ENVIRONMENTAL PROTECTION AGENCY
TECHNOLOGY TRANSFER SEMINAR

PHILADELPHIA, PENNSYLVANIA — AUGUST 21-22, 1973

UPGRADING DAIRY PRODUCTION AND TREATMENT FACILITIES TO REDUCE POLLUTION

CHOOSING THE OPTIMUM
FINANCIAL STRATEGY FOR POLLUTION CONTROL

J. A. Commins & Associates, Inc. Fort Washington, Pennsylvania 19034

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Foreword

Much has been written on how to select pollution control equipment, but relatively little on how to pay for it. A sound capital investment strategy, however, can mean the difference between profitable operation and controlled cash flow, on the one hand, and fiscal chaos on the other. This is an explanation of how some proven tax and financing strategies, and their use in various combinations, can help the financial position of three hypothetical dairy processing firms with differing management goals who face capital equipment expenditures. For dairy processors who have a choice of on-site treatment or sending their pretreated wastes to a municipal system, a method of financial analysis of these alternatives is also presented.

No matter how adept and capable a financial manager may be, it is entirely possible that he could overlook some important aspect of fiscal management of pollution control expenditures, because of the new and unique nature of the legislation, the high degree of complexity, and the one-shot nature of the decision. This report was especially prepared for the EPA Technology Transfer Seminar for dairy processors. It shows the small businessman the type of financial analysis that should be accorded a pollution control expenditure, because of the possibilities of substantially reducing the funds expended, and smoothing out the cash flow trauma that otherwise would develop.

The report has been tailored to the dairy processing industry which is defined as butter, natural cheese, powder and condensed products, ice crean and fluid milk. The dairy processing industry is faced with several federal regulatory programs of which water pollution control represents the most significant dollar outlay. However, the financial laws and analytical techniques have applicability to all air and occupational safety and health situations for any industry.

The analysis is applicable to dairy processors with their own treatment facilities and to those connecting with the municipal system. Available data for those dairy processing establishments using municipal facilities is limited to large plants processing 20 million or more gallons per year. Large ice cream and fluid plants being more market oriented discharge 72 and 76 percent of their wastes respectively into municipal treatment facilities. Butter, cheese and condensing plants discharge 44, 49 and 30 percent respectively into municipal treatment facilities. Together the large plants have municipalities treat 58 percent of their wastes. Facing higher user charges in the future, brought about by the Federal Water Pollution Control Act (FWPA) and new standards for private treatment, this mix of those using municipal facilities is subject to possible changes.

The reader should regard the illustrative situations used in this presentation as necessarily simplified, representative examples that by no means exhaust the variety of available alternative tax and financing strategies particularly those relating to pollution control equipment. Much financing, and to a lesser extent, tax treatment varies by jurisdiction. Consultation with the latest tax rulings and legislation governing in your location is necessary before undertaking the final decision making process.

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INTRODUCTION

As the 1970's proceed, environment-related management decisions will be more complex and frequent. The impact on businesses of non-productive environmental expenditures can be significant where by-product recovery is limited or non-existent. It is clear from provisions of the 1972 FWPCA amendments (PL92-500) coupled with the existing Clean Air Act, that industry must commit sizable capital to meet the environmental standards the nation has set.

Many governmental institutions have shown a form of compassion for the necessary private equipment expenditures and public treatment facilities by providing means of reducing or softening the financial expenditures for pollution control. There exists a mild governmental practice of spreading some of industries' pollution control costs over the general public in place of just the company, and, to some degree, its customers. This is accomplished by excusing pollution control devices from certain sales, use and property taxes, by allowing tax-exempt financing by the company of the expenditures, or through adjustment in company income taxes by the addition of special depreciation alternatives. All of these programs involve a company paying lower taxes than they normally would have to pay if that equipment was for some other manufacturing or service purpose. Another set of incentives provides for the possibility of government treatment of wastes at lower costs than self-treatment through federal government grant programs.

To put these incentives or cost reduction practices into perspective, it should be pointed out that these incentives do not pay for the pollution control investment nor do they overwhelmingly reduce the cost.

They can, however, have a pronounced effect on cash flow and profit positions depending on what alternatives are selected. Because procurement of control equipment is a relative unique business occurrence, and because of a considerable body of new and involved tax and financing regulations for such purposes, it is likely that company financial managers are not as familiar with the many possibilities as they would be with the more common business operations.

This report will demonstrate that it is well worth spending time in analyzing the unique added methods of financing pollution expenditures and their equally unique tax treatment. It will alert decision makers as to the availability of, and qualifications for some of the financing incentives that federal, state and local governments have made available.

Obtaining the optimum financial and tax incentives for your company could save tens of thousands of dollars over the life of the equipment. For example, a recent Business Week article (July 29, 1972 pp. 50-51) demonstrated the cost savings that tax exempt pollution control revenue bonds can provide. "Over the life of a 20 year $10 million issue, the typical interest saving is about $3.6 million." Some revenue bond issues allow for deferred repayments of principal and permit the largest payments at the end of a 20-30 year issue. Meanwhile, the company can take depreciations and use investment tax credits which lower taxes. Thus, it can build up a cash flow which is used in other areas of the business. On that cash flow, earnings are generated which help to repay the bond principal at the later time.

On balance, more of this report is devoted to the financial analysis for equipment purchases than for user charge analysis. The reasons are: first, that most industries will face equipment purchases for on-site treatment or municipal treatment since the latter alternative requires pre-treatment; second, other regulatory programs, namely the Clean Air Act, normally show their impact through required capital equipment expenditures.

The financial techniques utilized in examining pollution control expenditures are well establihsed; however, the future costs to be analyzed are only beginning to become apparent. Under the enforcement provisions of the FWPCA's National Pollutant Discharge Elimination System (NPDES) effluent guidelines relating to the best practicable technology are to be specifically issued for many industries treating on-site. These guidelines will give companies an idea as to how they will be required to control by 1977, but final cost estimates may not be ascertainable until compliance terms of a company's specific permit are set and issued.

For costs of discharging to municipal facilities pre-treatment guidelines from EPA are expected momentarily as this report goes to print. The other major cost factor of user charges for those who hook into municipal facilities which receive federal grants is beginning to unravel since federal guidelines were suggested in June, 1973. These costs consist of the equitable cost of capital and operating and maintenance costs assessed on the company by the municipality for municipal treatment costs. Once the EPA completes its process, processors and others will then be able to analyze whether it would be financially preferable to make a capital equipment investment for their own private treatment facilities, or whether being hooked into municipal treatments system is better. There may be regulations, however, that might preclude the exercise of the results of such a decision. This report will indicate how to proceed with an analysis once the permissibility and costs of using municipal facilities are more adequately defined.

Management Summary and Guide

We have noted that there are a number of new unique alternatives that have sizable differing financial consequences amounting to tens of thousands of dollars. Many of the alternatives require, by law, that once a financial decision is made it can't be changed, or changed in only one direction. Others are final in that it would be prohibitively costly to change later on in the program. Therefore, the following financial information should be analyzed as a minimum before equipment or charge decisions are made.

1. Determine for all debt financing of pollution control investments, the most effective combination of rate and term of the loan. Calculate the negative cash flows involved and their net present values.
2. Calculate the year-by-year cash inflows and the present values for each available choice of depreciation.
3. Select the management objective by which you would want

to judge the financial impact of the investment in equipment; for example, lowest short-term profit impairment, least cash drain, long-term profit impairment, etc. Compare the combinations of financing and depreciation values calculated in Steps 1 and 2 against the established management objective, and select the combination best suited for your company needs.

4. Determine what the municipality's user charge will be for processing wastes and estimate the capital expenditure necessary for any pre-treatment facility. Calculate the present values for the treatment expense and a present lease value for the user charge payment.
5. Compare the values and year-by-year effects of Step 4, and and Steps 1 through 3, against the selected financial management objective. This will allow you to make a choice between whether to plug into a municipality's waste water or invest in a private treatment facility, from a financial point of view.

This analysis presumes that the legal and tax implications of each financial alternative are fully understood by the analyst in order that present values and cash flows can be calculated. Likewise, the analysis does not include the legislative and technical matters which may preclude a processing plant from being able to have the freedom of choice.

Organization of the Report

The report is divided into six chapters. Chapter I describes the standard depreciation methods and those which have been established for pollution control facilities. Chapter II examines the costs of different methods of financing pollution control equipment. Chapter III relates the financing and tax strategies for equipment to normal company financial strategies. In other words, how do the incentives correspond to a company's maximum cash flow strategy or its profit maximization strategy, etc? Chapter IV is a look at the availability of the various financing alternatives already discussed, both from the federal government and from five northeastern states in which a large amount of dairy processing takes place. Some financing alternatives are for practical purposes always available, while others are dependent upon the source's budget. The fifth chapter examines the combination of the first four sections as opposed to the financial theory of a user charge system. This alternative analysis sets up a basis for decision when the costs of the Federal Water Pollution Control Act become predictable, an example of which follows in Chapter VI.

CHAPTER I

DEPRECIATION

Many pollution control acquisition incentives are in the form of special depreciation provisions. Sometimes, these provisions are called "rapid amortization", except that the amortization period bears no relation to useful life as in the case of strict depreciation. The underlying effect of any type of depreciation is on the taxes payable by a company and its cash flow. Normally, there exist two general kinds of depreciation incentives for any kind of equipment. One set of depreciation methods provides an annual deduction from income as a non-cash expense over a certain guideline period. The timing of deduction selection changes with different depreciation techniques. In other words, large portions of the cost of the equipment can be deducted early in the life of equipment by using one technique, or equal proportions are deductable over the life of the equipment, using another technique. This gives rise to the familiar terms: straight-line depreciation, double-declining-balance, sum-of-the-years'-digits, etc.

Another kind of equipment depreciation factor exists for all types of equipment, and that is an incentive to actually buy equipment; called an investment tax credit (Sections 46-48, 50, Internal Revenue Code). This provision, in effect, actually reduces the cost of the equipment because it gives a permanent tax credit. All the different depreciation methods noted previously, allow a corporation to adjust its depreciation schedule to conform with its financial management strategies.

To add an incentive for the purchase of pollution control facilities, the IRS permits a pollution control facility to be amortized over a period of 60 months (Section 169, IRC). Since the 60 month period may have no relationship to the actual life of the equipment, which could last 120 to 200 months, the incentive is called rapid amortization.

Depreciation involves consideration of both method and useful life. The ability to take any method of depreciation for pollution control facilities is not precluded because of the method a company customarily uses. The normal requirement for consistent adherence to class depreciation method is waived. For example, if a processor uses a foods manufacturing Asset Depreciation Range, into which all the assets customarily fall, and he uses the straight-line depreciation method, he could still take double-declining depreciation for the pollution control equipment.

Another nuance is that when an asset class depreciation range is used, a different useful life can be used for pollution control facilities upon sufficient justification. For example, if a processor customarily uses a guideline useful life of 12 years (permitted in the 9.5 to 14 year ADR), he could use 8 years for the control device if he could substantiate. This may be advantageous if the life of the equipment is less than that of the normal asset range.

Relationship of Depreciation to Taxes and Cash Flow

The financial strategy supporting the rapid amortization plan is a good entry into the methods of analysis for evaluating which depreciation, amortization and/or investment tax credit method to use. The incentive is that depreciation/amortization is an expense which does not actually involve any cash outlays by the taxpayer. The lower profits from the expense before taxes means a tax savings. The tax savings is a net cash inflow to the corporation and is represented by:

$$NCF = D\ T$$

where NCF = net cash flow

and D/A = amount of depreciation/amortization

T = the tax rate, expressed as a fraction

Positive cash flows (cash inflows) are able to be reinvested in the business for the productive side of the operation or to reduce the needs for obtaining cash from other sources. A shortened period of depreciation/amortization means larger deduction, larger tax savings and more cash flow.

Net Present Value

An analysis of this net cash flow through the depreciable life of the equipment will yield a Net Present Value. The total effect of depreciation on a company's cash flow is determined by using the present value approach which utilizes the time value of money. A dollar saved today has a greater long-term effect on the financing situation of an enterprise than a dollar saved a year from now, because the dollar that was saved today has the potential of yielding a return if invested or saved. Thus, at the end of the year, the future value of today's dollar is,

$$FV = 1 + r$$

where, r = yield (interest earned) on one dollar.

