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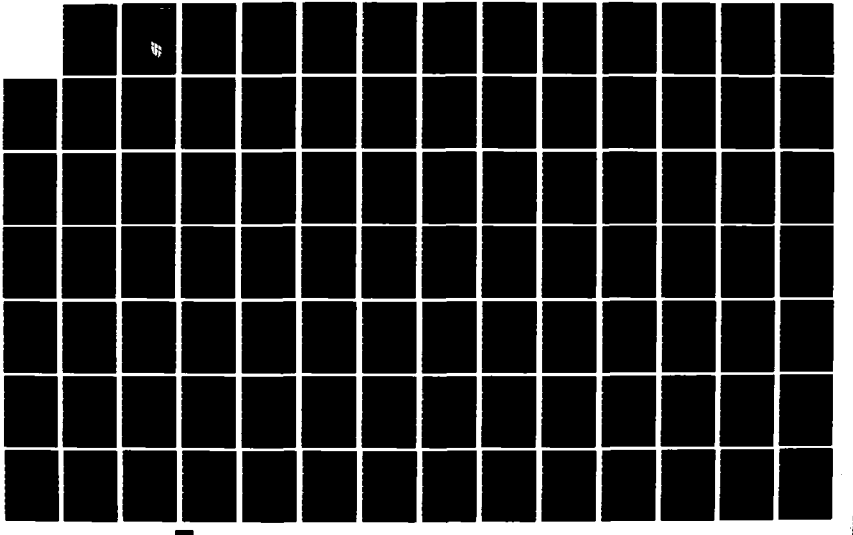

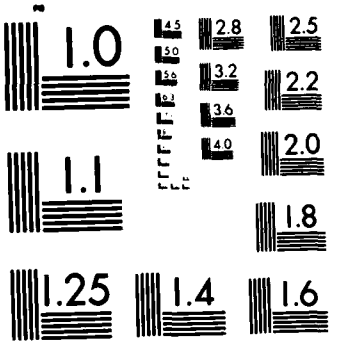

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USA-CERL

TECHNICAL REPORT E-85/07
November 1985

AD-A162 522

Development and Use of the Life Cycle Cost in Design Computer Program (LCCID)

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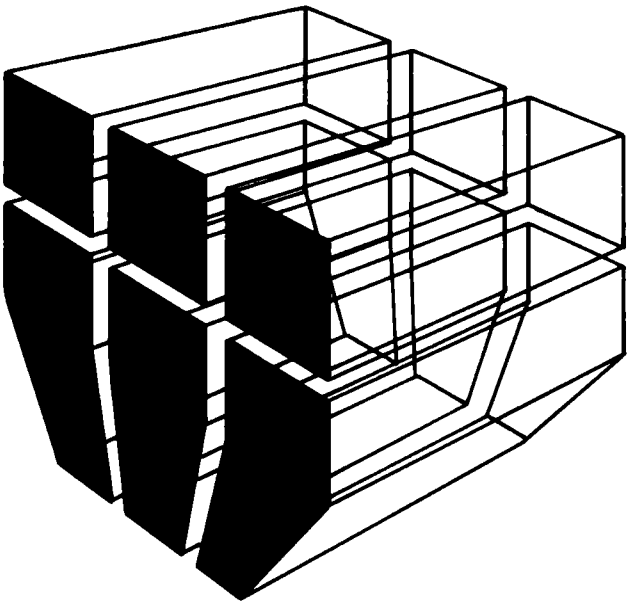
by Linda Lawrie

This report documents the development of and provides basic user instructions for a program to perform life cycle cost analysis of new military facilities. The program is easy for personnel who have not had much experience with computers to use. It allows the user to select parameters that best describe his/her design project from a menu of choices. Responses to computer queries can often be answered in one word.

The program output can either be displayed on the terminal or printed out as hard copy. The output contains much of the information needed for an economic review of a design.

The program is written in FORTRAN 77 and will be made available on the Corps of Engineers' time-sharing vendor, on District/Division Harris computers, and on Intel 8086 compatible microcomputers. The source code will be made available for conversions to other hardware, as well.



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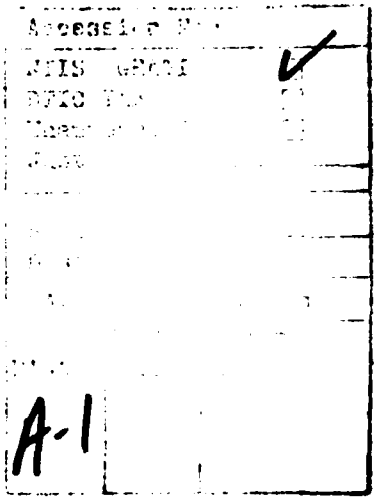
FOREWORD

This work was performed for the Directorate of Engineering and Construction, Office of the Chief of Engineers (OCE), under Project 4A162781AT45, "Energy and Energy Conservation"; Technical Area A, "New Construction Energy Design"; Work Unit 002, "Energy Analysis Tools for Concept Design." Mr. Joe McCarty, DAEN-ECE-E, was the OCE Technical Monitor.

This work was performed by the Energy Systems (ES) Division, U.S. Army Construction Engineering Research Laboratory (USA-CERL). Mr. R. G. Donaghy is Chief of USA-CERL-ES.

Appreciation is expressed to Mr. Robert Neathammer of the USA-CERL Facility Systems Division for his help with economic analysis information and testing of the program; to Mr. Dwight Beranek of the Missouri River Division for his assistance with the field view of life cycle cost studies and for writing the online help messages; and to Dr. Larry Schindler, DAEN-ECE-G, for his assistance with the criteria for life cycle cost studies. A special recognition is given to Mr. Paul Fischer (CERL-ES) for the microcomputer implementation.

COL Paul J. Theuer is Commander and Director of USA-CERL, and Dr. L. R. Shaffer is Technical Director.



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DEVELOPMENT AND USE OF THE LIFE CYCLE COST IN DESIGN COMPUTER PROGRAM (LCCID)

1 INTRODUCTION

Background

The Department of Defense *Construction Criteria Manual*[1] requires that all new construction be analyzed to determine the least life cycle cost (LCC) alternative. Engineer Technical Letter (ETL) 1110-3-309[2] specifies that an energy analysis be done on all new Army facility designs to ensure that they meet the design energy target. It also requires that the designer "consider all design options and trade-offs in order to minimize energy requirements and life cycle costs." ETL 1110-3-332[3] requires economic studies of all facilities to rank the design alternatives by overall net life cycle cost. The Air Force requires computer energy and LCC analyses for all new facilities, additions to existing facilities, and major building rehabilitation projects, depending on their size and operation.[4] For both Army and Air Force LCC analyses, the criteria contained in *Federal Register*, Volume 46, No. 222, 16 November 1981, TT-56721-56728, "Rules & Regulations" must be used.

Criteria for the Energy Conservation Investment Program (ECIP)[5] also require that project priorities be set on the basis of greatest potential LCC payback. The National Bureau of Standards' *Handbook 135*[6] provides another reference for many of the calculation procedures used to determine energy-saving life cycle costs.

Many criteria must be searched when performing LCC studies, and the data needed to perform the calculations may change, depending on the criteria being used and the facility location. An automated tool could lessen the need to search the criteria and prevent the use of incorrect standard data values, such as for differential energy escalation rates, discount factors, investment credits, and basic calculational procedures. Such an automated tool could serve the needs of the neophyte user of LCC analysis, yet still be able to meet the more experienced user's more complex requirements.

Since not every element of a life cycle cost study is required for each study, an interactive computer program with a menu-driven approach would allow the user to select desired elements. Online "helps" would allow a novice user to obtain extra assistance that the more experienced user would not necessarily require. The correct

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[1] DOD 4270.1-M, *Construction Criteria Manual* (Department of Defense, December 15, 1983).

[2] Engineer Technical Letter (ETL) 1110-3-309, *Interim Energy Budgets for New Facilities* (Office of the Chief of Engineers [OCE], 30 August 1979).

[3] ETL 1110-3-332, *Economic Studies* (OCE, 22 March 1982).

[4] ETL 84-2, *Computer Energy Analysis* (Department of the Air Force, 27 March 1984; Change 1, 16 May 1984).

[5] *Energy Conservation Investment Program (ECIP) Guidance*, Multiple-Address Letter from the Office of the Chief of Engineers (4 March 1985).

[6] *Life-Cycle Costing Manual for the Federal Energy Management Program*, Handbook 135 (National Bureau of Standards, December 1980).

criteria for the LCC calculations could be selected by asking the user a few simple questions (again an aid to the novice user, but not a burden to the experienced user).

Objective

The objective of this report is to describe the development and use of an automated method that Corps designers and their contractors can use to ensure that calculated life cycle cost analysis for new construction meets Corps criteria.

Approach

Army and Air Force LCC criteria were reviewed to identify prescriptive standards and techniques relating to LCC calculation. Data required in each of the criteria documents were analyzed for commonality.

An interactive computer program was developed to produce correct LCC study calculations that would be implemented on the Corps timesharing vendor as well as on Harris Corporation computers. The computer program was then field-tested at Corps Districts to determine changes required before its final release.

Mode of Technology Transfer

This program will be released initially in an Engineering Improvement Recommendation System (EIRS) bulletin. (The program will be made available on the Corps' timesharing vendor as well as on Harris Corporation computers, which are available in most Corps District and Division offices. A version of this program is implemented for use on microcomputers.) This program source code will be given to any Energy Analysis software vendor for use and incorporation into their program codes for producing correct DOD calculations. Any such program codes then remarketed will be validated by the Corps Missouri River Division Office (the Technical Center of Expertise for Energy Analysis and Energy Performance Standards).

