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ENERGY CONSERVATION PROJECT INVESTMENT EVALUATION MODEL (ECPIE): A USER'S MANUAL

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Contents

	PAGE	TITLE
INTRODUCTION	i	
CHAPTER 1	1.1	**GETTING STARTED WITH ECPIE**
	1.1	GETTING ECPIE READY TO RUN
	1.2	System With Two Disk Drives
	1.2	System With One Disk Drive
	1.3	CONFIGURING ECPIE FOR YOUR COMPUTER
	1.3	Computer With Minimum 64K Addressable RAM and Floppy Disk Storage
	1.4	Computer With At Least 320K RAM and Floppy Disk Storage
	1.5	Computer With Hard Disk Storage
CHAPTER 2	2.1	**ENTERING DATA**
	2.3	Entering the Initialization Data
	2.8	Entering Financial and Tax Data
	2.16	Entering Development Period Cost Data
	2.26	Entering Operating Period Cost Data

	PAGE	TITLE
	2.27	Entering Energy-Related Benefits/Cost Data
	2.29	Saving and Retrieving an ECPIE Data File
CHAPTER 3	3.1	REVIEWING AND EDITING DATA
CHAPTER 4	4.1	PERFORMING AN ANALYSIS
CHAPTER 5	5.1	VIEWING AND PRINTING ECPIE RESULTS
	5.1	OPTIONS FOR VIEWING AND PRINTING RESULTS
	5.6	Understanding ECPIE Results
	5.6	Financial Analysis Results
	5.8	Social Cost/Benefit Analysis Results
	5.9	Foreign Currency Usage Analysis Results
APPENDIX A		ECPIE FINANCIAL REPORT EXAMPLE

Introduction

Energy Conservation Project Investment Evaluation Model (ECPIE) is a computer program designed to assist in evaluating the financial/economic performance of energy conservation projects in industrial and commercial applications. The program is designed to run on the IBM Personal Computer and IBM-compatible equipment such as the COMPAQ personal computer. Various versions of the program are available to match specific hardware configurations, depending on memory size and availability of hard disk storage. ECPIE results may be viewed on the computer screen or printed as a pre-formatted financial/economic feasibility report. To print ECPIE results requires a printer capable of printing in standard 80-column and compressed-text modes.

ECPIE was initially developed under the sponsorship of the United States Agency for International Development for use in developing countries for analyzing energy conservation opportunities. However, because of the flexibility offered by the model in structuring an analysis, ECPIE may be used in almost any economic/institutional setting.

ECPIE automatically performs three separate analyses of a conservation project:

1. A **financial analysis** of project performance based on traditional cash-flow analysis principles. The financial analysis computes the financing requirements and after-tax cash flows associated with a project using information supplied by the user regarding project financial structure, taxation, and the cost of debt and equity financing. In addition, the financial analysis performs six sensitivity analyses on variables that are important determinants of the financial performance of a project -- namely, project capital cost, value of energy savings, cost of debt financing, operating expense, marginal tax rate, and financial structure. For both the base case and the sensitivity analyses, the following financial performance measures are computed: internal rate of

return on after-tax cash flow, present value of cash flows at the user's specified target return on equity, and length of time from project initiation to break-even or simple payback.

2. A **social cost/benefit analysis** for which the user may supply cost and price values (social values) that differ from those used in the financial analysis. This analysis ignores the effects of taxes and financial structure on project performance and evaluates the economic performance of a project from the standpoint of society. The following measures of economic performance are computed in the social cost/benefit analysis: ratio of operating period net benefits to development period costs, present value of net benefits at the user's specified social discount rate, and the length of time for the project's cumulative net benefits to become positive.

3. A **foreign current requirements analysis**, which evaluates the net use (or generation) of foreign currency by a project. Using information supplied by the user regarding the fraction of project cost and revenue accounts that involves an increase or reduction in foreign currency use, ECPIE computes the net foreign currency required (or displaced) in the operating period, the present value of the net foreign currency requirement of the project, the ratio of operating period reduction in foreign currency use to development period requirements, and the length of time required for the project's cumulative net foreign currency use to become negative.

For each of these analyses, ECPIE provides detailed preformatted reports of analysis results that may be printed or viewed on the computer monitor (in slightly summarized form). The printed reports should be useful in determining project feasibility and in arranging the financing needed for viable projects

ECPIE offers the user a high degree of flexibility in setting up a project analysis. An analysis may be conducted on a yearly, quarterly, or monthly basis. Also, because the financial and social cost/benefit values and analyses are kept separate in the model, the user may use different currency bases for the financial and

social cost/benefit analyses. For example, the financial analysis may be conducted in current currency values (i.e., including the effects of inflation on price changes), while the social cost/benefit analysis may be conducted in constant currency values (i.e., excluding the effects of inflation on price changes). In addition, the income tax structure embedded in the model is fairly general: a variety of different depreciation methods are available, and as many as five schedules may be used at once to depreciate user-specified fractions of the capital outlay accounts; tax rates may vary over time; an investment tax credit may be taken; and development period outlays, including interest, may be expensed or capitalized for tax purposes.

ECPIE has been designed with the goal of being highly "user-friendly," and, to a large degree, the model is self-documenting. That is, the procedures for entering, editing, and reviewing data, creating and reviewing analysis files, and performing and reporting analyses are explained on the computer screen as the user proceeds through the program. As such, we are hopeful that, with limited reading of this manual, you will be able to use ECPIE efficiently in your analysis of energy-related investments.

The manual is organized as follows. Chapter 1 explains procedures for getting ECPIE up and running. Chapter 2 describes the basic data entry procedures, while Chapter 3 discusses procedures for reviewing and editing data that have already been entered into the program. Chapter 4 describes the analysis procedure. Chapter 5 discusses the results from an ECPIE analysis and describes the options for viewing and printing analysis outputs. Appendix A contains examples of ECPIE outputs.

1 GETTING STARTED WITH ECPIE

In this chapter, we will describe the procedures for getting ECPIE up and running on your IBM PC or PC-compatible computer. The first section is devoted to some preparatory work that must be done by the user to get the ECPIE disk ready to run. Second, we describe procedures for running ECPIE under various hardware configurations.

GETTING ECPIE READY TO RUN

The ECPIE program is designed to run under Microsoft Disk Operating System (DOS) version 2.0 (or higher) and Microsoft Advanced BASIC (BASIC version 2.0 or higher, sometimes called BASICA). Because DOS and BASICA are proprietary, copyrighted software, they are not included on the ECPIE disk, and -- depending on how you wish to use ECPIE -- will generally need to be added to the disk by you. When the ECPIE program starts, it will look for BASICA and must be able to find it on the program disk or, if ECPIE is run in a hard-disk configuration, find it in the hard-disk directory containing ECPIE. If you wish the ECPIE disk to be "bootable" (that is, to be able to start ECPIE by inserting the disk in the default drive and turning on the computer), you must add DOS to the ECPIE disk. If you do not add DOS to the program disk, anytime that you use ECPIE you will need to ensure that the computer has been "booted" in DOS 2.0 (or higher). DOS 2.0 and BASICA are usually supplied with the computer at the time of purchase and are on the "system disk."

Adding DOS and BASICA to the ECPIE disk are simple operations that will require only a few minutes. To make the transfers, you will need your "system disk" and the ECPIE disk. The specific procedure to be followed will depend on whether your system has one or two disk drives.

System With Two Disk Drives

If your system has two disk drives, the process of transferring the DOS and BASICA files is essentially trivial:

1. Boot your computer system under DOS 2.0 (or higher).

2. Make sure drive A is the default drive (that is, the display cursor should say A>).

3. Place the ECPIE program disk in drive A and the DOS system disk in drive B.

4. Type "2DRIVE" and press return (enter).

The batch program, 2DRIVE, will transfer the needed files from the system disk to the ECPIE program disk.

System With One Disk Drive

Because of the need to swap the ECPIE and DOS system disks in and out of the single drive, the procedure for transferring the DOS and BASICA files to the ECPIE disk is slightly more complicated with only one disk drive than with two. To execute this transfer, follow the following steps:

1. Make sure drive A is the default drive. That is, the DOS prompt should be "A>."

2. Insert the DOS program disk into your disk drive and type "SYS B:" followed by return. When you are prompted to insert the disk for drive B, insert the ECPIE program disk and press return.

3. Insert the DOS program disk in the disk drive and type "COPY COMMAND.COM B:" followed by return. Again, when the computer prompts for the drive B disk, insert the ECPIE program disk.

4. Insert the DOS program disk into the disk drive and type "COPY BASICA.* B:" followed by return. Again, follow the instructions for removing and inserting the DOS and ECPIE disks. Remember, the DOS disk will be the drive A or source disk

and the ECPIE disk will be the drive B or target disk.

Once you have completed these file transfers, you may wish to make a backup copy of the program disk and place a write-protection label on the operating disk.

CONFIGURING ECPIE FOR YOUR COMPUTER

The most efficient procedure for running ECPIE on your IBM PC or PC-compatible computer will depend on the hardware configuration of your system. Specifically, there are three general hardware configurations under which ECPIE may be operated:

1. Computer with minimum of 64K addressable RAM and one or two floppy disk drives. This is the slowest of the ECPIE operating configurations, as program modules must be swapped in and out of memory using floppy disk operations. If you only have one disk drive, data transfers will require insertion and removal of data disks.

2. Computer with at least 320K RAM, floppy disk storage, and capability of establishing an electronic disk. In this configuration, the program module transfers may be executed with an electronic disk and, as a result, the program will run noticeably faster than in the first two configurations.

3. Computer with hard disk storage. In this arrangement, the program module swaps may be done with an electronic disk, which will give operations that are nearly as fast the third configuration.

We explain program configuration and startup procedures for each of these configurations below.

Computer With Minimum 64K Addressable RAM And Floppy Disk Storage

To start ECPIE in this configuration, you may simply turn on or "hot-restart" (e.g., using the CTRL-ALT-DEL key combination) the computer with the program disk in drive A (these procedures assume that drive A is the default drive). Alternatively, if the computer is

already on and in DOS 2.0, enter "ECPIE" from the keyboard with the program disk in drive A. If you are in ADVANCED BASIC (the program will not run in DISK BASIC), you may type RUN "ECPIE" with the program disk in drive A to start the program. After you have started ECPIE by one of these procedures, it is generally advisable to leave the program disk in drive A to facilitate efficient program operations.

Computer With At Least 320K RAM And Floppy Disk Storage

When ECPIE is run in a computer with at least 320K RAM, it is possible to partition RAM into operating memory and an "electronic disk," and install the program modules on the electronic disk segment of RAM. The program modules are subsequently swapped very quickly in and out of addressable memory as the program runs. To use this procedure, you must have a DOS utility program that allows creating an electronic disk within RAM. Such utility programs are provided as part of some DOS packages; for example, IBM DOS 3.0 and Talltree Systems' J-DOS contain an electronic disk capability.

If you have at least 320K RAM and this RAM partitioning ability, you should set up a CONFIG.SYS file that will allocate 192K for an electronic disk; at least 128K should be left for active RAM.* After initializing the electronic disk, you should declare the electronic disk the default drive. For example, on a two floppy drive system, the electronic disk will usually be drive "C." While in DOS, typing "C:" followed by return will declare C the default drive. Then, to start ECPIE, place the program disk in drive A and type "A:ESTART" followed by return. The batch file ESTART copies the program modules to the default electronic disk and executes the program.

If you have started ECPIE by the above procedure and subsequently are in DOS, you may restart the program by (1) ensuring that the electronic drive is the default

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*You will probably need to use your DOS manual to see just how to allocate RAM for the electronic disk. Although allocating an electronic disk sounds complicated, it really is not and will considerably speed ECPIE's program module swap operations.

drive, (2) inserting the program disk in drive A, and (3) typing "A:RESTART" followed by return.

Computer With Hard Disk Storage

To use ECPIE efficiently on a hard disk system, you should first copy the program files (i.e., those files ending with the extension ".BAS") to the hard disk, which we assume is named "drive C". Whether or not you need to copy the BASICA file(s) to the hard disk will depend on your computer. You may copy the files to a subdirectory of the hard disk. You may use a batch file to accomplish this copy sequence by declaring the hard disk (and the subdirectory, if you desire to use one) the default drive (e.g., "C:" followed by return and "CD__ directory name" followed by return). Then insert the ECPIE program disk in drive and type "A:HDISK" followed by return. The batch file HDISK will copy the needed files to the hard disk. You may then start ECPIE by (1) booting the computer in DOS 2.0 (or higher), (2) declaring the hard disk (and the ECPIE subdirectory, if relevant) the default drive, and (3) typing "ECPIE" followed by return.

