2578.8 | 2669.1 | 2763.6 | 2860 | 2958.6 | 3063.1 | 3169.7 | 3280.2 | 3396.7 | 3515.3 | 3637.9 | 3764.5 | 3897.2 | 4033.9 |
| -Amortised rent & expropriation | 278.3 | 278.3 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 556.5 |
| INCREASED CASH RESERVES | 0 | 0 | 0.2 | 0.3 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.3 | 0.5 | 0.4 | 0.4 | 0.5 | 0.5 | -1309.8 |
| WASTE TREATMENT COSTS- per annum | 15219 | 15290.8 | 55941.7 | 56270.7 | 56853.2 | 57234.3 | 57641.8 | 58070.8 | 58512 | 58918.7 | 59373.8 | 59796.6 | 60230 | 60694.8 | 61186.4 | 61671.6 | 62146.4 | 62655.1 | 63147.7 | 63652.2 | 64184.5 | 53711.3 |
| TARIFF-$/T. | 130 | 130.6 | 108.3 | 99.5 | 101.1 | 102.3 | 102.9 | 103.5 | 104.1 | 104.7 | 105.3 | 105.9 | 106.6 | 107.3 | 108 | 108.7 | 109.5 | 110.3 | 111.1 | 111.9 | 112.8 | 94.3 |

NET COST OVER 20yrs. EXPLOITATION: 1222403.

TABLE:CAPITAL COSTS

CAPITAL COSTS (`000$)

SUBMITTED CONSTRUCTION COSTS:Incinerator, Sorting Ctr., Composting Ctr.

| | | Costs-`92 | Costs-`93* |
|---|---|---|---|
| **COSTS-INCINERATOR-`91 | | | |
| -Develop.costs | 10366.8 | 10501.6 | 10736.3 |
| -Site prep. | 4473.3 | 4531.1 | 4632.4 |
| -Arc.chim.treatmt. | 1900 | 1924.7 | 1967.7 |
| -Building | 23316.5 | 23619.6 | 24147.5 |
| -Combust.equipmt. | 47119.6 | 47732.2 | 48799 |
| -Anti atm.pol.eqp. | 17501.6 | 17729.1 | 18125.3 |
| -Elec.gen.equipmt. | 11474.5 | 11623.7 | 11883.5 |
| -Cooling equipmt. | 7614 | 7713 | 7885.4 |
| -Foundations& Dump | 9143.4 | 9262.3 | 9469.3 |
| -Ash removal eqp. | 3480.9 | 3526.1 | 3604.9 |
| -Start-up & tests. | 7088 | 7180.1 | 7340.6 |
| Other | 5899.9 | 5976.6 | 6110.2 |
| Total | 149378.5 | 151320.1 | 154702.1 |

*(costs are indexed at 2% to financial closure 1993.3 only)
**(costs do not include labour)

| | | Costs-`92 | Costs-`93* |
|---|---|---|---|
| **COSTS-SORTING Ctr.-`91 | | | |
| -Developmt.costs | 514.4 | 521.1 | 532.7 |
| -Site prep. work | 457.7 | 463.6 | 474 |
| -Buildings | 10602.9 | 10740.7 | 10980.8 |
| -Equipment | 5979.4 | 6057.1 | 6192.5 |
| -Start-up & tests. | 212.4 | 215.2 | 220 |
| Other | 419.6 | 425.1 | 434.6 |
| Total | 18186.4 | 18422.8 | 18834.6 |

**(costs do not include labour)

| | | Costs-`92 | Costs-`93* |
|---|---|---|---|
| COSTS COMPOSTING Ctr.-`91 (includes labour) | | | |
| -Agregated costs | 4107 | 4160.4 | 4253.4 |

| | | Costs-`92 | Costs-`93* |
|---|---|---|---|
| TOTAL LABOUR EXCLUDING COMPOST Ctr. (300 pers.+)-`91 | 53000 | 53689 | 54888.9 |

| | 1993.3* | 1993.4 | 1994.1 | 1994.2 | 1994.3 | 1994.4 | 1995.1 | 1995.2 | 1995.3 | 1995.4 | 1996.1 | 1996.2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Calendar payments Incin.& Sort.ctrs.(%) | 7 | 8.7 | 12.5 | 6.8 | 2.1 | 10.6 | 28.2 | 10.8 | 4.1 | 4.4 | 3.4 | 1.4 |
| Calendar payments manpower excl.Comp.ctr.(%) | 7 | 8.7 | 12.5 | 6.8 | 2.1 | 10.6 | 28.2 | 10.8 | 4.1 | 4.4 | 3.4 | 1.4 |
| Calendar payments Comp.ctr.(%) | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22.5 | 22.5 | 22.5 | 22.5 |
| Progressive paymts. Incin.& Sort.ctrs. | 12147.6 | 15097.7 | 21692.1 | 11800.5 | 3644.3 | 18394.9 | 48937.3 | 18742 | 7115 | 7635.6 | 5900.2 | 2429.5 |
| Progressive paymts. manpwr.excl.Comp.ctr. | 3842.2 | 4775.3 | 6861.1 | 3732.4 | 1152.7 | 5818.2 | 15478.7 | 5928 | 2250.4 | 2415.1 | 1866.2 | 768.4 |
| Progressive paymts. Comp.ctr. | 425.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 957 | 957 | 957 | 957 |
| TOTAL CONSTRUCTION COSTS | 16415.1 | 19873 | 28553.2 | 15532.9 | 4797 | 24213.1 | 64416 | 24670 | 10322.4 | 11007.7 | 8723.4 | 4154.9 |

T4

| | 1993.3* | 1993.4 | 1994.1 | 1994.2 | 1994.3 | 1994.4 | 1995.1 | 1995.2 | 1995.3 | 1995.4 | 1996.1 | 1996.2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *FEES & COSTS OF DEVELOPMENT | 9577 | | | | | | | | | | | |
| Judicial Costs | 3077 | | | | | | | | | | | |
| Engineering | 734 | | | | | | | | | | | |
| Env.Impact Study & Permit | 2435 | | | | | | | | | | | |
| Financing | 467 | | | | | | | | | | | |
| Com.& pub. affairs | 2334 | | | | | | | | | | | |
| Other | 530 | | | | | | | | | | | |
| * these are projected costs-includes private indexation | | | | | | | | | | | | |
| FINANCIAL COSTS AND FEES | 6070.4 | 296.1 | 266.7 | 249.8 | 295.9 | 190.1 | 123 | 94.7 | 135 | 64.7 | 51.9 | 267.5 |
| L.T. Financial Commitmt.(.375%) | 0 | 244.3 | 214.3 | 197 | 189.8 | 163.4 | 95.9 | 67.4 | 52.5 | 37 | 23.5 | 0 |
| Lending Agency's Fee (indexed at variable rates) | 51.4 | 0 | 0 | 0 | 53.1 | 0 | 0 | 0 | 55 | 0 | 0 | 0 |
| Credit Establishmt. Fee (1.25%) | 3953 | | | | | | | | | | | |
| Indexation at variable rates | | | | | | | | | | | | |
| Lender's Legal Consellor | 720.2 | 25.9 | 26.2 | 26.4 | 26.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lender's Engineering Adviser | 102.9 | 25.9 | 26.2 | 26.4 | 26.5 | 26.7 | 27.1 | 27.3 | 27.5 | 27.7 | 28.4 | 57.4 |
| Lender's Environmtl. Adviser | 102.9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 110.1 |
| Lender's Insurance Adviser | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U.B.S. Financial Consultant Fees | 1120 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other (unforecasted costs) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| OTHER COSTS DURING CONSTRUCTION | 469.7 | 387.1 | 723.2 | 308.4 | 395.9 | 487.2 | 1615.3 | 507.5 | 494.1 | 209.8 | 168.6 | 685.1 |
| *H.Q. System Integration Fees | 160 | 0 | 160 | 0 | 300 | 0 | 300 | 0 | 300 | 0 | 0 | 616 |
| G & A (internal/external) Costs | 309.7 | 387.1 | 563.2 | 308.4 | 95.9 | 487.2 | 1315.3 | 507.5 | 194.1 | 209.8 | 168.6 | 69.1 |
| RESERVE-DEBT SERVICE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9532 |
| CASH RESERVES | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4719.7 |
| OTHER COSTS | 656.6 | 794.9 | 1142.1 | 621.3 | 191.9 | 968.5 | 2576.6 | 986.8 | 412.9 | 440.3 | 348.9 | 166.2 |
| SUB-TOTAL | 33188.8 | 21351.1 | 30685.2 | 16712.4 | 5680.7 | 25858.9 | 68730.9 | 26259 | 11364.4 | 11722.5 | 9292.8 | 19525.4 |
| INTEREST DURING CONSTRUCTION (IDC)- ANNUAL RATE 7.5% | 302.8 | 805.8 | 1295.2 | 1751.2 | 1987.4 | 2311.4 | 3216.5 | 4141.7 | 4560.4 | 4854.3 | 5134.5 | 5491.1 |
| TOTAL | 33491.6 | 22156.9 | 31980.4 | 18463.6 | 7668.1 | 28170.3 | 71947.4 | 30400.7 | 15924.8 | 16576.8 | 14427.3 | 25016.5 |
| CUMMULATIVE TOTAL | 33491.6 | 55648.5 | 87628.9 | 106092.5 | 113760.6 | 141930.9 | 213878.3 | 244279 | 260203.8 | 276780.6 | 291207.9 | 316224.6 |