The present value of the dollar saved a year from now is, on the other hand,

$$PV = \frac{1}{1 + r}$$

The present value of a dollar saved i years from now is obtained by discounting annually:

$$PV = \frac{1}{(1 + r)^i}$$

Thus, the present value of the net cash flow during year i, termed discounted cash flow, DCF, is,

$$DCF_i = \frac{NCF_i}{(1 + r)^i}$$

The sum total of all such discounted cash flows over the useful life is the net present value, NPV, of the tax savings:

$$NPV = \sum_{i=1}^{n} DCF_i = \sum_{i=1}^{n} \frac{NCF_i}{(1 + r)^i}$$

Since NPV is the sum of discounted cash inflows (tax savings), the higher the NPV, the more attractive the depreciation method. The annual discount rate, r, is termed the after-tax return on investment for the enterprise.

For dairy processors, the cost of capital (this is the same as the return if funds are reinvested) before tax is estimated to be about 6.0%. After taxes, this figure reduces to about 3.0%. Therefore,

$$r = 3.0 \text{ percent}$$

The effect of the net present values from each method of depreciation is to reduce the effective cost of the capital expenditure necessary for the pollution control facility.

Water Pollution Control Investment for Dairy Processors

At this time no one can be quite sure as to what the costs are for best practicable or the best available control technology for dairy processing or any other industry. For illustrative purposes, we are going to use an average investment figure of $400,000.

For accounting purposes, the Asset Depreciation Range of equipment used in the foods manufacturing industry into which a dairy processor usually falls, is 9.5 to 14.5 years. (Section 167, IRS Code.) We will select a 12 year life based on the guideline useful life of the Asset Depreciation Range. Salvage value is assumed to be zero.

Rapid Amortization

The Tax Reform Act of 1969, provides for rapid amortization of certified pollution control facilities over a 60-month period, irrespective of the guideline useful life of the equipment. This amortization is available under certain conditions outlined in Article 169 of the Internal Revenue Code. The accelerated writeoff was provided to encourage capital investment in pollution control. Note that a process change, even if it results in lower pollution does not qualify as a pollution control device, and such costs cannot be rapidly amortized.

The rapid amortization applies to the first fifteen years life of the equipment. The asset portion value over fifteen years can be depreciated by any method under Article 167 and depreciation taken immediately on that portion. The rapid amortization can begin in the month after installation and continue for a full 60 months, or it could begin in the next fiscal year. For the intervening months until the next fiscal year begins, a traditional depreciation method can be used.

An additional first year depreciation (Section 179, IRC) amount of 20 percent of a maximum asset value of $10,000 or a maximum deduction of $2,000 can be taken in the first year of an asset purchase. The "bonus" first year depreciation can be taken if a taxpayer elects to take the rapid amortization or any other method of depreciation. Although this provision is not considered a pollution control incentive, its inclusion is needed for accuracy of calculations.

For simplistic purposes it will be assumed that the effective date of purchase of the $400,000 waste treatment facility is the beginning of the fiscal year and that the corporate income tax rate is 48 percent. Computation of the net present value of the $400,000 investment using rapid amortization results in, Yearly Cash Flow = T D

= (.48) ($80,000)

$$NPV = \sum_{i=1}^{n} DCF_i$$

$$DCF = \frac{NCF_i}{(1 + r)^i} \qquad r - 3.0\%$$

NPV = $175,918

Straight Line Depreciation

The base or most simple form of depreciation involves taking an equal proportion of 8 1/3 percent for each year of the 12 year life of the depreciable base under the appropriate foods manufacturing depreciation class. In this case, the depreciable basis could have been reduced to $398,000 by taking the additional first year bonus depreciation of $2,000 (maximum), but the point of emphasis is to have the straight line method serve as a base. Using the above formula with the $400,000 basis, the NPV of cash inflows is $ 159,266.

Investment Tax Credit

The Internal Revenue Service (Sections 46-48, 50) allows an investment tax credit of 7 percent of the equipment cost to be applied to the reduction of corporate income taxes payable. Investment tax credit is a special incentive for the business community to purchase capital equipment. This tax credit is a full and direct tax savings of $28,000 in this example. This figure, adjusted by the NPV, should be added to the straight line depreciation NPV, since the investment tax credit is allowed for that method. The resulting NPV is $186,586 Also taken into account in this calculation, is the NPV of the after-tax additional first year depreciation. There is a special caution on investment tax credit. Rapid amortization and investment tax credit are mutually exclusive. A choice between the two must be made at the outset.

There are also many other details of these amortization and tax credit laws which are too detailed or peripheral to present here and do not change the essence of the calculations.

Double-declining Balance Depreciation

The double-declining balance method is the quickest allowable way, except for the aforementioned special rapid amortization of depreciating equipment through its useful life. The calculation provides that yearly, twice the straight line rate is deducted on the remaining life. In our case, the first year's depreciation is $68,347, .1667x$398,000 = $66,347 plus $2,000. In the second year, the 16 2/3% is taken against ($398,000-$66,347) or $331,653 resulting in a figure of $ 55,287.

When year-by-year cash flows are discounted using the rate of return the NPV for the $400,000 equipment using double-declining depreciation becomes $203,001.

There is, of course, another depreciation method called, "sum of the years digits", which has results between the straight line and double declining methods.

Net Present Value Calculation

Mathematically, the table below shows how the NPV is calculated for a $400,000 piece of equipment depreciated by the straight line depreciation method over 12 years. The effect of the investment tax credit plus the additional first year's depreciation is also considered.

TABLE 1

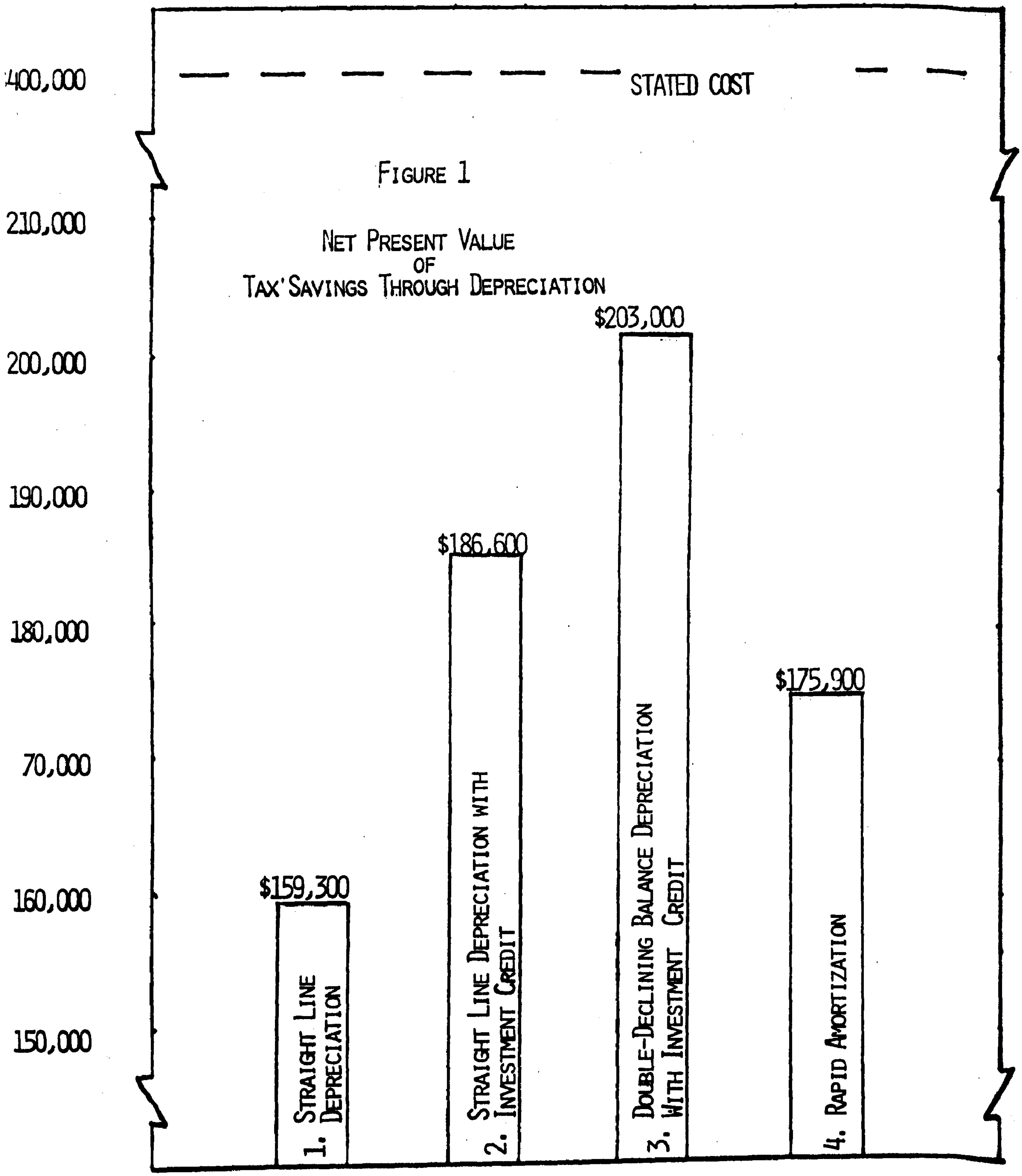
EXAMPLE OF NPV CALCULATION FOR STRAIGHT LINE DEPRECIATION

End of Year	Depreciable Base	Rate Deprec.	After Tax Deprec.	Rate of Disc.	NPV
1	$400,000*	Max.	$ 960	1.03	$ 928 AFYD
1	398,000	8 1/3%	15,920	1.03	15,456
2	398,000	8 1/3%	15,920	1.0609	15,006
3	398,000	8 1/3%	15,920	1.0927	14,569
4	398,000	8 1/3%	15,920	1.1255	14,145
5	398,000	8 1/3%	15,920	1.1592	13,734
6	398,000	8 1/3%	15,920	1.1940	13,333
7	398,000	8 1/3%	15,920	1.2298	12,945
8	398,000	8 1/3%	15,920	1.2667	12,568
9	398,000	8 1/3%	15,920	1.3047	12,202
10	398,000	8 1/3%	15,920	1.3438	11,847
11	398,000	8 1/3%	15,920	1.3841	11,502
12	398,000	8 1/3%	15,920	1.4256	11,167
					$159,402
		PLUS: 7% investment tax credit discounted back to year zero			27,184
				Total NPV	$186,586

*The $2,000 maximum additional first year's depreciation must reduce the succeding year's depreciable base by the same amount.

Depreciation Comparisons

Figure 1 is a bar graph of how the value of each depreciation method relates to the overall cost of the equipment. The values are less



400,000
210,000
200,000
190,000
180,000
70,000
160,000
150,000
STATED COST
FIGURE 1
NET PRESENT VALUE
OF
TAX SAVINGS THROUGH DEPRECIATION
$159,300
$186,600
$203,000
$175,900
1. STRAIGHT LINE DEPRECIATION
2. STRAIGHT LINE DEPRECIATION WITH INVESTMENT CREDIT
3. DOUBLE-DECLINING BALANCE DEPRECIATION WITH INVESTMENT CREDIT
4. RAPID AMORTIZATION

than the base cost because of the cost-offsetting earnings from the cash generated by the tax savings from depreciation.

Limiting the consideration to net present value, the optimal strategy in our example is the double-declining balance method accompanied by the investment tax credit and additional first year depreciation. The fact that this form of depreciation is favored over the special pollution control rapid amortization makes one question how the situation arises. When the rapid amortization provision was enacted into law, the investment tax credit, which is historically an on-and-off type of tax incentive, was not in effect. Later on, the investment tax credit became effective for equipment installed after March, 1971. Economic resurgence was the major consideration when the investment tax credit was reinstated, and not how it would relate to the rapid amortization method.

The investment tax credit plus double-declining preference is accentuated first by the fact that process changes made to comply with pollution control regulations do not meet requirements for rapid amortization (only control devices do), and secondly, by the fact that the investment credit, per se, never needs to be repaid whereas rapid amortization really represents only a postponement of taxes.

Figure 2 graphically shows the year-by-year after-tax positive cash flows from the various depreciation alternatives. The difference between the #1's and #2's is the additional tax investment credit and additional first year bonus depreciation taken in the first year of the #2's.