Entering data into ECPIE is a relatively straightforward procedure, which is accomplished in "interactive" mode with considerable assistance from the program through instructions and explanations displayed on the computer screen. Once ECPIE is running, you will soon see the MAIN MENU screen, which looks like this:

```
MAIN MENU

1. ENTER DATA FOR NEW ANALYSIS

2. RESUME DATA ENTRY

3. REVIEW/REVISE DATA FROM PRIOR ANALYSIS

4. PERFORM ANALYSES (previous data input required)

5. EXIT PROGRAM

ENTER NUMBER CHOICE, FOLLOWED BY (RET): ? 1
```

To begin entering data, select option 1, ENTER DATA FOR NEW ANALYSIS, and soon the following screen will be displayed:

INITIALIZE AND ENTER DATA FOR NEW ANALYSIS

In this section, the program requests data and sets up the files needed to analyze a conservation opportunity. Data are requested and filed in five steps:

1. Initialization (Name of project and other general information)
2. Financial and tax data
3. Development period cost data
4. Operating period cost data
5. Energy related benefits/costs.

Data entry would normally be accomplished by proceeding through each step in a single session; however, after the initialization step has been completed, it is possible to exit and save the data that has been entered to that point. To resume data entry in another session, the existing files would be recalled by choosing OPTION 2 from the program's main menu (i.e., 2. RESUME DATA ENTRY).

PRESS 'B' TO BEGIN DATA ENTRY, 'R' TO RETURN TO MAIN MENU

As the screen indicates, data entry is broken down into a series of five steps. If data entry is not completed in one session, the logical breakpoints for ending a data entry session would be at the end of one of the five steps: at the end of each step, ECPIE offers the opportunity to end data entry and store the partially completed data set. However, if for some reason it is necessary to exit or end data entry when you are not at the end of one of the five steps, you may press function key F1 to jump to the main menu or function key F2 to jump to the data storage procedure (once data storage is complete, you will return to the main menu). Depending on what the program is doing when you press F1 or F2, it may also be necessary to press (RET) to execute the jump.

Notice that if you exit data entry when you are partially through a data entry step (e.g., halfway through the development period cost data), you will not be able to use the RESUME DATA ENTRY option (option 2 from the MAIN MENU) to resume data entry in that step without

cancelling the data you have already entered in that step. To avoid losing the data entered prior to executing the jump, you should use the REVIEW/REVISE DATA FROM PRIOR ANALYSIS option (option 3 from the MAIN MENU) to complete the data entry for the partially completed step (using the REVIEW/REVISE procedure is explained in Chapter 3).

As a final point of introduction before discussing the data entry procedure for each of the five data steps, you should note that, from time to time, ECPIE will ask questions that require a yes (Y) or no (N) answer (e.g., is a data entry "OK"?) or will call for pressing a single key to execute a program command (e.g., "PRESS 'B' TO BEGIN DATA ENTRY; 'X' TO EXIT DATA ENTRY). **When you respond to such prompts, it is necessary to use upper-case letter responses -- that is, "Y" instead of "y" -- for ECPIE to properly recognize your answer.** If you forget to use the upper-case response, the computer will sometimes appear to "hang" or stop program execution. So, if the computer does not respond to what seems like an appropriate response, try switching the case of your response.

Entering the Initialization Data

The INITIALIZATION data are the first set of data that is requested by ECPIE during the data entry procedure. The initialization data consist of:

- Descriptive information on the project (e.g., name, location, and project description)
- Identification of the person(s) or organization to be cited as responsible for preparing the analysis in the printed outputs of the analysis
- Specification of the analysis "clock" and the monetary units for the analysis.

The following pages illustrate the screen displays that will be encountered in the INITIALIZATION step.

INITIALIZATION

PROJECT NAME (30 characters or less): Boiler Plant Rehabilitation
Boiler Plant Rehabilitation OK? Y

PROJECT LOCATION (30 characters or less): Colombo, Sri Lanka
Colombo, Sri Lanka OK? Y

COMPANY NAME (30 characters or less): National Steam Systems
National Steam Systems OK? Y

COMPANY CONTACT (30 characters or less): Mr. V. J. Amarasena
Mr. V. J. Amarasena OK? Y

TITLE OF COMPANY CONTACT (30 chars or less): Manager, Plant Engineering
Manager, Plant Engineering OK? Y

COMPANY TELEPHONE NUMBER: 247-982
247-982 OK? Y

REPORT PREPARATION RESPONSIBILITY

The analysis results will be printed in a report format with a title page that cites the person or organization responsible for preparing the analysis. Four lines of text, each containing not more than 50 characters, may be used to identify the preparer of the analysis.

(========== 50 character line ==========)
ENTER LINE 1 EDWAC
ENTER LINE 2 Ministry of Power and Energy
ENTER LINE 3 50, Sir Chittampalam A. Gardiner Mawatha
ENTER LINE 4 Colombo -02, Sri Lanka
Colombo -02, Sri Lanka OK? Y

PROJECT DESCRIPTION

You may provide a project description of up to six lines (56 characters/line). Simply type the description. Use (— to correct mistakes. Press (ret) only after entering the full description.

Column 56
+
+
+

This project involves the installation of a new coal fired boiler system at the NSS plant in Colombo. The new boiler will be capable of generating 50,000 lbs. of steam per hour. Coal will be....

SELECT THE TIME INTERVAL FOR THE ANALYSIS

The TIME INTERVAL for the analysis is the basic unit of time for which data will be provided to the program and in which analyses will be conducted. The TIME INTERVAL may be a month, quarter, or year. Selection of the TIME INTERVAL will define the maximum number of time periods that may be considered in the analysis:

1. YEAR (Maximum number of analysis periods = 20)

2. QUARTER (Maximum number of analysis periods = 40)

3. MONTH (Maximum number of analysis periods = 60)

ENTER NUMBER CHOICE, FOLLOWED BY (RET): ? 2

In selecting the TIME INTERVAL for an analysis, you should consider the length of the DEVELOPMENT PERIOD and choose a TIME INTERVAL that will permit the total ANALYSIS PERIOD to be at least twice (and preferably a greater multiple of) the DEVELOPMENT PERIOD. In fact, if you try to set the DEVELOPMENT PERIOD at greater than half the ANALYSIS PERIOD, ECPIE will require you to respecify the "clock" structure of the analysis. Another consideration to keep in mind in selecting the TIME INTERVAL is that the ANALYSIS PERIOD should extend beyond the tax depreciation and debt repayment periods; otherwise, you may get a misleading picture of the financial stability and performance of a project.

```
SPECIFY THE TIME PERIOD FOR THE BEGINNING OF THE ANALYSIS

Year in which development costs begin (xxxx):  ? 1984

Quarter in which development costs begin (x):  ? 3
```

SPECIFY THE TIME PERIOD FOR THE BEGINNING OF OPERATIONS

Year in which operations begin (xxxx): ? 1986

Quarter in which operations begin (x): ? 2

SPECIFY NUMBER OF TIME PERIODS FOR THE ANALYSIS

The previously selected time interval for the analysis is the QUARTER.
Therefore, the maximum number of time periods is 40 .

Number of time periods desired for the analysis: ? 40

SPECIFY MONETARY UNIT FOR ANALYSIS

The monetary unit must be specified so that the numbers entered for costs and revenues in the subsequent data entry steps will not exceed five digits. The monetary unit should be entered as the symbol for the currency (e.g., $) followed by a parentheses containing one or more 'zero's (0).
The number of 'zero's should equal the number of decimal places omitted from the cost and benefit numbers entered from the analysis.
For example, '$(000)' means monetary units of one-thousand dollars.

Monetary unit (15 characters or less): Rs(000)

When you have completed the INITIALIZATION step, ECPIE will ask whether you wish to continue data entry. If you respond "N", the program will automatically move to the data storage routine for saving the data that you have thus far entered (procedures for using the storage routine are explained in a later section of this chapter).

Entering Financial and Tax Data

The second step of data entry is entering the FINANCIAL AND TAX DATA, which are the data that describe the financial structure of the conservation project, the cost and terms of debt and equity financing, and the structure of taxation. As for the INITIALIZATION data entry procedure, the computer screen will explain the data entry procedure and and define the required data items for the FINANCIAL AND TAX DATA. The screens that you will see during the FINANCIAL AND TAX DATA entry procedure are presented below.

FINANCIAL AND TAX DATA

PROVIDE FRACTION OF DIRECT DEVELOPMENT COST THAT IS DEBT-FINANCED

The model groups development period outlays in three categories:

1. Design/Engineering Costs

2. Direct Capital Cost (i.e., the cost of purchasing and installing the improvement)

3. Indirect Development Period Costs (i.e., any loss in operating income resulting from shutdown of production activities while the conservation project is being installed).

For the financial analysis of a project, the model assumes that cost categories (1) and (2) represent project capital cost, as traditionally defined, and may be financed by a combination of debt and equity cash. Cost category (3) is assumed to require equity cash but may not be debt-financed as part of the project financial structure. Accordingly, the FRACTION OF DIRECT DEVELOPMENT COST THAT IS DEBT-FINANCED means the fraction of development cost categories (1) and (2) that is debt-financed.

PRESS 'B' TO BEGIN DATA ENTRY, 'R' TO RETURN TO MAIN MENU:

SPECIFY DEBT FRACTION OF DIRECT DEVELOPMENT COST

Fraction of direct development cost that is debt-financed
(must be a fraction not less than zero nor greater than one): ? .6

SPECIFY ANNUAL INTEREST RATES FOR DEVELOPMENT AND OPERATING PERIOD DEBT

During the development period, interest payments are made on project debt at the DEVELOPMENT PERIOD INTEREST RATE; however, no principal is repaid. In effect, development period debt is increased by an amount adequate to meet the development period interest expense. At the beginning of project operations, the development period debt is converted to longer term, operating period debt. Interest and principal payments on this debt are made at the OPERATING PERIOD INTEREST RATE, which will typically be 1 to 3 points higher than the development period debt rate.

Development period annual interest rate
(expressed as a percentage value; e.g., 14.5): ? 14
14 OK? Y

Operating period interest rate: ? 16

16 OK? Y

INTEREST AMORTIZATION

In some countries (e.g., USA), development period interest may not be expensed for tax accounting but must be capitalized and amortized on a straight line basis during the operating period.

NUMBER OF YEARS OVER WHICH DEVELOPMENT PERIOD INTEREST IS AMORTIZED (if interest may be expensed, enter '0'): ? 5

SPECIFY DEBT TERM AND MORATORIUM PERIOD (optional)

Debt is assumed to be repaid in constant principal and interest payments over a fixed number of repayment periods (DEBT TERM). Principal payments will begin with the second period of project operation unless delayed during a principal MORATORIUM PERIOD. Interest will accrue at the operating period interest rate and must be paid during the MORATORIUM PERIOD.

NUMBER OF QUARTERS OVER WHICH DEBT IS TO BE REPAID: ? 32

32 OK? Y

NUMBER OF QUARTERS IN MORATORIUM PERIOD: ? 3

3 OK? Y

SPECIFY REQUIRED RETURN ON EQUITY (Annual Rate)

In the financial analysis, the model will compute the present value of the project's net cash flow. This calculation requires a discount rate, the REQUIRED RETURN ON EQUITY, which is the minimum return acceptable to the equity investor or energy user undertaking the project.

REQUIRED RETURN ON EQUITY (enter as a percentage value; e.g., 20): ? 20

20 OK? Y

SPECIFY SOCIAL DISCOUNT RATE (Annual Rate)

In the analysis of a project from the public sector perspective, the model will compute the present value of the net benefits using a SOCIAL DISCOUNT RATE, which is the return required by society for delaying current consumption in return for increases in future income and consumption.

SOCIAL DISCOUNT RATE (entered as a percentage value; e.g., 10): ? 10

10 OK? Y

SPECIFY TAX RATE

In the financial analysis, project returns are calculated on an after-tax basis. Computing these returns requires a marginal TAX RATE, the tax rate at which additional income is taxed. TAX RATE may vary over time.

