User's Guide to BENCOS--Lotus 1-2-3
Templates for Benefit-Cost Analysis


by

Eric W. Crawford and A. Allan Schmid


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# USER'S GUIDE TO BENCOS -- LOTUS 1-2-3

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## TABLE OF CONTENTS

# USER'S GUIDE TO BENCOS -- LOTUS 1-2-3
## TEMPLATES FOR BENEFIT-COST ANALYSIS[*]

By Eric W. Crawford and A. Allan Schmid

## INTRODUCTION

BENCOS is a Lotus 1-2-3 template designed for benefit-cost analysis. It is adapted from BENCOST, a FORTRAN program written for the CDC Cyber 750 by Robert F. Ranger, Robert D. Stevens, Roy A. Saper, and Ting-Ing Ho. The current form of BENCOS is designed for relatively small problems. BENCOS was written on an IBM PC microcomputer, but it will run on any IBM-compatible system using Lotus 1-2-3 (Release 1A, 2.0, or 2.01), or any other spreadsheet program that can read .WK1 format files. The most recent version of the basic template, which has been significantly revised with the assistance of Margaret Beaver, is called BENCOS2.WK1 (for Lotus 1-2-3 Release 2.01) or BENCOS20.WK1 (for Lotus 1-2-3 Release 2). The extended version, which allows project ranking by alternative investment criteria, is called SCHMID2.WK1 (or SCHMID20.WK1 for Lotus 1-2-3 Release 2). A diskette containing the four BENCOS templates, formatted for the IBM PC, can be obtained from MSU for $15.00.

This guide assumes that the user is familiar with standard benefit-cost analysis techniques. A useful reference is J. Price Gittinger, Economic Analysis of Agricultural Projects, Second Edition, Baltimore, Johns Hopkins University Press, 1982. The concepts, structure, and calculations of BENCOS are generally consistent with those recommended by Gittinger.

This document begins with a description of the structure and capabilities of BENCOS, followed by instructions on how to use the template, and comments on possible modifications of the template.

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1

Figure 1.  Diagram of BENCOS Spreadsheet
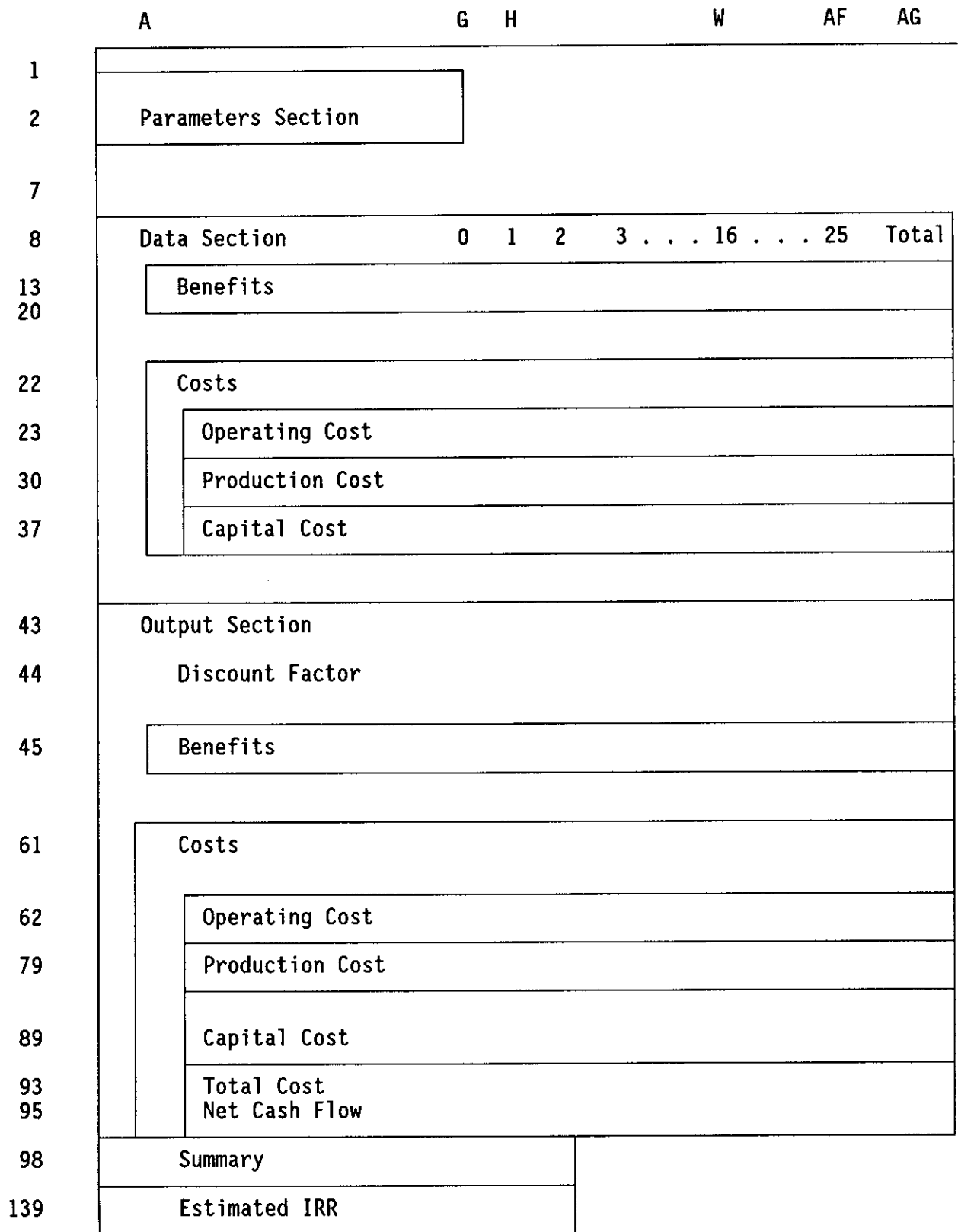
## DESCRIPTION OF THE BASIC TEMPLATE

The BENCOS template is divided into four main sections: (1) Parameters Section, (2) Data Section, (3) Output Section, and (4) Summary. The abbreviated diagram of the spreadsheet in Figure 1 shows the row and column coordinates of these sections. A photocopy of the main sections of the spreadsheet is shown in Annex 1.

### Parameters Section

Two parameters must be entered in this section: the interest rate to be used for discounting, and the user's definition of capital or scarce resource costs. BENCOS currently allows up to 25 years of benefits and costs.