The rapid amortization plan cash flows #4's are practically

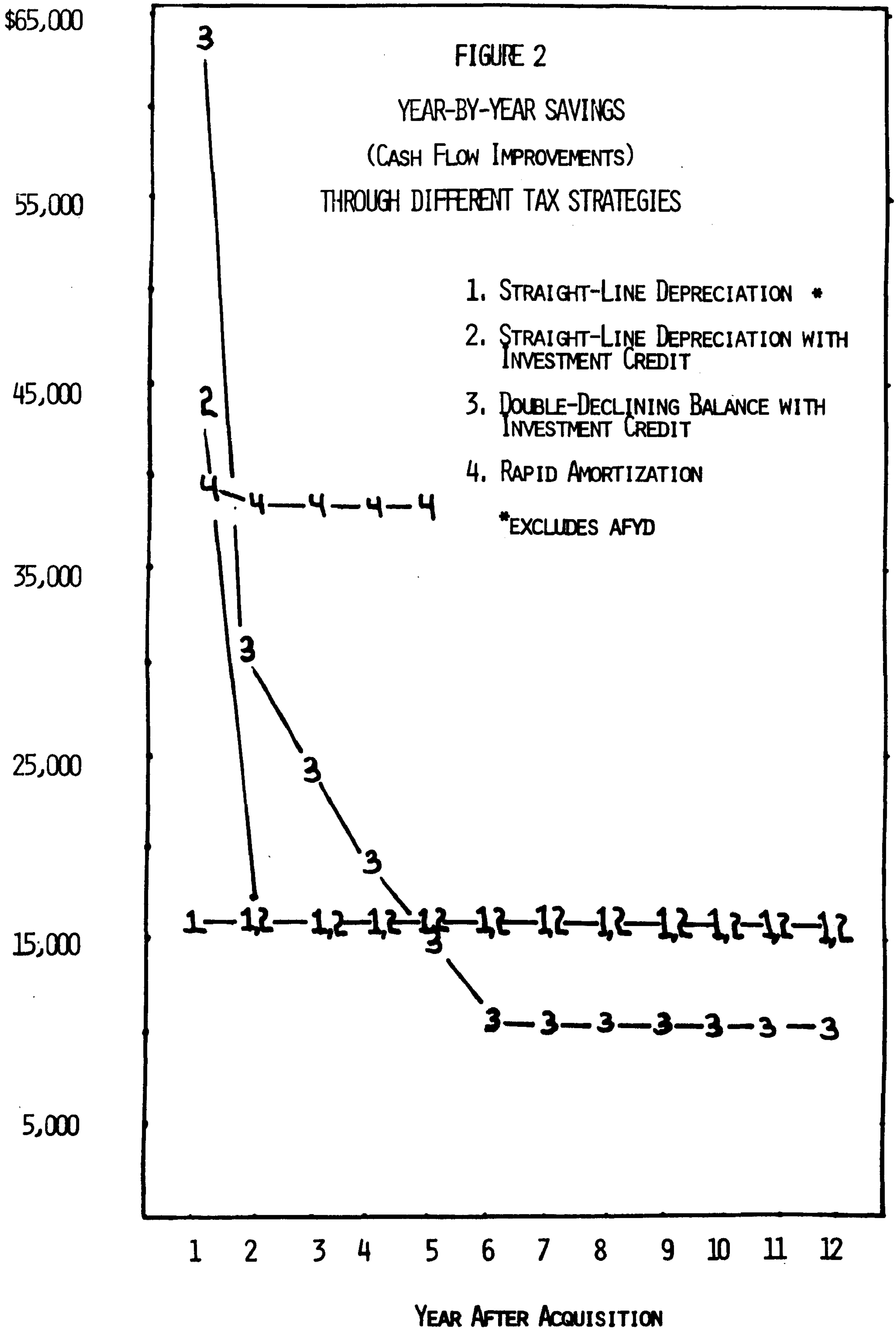


FIGURE 2
YEAR-BY-YEAR SAVINGS
(CASH FLOW IMPROVEMENTS)
THROUGH DIFFERENT TAX STRATEGIES
1. STRAIGHT-LINE DEPRECIATION *
2. STRAIGHT-LINE DEPRECIATION WITH INVESTMENT CREDIT
3. DOUBLE-DECLINING BALANCE WITH INVESTMENT CREDIT
4. RAPID AMORTIZATION
*EXCLUDES AFYD
$65,000
55,000
45,000
35,000
25,000
15,000
5,000
1
2
3
4
5
6
7
8
9
10
11
12
YEAR AFTER ACQUISITION

level because of the installation of the equipment at the beginning of the fiscal year. The slight hump in the beginning results from the additional first year's depreciation. A mid-year installation with an election to begin the 60-month amortization period the next fiscal year would have resulted, under optimal conditions, in a higher hump in the first year also with a level amount over the next five years at a very slightly lower level.

The large hump in the first year of the double-declining balance method shown by #3's, results from taking the investment tax credit and the additional first year's depreciation.

Ability to Use Investment Tax Credit

A company must have a sufficient level of pre-tax earnings to be able to fully utilize the investment tax credit. An investment tax credit greater than the amount of corporate income taxes payable would defeat some of the advantage of taking the investment tax credit. Not in this example, but in actuality, a company has to earn $71,875 before taxes to use the $28,000 available investment tax credit. This calculation used the corporate tax rates of 22% of all income and 26% of income over $25,000.

It is true that unused investment tax credits can be carried over into future, under certain conditions (Sec. 46b, IRC). However, the net present value of an investment tax credit carryover reduces, and its calculation here would present an unnecessarily complex situation.

This chapter demonstrated the large magnitude of differences in NPV's by using the various depreciation methods. The purpose of using

NPV was to have a common standard of analysis by which the available depreciation methods for pollution control facilities could be compared. The example used for calculations showed the advantage of the double-declining balance method with investment tax credit over all other methods including rapid amortization. The life of the equipment has to be very long (over 30 years) before another depreciation method becomes superior in this illustration.

Next we will look at the effect of the special incentives for financing pollution control equipment. The determination of the differences in values for these financing methods coupled with the analysis just performed will carry us into Chapter III where the tax and financing strategies are combined.

CHAPTER II

FINANCING STRATEGIES FOR POLLUTION CONTROL INVESTMENTS

Prior to any special pollution control legislation, a plant manager would make the decision about a piece of equipment and then, if money was to be borrowed to pay for the equipment, get in touch with his normal financing source and request arrangements. With the advent of special pollution control incentives, there are, in general, not only new sources of funds available, but lower rates than normal for most sources of financing. This situation requires another whole set of analyses before the best source of funds can be chosen.

Generally, two aspects of the financing strategy are covered in this chapter. The first aspect is the quantitative analysis using NPV as a tool for valuing each financial source and rate. The second aspect describes each financial source and based on rate and terms, calculates and compares the NPV of each. As in Chapter I, the example is based on a $400,000 waste treatment system.

Methods Used in Analyzing Financing Costs

In order to determine the cost to the company of the various available methods of raising funds, it is necessary to analyze the effect of such a venture on the company's operating financial position: its net profits after taxes. The methodology used in the subsequent comparisons is described below.

A comparison of the after-tax profits with and without the financing for pollution control equipment makes it possible to quantify and analyze such an effect: net annual profit after taxes, P, and the tax liability, L, can be related to other operating parameters by the equation:

$$P = p\ (1-T) \qquad L = p\ T$$

where, p = annual taxable income

and, T = the tax rate, expressed as a fraction.

The annual taxable income is related to the interest expense for the year by,

$$p = Q - I$$

where, Q = the operating income

and, I = the interest expense

combining the above two equations,

$$P = (Q - I)\ (1 - T) \qquad L = (Q - I)\ T$$

$$= Q\ (1 - T) - I\ (1 - T) \qquad = QT - IT$$

If there was no interest expense during the year, I=0, and the above equations become:

$$P = Q\ (1 - T) \qquad L = Q\ T$$

Thus, the effect of the interest expense I, is to reduce the net profit after taxes by $I \cdot (1 - T)$. The tax liability is reduced by $I \cdot T$.

If C is the amount of principal that is paid back during a year, and I the interest expense incurred as a result of the loan, the net cash outflow, NCF, is the net of cash outflows and the reduced tax liability (or tax savings):

$$NCF = (C + I) - (I\ T)$$
$$= C + I\ (1 - T)$$

The above equation represents the net effect of the loan on the company's cash balance during a year. (It must be kept in mind that, in this analysis, the operating costs resulting from the control equipment are not considered. The effect of initial investments in pollution control on the company's fiscal position is analyzed here.)

Present Value Analysis

The payment of interest and principal payback extends through the term of the loan, which is defined as more than one year for a long term loan. The net cash outflow, NCF_i during year i is given by:

$$NCF_i = C_i + I_i\ (1 - T) \qquad i = 1, 2, --, n$$

where, C_i = principal payback during year i

I_i = interest expense during year i

n = term of the loan, years.

The total effect of the loan on the company's cash flow is determined by using the present value approach which utilizes the concept of time-value of money, described in Chapter I.

Thus, the discounted cash flow during year i,

$$DCF_i = \frac{NCF_i}{(1 + r)^i}$$

The sum total of all such discounted cash flows over the terms of the loan is the net present value, NPV, of the loan:

$$NPV = \sum_{i=1}^{n} DCF_i = \sum_{i=1}^{n} \frac{NCF_i}{(1 + r)^i}$$

Since NPV is the sum of discounted outflows, the lower the NPV, the more attractive the loan. The annual discount rate, r, as in Chapter I, is the after-tax cost of capital for the dairy processor = 3.0 percent. For domestic corporations, the normal federal tax rate amounts to 22% on taxable income, plus a 26% surtax on income over $25,000. A tax rate of,

$$T = 48 \text{ percent}$$

is assumed throughout this analysis.

Bank Financing

Some commercial banks across the country have announced preferential rates and terms for certified pollution control facilities. Since these bank programs are quite random, the basis of analysis used here for financing pollution control equipment will be the type of normal equipment borrowing and not a special bank control loan.

The terms and rate suggested here as normal for this type of financing, are five years and 6 percent annually, with the effective rate of interest being 11.08 annually. The Net Present Value (NPV) analysis for financing the $400,000 waste treatment system through a bank is $ 422,353 The cash flows for this financing alternative are unique because of the bank repayments system. Although the repayment amounts are the same, the proportion of interest in those repayments is higher in the beginning. This interest is tax deductible, therefore, the net cash outflow is approximately halved. Since the repayments are equal and the proportions of the earlier payments have more tax-deductible interest expense and lower principal repayments, the net cash outflow is lower in the beginning.

Small Business Administration - Water Pollution Control Loans

Since it could occur that some dairy processors might have access to the funds legislated under the Federal Water Pollution Control Act, the cost of such an alternative will be analyzed. Since this fund was just recently legislated, its implementation has been awaiting some program details yet to be developed. The fund, however, will be administered through the SBA and will most likely bear a rate equal to the weighted average of all federal government borrowings. Presently, that rate is 5-3/8 percent, and with general interest increasing we have used 5.5 percent in our calculations.

Those who qualify for the SBA loans are "any small business concern in affecting additions to or alterations in the equipment facilities (including the construction of pre-treatment facilities and interceptor sewers) or methods of operation of such concern to meet water pollution control requirement...if such concern is likely to suffer substantial economic injury without assistance."

Obviously precarious is any attempt at determining how many companies in the dairy processing industry will sustain substantial economic injury without assistance.

SBA loans are permissible to 30 years, however, we have chosen a 10-year loan term to recognize the guideline useful life of the Asset Depreciation Range into which dairy processing belongs. Using the 5.5 percent rate and the 10-year repayment schedule, the NPV calculates to $397,272.

Government Aid to Financing (Tax-Free)

As a result of the effort to encourage industrial development in general, and in some cases to encourage industry to install control equipment on sources of pollution, governmental aid is available in the following areas:

(a) Aids to individual borrowers for low-cost capital, and

(b) tax aids to industry through special regulations and procedures.

The consequences of the latter will not be described at length, as their impact is not large and varies from state to state. They include sales, use and property tax exemptions.

Many states now have financing programs for the purchase and installation of pollution control facilities. These states, via governmental and/or quasi-governmental agencies, assist in floating attractive low-interest bond issues and in raising the required funds through industrial mortgages. Such bonds bear a lower interest rate than any of the aforementioned methods, since the interest payments are presently free of federal and state income taxes.

The terms in our example include a 5 percent interest rate with an initial underwriting cost of 5 percent. The repayment period is 15 years and the repayment schedule is as follows: 8 percent of principal annually during years 5 through 14, and the remaining 20 percent of the principal during year 15.

As a word of caution about tax-free status, it is prudent to obtain the advice of counsel. A whole set of provisions exists on the nature of the facilities qualifying and certified as eligible for tax-exempt financing.

The NPV of cash outflows for the tax-free financing method for the terms described above, and in our $400,000 example, is $389,137.

As was shown in Chapter I, the following table is an example of how NPV would be calculated for a five-year bank loan for $400,000. The rate of interest is stated at 6% and the loan is repaid quarterly.