Is TAX RATE constant over all analysis periods? Y

TAX RATE (enter as a decimal value less than one): ? .46

.46 OK? Y

The specification of the tax rate will be a more complicated procedure if you elect to have tax rates that vary over time. The use of varying tax rates would be important if the tax liability and the associated marginal tax rate of the equity investor in a project were expected to change over time. Alternatively, legislated changes in the tax code could change the marginal tax rate. Finally, some countries may provide "tax holidays" at the beginning of a project's operation during which the tax rate may be temporarily lower than the normal tax rate. If -- because of such considerations -- you select the varying tax rate option, you will need to enter the tax rate for each analysis period and, in doing so, will be presented with the following screen.

```
--------------------------------------------------------------------------------
SPECIFY TAX RATE BY TIME PERIOD

 #  TIME      TAX    #  TIME      TAX    #  TIME      TAX
    PERIOD    RATE      PERIOD    RATE      PERIOD    RATE
--------------------------------------------------------------------------------
 1  3q/1984  ? .46
 2  4q/1984  ? .46
 3  1q/1985  ? .25
 4  2q/1985  ? .25
 5  3q/1985  ? .25
 6  4q/1985  ? .25
 7  1q/1986  ? .25
 8  2q/1986  ? .46
 9  3q/1986  ? .46
10  4q/1986  ?

--------------------------------------------------------------------------------
```

SPECIFY DEPRECIATION METHOD AND SCHEDULES

In the financial analysis of a project, the direct development costs (i.e., DESIGN/ENGINEERING COST & DIRECT CAPITAL COST) may be depreciated for tax purposes by one of five methods:

1. Straight Line
2. Sum-of-the-Years Digits
3. Double Declining Balance
4. Accelerated Cost Recovery System (ACRS; USA IRC 1984)
5. Customized.

You may specify up to five schedules for the selected method (except for ACRS, which has four predetermined schedules). These schedules will subsequently be used to depreciate specified fractional components of the direct development costs. In this section, you must specify the DEPRECIATION METHOD, the number of schedules, and the associated depreciation periods that may be used in the financial evaluation of a project.

```
SPECIFY DEPRECIATION METHOD (enter number choice followed by (RET)):? 2
```

DEPRECIATION SCHEDULES (cont.)

```
HOW MANY DEPRECIATION SCHEDULES (not more than five)? 5

Schedule  1 .  Number of years in depreciation period:  ? 3
Schedule  2 .  Number of years in depreciation period:  ? 5
Schedule  3 .  Number of years in depreciation period:  ? 10
Schedule  4 .  Number of years in depreciation period:  ? 15
Schedule  5 .  Number of years in depreciation period:  ? 20
 20  OK? Y
```

The complexity of the procedure for specifying the depreciation method and schedules will depend on the depreciation method you select. For example, if you select option 4, Accelerated Cost Recovery System (ACRS), no additional information will be needed because the ACRS contains four specific schedules (i.e., 3, 5, 10, and 15 years) of the fractional amounts of a capital outlay to be depreciated in each year. For options 1, 2, and 3, you will need to specify the number of schedules and the number of years of depreciation in each schedule over which you may wish to depreciate specified fractions of the capital outlay for a conservation investment. The program takes care of computing the specific schedules and, in the case of double declining balance depreciation, switching to straight line at the appropriate point in the depreciation schedule. Finally, if the first four depreciation schedule options fail to encompass a needed depreciation method, selecting option 5 -- the customized schedule -- will allow you to specify up to five series of fractional values for depreciating capital equipment.

INVESTMENT TAX CREDIT

In some countries (e.g. USA), the project developer may receive a tax credit for qualifying capital outlays. The tax credit is computed as a fraction of the qualifying outlay. During the capital cost entry routine, you will be asked to specify the fraction of capital outlays which qualifies for the INVESTMENT TAX CREDIT (ITC).

```
INVESTMENT TAX CREDIT; enter as a decimal fraction (e.g. .1). If there is no
INVESTMENT TAX CREDIT, enter '0':? .1
 .1   OK? Y
```

Depending upon provisions of the tax code, the developer may have an option to:

1. Take the ITC as the capital outlays are incurred; or
2. Defer receipt of the ITC until the beginning of project operation.

```
INDICATE APPROPRIATE ITC TREATMENT BY NUMBER CHOICE:  ? 1
```

In the same way as for the INITIALIZATION data, when you reach the end of the FINANCIAL AND TAX DATA, you will be asked whether you wish to continue data entry. Giving a no (N) answer will again take you to the data storage procedure.

Entering Development Period Cost Data

The entry of project cost and revenue data is divided into three broad categories: DEVELOPMENT PERIOD COST DATA, OPERATING PERIOD COST DATA, and ENERGY RELATED BENEFITS/COSTS. Entering the data for each of these categories involves a similar procedure. For each data category, you will first be asked if the data item is relevant to the analysis. If you answer no (N), data entry for the item will be skipped. If you answer yes (Y), ECPIE will first ask for specific information (depending on the variable) regarding the variable's tax treatment, its foreign currency content, or the appropriate units for the variable and, second, for the data values by time period.

In the case of DEVELOPMENT PERIOD COST DATA, you will first be presented with the following introduction screen:

DEVELOPMENT PERIOD COST DATA

Development period costs are grouped in three categories:

1. Design/Engineering Costs (i.e., the cost of evaluating the investment opportunity and designing the conservation project)

2. Direct Capital Cost (i.e., the cost of installing the conservation project)

3. Indirect Development Period Costs (i.e., any loss in operating income resulting from shutdown of production activities while the conservation project is being installed).

In this section of the program, data are requested for these cost accounts. For each development period cost account, the model will request the cost in each QUARTER of the development period, the fraction of the cost account involving foreign purchases or reduction in receipts of foreign currency ,and the treatment of the outlay with respect to depreciation/expensing. The model will also permit entry of alternative cost values (SOCIAL COSTS/BENEFITS) for use in evaluating the project from the public sector perspective. In entering cost values, remember that the numbers may not have more than five decimal places or digits to the left of the decimal point. DEVELOPMENT PERIOD COSTS MAY NOT OCCUR AFTER THE LAST QUARTER BEFORE OPERATIONS BEGIN.
PRESS 'B' TO BEGIN DATA ENTRY; 'X' TO EXIT DATA ENTRY:

ECPIE will then begin obtaining data for each of the three development period cost accounts: DESIGN/ENGINEERING COST, DIRECT CAPITAL COST, and INDIRECT DEVELOPMENT COST. Beginning with DESIGN/ENGINEERING COST, ECPIE will first ask whether the account is relevant to the analysis.* If you answer yes (Y), ECPIE will ask for the foreign currency content of the outlay (i.e., the fraction of the outlay that involves a purchase of a product or service from a foreign country). Next, ECPIE will ask for the tax treatment of the outlay; that is, how much of DESIGN/ENGINEERING COST may be expensed (i.e., charged against income for tax

*With a few variations, the data entry procedures described in the following paragraphs apply for all of the eleven cost and revenue data accounts that may be entered into ECPIEM.

computation purposes on an as-incurred basis) and how much of the outlay must be capitalized and depreciated according to the different depreciation schedules you selected in the FINANCIAL AND TAX DATA entry procedure. The monitor display for these questions will appear as follows:

```
DEVELOPMENT PERIOD COST ENTRY
COST/BENEFIT ACCOUNT:  DESIGN/ENGINEERING COST

IS THIS ACCOUNT RELEVANT TO THE ANALYSIS? Y
```

```
DEVELOPMENT PERIOD COST ENTRY
COST/BENEFIT ACCOUNT:  DESIGN/ENGINEERING COST

DECIMAL FRACTION OF DESIGN/ENGINEERING COST
REQUIRING FOREIGN CURRENCY PURCHASES (e.g. 0.4):  ? .2
 .2   OK? Y
```

```
DECIMAL FRACTION OF DESIGN/ENGINEERING COST
 THAT MAY BE EXPENSED (e.g., .4):  ? 1

 1  OK? Y

DECIMAL FRACTION OF DESIGN/ENGINEERING COST
DEPRECIATED OVER  3  YEARS (e.g., 0.4):  ? 0
 0  OK? Y
DECIMAL FRACTION OF DESIGN/ENGINEERING COST
DEPRECIATED OVER  5  YEARS (e.g., 0.4):  ? 0
 0  OK? Y
DECIMAL FRACTION OF DESIGN/ENGINEERING COST
DEPRECIATED OVER  10  YEARS (e.g., 0.4):  ? 0
 0  OK? Y
DECIMAL FRACTION OF DESIGN/ENGINEERING COST
DEPRECIATED OVER  15  YEARS (e.g., 0.4):  ? 0
 0  OK? Y
DECIMAL FRACTION OF DESIGN/ENGINEERING COST
DEPRECIATED OVER  20  YEARS (e.g., 0.4):  ? 0
 0  OK? Y
```

Once you have provided this preliminary information on DESIGN/ENGINEERING COST, you will be asked to provide the values for the variable by time period that will be used in the financial and foreign currency usage analyses. Since DESIGN/ENGINEERING COST is a development period cost account, you will be asked to provide outlay data only for the development period. In entering cost and revenue data by time period, you must choose monetary units so that the data values will not have more than five decimal places to the left of the decimal point. In this sequence, you may enter values through a combination of the following methods:

- Individual values by time period
- A series of constant values
- A series of values growing at a constant exponential rate.

Specifically, after displaying the time interval for which data values must be provided, ECPIE will ask for the values beginning with the first, and proceeding through the last, relevant time period. If you wish to provide a single value for an entry (i.e., the entry will not begin a constant or exponentially growing series), simply enter a number, followed by return, and ECPIE will move on to the next time period. The screen for this procedure appears as follows:

```
-----------------------------------------------------------------------------
DEVELOPMENT PERIOD COST ENTRY
DESIGN/ENGINEERING COST                          MONETARY UNIT:  Rs(000)

 #  TIME      VALUE
    PERIOD
-----------------------------------------------------------------------------
 1  3q/1984? 1200
 2  4q/1984? 1400
 3  1q/1985?
 4  2q/1985
 5  3q/1985
 6  4q/1985



TO ENTER A VALUE, SIMPLY ENTER THE NUMBER, FOLLOWED BY <RET>;
TO BEGIN A CONSTANT SERIES, ENTER 'C'; OR AN EXPONENTIAL SERIES, ENTER 'E'

-----------------------------------------------------------------------------
```

If you wish to begin a constant valued series from the time period for which ECPIE is currently querying, type "C" followed by return. ECPIE will then ask for the value in that time period and the index of the last time period through which the constant series extends. ECPIE will then "fill in" the constant series and move on to the next time period following the end of the constant series. The screen will look like this:

```
---------------------------------------------------------------------------
DEVELOPMENT PERIOD COST ENTRY
DESIGN/ENGINEERING COST                          MONETARY UNIT:  Rs(000)

 #  TIME      VALUE
    PERIOD
---------------------------------------------------------------------------
 1  3q/1984? 1200
 2  4q/1984? C
 3  1q/1985
 4  2q/1985
 5  3q/1985
 6  4q/1985

# OF LAST TIME PERIOD IN CONSTANT SERIES:  ? 6
VALUE FOR DESIGN/ENGINEERING COST IN  4q/1984:  ? 1500
TO BEGIN A CONSTANT SERIES, ENTER 'C'; OR AN EXPONENTIAL SERIES, ENTER 'E'

---------------------------------------------------------------------------
```

The procedure for entering an exponential series is similar to that for the constant series. Specifically, if you wish to enter a series with constant exponential exponential growth, type "E" followed by return. ECPIE will then ask for the value of the series in the current time period, the rate of exponential change, and the index of the last time period through which the exponential series extends. Again, ECPIE will "fill in" the series and move on to the next time period following its end. The screen will look like this:

```
---------------------------------------------------------------------------
DEVELOPMENT PERIOD COST ENTRY
DESIGN/ENGINEERING COST                          MONETARY UNIT:  Rs(000)

 #  TIME      VALUE
    PERIOD
---------------------------------------------------------------------------
 1  3q/1984? 1200
 2  4q/1984? E
 3  1q/1985
 4  2q/1985
 5  3q/1985
 6  4q/1985


# OF LAST TIME PERIOD IN EXPONENTIAL SERIES:  ? 6
VALUE FOR DESIGN/ENGINEERING COST IN  4q/1984:  ? 1500
ANNUAL GROWTH RATE FOR EXPONENTIAL SERIES (decimal value):  ? .06

---------------------------------------------------------------------------
```

When you have completed the data entry by the three methods specified above, ECPIE will display back to you the entered values and ask whether they are "OK". If you answer "Y", ECPIE will move to the next procedure. If you answer "N", ECPIE will enter the data editing routine.