DATA ON LOAN: ANNUAL INTEREST RATE- % 10.5 NUMBER OF REIMBURSEMENT INSTALLMENTS 40
SEMESTRIAL PAYMENTS-('000$) 19064

TABLE: ENERGY

| | | 1996.3 | 1996.4 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ELECTRICITY AIDED BY GAS | | | | | | | | | | | | | | | | | | | | | | | |
| Garanteed prod.(kWh/T) | 684 | | | | | | | | | | | | | | | | | | | | | | |
| E.S.F. base-elect.(kWh/T) | 725 | | | | | | | | | | | | | | | | | | | | | | |
| Forecasted prod. (kWh/T) | 719 | | | | | | | | | | | | | | | | | | | | | | |
| Fraction energy winter | 0.297 | | | | | | | | | | | | | | | | | | | | | | |
| Contracted elect.power (kW) | 40000 | | | | | | | | | | | | | | | | | | | | | | |
| Elect. energy produced by waste (kWh) | | 62348 | 62348 | 270182 | 289047 | 277140 | 271060 | 271474 | 271888 | 272301 | 272715 | 273129 | 273793 | 274134 | 274476 | 274835 | 274972 | 275142 | 275312 | 275482 | 275678 | 275874 | |
| Aver. power winter/refuse (kW) | | 0 | 0 | 28097 | 30058 | 28820 | 28188 | 28231 | 28274 | 28317 | 28360 | 28403 | 28472 | 28508 | 28543 | 28581 | 28595 | 28613 | 28630 | 28648 | 28668 | 28689 | |
| Elect. energy produced by gas (kWh) | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Aver. power winter/gas (kW) | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Annual energy generated (MWh) | | 62348 | 62348 | 270182 | 289047 | 277140 | 271060 | 271474 | 271888 | 272301 | 272715 | 273129 | 273793 | 274134 | 274476 | 274835 | 274972 | 275142 | 275312 | 275482 | 275678 | 275874 | |
| Aver. power delivered winter (kW) | | 0 | 0 | 28097 | 30058 | 28820 | 28188 | 28231 | 28274 | 28317 | 28360 | 28403 | 28472 | 28508 | 28543 | 28581 | 28595 | 28613 | 28630 | 28648 | 28668 | 28689 | |
| Winter delivery coeff. | | 0 | 0 | 0.7024 | 0.7515 | 0.7205 | 0.7047 | 0.7058 | 0.7069 | 0.7079 | 0.709 | 0.7101 | 0.7118 | 0.7127 | 0.7136 | 0.7145 | 0.7149 | 0.7153 | 0.7158 | 0.7162 | 0.7167 | 0.7172 | |
| Annual energy/contract-MWh | 280000 | | | | | | | | | | | | | | | | | | | | | | |
| Winter delivery contr.coef | 0.702 | | | | | | | | | | | | | | | | | | | | | | |
| PURCHASE OF ELECTRICITY | | | | | | | | | | | | | | | | | | | | | | | |
| Internal utilisation (MWh) | 48000 | 12000 | 12000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 | 48000 |