2 ORGANIZATION OF THE LIFE CYCLE COST PROGRAM

During review of the life cycle cost documents, it was easy to see why designers were confused. Besides the mere numerical data involved (e.g., determining which version of the energy escalation rates were current), it was difficult to determine when to apply the different calculational procedures. As a result of the documentation review, several decisions were made regarding program flow. The most important of these appears to be the decision to ask the user several questions about his/her specific project in order to determine the necessary criteria for calculation. This method will cause far less confusion for the novice. As more and more designers become used to determining life cycle costs, a choice of immediate criteria selection versus the simple questioning method may be implemented. However, the current implementation does not take excessively long and assures that correct criteria will be used; review of immediate criteria selection to ensure that proper criteria selection had been used would take longer.

Some of the criteria are basically incompatible. For example, new building designs and buildings being considered for ECIP application would rarely share the same data. Thus, the program has been designed to prevent changing criteria selection from design to ECIP, or vice versa.

The user often requires guidance to answer questions, and the type of guidance provided depends on the criteria selection. Since the guidance can sometimes be lengthy, most of it has been placed into the online helps. Thus, the user needs to read the guidance only when he/she does not understand the meaning of the questions (either a novice or an infrequent user). The experienced user would not be burdened with reading lengthy explanations for many questions.

In some cases, no guidance is available. For example, determining maintenance and repair costs is more of an art than a science. However, as data on such issues become available, this guidance can also be placed into the online helps.

This chapter presents some of the basic responses to user input provided during the Life Cycle Cost in Design Program (LCCID) execution, as well as an overview of the program's capabilities. Figure 1 illustrates the program's functional layout.

Information Exchange

The designer gives the LCCID program instructions by issuing commands at an interactive terminal. This usually involves entering a command or response, and terminating with a carriage return. Lower-case entries are converted automatically to all capital letters.

Many of the user responses to questions from the program are naturally answered by a "yes" or "no." The program will recognize Y as an equivalent for "yes" and N as an equivalent for "no." Often, the program will present an option or a stored value for the user's review. If the user wishes to accept the option or retain the stored value, a carriage return (CR) may be entered rather than reentering the option or value.

The program can also recognize special answers in response to any query. Two of these answers are HELP (or @) and LIST (or ?). When a user responds to a query with the word HELP, the program will display text on the terminal to help the user respond appropriately. After displaying the help information, the program returns to the original

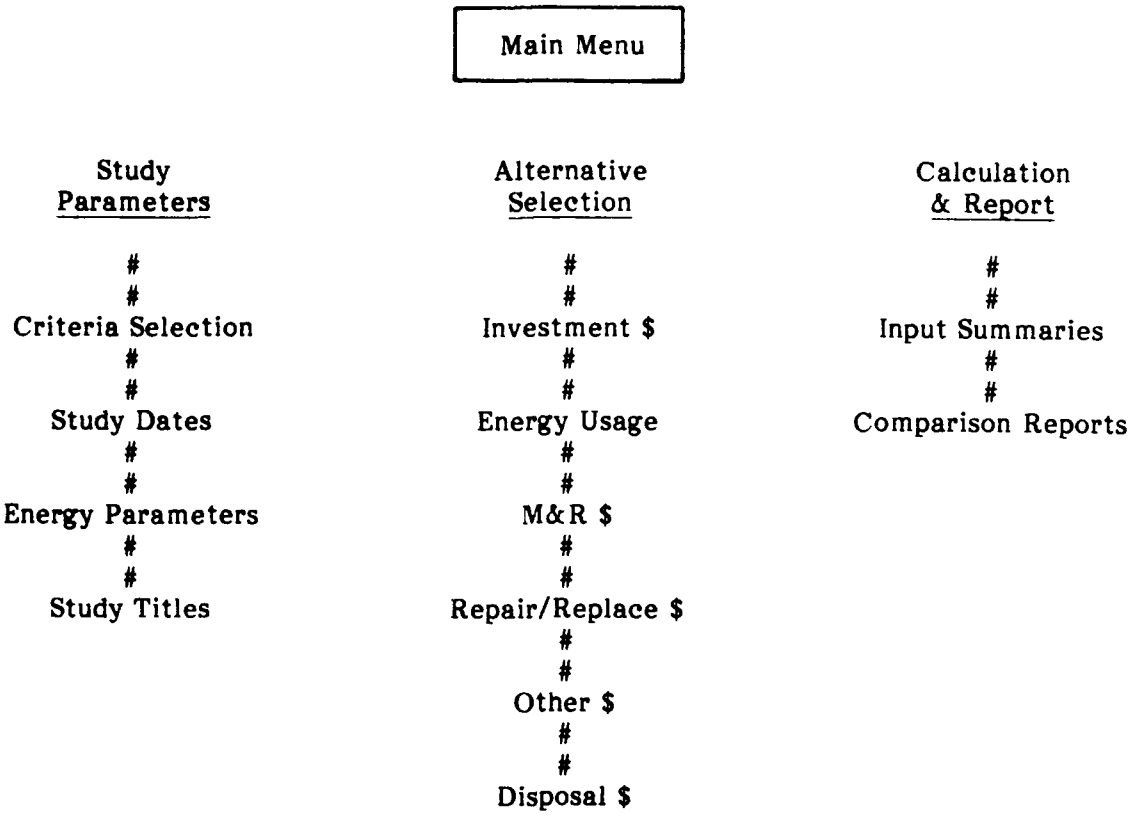

Figure 1. Program functional layout.

query for the actual user response. When a user responds to a query with the word LIST, the program will either reissue the query or display text listing more information applicable to the query. After displaying the response to the LIST entry, the program will expect the answer to the original query.

Another special answer that the program recognizes in response to any query is SAVE. The user may type this answer to immediately store the data to the Study File. (This response is discussed further on p 15.)

Date Selection

Several user inputs are concerned with dates. The program accepts several formats for date representation, with month and year specifications forming the basic response. The user may enter the dates in any of the following forms: month number year, month number/year, month_alpha year. Year may be specified as two or four digits. For example, 6 86, 6 1986, 6/1986, JUN 86, and June 1986 are equivalent representations.

Another form of date entry can be specified as a decimal number of years from an implied previously entered date. For example, all dates associated with entering one-time costs or nonannual recurring costs that occur during the facility life have an implied beginning at the facility's Beneficial Occupancy Date. After accepting this form of date entry, the program calculates the appropriate month and year of the cost or benefit and displays this month and year as an option to the user. Note that entering 2.5 for this

date form is equivalent to stating that the date is 2 years, 6 months from the implied beginning date. The user need not calculate the exact fraction for the month; i.e., 2.4 is equivalent to 2 years, 5 months.

The date-related information necessary for each study are: Date of Study, Midpoint of Construction, Beneficial Occupancy Date, and Economic Life of the building or facility for which the study has been undertaken. The designer should estimate this information if it is not provided from the project management office.

Menu Selections

In creating the data to calculate LCC, some information must be known before other data can be entered. For example, the associated dates (Date of Study, Midpoint of Construction, Beneficial Occupancy Date, and Economic Life) must be selected before actual calculations can be completed. The program illustrates these data relationships by the concept of Expanding Menu selections. The user will not see a choice displayed on a menu until that choice can be entered in the data sequence. Menus of choices do not imply that each choice must be entered nor do they imply the sequence in which the desired choices should be entered. The Expanding Menu concept can best be described by an example. When the user begins a new study, the following choices are initially displayed to select the study parameters:

SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculation
<cr> = exit SELECT STUDY PARAMETERS

The obvious choice is for the user to enter C to answer the questions that allow the program to select the proper values to calculate the costs. Once this selection is complete, the program then displays the following (if the user chooses an energy related study):

SELECT STUDY PARAMETER Choices
C = Select Criteria for Cost Calculation
D = Select Key Study Dates
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs
T = Select Study Identification in Block
<cr> = exit SELECT STUDY PARAMETERS

The user may now enter more of the study-related data values.

Some features of the cost calculations do not apply to every study type. For example, if the study is not considering energy, the user selects NONE for energy applicability during criteria selection. In these cases, the menu of choices will not display the energy-related items to the user.

Criteria Selection

To select the proper values to perform the LCC calculations, the program asks several questions about the study. These questions will determine how the calculations

are performed. The user does not need to know the exact criteria to make the program do the proper calculations. The questions are:

1. What kind of project is this? (i.e., Military Construction Army, Military Construction Navy, Military Construction Air Force, Non-DOD Construction);

2. What agency is doing the design? (i.e., U.S. Army Corps of Engineers, Naval Facilities Engineering Command, U.S. Air Force, Other);

3. What significance does energy have on the study? (i.e., Significant, Incidental, None);

If energy is significant:

4. What is the primary study objective? (i.e., Selection of Best Conventional Design, Special Directed Study, or Energy Conservation Investment Program [ECIP]);

If Special Directed Study:

5. What kind of Special Directed Study? (i.e., Solar or Nonsolar).

Study Files

Each study is maintained as a stored file on the computer system where the LCCID Program executes. The user can then enter portions of the data related to the study (e.g., energy prices, alternative(s), criteria) in several sessions on the computer. After each session, the information is stored on the computer for later retrieval. Thus, the user must input a study code for identifying the stored data. This study code (or name) should be no more than five characters, of which the first should be alphabetic.

The program requests this study code at the beginning of each session or whenever the Next Study command is issued from the MAIN MENU. If the name entered identifies an existing study, the program automatically retrieves the study's file for revisions and additions. If the named study does not exist, the program will initiate a new study by that name. (When the program begins execution, it also begins counting the number of questions answered by the user. After every 50 user responses, the study file will automatically be stored in the computer. The user may also enter SAVE in response to any prompt, and the program will immediately store the data entered so far. Entering ABORT later will cause the computer to ignore any data entered since the last "auto-save" or SAVE command. When doing substantial work on a study, users should periodically issue the SAVE response.) Also, before entering the calculational portion of the program, this action will save the data in case some calculation (such as a divide by zero) causes the program to abort.

Output Reports

The reports produced by the program are designed to fit on 8-1/2 by 11-in. paper. The reports can be displayed directly onto the user's interactive terminal or stored in a file for later printing. If the reports will be displayed at the terminal, the program will allow the user to set the terminal to the top of a page before producing the report. At the end of the report, the page will be completed with blank lines so that the reports have no extraneous program output on the sheets. Reports stored for later printing contain carriage controls for normal printer operation.