TABLE II

EXAMPLE OF NPV CALCULATION FOR BANK FINANCING

Year	Repayment Interest Portion	Principal Repayment	Yearly Repayment	Interest x (1-T)	Plus Principal	Discount Factor	NPV
1	$ 42,286	$ 61,714	$104,000	$21,989	$ 83,703	1.031	$ 81,265
2	33,143	70,857	104,000	17,234	88,091	1.0609	83,034
3	24,000	80,000	104,000	12,480	92,480	1.0927	84,634
4	14,857	89,143	104,000	7,726	96,869	1.1255	86,068
5	5,714	98,286	104,000	2,971	101,257	1.1592	87,352
	$120,000	$400,000	$520,000			Total NPV =	$422,353

Comparison of Financing Methods

Figure 3 is a bar graph of the net present values of the negative cash outflows in financing the $400,000 cost by the three alternatives. This set of alternatives actually represents a range of maximum and minimum financial costs into which fall all methods of financing. In other words, more alternatives exist, however, the results would fall between the highest and the lowest bar.

The figure clearly shows the superiority of the tax-free method of financing pollution control equipment under net present value considerations. As equally important in emphasis, is the magnitude of the range of values. Just on a $400,000 piece of equipment, the range is approximately $ 33,000; a substantial cost if all the financing possibilities had not been fully considered.

Figure 4 shows the great differences in year-by-year cash outflow that result from the three financing strategies. The conventional bank loan, for example, leads to much higher outflow during the first five years, than either of the other strategies. On the other hand, a bond issue has the lowest cash outflow for an extended period. Depending on the payoff method chosen, however, full repayment of principal at the end or a sinking fund will be required. In the first instance (illustrated), high cash outflow is generated due to the ballooning effect in the final year.

Now that the ranges of financing and tax strategies have been fully described and analyzed, we are prepared to relate the choices for selection purposes. In order to perform selection, the objectives by which companies are managed will be explained in the next chapter as they impact possible combinations of the tax and financing alternatives.

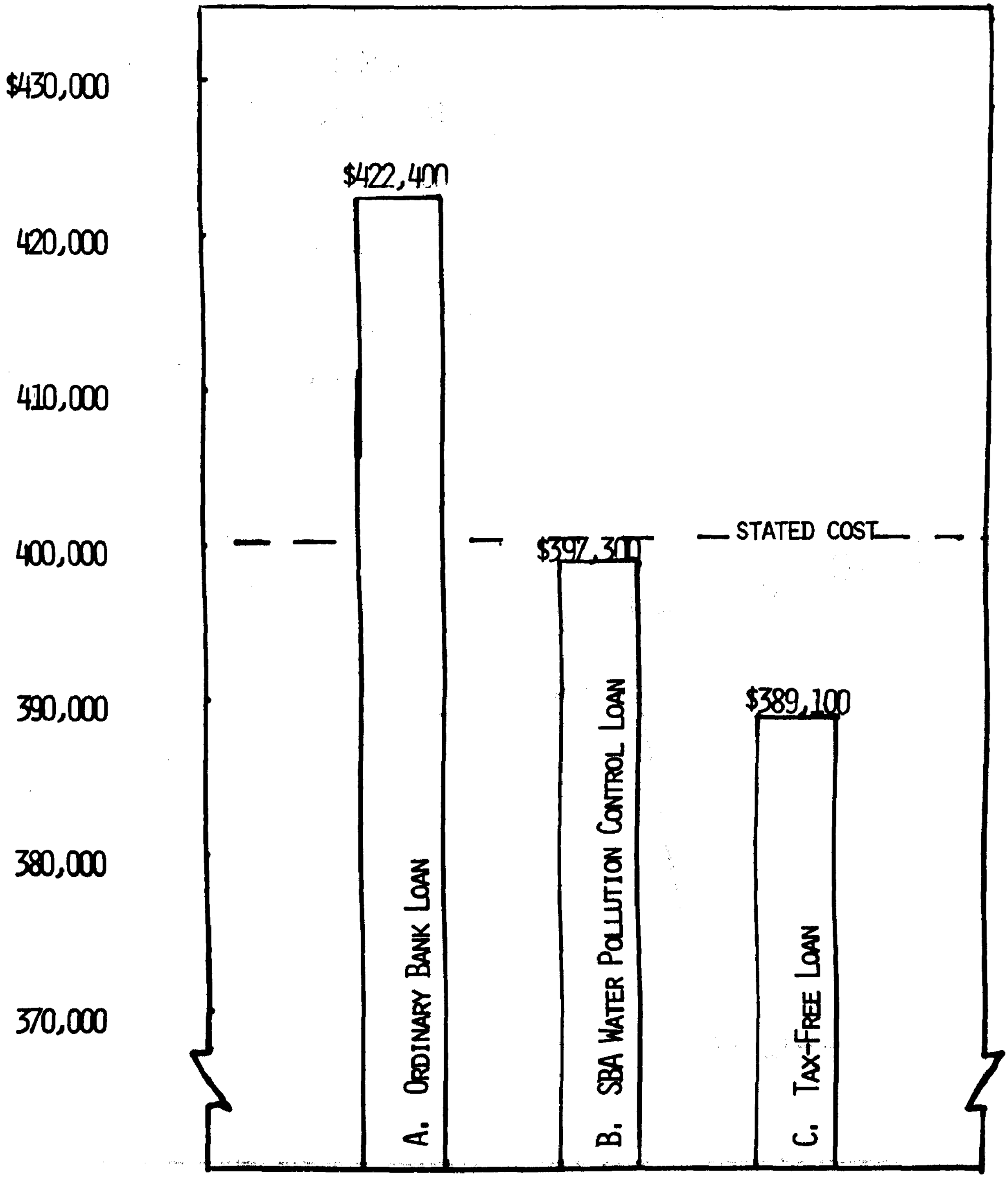


FIGURE 3

Net Present Values of Cash Outflows from Financing

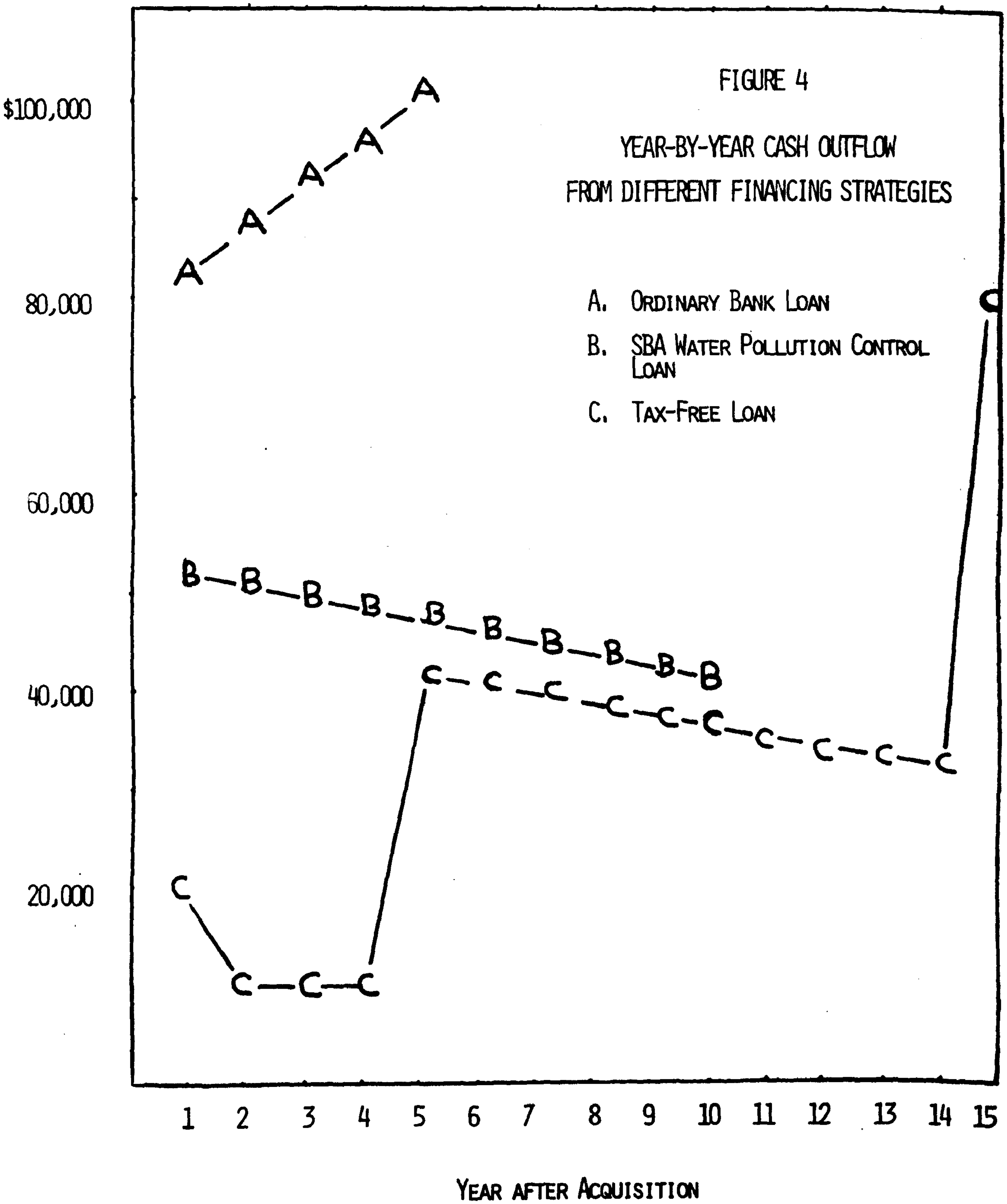


FIGURE 4
YEAR-BY-YEAR CASH OUTFLOW
FROM DIFFERENT FINANCING STRATEGIES
A. ORDINARY BANK LOAN
B. SBA WATER POLLUTION CONTROL LOAN
C. TAX-FREE LOAN
$100,000
80,000
60,000
40,000
20,000
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
YEAR AFTER ACQUISITION

CHAPTER III

OPTIMIMUM FINANCIAL STRATEGY FOR POLLUTION CONTROL FOR EQUIPMENT PURCHASES

With the data now available from the calculations discussed in Chapters I and II, it is now possible to develop the appropriate management approach to financing and tax strategies. The idea is to select the right combination of strategies to meet the management objectives of the company. To illustrate the pronounced effects involved, we will use a hypothetical plant procurement.

Figure 5 contains the key characteristics of three financing strategies, as well as fiscal characteristics of the hypothetical pollution control equipment needed. This will be used as the common base in developing the three illustrative examples that follow.

Few dairy processors face the same financial problems. And no two share exactly the same management objectives. To demonstrate the cumulative effects of the various tax and financing strategies covered so far, we have selected three typical business situations involving different management objectives that might exist in a dairy processing operation. We will show how different strategy combinations affect each situation.

Before discussing the objectives, we will present a table which shows the calculations for another simplified example. The objective is to show how the NPV of the combination of tax and financing strategies was obtained. As we will later see, the term NPV becomes synomyous with the lowest long-term profit impairment a project has on a company. The figures used are those developed in Chapters 1 and 2 for a $400,000 capital investment. Note that the equipment was depreciated in twelve years and financed in five years.

TABLE 3

EXAMPLE OF NPV CALCULATIONS FOR COMBINED CASH INFLOWS AND OUTFLOWS

Year	NPV of Year-by-Year Cash Inflows	NPV of Year-by-Year Cash Outflows	
1	$ 43,568	$ 81,265	
2	15,006	83,034	
3	14,569	84,634	
4	14,145	86,068	
5	13,734	87,352	
6	13,333	$422,353	
7	12,945		
8	12,568	NPV Cash Outflows	$422,353
9	12,202	less NPV Cash Inflows	186,586
10	11,847	Total NPV	$235,767
11	11,502		
12	11,167		
	$186,586		

First, let us select a dairy processor with a weak working capital. He needs pollution control equipment, but cannot "afford" it, now or in the foreseeable future. Clearly, the situation calls for the lowest possible cash outflow, year by year, over the life of the investment.

Figure 5

ILLUSTRATIVE FINANCIAL CHARACTERISTICS OF POLLUTION CONTROL EQUIPMENT FOR THE DAIRY PROCESSING INDUSTRY

1. **Equipment Characteristics**

Investment Cost	$400,000
Salvage Value	-0-
Useful Life	12 years

2. **Tax Status**

Corporate Income Tax Rate	48 percent
Investment Credit	7 percent subject to a certain maximum
Additional First Year's Depreciation	$2,000
Effective Cost-of-Capital Rate	3.0 percent annually

3. **Financing Terms**

(a) Ordinary Bank Loan	
Stated Interest Rate	6 percent annually
Effective Interest Rate	11.08 percent annually
Repayment Period	5 years
(b) SBA - Water Pollution Control Loan	
Interest Rate	Weighted average treasury rate
Present Treasury Rate	5-3/8% ~ 5.5 percent
Payment Period	As long as 30 years, not more than life of equipment, 10 years
(c) Tax-Free Loan	
Interest Rate	5 percent
Initial Cost of Obtaining Loan	5 percent of capital
Repayment Period	15 years
Repayment Schedule	8 percent of principal annually during years 5 through 14 20 percent of principal during year 15 (balloon)

The lowest cash outflow, and the strategy combinations that permit it, are shown in Figure 6. This value, shown boxed, is $34,400 the result of following a combination of Tax Strategy 2 and Financing Strategy B. It is the best choice for dairy processors with weak working capital acquiring pollution control equipment.