TABLE: MATERIALS- TONS

Worksheet of Materials-Tonnes

| | 1996.3 | 1996.4 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COMPOST | | | | | | | | | | | | | | | | | | | | | | |
| Total compostable waste | 12481 | 12481 | 50026 | 50125 | 50220 | 50311 | 50391 | 50471 | 50551 | 50631 | 50711 | 50776 | 50841 | 50907 | 50972 | 51037 | 51078 | 51118 | 51159 | 51159 | 51240 | 51281 |
| Compost produced (50%) | 6240 | 6240 | 25013 | 25063 | 25110 | 25156 | 25196 | 25236 | 25276 | 25316 | 25356 | 25388 | 25421 | 25453 | 25486 | 25519 | 25539 | 25559 | 25579 | 25600 | 25620 | 25640 |
| Landfill residues (5%) | 624 | 624 | 2501 | 2506 | 2511 | 2516 | 2520 | 2524 | 2528 | 2532 | 2536 | 2539 | 2542 | 2545 | 2549 | 2552 | 2554 | 2556 | 2558 | 2560 | 2562 | 2564 |
| SORTING CENTER | | | | | | | | | | | | | | | | | | | | | | |
| Total recyc. materials | 17200 | 17200 | 90596 | 114809 | 129702 | 136172 | 136351 | 136529 | 136708 | 136886 | 137065 | 137180 | 137320 | 137461 | 137601 | 137766 | 137856 | 137946 | 138036 | 138127 | 138219 | 138837 |
| Paper&Cardbord | | | | | | | | | | | | | | | | | | | | | | |
| -Cardboard | 5522 | 5522 | 28801 | 36120 | 40362 | 41934 | 41979 | 42025 | 42070 | 42116 | 42161 | 42195 | 42229 | 42262 | 42296 | 42330 | 42353 | 42376 | 42399 | 42422 | 42445 | 42594 |
| -Newspaper | 4487 | 4487 | 23950 | 30767 | 35227 | 37495 | 37555 | 37615 | 37674 | 37734 | 37794 | 37843 | 37892 | 37942 | 37991 | 38040 | 38070 | 38100 | 38130 | 38160 | 38190 | 38389 |
| -Mixed paper | 2871 | 2871 | 15277 | 19570 | 22342 | 23712 | 23748 | 23784 | 23821 | 23857 | 23893 | 23923 | 23954 | 23964 | 24015 | 24045 | 24063 | 24081 | 24099 | 24117 | 24135 | 24255 |
| Plastics | | | | | | | | | | | | | | | | | | | | | | |
| -HDPE | 23 | 23 | 121 | 152 | 170 | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 179 | 180 |
| -PET | 504 | 504 | 2627 | 3295 | 3684 | 3825 | 3829 | 3833 | 3838 | 3842 | 3846 | 3849 | 3852 | 3855 | 3858 | 3861 | 3863 | 3865 | 3867 | 3869 | 3872 | 3886 |
| Glass | | | | | | | | | | | | | | | | | | | | | | |
| -Clear | 873 | 873 | 4550 | 5706 | 6380 | 6625 | 6632 | 6639 | 6647 | 6654 | 6661 | 6666 | 6671 | 6677 | 6682 | 6687 | 6691 | 6695 | 6698 | 6701 | 6705 | 6728 |
| -Colored | 596 | 596 | 3106 | 6895 | 4354 | 4521 | 4526 | 4531 | 4535 | 4540 | 4549 | 4552 | 4556 | 4559 | 4563 | 4566 | 4569 | 4571 | 4574 | 4576 | 4577 | 4595 |
| -Mixed | 283 | 283 | 1477 | 1852 | 2070 | 2150 | 2152 | 2155 | 2157 | 2160 | 2162 | 2164 | 2165 | 2167 | 2168 | 2170 | 2172 | 2173 | 2174 | 2175 | 2176 | 2184 |
| Metals | | | | | | | | | | | | | | | | | | | | | | |
| -Ferrous | 930 | 930 | 4852 | 6085 | 6802 | 7084 | 7072 | 7079 | 7087 | 7094 | 7102 | 7108 | 7113 | 7119 | 7124 | 7130 | 7134 | 7138 | 7142 | 7146 | 7150 | 7176 |
| -Aluminium | 220 | 220 | 1147 | 1439 | 1609 | 1670 | 1672 | 1674 | 1676 | 1678 | 1680 | 1681 | 1682 | 1684 | 1685 | 1686 | 1687 | 1688 | 1689 | 1690 | 1691 | 1697 |
| Waste to Landfill | 301 | 301 | 1589 | 1968 | 2201 | 2278 | 2282 | 2286 | 2290 | 2294 | 2298 | 2300 | 2301 | 2303 | 2304 | 2306 | 2308 | 2309 | 2311 | 2312 | 2314 | 2324 |
| Waste to Incinerate | 592 | 592 | 3121 | 3960 | 4481 | 4720 | 4725 | 4730 | 4735 | 4740 | 4745 | 4750 | 4755 | 4760 | 4765 | 4770 | 4773 | 4776 | 4779 | 4781 | 4785 | 4830 |
| INCINERATOR | | | | | | | | | | | | | | | | | | | | | | |
| Total waste received | 87367 | 87367 | 375975 | 400548 | 382638 | 373111 | 373683 | 374255 | 374826 | 375398 | 375970 | 376441 | 376911 | 377382 | 377852 | 378323 | 378555 | 378788 | 379020 | 379253 | 379485 | 379717 |
| -Waste from Sorting Ctr. | 592 | 592 | 3121 | 3960 | 4481 | 4720 | 4725 | 4730 | 4735 | 4740 | 4745 | 4750 | 4755 | 4760 | 4765 | 4770 | 4773 | 4776 | 4779 | 4781 | 4785 | 4830 |
| -Waste to landfill | 1243 | 1243 | 3322 | 2496 | 1667 | 635 | 836 | 838 | 839 | 841 | 842 | 843 | 844 | 845 | 846 | 847 | 848 | 849 | 850 | 851 | 852 | 856 |
| -Combustible refuse | 86716 | 86716 | 375774 | 402012 | 385452 | 376996 | 377571 | 378147 | 378722 | 379298 | 379873 | 380323 | 380797 | 381272 | 381746 | 382246 | 382480 | 382715 | 382949 | 383183 | 383419 | 383691 |
| -Fly ash (3%) | 2601 | 2601 | 11273 | 12060 | 11564 | 11310 | 11327 | 11344 | 11362 | 11379 | 11396 | 11410 | 11424 | 11438 | 11452 | 11467 | 11474 | 11481 | 11488 | 11495 | 11503 | 11511 |
| -Clinker (22%) | 19077 | 19077 | 82670 | 88443 | 84799 | 82939 | 83066 | 83192 | 83319 | 83445 | 83572 | 83671 | 83775 | 83880 | 83984 | 84094 | 84146 | 84197 | 84249 | 84300 | 84352 | 84412 |
| TOTAL WASTE RECEIVED | 117048 | 117048 | 516599 | 565482 | 562560 | 559594 | 560424 | 561255 | 562085 | 562916 | 563746 | 564397 | 565073 | 565749 | 566425 | 567126 | 567489 | 567852 | 568215 | 568579 | 568944 | 569835 |
| TOTAL RESIDUES TO LANDFILL | 2168 | 2168 | 7392 | 6970 | 6379 | 5629 | 5638 | 5647 | 5657 | 5666 | 5676 | 5681 | 5687 | 5693 | 5699 | 5705 | 5710 | 5714 | 5719 | 5723 | 5728 | 5744 |

