CANADA/NOVA SCOTIA
SUBSIDIARY AGREEMENT FOR
ASSISTANCE TO THE
SYDNEY STEEL CORPORATION

COST-BENEFIT ANALYSIS

ECONOMIC ASSESSMENT
PROJECT TEAM

AUGUST 1979

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Cost-Benefit Analysis of Sysco Options

Introduction

This component of the economic analysis will provide estimates of the net economic benefits of the Sysco options to Canada and to Nova Scotia. The analysis will concentrate on essentially four options - immediate plant closure; electric steelmaking at approximately 250,000 tons per year; improved open hearth at 1/2 million tons per year and Q-BOP at 1 million tons per year.

Methodology

The cost-benefit analysis utilizes a model developed by DREE for the economic assessment of regional development opportunities and used in the DREE Cansteel studies. It is the objective of this section of the report to outline the methodology underlying that model. The model divides net benefits of a project into three categories:

(1) those arising out of job creation - labour benefits

(2) those arising out of imports and exports - foreign exchange benefits

(3) those arising out of the operations of the plant- economic cash flow.

Labour benefits

Impact analysis conventionally estimates the gross economic

benefits, measured in terms of incremental income, arising out of job creation. It measures the additional income from (a) direct job creation in the construction and operations phases of the project and (b) the indirect job creation resulting from the multiplier effect of (a). It implicitly assumes that such benefits are attained at no economic cost. (where a project involves elimination of jobs, impact analysis involves the calculation of gross economic costs or losses)

Cost-benefit analysis, on the other hand, deducts from gross benefits the social opportunity cost of labour (SOCL) -ie. the economic cost to society of the job creation. The SOCL is the value attached to activities foregone as a result of using labour in a particular project. At one time, it was conventional to view the SOCL as the value of the output which would be produced elsewhere in the economy in the absence of the project. It is now more normal to treat it as the supply price of labour - the minimum wage which must be paid to attract individuals to work on a project. The supply price is a measure of the value that the individual attaches to foregone activities. The economic cost to society from job creation is the aggregation of these individual valuations - it is the supply price per worker multiplied by the number of workers taking jobs as a result of the project.

In areas with low levels of unemployment, hiring on a project will be largely from among workers who are already employed. The supply price, and hence the SOCL, of these workers will be approximately equal to the going wage rate in the project. The gross benefit (incremental income generated)

of the project's job creation will be just equal to the social opportunity cost of that job creation. There would be no net labour benefits in this case.

Where job creation involves hiring largely from among unemployed workers, net labour benefits will be generated. The supply price approach asserts, however, that there is still an economic cost to hiring unemployed workers since they have to forego leisure and unemployment insurance benefits to take a job. Society faces a positive supply price (and incurs a positive SOCL) in hiring unemployed workers. If this were not the case, the implication would be that unemployed workers would accept jobs in which the wage rate was only marginally greater than zero. - a phenomenon which is not observed. However, the wage rate paid on a project and on the sectors affected by the project will typically be larger (and in some cases much larger) than the supply price. Therefore the gross benefits of job creation will exceed the economic cost to society of such creation (the SOCL) and the project will generate net labour benefits.

The model developed by DREE - Ottawa and used, in original and in modified form, in this study employs a supply price approach. The model incorporates one major feature which makes it particularly useful for evaluating projects in economically depressed areas. It attempts to take account of the movement of workers into the high unemployment area as a result of job creation and to estimate the impact that such a movement will have on the labour benefit calculation.

A more technical discussion of SOCL concept and the method used in estimating it for this study is provided in Appendix A.

Foreign Exchange Adjustment

The model asserts that due to market distortions such as import duties, export subsidies and domestic sales taxes, the true (social) value of foreign exchange exceeds the observed value as determined in the foreign exchange market. In other words, the going market price of foreign exchange, expressed in Canadian dollars, is an understatement of its true economic value. Therefore, when a project involves exports abroad, a premium should be attached to the incremental receipts of foreign exchange to reflect the true social benefits of such sales. Similarly when a project involves imports (raw materials and capital equipment) a premium is paid to reflect the economic costs of these purchases. In the DREE model the premium has been calculated to be approximately 15%. The foreign exchange adjustment is applied to incremental output sales to and input purchases from foreigners.

In addition, the foreign exchange adjustment will be made to input purchases from domestic suppliers when it is clear that such purchases are competitive with those of foreigners. That is, Canada gives up additional foreign exchange earnings by selling inputs (eg. coal and iron ore) to a domestic producer rather than to a foreign producer. These foreign earnings must be counted as a cost of the project.

Economic Cash Flow

Certain adjustments to the financial cash-flow analysis of a project must be made to arrive at an economic cash flow estimate. In general, only those costs which represent payments

for real resources are included. Hence, capital costs are included for those years in which such expenditures are actually made (usually in the early years of a project). Depreciation charges, which are an accounting method for spreading the capital cost over the life of the asset, are not included. Interest payments are financial costs arising out of a particular method used to pay for the capital asset; they do not involve the use of economic resources and are not included in an economic cash flow estimate. In sum, the economic cash flow is the (a) yearly sales revenue less (b) yearly operating costs less (c) capital costs for the years in which capital expenditures are made. The annual figures are discounted by the social discount rate to yield the net present value of the cash flow.

The sum of net labour benefits, net foreign exchange adjustment and net economic cash flow constitutes the measure of net economic benefits from a project. The calculations are made annually for the lifetime of the project and discounted at the social discount rate (10% is the rate adopted in the model and by the Treasury Board).

Difference Between Provincial and National Cost-Benefit Analysis

Since Nova Scotia is a part of Canada, the costs and benefits to the province are also costs and benefits to the nation as a whole. However, for at least the foreign exchange and cash flow calculations, the reverse is not true. Foreign exchange earnings from exports (payments for imports) which arise from a project in Nova Scotia are not wholly attributable to that province. The earnings (payments) are received by the country as a whole

and only a portion should reasonably be included in the provincial calculation. As well, in instances where the capital costs are shared by the provincial and federal governments, only the provincial share should be counted in the economic cash flow calculation for the Nova Scotia analysis. As regards the labour benefits calculation, the use of a supply price approach to estimating the SOCL implies that wages which must be paid to attract individuals to work in the project will be the same from both the provincial and national perspectives. The gross benefit will also be the same and therefore the net labour benefits estimate will be equal in the two sets of calculations.