### Data Section

Information on benefits and costs is entered here. Note that it is incremental benefits and costs which should be used, i.e., the difference between with-project and without-project figures. BENCOS currently allows for two categories each for benefits, operating costs, production costs, and capital costs. Operating costs are general project-level overhead costs (e.g., administration, maintenance of central facilities, etc.); production costs are the costs of producing project output (e.g., fertilizer, seed, hired labor, or other farm inputs). Data for each category can be entered either as values, or as separate sets of units and prices. The exception is that capital costs must be entered as values.

The BENCOS format allows a choice between the two standard ways of phasing initial cost and returns. One alternative is to enter initial investment (capital costs) in Year 0, with initial operating and production costs and initial benefits (if any) beginning in Year 1. Values in Year 0 are not discounted. The second alternative is to ignore Year 0 and to begin entering all initial costs and benefits (if any) in Year 1. Values in Year 1 are discounted by one year.

Prices may be entered directly for each year, or they may be projected automatically on the basis of a Year 0 or Year 1 price and an annual price compounding factor (defined by the user). A constant scale factor can also be defined for use in sensitivity analysis. The use of these factors is explained below under "Entering Parameters and Data."

## Output Section

This section first shows the discount factor for each year, based on the user-specified interest rate. Subsequent rows show the benefits and costs entered earlier by the user, the effect of the scale factor (if any), and the final values obtained as the product of price times quantity. The present value of the benefit and cost streams is also shown.

Total cost is the sum of operating, production, and capital costs. The "net investment" (sum of negative net cash flows), is calculated in a separate working space area (N98..P130) in order to calculate the second alternative definition of scarce resource costs (see "Summary" below, and Gittinger, 1982, p. 347.)

## Summary

The summary section contains the present value of total benefits and costs. Net cash flow (undiscounted annual net benefits) and the present value of annual net benefits are also shown. Three discounted benefit/cost ratios are calculated: (1) gross benefit/cost ratio (Benefits divided by Total Costs); (2) (Benefits minus Production Costs) divided by (Operating plus Capital Costs); and (3) the net benefit/scarce resource cost ratio. The third ratio is defined as either (a) (Benefits minus Operating and Production Costs) divided by the user-entered Capital or Scarce Resource Costs, or (b) the sum of values in years where net cash flow is positive (benefits exceed total costs), divided by the sum of values in years where net cash flow is negative.

Lastly, the internal rate of return is estimated by interpolation based on calculation of net present value at successive 5 percent intervals (up to 150 percent) until NPV turns negative. More exact estimates of IRR are also given using (a) interpolation over a 1% interval, and (b) the Lotus 1-2-3 @IRR function (only valid if benefits and costs start in Year 1).

## HOW TO USE BENCOS
### Loading the Template

First, load Lotus 1-2-3 into memory. It is generally sufficient to enter 123 from the A> prompt (if the Lotus 1-2-3 system disk is in the A drive), or from the C> prompt (if you are in the subdirectory which contains

the Lotus 1-2-3 program). When the Lotus 1-2-3 trademark information appears, hit Return to obtain the spreadsheet (not necessary with Release 2.01). Then, load BENCOS into the spreadsheet as follows: type /FR and 1-2-3 will ask for the name of the file to load; then type (for example) BENCOS2.WK1 and hit Return. Note: Loading and initial calculations may take up to one minute (depending on your computer and version of 1-2-3), during which the "Wait" message appears at the top. The titles and instructions will be at half-intensity on the screen because they are protected. Data you enter will be at full intensity.

## Entering Parameters and Data

Note: Dashes are used to indicate each cell in which data may be entered. (BENCOS20 contains zeroes in place of the dashes. LOTUS 1-2-3 Release 2 requires this version.) These dashes will be replaced by the numbers you enter.

Step 1: Enter the interest rate for discounting (in decimal form, e.g., enter 15% as .15) in cell E3.

Step 2: Enter either 1 or 2 in cell E5 to indicate your desired definition of capital or scarce resource costs. (See the "Summary" section above.)

Step 3: Enter your benefit and cost data.

There are three sets of data which are entered in the same way: benefits, operating costs, and production costs.

Note: (a) With a column width of 9, and using the $ format, the output section allows room for only 5 digits to the left of the decimal point, so you should define your data as necessary (e.g., thousands or millions).

(b) Be careful to enter your data in the correct row and column. Otherwise, the program will not recognize what you have entered. Inspecting a print-out of your input data is a good way to check this.

(1) Constant scale factor: You may leave this blank initially. A figure may be entered later when you want to do sensitivity analysis. Entering 1.10 will cause the corresponding type of benefit or cost to be increased by a constant 10 percent for all years. A scale factor of 0.95 would reduce your numbers by 5

percent for all years. A scale factor of 1.0 will result in no change.

(2) <u>Price compounding factor (PCF)</u>:

    (a)   If you are entering your benefits or costs as values, enter 1.0 for the price compounding factor and 1.0 as the price in Year 1 (or Year 0 if benefits or costs begin then).

    (b)   If you are entering benefits or costs as units, in which case you need to enter a price per unit, you have two options:

        (i)  enter your own price value for each year, leaving the PCF blank; or

        (ii) enter an initial price in Year 0 or Year 1 and a price compounding factor. Prices for subsequent years will then be projected using this compounding factor.
(Specifically, price in Year 1 will equal price in Year 0, if any; price in Year 2 will equal price in Year 1 times the PCF; price in Year 3 will equal price in Year 2 times $(PCF)^2$, and so on.)

    (c)   Sensitivity analysis involving compounded increases or decreases may be performed later by changing the PCF.

(3) <u>Units and Prices of Benefits and Costs, excluding Capital Costs</u>:
Two options are available.:

    (a)   To enter benefits or costs as values, enter your numbers in the units row and then enter a price of 1 in the initial year [see Step 3 (2) (a)].

    (b)   Alternatively, enter the units in the units row followed by prices in the price row [see Step 3 (2) (b)].

(4) <u>Capital Costs</u>: These must be entered as values.

(5) <u>Note</u>: The benefit/cost ratio calculations distinguish between operating and production costs. Organize your data entry with the definitions of the benefit/cost ratios in mind (see the "Summary" section above).

<u>Step 4</u>:   Once the Data Section is complete, save your worksheet (see Step 6). Then initiate recalculation by hitting the F9 key. When this is complete, you can move around the worksheet to examine the results,

or print them out as indicated below.  Row totals are shown in column AG.

Note:  If your results do not look right, you may have made an error in entering your data.  The best way to check for errors is to print out the data input section, as shown below.

Step 5:  Printing out convenient blocks of the worksheet can be done with a macro (initiated by pressing Alt-P) which has the following options: C=complete worksheet; D=data; and S=summary.  The macro assumes an IBM-compatible printer.  Output is printed with compressed type and 8 lines per inch.  The necessary right margin (180) is already set in the spreadsheet.