TABLE: UNIT PRICES

UNIT PRICES

| | | 1996.3 | 1996.4 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COMPOST | | | | | | | | | | | | | | | | | | | | | | | |
| Indexation (1%) | | 1.005 | 1.007 | 1.013 | 1.023 | 1.033 | 1.043 | 1.053 | 1.064 | 1.075 | 1.085 | 1.096 | 1.107 | 1.118 | 1.13 | 1.141 | 1.152 | 1.164 | 1.175 | 1.187 | 1.199 | 1.211 | 1.223 |
| -un.price $/T 1992 | 10 | | | | | | | | | | | | | | | | | | | | | | |
| -price 1996 ($/T) | 10.32 | | | | | | | | | | | | | | | | | | | | | | |
| -compost prices | | 10.37 | 10.39 | 10.45 | 10.56 | 10.66 | 10.76 | 10.87 | 10.98 | 11.09 | 11.2 | 11.31 | 11.42 | 11.54 | 11.66 | 11.77 | 11.89 | 12.01 | 12.13 | 12.25 | 12.37 | 12.5 | 12.62 |
| RECYCLABLE PRODUCTS | | | | | | | | | | | | | | | | | | | | | | | |
| Index. of Recyc. prod. (1%) | | 1.005 | 1.007 | 1.013 | 1.023 | 1.033 | 1.043 | 1.053 | 1.064 | 1.075 | 1.085 | 1.096 | 1.107 | 1.118 | 1.13 | 1.141 | 1.152 | 1.164 | 1.175 | 1.187 | 1.199 | 1.211 | 1.223 |
| Paper & Cardboard | | | | | | | | | | | | | | | | | | | | | | | |
| -cardboard $/T-'92 | 22 | | | | | | | | | | | | | | | | | | | | | | |
| -cardboard $/T-'96 | 22.7 | 22.81 | 22.86 | 22.99 | 23.22 | 23.45 | 23.68 | 23.9 | 24.15 | 24.4 | 24.63 | 24.88 | 25.13 | 25.38 | 25.65 | 25.9 | 26.15 | 26.42 | 26.67 | 26.95 | 27.22 | 27.49 | 27.76 |
| -newspaper $/T-'92 | 30 | | | | | | | | | | | | | | | | | | | | | | |
| -newspaper $/T-'96 | 30.97 | 31.12 | 31.19 | 31.37 | 31.68 | 31.99 | 32.3 | 32.61 | 32.95 | 33.29 | 33.6 | 33.94 | 34.28 | 34.62 | 34.99 | 35.34 | 35.68 | 36.05 | 36.39 | 36.76 | 37.13 | 37.5 | 37.88 |
| -* other $/T | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Plastics | | | | | | | | | | | | | | | | | | | | | | | |
| -HDPE $/T 1992 | 100 | | | | | | | | | | | | | | | | | | | | | | |
| -HDPE $/T 1996 | 103.23 | 103.75 | 103.95 | 104.6 | 105.6 | 106.6 | 107.67 | 108.7 | 109.84 | 110.97 | 112 | 113.14 | 114.27 | 115.41 | 116.65 | 117.78 | 118.92 | 120.16 | 121.29 | 122.53 | 123.77 | 125.01 | 126.25 |
| -PET $/T 1992 | 210 | | | | | | | | | | | | | | | | | | | | | | |
| -PET $/T 1996 | 216.8 | 217.88 | 218.32 | 219.62 | 221.77 | 223.95 | 226.12 | 228.29 | 230.67 | 233.06 | 235.23 | 237.61 | 239.99 | 242.38 | 244.98 | 247.37 | 249.75 | 252.35 | 254.74 | 257.34 | 259.94 | 262.54 | 265.15 |
| Glass | | | | | | | | | | | | | | | | | | | | | | | |
| -clear $/T 1992 | 33 | | | | | | | | | | | | | | | | | | | | | | |
| -clear $/T 1996 | 34.07 | 34.24 | 34.31 | 34.51 | 34.85 | 35.19 | 35.53 | 35.87 | 36.25 | 36.62 | 36.96 | 37.34 | 37.71 | 38.09 | 38.5 | 38.87 | 39.25 | 39.66 | 40.03 | 40.44 | 40.85 | 41.26 | 41.68 |
| -colored $/T 1992 | 5 | | | | | | | | | | | | | | | | | | | | | | |
| -colored $/T 1996 | 5.16 | 5.18 | 5.19 | 5.23 | 5.27 | 5.33 | 5.38 | 5.43 | 5.49 | 5.55 | 5.6 | 5.65 | 5.71 | 5.77 | 5.83 | 5.89 | 5.94 | 6 | 6.06 | 6.12 | 6.19 | 6.25 | 6.31 |
| -aggregates $/T | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Metals | | | | | | | | | | | | | | | | | | | | | | | |
| -ferrous $/T 1992 | 40 | | | | | | | | | | | | | | | | | | | | | | |
| -ferrous $/T 1996 | 41.3 | 41.51 | 41.59 | 41.84 | 42.25 | 42.66 | 43.07 | 43.49 | 43.94 | 44.39 | 44.81 | 45.26 | 45.72 | 46.17 | 46.67 | 47.12 | 47.58 | 48.07 | 48.53 | 49.02 | 49.52 | 50.01 | 50.51 |
| -aluminium $/T-'92 | 860 | | | | | | | | | | | | | | | | | | | | | | |
| -aluminium $/T-'96 | 887.35 | 892.29 | 894.06 | 899.39 | 908.27 | 917.15 | 926.03 | 934.91 | 944.67 | 954.44 | 963.32 | 973.08 | 982.85 | 992.62 | 1003.27 | 1013.04 | 1022.8 | 1033.45 | 1043.22 | 1053.88 | 1064.53 | 1075.18 | 1085.84 |

| ELIMINATION OF RESIDUES | | 1996.3 | 1996.4 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Indexation (3.5%) | | 1.017 | 1.026 | 1.044 | 1.08 | 1.118 | 1.157 | 1.198 | 1.239 | 1.283 | 1.328 | 1.375 | 1.423 | 1.472 | 1.524 | 1.577 | 1.632 | 1.69 | 1.749 | 1.81 | 1.873 | 1.939 | 2.007 |
| Landfill $/T-`92 | 40 | | | | | | | | | | | | | | | | | | | | | | |
| Landfill $/T-`96 | 44.11 | 44.86 | 45.26 | 46.05 | 47.64 | 49.31 | 51.03 | 52.84 | 54.65 | 56.59 | 58.58 | 60.65 | 62.77 | 64.93 | 67.22 | 69.56 | 71.99 | 74.55 | 77.25 | 79.84 | 82.62 | 85.53 | 88.53 |
| Clinker $/T-`92 | 30 | | | | | | | | | | | | | | | | | | | | | | |
| Clinker $/T-`96 | 33.08 | 33.64 | 33.94 | 34.53 | 35.72 | 36.98 | 38.27 | 39.63 | 40.98 | 42.44 | 43.93 | 45.49 | 47.07 | 48.69 | 50.41 | 52.17 | 53.99 | 55.9 | 57.86 | 59.87 | 61.96 | 64.14 | 66.39 |
| Fly ash $/T-`92 | 150 | | | | | | | | | | | | | | | | | | | | | | |
| Fly ash $/T-96 | 165.41 | 168.22 | 169.71 | 172.69 | 178.64 | 184.93 | 191.38 | 198.16 | 204.94 | 212.22 | 219.66 | 227.44 | 235.38 | 243.48 | 252.08 | 260.85 | 269.95 | 279.54 | 289.3 | 299.39 | 309.81 | 320.73 | 331.98 |
| NATURAL GAS | | | | | | | | | | | | | | | | | | | | | | | |
| Indexation (3.5%) | | 1.017 | 1.026 | 1.044 | 1.08 | 1.118 | 1.157 | 1.198 | 1.239 | 1.283 | 1.328 | 1.375 | 1.423 | 1.472 | 1.524 | 1.577 | 1.632 | 1.69 | 1.749 | 1.81 | 1.873 | 1.939 | 2.007 |
| -*gas $/m3 1992 | 0.04 | | | | | | | | | | | | | | | | | | | | | | |
| -*gas $/m3 1996 | 0.044 | 0.045 | 0.045 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 |
| Indexation (1.75%) | | 1.009 | 1.013 | 1.0219 | 1.04 | 1.058 | 1.076 | 1.095 | 1.114 | 1.134 | 1.154 | 1.174 | 1.195 | 1.215 | 1.237 | 1.258 | 1.28 | 1.303 | 1.326 | 1.349 | 1.372 | 1.396 | 1.421 |
| -interupt.$/m3-`92 | 0.075 | | | | | | | | | | | | | | | | | | | | | | |
| -interupt.$/m3-`96 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 |
| -uninter.$/m3-`92 | 0.16 | | | | | | | | | | | | | | | | | | | | | | |
| -uninter.$/m3-`96 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.18 | 0.18 | 0.18 | 0.19 | 0.19 | 0.19 | 0.2 | 0.2 | 0.2 | 0.21 | 0.21 | 0.22 | 0.22 | 0.22 | 0.23 | 0.23 | 0.24 | 0.24 |
| PURCHASE OF ELECTRICITY | | | | | | | | | | | | | | | | | | | | | | | |
| Indexation (3.5%) | | 1.017 | 1.026 | 1.044 | 1.08 | 1.118 | 1.157 | 1.198 | 1.239 | 1.283 | 1.328 | 1.375 | 1.423 | 1.472 | 1.524 | 1.577 | 1.632 | 1.69 | 1.749 | 1.81 | 1.873 | 1.939 | 2.007 |
| E.& pwr. $/kWh-`92 | 0.0397 | | | | | | | | | | | | | | | | | | | | | | |
| E.& pwr. $/kWh-`96 | 0.044 | 0.0447 | 0.0451 | 0.0459 | 0.0475 | 0.0492 | 0.0509 | 0.0527 | 0.0545 | 0.0564 | 0.0584 | 0.0605 | 0.0626 | 0.0648 | 0.067 | 0.0694 | 0.0718 | 0.0744 | 0.0769 | 0.0796 | 0.0824 | 0.0853 | 0.0883 |
| ELECTRICAL GENERATION | | | | | | | | | | | | | | | | | | | | | | | |
| Oc-energ $/kWh-`96 | .03* | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Indexation (3.5%) | | 1.017 | 1.026 | 1.044 | 1.08 | 1.118 | 1.157 | 1.198 | 1.239 | 1.283 | 1.328 | 1.375 | 1.423 | 1.472 | 1.524 | 1.577 | 1.632 | 1.69 | 1.749 | 1.81 | 1.873 | 1.939 | 2.007 |
| Ener-pen.$/kWh-`91 | 0.011 | | | | | | | | | | | | | | | | | | | | | | |
| Ener-pen.$/kWh-`96 | 0.0124 | 0.0126 | 0.0127 | 0.0129 | 0.0134 | 0.0139 | 0.0143 | 0.0148 | 0.0154 | 0.0159 | 0.0165 | 0.017 | 0.0176 | 0.0182 | 0.0189 | 0.0195 | 0.0202 | 0.0209 | 0.0217 | 0.0224 | 0.0232 | 0.024 | 0.0249 |
| Indexation (3.5%) | | | | 1.017 | 1.026 | 1.044 | 1.08 | 1.118 | 1.157 | 1.198 | 1.239 | 1.283 | 1.328 | 1.375 | 1.423 | 1.472 | 1.524 | 1.577 | 1.632 | 1.69 | 1.749 | 1.81 | 1.873 |
| E-tarif $/kWh-`96 | 0.039 | 0.039 | 0.039 | 0.0397 | 0.04 | 0.0407 | 0.0421 | 0.0436 | 0.0451 | 0.0467 | 0.0483 | 0.05 | 0.0518 | 0.0536 | 0.0555 | 0.0574 | 0.0594 | 0.0615 | 0.0636 | 0.0659 | 0.0682 | 0.0706 | 0.073 |
| Pw-tarif $/kWh-`96 | 96.48 | 96.48 | 96.48 | 98.12 | 98.99 | 100.72 | 104.2 | 107.86 | 111.63 | 115.58 | 119.54 | 123.78 | 128.12 | 132.66 | 137.29 | 142.02 | 147.03 | 152.15 | 157.45 | 163.05 | 168.74 | 174.63 | 180.71 |