If we use a three-year period as the near term, Figure 7 shows the cumulative profit impacts of the different strategies in their various possible combinations, resulting in the best near-term profit. The boxed value, $51,900, represents the lowest possible cash outflow under the circumstances. It is derived from a combination of Strategies 2 and B.

Finally there's the dairy processor with enough resources and stability to concentrate on maximizing its long-term profit. Figure 8 shows that the strategies producing the lowest long-term profit impairment ($186,100) are double-declining-balance depreciation with investment credit combined with a tax-free loan (Strategies 3 and C).

The hypothetical examples of Figures 6, 7 and 8 do not represent straightforward totals of year-by-year values, but rather the totals of present values, attributable at the start of the period to the future events portrayed in the examples. This replacement is necessary because a meaningful comparison between financial effects occurring at varying times in the future can be obtained only by relating them all to a common point in time, such as the present.

Having chosen a combination of tax and financing strategies based on analyses such as those presented in Figures 6, 7 and 8, it is

FIGURE 6

COMPARISONS OF PEAK ANNUAL CASH DRAIN
FROM
DIFFERENT TAX AND FINANCING STRATEGIES

USEFUL LIFE = 12 YEARS

INVESTMENT COST = $400,000

TAX STRATEGY	FINANCING STRATEGY		
	A. CONVENTIONAL BANK LOAN	B. SBA WATER POLLUTION CONTROL PLAN	C. TAX-FREE LOAN
1. STRAIGHT LINE DEPRECIATION	$85,300(5)*	$35,400 (1)	$80,000(15)
2. STRAIGHT LINE DEPRECIATION WITH INVESTMENT CREDIT+	$85,300(5)	$34,400(2)	$80,000(15)
3. DOUBLE DECLINING BALANCE DEPRECIATION WITH INVESTMENT CREDIT+	$85,600(5)	$34,500(6)	$80,000(15)
4. SPECIAL AMORTIZATION FOR POLLUTION CONTROL EQUIPMENT+	$63,000(5)	$45,700(6)	$80,000(15)

*INDICATES YEAR AFTER ACQUISITION DURING WHICH STATED PEAK CASH DRAIN IS REACHED.

+ALSO INCLUDES EFFECT OF ADDITIONAL FIRST YEAR DEPRECIATION, SECTION 179, INTERNAL REVENUE CODE.

FIGURE 7

COMPARISONS OF SHORT-TERM PROFIT IMPAIRMENT FROM DIFFERENT TAX AND FINANCING STRATEGIES

USEFUL LIFE = 12 YEARS
INVESTMENT COST: $400,000

TAX STRATEGY	FINANCING STRATEGY		
	A. CONVENTIONAL BANK LOAN	B. SBA WATER POLLUTION CONTROL LOAN	C. TAX-FREE LOAN
1. STRAIGHT LINE DEPRECIATION	$98,000	$78,200	$88,500
2. STRAIGHT LINE DEPRECIATION WITH INVESTMENT CREDIT*	$71,700	$51,900	$62,200
3. DOUBLE DECLINING BALANCE DEPRECIATION WITH INVESTMENT CREDIT *	$90,600	$70,800	$81,100
4. SPECIAL AMORTIZATION FOR POLLUTION CONTROL EQUIPMENT*	$168,000	$148,200	$158,500

*ALSO INCLUDES EFFECT OF ADDITIONAL FIRST YEAR DEPRECIATION, SECTION 179, INTERNAL REVENUE CODE.

FIGURE 8

COMPARISON OF LONG-TERM PROFIT IMPAIRMENT
FROM
DIFFERENT TAX AND FINANCING STRATEGIES

Useful life = 12 years
Investment Cost: $400,000

TAX STRATEGY	FINANCING STRATEGY		
	A. Conventional Bank Loan	B. SBA Water Pollution Control Loan	C. Tax-Free Loan
1. Straight Line Depreciation	$263,100	$238,000	$229,900
2. Straight Line Depreciation with Investment Credit*	$235,800	$210,700	$202,500
3. Double Declining Balance Depreciation with Investment Credit*	$219,400	$194,300	$186,100
4. Special Amortization for Pollution Control Equipment*	$246,400	$221,400	$213,200

*Also includes effect of additional first year depreciation, Section 179, Internal Revenue Code.

good practice to refer to separate year-by-year projections like those in Figures 2 and 4. Doing so determines year-by-year effects and makes them fall within acceptable limits.

In all three cases above, the rapid amortization plan for pollution control equipment was not the optimal choice. By the very fact that tax incentive exists it is logical to be drawn to its use. However, as demonstrated, the management objective carries the deciding weight in determining whether or not rapid amortization is the optimal choice.

Figure 9 clearly demonstrates why all this analysis is so important. From the consideration of long-term profit impairment, the magnitude of the difference in costs to a company is the height of the difference in the maximum and minimum costs. If a pollution control facility in our example was financed by an ordinary bank loan and rapid amortization was taken (a fairly traditional choice), the effective cost would have been $246,400. A tax-free loan and investment tax credit with double declining balance depreciation resulted in an effective cost of $186,100, a savings over the former plan of $ 60,300. It is well worth devoting whatever cost is necessary to explore the various alternatives available to arrive at the optimal choice.

To determine how optimal the choice can be for an equipment investment, we will further explore in the next chapter just how available are all of these alternatives. Limitations in the availability may possibly reduce the optimum savings, however, the savings will still be substantial.

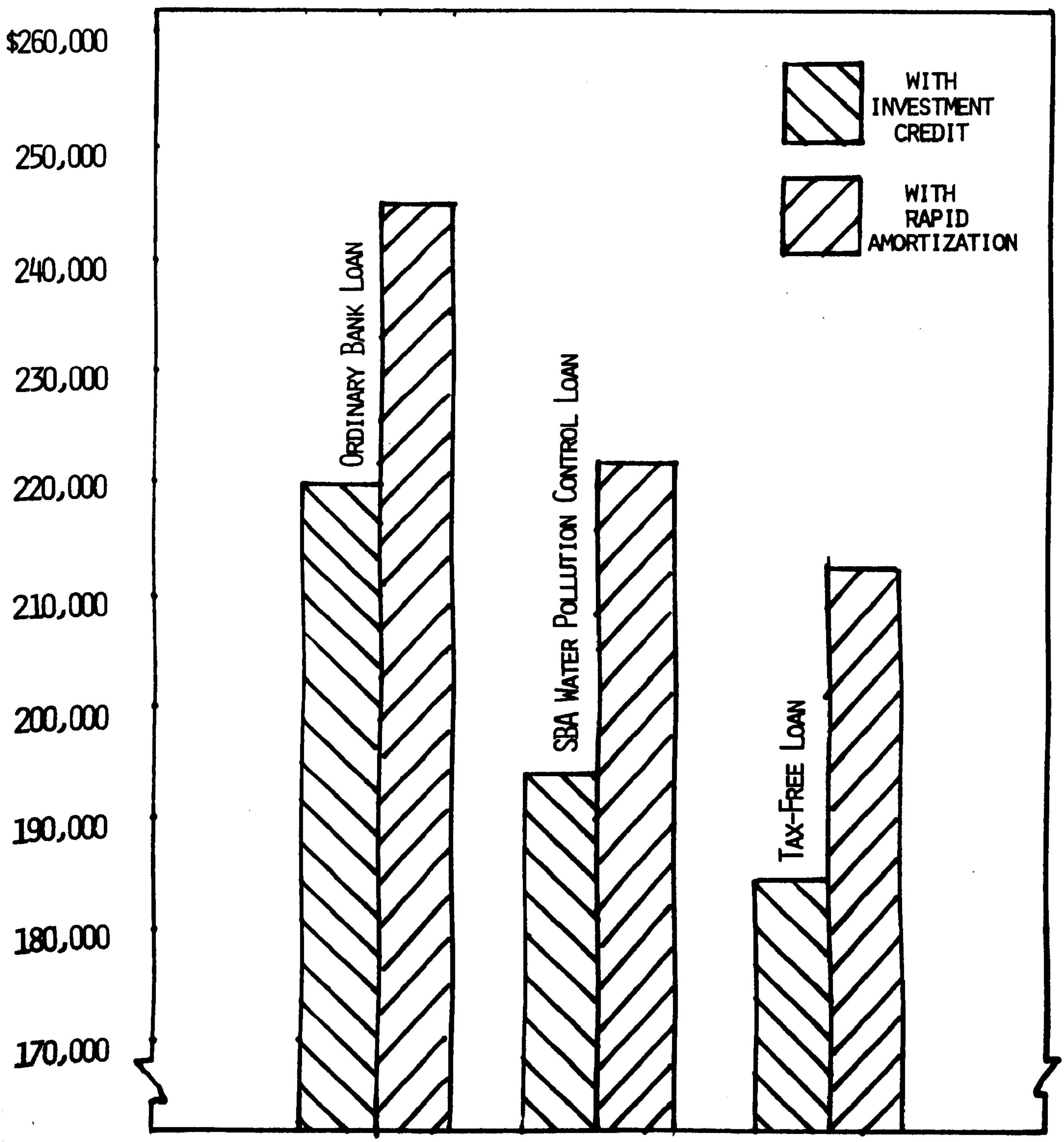


FIGURE 9

LONG-TERM PROFIT IMPAIRMENT
FROM VARIOUS FINANCING AND TAX ALTERNATIVES

CHAPTER IV

STATE FINANCING & TAX INCENTIVES

The tax and financing strategies discussed in Chapters I and II and the simplified examples of how they relate to management objectives (Chapter III) were based on an assumption that all companies would have access to each alternative. Whether or not this is true for a company depends considerably on size and location. The depreciation methods for tax strategies are available for any size company in any location.

Financial strategy availability is a much more complex matter requiring expert legal and tax advice. For example, although the tax-exempt financing is generally more attractive than regular bank borrowing, smaller companies generally do not have access to this source throughout the United States, except for a very few states.

A general statement cannot be made concerning tax-free financing which conveys obvious advantages to the borrower because of the many variations from state to state, but generally the borrower must qualify for the credit from either the public or a private source of capital. Enabling legislation must have also been passed in the state that permits revenue bond/industrial development financing for pollution control facilities. The ultimate tax-free eligibility ruler is the IRS. Specific attention must therefore be paid to what each dairy processors' state has passed into law as to availability of anti-pollution revenue bonds.

Size also is an important factor since there is usually a fixed portion of any bond underwriting expense. This requires a bond issue to be large enough to make those initial fixed costs effectively minimal. This limitation cuts off many potential users, or requires that a state have a form of private placement system for loans of less than nominally a million dollars.

The possible financing via states varies widely as can be seen from Table 4. The tax regulations are usually fairly lengthy, and considerably involved so that they generally defy any attempt to condense and simplify. They are also time-varying so that the reader is cautioned to obtain a current reading before selecting a course of action.

The above relates to the alternative involving equipment purchases, whereas we also need to be concerned about state and federal programs for financing the municipal treatment plants into which individual companies connect themselves. As for the federal portion of construction grants, the monies contained in the 1972 FWPCA were based on a survey of municipal areas planning to upgrade. Thus the authorization was designed in nature to satisfy all plants. However, the municipalities then in question were not necessarily relating their estimates to secondary treatment, defined as best practicable, nor any advanced treatment. A new survey will be taken to determine just how suitable was the FWPCA authorization. Presumably, construction grant money over time will be available for the vast majority of plants. A major appeal of this money is that interest is not included in any repayments.

Of quite a varying nature will be the cost and source of the monies to finance the remaining minimum 25 percent. Further complicating the situation is the degree to which these funds have to be repaid. Obviously, if a bond issue was floated to raise the local portion, the full cost plus interest requires repayment. Funds appropriated from a state public works budget will have different repayment schemes and degrees depending on the state.

What follows is a brief and simplified overview of several states' financial incentives for pollution control which are expected to be of special interest to this audience.