Step 6:  Saving your worksheet.  If you wish to save your worksheet at any point, enter the following command:

/FS BCname <return>

("BCname" is just a sample file name; it can be something else. Using "BENCOS2" would cause you to overwrite the blank worksheet stored by that name, which you do not want to do.  Write down the file name you use here.)

Step 7:  Recalling a previously saved worksheet (after loading 1-2-3) can then be done by typing, for example: /FR BCname <return>

## MODIFYING THE TEMPLATE

There are several relatively straightforward modifications which the user may wish to make.  Sections being modified would need to be unprotected first, and then reprotected.

## More Years or Cost/Benefit Items

By inserting new rows, additional categories of benefits or costs could be accommodated.  Some adjustment of formulas in the output section would be required.  It is also possible to insert columns for additional years (between columns AE and AF, so that the formulas for row totals adjust automatically). Providing no columns are inserted before column P, this will not disrupt the spreadsheet.

## Vertical Titles

Users who find it difficult to keep track of what row they are in when entering data may wish to fix the titles in column A. However, this would show only the first nine characters of the present titles, which would not be self-explanatory. This can be remedied either by rewriting the titles in condensed form, or (more simply) by inserting a new column of one-word acronyms in front of column A. Fixing the vertical titles would then keep this information on screen. Of course, the condensed titles would not have to be shown on any printed output. (Ranges in the \P print macro would need to be adjusted.)

## Calculating Additional B/C Ratios

The calculation of one or more types of B/C ratios at 5% intervals could easily be added to the summary section (e.g., in columns K-M).

## DESCRIPTION OF THE EXTENDED TEMPLATE
### Introduction

Different investment criteria produce different project rankings because of different implicit rates of reinvestment of the net cash flow. The capital budgeting program described here implements a normalization procedure which explicitly controls the rate for reinvestment and makes all criteria produce the same ranking (for a given definition of scarce capital).

The extended template was developed to facilitate comparison of projects ranked by different investment criteria. The basic template illustrates such criteria as present value, present value ratios (with different definitions of the scarce resource), and internal rate of return. The extended template illustrates terminal values, normalized ratios and internal rates of return, and synthetic investment criteria involving different opportunity costs and benefit streams.

Second best conditions are often present in analysis. Capital rationing is common and the character of capital markets creates disequilibria in opportunities among groups. These conditions require explicit attention to the rate of reinvestment of capital flows. The theory of second-best investment criteria is developed in Schmid (1989, Ch. 9).

## Parameters Section

After the Lotus 1-2-3 spreadsheet has been loaded, retrieve the template file depending on the version of Lotus you have: SCHMID20.WK1 for release 1.0 (displays zeros in empty data fields), or SCHMID2.WK1 for later releases (displays dashes in empty data fields).

The entry for "Interest Rate for Discounting" applies to Output Section I and would be sufficient for first-best analysis assuming equilibrium conditions. It is important for the extended analysis to define capital as the sum of negative cash flows, so enter "2" in cell E5. On the right-hand side of the screen is an additional input section entitled PART II (see Annex 2). Enter the Terminal Year as the year of benefits or cost of the longest-lived project to be compared with others. Enter the Interest Rate for Compounding Benefits (which will be the same as the Interest Rate for Discounting entered previously) and the Interest Rate for Compounding Costs. The rates in Part II control the calculation of terminal values in Output Section II. This allows different rates to reflect different opportunity costs for benefits reinvested and for cost streams. Use of different rates is part of the normalization calculation which makes the opportunity for reinvestment explicit. When cash flows are explicitly brought to terminal values, all investment criteria then produce the same ranking of projects. For a discussion of normalization, see Mishan (1976, Chs. 35-38).

## Data Section

Enter data as directed in the above section entitled "How to Use BENCOS, Entering Parameters and Data."

## Output Section I and Summary

This section of the extended template is identical to the basic template and includes the net present value ratio of benefits to costs (net benefit/scarce resource cost). The computed value is in cell G135. The net cash flow is displayed on line 95. This line indicates the years when cash flow is negative and capital must be borrowed rather than all costs being covered by receipts. The net present value is shown in line 96 and the Summary-Output I section in the column labeled "Net Cash Flow." The Output

Section also displays the internal rate of return on line 145 computed at a 1% interval for interpolation.

## Output Section II

This section shows the results of compounding all flows forward to the chosen terminal year. By explicitly choosing the rate for compounding, all projects are thereby "normalized." The compounding factor at the chosen rate for each year is displayed on line 154 for costs and line 156 for benefits. The compounding factor is given by $(1 + r)t$. The relevant values are found as follows:

| | |
|---|---:|
| TVB (Terminal value of benefits) | AG157 |
| TVK (Terminal value of capitol costs) | AG160 |
| TV B/K (Terminal value benefit-cost ratio) | F206 |
| NTV (Net terminal value) | AG162 and F204 |
| NIRR (Normalized internal rate of return) | G222 |

The NIRR is computed by calculating the present value of all negative cash flows (labeled -K). All positive cash flows are explicitly compounded forward to the terminal year. Thus the normalized or reconstructed cash flow is -K, 0, 0, ..., TVB and is shown in the section labeled Summary - Output II in column C under the heading Normalized Cash Flow. The NIRR is the rate of interest which reduces this normalized cash flow to zero. Once the normalization has been done, the terminal values can be expressed in present value terms and present value ratios computed. Ranking of projects by these normalized present value ratios will be identical to the ranking by NIRR (which is not true for ordinary present value ratios and IRR).

The effect of choosing different kinds of cost as limiting, i.e., the base to which rates of return are computed and projects chosen to maximize the total return, can be seen in the following cells:

PVB (gross): AG55 (gross benefits as entered line 15)

PVOC: AG71 (present value of operating cost)

PV of Capital Cost: AG92 (capital as entered line 37)

PVK: AG165 (K = negative cash flow)

NPV: AG96

line 96 -- if scarce resource costs were defined this way by
entering 2 in cell E5)

B/(OC + K): G134 (present value of benefit (cell AG55)/present value of
total cost (cell AG93)). Cell AG93 is the present value of
operating cost (PVOC) plus the present value of capital cost (PVK).

If policy suggests that only the years of negative cash flow requiring
borrowing are limiting (regardless of the source of capital), the formula
(B - OC)/K is appropriate. The effects of ranking by the two criteria are
shown by comparing projects with the two ratios above. If some source of
capital such as state or Federal funding is considered limiting, the limiting
source is entered as data on line 37 and the non-limiting source is entered as
Operating Cost 2 on line 27. The non-limiting source is then netted from
gross benefits and does not enter the denominator of any ratio.