TABLE: REVENUES AND COSTS

REVENUES & ELIMINATION COSTS (000$)
(PRICE*QUANTITY)

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| REVENUES | 1996.3 | 1996.4 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COMPOST | 64.7 | 64.8 | 261.4 | 264.7 | 267.7 | 270.7 | 273.4 | 277.1 | 280.3 | 283.5 | 286.8 | 289.9 | 293.4 | 296.8 | 300 | 303.4 | 306.7 | 310 | 313.3 | 316.7 | 320.2 | 323.6 |
| RECYCLABLE PRODUCTS | 664.2 | 647.1 | 3410.8 | 4359.4 | 4931.7 | 5199.5 | 5254.7 | 5316 | 5377.7 | 5434.4 | 5496.1 | 5556.3 | 5616.1 | 5682.2 | 5742.7 | 5802.9 | 5866.7 | 5925.9 | 5990.2 | 6054.3 | 6118.8 | 6204.3 |
| Paper & Cardboard | | | | | | | | | | | | | | | | | | | | | | |
| -cardboard | 125.9 | 126.2 | 662.1 | 838.7 | 946.5 | 993 | 1003.3 | 1014.9 | 1026.5 | 1037.3 | 1048.9 | 1060.4 | 1071.8 | 1084 | 1095.5 | 1106.9 | 1119 | 1130.2 | 1142.6 | 1154.7 | 1166.8 | 1182.4 |
| -newspaper | 139.6 | 140 | 751.3 | 974.7 | 1128.5 | 1211.1 | 1224.7 | 1239.4 | 1254.2 | 1267.9 | 1282.7 | 1297.3 | 1311.8 | 1327.6 | 1342.6 | 1357.3 | 1372.4 | 1386.5 | 1401.7 | 1416.9 | 1432.1 | 1454.2 |
| -mixed paper | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Plastics | | | | | | | | | | | | | | | | | | | | | | |
| -HDPE plastic | 2.4 | 2.4 | 12.7 | 16.1 | 18.1 | 19.2 | 19.3 | 19.5 | 19.7 | 19.9 | 20.1 | 20.3 | 20.5 | 20.8 | 21 | 21.2 | 21.4 | 21.6 | 21.8 | 22 | 22.4 | 22.7 |
| -PET plastic | 109.8 | 110 | 576.9 | 730.7 | 825 | 864.9 | 874.1 | 884.2 | 894.5 | 903.7 | 913.8 | 923.7 | 933.6 | 944.4 | 954.3 | 964.3 | 974.8 | 984.6 | 995.1 | 1005.7 | 1016.5 | 1030.4 |
| Glass | | | | | | | | | | | | | | | | | | | | | | |
| -clear glass | 29.9 | 30 | 157 | 198.8 | 224.5 | 235.4 | 237.9 | 240.7 | 243.4 | 245.9 | 248.7 | 251.4 | 254.1 | 257.1 | 259.7 | 262.5 | 265.4 | 268 | 270.9 | 273.7 | 276.7 | 280.4 |
| -colored glass | 3.1 | 3.1 | 16.2 | 36.3 | 23.2 | 24.3 | 24.6 | 24.9 | 25.2 | 25.4 | 25.7 | 26 | 26.3 | 26.6 | 26.9 | 27.1 | 27.4 | 27.7 | 28 | 28.3 | 28.6 | 29 |
| -other' | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Metals | | | | | | | | | | | | | | | | | | | | | | |
| -ferrous | 38.6 | 38.7 | 203 | 257.1 | 290.2 | 305.1 | 307.6 | 311 | 314.6 | 317.9 | 321.4 | 325 | 328.4 | 332.2 | 335.7 | 339.2 | 342.9 | 346.4 | 350.1 | 353.9 | 357.6 | 362.5 |
| -aluminium | 196.3 | 196.7 | 1031.6 | 1307 | 1475.7 | 1546.5 | 1563.2 | 1581.4 | 1599.6 | 1616.4 | 1634.8 | 1652.2 | 1669.6 | 1689.5 | 1707 | 1724.4 | 1743.4 | 1760.9 | 1780 | 1799.1 | 1818.1 | 1842.7 |
| ELECTRICAL GENERATION | 1870.4 | 1870.4 | 13481.4 | 14341.5 | 14107.8 | 14337.5 | 14865 | 15396.7 | 15962 | 16528.8 | 17132.1 | 17762.4 | 8400.4 | 19069.5 | 19742.8 | 20453.8 | 21183.2 | 21920.2 | 22721.5 | 23526.1 | 24366.5 | 25213.1 |
| Energy | 1870.4 | 1870.4 | 10726.2 | 11561.9 | 11279.6 | 11411.6 | 11836.3 | 12262.1 | 12716.5 | 13172.1 | 13656.4 | 14164.8 | 4675.3 | 15214.4 | 15754.9 | 16325.2 | 16910.8 | 17499 | 18143.1 | 18787.9 | 19462.9 | 20138.8 |
| Power | 0 | 0 | 2755.2 | 2779.6 | 2828.2 | 2925.9 | 3028.7 | 3134.6 | 3245.5 | 3356.7 | 3475.7 | 3597.6 | 3725.1 | 3855.1 | 3987.9 | 4128.6 | 4272.4 | 4421.2 | 4578.4 | 4738.2 | 4903.6 | 5074.3 |