In the data editing routine, ECPIE will first ask whether you wish to "REENTER" or "EDIT A FEW ENTRIES". If you wish to replace most or all of the displayed entries, choose "REENTER" (R) and ECPIE will take you through the data entry procedure outlined in the preceding paragraphs. If you wish to change only a single entry or a small number of entries, select "EDIT A FEW ENTRIES" (E), and ECPIE will ask which data entry to change. Identify the entry to be changed with the index number (i.e., 1, 2, 3,...) appearing in the column labeled "#". ECPIE will ask for the correct value

for the specified time period. After you have entered the new value, ECPIE will again display the entire data set and ask whether it is "OK". The display screens for this review/edit sequence are as follows:

```
DEVELOPMENT PERIOD COST ENTRY
DESIGN/ENGINEERING COST                    MONETARY UNIT:  Rs(000)

 #  TIME      VALUE
    PERIOD
 1  3q/1984     300
 2  4q/1984     300
 3  1q/1985     300
 4  2q/1985     300
 5  3q/1985     300
 6  4q/1985     300
 7  1q/1986     300

VALUES FOR DESIGN/ENGINEERING COST OK? N
REENTER ALL VALUES (SELECT 'R') OR EDIT A FEW VALUES (SELECT 'E'):  ? E
```

```
DEVELOPMENT PERIOD COST ENTRY
DESIGN/ENGINEERING COST                    MONETARY UNIT:  Rs(000)

 #  TIME      VALUE
    PERIOD

 1  3q/1984     300
 2  4q/1984     300
 3  1q/1985     300
 4  2q/1985     300
 5  3q/1985     300
 6  4q/1985     300
 7  1q/1986     300


# OF ENTRY TO BE CHANGED? 3
CORRECT VALUE FOR ENTRY  3  IS:  ? 350
```

After completing data entry for the financial and foreign currency use analysis values for the variable (in this example case, DESIGN/ENGINEERING COST), ECPIE will allow optional entry of alternative SOCIAL VALUES of the variable for the social cost/benefit analyses. If you choose to enter SOCIAL VALUES that are different from the FINANCIAL ANALYSIS VALUES, ECPIE will proceed through the same data entry procedure as that outlined above. If you do not elect to enter different values, ECPIE will use the FINANCIAL ANALYSIS VALUES for the social cost/benefit analysis. The screen for selecting this procedure will appear as follows:

```
SPECIFY SOCIAL VALUES FOR DESIGN/ENGINEERING COST

In the evaluation of a conservation project from the public sector perspective,
it is possible to substitute SOCIAL VALUES for the cost, revenue or price
values entered in the preceding section. The SOCIAL VALUES should reflect
the opportunity cost (or value) to society of not using a production input in
other applications (or of having available for consumption, a production output
 of a conservation project). These SOCIAL VALUES may often be different
from the market or posted values for production inputs and outputs.

Do you wish to enter SOCIAL VALUES that differ from those previously entered for
DESIGN/ENGINEERING COST?
? N
```

After completing the SOCIAL VALUES entry option, you will have completed data entry for the variable DESIGN/ENGINEERING COST. For the remainder of the DEVELOPMENT PERIOD COST entry routine, ECPIE will request data for the variables DIRECT CAPITAL COST and INDIRECT DEVELOPMENT PERIOD COSTS. Entering the data for these variables will follow the same procedures as those outlined for entering the data for DESIGN/ENGINEERING COST.

Entering Operating Period Cost Data

The second category of cost and revenue data is the OPERATING PERIOD COST DATA, which includes two accounts: OPERATING AND MAINTENANCE COSTS and OTHER OPERATING PERIOD COSTS. Entering data for these accounts is accomplished in the same manner as for the DEVELOPMENT PERIOD COST DATA with the exceptions that: all of the operating period costs are assumed to be

expensed and accordingly there are no questions regarding the tax treatment of operating period costs; and OPERATING PERIOD COST DATA may only be entered in the operating period. The screen display that you will see as the introduction to the OPERATING PERIOD COST DATA section is illustrated below (subsequent screens are similar to those shown for the development period accounts):

OPERATING PERIOD COST DATA

Operating period costs are grouped in two categories:

1. Operating and Maintenance Costs (i.e., the periodic cost of running and maintaining the conservation project. These costs will typically include labor and materials and will specifically exclude any energy related costs.)

2. Other Operating Period Costs (i.e., the incremental change in any other facility operating costs [excluding energy] that result from installation and operation of the conservation project. If the change in costs is a reduction, then this account would be entered as negative values.).

In this section of the program, data are requested for these cost accounts. For each operating period account, the model will request the cost in each QUARTER of the operating period and the fraction of the cost account involving foreign purchases or a reduction in receipts of foreign currency. The model will also permit entry of alternative cost values (SOCIAL COSTS/BENEFITS) for use in evaluating the project from the public sector perspective. In entering the cost values, remember that the numbers may not have more than five decimal places or digits to the left of the decimal point.

PRESS 'B' TO BEGIN DATA ENTRY; 'X' TO EXIT DATA ENTRY:

Entering Energy-Related Benefits/Cost Data

The third category of cost and revenue data is ENERGY-RELATED BENEFITS/COST DATA, which includes the following three accounts for which both quantity and price data may be entered:

- VALUE OF ENERGY SAVED, which is determined as the product of the variables QUANTITY OF ENERGY SAVED and PRICE OF ENERGY SAVED

- VALUE OF ENERGY CONSUMED, which is determined as the product of the variables QUANTITY OF ENERGY CONSUMED and PRICE OF ENERGY CONSUMED

- VALUE OF ENERGY PRODUCED OR SOLD, which is determined as the product of the variables QUANTITY OF ENERGY SOLD and PRICE OF ENERGY SOLD.

The entry of the values for these variables follows essentially the same procedure as that discussed in the earlier section on DEVELOPMENT PERIOD COST DATA. The only minor differences include: (1) you must enter the UNITS for the energy quantities (these will later be used in printing ECPIE results); and (2) you will not be asked to enter alternative SOCIAL VALUES for the energy quantities. The introductory monitor screens that you will see as you begin data entry for the ENERGY-RELATED BENEFITS/COSTS DATA are illustrated below:

ENERGY RELATED BENEFITS/COSTS

Energy related benefits/costs are grouped in three categories:

1. Value of Energy Saved as a result of the conservation project (i.e., a conservation project will usually reduce consumption of an energy input)

2. Cost of any additional Energy Inputs required by the conservation project (i.e., a conservation project may substitute a less expensive energy input for the energy input(s) previously consumed at a facility)

3. Value of any Energy Produced for External Sale by the conservation project (i.e., a conservation project such as a cogeneration plant may produce energy for sale to a utility or other electricity users).

In this section of the program, data are requested for the quantity and price in each of these accounts. For each energy related account, the model will request the quantity of energy saved, consumed, or sold in each QUARTER of the operating period, the associated price of the energy resource, and the fraction of the energy account reducing or increasing foreign currency purchases. The model will also permit entry of alternative values (SOCIAL VALUES) for the energy prices to be used in evaluating the project from the public sector perspective.
PRESS (RET) TO CONTINUE?

ENERGY RELATED BENEFITS/COSTS (continued)

In entering the values for the energy quantities and prices, you must use units which, when multiplied to calculate the value of energy saved, consumed, or produced, will yield monetary values in Rs(000). The resulting monetary values may not have more than five digits to the left of the decimal point.

PRESS 'B' TO BEGIN DATA ENTRY; 'X' TO EXIT DATA ENTRY:

After completing data entry for the ENERGY-RELATED BENEFITS/COSTS DATA, you will have entered a full set of data for an ECPIE analysis. At this point, ECPIE will automatically take you to the data storage routine so that you may save your data set (data storage and retrieval are explained in the next section).

Saving and Retrieving an ECPIE Data File

After each step in the data entry process and as well at other locations in the program, you will be given the opportunity to save the data set that is currently in the computer's memory. Recall also that, while you are in the data entry and management sections of ECPIE, pressing function key F2 (sometimes followed by (RET)) will automatically take you to the data storage routine.

Saving and subsequently retrieving a data set are straightforward procedures. ECPIE will first obtain

information on the disk drive (or other device) for the operation and the name of the file under which the data are to be saved or retrieved. Then you must simply insert the disk in the indicated drive and press (RET).

In selecting a file name for a data set, you may use standard IBM PC-DOS conventions regarding permitted characters and length of file name. Specifically, the length of a file name may not exceed eight characters; permitted characters include the letters of the alphabet, numbers, and the following special characters: $ # & @ ! % ( ) - ^ ≈ < > ' _ \ { } |. Do not use an extension (e.g., ".PJT") in the file name as extensions are provided by the program for the different components of the data set. ECPIE creates standard DOS text files, which may be manipulated by DOS procedures for copying, renaming, transferring, and other file management operations.

Error trap procedures are included for the data storage/retrieval operations. If you make a procedure error, such as inserting the retrieval disk in the wrong drive, ECPIE will take you back to the appropriate point in the procedure to correct the problem. For example, in the case of a misspecified drive, ECPIE will be unable to find the indicated file and will ask you to respecify the file name and drive specification before restarting the data retrieval procedure.

The monitor screens for the data storage procedure are illustrated below:

SPECIFY THE FILENAME UNDER WHICH DATA WILL BE SAVED

The filename will be used by you to recall data for analysis or revision.
Accordingly, you should remember the filename. If you use the same filename
as one already on the storage disk, then the data currently stored under that
name will be deleted and replaced by the data now in memory.
Use only alphabetic and numeric characters in the filename.
The filename may not exceed 8 characters in length.

Filename: ? STEAM#1

INSERT STORAGE DISK IN DRIVE B. PRESS (RET) WHEN READY: ?

The monitor screens for the data retrieval procedure are as follows:

```
LOAD DATA FROM FILES

Loading data from files will cancel and overwrite any input data currently in
memory.

Do you wish to load data from storage files? Y

Enter filename used in previously saving data:  ? STEAM01

Enter storage device (i.e., A, B, or C) for loading data:  ? B
```

```
Insert storage disk in drive B.  Press (RET) when ready:  ?
```

3 REVIEWING AND EDITING DATA

Once you have entered a partial or total data set into ECPIE, you may use ECPIE's REVIEW AND EDIT procedures to review the data and change entries in, or add data to, the data set. As mentioned in Chapter 2, this procedure is particularly useful if you exit the data entry procedure at a point other than the end of one of the five data entry steps. By using the REVIEW AND EDIT procedure, you may complete entry of a partially complete component of a data set without losing the previously entered data. In addition, the procedure is useful for making minor adjustments to a data set to test the effect of changes in input variables.

The REVIEW AND EDIT procedure is accessed from the MAIN MENU by selecting option 3, REVIEW/REVISE DATA FROM PRIOR ANALYSIS. When you select this option, there will be a brief pause in the program's operation while the review/edit module is loaded. Soon you will see the following screen:

```
REVIEW/REVISE DATA FROM PRIOR ANALYSIS

In this procedure, you may review and revise input data that is currently in
memory or that has previously been entered and saved to files.


INDICATE PROCEDURE TO BE FOLLOWED

  1. USE DATA CURRENTLY IN MEMORY

  2. USE DATA FROM STORAGE FILES

  3. SAVE DATA CURRENTLY IN MEMORY

  4. EXIT TO MAIN PROGRAM MENU

ENTER NUMBER CHOICE, FOLLOWED BY (RET): ? 2
```

To begin the REVIEW AND EDIT procedure, you should select from options 1 and 2 depending on whether the data set is currently in memory or disk storage. Selecting option 2 will take you to the data retrieval procedure discussed in Chapter 2. If you have completed a REVIEW AND EDIT procedure and wish to save the revised data, select option 3. To return to the MAIN MENU, for example, to begin an analysis, select option 4.