## HOW TO USE THE EXTENDED TEMPLATE

Follow the directions in "How to Use BENCOS." Note that you can go to
any cell in Lotus 1-2-3 by pressing F5 and entering the appropriate letter and
number of the cell coordinates. Computing (recalculation) must be done by
pressing F9. Saving and printing your worksheet are done as described for
BENCOS. Printing is initiated with a macro by pressing Alt-P.

ANNEX 1

| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ** BENCOS ** By Ting-Ing Ho and Eric W. Crawford (Michigan State Univ.). Modified 5/88 by Beaver & Crawford | | | | | | | | | | | | |
| 2 | PARAMETERS SECTION || To print worksheet, press <ALT> P for menu.|| | | | | | | | | | | |
| 3 | Interest Rate for Discounting = >> 0.15 << (Enter a decimal value) | | | | | | | | | | | | |
| 4 | Definition of Capital | | | | | | | | | | | | |
| 5 | or Scarce Resource Costs = >> 2 << (Enter 1 or 2 as described below) | | | | | | | | | | | | |
| 6 | (1): use rows 37 & 38; OR (2): use negative net cash flows from row 95 | | | | | | | | | | | | |
| 7 | ------------------------------------------------------------------------------------------ | | | | | | | | | | | | |
| 8 | DATA SECTION | | | | | | | | | | | | |
| 9 | *NOTE* You have two options for entering prices: | | | | | | | | | | | | |
| 10 | (1) Enter price manually for each year; | | | | | | | | | | | | |
| 11 | (2) Enter price in first year, and price compounding factor. | | | | | | | | | | | | |
| 12 | | | | | | | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
| 13 | Benefits | | | | | | | | | | | | |
| 14 | Benefit 1: | | | | | | | | | | | | |
| 15 | (constant scale factor = -- ) | | | | units | -- | 0 | 4 | 5 | 6 | 7 | -- | |
| 16 | (price compounding factor 1 ) | | | | price | -- | 1 | -- | -- | -- | -- | -- | |
| 17 | Benefit 2: | | | | | | | | | | | | |
| 18 | (constant scale factor = -- ) | | | | units | -- | -- | -- | -- | -- | -- | -- | |
| 19 | (price compounding factor -- ) | | | | price | -- | -- | -- | -- | -- | -- | -- | |
| 20 | | | | | | | | | | | | | |
| 21 | | | | | | | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
| 22 | Costs | | | | | | | | | | | | |
| 23 | Operating Cost 1: | | | | | | | | | | | | |
| 24 | (constant scale factor = -- ) | | | | units | -- | 5 | 1 | 1 | 1 | 1 | -- | |
| 25 | (price compounding factor 1 ) | | | | price | -- | 1 | -- | -- | -- | -- | -- | |
| 26 | Operating Cost 2: | | | | | | | | | | | | |
| 27 | (constant scale factor = -- ) | | | | units | -- | -- | -- | -- | -- | -- | -- | |
| 28 | (price compounding factor -- ) | | | | price | -- | -- | -- | -- | -- | -- | -- | |
| 29 | | | | | | | | | | | | | |
| 30 | Production Cost 1: | | | | | | | | | | | | |
| 31 | (constant scale factor = -- ) | | | | units | -- | 0 | 2 | 2 | 2 | 2 | -- | |
| 32 | (price compounding factor 1 ) | | | | price | -- | 1 | -- | -- | -- | -- | -- | |
| 33 | Production Cost 2 | | | | | | | | | | | | |
| 34 | (constant scale factor = -- ) | | | | units | -- | -- | -- | -- | -- | -- | -- | |
| 35 | (price compounding factor -- ) | | | | price | -- | -- | -- | -- | -- | -- | -- | |
| 36 | | | | | | | | | | | | | |
| 37 | Capital Cost(or Scarce Resource) 1: | | | | | | -- | -- | -- | -- | -- | -- | -- |
| 38 | Capital Cost(or Scarce Resource) 2: | | | | | | -- | -- | -- | -- | -- | -- | -- |
| 39 | | | | | | | | | | | | | |
| 40 | ------------------------------------------------------------------------------------------ | | | | | | | | | | | | |
| 41 | | | | | | | | | | | | | |
| 42 | | | | | | | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
| 43 | OUTPUT SECTION(1) | | | | | | | | | | | | |
| 44 | Discount Factor (at 15 %) | | | | | | 1 | 0.869565 | 0.756143 | 0.657516 | 0.571753 | 0.497176 | 0.432327 |
| 45 | Benefits | | | | | | | | | | | | |
| 46 | Benefit 1: (units) | | | | | -- | | 0.00 | 4.00 | 5.00 | 6.00 | 7.00 | -- |
| 47 | (price) | | | | | -- | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 48 | (price*scale) | | | | | -- | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 49 | (revenue) | | | | | | 0.00 | 0.00 | 4.00 | 5.00 | 6.00 | 7.00 | 0.00 |
| 50 | Benefit 2: (units) | | | | | -- | -- | -- | -- | -- | -- | -- | |
| 51 | (price) | | | | | -- | -- | -- | -- | -- | -- | -- | |
| 52 | (price*scale) | | | | | -- | -- | -- | -- | -- | -- | -- | |
| 53 | (revenue) | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 54 | Total Benefits | | | | | | 0.00 | 0.00 | 4.00 | 5.00 | 6.00 | 7.00 | 0.00 |
| 55 | Present Value of Benefits | | | | | | 0.00 | 0.00 | 3.02 | 3.29 | 3.43 | 3.48 | 0.00 |
| 56 | | | | | | | | | | | | | |
| 57 | | | | | | | | | | | | | |
| 58 | ------------------------------------------------------------------------------------------ | | | | | | | | | | | | |
| 59 | | | | | | | | | | | | | |
| 60 | | | | | | | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
| 61 | Costs | | | | | | | | | | | | |
| 62 | Operating Cost 1: (units) | | | | | -- | | 5.00 | 1.00 | 1.00 | 1.00 | 1.00 | -- |
| 63 | (price) | | | | | -- | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 64 | (price*scale) | | | | | -- | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 65 | (cost) | | | | | | 0.00 | 5.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| 66 | Operating Cost 2: (units) | | | | | -- | -- | -- | -- | -- | -- | -- | |
| 67 | (price) | | | | | -- | -- | -- | -- | -- | -- | -- | |
| 68 | (price*scale) | | | | | -- | -- | -- | -- | -- | -- | -- | |
| 69 | (cost) | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 70 | Total Operating Cost | | | | | | 0.00 | 5.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| 71 | Present Value of Operating Cost | | | | | | 0.00 | 4.35 | 0.76 | 0.66 | 0.57 | 0.50 | 0.00 |
| 72 | | | | | | | | | | | | | |
| 73 | | | | | | | | | | | | | |
| 74 | | | | | | | | | | | | | |
| 75 | ------------------------------------------------------------------------------------------ | | | | | | | | | | | | |

```
77|| A || B || C || D || E || F || G || H || I || J || K || L || M |
78|                                           Year 0  Year 1  Year 2  Year 3  Year 4  Year 5  Year 6
79| Production Cost 1: (units)                  --      0.00    2.00    2.00    2.00    2.00 --
80|                    (price)                  --              1.00    1.00    1.00    1.00    1.00    1.00
81|                    (price*scale)            --              1.00    1.00    1.00    1.00    1.00    1.00
82|                    (cost)                          0.00    0.00    2.00    2.00    2.00    2.00    0.00
83| Production Cost 2: (units)                  --      --      --      --      --      --      --
84|                    (price)                  --      --      --      --      --      --      --
85|                    (price*scale)            --      --      --      --      --      --      --
86|                    (cost)                          0.00    0.00    0.00    0.00    0.00    0.00    0.00
87| Total Production Cost                              0.00    0.00    2.00    2.00    2.00    2.00    0.00
88| Present Value of Production Cost                   0.00    0.00    1.51    1.32    1.14    0.99    0.00
89| Capital Cost 1                              --      --      --      --      --      --      --
90| Capital Cost 2                              --      --      --      --      --      --      --
91| Total Capital Cost                                 0.00    0.00    0.00    0.00    0.00    0.00    0.00
92| Present Value of Capital Cost                      0.00    0.00    0.00    0.00    0.00    0.00    0.00
93| Total Cost                                         0.00    5.00    3.00    3.00    3.00    3.00    0.00
94| Present Value of Total Costs                       0.00    4.35    2.27    1.97    1.72    1.49    0.00
95| Net Cash Flow                                      0.00   -5.00    1.00    2.00    3.00    4.00    0.00
96| Present Value of Net Cash Flow                     0.00   -4.35    0.76    1.32    1.72    1.99    0.00
97|----------------------------------------------------------------------------------------------------
```

```
98| SUMMARY                  Present Value at     15%
99| -------          Net Cash    Total   Total   Net                      Net
100|                    Flow     Benefit  Cost   Cash Flow      Interest  Present
101|   Year          (line 95)  (line 55)(line 93)(line 96)      Rate     Value
102| -----           --------   -------- -------- --------      -------- --------
103|    0              0.00       0.00    0.00    0.00            0.05     3.48
104|    1             -5.00       0.00    4.35   -4.35            0.10     2.32
105|    2              1.00       3.02    2.27    0.76            0.15     1.43
106|    3              2.00       3.29    1.97    1.32            0.20     0.74
107|    4              3.00       3.43    1.72    1.72            0.25     0.20
108|    5              4.00       3.48    1.49    1.99            0.30    -0.22
109|    6              0.00       0.00    0.00    0.00            0.35    -0.55
110|    7              0.00       0.00    0.00    0.00            0.40    -0.81
111|    8              0.00       0.00    0.00    0.00            0.45    -1.01
112|    9              0.00       0.00    0.00    0.00            0.50    -1.18
113|   10              0.00       0.00    0.00    0.00            0.55    -1.31
114|   11              0.00       0.00    0.00    0.00            0.60    -1.41
115|   12              0.00       0.00    0.00    0.00            0.65    -1.49
116|   13              0.00       0.00    0.00    0.00            0.70    -1.55
117|   14              0.00       0.00    0.00    0.00            0.75    -1.59
118|   15              0.00       0.00    0.00    0.00            0.80    -1.63
119|   16              0.00       0.00    0.00    0.00            0.85    -1.65
120|   17              0.00       0.00    0.00    0.00            0.90    -1.67
121|   18              0.00       0.00    0.00    0.00            0.95    -1.68
122|   19              0.00       0.00    0.00    0.00            1.00    -1.69
123|   20              0.00       0.00    0.00    0.00            1.05    -1.69
124|   21              0.00       0.00    0.00    0.00            1.10    -1.69
125|   22              0.00       0.00    0.00    0.00            1.15    -1.68
126|   23              0.00       0.00    0.00    0.00            1.20    -1.67
127|   24              0.00       0.00    0.00    0.00            1.25    -1.66
128|   25              0.00       0.00    0.00    0.00            1.30    -1.65
129|                 --------            -------- -------- --------       1.35    -1.64
130|       TOTAL      5.00              13.22   11.80    1.43            1.40    -1.62
131|                                                                    1.45    -1.61
132|                                                                    1.50    -1.59
133| Gross B/C Ratio                      =        1.12
134| Net Benefit/Scarce Resource Cost Ratio  =     1.33
135| Ratio of (Benefits - Production Costs)/
136|        (Operating + Capital Costs)     =        1.21
137|
138|----------------------------------------------------------------------------------------------------
139|Estimated Internal Rate
140|  of Return (IRR) at 5% interval =  0.274233   or     27.42%
141|(If reported IRR > 145%, check NPV (cell J132).  If NPV at 150% > 0, IRR > 150%.)
142|----------------------------------------------------------------------------------------------------
143|Estimated Internal Rate
144|  of Return (IRR) at 1% interval =  0.272780   or     27.28%
145|----------------------------------------------------------------------------------------------------
146|Internal Rate of Return (aIRR)  =  0.272732   or     27.27%
147|(** Valid only if benefits and costs start in year 1 **)
148|
149|----------------------------------------------------------------------------------------------------
```