Canadian Cost-Benefit Analysis

Base Case

The examination of the net economic benefit from a project or, in this case, several projects (options) necessitates the choice of a base case with which the projects may be compared. It is conventional to use the status quo as the basis of comparison. However, the implicit assumption in such a choice is that the existing operation can be maintained in the absence of a project or projects. The status quo at Sysco, both in terms of employment and output levels, has fluctuated in recent years and is, in any event, generally agreed to be incapable of being maintained in the absence of any of the options under review. As well, the data provided by the PTFA are available only for the options themselves and not for the existing Sysco operation. As a result, the foreign exchange and cash flow calculations made by the PTEA are restricted to those for the options. Therefore, the status quo is not an appropriate base case for the cost-benefit analysis and immediate closure has been chosen in its stead.

Labour Benefits

Because of the particular features of the model employed to calculate net labour benefits, the starting point for each of the options was the level of employment at Sysco in 1979 - 3000 workers. For the Q-BOP option, 722 Sysco employees would be laid off in 1980 and 731 hired back in 1983. As well, the option involves hiring a total of 1077 construction workers over

Table I

Changes in Construction and Operating Employment by Year

OPTION / YEAR	Q-BOP Change in Employment	IMPROVED O.H. Change in Employment	RAILMILL (ELECTRIC) Change in Employment	CLOSURE Change in Employment
1980	+255(C)	+111(C)	+70(C)	-3000(O)
1980	-722(O)	-722(O)	-722(O)	--
1981	+822(C)	+50(C)	+579(C)	--
1982	-800(C)	-154(C)	-370(C)	--
1983	-255(C)	-7(C)	-267(C)	--
1984	-22(C)		-12(C)	--
1984	+731(O)		-1678(O)	--

1980-81 and laying them off in the following three years. Analogous employment estimates were made for the other options. Specific details are provided in Table I. The source of employment data was the engineering study done by Met Chem. The operating employment data during construction was developed by Siper and Touche Ross.

Sysco provided data on current wage and salary levels for their employees and construction wage rates were available from the current contracts. Since those figures were in 1978 dollars they were adjusted upwards by 6% to reflect anticipated 1979 wage and salary levels.

DREE - Ottawa personnel provided estimates on other parameters required to use the model for the computer runs (e.g., average tax rates, unemployment rate estimates, etc.)

In the initial set of calculations, the DREE - Ottawa assumptions on SOCL estimate, the rate of migration and the equilibrium unemployment rate were used. (See Appendix B for details.) These assumptions were then modified and additional sets of calculations made. The results and their interpretation are laid out below.

Initial Run

The net labour benefits for the production options relative to closure are presented in Table 2. The original estimates on which the benefits relative to closure have been based are provided in Appendix B, Table 2. There it is also demonstrated how such a calculation is made.

Table 2

Net Present Value of Labour Benefits from Production Options Relative to Closure (Initial Assumptions)

OPTION	Q-BOP	IMPROVED OPEN HEARTH	RAIL (ELECTRIC)
NET LABOUR BENEFITS ($ MILLION)	+268.9	+230.9	+131.0

Not surprisingly, the labour benefits increase as one moves from options with lower employment levels (Rail Electric - 600;) to those with higher levels (Q-BOP - 3009; Improved O.H. - 2278). Individual options are easily compared with each other. For example, the option with the highest employment level (Q-BOP) generates labour benefits that exceed those of the lowest employment option (Rail Electric) by a factor of 2 or in absolute terms by about $140 million (i.e., $268.9 million - $131.0 million). Put simply, if the choice were solely between the Q-BOP and the Rail Electric option the former is better than the latter, in terms of labour benefits, by $140 million. Similarly the Q-BOP option is superior to the Improved O.H. option by an amount equal to $35 million (by approximately 15%).

Modifications

(a) Valuation of Leisure

As noted in Appendix B, the DREE - Ottawa model estimates the value that unemployed workers attach to leisure (while unemployed) at about $2,850. While it was at one time conventional

to assume that the value of leisure to unemployed workers is 0, the view is no longer commonly held by those engaged in cost-benefit analysis. However, there is disagreement about how such a measurement should be made. The leisure value estimate in the DREE - Ottawa model could well overstate the value of leisure and hence overstate the SOCL estimate. This would tend, then, to yeild an underestimate the net labour benefits. As a result, calculations were made in which the value of leisure assumed in the DREE model was reduced by 50%. The results are shown in Table 3.

Table 3

Net Present Value of Labour Benefits from Production Options Relative to Closure (Reduced Value of Leisure)

OPTION	Q-BOP	IMPROVED O.H.	RAIL ELECTRIC
Net Labour Benefits ($ millions)	329.0	278.3	160.8
Change from Initial Run ($ millions)	+60.1	+47.4	+29.8
Change from Initial Run (%)	+22%	+21%	+23%

As expected, the labour benefits of the production options increased and did so significantly. As well, the differences between individual options widened. For example, the gap between the Q-BOP and Improved O.H. options increased by 12.7 million

or by 33%. Initially the difference between the two was $38 million ($268.9 million - $230.9 million). After changing the leisure valuation the difference was $50.7 million ($329 million - $278.3 million). Hence the difference increased by $12.7 million ($50.7 million - $38 million).

Hence, the change in the estimate of leisure valuation makes a significant difference to the results.