After the data set to be reviewed has been brought into memory, you will see the following screen:

```
INDICATE INPUT DATA TO BE REVIEWED

  1. Initialization File

  2. Financial and Tax Data

  3. Cost and Benefit Data

  4. Save Revised Data

  5. Return to Procedure Menu.

ENTER NUMBER CHOICE, FOLLOWED BY (RET): ? 1
```

Options 1 and 2 correspond to the first two steps of the data entry process while option 3 encompasses steps 3, 4, and 5: that is, all of the revenue and cost data entered for DEVELOPMENT PERIOD COSTS, OPERATING PERIOD COSTS, and ENERGY RELATED BENEFITS/COSTS. If you select option 1, INITIALIZATION FILE, you will be presented with a single scren summary of all the data entered into the INITIALIZATION FILE.

```
REVIEW/REVISE INITIALIZATION FILE

1. PROJECT NAME:  BOILER PLANT REHABILITATION #2
2. PROJECT LOCATION:  KELANIYA, SRI LANKA
3. COMPANY NAME:  SRI LANKA TYRE CORPORATION
4. COMPANY CONTACT:  MR. PALITA SUBASINGHE
5. TITLE:  SENIOR POWER ENGINEER
6. TELEPHONE NUMBER:  521-241
7. PROJECT DESCRIPT.:This study is concerned with replacing an inefficient
                     oil-fired boiler plant with modern, packaged multi-
                     fuel fired boilers of high efficiency.  The boilers
                     would be fired on a mixture of approximately 85% wood
                     and 15% oil.  Boiler efficiency would be expected to
                     increase from 54% to about 72% (wood)/80% (oil).
8. MONETARY UNIT:  Rs(000)
9. PREPARATION:  EDMAC
10. PREPARATION:  Ministry of Power and Energy
11. PREPARATION:  50, Sir Chittampalam A. Gardiner Mawatha
12. PREPARATION:  Colombo -02, Sri Lanka

  TIME INTERVAL:  QUARTER
  START OF DEVELOPMENT:  3q/1984     START OF OPERATIONS:  1q/1986
  LAST ANALYSIS PERIOD:  2q/1994
CHANGE AN ENTRY (Y/N)?
(Input data pertaining to the analysis 'clock' may not be changed)
```

You may change any of the initialization file entries except those pertaining to the analysis "clock" (i.e., the time interval of the analysis, time periods for beginning of project development and operations, and the last analysis period). The reason that the clock data may not be changed is that changes in these variables may profoundly affect the other cost and revenue data variables entered into the program. However, the program itself has no way of adjusting for some of the possible effects. To avoid the possibility of performing erroneous analyses because of a failure, for example, to adjust the operating period cost and revenue values to reflect a lengthened or shortened development period, we restricted potential changes to the INITIALIZATION FILE to variables other than those affecting the analysis clock.

To change an INITIALIZATION FILE entry, answer yes (Y) to the program's inquiry and specify the number of the variable to be changed. ECPIE will then permit reentry of the value for the selected variable. Each time the

value for a variable is changed, ECPIE will subsequently display the revised data set and ask whether you wish to change another value. Answering no (N) will return you to the INDICATE INPUT DATA TO BE REVIEWED screen.

If you select option 2 from the INDICATE INPUT DATA TO BE REVIEWED screen, you will be presented with a single screen summary of the FINANCIAL AND TAX DATA FILE:

```
REVIEW/REVISE FINANCIAL AND TAX DATA FILE

1. DEBT FRACTION:  .6
2. DEVELOPMENT PERIOD INTEREST RATE:  14 %
3. OPERATING PERIOD INTEREST RATE:  14 %
4. DEVELOPMENT PERIOD INTEREST EXPENSED
5. DEBT REPAYMENT TERM:  32  QUARTERS
6. DEBT MORATORIUM PERIOD:  3  QUARTERS
7. REQUIRED RETURN ON EQUITY:  20 %
8. SOCIAL DISCOUNT RATE:  10 %
9. DEPRECIATION METHOD:  SUM-OF-THE-YEARS DIGITS
   SCHEDULE 1 :  3 YEARS
   SCHEDULE 2 :  5 YEARS
   SCHEDULE 3 :  10 YEARS
   SCHEDULE 4 :  15 YEARS
   SCHEDULE 5 :  20 YEARS

10. MARGINAL TAX RATE:  0.50
11. INVESTMENT TAX CREDIT:  0.00
12. INVESTMENT TAX CREDIT DEFERRED UNTIL BEGINNING OF OPERATIONS


CHANGE AN ENTRY (Y/N)? N
```

Again, to change an entry, simply respond yes (Y) to the prompt and indicate the number of the variable to be changed. As before, responding no (N) to the prompt will return you to the INDICATE INPUT DATA TO BE REVIEWED screen.

If you select option 3, COST AND BENEFIT DATA, from the INDICATE INPUT DATA TO BE REVIEWED screen, you will be presented with a menu of the 11 ECPIE cost and revenue accounts:

```
REVIEW/REVISE COST AND BENEFIT DATA

INDICATE DATA SERIES TO BE REVIEWED

  1. DESIGN/ENGINEERING COST
  2. DIRECT CAPITAL COST
  3. INDIRECT DEVELOPMENT COST
  4. OPERATING/MAINTENANCE COST
  5. OTHER OPERATING PERIOD COST
  6. QUANTITY OF ENERGY SAVED
  7. PRICE OF ENERGY SAVED
  8. QUANTITY OF ENERGY CONSUMED
  9. PRICE OF ENERGY CONSUMED
 10. QUANTITY OF ENERGY SOLD
 11. PRICE OF ENERGY SOLD
 12. RETURN TO PROCEDURE MENU

ENTER NUMBER CHOICE, FOLLOWED BY (RET): ? 2
```

Selecting any of the 11 accounts will lead you through a series of screens summarizing the data that you have entered for those accounts. The first screen will list the data pertaining to tax treatment, foreign currency content, or energy quantity units and will look something like the following:

```
1. FRACTION OF DIRECT CAPITAL COST
   REQUIRING FOREIGN CURRENCY PURCHASES:  .642

2. FRACTION OF DIRECT CAPITAL COST THAT MAY BE EXPENSED:  0

3. FRACTION OF DIRECT CAPITAL COST DEPRECIATED OVER  3  YEARS:  .5

4. FRACTION OF DIRECT CAPITAL COST DEPRECIATED OVER  5  YEARS:  .5

5. FRACTION OF DIRECT CAPITAL COST DEPRECIATED OVER  10  YEARS:  0

6. FRACTION OF DIRECT CAPITAL COST DEPRECIATED OVER  15  YEARS:  0

7. FRACTION OF DIRECT CAPITAL COST DEPRECIATED OVER  20  YEARS:  0

CHANGE AN ENTRY (Y/N)?
```

After you have approved the preliminary data screen, the computer will display the time-period-by-time-period FINANCIAL AND FOREIGN CURRENCY USAGE ANALYSIS values for the selected variable. To change any of the values on the screen, including a complete reentry of the data, use exactly the same edit/reenter procedure as that discussed for the basic entry of data in Chapter 2. The screen will appear as follows:

DIRECT CAPITAL COST MONETARY UNIT: Rs(000)

#	TIME PERIOD	VALUE
1	3q/1984	7400
2	4q/1984	6850
3	1q/1985	6452
4	2q/1985	3042
5	3q/1985	1772
6	4q/1985	550

VALUES FOR DIRECT CAPITAL COST OK?

When you have approved the FINANCIAL AND FOREIGN CURRENCY USAGE ANALYSIS data values, ECPIE will display the SOCIAL COST/BENEFIT VALUES for the variable (unless the variable is an energy quantity) and offer the possibility of revisions. Unless you entered SOCIAL COST/BENEFIT VALUES that are different from the FINANCIAL AND FOREIGN CURRENCY USAGE ANALYSIS data values, you will simply be shown the FINANCIAL AND FOREIGN CURRENCY USAGE ANALYSIS data values again.

Exiting the REVIEW/REVISE DATA procedure is accomplished by returning to the PROCEDURE MENU and selecting option 4, EXIT TO MAIN PROGRAM MENU. Again, there will be a brief pause in program execution as the main program module is reloaded.

4 PERFORMING AN ANALYSIS

Performing an analysis is perhaps the simplest procedure in ECPIE. When you have completed entering (and, if you are prudent in the use of computers, saving) a data set, return to the MAIN MENU and select option 4, PERFORM ANALYSES. At this point, ECPIE will ask whether the data is currently in memory or must be retrieved from a file:

```
PERFORM AND REPORT FINANCIAL/ECONOMIC ANALYSIS OF CONSERVATION PROJECTS

USE DATA:

  1. CURRENTLY IN MEMORY

  2. FROM STORAGE FILES.


ENTER NUMBER CHOICE, FOLLOWED BY (RET): ? 1
```

When you have the right data in memory, ECPIE will give you a final choice on whether or not to begin the analysis:

```
TO BEGIN ANALYSIS, PRESS 'B' FOLLOWED BY (RET).
TO CANCEL ANALYSIS AND RETURN TO MAIN MENU, PRESS 'R' FOLLOWED BY (RET).

INDICATE CHOICE: ?
```

Assuming you select "B", ECPIE will begin loading the analysis module, which will take a few seconds. However, before the analysis actually starts, you must specify the structure of the six sensitivity analyses that are completed as part of the FINANCIAL ANALYSIS. In addition to performing the "base case" analysis using the data values that you have entered, ECPIE will perform six additional analyses in which each of six variables (in some cases, combinations of variables) may be varied, one at a time, from their base case value. The six sensitivity analysis variables are:

1. DIRECT DEVELOPMENT COSTS (i.e., the sum of DIRECT CAPITAL COST and DESIGN/ENGINEERING COST), which is varied as a specified percentage increase or decrease from the base case values

2. VALUE OF ENERGY SAVED and VALUE OF ENERGY SOLD, which are varied in tandem as a specified

percentage increase or decrease from the base case values

3. OPERATING AND MAINTENANCE EXPENSE, which is varied as a specified percentage increase or decrease from the base case values

4. INTEREST RATES ON PROJECT DEBT (both development and operating period rates), which are varied as a specified percentage point addition or subtraction from the base case values

5. PERCENT OF CAPITAL COST THAT IS DEBT FINANCED, which is varied by specifying a substitute for the base case value

6. MARGINAL TAX RATE, which is varied by specifying a substitute for the base case value(s).

You have three options in structuring the sensitivity analyses: (1) use a set of default sensitivity analyses that are incorporated into ECPIE; (2) use a set of sensitivity analyses that you have previously specified and saved; or (3) enter a new set of sensitivity analyses. The screen illustrating this choice appears as follows:

```
SET UP SENSITIVITY ANALYSES

The program will perform six sensitivity analyses.  To conduct the sensitivity
analyses, you may:

  1.  Use the default sensitivity analysis values
  2.  Use previously filed sensitivity analysis values
  3.  Enter a new set of sensitivity analysis values.

Indicate numerical choice: ? 3


Specifications for the six default sensitivity analyses are:

  1.  DIRECT DEVELOPMENT COSTS 20% GREATER THAN EXPECTED
  2.  DIRECT DEVELOPMENT COSTS 20% LESS THAN EXPECTED
  3.  ENERGY SAVINGS/SALES 20% GREATER THAN EXPECTED
  4.  ENERGY SAVINGS/SALES 20% LESS THAN EXPECTED
  5.  INTEREST RATES 4 POINTS HIGHER THAN EXPECTED
  6.  0% OF DIRECT DEVELOPMENT COST DEBT FINANCED
```

If you select option 1, USE DEFAULT VALUES, ECPIE will immediately begin analysis execution using the sensitivity analysis structure specified on the monitor screen. If you select option 3, ECPIE will lead you through a set of questions to set up each of the six sensitivity analyses. The screen controlling this procedure with an example display for the specification of a sensitivity analysis on DIRECT DEVELOPMENT COSTS is illustrated below:

```
SET NEW SENSITIVITY ANALYSIS VALUES

You may specify six sensitivity analyses on the following variables:

  1. Direct development costs
  2. Value of energy saved/sold
  3. Operating and maintenance expense
  4. Interest rates on project debt
  5. Percent of capital cost that is debt financed
  6. Marginal tax rate.

The value for only one variable may be varied in each of the six analyses.
To specify a sensitivity analysis, you select the variable that will be varied
and then specify the alternate value for the variable.
Enter number of variable for sensitivity analysis # 1 :  ? 1

Percentage amount by which base case direct development costs are increased (+)
or decreased (-) (e.g., 20):? .2
```

When you have completed entry of a set of sensitivity analysis values, ECPIE will give you the opportunity to save the values for later use. The procedure for saving a set of sensitivity analysis values is essentially the same as that discussed for saving an ECPIE data set. That is, ECPIE will request information on the storage device and the name of the file to which the sensitivity analysis values are to be saved. Retrieving a set of previously stored sensitivity analysis values (i.e., option 2 from the SET UP SENSITIVITY ANALYSES menu) also follows the same procedure. The set-up screen for storing a set of sensitivity analysis values is shown below:

```
SAVE SENSITIVITY ANALYSIS VALUES

The specified sensitivity analysis values may be saved to disk for use in
performing subsequent analyses. Using the saved values will eliminate the
need to reenter sensitivity analysis values each time an analysis is performed.

Do you wish to save sensitivity analysis values for later use? Y


Disk device (i.e., A, B, or C): ? A


File name (not more than 8 characters in length):? SEN01
```

After completing specification of the sensitivity analysis structure, ECPIE will begin its analysis. At this point, you will see a screen with an "hour glass" that illustrates approximately where the analysis execution is currently occurring. In all, there are ten chunks of execution that must occur, and these are simulated by the ten "sand" lines in the hour glass. The actual time required for an analysis will depend on the number of time periods to be simulated and the speed of your computer's CPU. You may typically expect the analysis to take about 5 minutes.