These reports contain the information needed to submit an economic review of the design but are not considered complete documentation of the analysis effort. Examples of additional required material are:

1. Backup sheets, showing derivation of all basic input data used and/or appropriate references to such material.

2. Statement of and justification for all principal assumptions made.

The relevant criteria documents or standard practice of the agency issuing the report may contain a full checklist of material required for economic analysis submittal.

3 COPING WITH THE COMPUTER

The following instructions apply to the LCCID program as it is accessed on the Harris computer systems available in most Corps District and Division offices. Access procedures for other systems will differ and will be included as revisions to future editions of this report.

The following abbreviations are used throughout this report:

Carriage return is denoted by CR, or as <cr> in notations of actual output.

Computer response is prefaced by C:.

User response is prefaced by U:.

Explanatory material appears in brackets.

Using the LCCID Program

Executing the LCCID program requires the following basic steps. (Any questions regarding these procedures can be answered by the user's local ADP department.)

1. Start up your terminal and acoustic coupler.

2. U: [Dial the appropriate computer number and make the connection. Your ADP department will supply the actual procedure for connecting with the computer.]

3. The Harris system has a login prompt, for example:

   C: CERL VOS 3.1
   ENTER SIGNON

   U: [Signon for the Harris must be obtained from your local ADP department. They can also help you learn the Harris file system to delete studies, if desired.]

4. To execute the LCCID program:

   U: LCCID [If this does not work, check with your ADP department.]

5. A brief message relating to the program and USA-CERL will be displayed. Then:

   C: Instructions?

   U: Y CR [if you are using the program for the first time or want to see the basic program instructions]

   U: N CR [if you are familiar with the program]

6. When the program is ready to begin execution:

C: Enter Study Code>

U: [Type in desired study code.] CR

If the study exists, the LCCID program reads it into its internal data structure and proceeds to the MAIN MENU. For full compatibility with all computer systems, the study code should be one to five alphanumeric characters.

If the study does not exist (i.e., a new study is being initiated):

C: New Project?

U: Y CR [if it is a new project]

U: N CR [if it not a new project. In this case, the program allows another chance to enter the study code.]

C: Enter the existing study code to start, or CR if none

U: [Existing Study Code] CR [if you wish to begin this new study with previously entered data]

U: CR [if new study is to begin at the beginning]

7. The MAIN MENU choices will now be displayed. Following the Expanding Menu concept, the actual choices displayed will depend on the data entered so far (existing projects). The program execution (or session with the program) can now proceed as described in the Appendix. Chapter 4 provides details about the commands.

8. Saving. When the program begins execution, it also begins counting the number of questions answered by the user. After every 50 user responses, the study file will automatically be stored in the computer. The user may also enter SAVE in response to any prompt, and the program will immediately store the data entered so far. Entering ABORT later will cause the computer to ignore any data entered since the last "auto-save" or SAVE command. When doing substantial work on a study, users should periodically issue the SAVE response.

9. Signing off LCCID program. The program can be terminated by one of two actions:

a. If you wish to save the entered data from the MAIN MENU:

U: CR

C: [Repeats Study Code entered previously.] LC Saved
(Program Complete, e.g., TEST.LC Saved)

b. If you wish to terminate the session (all data entered since the last SAVE will be lost), at any point in the program:

U: ABORT CR

C: Program terminated

Use of the Keyboard

Responses to the program must always be typed and must be followed by a CR before the computer will interpret them.

Typing errors can be corrected in two ways:

1. To delete the entire response before completion (i.e., before typing CR), press the ESC (ESCAPE) key.

2. Depressing the H key while simultaneously depressing the CTRL key will backspace one space. If multiple spaces are backspaced, all characters that have been backspaced over, even the correct ones, must be retyped.

Frequently, the terminal may appear to stop and no longer accept user entries. This will occur most often during the output reporting phases. Computers know when output is being produced too rapidly for the terminal to keep up. When this happens, the computer or terminal will send a sequence of characters that restricts the flow of data so that no output data is lost (XOFF). Unfortunately, computers do not always know when to restart the data flow between the terminal and the host, and during such an overload the computer will no longer accept user commands. If this happens, depress the Q key while simultaneously depressing the CTRL key (XON). This will usually correct the problem. Depressing the S key while simultaneously depressing the CTRL key will send an XOFF to the computer, allowing you to slow down output to the terminal, if desired.

Occasionally, letters will appear on the terminal that are neither the user's response nor the computer's. This is caused by what is called "noise" and is attributable to some aberration in the phone and/or computer connection. When this happens, try the ESC key or check the entry later and correct it, if necessary.

If excessive "noise" problems occur, try to save the study file. Then sign off, hang up the phone, and try to reconnect with the computer.

CAUTION: The BREAK key will abort any program on the Harris. If the BREAK key is pressed, all parts of the session since the last SAVE will be lost.

Deleting Study Files

The study files (or study data bases) are stored in the computer's online storage. After a study is complete and no longer needed as an example for new studies, it may be deleted. The file name created for a study data base is the user-entered study code suffixed with ".LC." Thus, the command to delete study file (EXAM) would be:

$EL EXAM.LC

Repeat this command for each study file to be deleted.

Signing Off the Computer

Once the program is complete:

U: $OFF CR [will log you off the Harris system.]

4 DETAILED MENU AND COMMAND DESCRIPTION FOR LCCID PROGRAM

This chapter presents an overview of each menu used by the program. Since the program has extensive online help, only the basic details about the menus and associated commands are given. Actual guidance and instructions for responding to the questions will be available primarily in the online helps.

During initialization of values, the user typically responds to the program prompts. Since the same basic responses also appear after initialization, the program will usually display the current value when a choice is selected. A CR entry will typically retain the displayed choice as the value. To change the current value of an entry, the user merely types the new value in response to the program prompt.

General Menu Overview

There are three basic categories of program choices: selecting the parameters applicable to the study, defining or changing the cost figures for the study alternatives, and calculating and reporting on the life cycle costs of the alternatives.

Examples of parameters that apply to the entire study are the criteria for calculating life cycle costs, the location of the facility being studied, the energy prices to be used, and the dates that determine the timeframe of the costs.

The study consists of one or more alternatives. Each alternative has associated investment costs, possible energy consumption figures, annually recurring maintenance and repair costs, and other types of costs. For ease of reference, the program also allows user-supplied titles for many of the alternative data items.

The procedures for determining the life cycle costs of the study alternatives are based on user-selected criteria. This action sets up the basic data elements (discount rate, investment credit, payment time convention for frequently recurring costs) used during calculations. The available reports either display details of an alternative or compare the entered alternatives.

MAIN MENU Choices

The MAIN MENU is the outermost list of choices available to the user. This menu provides access to the program's general capabilities. When a new study is being entered, the following illustrates the allowable choices:

```
    MAIN MENU Choices
S = Select Study Parameters
N = Select Next Study
<cr> = exit PROGRAM
```

After selecting the study parameters, including the study dates, the allowable choices become:

```
    MAIN MENU Choices
S = Select Study Parameters
```

R = Select Non-fuel Cost Growth Values*
A = Define/Change Alternatives
N = Select Next Study
<cr> = exit PROGRAM

After defining one or more alternatives (e.g., selecting investment costs), choices become:

MAIN MENU Choices
S = Select Study Parameters
R = Select Non-fuel Cost Growth Values
A = Define/Change Alternatives
C = Calculate and Report Life Cycle Costs
N = Select Next Study
<cr> = exit PROGRAM

The S, A, and C choices are discussed in more detail on pp 20, 23, and 27-28, respectively.

R = Select Non-fuel Cost Growth Values

Cost growth values are escalation rates for costs which are expected to grow at a rate different than the general inflation rate. Since fuel escalation rates are established (and cannot be altered) for military construction studies, only non-fuel cost growth values are allowed for the general user. Non-fuel cost growth values may not be used in FEMP studies.

The user makes this selection from the MAIN MENU. The next display on the terminal will appear:

C: Enter non-fuel reference name or number.

The non-fuel escalation rates are keyed by a user-supplied name. A predefined selection titled NONE will always exist (escalation rate is zero). In response to the computer prompt, the user enters either a previous specified name or number or a nonexistent name or number. (LIST will display the items currently available.) If an existing name is entered, the escalation values will be displayed and the user can change the stored values (item NONE cannot be changed). Entering CR in response to this prompt exits back to the MAIN MENU. The user may enter values (either changing a previous value or entering a new one) in periods of years (similar to the fuel escalation rates) or as a year-by-year list of numbers. The algorithms used by LCCID require the values to be tied to a specific starting date--the same as the fuel escalation values for energy studies or the date of study for non energy studies.

N = Select Next Study

With this choice, the user saves the current study file and begins working on another study without leaving the program.

*For non-FEMP studies only.

SELECT STUDY PARAMETERS Choices

The SELECT STUDY PARAMETERS choices allow the user to select various items applicable to the entire study. When a new study is being defined, the choices appear to the user:

SELECT STUDY PARAMETERS Choices
C = Select Criteria for Present Worth Calculations
<cr> = exit SELECT STUDY PARAMETER

After selecting the criteria, the allowable choices become:

SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs*
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS

Note: For an ECIP project, the dollar input multiplier is fixed at none. Thus, M is not a choice during ECIP project study entry.

M = Select Dollar Input Multiplier

The user may choose to input his/her dollar values in different multiples of actual dollars; the choices are none, thousands, and millions. If this value is changed after dollar entries have been made, the entries are automatically changed to reflect the new multiplier.

The T and D choices are discussed on p 22.