TABLE 4

FINANCIAL ASSISTANCE AND TAX INCENTIVES FOR INDUSTRY

	1 State Sponsored Industrial Development Authority	2 Privately Sponsored Development Credit Corp.	3 State Authority or Agency Revenue Bond Financing	4 City and/or County Revenue Bond Financing	5 State Loans for Equipment, Machinery	6 Excise Tax Exemption	7 Tax Exemption or Moratorium On Land, Capital Improvements	8 Tax Exemption or Moratorium On Equipment, Machinery	9 Sales/Use Tax Exemption On New Equipment	10 Sales/Use Tax Exemption Applicable to Lease of Pollution Control Facilities
Alabama	X	X	X	X		X	X	X	X	
Alaska	X	X	X	X	X	X	X	X	X	
Arizona	X		X	X						
Arkansas	X	X	X	X					X	
California		X							X	
Colorado	X	X	X	X						
Connecticut	X	X	X		X				X	
Delaware	X		X					X	X	
Florida	X	X	X	X						
Georgia	X		X	X					X	X
Hawaii	X		X	X	X	X		X	X	X
Idaho						X			X	
Illinois	X	X	X	X						
Indiana	X		X	X				X	X	
Iowa	X	X	X	X						
Kansas	X	X	X	X			X	X		
Kentucky	X	X	X	X	X		X	X	X	
Louisiana	X		X	X	X		X	X		
Maine	X	X	X	X					X	
Maryland	X	X	X	X			X	X	X	
Massachusetts	X	X	X	X				X		
Michigan	X		X	X				X	X	X
Minnesota	X	X	X	X	X		X	X		
Mississippi	X	X	X	X			X	X		
Missouri	X	X	X	X			X	X	X	

TABLE 4 (cont'd)

	1 State Sponsored Industrial Development Authority	2 Privately Sponsored Development Credit Corp.	3 State Authority or Agency Revenue Bond Financing	4 City and/or County Revenue Bond Financing	5 State Loans For Equipment, Machinery	6 Excise Tax Exemption	7 Tax Exemption or Moratorium ON Land, Capital Improvements	8 Tax Exemption or Moratorium On Equipment, Machinery	9 Sales/Use Tax Exemption On New Equipment	10 Sales/Use Tax Exemption Applicable to Lease of Pollution Control Facilities
Montana	X	X	X	X			X	X		
Nebraska	X	X	X	X						
Nevada	X		X	X						X
New Hampshire	X	X	X						X	
New Jersey	X	X								X
New Mexico				X		X				
New York	X	X	X	X	X		X	X	X	X
North Carolina		X							X	
North Dakota	X	X	X	X		X	X	X		
Ohio	X	X	X	X					X	X
Oklahoma	X		X	X	X				X	
Oregon	X	X	X	X		X	X			
Pennsylvania	X	X	X	X		X		X	X	X
Rhode Island	X	X	X	X			X	X		X
South Carolina	X	X	X	X			X	X	X	
South Dakota	X		X	X		X				
Tennessee	X	X	X	X			X	X	X	X
Texas	X		X	X			X			
Utah	X	X	X	X						
Vermont	X	X	X	X						X
Virginia	X	X	X	X					X	
Washington	X	X	X	X						
West Virginia	X	X	X	X	X	X			X	
Wisconsin	X		X	X					X	
Wyoming	X	X	X	X		X				

Maryland.

Maryland has a sales and use tax rate reduction for pollution control equipment and a revenue bond program. To aid in financing construction costs of local wastewater treatment facilities Maryland has the Maryland Environmental Service for taking over certain treatment functions at a cost to the user. The state also has created a Sanitary Facilities Fund for providing local sewage collection and treatment funds.

Under Maryland Annotated Code, Article 81 Section 342 (s), Section 325(g), Section 372(r) and Section 373 (g) pollution control devices are taxed at a reduced rate for the Sales and Use taxes. In place of there being a 4 percent sales tax, pollution control equipment is taxed at the machinery equipment rate of 2 percent.

In 1972 the state of Maryland passed legislation enabling counties and municipalities to finance pollution control facilities through the sale of revenue bonds. The municipality can then sell or lease the facilities to industry. Thus industry can finance their pollution control facilities at a rate lower than that incurred by other forms of conventional borrowing.

Companies having waterwastes treated municipally get two forms of lower costs. In addition to the 75 percent construction grant for capital costs for which the municipal waste treatment plants are eligible, the state also contributes 12.5%. The state raises money for these grants, which the municipalities do not have to repay to the state, through bonds that bear the full faith and credit of the state of Maryland. Presumably the remaining 12.5% to be raised locally will have a repayment contribution to be assessed both industrially and residentially. Thus, that proportion of capital costs to be repaid by industry is 50% of the 75% (see next chapter for fuller explanation) plus the 12.5% or 50% in all.

The State of Maryland does not have any grant programs to reimburse the municipal waste treatment plants for yearly operating and maintenance costs as does New York, for example.

New Jersey

Chapter 127, PL, 1966 (Title 54: 4-3.56 to 3.58) of New Jersey permits a property tax exemption for pollution control facilities. Revenue bond provisions are not in effect in New Jersey, and a sales tax exemption bill did not get out of committee in 1972.

It is still possible that tax-exempt financing could be obtained by a company through a local development corporation even though the state does not have industrial development authorities. However, the process requires much legal assistance and is very complex.

New Jersey permits sewage districts to issue bonds for the local portion of construction costs of treatment plants benefiting one or multiple municipalities. There is also a state program to provide 15% grants to municipalities for the portion of construction costs not eligible for federal grants. The funds were derived through a 1969 $240 million bond issue under the Water Conservation Bond Act. The funds do not have to be repaid. As a result of the federal and state construction grant program the municipality's fund raising amount is reduced to 10%. Thus in New Jersey the construction cost amount most likely to be assessed industrially (based only on proportionate flow) is 50% of 75% plus 10% or 47.5%.

New York

The State of New York has several tax incentives and financing programs for pollution control facilities including two of the largest public bond issues in the United States. The tax incentives refer to sales, property and corporate income taxes for qualified pollution control equipment. A revenue bond financing capability for corporations also exists.

Pollution control equipment and utilities are exempt from state and local sales taxes except for those of New York City.

Local municipalities are also given the power by the state to excuse pollution control facilities from real estate taxation and special ad valorem levies (Section 481, Real Property Law)

A feature unique to these five states is New York State's one-year depreciation provision. Corporations can deduct the full cost of pollution control facilities in one year against their state corporate income taxes (Sections 208,602,683, 706 and 1083 of the Tax Law). For those who decide against the one-year depreciation, a one percent tax credit is allowed on state corporate income taxes payable (Section 210(12)f, 701(d) (6). The amount of the corporate income tax credit cannot reduce total state corporate income taxes below a $125 minimum.

Corporations can finance their pollution control facilities located in New York State via revenue bonds. The I. R. S., is of course in all states the ultimate ruler on all tax-exempt issues; however, the state must, in most cases, pass legislation enabling revenue/industrial bonds to be utilized for pollution control purposes.

Municipalities in the State of New York can obtain a considerable amount of grant assistance from the state and federal governments for construction and operating and maintenance costs. For industries having their wastes treated by municipalities this assistance means lower costs assessed to them for recovery of capital and operating and maintenance costs.

In 1966 and 1972 there were $1 and $1.15 billion bond issues floated in the state for conservation projects. Under the $1.15 billion 1972 Environmental Quality Bond Act $650 is for construction grants that will provide 15% on top of the 75% federal grant. Eligible construction costs, by state definition, however, disallow collection systems. Thus the local government obtains 75% for collection system since the federal government does fund collection systems. The local municipality obtains 87.5% for the remainder of the entire waste treatment facility. What the industrial constributors are assessed, based only on proportional flow is 1) 50% of 75% plus 25% for the industrial portion of the collection system, plus 2) 50% of 75% plus 12.5% of the industrial portion of the remaining waste treatment costs.

New York also has another grant contribution to the municipality of one-third the costs of eligible operating and maintenance costs.

<u>Ohio</u>

The State of Ohio has three tax exemptions and a revenue bond program for pollution control facilities. There are no grant contributions by the State of Ohio to municipalities for either construction or operating and maintenance costs. However, Ohio does have a payment program which prevents unnecessary delays in treatment plant construction due to delays in federal appropriations of grant money.

The three taxes for which pollution control equipment is exempt are the property tax, sales and use tax, and franchise tax. The property tax exemptions are derived from Ohio Revised Code, Section 5709.25(A), Section 6111.34 of the Ohio Water Pollution Control Act - corporate property, and Section 6111.35 - personal property. Under Section 6111.36 pollution control equipment is not an asset in determining value of issued or outstanding shares of property owned and used for purposes of franchise tax. Section 6111.37 contains the sales tax exemption. Should any certificate be revoked then all past taxes are due as if there had been no exemption.

Under the revenue bond program companies can obtain tax-free financing for pollution control facilities.

The state's financing program consists of paying the construction costs to the contractor and then having the municipality assign the federal grant to the state.

Pennsylvania

Pennsylvania has the most unique revenue bond program that enables all size companies to obtain tax-free financing rates for pollution control equipment. In most states the company desiring a tax-free rate must float a public bond issue. Because of initial underwriting costs the bond issues must usually be one million dollars or more for the interest savings to offset the underwriting costs. Therefore, the tax-free route is not open to all, even if their credit rating is basically good to excellent.

In Pennsylvania, under the Revenue Bond and Mortgage Act, any size company with a good credit rating can achieve tax-free financing for pollution control facilities. Certified pollution control facilities can be financed by a bank or other financial institution and gain the low rate without having to go to the bond market. All that is required is an application by the company describing the financing source, to an industrial development corporation which processes and obtains permission from the state Secretary of Commerce.

The tax exemption privileges available in the state for pollution control equipment are sales and use and franchise.

Pennsylvania had a construction grant program when municipalities received between 30 and 55 percent federal grants. However, that program has not been extended to provide state grants on top of the 75 percent federal amounts. Pennsylvania is considering a grant program for portions of the local construction costs in low income areas.

Under Act 339 of Pennsylvania there is a 2 percent contribution to municipalities for eligible operating and maintenance costs.

The above description of incentives in various states should strongly demonstrate two aspects:

1. It would be unusual to find the exact condition in two states, especially where the incentive legislation is time-varying.

2. It is worth the effort to study the tax and financing schemes available in the pertinent state.

Review

From the above explanation, it becomes clear that the ability to achieve an optimum financial strategy is highly dependent upon the size of the firm, and its location. Parameters used in Chapters II and III in the optimal choice analysis may have to be altered to reflect a firm's real spectrum of choices. The stress in the analysis thus far has been a firm's capital costs. In the next and last chapter, the realm of user charges and their possible modifications in the future will be discussed. Complete optimization under long-range management objectives can then be made by weighing the ramifications of being a part of a municipal waste water treatment system vis-a-vis constructing private treatment facilities.

CHAPTER V

FINANCIAL DECISION MAKING THEORY FOR MUNICIPAL VERSUS PRIVATE FACILITIES

The analysis completed in the first three chapters applies to air and waste treatment control systems of a capital nature applied by private industries before the release of their effluents to the public domain. Companies with requirements to control air pollution emissions must undertake the responsibilities of control themselves. Companies with water-borne wastes have in many instances an option to treat their process, sanitary and cooling wastes themselves or turn the chore over to the municipality by sewering their wastes. Economics play a very important part in this decision and the economics of the past are changing considerably. Before entering the economic aspects we first want to demonstrate that dairy processors do have this choice available to them. First we will describe the extent to which large industrial categories use public treatment facilities and then narrow down to use by dairy processors. Then we will explore recent regulatory and economic programs that will influence changes in the usage of public treatment facilities by all industry and dairy processors.

A 1970 survey of seven broad industrial categories essentially involving all of manufacturing business by The Conference Board of New York conducted for EPA, showed that only 5.0 percent volume of wastewater discharge went to public sewers while 92.9 percent went to receiving waters. This study compares very closely with the Census of Manufacturers study of 1967 that was five times as large which indicated that 5.4 percent volume of wastewater was discharged to sewers (Table 5).