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| | 1996.1 | 1996.4 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COSTS: ELECT., NAT.GAS, WASTE DISP. | | | | | | | | | | | | | | | | | | | | | | |
| PURCHASE OF ELECTRICITY | | | | | | | | | | | | | | | | | | | | | | |
| Energy & power | 536.4 | 541.2 | 2203.2 | 2280 | 2361.6 | 2443.2 | 2529.6 | 2616 | 2707.2 | 2803.2 | 2904 | 3004.8 | 3110.4 | 3216 | 3331.2 | 3446.4 | 3571.2 | 3691.2 | 3820.8 | 3955.2 | 4094.4 | 4238.4 |
| NATURAL GAS COSTS | | | | | | | | | | | | | | | | | | | | | | |
| Interupt. gas | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Noninterupt. gas | 45.7 | 45.7 | 187 | 187 | 195.5 | 195.5 | 195.5 | 204 | 212.5 | 212.5 | 221 | 221 | 221 | 238 | 238 | 246.5 | 246.5 | 255 | 263.5 | 263.5 | 272 | 280.5 |
| WASTE ELIMINATION COSTS | | | | | | | | | | | | | | | | | | | | | | |
| Landfilling | 97.2 | 98.1 | 340.4 | 332 | 314.5 | 287.2 | 297.9 | 308.6 | 320.1 | 331.9 | 344.2 | 356.6 | 369.2 | 382.7 | 396.4 | 410.7 | 425.7 | 440.8 | 456.6 | 472.8 | 489.9 | 508.5 |
| Clinker-slag | 641.7 | 647.5 | 2854.6 | 3159.2 | 3135.9 | 3174.1 | 3291.9 | 3409.2 | 3536.1 | 3665.7 | 3801.7 | 3938.4 | 4079 | 4228.4 | 4381.4 | 4540.2 | 4703.8 | 4871.6 | 5044 | 5223.2 | 5410.3 | 5604.1 |
| Fly ash | 437.5 | 441.4 | 1946.7 | 2154.4 | 2138.5 | 2164.5 | 2244.5 | 2324.8 | 2411.2 | 2499.5 | 2591.9 | 2685.7 | 2781.5 | 2883.3 | 2987.3 | 3095.5 | 3207.4 | 3321.4 | 3439.4 | 3561.3 | 3689.4 | 3821.4 |
| NET REVENUES-ELECT. WITH GAS FIRING | 1334 | 1329.2 | 11278.2 | 12061.5 | 11746.2 | 11894.3 | 12335.4 | 12780.7 | 13254.8 | 13725.6 | 14228.1 | 14757.6 | 15290 | 15853.5 | 16411.6 | 17007.4 | 17612 | 18229 | 18900.7 | 19570.9 | 20272.1 | 20974.7 |

TABLE: ANNUAL EXPENDITURES

ANNUAL EXPENDITURES (000$)

| | | | 1996.3 | 1996.4 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SERVICE COSTS | | | 7589.6 | 7639.8 | 32124.8 | 34191.2 | 35036.8 | 35837.7 | 36745.9 | 37686.9 | 38667.2 | 39607.6 | 40633.9 | 41651.2 | 42684.3 | 43780.4 | 44899.1 | 46045.4 | 47196.7 | 48383.1 | 49618.4 | 50864.7 | 52169 | 53529.5 |
| (Op.costs & compens. costs) | | | | | | | | | | | | | | | | | | | | | | | | |
| OPERATING & MAINTENANCE COSTS | | | 5339.3 | 5371 | 21695.9 | 22119.3 | 22563.7 | 23008.2 | 23474 | 23960.7 | 24426.3 | 24913.4 | 25421.3 | 25929.2 | 26437.4 | 26966.4 | 27516.7 | 28067.1 | 28617.4 | 29188.9 | 29781.6 | 30374.4 | 30988.2 | 31601.9 |
| Indexation (2%) | | | 1.009 | 1.015 | 1.025 | 1.045 | 1.066 | 1.087 | 1.109 | 1.132 | 1.154 | 1.177 | 1.201 | 1.225 | 1.249 | 1.274 | 1.3 | 1.326 | 1.352 | 1.379 | 1.407 | 1.435 | 1.464 | 1.493 |
| | Costs-`91 | Costs-`96 | | | | | | | | | | | | | | | | | | | | | | |
| Labour (+ other) | 5355 | 6045.7 | 1525 | 1534.1 | 6196.8 | 6317.7 | 6444.7 | 6571.7 | 6704.7 | 6843.7 | 6976.7 | 7115.8 | 7260.9 | 7406 | 7551.1 | 7702.2 | 7859.4 | 8016.6 | 8173.8 | 8337 | 8506.3 | 8675.6 | 8850.9 | 9026.2 |
| Repairs & maint. | 3356 | 3788.7 | 955.7 | 961.4 | 3883.417 | 3959.2 | 4038.7 | 4118.3 | 4201.7 | 4288.8 | 4372.1 | 4459.3 | 4550.2 | 4641.1 | 4732.1 | 4826.8 | 4925.3 | 5023.8 | 5122.3 | 5224.6 | 5330.7 | 5436.8 | 5546.7 | 5656.5 |
| Res.equip.replmt. | 3005 | 3392.5 | 855.8 | 860.8 | 3477.3 | 3545.2 | 3616.4 | 3687.6 | 3762.3 | 3840.3 | 3914.9 | 3993 | 4074.4 | 4155.8 | 4237.2 | 4322 | 4410.2 | 4498.4 | 4586.6 | 4678.2 | 4773.2 | 4868.2 | 4966.6 | 5065 |
| Chem.prods.& mats. | 3067 | 3462.5 | 873.4 | 878.6 | 3549.1 | 3618.3 | 3691 | 3763.7 | 3839.9 | 3919.5 | 3995.7 | 4075.4 | 4158.5 | 4241.5 | 4324.7 | 4411.2 | 4501.2 | 4591.3 | 4681.3 | 4774.8 | 4871.7 | 4968.7 | 5069.1 | 5169.5 |
| Other services | 3966 | 4477.4 | 1129.4 | 1136.1 | 4589.3 | 4678.9 | 4772.9 | 4866.9 | 4965.4 | 5068.4 | 5166.9 | 5269.9 | 5377.3 | 5484.8 | 5592.3 | 5704.2 | 5820.6 | 5937 | 6053.4 | 6174.3 | 6299.7 | 6425.1 | 6554.9 | 6684.7 |
| Index.I.P. to 1992-4.3% | | | | | | | | | | | | | | | | | | | | | | | | |
| (*Index.I.P. constant 2% to 1996) | | | | | | | | | | | | | | | | | | | | | | | | |
| COMPENSATORY COSTS | | | 2250.3 | 2268.8 | 10428.9 | 12071.9 | 12473.1 | 12829.5 | 13271.9 | 13726.2 | 14240.9 | 14694.2 | 15212.6 | 15722 | 16246.9 | 16814 | 17382.4 | 17978.3 | 18579.3 | 19194.2 | 19836.8 | 20490.3 | 21180.8 | 21927.6 |
| Indexation (3.5%) | | | 1.017 | 1.026 | 1.044 | 1.08 | 1.118 | 1.157 | 1.198 | 1.239 | 1.283 | 1.328 | 1.375 | 1.423 | 1.472 | 1.524 | 1.577 | 1.632 | 1.69 | 1.749 | 1.81 | 1.873 | 1.939 | 2.007 |
| | Costs-`92 | Costs-`96 | | | | | | | | | | | | | | | | | | | | | | |
| Insurance | 1000 | 1102.7 | 280.4 | 282.8 | 1151.2 | 1190.9 | 1232.8 | 1275.8 | 1321 | 1366.2 | 1414.8 | 1464.4 | 1516.2 | 1569.1 | 1623.2 | 1680.5 | 1739 | 1799.6 | 1863.6 | 1928.6 | 1995.9 | 2065.4 | 2138.1 | 2213.1 |
| Water usage | 57.4 | 63.3 | 16.1 | 16.2 | 66.1 | 68.4 | 70.8 | 73.2 | 75.8 | 78.4 | 81.2 | 84.1 | 87 | 90.1 | 93.2 | 96.5 | 99.8 | 103.3 | 107 | 110.7 | 114.6 | 118.6 | 122.7 | 127 |
| Purch. electricity-see table REVENUES & COSTS | | | 536.4 | 541.2 | 2203.2 | 2280 | 2361.6 | 2443.2 | 2529.6 | 2616 | 2707.2 | 2803.2 | 2904 | 3004.8 | 3110.4 | 3216 | 3331.2 | 3446.4 | 3571.2 | 3691.2 | 3820.8 | 3955.2 | 4094.4 | 4238.4 |
| Maint. fees H.Q. | 15 | 16.5 | 4.2 | 4.2 | 17.2 | 17.8 | 18.4 | 19.1 | 19.8 | 20.4 | 21.2 | 21.9 | 22.7 | 23.5 | 24.3 | 25.1 | 26 | 26.9 | 27.9 | 28.9 | 29.9 | 30.9 | 32 | 33.1 |
| Interupt.nat.gas -see table REVENUES & COSTS | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Uninterupt.nat.gas-see table REVENUES & COSTS | | | 45.7 | 45.7 | 187 | 187 | 195.5 | 195.5 | 195.5 | 204 | 212.5 | 212.5 | 221 | 221 | 221 | 238 | 238 | 246.5 | 246.5 | 255 | 263.5 | 263.5 | 272 | 280.5 |
| Resid. disposal -see table REVENUES & COSTS | | | 1176.4 | 1187 | 5141.7 | 5645.6 | 5588.9 | 5625.8 | 5834.3 | 6042.6 | 6267.4 | 6497.1 | 6737.8 | 6980.7 | 7229.7 | 7494.4 | 7765.1 | 8046.4 | 8336.9 | 8633.8 | 8940 | 9257.3 | 9589.6 | 9934 |
| Act.carbon inject. | 117 | 129 | 32.8 | 33.1 | 134.7 | 139.3 | 144.2 | 149.3 | 154.5 | 159.8 | 165.5 | 171.3 | 177.4 | 183.6 | 189.9 | 196.6 | 203.4 | 210.5 | 218 | 225.6 | 233.5 | 241.6 | 250.1 | 258.9 |
| Env.assess.& perm. | 150 | 165.4 | 42.1 | 42.4 | 172.7 | 178.6 | 184.9 | 191.4 | 198.1 | 204.9 | 212.2 | 219.7 | 227.4 | 235.4 | 243.5 | 252.1 | 260.8 | 269.9 | 279.5 | 289.3 | 299.4 | 309.8 | 320.7 | 332 |
| Unsold recyc.mats. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unsold compost | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Asses.recyc.+comp. | 50 | 55.1 | 14 | 14.1 | 57.5 | 59.5 | 61.6 | 63.8 | 66 | 68.3 | 70.7 | 73.2 | 75.8 | 78.4 | 81.1 | 84 | 86.9 | 89.9 | 93.1 | 96.4 | 99.7 | 103.2 | 106.8 | 110.6 |
| *(Ann.C.P.I. from `92-`96: 1.9%, 2.3%, 2.7%, 3%) | | | | | | | | | | | | | | 3%) | | | | | | | | | | |
| Exploit Credits-Electricity | | | 66.7 | 66.5 | 718.6 | 915.2 | 803.4 | 765.1 | 796.9 | 829.3 | 896.4 | 898.3 | 935.2 | 973.2 | 1011.8 | 1052.7 | 1093.5 | 1137.3 | 1179.7 | 1223.1 | 1270.3 | 1317.5 | 1367 | 1417.1 |
| Exploit Credits- Recyc. Prods. | | | 32.3 | 32.4 | 170.5 | 330.4 | 583.7 | 709.7 | 719.7 | 730.6 | 741.7 | 752 | 763.2 | 773.2 | 783.6 | 794.9 | 805.5 | 816.4 | 826.8 | 836.5 | 847 | 857.5 | 868.1 | 990.1 |
| Exploit Credits- Compost | | | 3.2 | 3.2 | 13.1 | 13.2 | 13.4 | 13.5 | 13.7 | 13.9 | 14 | 14.2 | 14.3 | 14.5 | 14.7 | 14.8 | 15 | 15.2 | 15.3 | 15.5 | 15.7 | 15.8 | 16 | 16.2 |