ENERGY RELATED STUDY INPUT Choices

Energy related inputs are grouped under this menu. Selection of energy escalation values is based on Department of Energy (DOE) regions. DOD criteria dictate that industrial sector values be used. The source of these values is the DOE criteria, after approval from the agency sponsoring the study. During new study initialization, the allowable choices appear:

SELECT ENERGY RELATED STUDY Choices
S = Select DOE Region**
U = Select Energy Input Units
K = Select Energy Input Multiplier
<cr> = exit SELECT ENERGY RELATED STUDY INPUT

*If energy is considered significant or incidental.
**For non-DOD calculations, this reads: S = Select Energy Cost Growth Values.

After the DOE region (for standard DOD calculations) or location and fuel escalation rates (non-DOD calculations) are selected, the allowable choices become:

SELECT ENERGY RELATED STUDY Choices
S = Select DOE Region
U = Select Energy Input Units
K = Select Energy Input Multiplier
P = Select Energy Prices
<cr> = exit SELECT ENERGY RELATED STUDY INPUT

For ECIP projects, the energy input units are fixed at millions of Btus. Thus, after DOE region selection, the menu for ECIP projects appears as:

SELECT ENERGY RELATED STUDY Choices
S = Select DOE Region
P = Select Energy Prices
<cr> = exit SELECT ENERGY RELATED STUDY INPUT

S = Select DOE Region

When this selection is made, the user is asked to enter the state (location) of the study. (If LIST is used as a response, the program will display the DOE region numbers with associated states.) The user may enter the standard two-letter abbreviation for the state or any unique combination of letters that identifies that state. The program will search the list of allowable inputs and echo back its interpretation to the user for acceptance. If a nonunique combination is entered (i.e., MISS will catch both Missouri and Mississippi), the program will display the duplicate choices and request re-entry. Once the correct state is entered, the program will read the fuel types and fuel escalation values for the industrial sector into memory.

S = Select Energy Cost Growth Values (for Non-DOD Calculations)

This selection is used only for non-DOD project types. Here, the user may choose a DOE region and sector, if desired, to initialize the fuel types and fuel escalation factors. He/she may also enter each allowable fuel type and its associated escalation values, or a combination that begins with DOE sector values which are then added to or changed.

U = Select Energy Input Units

The user may input energy values in different units. For significant energy use, the unit choices are Btus or watts. If energy use is considered incidental, "Monetary" is an additional choice.

K = Select Energy Input Multiplier

The user may input energy values in different multiples of actual energy units: the choices are none, thousands, and millions. If the multiplier value is changed after the energy consumption entries have been made, the entries are automatically changed to reflect the new choice.

P = Select Energy Prices

When this selection is made, the allowable energy types are displayed in menu form, and the user may choose any energy type for price entry. If the project type is a

DOD project, the allowable energy types reflect the DOE industrial sector types: electricity, distillate oil, residual oil, natural gas, and steam coal. For non-DOD projects, the displayed energy types will reflect the user choices from the energy cost growth selections.

SELECT STUDY IDENTIFICATION BLOCK Choices

The SELECT STUDY IDENTIFICATION BLOCK is a set of titles that will appear on the output reports. When this menu is initially chosen, the user is prompted for each of the titles: Project Number, Fiscal Year, Project Title, Installation Name, Name of Analyst, and Study Design Feature. After initial entry, the user may change any or all of these, according to the menu of choices:

SELECT STUDY IDENTIFICATION BLOCK Choices
I = Re-enter All Study Identification Block Data
T = Specify Project Title
L = Specify Installation Name
P = Specify Project Number
F = Specify Fiscal Year
A = Specify Name of Analyst
F = Specify Design Feature*
<cr> = exit SELECT STUDY IDENTIFICATION BLOCK

SELECT KEY STUDY DATES Choices

The Key Study Dates are dates that set the timeframe of the economic study. The program prompts the user for each date: Date of Study, Midpoint of Design, Midpoint of Construction, Beneficial Occupancy Date, and Economic Life. User response should follow the date selection criteria presented on pp 10-11. The dates entered should be the actual study dates applicable to the project, regardless of the LCC calculation criteria to be used. Once the dates are entered, the user may change them, as desired:

SELECT KEY STUDY DATES Choices
I = Re-initialize All Dates
S = Date of Study
D = Midpoint of Design
M = Midpoint of Construction
B = Beneficial Occupancy Date
L = Economic Life of Building
<cr> = exit SELECT KEY STUDY DATES

If the user chooses to enter the dates as a decimal number of years, then (1) the date of the fuel escalation tables serves as the reference for the Date of Study, (2) the Date of Study serves as the reference for the Midpoint of Design, Midpoint of Construction, and Beneficial Occupancy Date, and (3) the Beneficial Occupancy Date serves as the reference for the Economic Life of the Building.

For ECIP projects, only the Economic Life of the Building may be input and must be less than or equal to 25 years for Army projects for Air Force projects. Actual Economic Life allowable is based on the ECIP project type as cited in the ECIP guidance.

*For non-ECIP projects.

DEFINE/CHANGE ALTERNATIVES Choices

Alternatives are the different cases that comprise the entire economic study. They are designated by alphabetic values in ascending order (i.e., A, B, C).

DEFINE/CHANGE ALTERNATIVES Choices
L = List Alternatives by Title
S = Define/Change Alternative Values
D = Delete an Alternative
<cr> = exit DEFINE/CHANGE ALTERNATIVES

For ECIP projects, the word "alternative" is synonymous with "discrete portion."

L = List Alternatives by Title

The list of alternatives already entered is displayed.

D = Delete an Alternative

The user may delete an alternative. Following a deletion, the remaining alternatives are automatically resequenced. For example, if there are three alternatives (A, B, and C), and the user deletes B, then alternative C will now be alternative B.

S = Define/Change Alternative Values

This choice allows the user to define or change the values for an alternative. The program displays:

Enter Alternative identifier or title.
Enter LIST to see defined Alternatives by Title
<cr> to exit Alternative Selection

If the user responds with an existing alternative identifier (e.g., B) or an existing title (e.g., INSULATION R=19), the program will allow changes or additions to the data previously specified. If the user responds with a nonexistent alternative identifier or title, the program will assume that a new alternative is to be entered. If previous alternatives have been entered, the user may choose to start the new alternative with the data from the previous alternative. This data consists of the normal set of choices for the alternatives:

DEFINE/CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair and Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs and Monetary Benefits
L = List Alternatives by Title
D = Delete This Alternative
<cr> exit DEFINE/CHANGE ALTERNATIVE VALUES

The V and E choices are discussed on pp 24-25.

M = Specify M&R and Custodial Costs

This selection is used to specify the maintenance and repair and the custodial costs for the study. These costs are considered to be annual recurring costs beginning at the Beneficial Occupancy Date and continuing through the building's Economic Life. Using this selection sends the program into the Annual Values choices section, but retains the information that the type of cost being entered is maintenance and repair or custodial.

R = Specify Major Repair and Replacement Costs

This selection is used to specify the major repair and replacement costs for the study. These costs can be either one-time costs at a specific date after the Beneficial Occupancy Date or periodic costs beginning after the Beneficial Occupancy Date and recurring at some increment of time. Choice of the cost occurrence type (i.e., one-time or periodic) sends the program into the appropriate cost category section, but retains the information that the kind of cost being entered is "Major Repair and Replacement."

S = Specify Net Disposal Cost or Retention Value

This selection specifies the net disposal cost or retention value of building systems removed or replaced during the study period, remaining at the end of the study period, or recovered through resale at the end of the study period. A single value is allowed per alternative with an assumed occurrence at the end of the building's economic life.

For ECIP projects, this value is assumed to be the net disposal cost of existing equipment and has an assumed occurrence at the beginning of the analysis period.

O = Specify Other Costs and Monetary Benefits

This selection specifies other costs or monetary benefits that do not fit the previous categories. These costs can be entered as one-time costs, periodically recurring costs, or annually recurring costs. Choice of the cost occurrence type (i.e., one-time, periodic, or annual) sends the program into the appropriate cost category section while retaining the information that the kind of cost being entered is "Other Costs and Monetary Benefits."

INITIAL INVESTMENT COST Choices

For most study types, the user may choose between specifying the initial investment costs as one amount or as separate amounts--construction, design, and supervision, inspection, and overhead (SIOH). For ECIP projects, the user must specify construction, design, and SIOH costs. After making the choice, the user enters the desired costs and associated dates. The costs are entered in their full amounts, without regard to possible investment credits allowed by the criteria. When calculating the life cycle study costs, the program will figure in the allowable investment credits. The assumed date for these costs is the midpoint of construction--following standard DOD practice.

ENERGY USAGE VALUES Choices

This selection allows the user to specify average annual consumption of the various fuels. Over the economic life of the study, the user may specify up to three different

consumption values for each fuel type. After entering the first value, the user is asked if that specific annual consumption rate continues through the end of the economic life. If the response is affirmative, only one consumption figure is used; if it is negative, the user is then prompted for the ending dates of each consumption amount. Any date entered that occurs later than the end of economic life will be truncated to the date corresponding to the project's life. The user may also enter the electric peak values at this menu (used in conjunction with previously entered electric demand charge). If the user enters a fuel consumption amount for which a price has not been selected, the program will issue an appropriate warning message.

Three allowable cost choices are allowed as outlined under the M, R, and O commands for this section. As stated during that discussion, costs may be annual, one-time, or periodic depending upon the cost type. The following commands describe how these cost types are used. It should be noted that each cost is stored in the study data base by cost type (M, R, O), by frequency (annual, one-time, periodic) and by alternative.

ANNUAL VALUES Choices

This selection allows the user to specify either maintenance and repair costs or an annual recurring other cost. The user can also list all previously entered annual values or delete any specific item of the same cost type.

SPECIFY ANNUAL VALUES Choices
L = List Annual Values for This Alternative by Title
S = Define/Change Annual Values
D = Delete an Annual Value
<cr> = exit SPECIFY ANNUAL VALUES

If S (Define/Change Annual Values) is chosen, the following is displayed:

Annual Value for Alternative <title is displayed>
Enter Existing Annual Value number or title
Enter LIST to see defined Annual Values by Title
Enter 0 to begin defining a new Annual Value
<cr> to exit entering Annual Values

If an existing number or title are entered, the user can change the annual amount. Note that zero (0) must be entered to specify new annual value amounts.