While these studies showed that the vast volume of wastewater was consigned to receiving water, the story is quite different where sewer facilities were available, thus suggesting a high preference for consignment to sewer systems when such are available. For example, the Conference Board survey revealed that 63 percent of the companies surveyed had public sewers available to them and 54% used them. In other words, 418 of the 489 plants or 85.4% utilized the public sewer facility. However, there is data showing that many of these public sewer connections may have been for the sanitary portion of wastewater and not process water. Of the 418 plants using sewers, 342 also maintained their own treatment facilities. (Table 6)

Table 5

Use of Public Treatment Facilities by Volume of Wastewater Discharged, 1969 and 1967

Major Industry Categories 1969 +1967	Food and Kindred Products Industry 1969	Dairy Processing: Users of 20,000,000 gals. or more/yr 1967	Dairy Processing: Plants of all size in Wisconsin 1967
5.0 - 5.4%	23.0%	58%	39%

Table 6

Use of Public Treatment Facilities by Numbers of Plants Where Public Systems Available, 1969

Major Industry Categories	Food and Kindred Products
85.4	94.2

Before narrowing in on dairy processors the data shows that the food and kindred products, dairy's parent industry, category discharges more volume of wastewater to public treatment facilities than for industry in general, 23% to 5% (Table 5). Likewise more plants in the food and kindred products industry use public treatment facilities where the public facilities are available (94.2 to 85.4% - Table 6).

For the dairy processing industry some data is available for large plants processing 20 million or more gallons per year and plants of all sizes in Wisconsin. Large ice cream and fluid plants being market oriented in their location discharge 72 and 76 percent of their wastes respectively into municipal treatment facilities. Butter, cheese and condensing plants discharge 44, 49 and 30 percent respectively into municipal treatment facilities. Together the large plants across the U.S. call upon municipalities to treat 58 percent of their wastes. For the state of Wisconsin, but for all size dairy processing plants, 39 percent of wastes are treated by municipalities. An indication of why there is a low percentage of wastes treated by municipalities in Wisconsin is that 70 percent of the dairy processing plants are in communities with populations of less than 5,500.

There are several factors that will influence the mix of companies being hooked into municipal waste treatment systems, as described above, for all industry as well as dairy processing.

- more and more areas are being opened up to public treatment systems.
- industry will have to pay their equitable costs of treatment performed by municipalities which in the majority of cases is more than they previously paid.

- more federal construction grant money has been made available to municipalities for upgrading their plants to secondary treatment or better.
- effluent guidelines based on best practicable and best available technology will be imposed upon dairy processing and all other industries.
- pre-treatment guidelines may affect the need for preparation of waste before sewerage for dairy processors and other industries.

More geographical areas are being required to provide more and better treatment which will largely be financed by federal grants. Presumably, from the data in Tables 5 and 6, more companies will have the opportunity to have their wastes treated by such facilities. Likewise, all processes generating wastewater will face more stringent effluent guidelines which will raise the question of public or private treatment.

The financial outlook for tying into public treatment facilities contains conflicting aspects which will all have to be analyzed individually by a company. There will be two higher municipal costs from what might have been analyzed in the past and one lower cost. The lower cost is that there are no interest charges for industry on that part of the construction grant which has to be repaid (more below) to the municipality. The higher costs ensue from the equitable treatment costs which must be assessed on industry, and the fact that treatment in general will be more costly. Even with these municipal costs on balance going up they may not be increasing as rapidly as the costs of private treatment brought on by the effluent guidelines under the EPA permit system.

From the above listed technological, regulatory and economic considerations it is fairly safe to say that a major decision-making process in water pollution control will take place in the United States. As part of this movement many dairy processors will face changing and upgrading of their plants at different costs than they previously used in their analyses. And faced with the opportunities of on-site or municipal treatment a company will essentially be faced with the economics of which costs less and the implications of a capital investment versus higher yearly operating costs.

Equitable Cost Recovery Systems

The yearly treatment costs to dairy processors using public facilities arises from the methods that municipalities have available to them for financing their construction costs. To start with, recent federal legislation made an assumption that in the past companies were not being charged what the municipal treatment actually cost. EPA, under the 1972 FWPCA amendment construction grant program, now requires that all municipalities receiving a construction grant charge industry equitable costs covering operating, maintenance and capital costs.

Under previous amendments to the FWPCA there has always been a grant system, although comparatively small, through which federal funds were apportioned to the states. The 1972 FWPCA amendments continue the grant concept but at a tremendously bolstered dollar level. The fraction of total municipal treatment construction costs that can be funded by the federal grants has also been increased: at least $21 billion in future and repayment construction grants will eventually be funneled to municipalities; provisions of the FWPCA will permit up to 75 percent of the construction costs to be derived from the federal grant.

Contrary to past municipal treatment costs, a higher rate structure is in the offing as the FWPCA requires the municipality to recover, through charges, the operational costs and replacement value attributable to the industrial proportion of the federal grant. For certain replacement equipment based on flow only, a municipal plant devoting 60 percent of its capacity to the general population and 40 percent to industry, must recover at least 40 percent of the 75 percent federal portion. The number of years over which industry's share of capital costs must be recovered is 30, or less if the facility's intended useful life is less. Quite important is the fact that no interest is charged on the capital costs that are being paid overtime.

There are several other items of interest to municipal users: (1) Quantity discounts for large flow volumes are discontinued. Savings from economies of scale must be shared by all users. (2) To reduce administrative burden companies and industries whose waste characteristics are similar can be classed together and the class is assessed a rate. (3) Large users of more than 10 percent of the municipal volume must sign a letter of agreement with the municipality saying that the user agrees to pay that portion of the grant allocable to the treatment of its wastes.

The remaining portions of this chapter will construct a type of analysis for use in making the "user charge versus private facility" decision.

It will pick up from where Chapter III ended in that additional operating costs have to be added to equipment costs to fully know complete costs of self-treatment.

There are at least three major factors - pre-treatment costs, by-product recovery value, and two sets of operating costs - which must be separately calculated before the final decision phase is consumated.

Pre-Treatment Costs

The first factor is pre-treatment costs for the conditioning of pre-treating of a company's waste water by a company before the wastes reach the municipal system. The costs of pre-treatment depend on the nature and volume of the wastes and will vary widely from industry to industry. It is conceivable that very little in the way of expensive equipment may be needed for some industries, where pre-treatment costs would consist of chemicals and other consumable supplies. Certain other industries will require capital investments for pre-treatment but not quite as large as would be needed for complete private treatment.

The net present value (NPV) method of analysis will again be used to calculate a cost for pre-treatment. The financial and tax strategy calculations for this equipment are the same as those used in Chapters I and II. Further analysis would have to take into account the expected difference in useful life of a pre-treatment facility from a municipality's.

By-Product Recovery Value

It is reasonable that pre-treatment will produce by-product recovery in a processing plant, however, the relativity of the subject here is for its value in a complete private facility. For our purposes, we will describe the value of annual by-product recoveries as an offset to the equipment costs. Rather than offset the recovery values against annual operating costs, the reason for offsetting against capital costs involves the factor that by-product recovery could effectively have in the initial facility decision.

We purposely did not enter by-product considerations earlier in the equipment decision phase. Its description here takes note of the fact that before the 1972 FWPCA, by-product recovery of some degree did exist in the dairy processing industry. The emphasis on by-product recovery here is the very likely increase in extent as events proceed in the dairy processing industry.

Operating Cost Differentials

Intuitively, the operating costs for a pre-treatment and municipal use system will be less than the costs to operate a private facility. This yearly difference must be assigned a NPV to be added to the NPV of the private treatment facility. The analytical method is the same as that described in Chapter II for a negative cash flow.

Municipal Versus Private Waste Water Treatment

To complete the sequence necessary for constructing a municipal versus private treatment analysis the remaining step is the calculation of a NPV for user charges. Using the formula in Chapter II, the yearly cash flows for the longest predictable horizon of the user charge system should be valued at NPV (as that horizon lengthens, the NPV approaches the value that would have resulted if the present value of an annuity had been used where the payments are infinite in duration). The sets of costs that we now have to compare in the decision process, have been adjusted as follows:

	effective equipment cost
minus	NPV of by-product recovery
plus	NPV of greater operations cost
equals	<u>Adjusted Effective Equipment Cost for a Private Treatment Facility</u>
	effective use charge value
plus	NPV of pre-treatment costs
equals	<u>Adjusted Effective User Charge Value for Using a Municipal Facility</u>

The basis for a financial decision between the two alternatives is outlined above. The financial data can be added to the technical factors that enter into the final decision.

<u>Summary</u>

Figure 10 is a flow chart of the analytical guides suggested for choosing the optimum financial strategy for pollution control. The chart summarizes the entire flow of this Report. Under the previously defined pollution control laws we were able, as we did in Chapters I, II and III, to use quantifiable examples to optimize tax and financial strategies for equipment decisions. This area of the chart is depicted to the left of the dashed line. Chapter IV, while not in the flow, showed how these alternatives may be limited due to specific state programs.

The tradeoffs and factors entering the municipal versus private treatment decision process are shown on the right of the dashed line.

Figure 10

Guide to Management For Choosing The Optimum Financial Strategy For Pollution Control

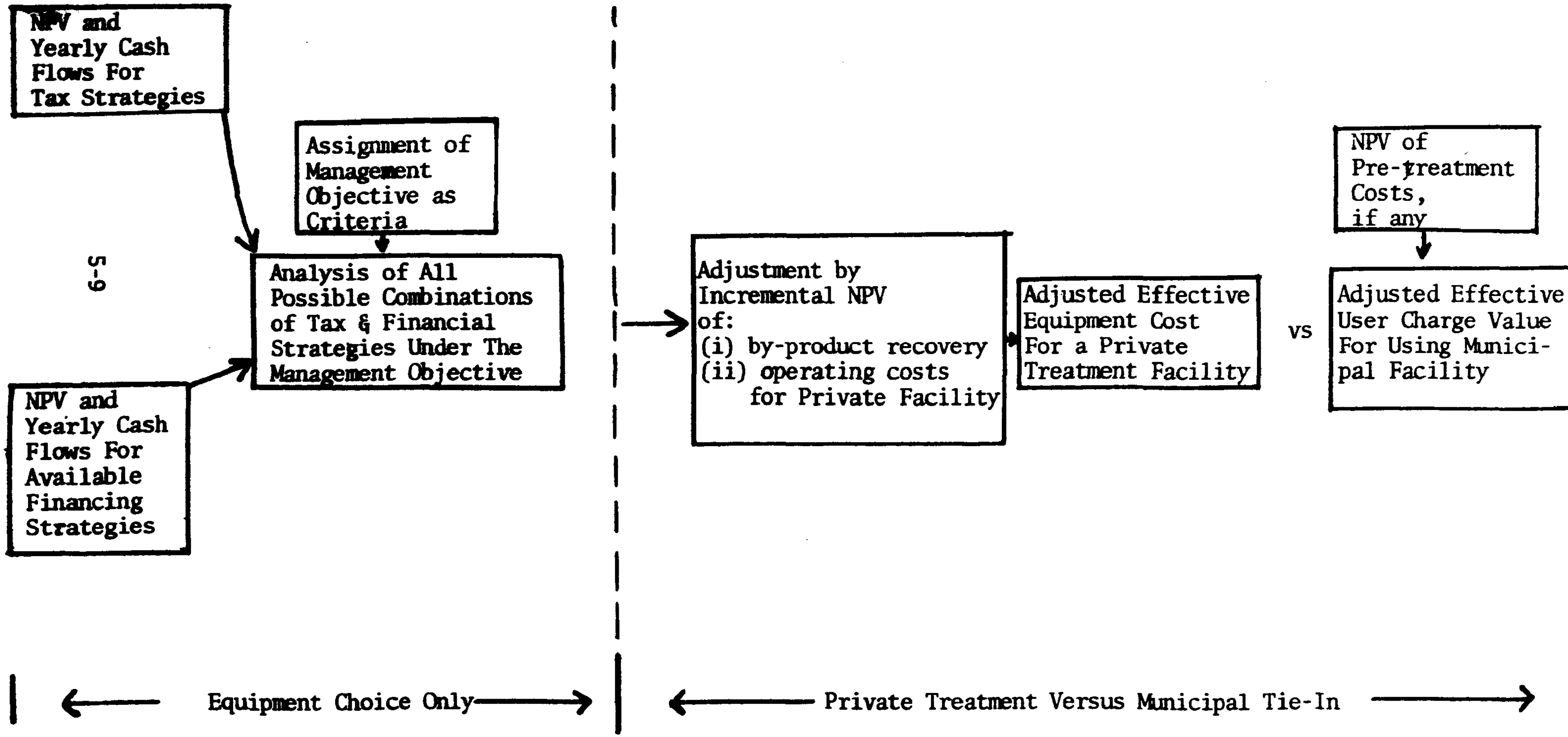
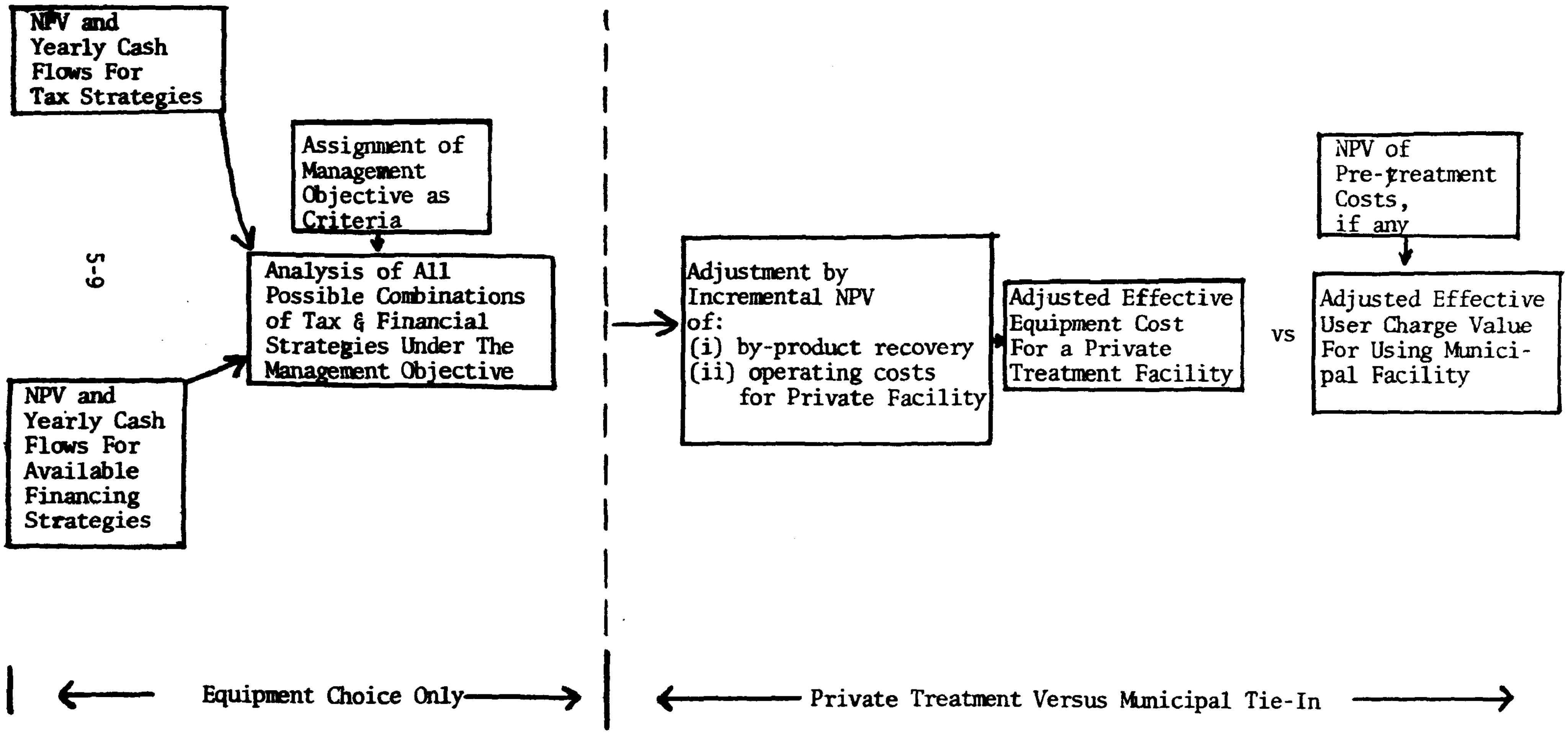