(b) Migration Response

The model assumes that, under all options, the migration response to a change in employment conditions will be such that 40% of the difference between the unemployment rate in a given year and the long-run unemployment to which the labour market is moving will be eliminated. (See Appendix B on assumptions) We attempted to determine whether changing that assumption would markedly affect the labour benefits calculation. In those options which involved a permanent reduction in operating employment levels relative to the (model's) starting point of 3000 - that is to say, in all options except Q-BOP - we assumed a slightly faster rate of out-migration; for Q-BOP, a slower rate. The result was that labour benefits changed but only slightly - 4% and 5% in the case of, respectively, Improved O.H. and Q-BOP and 4% in the case of Rail Electric. The appropriate figures appear in Table 4. The changes were small enough to warrant the conclusion that its effect could reasonably be disregarded.

Table 4

Net Present Value of Labour Benefits from Production Options Relative to Closure (Faster Migration Response)

	Q-BOP	IMPROVED O.H.	RAIL ELECTRIC
Net Labour Benefits ($ million)	+ 254.3	+221.3	125.6
Change from Initial Run ($ million)	-14.6	-9.6	- 5.4
Change from Initial Run (%)	-5%	-4%	- 4%

(c) Long-Run Unemployment Rate

The model assumes that, after an initial change in unemployment conditions under each option, the labour market in Cape Breton eventually returns to the unemployment rate in the temporary sector prevailing before the change. This occurs by way of in-migration when jobs are created and out-migration when they are destroyed. We changed the assumption so that in options where there was a permanent reduction in operating employment - in all options except Q-BOP given the 3000 job starting point - the long-run unemployment rate increased by 2% points. As in the previous case, the resulting effects on the labour benefits calculations were small enough to be considered insignificant - net benefits increased by only 2 - 7%. The results are displayed in Table 5.

Table 5

Net Present Value of Labour Benefits from Production Options Relative to Closure (Higher Long-Run Unemployment Rate)

	Q-BOP	IMPROVED O.H.	RAIL ELECTRIC
Net Labour Benefits ($ million)	+287.5	+246.3	128.9
Change from Initial Run ($ million)	+18.6	+12.3	-2.1
Change from Initial Run (%)	+7%	+5%	-2%

Foreign Exchange Adjustment

The foreign exchange adjustment estimate includes both positive (benefits) and negative (costs) components. The foreign exchange benefits and the assumptions on which their calculation is based are as follows:

(a) rail exports = 50% of total rail sales

(b) slab exports = 100% of total slab sales

(c) billet exports = 100% of total sales of output in excess of 350,000 tons per annum.

The assumptions on percentages were provided by the PTMA from the MacKinsey study. The foreign exchange costs and the assumptions on which their calculation is based are as follows:

(d) imports of raw materials = approximately 5% of total operating costs. (calculated from figures provided by Touche-Ross to PTEA)

(e) imports of capital equipment = $28.2 million, $2.5 million and $0.2 million for, respectively, Q-BOP, Improved O.H. and Rail-Electric. (Data provided by Met Chem)

(f) proportion of coal purchases that would otherwise be exported = 50% of Sysco coal purchases (information provided by DEVCO).

Two other adjustments have been calculated but are of a sufficiently different nature to warrant separate discussion. First, in the case of closure, it is possible that the sale of some of the existing capital equipment could be made to non-Canadian buyers. Specifically, it has been suggested that the

caster could be sold abroad at an estimated value of $9 million. Using the 15% adjustment rate, the foreign exchange adjustment for production options (relative to closure) would be about $1.4 million lower than would be the case without consideration of this point. The results in Table 6 do not reflect this particular adjustment since it is so small.

The second adjustment involves the treatment of iron ore purchases - i.e. whether those made by Sysco are competitive with or incremental to other domestic or foreign uses. If wholly incremental, then benefits accrue to Canadians because of the Q-BOP and Improved O.H.; if competitive only with domestic users, no adjustment in benefits or costs need be made; if competitive with foreign users, then a foreign exchange cost (foregone exchange earnings) is attributable to those two options. Based on information provided by both private sector and government sources, it appears that Sysco's iron ore purchases would involve a combination of the first and third possibilities. For the first 4 years (1980-83) of both options iron ore purchases would be wholly incremental; for the remaining years all of Sysco's iron ore purchases would compete with foreign uses. Hence, in the first four years of the Q-BOP and Improved O.H. options, there are benefits (positive) from iron ore purchases* and for the remaining years costs (negative) from them. These calculations are included in Table 6 and spelled out in detail in Appendix B.

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* Strictly speaking, these benefits are not foreign exchange adjustments. However, foreign costs are involved in later years, and it would be awkward and confusing to include the incremental benefits somewhere else in the report.

Table 6

Net Present Value of Foreign Exchange Benefits From Production Options Relative to Closure

	Q-BOP	Improved Open Hearth	Rail (Electric)
Net Foreign Exchange Benefits ($ millions)	+67.2	+71.9	+43.1

Economic Cash Flow

As explained in the Methodology section of this report* the economic cash flow is the sum of (a) yearly sales revenue less (b) yearly operating costs less (c) capital costs for the years in which capital expenditures are made, which is then discounted at 10% to yield the net present value of the cash flow. In our calculations, we have also added the (depreciated) 1992 value of each option's new capital assets which are assumed to be 50% of their original purchase price.

The net economic cash flow for each option relative to closure is indicated in Table 7.

Table 7

Net Present Value of Economic Cash Flow From Production Options Relative to Closure

	Q-BOP	Improved Open Hearth	Rail (Electric)
Net Economic Cash Flow ($ million)	-128.6	-68.0	-47.9

It can be clearly seen from the table that the ranking of the production options on the basis of economic cash flow is in inverse relationship to the level of production; Rail Electric

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* See pages 4-5.

has the best (least negative relative to closure) cash flow while Q-BOP has the worst. This is exactly the reverse of the ranking on the basis of net labour benefits. In the case of the comparison between Q-BOP and Rail Electric this is primarily a result of the higher initial capital costs of the former option. The same is true for the Q-BOP and Improved Open Hearth comparison. On the other hand, the difference between Improved Open Hearth and Rail Electric is due to the fact that the Rail option, in spite of a higher capital cost, generates a positive annual net revenue (total revenue minus total operating costs) while Improved Open Hearth involves a net cost in the years following construction.