It is possible that an analysis may fail for one or more reasons. The most common problem would result from attempting to analyze an incomplete data set (e.g., debt terms inadequately structured). In this case, the program will attempt to execute divisions by zero. While it is not likely, you may also experience "overflow" problems if you have managed to slip values into the data set that result in numbers being

calculated that are too large for the computer to manipulate and display (this problem should not occur because of the number value checks that have been incorporated in the code for the data entry sequences). When such an execution problem occurs, the computer will beep, print an error message, and ask whether execution should continue. Generally, you should halt execution and closely inspect your data set if such problems occur.

When the analysis is complete, you will hear a beep and then be presented with the results display menu, which takes us to the next chapter.

5 VIEWING AND PRINTING ECPIE RESULTS

ECPIE provides an extensive array of outputs for its three modes of analysis: FINANCIAL ANALYSIS, SOCIAL COST/BENEFIT ANALYSIS, and FOREIGN CURRENCY USAGE ANALYSIS. These outputs may be viewed on the computer monitor or printed in a pre-formatted feasibility study booklet using a dot matrix printer that is capable of printing in standard pica and compressed character modes. In the following section, we first describe the procedures for viewing and printing ECPIE results. Second, we provide a glossary which we are hopeful will assist in the interpretation of ECPIE results.

OPTIONS FOR VIEWING AND PRINTING RESULTS

When the ECPIE analysis is complete, the computer will display a RESULTS DISPLAY MENU delineating the various options for viewing and printing the analysis results:

```
MONITOR DISPLAY AND PRINTER MENU

  1. MONITOR DISPLAY: RESULTS OF FINANCIAL ANALYSIS

  2. MONITOR DISPLAY: RESULTS OF SOCIAL VALUE ANALYSIS

  3. MONITOR DISPLAY: RESULTS OF FOREIGN CURRENCY REQUIREMENTS ANALYSIS

  4. PRINT FINANCIAL ANALYSIS REPORT

  5. PRINT SOCIAL VALUE AND FOREIGN CURRENCY REQUIREMENTS ANALYSIS REPORT

  6. PRINT COMBINED REPORT

  7. SAVE INPUT DATA TO DISK FILE

  8. RETURN TO MAIN MENU

  9. EXIT PROGRAM

ENTER NUMBER CHOICE FOLLOWED BY (RET): ? 1
```

Selecting one of the first three options will cause the analysis results to be displayed on the computer in a series of screens. The monitor displays are a slightly summarized version of the printed results. For each mode of analysis, the first screen will be a summary of the analysis results. To proceed beyond the first and subsequent screens, simply follow the instructions displayed at the bottom of the screen (e.g., "PRESS (RET) TO CONTINUE"). For the FINANCIAL ANALYSIS results, the screens following the first will be a summary of the sensitivity analysis results; one or more "spreadsheet pages" of the development period financing requirements analysis; one or more pages of the cash flow/financial analysis; and a graphics display of the after-tax cash flow profile over the analysis period. When you are viewing the "spreadsheet pages," you may flip back and forth among screens by pressing the "F" (forward in time) and "R" (reverse) keys. Pressing the "M" key will cause the display to skip the remaining screens and return directly to the RESULTS DISPLAY MENU.

Pressing the "G" key will cause the display to skip to the graphics screen of after-tax cash flow.

The screen displays for the SOCIAL COST/BENEFIT ANALYSIS and the FOREIGN CURRENCY USAGE ANALYSIS are similar to those for the FINANCIAL ANALYSIS, with the exclusion of the sensitivity analysis results and graphics displays. Some examples of the display screens for the FINANCIAL ANALYSIS results are illustrated below:

```
SUMMARY RESULTS OF FINANCIAL ANALYSIS

All Monetary Values In: Rs(000)

PROJECT NAME: BOILER PLANT REHABILITATION #2

DEVELOPMENT STARTS: 3q/1984          OPERATIONS START: 1q/1986
LAST TIME PERIOD IN ANALYSIS: 2q/1994

TOTAL DIRECT CAPITAL COST: 31592
TOTAL DIRECT DEVELOPMENT PERIOD COST (includes interest): 33797

TOTAL INDIRECT DEVELOPMENT PERIOD COST: 0

DEBT FRACTION: 60.0%  TOTAL DEBT: 20278  TOTAL EQUITY: 13519

DEVELOPMENT PRD INTEREST RATE: 14.0%  OPERATING PRD INTEREST RATE: 14.0%

PRESENT VALUE OF AFTER TAX CASH FLOW AT 20.0%: 14291
INTERNAL RATE OF RETURN: 51.9%
CUMULATIVE CASH FLOW BECOMES POSITIVE IN 3q/1987.
NUMBER OF QUARTERS FROM BEGINNING OF OUTLAYS TO SIMPLE PAYBACK: 13
NUMBER OF OPERATING PERIOD QUARTERS WITH NEGATIVE CASH FLOW: 0

PRESS (RET) TO CONTINUE?
```

```
DIRECT DEVELOPMENT COSTS 20% GREATER THAN EXPECTED
  PRESENT VALUE OF AFTER TAX CASH FLOW AT 20.0%:    11822
  INTERNAL RATE OF RETURN:   43.7%
  CUMULATIVE CASH FLOW BECOMES POSITIVE IN  4q/1987.
DIRECT DEVELOPMENT COSTS 20% LESS THAN EXPECTED
  PRESENT VALUE OF AFTER TAX CASH FLOW AT 20.0%:    16761
  INTERNAL RATE OF RETURN:   62.7%
  CUMULATIVE CASH FLOW BECOMES POSITIVE IN  2q/1987.
ENERGY SAVINGS/SALES 20% GREATER THAN EXPECTED
  PRESENT VALUE OF AFTER TAX CASH FLOW AT 20.0%:    26269
  INTERNAL RATE OF RETURN:   71.3%
  CUMULATIVE CASH FLOW BECOMES POSITIVE IN  1q/1987.
ENERGY SAVINGS/SALES 20% LESS THAN EXPECTED
  PRESENT VALUE OF AFTER TAX CASH FLOW AT 20.0%:     2314
  INTERNAL RATE OF RETURN:   26.6%
  CUMULATIVE CASH FLOW BECOMES POSITIVE IN  4q/1988.
INTEREST RATES 4 POINTS HIGHER THAN EXPECTED
  PRESENT VALUE OF AFTER TAX CASH FLOW AT 20.0%:    13218
  INTERNAL RATE OF RETURN:   49.8%
  CUMULATIVE CASH FLOW BECOMES POSITIVE IN  3q/1987.
0% OF DIRECT DEVELOPMENT COST DEBT FINANCED
  PRESENT VALUE OF AFTER TAX CASH FLOW AT 20.0%:     6103
  INTERNAL RATE OF RETURN:   25.6%
  CUMULATIVE CASH FLOW BECOMES POSITIVE IN  2q/1989.
PRESS (RET) TO CONTINUE
```

DEVELOPMENT PERIOD ANALYSIS: BOILER PLANT REHABILITATION 02
All monetary values in: Rs(000)

TIME PERIOD:	3q/1984	4q/1984	1q/1985	2q/1985	3q/1985	4q/1985
ENG/DESIGN COST	400	750	768	1049	806	1754
DIRECT CAPITAL COST	7400	6850	6452	3042	1772	550
DVL PRD INTEREST AT 14.0%	0	164	327	485	581	648
TOTAL FINANCING REQD	7800	7764	7547	4576	3159	2552
EQUITY CONTRIBUTED	3120	3106	3019	1830	1264	1181
DEBT REQUIRED	4680	4658	4528	2745	1896	1771
CUMULATIVE EQUITY	3120	6226	9244	11075	12338	13519
CUMULATIVE DEBT	4680	9338	13866	16612	18507	20278
CUMULATIVE CAPITAL	7800	15564	23111	27686	30846	33797
DVL COST EXPENSED	400	750	768	1049	806	1754
DVL COST DEPRECIATED	7400	6850	6452	3042	1772	550
INDIRECT DVL COST	0	0	0	0	0	0
CUMULATIVE IND COST	0	0	0	0	0	0

PAGE 1 OF 1. PRESS 'F' FOR NEXT PAGE; 'M' FOR MENU

FINANCIAL ANALYSIS: BOILER PLANT REHABILITATION #2 MONEY UNIT: Rs(000)

TIME PERIOD:	3q/1984	4q/1984	1q/1985	2q/1985	3q/1985	4q/1985
VALUE ENERGY SAVED	0	0	0	0	0	0
VALUE ENERGY SOLD	0	0	0	0	0	0
DVL PRD EXPENSE	400	750	768	1049	886	1754
DVL PRD INTEREST	0	164	327	485	581	648
INDIRECT DVL COST	0	0	0	0	0	0
OPER & MAINT EXPENSE	0	0	0	0	0	0
ENERGY CONSUMED	0	0	0	0	0	0
OPER PRD INTEREST	0	0	0	0	0	0
OTHER OPER PRD COST	0	0	0	0	0	0
DEPR & AMORT	0	0	0	0	0	0
TAXABLE INCOME	-400	-914	-1095	-1534	-1387	-2402
INVESTMENT TAX CRED	0	0	0	0	0	0
INCOME TAX	-200	-457	-547	-767	-693	-1201
DEBT PRINCIPAL	0	0	0	0	0	0
EQUITY CONTRIBUTION	3120	3106	3019	1830	1264	1181
AFTER-TAX CASH FLOW	-2920	-2649	-2471	-1063	-570	20

PAGE 1 OF 7. PRESS 'F' FOR NEXT PAGE; 'M' FOR MENU

If you select from options 4, 5, and 6 of the RESULTS DISPLAY MENU, you will print a booklet of the analysis results for the selected report option. Printing an analysis report is a simple procedure. After you have selected a report option, ECPIE will enter the printing sequence. In this sequence, ECPIE will request information on the type of printer, whether you will use continuous feed or single sheet plaper (if you indicate single sheet (S), ECPIE will stop printing at the end of each page to permit you to feed the next sheet of paper into the printer), and the data that you wish printed on the report. Once you have started printing a report, you may abort the printing sequence and return to the RESULTS DISPLAY MENU by pressing the function key F1. An example of an ECPIE financial analysis report is contained in Appendix A.

Understanding ECPIE Results

In this section, we provide a brief glossary of the important analytic results that are calculated and reported by ECPIE. Our glossary is organized by the different analysis modes: FINANCIAL ANALYSIS, SOCIAL COST/BENEFIT ANALYSIS, and FOREIGN CURRENCY USAGE ANALYSIS.

Financial Analysis Results

The important results calculated in the FINANCIAL ANALYSIS include:

- **Total Direct Capital Cost:** the sum of DESIGN/ENGINEERING COST and DIRECT CAPITAL COST for the entire development period.

- **Total Direct Development Period Cost:** the sum of TOTAL DIRECT CAPITAL COST and TOTAL DEVELOPMENT PERIOD INTEREST.

- **Total Indirect Development Period Cost:** the total of INDIRECT DEVELOPMENT COST for the development period.

- **Total Debt:** the total drawdown of construction debt that is needed to finance the project at the specified debt financing fraction.

- **Total Equity:** the total equity contribution required to finance the project at the specified debt financing fraction. The equity contribution and debt drawdown are scheduled over the development period in such a way that the debt component of the project's FINANCING REQUIREMENTS (i.e., the sum of DIRECT CAPITAL COST, DESIGN/ENGINEERING COST, and DEVELOPMENT PERIOD INTEREST) exactly matches the DEBT FRACTION in each time period of the development period.