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SURCHARGES ON SERVICE COSTS

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Indexation (2%) | | | 1.009 | 1.015 | 1.025 | 1.045 | 1.066 | 1.087 | 1.109 | 1.132 | 1.154 | 1.177 | 1.201 | 1.225 | 1.249 | 1.274 | 1.3 | 1.326 | 1.352 | 1.379 | 1.407 | 1.435 | 1.464 | 1.493 |
| -Ann. quantities- incinerator | | | 0 | 0 | 395 | 812.6 | 565 | 438.7 | 457.1 | 476.3 | 495.5 | 515.5 | 536.4 | 555.3 | 575.1 | 595.6 | 617 | 639.2 | 656.5 | 674.5 | 693.1 | 711.9 | 731.4 | 752 |
| -Ann. quantities- sorting ctr. | | | 0 | 0 | 0 | 231.4 | 645.4 | 860.3 | 883.4 | 907.5 | 931.1 | 955.7 | 981.4 | 1005 | 1029.7 | 1055.5 | 1082.3 | 1110.2 | 1135.5 | 1162.1 | 1189 | 1216.4 | 1244.8 | 1295 |
| -Ann. quantities- comp. ctr. | | | 0 | 0 | 0.4 | 1.95 | 3.5 | 5.1 | 6.5 | 8 | 9.5 | 11.1 | 12.8 | 14.2 | 15.7 | 17.3 | 18.9 | 20.6 | 21.8 | 23 | 24.4 | 25.7 | 27.1 | 28.6 |
| -Electrical generation | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| OTHER ANNUAL COSTS | | | | | | | | | | | | | | | | | | | | | | | | |
| Indexation (3.5%) | | | 1.017 | 1.026 | 1.044 | 1.08 | 1.118 | 1.157 | 1.198 | 1.239 | 1.283 | 1.328 | 1.375 | 1.423 | 1.472 | 1.524 | 1.577 | 1.632 | 1.69 | 1.749 | 1.81 | 1.873 | 1.939 | 2.007 |
| | Costs-`93 | Costs-`96 | | | | | | | | | | | | | | | | | | | | | | |
| Taxes: | | | 789.4 | 793.8 | 3211.3 | 3283.7 | 3360.1 | 3438.5 | 3520.9 | 3603.2 | 3691.8 | 3782.1 | 3876.6 | 3973 | 4071.6 | 4176.1 | 4282.7 | 4393.2 | 4509.7 | 4628.3 | 4750.9 | 4877.5 | 5010.2 | 4590.4 |
| M.Is*-`92 | N/A | 199.6 | | 223.5 | 56.8 | 57.3 | 233.3 | 241.4 | 249.9 | 258.6 | 267.8 | 276.9 | 286.8 | 296.8 | 307.3 | 318 | 329 | 340.6 | 352.5 | 364.8 | 377.7 | 390.9 | 404.5 | 418.6 | 433.4 | 448.6 |
| Mtl.E-`92 | 1620 | 1650.8 | | 1786.4 | 454.3 | 458.2 | 1865 | 1929.3 | 1997.2 | 2066.9 | 2140.1 | 2213.3 | 2292 | 2372.3 | 2456.3 | 2542 | 2629.6 | 2722.5 | 2817.2 | 2915.4 | 3019 | 3124.4 | 3233.4 | 3345.9 | 3463.8 | 3585.3 |
| **Exprop.& leasage | 1113 | 1113 | 1113 | | 278.3 | 278.3 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 1113 | 556.5 |