Summary Canadian Net Benefits

The tables below show the sum of the net present values of (a) labour benefits (b) foreign exchange benefits and (c) economic cash flow, for each production option relative to closure. The results of the calculation constitutes the net economic benefits from each option. In Table 8, the results are based on the initial assumptions; Table 9 presents those obtaining after adjustment of the leisure value estimate.*

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* To get the results when it is assumed that with closure, the caster can be sold abroad, simply deduct $9 million from each of the final net benefits figures in both tables.

Table 8

Net Present Value of Economic Benefits From Production Options Relative to Closure
(Initial Assumptions)

	Q-BOP	Improved Open Hearth	Electric Furnace
Labour Benefits	+ $268.9 M	+ $230.9 M	+ 131.0 M
Foreign Exchange Benefits	+ $ 67.2 M	+ $ 71.9 M	+ $43.1 M
Economic Cash Flow	- $128.6 M	- $ 68.0 M	- $47.9 M
TOTAL	+ $207.5 M	+ $234.8 M	+ 126.2 M

Table 9

Net Present Value of Economic Benefits for Production Options Relative to Closure
(Reduced Value of Leisure)

	Q-BOP	Improved Open Hearth	Rail (Electric)
Labour Benefits	+ 329.0	+ 278.3	+ 160.8
Foreign Exchange Benefits	+ 67.2	+ 71.9	+ 43.1
Economic Cash Flow	- 128.6	- 68.0	- 47.9
TOTAL	+ 267.6	+ 282.2	+ 156.0

Not surprisingly, due to their much larger labour benefits, the high employment options yield significantly larger net economic benefits than either Rail-Electric or closure. However, in the comparison of the Q-BOP and Improved Open Hearth options, it is the option with the lower level of employment, Improved Open Hearth, which generates higher net economic benefits. Under initial assumptions the difference is about $27 million (12%). However, changing the value of leisure reduces the gap between these two particular options to about $15 million (a 5% difference).

To this point, it is reasonable to conclude that either the Q-BOP or the Improved Open Hearth option is preferable to both the Rail-Electric and closure options. However, it is not reasonable to conclude, on the basis of the above results, that the Improved Open Hearth option is more desireable than the Q-BOP one even though its net economic benefits are larger. The difference between the two options is relatively small especially when the initial assumption on the valuation of leisure is changed. It is obvious that the more favourable cash flow for the Open Hearth option is significant enough to swamp the higher labour benefits from Q-BOP. As noted above, the differences in the respective cash flows is due to capital cost differences. It is worth noting that after the construction period, the net economic revenue per annum from the Q-BOP is postitive (about $17.5 million per year) while that from the Improved Open Hearth is (slightly) negative (- $1.2 million per year).

Because of the closeness of the results for Q-BOP and Improved Open Hearth, it is our conclusion that no clear choice between the two options is possible solely on measurable economic grounds.

Cost-Benefit Analysis for Nova Scotia

The same format has been used for the Nova Scotia cost-benefit calculation as for the Canadian one. As explained in an earlier section*, the difference between the two perspectives revolves around differences in the estimation of the foreign exchange adjustment and the economic cash flow; the net labour benefits will be the same.

For the foreign exchange adjustment it is not clear what criteria should be used to determine the proportion of total foreign exchange benefits should be made attributable to Nova Scotia. We have decided that it would be appropriate to apportion the benefits in line with Nova Scotia's share of overall Canadian economic activity. Hence a criteria such as the percentage of GNP generated in Nova Scotia or the proportion of the total Canadian employed labour force working in Nova Scotia would satisfy the need for a criteria. By latest estimates (1977), the relevant figure in both cases is about 3%. The results of allocating foreign exchange benefits to Nova Scotia in that manner are shown in Table 10.

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* See pages 5-6

Table 10

Net Present Value of Nova Scotia's Foreign Exchange Benefits from Production Options Relative to Closure

	Q-BOP	Improved Open Hearth	Rail Electric
Foreign Exchange Benefits ($ million)	2.1	2.2	1.3

For economic cash flow, all of the calculations done for Canada are relevant to Nova Scotia except for the cost of capital, assuming that the province pays only a portion of those total costs. Assuming a 65 : 35 (federal : provincial) cost-sharing arrangement, the net economic cash flow for Nova Scotia is as presented in Table 11.

Table 11

Net Present Value of Nova Scotia's Economic Cash Flow from Production Options Relative to Closure

	Q-BOP	Improved Open Hearth	Rail Electric
Economic Cash Flow ($ million)	-27.6	-50.8	-4.3

The result of the reduction in the cost of capital for Nova Scotia (relative to the Canadian cost-benefit analysis) is that the net economic cash flow for Q-BOP is actually lower than for Open Hearth. In Table 12 and 13 below, the sum of (a) labour benefits (b) foreign exchange benefits and (c) economic cash flow yields the net economic benefits to Nova Scotia of each option relative to closure.

Table 12

Net Present Value of Economic Benefits to Nova Scotia of Production Options Relative to Closure (Initial Assumptions)

	Q-BOP	Improved Open Hearth	Rail Electric
Labour Benefits	+ $268.9 M	+ $230.9 M	+$131.0 M
Foreign Exchange Benefits	+ $ 2.1 M	+ $ 2.2 M	+ $ 1.3 M
Economic Cash Flow	- $ 27.6 M	- $ 50.8 M	- $ 4.3 M
TOTAL	+ $243.4 M	+ $182.3 M	+ $128.0M

Table 13

Net Present Value of Economic Benefits to Nova Scotia of Production Options Relative to Closure (Reduced Value of Leisure)

	Q-BOP	Improved Open Hearth	Rail Electric
Labour Benefits	+ $329.0 M	+ $282.7 M	+ $160.8M
Foreign Exchange Benefits	+ $ 2.1 M	+ $ 2.2 M	+ $ 1.3 M
Economic Cash Flow	- $ 27.6 M	- $ 50.8 M	- $ 4.3 M
TOTAL	+ $303.5 M	+ $234.1 M	+ $157.8M