- **After Tax Cash Flow:** the actual change in the cash position of the equity investor in each of the project analysis periods. Cash flow analysis differs from earnings or income analysis in that non-cash expenses (i.e., depreciation) are not deducted from cash revenues while non-tax deductible (but real cash) outlays (i.e., equity contributions and repayments of debt

principal) are deducted from cash revenues. The formula for computing cash flow in the DEVELOPMENT PERIOD is:

CASH FLOW = - (EQUITY CONTRIBUTION + INDIRECT DEVELOPMENT PERIOD COST) - INCOME TAX.

Note: The EQUITY CONTRIBUTION is calculated in the FINANCING REQUIREMENTS ANALYSIS in such a way as to cover all project capital outlays, interest charges, and expenses that are not covered by the drawdown of project debt. Therefore, these items do not appear in the cash flow calculation. INCOME TAX will usually be negative in the DEVELOPMENT PERIOD.

The formula for computing cash flow in the OPERATING PERIOD is:

CASH FLOW = VALUE OF ENERGY SAVED + VALUE OF ENERGY SOLD - VALUE OF ENERGY CONSUMED - OPERATING AND MAINTENANCE EXPENSE - INTEREST ON PROJECT DEBT - OTHER OPERATING PERIOD EXPENSE - TAXES - REPAYMENT OF DEBT PRINCIPAL.

- **Present Value of After-Tax Cash Flow at XX.X%:** the cumulated value of all project cash flows that have been discounted to the beginning of the development period at the user's specified TARGET AFTER TAX RETURN ON EQUITY. This value is a measure of the increase in the equity investor's net worth that could be expected from undertaking the conservation project.

- **Internal Rate of Return:** the after-tax return on equity that causes the PRESENT VALUE OF AFTER TAX CASH FLOW to equal zero. This value is a measure of the project's financial performance per currency unit of equity invested.

- **Cumulative Cash Flow Becomes Positive in XXXX:** is the time period in which the cumulative, undiscounted cash flows from the project first turn from negative to positive; the point at which the equity investor will have recovered his cash equity investment. Unless the project has a cash flow pattern in which cash flows subsequently become negative and cause the cumulative cash balance to become negative, the

project should be "in the black" from this point forward.

- **Number of Months/Quarters/Years from Beginning of Outlays to Simple Payback:** the length of time required for the project's cumulative cash flow to become positive; the "payback period."

- **Number of Operating Period Quarters with Negative Cash Flow:** an indicator of the financial stability/strength of the project. If a project experiences negative cash flow during the operating period, the cash losses will have to be made up from a cash source (e.g., additional debt or equity) and difficulty may be experienced in making debt principal payments.

Social Cost/Benefit Analysis Results

The important results calculated in the SOCIAL COST/BENEFIT ANALYSIS include:

- **Total Development Period Cost:** the total undiscounted outlay in the development period measured in SOCIAL VALUES; a measure of the amount of current consumption that must be delayed to undertake the conservation project. The SOCIAL COST/BENEFIT ANALYSIS does not consider such items as taxes, depreciation, and interest payments as costs.

- **Total Net Benefits in Operating Period:** the total undiscounted net benefits (i.e., benefits less costs) during the operating period measured in SOCIAL VALUES; a measure of the gross increase (i.e., not net of project development costs) in society's consumption capability as a result of undertaking the project.

- **Present Value of Net Benefit Stream at XX.X%:** the cumulated value of all project net benefits which have been discounted to the beginning of the development period at the user's specified SOCIAL DISCOUNT RATE. This value is a measure of the increase in society's net consumption ability or welfare that could be expected from undertaking the conservation project.

- **Ratio of Operating Period Net Benefits to Development Period Costs:** the conservation project's benefit/cost ratio; a measure of the return to society per unit of current consumption that is delayed to undertake the conservation project.

- **Cumulative Net Social Benefits Become Positive in XXXX:** is the time period in which the cumulative, undiscounted net social benefits from the project first turn from negative to positive; the point at which society will have broken even on the project.

Foreign Currency Usage Analysis Results

The important results calculated in the FOREIGN CURRENCY USAGE ANALYSIS include:

- **Foreign Currency Usage:** is calculated by multiplying the FOREIGN CURRENCY CONTENT of an individual account (e.g., the fraction of DIRECT CAPITAL COST that involves foreign currency purchases) by the value of the account as used in the FINANCIAL ANALYSIS. The values for individual accounts are added by time period to calculate the total foreign usage requirement for each period. Positive values imply foreign currency use; negative values mean that the cumulative effect of the transactions is to reduce foreign currency requirements.

  The accumulation of foreign currency usage accounts does not follow true "cash flow" accounting rules. That is, the analysis does not consider a foreign currency loan as a source of foreign currency, and correspondingly does not consider a debt principal payment as a use of foreign currency. Rather, the analysis looks at the needs of the project for foreign currency irrespective of how the foreign currency is obtained or what a foreign currency displacement is used for (e.g., debt repayment). The only divergence from this rule occurs with respect to the calculation of interest payments on project debt. The analysis allocates a fraction of interest payments as a use of foreign currency; the fraction so allocated is the same as the fraction of total project capital

outlays requiring foreing currency purchases. The implicit assumption in this procedure is that the debt/equity structure of capital outlays for the domestic and foreign currency components of a project are the same.

- **Total Foreign Currency Requirement in Development Period:** the undiscounted sum of foreign currency needs for the development period.

- **Total Foreign Currency Requirement in Operating Period:** the undiscounted sum of foreign currency needs for the operating period (often negative).

- **Total Foreign Currency Requirement for Analysis Period:** the undiscounted sum of foreign currency needs for both the development and operating period.

- **Present Value of Foreign Currency Requirement at XX.X%:** the discounted sum of foreign currency needs for both the development and operating periods. The present value of foreign currency requirement is computed using the user-specified SOCIAL DISCOUNT RATE.

- **Cumulative Foreign Currency Use Becomes Negative in XXXX:** is the time period in which the cumulative, undiscounted foreign currency requirements of the project first turn from positive to negative; the point at which the project will have paid its way in terms of foreign currency use.

- **Ratio of Operating Period Reduction in Foreign Currency Use to Development Period Foreign Currency Need:** the foreign currency "benefit/cost" ratio. The ratio is a measure of the project's ability to "generate" foreign currency.

Appendix A ECPIE FINANCIAL REPORT EXAMPLE

CONSERVATION PROJECT FINANCIAL EVALUATION

BOILER PLANT REHABIITATION #3

Prepared for:
MR. PALITA SUBASINGHE
SRI LANKA TYRE CORPORATION
KELANIYA, SRI LANKA

Prepared by:
EDMAC
Ministry of Power and Energy
50, Sir Chittampalam A. Gardiner Mawatha
Colombo -02, Sri Lanka

July 24, 1984

ACKNOWLEDGEMENT

This feasibility study was conducted under a joint program of the Sri Lanka Ministry of Power and Energy and the United States Agency for International Development. The analyses for the study were performed using a conservation project financial evaluation model developed by Hagler, Bailly & Company under contract to the Office of Energy, Bureau for Science and Technology, U.S. AID. For information on the model, contact:

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TABLE OF CONTENTS

Summary Project Information	Page 1
Summary Results of Financial Analysis	Page 2
Development Period Financial Summary	Page 3
Project Financial Analysis	Page 4
Summary Results Of Sensitivity Analysis	Page 8

LIST OF ABBREVIATIONS USED IN THIS REPORT:

CAP: Capital
DVL: Development
ENG: Engineering
IND: Indirect
PRD: Period
RQRD: Required
Q: Quantity
OPER & MAINT: Operating & Maintenance

SUMMARY PROJECT INFORMATION

Project Name: BOILER PLANT REHABIITATION #3

Project Location: KELANIYA, SRI LANKA

Company: SRI LANKA TYRE CORPORATION

Company Contact: MR. PALITA SUBASINGHE, SENIOR POWER ENGINEER

Telephone: 521-241

Project Description:

This study is concerned with replacing an inefficient boiler plant with a cogeneration system consisting of a multi-fuel fired boiler and a back-pressured steam turbine. The boiler would be fired on a mixture of 85% wood/15% oil. Boiler operating efficiency would be improved from 54% to about 75%.

Start of Project Development: 3q/1984

Start of Project Operation: 1q/1986

SUMMARY RESULTS OF FINANCIAL ANALYSIS
==========

BOILER PLANT REHABIITATION #3

All Monetary Values In: Rs(000)

PROJECT SCHEDULE
DEVELOPMENT STARTS: 3q/1984
OPERATIONS START: 1q/1986
LAST TIME PERIOD IN ANALYSIS: 2q/1994

DEVELOPMENT PERIOD COSTS
TOTAL DIRECT CAPITAL COST: 42900
TOTAL DIRECT DVL PERIOD COST (includes interest): 45766
TOTAL INDIRECT DVL PERIOD COST: 0

FINANCIAL STRUCTURE
DEBT FRACTION: 60.0%
TOTAL DEBT REQUIRED: 27460
TOTAL EQUITY CONTRIBUTED: 18307

DEBT TERMS
DEVELOPMENT PRD INTEREST RATE: 14.0%
OPERATING PERIOD INTEREST RATE: 14.0%
OPERATING PERIOD DEBT TERM: 32 QUARTERS
DEBT MORATORIUM PERIOD: 3 QUARTERS

MARGINAL TAX RATE: 50.0%

FINANCIAL PERFORMANCE
TARGET AFTER TAX RETURN ON EQUITY: 20.0%
PRESENT VALUE OF AFTER TAX CASH FLOW
AT 20.0%: 13043
INTERNAL RATE OF RETURN: 43.3%
CUMULATIVE CASH FLOW BECOMES POSITIVE IN 4q/1987.
NUMBER OF QUARTERS FROM BEGINNING OF OUTLAYS
TO SIMPLE PAYBACK: 14
NUMBER OF QUARTERS IN OPERATING PERIOD
WITH NEGATIVE CASH FLOW: 0

DEVELOPMENT PERIOD FINANCIAL SUMMARY
BOILER PLANT REHABIITATION #3

All Monetary Values In: Rs(000)

TIME PERIOD	3q/1984	4q/1984	1q/1985	2q/1985	3q/1985	4q/1985
ENG/DESIGN COST	253	859	830	1589	1357	2197
DIRECT CAPITAL COST	10608	6397	8262	7635	2055	858
DVL PRD INTEREST AT 14.0%	0	228	385	584	790	878
TOTAL FINANCING RQRD	10861	7484	9477	9808	4202	3933
EQUITY CONTRIBUTED	4344	2994	3791	3923	1681	1573
DEBT REQUIRED	6517	4490	5686	5885	2521	2360
CUMULATIVE EQUITY	4344	7338	11129	15052	16733	18307
CUMULATIVE DEBT	6517	11007	16693	22578	25100	27460
CUMULATIVE CAPITAL	10861	18345	27822	37631	41833	45766
DVL COST EXPENSED	253	859	830	1589	1357	2197
DVL COST DEPRECIATED	10608	6397	8262	7635	2055	858
INDIRECT DVL COST	0	0	0	0	0	0
CUMULATIVE IND COST	0	0	0	0	0	0

FINANCIAL ANALYSIS BY TIME PERIOD
BOILER PLANT REHABIITATION #3
All Monetary Values In: Rs(000)

TIME PERIOD	3q/1984	4q/1984	1q/1985	2q/1985	3q/1985	4q/1985	1q/1986	2q/1986	3q/1986	4q/1986
PROJECT REVENUES										
ENERGY SAVED (TONNES OF OIL)	0	0	0	0	0	0	1050	1050	1050	1050
PRICE ENERGY SAVED	0.00	0.00	0.00	0.00	0.00	0.00	5.67	5.83	6.00	6.17
VALUE ENERGY SAVED	0	0	0	0	0	0	5955	6126	6302	6483
ENERGY SOLD (MWH ELECTRICITY)	0	0	0	0	0	0	414	414	414	414
PRICE ENERGY SOLD	0.00	0.00	0.00	0.00	0.00	0.00	2.30	2.37	2.43	2.50
VALUE ENERGY SOLD	0	0	0	0	0	0	952	980	1008	1037
TOTAL REVENUE	0	0	0	0	0	0	6907	7105	7310	7520
BEFORE TAX COSTS										
ENERGY USED (TONNES OF WOOD)	0	0	0	0	0	0	4130	4130	4130	4130
PRICE ENERGY USED	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.69	0.71	0.73
VALUE ENERGY USED	0	0	0	0	0	0	2792	2859	2928	2998
DVL PRD EXPENSE	253	859	830	1589	1357	2197	0	0	0	0
DVL PRD INTEREST	0	228	385	584	790	878	961	0	0	0
INDIRECT DVL COST	0	0	0	0	0	0	0	0	0	0
OPER & MAINT EXPENSE	0	0	0	0	0	0	1328	1362	1398	1434
OTHER OPER PRD COST	0	0	0	0	0	0	0	0	0	0
OPER PRD INTEREST	0	0	0	0	0	0	0	961	961	961
DEPR & AMORT	0	0	0	0	0	0	1679	1679	1679	1679
TOTAL COST	253	1087	1215	2173	2147	3075	6759	6861	6965	7072
TAXABLE INCOME	-253	-1087	-1215	-2173	-2147	-3075	147	244	344	448
INVESTMENT TAX CRED	0	0	0	0	0	0	0	0	0	0
INCOME TAX	-127	-544	-608	-1087	-1074	-1538	74	122	172	224
AFTER TAX OUTLAYS										
DEBT PRINCIPAL	0	0	0	0	0	0	0	0	0	0
EQUITY CONTRIBUTED	4344	2994	3791	3923	1681	1573	0	0	0	0
TOTAL AFTER TAX OUTLAYS	4344	2994	3791	3923	1681	1573	0	0	0	0
AFTER-TAX CASH FLOW	-4218	-2450	-3183	-2837	-607	-36	1753	1801	1851	1903
CUMULATIVE CASH FLOW	-9933	-16610	-24762	-32886	-35864	-38442	-36700	-34938	-33157	-31357