| | AA | | AB | | AC | | AD | | AE | | AF | | AG | | AH | | AI | | AJ | |

```
1
2
3
4
5
6
7   ------------------------------------------------------------------------
8                    DATA SECTION
9
10
11
12  Year 20  Year 21  Year 22  Year 23  Year 24  Year 25      TOTAL
13
14
15     --       --       --       --       --       --         22    (Units, Benefit 1)
16     --       --       --       --       --       --
17
18     --       --       --       --       --       --          0    (Units, Benefit 2)
19     --       --       --       --       --       --
20
21  Year 20  Year 21  Year 22  Year 23  Year 24  Year 25      TOTAL
22
23
24     --       --       --       --       --       --          9    (Units, Op Cost 1)
25     --       --       --       --       --       --
26
27     --       --       --       --       --       --          0    (Units, Op Cost 2)
28     --       --       --       --       --       --
29
30
31     --       --       --       --       --       --          8    (Units, Prod Cost 1)
32     --       --       --       --       --       --
33
34     --       --       --       --       --       --          0    (Units, Prod Cost 2)
35     --       --       --       --       --       --
36
37     --       --       --       --       --       --          0    (Value, Capital Cost 1)
38     --       --       --       --       --       --          0    (Value, Capital Cost 2)
39
40  ------------------------------------------------------------------------
41                   OUTPUT SECTION
42   Year 20  Year 21  Year 22  Year 23  Year 24  Year 25      TOTAL
43
44  0.061100 0.053130 0.046200 0.040174 0.034934 0.030377
45
46     --       --       --       --       --       --        22.00   (Units, Benefit 1)
47    1.00     1.00     1.00     1.00     1.00     1.00
48    1.00     1.00     1.00     1.00     1.00     1.00
49    0.00     0.00     0.00     0.00     0.00     0.00       22.00   (Revenue, Benefit 1)
50     --       --       --       --       --       --         0.00   (Units, Benefit 2)
51     --       --       --       --       --       --
52     --       --       --       --       --       --
53    0.00     0.00     0.00     0.00     0.00     0.00        0.00   (Revenue, Benefit 2)
54    0.00     0.00     0.00     0.00     0.00     0.00       22.00   (Total Benefit)
55    0.00     0.00     0.00     0.00     0.00     0.00       13.22   (PV of Benefit)
56
57
58  ------------------------------------------------------------------------
59
60  Year 20  Year 21  Year 22  Year 23  Year 24  Year 25      TOTAL
61
62     --       --       --       --       --       --         9.00   (Units, Op Cost 1)
63    1.00     1.00     1.00     1.00     1.00     1.00
64    1.00     1.00     1.00     1.00     1.00     1.00
65    0.00     0.00     0.00     0.00     0.00     0.00        9.00   (Cost, Op Cost 1)
66     --       --       --       --       --       --         0.00   (Units, Op Cost 2)
67     --       --       --       --       --       --
68     --       --       --       --       --       --
69    0.00     0.00     0.00     0.00     0.00     0.00        0.00   (Cost, Op Cost 2)
70    0.00     0.00     0.00     0.00     0.00     0.00        9.00   (Total Op Cost)
71    0.00     0.00     0.00     0.00     0.00     0.00        6.83   (PV of Op Cost)
72
73
74
75  ------------------------------------------------------------------------
```