As in the case of the Canadian cost-benefit analysis Q-BOP and Improved Open Hearth generate net benefits which are larger than the Rail Electric option. However, in the Nova Scotia analysis, because of the lower capital costs Q-BOP has higher net economic benefits than Improved Open Hearth. Under initial assumptions, they are higher by $52 million (29%); when the value of leisure is changed, the gap between the two options increases to $70 million (30%). In both absolute and percentage terms the differences in economic benefits are significantly larger than in the Canadian analysis and the ranking is reversed. As in the Canadian case, we believe that no definitive conclusions as to a choice between the two options can be drawn from these results. Other factors such as comparative production and marketing flexibility and risks, productive value of the physical plant at the end of the period under consideration, and the political and social trade-off between higher employment benefits and larger financial subsidies have to be considered. Not only are these factors not, strictly speaking, measurable but some of them involve value judgements which economists are no more qualified to make than any other informed citizen.

Sensitivity Analysis

There has been some discussion among the project teams concerning the validity of the sales price conclusions drawn in the consultant's report to the PTMA. It is the purpose of this section of the study to estimate the effect on the economic benefits of each option of variations in the output prices. We have examined a 10% increase and a 10% decrease in selling prices. The results for the net economic benefits from a Canadian perspective of the production options are presented in Tables 14 and 15 below.

Table 14

Net Present Value of Economic Benefits to Canada of Production Options Relative to Closure* (10% Increase in Prices)

	Q-BOP	Improved Open Hearth	Rail Electric
Labour Benefits	+ $268.9 M	+ $230.9 M	+ $131.0 M
Foreign Exchange Benefits	+ $ 77.6 M	+ $ 81.8 M	+ $ 47.9 M
Economic Cash Flow	+ $ 1.0 M	+ $ 30.5 M	+ $ 14.5 M
TOTAL	+ $347.5 M	+ $343.2 M	+ 193.4 M

* This is under initial assumptions apart from the change in selling prices.

It can be seen from the table that the ranking of options of the basis of economic benefits changes from the original*, and the absolute level of benefits is higher by about $140 million in the Q-BOP case, $110 million for the Improved Open Hearth case and by $70 million in the case of Rail Electric.

Table 15

Net Present Value of Economic Benefits to Canada of Production Options Relative to Closure** (10% Decrease in Prices)

	Q-BOP	Improved Open Hearth	Rail Electric
Labour Benefits	+ $268.9 M	+ $230.9 M	+ $131.0 M
Foreign Exchange Benefits	+ $ 56.8 M	+ $ 62.0 M	+ $ 38.3 M
Economic Cash Flow	- $257.9 M	- $166.5 M	- $133.7 M
TOTAL	+ $ 67.8 M	+ $126.4 M	+ $ 35.6 M

** This is under initial assumptions apart from the change in selling prices

When prices are reduced by 10% the net economic benefits decrease significantly but the ranking of options remains unchanged from the original.

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* See pages 18-21

Summary

In Table 16, we present a summary of the net economic benefits for the production options relative to closure given the initial assumptions and given varying assumptions as to changing the valuation of leisure as well as to varying the selling prices of output. The ranking of options is also presented in the table.

Table 16

Net Present Value of Economic Benefits to Canada of Production Options Relative to Closure Under Various Assumptions

Assumptions	Q-BOP	Improved Open Hearth	Rail Electric
(a) Initial Assumptions	+ $207.5 M	+ $234.8 M	+ $126.2 M
Ranking	2	1	3
(b) Reduced Leisure Value	+ $276.6 M	+ $282.2 M	+ $156.0 M
Ranking	2	1	3
(c) 10% Increase in Prices	+ $347.5 M	+ $343.2 M	+ $193.4 M
Ranking	1	2	3
(d) 10% Decrease in Prices	+ $ 67.8 M	+ $126.4 M	+ $ 35.6 M
Ranking	2	1	3
(e) Reduced Leisure Value and 10% Price Increase*	+ $407.6 M	+ $390.6 M	+ $223.2 M
Ranking	1	2	3
(f) Reduced Leisure Value and 10% Price Decrease**	+ $127.9 M	+ $173.8 M	+ $ 65.4 M
Ranking	2	1	3

* Labour benefits figures from Table 9 and foreign exchange benefits and economic cash flow from Table 14.

** Labour figures from Table 9 and foreign exchange benefits and economic cash flow from Table 15.

Since the economic benefits from Q-BOP and Improved Open Hearth are significantly larger than those for Rail Electric and (because they are positive) than closure, either one is unquestionably preferable from an economic point of view. As to a choice between Q-BOP and Improved Open Hearth, however, the PTEA concludes that the differences are not large enough to warrant the conclusion that one is clearly preferrable to the other. This position (or lack of it) is strengthened by the results from the Nova Scotia cost-benefit analysis and from the price sensitivity analysis (when prices increase) in which the results yield a ranking for the two options that is the reverse of that shown in Tables 8 and 9.

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* See pages 22-25

Appendix A

The Model Used to Estimate the Social Opportunity Cost of Labour

As explained in the methodology section of the study*, in cost-benefit analysis, an estimate needs to be made of the social opportunity cost of labour which is then subtracted from the gross benefits (total labour income generated) to yield a figure for net labour benefits. The approach used in the DREE model is a supply-price oriented one in which the SOCL is an estimate of the social cost of attracting individuals to work on a project in Cape Breton. It measures the value that an individual worker attaches to activities which must be given up to accept a job on a project. The DREE model incorporates four features which make it different from the conventional type of study.

(1) It attempts to account for inter-regional labour migration that results from job creation (or destruction) in high unemployment areas. Specifically, it assumes what when new jobs are created, unemployed workers, who might otherwise have migrated out of the area, take the job and that some workers will move into the area from outside. Out-migration will occur when jobs are destroyed.