* Mtl.E. was used as proxy for this evaluation

** value 8 863 000$ amort. 20yrs. at 11%

## PROBIT MODEL TABLE

Number of days After Lay-Off

| Variables: | 0-30 | 31-90 | 91+ |
|---|---|---|---|
| Constant | .8730<br>(.70) | 1.403<br>(.73) | 4.797<br>(1.32) |
| Age at Lay-Off | -.0202<br>(.0076) | -.0258<br>(.0098) | -.0329<br>(.012) |
| Seniority | -.000189<br>(.00017) | -.000471<br>(.0022) | -.000469<br>(.00026) |
| Education | .0536<br>(.022) | .0387<br>(.028) | .0401<br>(.031) |
| Ability/Training | .0165<br>(.026) | .0160<br>(.031) | .0190<br>(.037) |
| Unemployment Rate | -.1937<br>(.100) | -.1575<br>(.093) | -.5811<br>(.160) |
| Time since Lay-off (days: 0= 90) | | | .000107<br>(.00086) |

Source: "Estimating The Private and Social Opportunity Cost of Displaced Workers" by Glenn P. Jenkins and Claude Montmarquette, The Review of Economics and Statistics, August 1979.

TABLE: SOCIAL ANALYSIS

SOCIAL ANALYSIS (CURRENT '000$)

| | | 1993.3 | 1993.4 | 1994.1 | 1994.2 | 1994.3 | 1994.4 | 1995.1 | 1995.2 | 1995.3 | 1995.4 | 1996.1 | 1996.2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COSTS DURING CONSTRUCTION: | | | | | | | | | | | | | |
| SOCIAL COST OF LOST LABOUR: | | | | | | | | | | | | | |
| -Auto Berpa (10 employees) (only on first 2.5 years) | | 5.135 | 5.135 | 5.135 | 5.135 | 5.135 | 5.135 | 5.135 | 5.135 | 5.135 | 5.135 | 0 | 0 |
| ENVIRONMENTAL COSTS: | | | | | | | | | | | | | |
| **payment schedule % | | 7 | 8.7 | 12.5 | 6.8 | 2.1 | 10.6 | 28.2 | 10.8 | 4.1 | 4.4 | 3.4 | 1.4 |
| -Site development costs | 11269 | 788.8 | 980.4 | 1408.6 | 766.3 | 236.6 | 1194.5 | 3177.9 | 1217.1 | 462 | 495.8 | 383.1 | 157.8 |
| -Territorial restructuring | 5106.4 | 357.4 | 444.3 | 638.3 | 347.2 | 107.2 | 541.3 | 1440 | 551.5 | 209.4 | 224.7 | 173.6 | 71.5 |
| Internalized Externalities: | | | | | | | | | | | | | |
| ***same payment schedule as above | | | | | | | | | | | | | |
| -Anti atm.pollution equipment @ 5% | 906.265 | 63.4 | 78.8 | 113.3 | 61.6 | 19 | 96.1 | 255.6 | 97.9 | 37.2 | 39.9 | 30.8 | 12.7 |
| -Anti atm.pollution equipment @10% | 1812.53 | 126.9 | 157.7 | 226.6 | 123.3 | 38.1 | 192.1 | 511.1 | 195.8 | 74.3 | 79.8 | 61.6 | 25.4 |
| -Arch. chimnee modifications @ 5% | 98.385 | 6.9 | 8.6 | 12.3 | 6.7 | 2.1 | 10.4 | 27.7 | 10.6 | 4 | 4.3 | 3.3 | 1.4 |
| -Arch. chimnee modifications @ 10% | 196.77 | 13.8 | 17.1 | 24.6 | 13.4 | 4.1 | 20.9 | 55.5 | 21.3 | 8.1 | 8.7 | 6.7 | 2.8 |
| BENEFITS DURING CONSTRUCTION: | | | | | | | | | | | | | |
| -Labour employment (300 pers.) | | 1684.6 | 1684.6 | 1684.6 | 1684.6 | 1684.6 | 1684.6 | 1684.6 | 1684.6 | 1684.6 | 1684.6 | 1684.6 | 1684.6 |
| -Labour employment (comp. ctr.) | unknown | | | | | | | | | | | | |
| NET SOCIAL COST DURING CONSTRCUTION @ 5%: | | -463 | -167.4 | 493 | -497.7 | -1314.6 | 162.8 | 3221.7 | 197.6 | -966.9 | -914.8 | -1093.8 | -1441.2 |
| NET SOCIAL COST DURING CONSTRCUTION @ 10%: | | -392.6 | -80 | 618.6 | -429.3 | -1293.5 | 269.3 | 3505 | 306.2 | -925.7 | -870.5 | -1059.6 | -1427.1 |

TOT.NET SOCIAL COST DURING CONSTRUCTION @ 5%: -2784.3

TOT.NET SOCIAL COST DURING CONSTRUCTION @ 10% -1779.2

| | | 1996.3 | 1996.4 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COSTS DURING EXPLOITATION: | | | | | | | | | | | | | | | | | | | | | | | |
| -Waste treatment cost:<br>(this is net of debt service and of taxes) | | 4927.5 | 5024 | 15119.9 | 15867.4 | 16794.6 | 17550.5 | 18347.4 | 19181.3 | 20040.3 | 20876.3 | 21779.5 | 22667.9 | 23581 | 24544.6 | 25546.1 | 26564.4 | 27586.8 | 28657.2 | 29747.2 | 30859.5 | 32024.1 | 26457.2 |
| -*Debt reimbursement @ 14.95% | 25041.7 | 12520.8 | 12520.8 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 | 50083.4 |
| *this percentage is in current terms | | | | | | | | | | | | | | | | | | | | | | | |
| -*Expropriation and leasage<br>(amortized annually 20yrs. at 14.95%) | 8863 | 334.6 | 334.6 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 1338.2 | 669.1 |
| BENEFITS DURING EXPLOITATION: | | | | | | | | | | | | | | | | | | | | | | | |
| -Municipal taxes (Mtl.E.& W.Is.)<br>(rule of thumb: ⅓) | | 255.6 | 257.8 | 1049.2 | 1085.4 | 1123.6 | 1162.8 | 1204 | 1245.1 | 1289.4 | 1334.6 | 1381.8 | 1430 | 1479.3 | 1531.6 | 1584.9 | 1640.1 | 1698.4 | 1757.7 | 1819 | 1882.3 | 1948.6 | 2017 |
| -Labour all ctrs.:<br>*includes extra labour of Sorting ctr.<br>(from 1997 to 2000) | | 22.9 | 22.9 | 95.2 | 97.5 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 | 100.6 |
| NET SOCIAL COST DURING EXPLOITATION: | | 17504.4 | 17598.7 | 65397.1 | 66106.1 | 66992 | 67708.7 | 68464.4 | 69257.2 | 70071.9 | 70862.7 | 71718.3 | 72558.9 | 73422.7 | 74334 | 75282.2 | 76245.3 | 77209.4 | 78220.5 | 79249.2 | 80298.2 | 81396.5 | 75092.1 |
| TOTAL NET SOCIAL COST OF PROJECT @ 5%: | | 1492206. | | | | | | | | | | | | | | | | | | | | | |
| TOTAL NET SOCIAL COST OF PROJECT @ 10%: | | 1493211. | | | | | | | | | | | | | | | | | | | | | |