| | AA | AB | AC | AD | AE | AF | AG | AH | AI | AJ |
|---|---|---|---|---|---|---|---|---|---|---|
| 77 | Year 20 | Year 21 | Year 22 | Year 23 | Year 24 | Year 25 | TOTAL | | | |
| 78 | | | | | | | | | | |
| 79 | -- | -- | -- | -- | -- | -- | 8.00 | (Units, Prod Cost 1) | | |
| 80 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| 81 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| 82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 8.00 | (Value, Prod Cost 1) | | |
| 83 | -- | -- | -- | -- | -- | -- | 0.00 | (Units, Prod Cost 2) | | |
| 84 | -- | -- | -- | -- | -- | -- | | | | |
| 85 | -- | -- | -- | -- | -- | -- | | | | |
| 86 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (Value, Prod Cost 2) | | |
| 87 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 8.00 | (Total Prod Cost) | | |
| 88 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.97 | (PV of Prod Cost) | | |
| 89 | -- | -- | -- | -- | -- | -- | 0.00 | (Capital Cost 1) | | |
| 90 | -- | -- | -- | -- | -- | -- | 0.00 | (Capital Cost 2) | | |
| 91 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (Total Capital Cost) | | |
| 92 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (PV of Capital Cost) | | |
| 93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 17.00 | (Total Cost) | | |
| 94 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 11.80 | (PV of Total Cost) | | |
| 95 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | (Net Cash Flow (B-C)) | | |
| 96 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.43 | (PV of Net Cash Flow) | | |
| 97 | | | | | | | | | | |

**ANNEX 2**

```
A   B   C   D   E   F   G   H   I   J                          K        L        M        N
 1 BENCOS/SCHMID--By Ting-Ing Ho, E. Crawford, and A. Schmid, Michigan State University   Modified 6/88 by Beaver, Crawford, and Schmid
 2 PARAMETERS SECTION  || To print worksheet, press <ALT> P for menu.||   PART II - SUMMARY OF BENEFIT-COST ANALYSIS
 3 Interest Rate for Discounting =  >>   0.08 <<  (Enter a decimal value)    Terminal Year              =  >>   3 <<
 4 Definition of Capital                         PART II -->                 Interest Rate for Compounding Costs    =  >>  0.07 <<  (Enter a decimal value)
 5    or Scarce Resource Costs =  >>   2 <<  (Enter 1 or 2 as described below)   Interest Rate for Compounding Benefits =  >>  0.08 <<  (Enter a decimal value)
 6 (1): use rows 37 & 38; OR (2): use negative net cash flows from row 95
 7
 8 DATA SECTION
 9 *NOTE* You have two options for entering prices:
10        (1) Enter price manually for each year;
11        (2) Enter price in first year, and price compounding factor.
12                                                   Year 0   Year 1   Year 2   Year 3   Year 4   Year 5   Year 6  ... TOTAL
13 Benefits
14 Benefit 1:
15    (constant scale factor =  --  )     units      --       --       100      128.1    --       --       --        228.1   (Units, Benefit 1)
16    (price compounding factor  1  )     price       1       --       --       --       --       --
17 Benefit 2:
18    (constant scale factor =  --  )     units      --       --       --       --       --       --       --          0     (Units, Benefit 2)
19    (price compounding factor  --  )    price      --       --       --       --       --       --
20
21                                                   Year 0   Year 1   Year 2   Year 3   Year 4   Year 5   Year 6  ... TOTAL
22 Costs
23 Operating Cost 1:
24    (constant scale factor =  --  )     units      --       50       50       50       --       --       --        150    (Units, Op Cost 1)
25    (price compounding factor  1  )     price       1       --       --       --       --       --
26 Operating Cost 2:
27    (constant scale factor =  --  )     units      --       --       --       --       --       --       --          0     (Units, Op Cost 2)
28    (price compounding factor  --  )    price      --       --       --       --       --       --
29
30 Production Cost 1:
31    (constant scale factor =  --  )     units      --       --       --       --       --       --       --          0     (Units, Prod Cost 1)
32    (price compounding factor  --  )    price      --       --       --       --       --       --
33 Production Cost 2
34    (constant scale factor =  --  )     units      --       --       --       --       --       --       --          0     (Units, Prod Cost 2)
35    (price compounding factor  --  )    price      --       --       --       --       --       --
36
37 Capital Cost(or Scarce Resource) 1:              54.55     --       --       --       --       --       --        54.55   (Value, Capital Cost 1)
38 Capital Cost(or Scarce Resource) 2:               --       --       --       --       --       --       --          0     (Value, Capital Cost 2)
39
40
```