(2) The model distinguishes two types of workers - those who are rarely unemployed (permanent) and those who consistently work part of the year and are unemployed part of the year (temporary). It is from this latter group that new jobs are filled when they are created in a high unemployment area. This is also

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* See pages 1-3

the group involved in any inter-regional migration that takes place.

(3) The model further assumes that the rate of unemployment for the temporary labour force is constant in the long run. As a result migration will take place into (with job creation) and out of (with job destruction) an area until the size of the temporary labour force is the size sufficient to return the unemployment rate to its original long-run (equilibrium) level. A hypothetical example will help to demonstrate how this works. Suppose an area has a total labour force of 10,000 in which there are 6,000 full-time (permanent) jobs. This will require 6000 fully employed individuals to fill the jobs. Suppose that for the remaining 4,000 workers there are 2000 man-years of work. On average these temporary workers will work 50% of the year and be unemployed 50% of the year. The temporary unemployment rate is then 50%. (The overall unemployment rate, the one officially measured will be 20% = $\frac{2000}{10000}$). In that situation, if a project creates 1000 new permanent jobs, the initial effect will be that 1,000 temporary workers will now have permanent jobs and the temporary labour force will fall to 3,000. With (a constant) 2,000 man-years of work, the average temporary worker will be employed for 2/3 of the year and the temporary unemployment rate will fall to 33 1/3%. However, this lower unemployment rate will attract in-migrants. Specifically, 1,000 workers will move into the area so that the temporary labour force increases to 4,000 and the temporary unemployment returns to its original level of 50%.

In the model it is the mechanism described above that is utilized to estimate inter-regional migration and the total number of workers for whom a SOCL calculation needs to be made. It is somewhat more complicated in the model because the creation of permanent jobs results in the creation of additional temporary jobs due to the multiplier effect. However, the mechanism is basically the same.

Since it will take time for the appropriate (to the model) level of migration to occur, the model assumes that, in each year, migration is at a rate sufficient to reduce the differential between the existing temporary unemployment rate in that year and the long-run rate to which the labour market is moving by some constant percentage. For example, if we assume that the differential is reduced by 50% each year, it would mean for our hypothetical case above that, in the first year after a project starts, the temporary unemployment rate will increase to about 42% [=33 1/3% + .1/2(50% - 33 1/3%)]. For the temporary unemployment rate to increase to 42% would require an in-migration of 450 workers*.

(4) In actually calculating the SOCL, the model assumes that there is a competitive wage rate which, if it existed, would "clear" the labour market or, in other words, reduce unemployment to a level at which those actively seeking work are able to find jobs. In fact, the going wage rate on a project in a high unemployment area is <u>higher</u> than the competitive wage rate.

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* With 450 additional workers the temporary labour force has grown to 3450. With 2000 man-years of work to be shared among 3450 individuals, each individual works 58% of the year and is unemployed for 42% of the year. The temporary unemployment rate is 42%.

However, it is the competitive rate which is the benchmark for measuring the SOCL since it represents the wage that would be sufficient to attract workers to the project.

Having estimated migration for each year, the model calculates the SOCL in a job-creating project to be the sum of

(a) the net-of-tax competitive wage paid to the temporary worker for the proportion of time spent in employment.*

(b) the net-of-tax unemployment insurance payments made to the temporary worker for the proportion of time he is unemployed.

(c) the value that the temporary worker attaches to his leisure while unemployed.

(d) taxes that would have been paid if he had migrated to (stayed in another region) net of

(e) the U.I.C. benefits he would have received had he migrated to (stayed in) another region.

Some explanation of certain of these items require explanation. Items (a)-(c) constitute the conventional measure of the supply price of labour to a project with the added wrinkle of the distinction between temporary and permanent workers. Since the supply price is the rate of pay just necessary to induce an individual to take a particular job, it must be high enough to overcome the financial income he is already earning (a + b) as well as the value attached by the individual

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* It is the net-of-tax competitive wage because it is the net take-home pay which is just sufficient to induce him to take the job. It is for the temporary worker because ultimately, all jobs created are filled by temporary workers so it is their SOCL which must be calculated

to the leisure time he has while unemployed. However, we do not observe the competitive wage rate but rather the existing wage rate which is, in the model, asserted to be above the competitive one. Nor do we know how much value any individual attaches to the "consumption" of leisure time. What we do know is that given a known competitive wage, the value that leisure could take on is equal to the difference between the competitive wage rate and the level of U.I.C. payments that could be earned by the individual while unemployed. If the value for leisure were higher, the sum of U.I.C. payments and the non-monetary value of leisure would exceed the wage rate and the individual would not take the job.

Therefore, if we could estimate the competitive rate and combine that with obtainable information on the level of U.I.C. payments that would be paid to someone earning that rate, we could calculate a value of leisure. When the DREE model was actually used, it was asserted (for reasons too involved to be discussed here) that the competitive wage was 3/4 of the existing observable wage rate. Therefore, the value of leisure can be calculated by taking 3/4 of the going wage rate, estimating the value of U.I.C. payments appropriate to the resulting wage rate and subtracting the second figure from the first.

Finally, items (d) and (e) constitute what are referred to by economists as externalities - costs incurred (benefits received) by society due to the actions of an individual though

the individual does not himself incur (receive) them. In this case, society foregoes tax payments (a cost) and U.I.C. payments (a benefit) when an individual migrates to a region to take a newly-created job. (The tax and U.I.C. payments would have been made in the region from which the individual has migrated). The costs (taxes) are added to and the benefits (U.I.C. payments) subtracted from the SOCL.*

Having calculated the SOCL per individual, the model calculates the total SOCL for a project by multiplying by the number of individuals who receive jobs in and/or migrate to a region. The resulting figure is subtracted from the gross benefits (total labour income) to get net labour benefits.

When a project destroys jobs, the calculation is reversed. What were costs from the perspective of job creation (SOCL) become benefits because they are no longer incurred when jobs are destroyed. Conversely what were benefits from job creation (labour income) become costs because they are no longer being received.