Figure 10

Guide to Management For Choosing The Optimum Financial Strategy For Pollution Control



CHAPTER VI

ILLUSTRATION OF OPTIMUM FINANCIAL STRATEGY FOR POLLUTION CONTROL FOR MUNICIPAL VS ON-SITE TREATMENT

Chapter III developed various financial decision making processes for management use where pollution control equipment is bought. These took into consideration cash flow, long and short-term profit management objectives, and compared various strategies in buying and writing off the equipment. This chapter presents an example of the application of this financial theory where the comparison is between buying equipment for treating your wastes on-site versus municipal treatment costs. This assumes that the pertinent regulations permit such choice.

Rather than repeat the theory for all three financial management strategies discussed in the previous chapter when buying equipment, the complexity of each is enough to only make it desirable to limit the illustration to one strategy. For illustration of the analysis for economically choosing municipal versus on-site treatment, we will choose the financial strategy analysis of long-term profit which is primarily net present value consideration. This method, incidently, is the one used most frequently by EPA in their economic impact studies.

Recalling the costs from the previous chapter which were to be utilized in the comparison, we find for on-site treatment the capital costs which include financing and depreciation, the operating costs and by-product values. For municipal treatment, the costs are pre-treatment plus the associated operating and maintenance costs and the user charge assessed by the municipality. In order for the costs of each option to be comparable, the number of years or length of analysis must be the same over which the calculations are performed.

On-Site

In choosing the length of analysis, the lives of the two alternatives must be relatable for proper costs matching. The user charge cost recovery guidelines issued by EPA in May, 1973, have an impact on the length of analysis. One of the guidelines determined the number of years in which industry's portion of the capital construction cost granted by the federal government must be repaid. The guideline specified cost recovery for the shorter of 30 years or the life of the equipment. Therefore, we will choose a 20-year analysis for the two alternatives; shorter due to technological obsolescense. The processing investment we used earlier in the report was for 12 years at a cost of $400,000. We will speculate that even though that equipment could last longer than 12 years, regulatory obsolescense will require updating which will leave us with an $800,000 cost of on-site treatment over 20 years.

One of the assumptions we will make is that the on-site equipment will be depreciated and financed by the same methods which were superior in the long-term profit anslysis of Chapter III; double-declining balance depreciation with investment tax credit and a tax-free pollution control loan. The terms of the tax-free loan will be repayment of 8 per cent of the principal in years five through fourteen and a 20 percent balloon payment in the fifteenth year. The tax-free loan rate will be 5 percent.

Since the dairy processing plant has to perform all maintenance and operation, we have to include those costs as well as any sludge handling and disposal costs. We will consider the "O & M" costs to be 8 percent of the total facilities investment cost or $ 8,000 per year.

The table below shows how the NPV for this example was derived.

Municipal Treatment

The size, capital and operating characteristics of the municipal treatment plant directly influence the fee they charge for treatment. We will assume a municipal treatment plant capable of handling 2 million gallons per day (MGPD). At an approximate capital cost of $1.2 million per MGD, the total plant cost would round out to $ 2,400,000. We will further assume for illustrative purposes that a dairy processing plant contributes to 2 percent of this total flow. The flow of the on-site treatment plant for the costs assumed would be a dairy processing plant with an assumed flow of .04 MGD.

Taking the above assumed costs, we will make the following additional assumptions:

- 75% of the cost of the construction is provided by federal grant at no interest
- 25%, or the local/state share is raised through a tax-exempt bond issue at 5 percent

TABLE 7

NPV OF TWENTY YEAR ON-SITE TREATMENT PLANT

Year	O&M	Yearly Depreciation	Interest Payments	Principal Payments	After-Tax Negative Cash Flow	After-Tax Positive Cash Flow	Net Cash Flow NPV
1	$64,000	$161,600*	$80,000***	-	$ 74,160	$133,568	$ 57,678**
2	64,000	127,680	40,000	-	54,080	61,286	6,792**
3	64,000	102,144	40,000	-	54,080	49,029	4,622
4	64,000	81,715	40,000	-	54,080	39,223	13,200
5	64,000	65,372	40,000	-	54,080	31,379	19,583
6	64,000	52,298	40,000	-	54,080	27,195	22,517
7	64,000	41,838	40,000	-	54,080	21,756	26,284
8	64,000	33,471	40,000	-	54,080	16,066	30,010
9	64,000	11,157	40,000	-	54,080	5,355	37,346
10	64,000	11,157	40,000	$ 64,000	118,080	5,355	83,885
11	64,000	11,157	36,800	64,000	116,416	5,355	80,241
12	64,000	11,157	33,600	64,000	114,752	5,355	76,738
13	64,000	11,157	30,400	64,000	113,088	5,355	73,373
14	64,000	11,157	27,200	64,000	111,424	5,355	70,133
15	64,000	11,157	24,000	64,000	109,760	5,355	67,021
16	64,000	11,157	20,800	64,000	108,096	5,355	64,033
17	64,000	11,157	17,600	64,000	106,432	5,355	61,162
18	64,000	11,157	14,400	64,000	104,768	5,355	58,403
19	64,000	11,157	11,200	64,000	103,104	5,355	55,755
20	64,000	11,157	8,000	160,000	197,440	5,355	106,371
							$886,207

* Includes Additional First Year's Depreciation of $2,000
** Positive Cash Flows, the remaining eighteen years being negative
***Includes 5% underwriting expense for bond issue

- the yearly "O & M" of the municipal plant is 3 percent of total investment cost or $ 72,000.
- the dairy processing plant requires pre-treatment equipment which, for the 12 years cost, is $ 10,000 and is financed via a 5 percent tax-free loan and depreciated via the double-declining balance plus investment credit method
- the "O & M" for the pre-treatment facility incurred by the dairy processing plant is 8 percent or $ 800 per year

The user charge for the dairy processing plant thus consists of the following costs:

- 2% (percentage flow) of 75% of $ 2,400,000 over 12 years which equals $3,000. (federal capital proportion)
- 5% of 25% of $ 2,400,000 plus yearly interest of 5% on the unpaid balance (local/state capital proportion)
- The NPV of the pre-treatment capital costs after cash flow considerations from depreciation and financing costs
- Yearly municipal and pre-treatment "O&M" of $1,440 and $800

In the example presented here, the financial choice between buy and treat on-site versus pre-treat and use of municipal facilities, results in the pre-treat and municipal facility choice by a sizable margin of $18,937. It would not be prudent to extend the implications of this simplified example to a general dairy processing industry preference for municipal treatment. As one reason, we excluded the value of by-

TABLE 8

NPV OF USER CHARGES FOR TWENTY YEAR COST RECOVERY SYSTEM

				Pre-Treatment Capital Costs					
Year	Federal Portion User Charge	Local* State Portion	Treatment & Pre-Treatment O&M	Depr.	Int.	Prin.	After Tax Positive Cash Flow	After Tax Negative Cash Flow	Net Cash Flow NPV
1	$35,625	$23,750	$36,500	$21,600	$10,000		$17,368	$55,055	$36,589
2	35,625	23,156	36,500	15,680	5,000		7,526	52,146	42,058
3	35,625	22,562	36,500	12,544	5,000		6,021	51,837	41,929
4	35,625	21,968	36,500	10,035	5,000		4,817	51,528	41,503
5	35,625	21,374	36,500	8,028	5,000		3,853	51,219	40,859
6	35,625	20,781	36,500	6,423	5,000		3,083	50,910	40,056
7	35,625	20,188	36,500	5,138	5,000		2,466	50,601	39,140
8	35,625	19,594	36,500	1,581	5,000		759	50,292	39,104
9	35,625	19,000	36,500	1,581	5,000		759	49,983	37,728
10	35,625	18,407	36,500	1,581	5,000	$8,000	759	57,674	42,353
11	35,625	17,814	36,500	1,581	4,600	8,000	759	57,160	40,749
12	35,625	17,220	36,500	1,581	4,200	8,000	759	56,643	39,200
13	35,625	16,626	36,500	1,581	3,800	8,000	759	56,127	37,708
14	35,625	16,032	36,500	1,581	3,400	8,000	759	55,609	36,267
15	35,625	15,438	36,500	1,581	3,000	8,000	759	55,093	34,878
16	35,625	14,845	36,500	1,581	2,600	8,000	759	54,576	33,541
17	35,625	14,251	36,500	1,581	2,200	8,000	759	54,060	32,253
18	35,625	13,658	36,500	1,581	1,800	8,000	759	53,543	31,009
19	35,625	13,064	36,500	1,581	1,400	8,000	759	53,026	29,812
20	35,625	12,470	36,500	1,580	1,000	20,000	758	64,509	35,304
									$752,040

* Pre-Calculated

product recovery from the on-site and pre-treatment facilities. Should the yearly by-product recovery from on-site be greater than that from pre-treatment by $ 1,578 in this example, the two alternatives become equal in value. In addition, the reader will note that this chapter is rife with assumptions since many pertinent regulations are not available at this writing. Nevertheless, this chapter can serve as a general guide to completing a more definitive analysis for your plant when appropriate data is available.

Completed now are the analytical financial guides necessary for making the proper choices of treatment alternatives and pollution control incentives as soon as they are available. In this era of regulatory programs for health and welfare, it is, as demonstrated herein, important to perform the financial analysis with as much zeal as goes into the choice of proper equipment.