NON-ANNUAL RECURRING VALUES Choices

This selection allows the user to specify either major repair and replacement costs or a periodically recurring other cost. The user also has the chance to list all previously entered non-annually recurring values or delete any specific item of the same cost type.

SPECIFY NON-ANNUAL RECURRING VALUES Choices
L = List Non-annual Recurring Values for this Alternative by Title
S = Define/Change Non-annual Recurring Values
D = Delete a Non-annual Recurring Value
<cr> = exit SPECIFY NON-ANNUAL RECURRING VALUES

If S (Define/Change Non-annual Recurring Values) is chosen, the following is displayed:

Non-annual Recurring Value for Alternative <title>
Enter Existing Non-annual Recurring Value number or title.
Enter LIST to see defined Non-annual Recurring Values by Title
Enter 0 to begin defining a new Non-annual Recurring Value
<cr> to exit entering Non-annual Recurring Values

If an existing number or title is entered, the user can change the Non-Annual Recurring Value amount. Note that zero (0) must be entered to specify new Non-annual Recurring Value amounts.

Once the dollar amount is entered, the program will need information about the first time this cost is incurred as well as how often it recurs. Thus, the program requests:

When does this cost first occur (years since BOD)?

The user should respond with the number of years (or actual date) after the Beneficial Occupancy Date that designates the occurrence of this cost. Then, the program requests:

How often does this recur (years)?

The user should respond with how often (in years) this cost recurs.

ONE-TIME VALUES Choices

This selection allows the user to specify either major repair and replacement costs or another cost that occurs only once during the study period. The user can also list all previously entered one-time values or delete any specific item of the same cost type.

SPECIFY ONE-TIME VALUES Choices
L = List One-time Values for this Alternative by Title
S = Define/Change One-time Values
D = Delete a One-time Value
<cr> = exit SPECIFY ONE-TIME VALUES

If S (Define/Change One-time Values) is chosen, the following is displayed:

One-time Value for Alternative <alternative title is displayed>
Enter Existing One-time Value number or title.
Enter LIST to see defined One-time Values by Title
Enter 0 to begin defining a new One-time Value
<cr> to exit entering One-time Values

If an existing number or title is entered, the user can change the one-time amount. Note that zero (0) must be entered to specify new one-time value amounts.

Once the dollar amount is entered, the program will need information about the time over which this cost is incurred. Thus, the program requests:

When does this cost occur (years since BOD)?

The user should respond with the number of years (or actual date) after the Beneficial Occupancy Date that designates the occurrence of this cost.

CALCULATE & REPORT LIFE CYCLE COSTS Choices

This selection allows the user to calculate the life cycle costs of each alternative and to display various reports. When this selection is chosen, the program displays:

CALCULATE & REPORT LIFE CYCLE COSTS Choices
B = Select the Baseline Alternative
I = Individual Alternative Summary Reports
C = Alternative Comparison Summary Reports
<cr> = exit CALCULATE & REPORT LIFE CYCLE COSTS

B = Select the Baseline Alternative

For certain calculations (i.e., Savings to Investment Ratio, Discounted Payback Period), the program must have an identifiable baseline alternative. When this item is chosen, the program will ask the user to enter the identifier of the desired baseline alternative. The user may then display the desired reports and may later choose another alternative as the baseline.

I = Individual Alternative Summary Reports

This choice provides a summary report that details all the basic input data applicable to an alternative. In addition to user-specified values, the report will have various details used in the cost calculations (i.e., discount rate, projected dates). When this selection is chosen, the program displays:

Enter Existing Alternative identifier for the report
Enter 0 to report on ALL Alternatives
Enter LIST to see defined Alternatives by Title
<cr> to exit Input Summary Reports

Two optional reports are available for individual alternatives. The first, the escalation values report, will display the assumed escalation rates for each cost type. Refer to the R command in the Main Menu for further information about optional escalation rates. The second optional report, the year-by-year incremental report, will display year-by-year amounts for each energy and cost type from BOD to end of Economic Life.

The user may enter a single alternative identifier (i.e., A) or zero (0) to select the alternatives to be displayed. The program then displays:

Enter Y to display optional escalation values report.

After the response to this:

Enter Y to display costs in year-by-year increments.

Both of the preceding reports are optional. The standard input summary reports will be produced whenever this item is selected.

Finally, the program is ready to produce the reports:

Output report to terminal?

The user should respond affirmatively if the report should be printed directly on the interactive terminal.

Output report to standard file (printer format)?

The user should respond affirmatively if the report should be directed to a temporary file for later printing on an available high-speed printer.

If the user elects to have the report printed at the terminal he/she should set the paper to the top line of the page, and CR when ready. The program is set up to produce 8-1/2-by 11-in. sheets. To do this, it assumes 66 lines on an 11-in. page. Since the output reports will frequently be longer than a single page, the user must physically set the paper to the top line of the first page so that all the copy will fit; the remaining pages will automatically be spaced for proper format.

C = Alternative Comparison Summary Reports

Besides LCC data about a single alternative, the program can produce summary reports that display information comparing all alternatives specified in the study. The user may elect to have Savings to Investment Ratio and Discounted Payback Periods (standard for solar studies) displayed.

The actual output display follows the page setup outlined in the Individual Summary Reports section above.

5 ALGORITHMS AND TERMS

This chapter describes various algorithms and terms used by the program and in the output reports. The algorithms and terms are consistent with those in general use today throughout the Military Construction (MILCON) design community and with those used in current, official Army documents (e.g., ETL 1110-3-332 and Technical Manual TM 5-802-1 Draft[7]).

Basically two different types of criteria packages govern the conduct of life cycle costing studies in connection with the design of facilities in the MILCON program. The first, which deals with special energy studies directed by statute (for both general energy conservation and for utilization of renewable energy resources), is based on the provisions of the Code of Federal Regulations (10 CFR 436A). The second, which covers most other applications, is based on the provisions of OMB Circular A-94.[8] These criteria packages are covered in ETL 110-3-332, Part II (Paragraphs 2 and 3) and Part I, respectively. Table 1 provides a summary of the key provisions of these two criteria packages.

The LCCID program uses the provisions in Table 1 as the key elements for calculating the life cycle costs. Standard formulae, as described later in this chapter, form the basis for the calculations. Other parts of Table 1 become values of variables in these formulae depending upon the type of criteria (A-94 or FEMP) being used. Following Table 1 item by item, the usage is:

1. PW discounting--a variable with values of 0.10 and 0.07 are used for A-94 and FEMP calculations, respectively.

2. Analysis Base Date (ABD)--the user-entered Date of Study is used for Army and Air Force Studies governed by A-94, the user-entered Midpoint of Construction is used for Navy Studies governed by A-94, and an Artificial Standardized Date (the base date of the escalation rates from DOE) is used for FEMP calculations. The user always enters the actual project dates as though the A-94 procedure were to be used; the LCCID program determines which artificial dates are appropriate for FEMP calculations and makes the necessary adjustments internally.

3. Analysis Period--the user-entered Economic Life value is used as the basis for determining the analysis period. Economic Life values in excess of 25 years require special approval prior to use.

4. Constant Dollars--dollar amounts used reflect the purchasing power of the dollar at the time of ABD.

5. Energy Escalation Rates--DOE supplies values for energy escalation on a periodic basis. DOD criteria use the values from the Industrial Sector for the DOE region of the facility. The LCCID program uses an on-line data file which has the values

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[7] ETL 1110-3-332, *Economic Studies* (OCE, 22 March 1982); Technical Manual (Draft) 5-802-1, *Economic Studies for Military Construction Design—Applications* (Department of the Army).

[8] *Office of Management and Budget (OMB) Circular A-94* (Executive Office of the President, March 27, 1972).

Table 1

Key Provisions of Principal Criteria Packages Used for Determining Life Cycle Costs in MILCON Design Applications

	Basic Source of Criteria Package	
	FEDS[a]:OMB A-94	FEMP[b]:10CFR 436A
Standard PW discounting	10%	7%
Analysis Base Date (ABD)	Air Force & Army: Date of Study Navy: Mid-Construction	Artificial Standard Date
Analysis Period	Economic Life or 25 years[c]	Economic Life or 25 years[c]
Constant Dollars	ABD	ABD
Energy Escalation Rates	Per DOE	Per DOE
Cash Flow Basis[d]	Mid-year	End of year
Investment Credits	0%	10%
Nonenergy Escalation Rates	User Option	0%

[a]Federal Standard (FEDS)
[b]Federal Energy Management Program (FEMP)
[c]Whichever is less, measured from Beneficial Occupancy Date (BOD)
[d]Time of Cost for lumping frequently occurring costs (more than once per year)

for all DOE regions and sectors. During data entry, the user must enter the state which specifies the DOE region of the facility. The program then retrieves the appropriate values from the on-line file and stores them in the program's memory.

6. Cash Flow Basis--a variable with values 0.5 (mid-year) and 1.0 (end of year) are used.

7. Investment Credit--a variable with values of 0.0 and 0.10 are used.

8. Non-energy Escalation Rates--user-specified differential escalation rates may be specified for studies governed by A-94 calculations. The user will enter appropriate values beginning at the same date as the DOE energy escalation values (i.e., the FEMP ABD). For FEMP calculations, the program ignores these values, as required.

The above descriptions apply to all DOD energy studies. For DOD nonenergy studies, the A-94 procedure is always used and the DOE escalation value date is not known. In this case, the program uses the user-supplied Date of Study as the base date for item 8--the non-energy escalation rates. All other items from the FEDS:A-94 column apply.