FINANCIAL ANALYSIS BY TIME PERIOD
BOILER PLANT REHABIITATION #3
All Monetary Values In: Rs(000)

TIME PERIOD	1q/1987	2q/1987	3q/1987	4q/1987	1q/1988	2q/1988	3q/1988	4q/1988	1q/1989	2q/1989
PROJECT REVENUES										
ENERGY SAVED (TONNES OF OIL)	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
PRICE ENERGY SAVED	6.35	6.53	6.72	6.92	7.11	7.32	7.53	7.74	7.97	8.20
VALUE ENERGY SAVED	6669	6861	7058	7261	7470	7684	7905	8132	8366	8606
ENERGY SOLD (MWH ELECTRICITY)	414	414	414	414	414	414	414	414	414	414
PRICE ENERGY SOLD	2.58	2.65	2.73	2.80	2.89	2.97	3.05	3.14	3.23	3.32
VALUE ENERGY SOLD	1066	1097	1129	1161	1194	1229	1264	1300	1338	1376
TOTAL REVENUE	7736	7958	8187	8422	8664	8913	9169	9433	9704	9982
BEFORE TAX COSTS										
ENERGY USED (TONNES OF WOOD)	4130	4130	4130	4130	4130	4130	4130	4130	4130	4130
PRICE ENERGY USED	0.74	0.76	0.78	0.80	0.82	0.84	0.86	0.88	0.90	0.92
VALUE ENERGY USED	3071	3145	3221	3298	3378	3459	3543	3628	3716	3805
DVL PRD EXPENSE	0	0	0	0	0	0	0	0	0	0
DVL PRD INTEREST	0	0	0	0	0	0	0	0	0	0
INDIRECT DVL COST	0	0	0	0	0	0	0	0	0	0
OPER & MAINT EXPENSE	1471	1509	1548	1588	1629	1671	1714	1759	1804	1851
OTHER OPER PRD COST	0	0	0	0	0	0	0	0	0	0
OPER PRD INTEREST	961	944	927	909	890	871	851	831	809	787
DEPR & AMORT	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679
TOTAL COST	7181	7277	7374	7474	7576	7680	7787	7896	8008	8122
TAXABLE INCOME	554	681	812	948	1088	1233	1382	1536	1696	1861
INVESTMENT TAX CRED	0	0	0	0	0	0	0	0	0	0
INCOME TAX	277	341	406	474	544	616	691	768	848	930
AFTER TAX OUTLAYS										
DEBT PRINCIPAL	479	496	513	531	550	569	589	609	631	653
EQUITY CONTRIBUTED	0	0	0	0	0	0	0	0	0	0
TOTAL AFTER TAX OUTLAYS	479	496	513	531	550	569	589	609	631	653
AFTER-TAX CASH FLOW	1477	1524	1572	1622	1673	1726	1781	1838	1896	1956
CUMULATIVE CASH FLOW	-29537	-27697	-25838	-23959	-22060	-20141	-18202	-16242	-14263	-12263

FINANCIAL ANALYSIS BY TIME PERIOD
BOILER PLANT REHABIITATION #3
All Monetary Values In: Rs(000)

TIME PERIOD	3q/1989	4q/1989	1q/1990	2q/1990	3q/1990	4q/1990	1q/1991	2q/1991	3q/1991	4q/1991
PROJECT REVENUES										
ENERGY SAVED (TONNES OF OIL)	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
PRICE ENERGY SAVED	8.43	8.67	8.92	9.18	9.44	9.72	9.99	10.28	10.58	10.88
VALUE ENERGY SAVED	8854	9108	9370	9639	9916	10201	10494	10796	11106	11425
ENERGY SOLD (MWH ELECTRICITY)	414	414	414	414	414	414	414	414	414	414
PRICE ENERGY SOLD	3.42	3.52	3.62	3.72	3.83	3.94	4.05	4.17	4.29	4.41
VALUE ENERGY SOLD	1416	1456	1498	1541	1586	1631	1678	1726	1776	1827
TOTAL REVENUE	10269	10564	10868	11180	11502	11832	12172	12522	12882	13252
BEFORE TAX COSTS										
ENERGY USED (TONNES OF WOOD)	4130	4130	4130	4130	4130	4130	4130	4130	4130	4130
PRICE ENERGY USED	0.94	0.97	0.99	1.01	1.04	1.06	1.09	1.11	1.14	1.17
VALUE ENERGY USED	3897	3991	4087	4186	4287	4390	4496	4604	4715	4829
DVL PRD EXPENSE	0	0	0	0	0	0	0	0	0	0
DVL PRD INTEREST	0	0	0	0	0	0	0	0	0	0
INDIRECT DVL COST	0	0	0	0	0	0	0	0	0	0
OPER & MAINT EXPENSE	1898	1948	1998	2050	2103	2157	2213	2270	2329	2389
OTHER OPER PRD COST	0	0	0	0	0	0	0	0	0	0
OPER PRD INTEREST	764	741	716	691	665	638	610	580	550	519
DEPR & AMORT	1679	1679	560	560	560	560	560	560	560	560
TOTAL COST	8239	8358	7361	7486	7614	7744	7878	8014	8154	8297
TAXABLE INCOME	2031	2206	3507	3695	3888	4088	4295	4508	4728	4955
INVESTMENT TAX CRED	0	0	0	0	0	0	0	0	0	0
INCOME TAX	1015	1103	1754	1847	1944	2044	2147	2254	2364	2478
AFTER TAX OUTLAYS										
DEBT PRINCIPAL	676	699	724	749	775	802	830	860	890	921
EQUITY CONTRIBUTED	0	0	0	0	0	0	0	0	0	0
TOTAL AFTER TAX OUTLAYS	676	699	724	749	775	802	830	860	890	921
AFTER-TAX CASH FLOW	2019	2083	1589	1658	1728	1801	1876	1954	2034	2117
CUMULATIVE CASH FLOW	-10242	-8201	-6139	-4056	-1953	172	23797	25751	27785	29901

FINANCIAL ANALYSIS BY TIME PERIOD
BOILER PLANT REHABILITATION #3
All Monetary Values In: Rs(000)

TIME PERIOD	1q/1992	2q/1992	3q/1992	4q/1992	1q/1993	2q/1993	3q/1993	4q/1993	1q/1994	2q/1994
PROJECT REVENUES										
ENERGY SAVED (TONNES OF OIL)	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
PRICE ENERGY SAVED	11.19	11.52	11.85	12.19	12.54	12.90	13.27	13.65	14.04	14.44
VALUE ENERGY SAVED	11753	12091	12439	12796	13164	13542	13931	14332	14743	15167
ENERGY SOLD (MWH ELECTRICITY)	414	414	414	414	414	414	414	414	414	414
PRICE ENERGY SOLD	4.54	4.67	4.80	4.94	5.08	5.23	5.38	5.54	5.69	5.86
VALUE ENERGY SOLD	1879	1933	1989	2046	2105	2166	2228	2292	2358	2425
TOTAL REVENUE	13633	14025	14428	14842	15269	15708	16159	16623	17101	17593
BEFORE TAX COSTS										
ENERGY USED (TONNES OF WOOD)	4130	4130	4130	4130	4130	4130	4130	4130	4130	4130
PRICE ENERGY USED	1.20	1.23	1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48
VALUE ENERGY USED	4945	5065	5187	5312	5440	5571	5705	5843	5984	6128
DVL PRD EXPENSE	0	0	0	0	0	0	0	0	0	0
DVL PRD INTEREST	0	0	0	0	0	0	0	0	0	0
INDIRECT DVL COST	0	0	0	0	0	0	0	0	0	0
OPER & MAINT EXPENSE	2451	2514	2579	2646	2714	2784	2856	2930	3006	3083
OTHER OPER PRD COST	0	0	0	0	0	0	0	0	0	0
OPER PRD INTEREST	487	454	419	383	346	308	269	228	185	141
DEPR & AMORT	560	560	560	560	560	560	560	560	0	0
TOTAL COST	8443	8592	8744	8900	9060	9223	9390	9560	9175	9353
TAXABLE INCOME	5190	5433	5683	5942	6209	6485	6769	7063	7926	8240
INVESTMENT TAX CRED	0	0	0	0	0	0	0	0	0	0
INCOME TAX	2595	2716	2842	2971	3104	3242	3385	3532	3963	4120
AFTER TAX OUTLAYS										
DEBT PRINCIPAL	953	986	1021	1057	1094	1132	1171	1212	1255	1299
EQUITY CONTRIBUTED	0	0	0	0	0	0	0	0	0	0
TOTAL AFTER TAX OUTLAYS	953	986	1021	1057	1094	1132	1171	1212	1255	1299
AFTER-TAX CASH FLOW	2202	2290	2380	2474	2570	2670	2773	2879	2708	2821
CUMULATIVE CASH FLOW	32103	34393	36773	39247	41817	44487	47260	50139	52847	55668

SUMMARY RESULTS OF SENSITIVITY ANALYSIS
BOILER PLANT REHABIITATION #3

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BASE OR EXPECTED CASE
PRESENT VALUE OF AFTER TAX CASH FLOW
AT 20.0%: 13043
INTERNAL RATE OF RETURN: 43.3%
CUMULATIVE CASH FLOW BECOMES POSITIVE IN 4q/1987.

DIRECT DEVELOPMENT COSTS 20% GREATER THAN EXPECTED
PRESENT VALUE OF AFTER TAX CASH FLOW
AT 20.0%: 9693
INTERNAL RATE OF RETURN: 35.6%
CUMULATIVE CASH FLOW BECOMES POSITIVE IN 2q/1988.

DIRECT DEVELOPMENT COSTS 20% LESS THAN EXPECTED
PRESENT VALUE OF AFTER TAX CASH FLOW
AT 20.0%: 16394
INTERNAL RATE OF RETURN: 53.3%
CUMULATIVE CASH FLOW BECOMES POSITIVE IN 3q/1987.

ENERGY SAVINGS/SALES 20% GREATER THAN EXPECTED
PRESENT VALUE OF AFTER TAX CASH FLOW
AT 20.0%: 26676
INTERNAL RATE OF RETURN: 61.3%
CUMULATIVE CASH FLOW BECOMES POSITIVE IN 2q/1987.

ENERGY SAVINGS/SALES 20% LESS THAN EXPECTED
PRESENT VALUE OF AFTER TAX CASH FLOW
AT 20.0%: -590
INTERNAL RATE OF RETURN: 18.6%
CUMULATIVE CASH FLOW BECOMES POSITIVE IN 3q/1989.

INTEREST RATES 4 POINTS HIGHER THAN EXPECTED
PRESENT VALUE OF AFTER TAX CASH FLOW
AT 20.0%: 11598
INTERNAL RATE OF RETURN: 41%
CUMULATIVE CASH FLOW BECOMES POSITIVE IN 1q/1988.

0% OF DIRECT DEVELOPMENT COST DEBT FINANCED
PRESENT VALUE OF AFTER TAX CASH FLOW
AT 20.0%: 2043
INTERNAL RATE OF RETURN: 21.5%
CUMULATIVE CASH FLOW BECOMES POSITIVE IN 3q/1989.