## OUTPUT SECTION(I)

| | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | … TOTAL | |
|---|---|---|---|---|---|---|---|---|---|
| Discount Factor  (at 8 %) | 1 | 0.925925 | 0.857338 | 0.793832 | 0.735029 | 0.680583 | 0.630169 | | |
| **Benefits** | | | | | | | | | |
| Benefit 1: (units) | -- | -- | 100.00 | 128.10 | -- | -- | -- | 228.10 | (Units, Benefit 1) |
| (price) | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | |
| (price*scale) | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | |
| (revenue) | 0.00 | 0.00 | 100.00 | 128.10 | 0.00 | 0.00 | 0.00 | 228.10 | (Revenue, Benefit 1) |
| Benefit 2: (units) | -- | -- | -- | -- | -- | -- | -- | 0.00 | (Units, Benefit 2) |
| (price) | | | | | | | | | |
| (price*scale) | | | | | | | | | |
| (revenue) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (Revenue, Benefit 2) |
| Total Benefits | 0.00 | 0.00 | 100.00 | 128.10 | 0.00 | 0.00 | 0.00 | 228.10 | (Total Benefit) |
| Present Value of Benefits | 0.00 | 0.00 | 85.73 | 101.69 | 0.00 | 0.00 | 0.00 | 187.42 | (PV of Benefit) |

| | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | … TOTAL | |
|---|---|---|---|---|---|---|---|---|---|
| **Costs** | | | | | | | | | |
| Operating Cost 1: (units) | -- | 50.00 | 50.00 | 50.00 | -- | -- | -- | 150.00 | (Units, Op Cost 1) |
| (price) | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | |
| (price*scale) | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | |
| (cost) | | 0.00 | 50.00 | 50.00 | 0.00 | 0.00 | 0.00 | 150.00 | (Cost, Op Cost 1) |
| Operating Cost 2: (units) | -- | -- | -- | -- | -- | -- | -- | 0.00 | (Units, Op Cost 2) |
| (price) | | | | | | | | | |
| (price*scale) | | | | | | | | | |
| (cost) | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (Cost, Op Cost 2) |
| Total Operating Cost | 0.00 | 50.00 | 50.00 | 50.00 | 0.00 | 0.00 | 0.00 | 150.00 | (Total Op Cost) |
| Present Value of Operating Cost | 0.00 | 46.30 | 42.87 | 39.69 | 0.00 | 0.00 | 0.00 | 128.85 | (PV of Op Cost) |

| | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | … TOTAL | |
|---|---|---|---|---|---|---|---|---|---|
| Production Cost 1: (units) | -- | -- | -- | -- | -- | -- | -- | 0.00 | (Units, Prod Cost 1) |
| (price) | | | | | | | | | |
| (price*scale) | | | | | | | | | |
| (cost) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (Value, Prod Cost 1) |
| Production Cost 2: (units) | -- | -- | -- | -- | -- | -- | -- | 0.00 | (Units, Prod Cost 2) |
| (price) | | | | | | | | | |
| (price*scale) | | | | | | | | | |
| (cost) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (Value, Prod Cost 2) |
| Total Production Cost | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (Total Prod Cost) |
| Present Value of Production Cost | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (PV of Prod Cost) |
| Capital Cost 1 | 54.55 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 54.55 | (Capital Cost 1) |
| Capital Cost 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (Capital Cost 2) |
| Total Capital Cost | 54.55 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 54.55 | (Total Capital Cost) |
| Present Value of Capital Cost | 54.55 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 54.55 | (PV of Capital Cost) |
| Total Cost | 54.55 | 50.00 | 50.00 | 50.00 | 0.00 | 0.00 | 0.00 | 204.55 | (Total Cost) |
| Present Value of Total Costs | 54.55 | 46.30 | 42.87 | 39.69 | 0.00 | 0.00 | 0.00 | 183.40 | (PV of Total Cost) |
| Net Cash Flow | -54.55 | -50.00 | 50.00 | 78.10 | 0.00 | 0.00 | 0.00 | 23.55 | (Net Cash Flow (B-C)) |
| Present Value of Net Cash Flow | -54.55 | -46.30 | 42.87 | 62.00 | 0.00 | 0.00 | 0.00 | 4.02 | (PV of Net Cash Flow) |

SUMMARY - OUTPUT 1

Present Value at 8%

| Year | Net Cash Flow (line 95) | Total Benefit (line 55) | Total Cost (line 94) | Net Cash Flow (line 96) | Interest Rate | Net Present Value |
|---|---|---|---|---|---|---|
| 0 | -54.55 | 0.00 | 54.55 | -54.55 | 0.05 | 10.65 |
| 1 | -50.00 | 0.00 | 46.30 | -46.30 | 0.10 | 0.00 |
| 2 | 50.00 | 85.73 | 42.87 | 42.87 | 0.15 | -8.87 |
| 3 | 78.10 | 101.69 | 39.69 | 62.00 | 0.20 | -16.30 |
| 4 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | -22.56 |
| 5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 | -27.88 |
| 6 | 0.00 | 0.00 | 0.00 | 0.00 | 0.35 | -32.41 |
| 7 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | -36.29 |
| 8 | 0.00 | 0.00 | 0.00 | 0.00 | 0.45 | -39.63 |
| 9 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | -42.52 |
| 10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.55 | -45.02 |
| 11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.60 | -47.20 |
| 12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.65 | -49.10 |
| 13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.70 | -50.76 |
| 14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | -52.22 |
| 15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.80 | -53.50 |
| 16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.85 | -54.63 |
| 17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | -55.63 |
| 18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.95 | -56.51 |
| 19 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | -57.29 |
| 20 | 0.00 | 0.00 | 0.00 | 0.00 | 1.05 | -57.98 |
| 21 | 0.00 | 0.00 | 0.00 | 0.00 | 1.10 | -58.59 |
| 22 | 0.00 | 0.00 | 0.00 | 0.00 | 1.15 | -59.13 |
| 23 | 0.00 | 0.00 | 0.00 | 0.00 | 1.20 | -59.61 |
| 24 | 0.00 | 0.00 | 0.00 | 0.00 | 1.25 | -60.04 |
| 25 | 0.00 | 0.00 | 0.00 | 0.00 | 1.30 | -60.42 |
|  |  |  |  |  | 1.35 | -60.75 |
|  |  |  |  |  | 1.40 | -61.05 |
|  |  |  |  |  | 1.45 | -61.32 |
|  |  |  |  |  | 1.50 | -61.55 |
| TOTAL | 23.55 | 187.42 | 183.40 | 4.02 |  |  |

Gross B/C Ratio = 1.02

Net Benefit/Scarce Resource Cost Ratio = 1.04

Ratio of (Benefits - Production Costs)/
(Operating + Capital Costs) = 1.02

Estimated Internal Rate
of Return (IRR) at 5% interval = 0.099979   or   10.00%
(If reported IRR > 145%, check NPV (cell J133).  If NPV at 150% > 0, IRR > 150%.)