Those wishing a more detailed and technical explanation of the model used in the study are invited to read a paper by Glenn Jenkins and Chun-Yan Kuo entitled "On Measuring the Social Opportunity Cost of Permanent and Temporary Employment" published in the Canadian Journal of Economics May 1978.

* If these externalities were calculated separately from the SOCL, the foregone taxes would count as a cost to be subtracted from total benefits and foregone U.I.C. payments as a benefit to be added to total benefits.

Appendix B

Detailed Calculations of Economic Costs and Benefits

A. Labour Benefits

The following are the most important of the assumptions made in the labour benefits analysis:

(i) Total temporary labour force in Cape Breton (1980) = 36,460

(ii) Total man-years of work for temporary labour force (1980) = 19,580

(iii) Unemployment rate for temporary labour force (1980) = 46% . This is the long-run equilibrium unemployment rate used in the model. It is also increased to 48% in those cases where level of employment at Sysco falls relative to a starting point of 3,000 (see below)

(iv) Rate of migration response (= rate at which gap between long-run unemployment rate and actual rate is closed each year) = 40%. This is also changed to 45% in the case of Improved Open Hearth and 50% in the cases of Rail Electric and closure and to 20% for Q-BOP.

(v) Average yearly wages and salaries at Sysco = $14,140-$15,610. The annual wage and salary figure varies from one option to another because of differences in the composition of the labour force. For example, it

was assumed that in the Rail Electric case that most of the people who continued to work at the plant from the existing labour force would be the more senior people whose average wage would then be higher than in other production options.

(vi) Average yearly wages and salaries in construction = 17,000 - 18,500. As in the case of Sysco operating workers, the average wage and salary figure varies both from option to option and year by year as the trades composition of the construction labour force varies.

(vii) Valuation of leisure per year = $2855. This varies as between worker in the base sector of the Cape Breton economy (Sysco mainly) and in the secondary sector (where jobs are created through the multiplier effect). This figure is an average one.

(viii) Social opportunity cost of labour per year = $7620. As in (vii) this is an average figure.

(ix) Income multiplier = 1.52.

In order to calculate net labour benefits, the model has to start from an existing employment base. At the time of the computer runs of the model, the employment level at Sysco was about 3000. That became the starting point for calculations. Relative to that starting point, the changes in employment are as indicated in Table I.

Table I

Changes in Construction and Operating Employment by Year

OPTION / YEAR	Q-BOP Change in Employment	IMPROVED O.H. Change in Employment	RAILMILL (ELECTRIC) Change in Employment	CLOSURE Change in Employment
1980	+255(C)	+111(C)	+70(C)	-3000(O)
1980	-722(O)	-722(O)	-722(O)	--
1981	+822(C)	+50(C)	+579(C)	--
1982	-800(C)	-154(C)	-370(C)	--
1983	-255(C)	-7(C)	-267(C)	--
1984	-22(C)		-12(C)	--
1984	+731(O)		-1678(O)	--

Starting from an employment level at Sysco in 1980 of 3,000, the net labour benefits for all options including closure are as shown in Table 2.

Table 2

Net Present Value of Labour Benefits to Canada From Each Option (Relative to 3000)

	Q-BOP	Improved Open Hearth	Rail Electric	Closure
Net Labour Benefits	- $18.9 M	- $56.4 M	- $-156.8M	- $287.8 M

The reason for the negative labour benefits for Q-BOP is that, in spite of the net increase in employment (3000 up to 3009), there is an initial loss of employment of 722 (in 1980) which is not recovered until 1984. To get the net labour benefits relative to closure, you simply subtract the difference between the (negative) benefits for closure and the (negative benefits for each option. As explained in the text of the study, it is not valid to use the figures as they appear in Table 1 for that would imply a base case in which employment is maintained at 3000 with no change in existing facilities. This is generally agreed not to be a viable option for any reasonable time period (certainly not 12 years). Therefore, closure has been used as the base case in this study. The results of so doing are shown in Table 3 which is the same as Table 2, page 9 of the text.

Table 3

Net Present Value of Labour Benefits to Canada
From Production Options Relative to Closure

OPTION	Q-BOP	IMPROVED OPEN HEARTH	RAIL (ELECTRIC)
NET LABOUR BENEFITS ($ MILLION)	+268.9	+230.9	+131.0

Modifications

(a) Valuation of Leisure

The valuation of leisure was changed from a maximum value (see Appendix A) of $2855 to 50% of that value. This is simply halfway between the maximum value and a value of 0 which was, at one time (and still is in some studies) the value normally attributed to leisure for unemployed workers. The results relative to a starting point of 3000 and to closure are shown in Table 4 .

Table 4

Net Present Value of Labour Benefits to Canada From Sysco Options (Reduced Value of Leisure)

	Q-BOP	Improved Open Hearth	Rail Electric	Closure
Net Labour Benefits Relative to 3000	- $ 18.8 M	- $ 69.5 M	- $187.0 M	- $347.8 M
Net Labour Benefits Relative to Closure	+ $329.0 M	+ $278.3 M	+ $160.8 M	---

(b) Migration Response

We changed the rate at which the gap between the long-run unemployment rate and the actual unemployment pertaining in the temporary sector in any one year is reduced. The original assumption was a 40% reduction year by year. We increased that to a 50% reduction rate for Rail Electric and Closure and to 45% for Improved Open Hearth and lowered it to 20% for Q-BOP

The rationale for the variation in rates is that the options in which employment is significantly lowered (relative to 3000) are likely to generate a faster rate of out-migration and hence a greater rate of reduction in the unemployment rate gap. On the other hand, for Q-BOP there is little long-run change in Sysco employment albeit there is a 3 year period in which employment is significantly reduced. For that reason, we made the migration response rate fairly low for Q-BOP. The results are as indicated in Table 5.