For non-DOD studies, the user specifies items 1, 6, and 7 during criteria selection. During study date selection, the user is asked for the analysis base date for discounting purposes and for the reference date of costs such as maintenance and repair, replacement, salvage (usually Beneficial Occupancy Date). For non-DOD energy studies, the user may retrieve the DOE escalation values for any sector as the initial differential escalation rates; the FEMP ABD is then used as the base date for all energy and non-energy escalation values. For non-DOD, nonenergy studies, the user-supplied ABD is used as the base date for any nonenergy escalation values.

Two forms of energy escalation rates are currently being published from DOE. In the first form, yearly fuel price indices are assigned. In the second form, periods of equal escalation value are assigned (e.g., 1985-1990). These escalation periods are calculated from the yearly fuel price indices. The LCCID program can accept either form as assigned by the user and it stores the values yearly as escalation rates.

Present Worth Formulae

Present worth formulae are used to calculated the present-worth-equivalent values (at ABD) of future cash flow transactions (costs, income). Terms basic in the formula are (from Table 1): discount rate, escalation values, and cash flow basis time. The LCCID program uses the following procedures:

For a specific, nonescalating, one-time cost:

$$PW_{One\text{-}Time} = Cost_{ABD} / (1+d)^n \qquad \text{[Eq 1]}$$

where d is the annual discount rate
n is the number of years, expressed in decimal, from the time of cost occurrence to ABD.

For a specific, constant escalating, one-time cost:

$$PW_{One\text{-}Time} = Cost_{ABD}\, v^n \qquad \text{[Eq 2]}$$

where v^n is $[\,(1+e)/(1+d)\,]^n$ and e is the rate of differential escalation.

For a specific, variably escalating (k periods), one-time cost:

$$PW_{One\text{-}Time} = Cost_{ABD} \left[SUM_{j=1..n1} (v^j) + v^{n1}\, SUM_{j=1..n2}(v^j) + \ldots + v^{n1}\, v^{n2} \ldots v^{nk-1}\, SUM_{j=1..nk} (v^j) \right] \qquad \text{[Eq 3]}$$

where n_1 is the number of years for which escalation e_1 applies.

For annually recurring costs:

$$PW_{Annual} = SUM_{j=1..N} (PW_{One\text{-}Time} \text{ for cash flow payment } _j) \qquad \text{[Eq 4]}$$

where cash flow payment occurs at mid-year or end of year.

Equivalent Uniform Differential Escalation Rate

This term is found on the individual output summary reports. The equivalent uniform differential escalation rate for any given annually recurring cost series (or one-time cost) is that constant rate of differential escalation that would yield the same present worth equivalent value for the cost series (or one-time cost) as would the actual projected differential escalation rate(s). If the LCCID program cannot calculate this value, the output field will appear as all asterisks (*).

Savings to Investment Ratio (SIR)

This term is found on the comparison summary reports. The savings to investment ratio (SIR) is calculated by comparing two alternatives. Usually, this calculation is performed between an energy saving investment alternative and an existing or non-energy saving alternative (considered baseline). The SIR is automatically calculated for SOLAR studies; for nonsolar studies, the user may optionally choose to see the SIR. The formula used in the LCCID program is consistent with the formula in the Federal Energy Management Program (FEMP):

$$SIR = \frac{(\Delta\ [Energy] - \Delta\ [M\&R])}{(\Delta\ [Investment] - \Delta\ [Salvage] + \Delta\ [Other])} \qquad [Eq\ 5]$$

where Δ [Energy] is the present worth amount of reduction in energy costs (i.e., Considered Baseline Alternative Energy minus Energy Savings Alternative Energy);

Δ [M&R] is the present worth amount of Non-fuel Operation and Maintenance Costs (i.e., M&R of Energy Saving Alternative minus M&R of Considered Baseline Alternative). In the terms of the LCCID program, these are usually referred to as M&R - maintenance and repair;

Δ [Investment] is the amount of differential investment (i.e., Investment of Energy Savings Alternative minus Investment of Considered Baseline Alternative);

Δ [Salvage] is the amount of differential salvage (i.e., Salvage of Energy Saving Alternative minus Salvage of Considered Baseline Alternative);

Δ [Other] is the amount of differential replacement and other costs (i.e., Costs of Energy Saving Alternative minus Costs of Considered Baseline Alternative).

Discounted Payback Period

The term discounted payback period (DPP) is found on the comparison summary reports. Similarly to the SIR, it is usually calculated between a baseline alternative (Existing or Non-energy) and an investment (Energy Savings). The discounted payback period is the number of years required to recoup an investment through the net savings it provides, with the time value of money and future price level changes taken into account. This number of years is measured from the BOD and, if used for the analysis period of the LCC analysis, would result in an SIR of 1.0. The DPP calculation procedure used by the LCCID program follows this approach: a trial analysis period is computed, and then an SIR is computed for this period; if the SIR is not close enough to 1.0, a new trial analysis period is calculated and a new SIR found. These steps are repeated until an

SIR of 1.0 is obtained or until the LCCID program determines that the investment will not pay back within the economic life of the study. The DPP is automatically calculated for SOLAR studies; for nonsolar studies, the user may choose to calculate the DPP. If the initial SIR calculated for the investment alternative is not greater than 1.0, LCCID will not attempt DPP calculations. If no DPP is found, the field on the output reports will appear as all asterisks (*).

Baseline Alternative

Baseline alternative is the term used by the LCCID program to represent the alternative for comparisons as described above. The user is required to choose a baseline alternative before comparison reports may be viewed. In the comparison reports, the alternative with the least investment cost is chosen as the baseline for comparisons. However, the user may optionally choose to see these comparisons with the user-selected baseline.

6 LCCID PROGRAM FIELD TEST

In November 1984, field testing of the LCCID program began at the Corps' Kansas City and Omaha Districts, both of which were serving as alpha test sites for the software. The two Districts helped develop the program user interface by suggesting phrasing, online helps, and program execution flow. Program validation and actual design alternative calculations were not part of the test; although the Kansas City District appears to have accepted the program as part of standard operating procedure for design life cycle cost calculations.

Designers had to use the program without benefit of a user's manual and with little instruction. Since field testing was concurrent with most of the program development, initial user comments were implemented directly into the program and tested fairly quickly. Incorporation of these comments has made the program more user-friendly.

The field test results illustrated the success of the menu-driven approach to interactive programs and several suggestions from the test sites were incorporated into the final program. Since the output from the calculations can be submitted as part of the design review, a suggestion from the Omaha District was incorporated to control the output so that it fits neatly onto an 8-1/2 by 11-in. sheet of paper. Also, their suggestion for wording of the online help message for entering dates was incorporated.

Additional suggestions considered included (1) having minimal necessity for the user's manual and maximal implementation of constructive online helps, (2) providing necessary validation of the calculations so that assurance of results is guaranteed as much as possible, (3) helping the user find difficult information (e.g., maintenance and repair costs), (4) assuring that reviewers understand the reports produced, and (5) assuring that calculational procedures and required data are updated as necessary. Each of these suggestions were used as much as possible in the program's development. Other items requested that may be addressed in future versions include (1) verification of user intent when exiting the program, resetting data values, or when any other time major data undertaking occurs, and (2) showing current values for items as part of menu selections.

One need stressed by the field test was to have this program in a form that can be given to the Architect-Engineer (A/E) firms under contract to the Districts. Since most A/E firms seem to have at least personal-sized computers, development of a microcomputer version of the program was accelerated.

The LCCID program was extensively tested at USA-CERL to verify the results produced. These test cases form the standard cases for verifying future or different versions of the program. The source code of the program will be made available to software vendors who may modify the program to fit their needs as long as the tests can still be benchmarked.

In general, the field test to date has been very successful. Designers feel comfortable with the program's approach to the user as well as with the output produced.

7 MICROCOMPUTER IMPLEMENTATION

Partially as a result of the field test and partially as a result of increasing availability of microcomputers to all organizations, an effort was made to convert this computer program to execute on an MS-DOS* based microcomputer. Since the program had been written in Fortran 77, a similar microbased compiler was used (Microsoft Fortran 3.3*). This conversion was easily achieved.

Principal changes required to the code included modifying data base retrieval and storage, simplifying some complex output statements, and changing FORMAT statements into arrays to accommodate the micro version's structure of the executable program. The original conversion was done on an INTEL 8086** based microcomputer and has been shown to execute correctly on any IBM‡ compatible (or INTEL 8086/8088/80186/80286 based) microcomputer.

Once the initial microcomputer version had been tested, several minor enhancements were added to aid the microcomputer user:

1. An installation procedure to tailor the file locations to the specific user

2. The option of using LIST as a response to request for file names, which will display names of files on the user's disk

3. A procedure allowing entry of file names as output for the reports, thus allowing the user to tailor the output for his/her printer using a text editing or word processing system of choice.

*MS-DOS and Microsoft Fortran 3.3 are trademarks of Microsoft Corporation.
**INTEL is a registered trademark of Intel Corporation.
‡International Business Machines Corporation.

8 SUMMARY

This report has documented the development of and provided basic user instructions for the Life Cycle Cost in Design computer program that provides Army designers with the capability to perform life cycle cost energy analysis for new military facilities. The program will be implemented on the Corps timesharing vendor as well as on the Harris computers. As described in Chapter 7, the program will be available on Intel 8086 compatible microcomputers.

The designer gives the program instructions by issuing commands at an interactive terminal. Many user responses can be indicated by a "yes" or "no," which makes the program easy for a person inexperienced in computers to use. A series of menu selections allows the user to choose from among several parameters to best define his/her project.

Each study is maintained as a stored file on the computer for later retrieval. Completed reports are provided either directly on the user's terminal or printed out on paper. The reports contain much of the information needed for an economic review of a design.

The program has been successfully field-tested at two Corps Districts, with user comments incorporated to improve the program. Field testing will continue with each version of the program. Expected enhancements for the next version include sensitivity analysis, extension of allowable energy types, and spreadsheet type input and output.

The body of this report can be used as the basis of a user's manual. Chapter 3 can be rewritten for the specific computer sy_tem to be used.

REFERENCES

DOD 4270.1-M, *Construction Criteria Manual* (Department of Defense, December 15, 1983).