Estimated Internal Rate
of Return (IRR) at 1% interval = 0.099977   or   10.00%

Internal Rate of Return (@IRR) = NA   or   NA
(** Valid only if benefits and costs start in year 1 **)

|  | A | B | C | D | E | F | G | H | I | J | K | L | M | AG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 151 | :: | | | | | | | | | | | | | |
| 152 | OUTPUT SECTION(II) | | | | | | | | | | | | | |
| 153 | | | | | | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | ... TOTAL |
| 154 | Compound Factor (Costs at | | | | 7.00%) | | 1.23 | 1.14 | 1.07 | 1.00 | 0.93 | 0.87 | 0.82 | |
| 155 | Discount Factor at | | | | 7.00% | | 1.00 | 0.93 | 0.87 | 0.82 | 0.76 | 0.71 | 0.67 | |
| 156 | Compound Factor (Benefits at | | | | 8.00%) | | 1.26 | 1.17 | 1.08 | 1.00 | 0.93 | 0.86 | 0.79 | |
| 157 | Terminal Value of Benefits (line 14) | | | | | | 0.00 | 0.00 | 108.00 | 128.10 | 0.00 | 0.00 | 0.00 | 236.10 |
| 158 | Terminal Value of Operating Cost (lines 23,26) | | | | | | 0.00 | 57.25 | 53.50 | 50.00 | 0.00 | 0.00 | 0.00 | 160.75 |
| 159 | Terminal Value of Total Production Cost (lines 30,33) | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 160 | Terminal Value of Total Capital Cost (line 37) | | | | | | 66.83 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 66.83 |
| 161 | Terminal Value of Total Costs (lines 23+26+30+33+37) | | | | | | 66.83 | 57.25 | 53.50 | 50.00 | 0.00 | 0.00 | 0.00 | 227.57 |
| 162 | Terminal Value of Net Cash Flow | | | | | | -66.83 | -57.25 | 54.50 | 78.10 | 0.00 | 0.00 | 0.00 | 8.53 |
| 163 | Terminal Value of Negative Cash Flow | | | | | | -66.83 | -57.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -124.07 |
| 164 | Terminal Value of Positive Cash Flow at | | | | | 8.00% | 0.00 | 0.00 | 54.50 | 78.10 | 0.00 | 0.00 | 0.00 | 132.60 |
| 165 | Present Value of Negative Cash Flow at | | | | | 7.00% | -54.55 | -46.73 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -101.28 |

Column AG descriptions:
- 157 (Terminal Value of Benefits)
- 158 (Terminal Value of Operating Cost)
- 159 (Terminal Value of Production Cost)
- 160 (Terminal Value of Capital Cost)
- 161 (Terminal Value of Total Costs)
- 162 (Terminal Value of Net Cash Flow)
- 163 (Terminal Value of Negative Cash Flow)
- 164 (Terminal Value of Positive Cash Flow)
- 165 (Net Present Value of Negative Cash Flow)

SUMMARY - OUTPUT II
--------

Estimated Normalized Internal
Rate of Return (NIRR)

| Year | Normalized Net Cash Flow | Interest Rate | Net Present Value |
|---|---|---|---|
| 0 | -101.28 | 0.05 | 13.27 |
| 1 | 0.00 | 0.10 | -1.65 |
| 2 | 0.00 | 0.15 | -14.09 |
| 3 | 132.60 | 0.20 | -24.54 |
| 4 | 0.00 | 0.25 | -33.39 |
| 5 | 0.00 | 0.30 | -40.92 |
| 6 | 0.00 | 0.35 | -47.38 |
| 7 | 0.00 | 0.40 | -52.96 |
| 8 | 0.00 | 0.45 | -57.78 |
| 9 | 0.00 | 0.50 | -61.99 |
| 10 | 0.00 | 0.55 | -65.67 |
| 11 | 0.00 | 0.60 | -68.91 |
| 12 | 0.00 | 0.65 | -71.76 |
| 13 | 0.00 | 0.70 | -74.29 |
| 14 | 0.00 | 0.75 | -76.54 |
| 15 | 0.00 | 0.80 | -78.54 |
| 16 | 0.00 | 0.85 | -80.34 |
| 17 | 0.00 | 0.90 | -81.95 |
| 18 | 0.00 | 0.95 | -83.40 |
| 19 | 0.00 | 1.00 | -84.70 |
| 20 | 0.00 | 1.05 | -85.89 |
| 21 | 0.00 | 1.10 | -86.96 |
| 22 | 0.00 | 1.15 | -87.94 |
| 23 | 0.00 | 1.20 | -88.83 |
| 24 | 0.00 | 1.25 | -89.64 |
| 25 | 0.00 | 1.30 | -90.38 |
| | | 1.35 | -91.06 |
| | 31.32 | 1.40 | -91.69 |
| | | 1.45 | -92.26 |
| | | 1.50 | -92.79 |

```
     A        B         C        D     E     F      G
203
204  Terminal Value of Net Benefit           =     8.53
205  Gross Terminal B/C Ratio                =     1.04
206  Net Benefit/Scarce Resource Cost Ratio  =     1.07
207  Ratio of (Benefit - Production Costs)/
208          (Operating + Capital Costs)     =     1.04
209
210  P. V.(at  8.00%) of Terminal Value Total Benefits =  187.42
211  P. V.(at  7.00%) of Terminal Value Total Costs    =  185.77
212  Present Value Ratio of Gross B/C                  =    1.01
213  Net Present Value of Terminal Value of Net Benefit:
214          (at rate used to compound costs)    =   6.96
215          (at rate used to compound benefits)=    6.77
216
217  Estimated Normalized Internal Rate
218  of Return (NIRR) at 5% interval = 0.094455   or    9.45%
219  (If reported NIRR > 145%, check NPV (cell F202).  If NPV at 150% > 0, NIRR > 150%.)
220
221  Estimated Normalized Internal Rate
222  of Return (NIRR) at 1% interval = 0.094021   or    9.40%
223
224  Normalized IRR (NIRR)            =    NA     or     NA
225  (** Valid only if benefits and costs start in year 1 **)
226
227
```

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