Table 5

Net Present Value of Labour Benefits to Canada from Sysco Options (Changed Migration Response)

	Q-BOP	Improved Open Hearth	Rail Electric	Closure
Net Labour Benefits Relative to 3000	- $ 21.1M	- $ 54.1M	- $146.8M	- $275.4M
Net Labour Benefits Relative to Closure	+ $254.3M	+ $221.3M	+ $125.6M	---

(c) Long-run Unemployment Rate

The assumption that the unemployment rate in the temporary sector returns to its original level was changed on the assumption that cases which involved a permanent reduction in employment at Sysco would generate a long-run increase in the unemployment rate. Therefore, in all cases except Q-BOP, the unemployment rate was assumed to increase from 46% to 48%. The results are shown in Table 6.

Table 6

Net Present Value of Benefits to Canada from Sysco Options (Changed Unemployment Rate)

	Q-BOP	Improved Open Hearth	Rail Electric	Closure
Net Labour Benefits Relative to 3000	- $ 18.9 M	- $ 60.1 M	- $177.5 M	- $306.4
Net Labour Benefits Relative to Closure	+ $ 287.5 M	+ $246.3 M	+ $128.9 M	---

B. Foreign Exchange Adjustment

Given the assumptions as outlined on pages 14-15 in the text, the foreign exchange adjustment of 15% was applied to foreign exchange earnings (benefits) from sales of output abroad and to foreign exchange payments (costs) resulting from input purchases abroad. As well, an adjustment was made for the portion of Sysco coal purchases (50%) that would be sold to foreigners if Sysco were not operating. Finally, an adjustment was calculated for iron ore purchases. In the first four years of appropriate options, if Sysco did not purchase iron ore it would not be mined according to private and public sector sources. To get an estimate of the value to Canadians of Sysco's purchases for those years, we assumed that their primary effect would be on the net earnings of iron ore producers estimated to be approximately 20% of the total sales value of the iron ore. In the remaining years, the total of all ore purchases would have been sold to foreigners in Sysco's absence.

In Tables 7-9, the year by year foreign exchange adjustment is shown for each production option. It is to this stream of adjustments that the 10% discount rate is applied to generate the net present value of foreign exchange benefits as shown in Table 6, page 16. Since the whole of the relevant revenues and costs for each option is used to calculate the adjustment, the implicit bases (base case) on which the calculation is predicated is closure (i.e. 0 output, 0 adjustment). If it is assumed that, on closure, part of the plant (the caster) could be sold to a foreign company, the value of that foreign exchange earning is attributable to closure. To get the net foreign exchange benefits relative to closure, in that instance, the adjusted value of the caster sale is subtracted from each of the original net benefits figures for production options since the earnings are foregone under each of those options. This is shown in Table 6A, page 16 of the text.

Table 7

Foreign Exchange Adjustment for the Q-BOP Option

Year	Foreign Exchange Revenue ($ millions)	Foreign Exchange Costs ($ millions) Capital	Operations*	Coal	Iron Ore	Net Foreign Exchange Earnings Before Adjustment	Net Foreign Exchange Earnin After Adjustme (15%)
1980	$ 46.2	(6.5)**	(6.2)	(15.1)	7.2	25.6	3.8
1981	"	(15.3)	"	"	"	16.8	2.5
1982	"	(6.4)	"	"	"	25.7	3.8
1983	99.8		(8.5)	(19.9)	9.4	80.8	12.1
1984	125.6		(9.3)	(21.7)	(7.7)	86.9	13.0
1985	134.7		(9.7)	(22.4)	(7.6)	95.0	14.3
1986	"		"	"	"	"	"
1987	122.8		(9.2)	(21.5)	(7.3)	84.8	12.7
1988	134.7		(9.7)	(22.4)	(7.6)	95.0	14.3
1989	"		"	"	"	"	"
1990	122.8		(9.2)	(21.5)	(7.3)	84.8	12.7
1991	134.7		(9.7)	(22.4)	(7.6)	95.0	14.3
1992	"		"	"	"	"	"

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* Costs of inputs actually imported

** Brackets denote costs which are a negative component of the foreign exchange adjustment

Table 8

Foreign Exchange Adjustment for the Improved Open Hearth Option

Year	Foreign Exchange Revenue ($ millions)	Foreign Exchange Costs ($ millions) Capital	Operations*	Coal	Iron Ore	Net Foreign Exchange Earnings Before Adjustment ($ millions)	Net Foreign Exchange Earnings After Adjustment ($ millions)
1980	93	(1.0)	(8.4)**	(16.8)	7.3	74.1	11.1
1981	"	(1.5)	"	"	"	73.6	11.0
1982	"		"	"	"	75.1	11.3
1983	"		"	"	"	75.1	11.3
1984	"		"	"	(5.4)	62.4	9.4
1985	"		"	"	"	"	"
.							
.							
.							
1992	"		"	"	"	"	"

* Costs of inputs actually imported

** Brackets denote costs which are negative components of the foreign exchange adjustments

Table 9

Foreign Exchange Adjustment for the Rail Electric Option

Year	Foreign Exchange Revenue ($ millions)	Foreign Exchange Costs ($ millions) Capital	Foreign Exchange Costs ($ millions) Operations	Net Foreign Exchange Earnings Before Adjustment	Net Foreign Exchange Earnings After Adjustment (15%)
1980	46.2	(0.1)	(6.7)	39.4	5.9
1981	"	(0.1)	"	"	"
1982	"		"	"	"
1983	"		(3.8)	42.4	6.3
.					
.					
.					
992	"		"	"	"

C. Net Economic Cash Flow

There is no need to provide specific detailed tables for the economic cash flow. It is derived in a straight forward manner from the financial cash flow figures provided by Touche-Ross to the PTFA. From those figures, for each production option, we take the yearly sales revenue and subtract from it yearly operating costs as well as the capital costs in the years in which capital expenditures are made. (these latter figures are provided by Met Chem). To the result in 1992 is added the depreciated value of new capital assets (assumed to be 50% of the original purchase price). The stream of yearly net revenue figures is then discounted at 10% to get the net present value of the cash flow. Finally, from the net economic cash flow result for each production option is subtracted the cash flow resulting from closure ($37.9 million) in order to get the results for each option relative to closure.