Energy Conservation Investment Program (ECIP) Guidance, Multiple-Address Letter from the Office of the Chief of Engineers (4 March 1985).

Engineer Technical Letter (ETL) 1110-3- (Draft), *Energy Conservation Design (Including Design Energy Targets* (Office of the Chief of Engineers [OCE]). Note: This will replace ETL 1110-3-309.

ETL 1110-3-332, *Economic Studies* (OCE, 22 March 1982).

ETL 84-2, *Computer Energy Analysis* (Department of the Air Force, 27 March 1984; Change 1, 16 May 1984). Augmented by multiple address letter from LEEEU (1 Apr 85).

ETL 1110-3-309, *Interim Energy Budgets for New Facilities* (OCE, 30 August 1979).

Life-Cycle Costing Manual for the Federal Energy Management Program, Handbook 135 (National Bureau of Standards, December 1980).

Office of Management and Budget (OMB) Circular A-94 (Executive Office of the President, March 27, 1972).

Technical Manual (Draft) 5-802-1, *Economic Studies for Military Construction Design—Applications* (Department of the Army).

APPENDIX:

EXAMPLE SESSION(S) AND OUTPUT EXAMPLES

The following examples illustrate the use of the LCCID program. The following conventions are used:

User-entered carriage return is denoted by CR.
User response is prefaced by U:
User actions for use with printers are shown in italics.

The examples are:

1. A 'teach' example illustrating all the online help messages. A complete alternative is defined.

2. Using the base alternative in example 1, define another alternative and report the results.

3. An example illu trating the incremental capabilities of LCCID.

4. An example illustrating the ECIP entries.

5. Using the alternatives in example 3, change the criteria to SOLAR and report.

In all the examples, the text shown is representative of the LCCID execution but, since computer programs continually change, the actual execution may be slightly different.

EXAMPLE 1.

```
Instructions ?
U:y
   This is the LIFE CYCLE COST IN DESIGN Program.  It allows you to
   calculate building life cycle costs using DOD criteria.  It has
   built in calculation procedures for Army, Navy, Air Force, and ECIP
   criteria.  The program allows you to select options from Menu(s) of
   items.  Each MENU item may lead into questions to be answered (known
   as 'PROMPTS') or into other MENUs.

   The program can help you as you go along.  To receive this help, all
   you need to do is enter some special words (or single characters):
   Enter:
      HELP or @  - To SHOW how the question pertains to LCC
                   and to display hints on allowable answers.
      LIST or ?  - To DISPLAY a LIST of allowable inputs.
      TEACH      - To begin seeing all the help messages before
                   entering your response.
      SAVE       - To save the Study File from any prompt.

   Also, if you get lost or feel you have made too many mistakes, type:
      ABORT - To TERMINATE the program without saving any
                   information since the last SAVE or Auto-save.
```

```
Enter LCC Study Code>
U:teach
Enter LCC Study Code>
   This is an identifier used to save the Study entries for recall
   in a subsequent execution of the program.

U:examl
New LCC Study?
   The computer could not access the study specified by the entered study
   code.  If that was what you expected, type Y or YES as a response.
   If you thought that study existed, type ABORT (which will immediately
   exit the program) and figure out why you can't access that study.

U:y
Enter existing LCC Study code to start with
  or press return if none
   If you have entered most of the data for this new LCC study in a
   previous study, you may begin with that study by entering that
   study code here.  You may then change or delete items as desired
   for the new study.  If you do not have a previous study to use as
   a starting point, press the RETURN key.

U:  CR
    MAIN MENU CHOICES
S = Select Study Parameters
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
   For a new study, you may choose S to begin defining the parameters
   of the Study.  Later, you will have more choices available in this
   Menu.  Or you may choose N to revise, define, or report on another
   Study. Entering <cr> will exit the program, saving the study data
   so far.

U:s
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
<cr> = exit SELECT STUDY PARAMETERS
   The first Study parameter defined in a new study is the selection
   of criteria.  After setting up the criteria choices for proper
   cost calculations, you will have more choices available at this
   menu.  Type C to begin criteria selection.

U:c
Criteria Package Selection

Enter Project Type of the Study.
 1 = Military Construction Army (MCA)
 2 = Military Construction Navy (MCN)
 3 = Military Construction Air Force (MCAF)
 4 = Non-DOD Construction (NON-DOD)
```

```
   The Program funding, i.e. MCA, helps determine the economic criteria
   or methodology required for this study. If you Type 1 this study will
   be conducted using ARMY ETL 1110-3-332. Type 2 and the methodology
   will conform to NAVY economic criteria. Type 3 to conduct a study
   complying with AIR FORCE ETLs. Type 4 to select a general economic
   analysis methodology similar to commercial practices.

U:1

Enter Significance of Energy on the Feature being studied.
 1 = Energy Effects Significant or Primary (SIGNIFICANT)
 2 = Energy Effects Incidental (INCIDENTAL)
 3 = Energy Effects Not Applicable (NONE)
   The economic criteria for studying energy conservation alternatives
   may be different than those for studying other design features. If
   the primary purpose for conducting this study is to compare the
   economic consequences of energy consuming design features, type 1.
   If the alternatives being studied involve energy consuming features
   but include comparisons of nonenergy features as well, type 2.
   If the alternatives being analyzed will not impact the energy
   consumption of the completed project, type 3. In the latter case
   the program will bypass all input/output requirements relating to
   energy.

U:1

Enter Primary Study Objective.
 1 = Selection of Best Conventional Design (CONVENTIONAL)
 2 = Special Directed Design Study (SPECIAL DIRECTED)
 3 = Retrofit Energy Conservation Investment Program (ECIP)
   If this study is evaluating one or more conventional design
   features such as VAV vs fan coil units, type 1. If the study
   arises because of a statutory requirement to either evaluate
   solar or nonsolar extraordinary features or to perform an
   ECIP study, type 2. Also consult Air Force ETLs and Army
   criteria as necessary for help in these definitions.

U:1
This study is based on a project type of MCA
The effect on energy of this study is SIGNIFICANT
The primary study objective is the Selection of
the Best Conventional Design.
The Life Cycle Costs for this study will be calculated
based on the FEDS/A-94 criteria -- the standard federal
criteria package specified in OMB circular A-94.
(Army ETL 1110-3-332, Part I)
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
```

If this is a new study not based on an existing study, complete all menu items. If this is a study which reuses data input from a previous study, type the letter corresponding to the parameters, if any, that you want change. The input parameters may be called up in any order.

U:d
** Begin date initialization procedure.
Enter actual dates for your building. **

Enter Date of Study (Month Year)
Enter the date (month and year) of the date of study (e.g. NOV 84). Use today's date unless you want to keep the date of a previous study. The date you type here will be used as the date to which all costs and savings will be discounted to for non-FEMP studies. For FEMP studies the program will automatically use the appropriate Analysis Base Date during calculations.

U:oct 85
Enter Midpoint of Construction (Month Year)
Enter the date (month and year) of the midpoint of construction. You may also enter an integer or decimal number of years (e.g., 2.5 is 2 years 6 months) and the date will be calculated from the previously entered date of study.
You may later elect to enter all your design and construction costs as one lump sum initial investment cost. In that event the design and construction costs (for non-FEMP studies) will all be discounted from the this date to the Date of Study.

U:1 87
Enter Beneficial Occupancy Date (Month Year)
Enter the date (month and year) of the building occupancy. You may also enter an integer or decimal number of years (e.g., 2.5 is 2 years 6 months) and the date will be calculated from the previously entered date of study.
This date is when you estimate the building will be ready for occupancy by the user. The program uses this date on non-FEMP studies to start the economic life of the study period. For FEMP studies the economic life commences at the analysis base date, ABD, but the program uses the actual date along with the end of economic life as projections.

U:1/89
Enter Economic Life of Building (Years from BOD)
Enter the number of years in the economic life of the building. (e.g., 25) The proper ending date will be calculated from the previously entered Building Occupancy Date and displayed for your acceptance. You may also enter the ending date (month and year) for this value (e.g., JAN 2010 or JAN 10)
For FEMP studies the ending date for the economic life will be computed from the analysis base date instead of the BOD since FEMP criteria assumes all initial investment costs occur on the analysis base date.

```
U:25
Calculated Month/Year JAN 2014?
   If this date is incorrect, enter N to reenter the proper value.
   To accept this date, enter Y or <cr>.

U:y

** Initialization of dates complete.
Dates can now be changed, if desired, or exit this menu.
    SELECT PROJECT DATES Choices
I = Re-initialize All Dates
S = Date of Study
M = Midpoint of Construction
B = Beneficial Occupancy Date
L = Economic Life of Building
<cr> = exit SELECT PROJECT DATES
   To view the current values for a specific project date, type the
   appropriate letter. Dates may be changed if desired. Type <cr>
   if you are satisfied with the dates previously entered.

U:  CR
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
   If this is a new study not based upon an existing study complete
   all menu items. If this is a study which reuses data input from a
   previous study type the letter corresponding to the parameters, if
   any, that you want change. The input parameters may be called up in
   any order.

U:m
Currently, Dollars are entered as Thousand(s)Dollars.
Enter the appropriate code for the dollar multiplier now.
Enter Costs / Benefits Input Multiplier
 0 - Costs / Benefits entered in Dollars
 1 - Costs / Benefits entered in Thousand(s) Dollars
 2 - Costs / Benefits entered in Million(s) Dollars
<cr> - Costs / Benefits entered in Thousand(s) Dollars
   The dollar multiplier you select will be used in all the
   calculations. Input and output on the reports will in terms
   of this multiplier as well. Make sure you express all your dollar
   input reduced to this multiplier.

U:0
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs
```

```
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
   If this is a new study not based upon an existing study, complete
   all menu items. If this is a study which reuses data input from a
   previous study, type the letter corresponding to the parameters, if
   any, that you want change. The input parameters may be called up in
   any order.

U:e
    SELECT ENERGY RELATED STUDY INPUT Choices
S = Select DOE Region
U = Select Energy Input Units
K = Select Energy Input Multiplier
<cr> = exit SELECT ENERGY RELATED STUDY INPUT
   If this is a new study not based upon an existing study, complete
   all menu items. If this is a study which reuses data input from a
   previous study, type the letter corresponding to the parameters, if
   any, that you want change. The input parameters may be called up in
   any order.

U:s
Enter study location (State)
   Differential escalation rates for fuels used in this program
   are those stated in FEMP tables. These tables are updated as
   new ones are issued by DOE. The program will select the correct
   values for you and print them out in the reports for your review.
   Type in the state in which the project is being built to direct
   the program to the correct part of these tables. Type LIST to view
   the state by state table for DOE regions.

U:list
Region  1. MA  NH  VER  MASS  CONN  RI
Region  2. NY  NJ  Puerto Rico  Virgin Is
Region  3. PENN  MD  W VA  VA  DC  DEL
Region  4. KY  TEN  NC  SC  MISSI  AL  GA  FL  Canal Zone
Region  5. MINN  WI  MICH  ILL  IN  OH
Region  6. TX  NM  OK  ARK  LOU
Region  7. KAN  MO  IOWA  NEB
Region  8. MONT  ND  SD  WYO  UTAH  COLO
Region  9. ARIZ  CAL  NEV  HA  Pacific Is  Samoa  Guam
Region 10. WASH  OREG  IDAHO  ALASKA
Region 11. US Average use or OCONUS
Enter study location (State)
   Differential escalation rates for fuels used in this program
   are those stated in FEMP tables. These tables are updated as
   new ones are issued by DOE. The program will select the correct
   values for you and print them out in the reports for your review.
   Type in the state in which the project is being built to direct
   the program to the correct part of these tables. Type LIST to view
   the state by state table for DOE regions.

U:miss
Your input MISS matched more than one choice
```

```
It matched --
Abbrev. MS  Full: MISSISSIPPI
Abbrev. MO  Full: MISSOURI
Please input the correct value (either abbreviation or full value).
Enter study location (State)
   Differential escalation rates for fuels used in this program
   are those stated in FEMP tables. These tables are updated as
   new ones are issued by DOE. The program will select the correct
   values for you and print them out in the reports for your review.
   Type in the state in which the project is being built to direct
   the program to the correct part of these tables. Type LIST to view
   the state by state table for DOE regions.

U:mo
DOE Region  7 assigned. -- MISSOURI
Is above assignment correct?  Y or <cr>
   The FEMP tables are broken down into ten geographic regions,
   plus an eleventh table for the U.S. average. The state
   printed above is in the region indicated. If you wish to
   change the state,type N. If you want to change to a different
   DOE region you must do so by changing the state you input.
   Type Y or <cr> to keep the input shown.

U:y
There are two energy escalation rate files available.
 1 = Escalation values from July 1981
 2 = Escalation values from July 1984
<cr> = July 1984 values

July 1984 values become effective on 1 March 1985.
   The different available energy escalation rate files are
   displayed.  Pick the appropriate one for the project.

U:2
    SELECT ENERGY RELATED STUDY INPUT Choices
S = Select DOE Region
U = Select Energy Input Units
K = Select Energy Input Multiplier
P = Select Energy Prices
<cr> = exit SELECT ENERGY RELATED STUDY INPUT
   If this is a new study not based upon an existing study, complete
   all menu items. If this is a study which reuses data input from a
   previous study, type the letter corresponding to the parameters, if
   any, that you want change. The input parameters may be called up in
   any order.

U:k
Currently, Energy Units are entered in Thousand Btus
Enter the appropriate code for the study now.
Enter Energy Unit Input Magnitude Multiplier
 0 - Input in Btus
 1 - Input in Thousand(s) Btus
 2 - Input in Million(s) Btus
<cr> - Input in Thousand(s) Btus
```

```
   Express energy consumption for all fuels in the units you select
   here.

U:2
     SELECT ENERGY RELATED STUDY INPUT Choices
S = Select DOE Region
U = Select Energy Input Units
K = Select Energy Input Multiplier
P = Select Energy Prices
<cr> = exit SELECT ENERGY RELATED STUDY INPUT
   If this is a new study not based upon an existing study, complete
   all menu items. If this is a study which reuses data input from a
   previous study, type the letter corresponding to the parameters, if
   any, that you want change. The input parameters may be called up in
   any order.

U:p
     SELECT ENERGY PRICES Choices
 0 = Initialize All Energy Type Prices
 1 = Select Prices of ELECT
 2 = Select Prices of DIST
 3 = Select Prices of RESID
 4 = Select Prices of NAT G
 5 = Select Prices of COAL
 <cr> exit SELECT ENERGY PRICES
   Enter the prices for each of the fuels being consumed under the
   study conditions. Prices should be based upon the best information
   available at the location of the project.
   Prices are entered in $ per MBtu (Million Btu).
   If LIST is entered during requested input of fuel costs,
   the DOE stored price escalated to the current Date of Study
   will be displayed.

U:1
Prices are specified in $ / MBtu, as of Date of Study
Entering Cost for ELECT
   Enter the cost for this fuel in $ per MBtu (Million Btu).
   Use locally derived information for these fuel costs
   where ever possible.
   Entering LIST will display the DOE stored cost for this
   fuel escalated to the current Date of Study.

U:list
Cost from DOE is  17.79 $ / MBtu, in FEMP ABD (JUL 1984) Dollars.
Cost from DOE is  18.93 $ / MBtu, in ABD (OCT 1985) Dollars.
Entering Cost for ELECT
   Enter the cost for this fuel in $ per MBtu (Million Btu).
   Use locally derived information for these fuel costs
   where ever possible.
   Entering LIST will display the DOE stored cost for this
   fuel escalated to the current Date of Study.
```

```
U:19.00
     SELECT ENERGY PRICES Choices
 0 = Initialize All Energy Type Prices
 1 = Select Prices of ELECT
 2 = Select Prices of DIST
 3 = Select Prices of RESID
 4 = Select Prices of NAT G
 5 = Select Prices of COAL
 <cr> exit SELECT ENERGY PRICES
   Enter the prices for each of the fuels being consumed under the
   study conditions. Prices should be based upon the best information
   available at the location of the project.
   Prices are entered in $ per MBtu (Million Btu).
   If LIST is entered during requested input of fuel costs,
   the DOE stored price escalated to the current Date of Study
   will be displayed.

U:4
Prices are specified in $ / MBtu, as of Date of Study
Entering Cost for NAT G
   Enter the cost for this fuel in $ per MBtu (Million Btu).
   Use locally derived information for these fuel costs
   where ever possible.
   Entering LIST will display the DOE stored cost for this
   fuel escalated to the current Date of Study.

U:list
Cost from DOE is   4.11 $ / MBtu, in FEMP ABD (JUL 1984) Dollars.
Cost from DOE is   4.14 $ / MBtu, in ABD (OCT 1985) Dollars.
Entering Cost for NAT G
   Enter the cost for this fuel in $ per MBtu (Million Btu).
   Use locally derived information for these fuel costs
   where ever possible.
   Entering LIST will display the DOE stored cost for this
   fuel escalated to the current Date of Study.

U:4.50
     SELECT ENERGY PRICES Choices
 0 = Initialize All Energy Type Prices
 1 = Select Prices of ELECT
 2 = Select Prices of DIST
 3 = Select Prices of RESID
 4 = Select Prices of NAT G
 5 = Select Prices of COAL
 <cr> exit SELECT ENERGY PRICES
   Enter the prices for each of the fuels being consumed under the
   study conditions. Prices should be based upon the best information
   available at the location of the project.
   Prices are entered in $ per MBtu (Million Btu).
   If LIST is entered during requested input of fuel costs,
   the DOE stored price escalated to the current Date of Study
   will be displayed.
```

```
U:  CR
     SELECT ENERGY RELATED STUDY INPUT Choices
S = Select DOE Region
U = Select Energy Input Units
K = Select Energy Input Multiplier
P = Select Energy Prices
<cr> = exit SELECT ENERGY RELATED STUDY INPUT
   If this is a new study not based upon an existing study complete
   all menu items. If this is a study which reuses data input from a
   previous study type the letter corresponding to the parameters, if
   any, that you want change. The input parameters may be called up in
   any order.

U:  CR
     SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
   If this is a new study not based upon an existing study complete
   all menu items. If this is a study which reuses data input from a
   previous study type the letter corresponding to the parameters, if
   any, that you want change. The input parameters may be called up in
   any order.

U:t
** Begin Study Identification Block Initialization
Enter descriptive titles or appropriate values.
Enter Project Number
   Type in the appropriate project number such as "PN 455". If
   there is no project number or this is a generic study of
   some kind make up something.

U:pn 776
Enter Fiscal Year
   Type in the program fiscal year of the project, i.e. 1987
   for a project programmed in fy 87. The fiscal year entered
   here will be used to select the appropriate economic criteria
   when those criteria are determined by the fiscal year of the program.

U:1987
Enter Project Title
   For a study of a future construction project enter the
   name of that project at this time (i.e. Company Admin Bldg.).
   If the study is not associated with any particular project
   enter any letter, word, or number. The entry will appear on
   your output reports.

U:Administration Building
Enter Installation Name
   The name of the installation, such as Ft. Jackson, where
   the project will be constructed goes here.
```

```
:ft. leonard wood
Enter Name of Person Preparing Study.
   Type in the name of the person performing the study.  this
   person's name will appear on the output report title block.

U:joe designer
Enter Design Feature of Study.
   Enter the part of the building being studied. If you will be
   comparing alternate roofing systems you might enter "roofs"
   here. If you are studying alternate types of heating systems enter
   something like "heating" as the design feature. Do not confuse this
   with the name of a specific alternative like "built-up roofing"
   or "central steam heating system". Alternative titles will be entered
   later.

U:building envelope

** Study Identification Block initialization complete.
Data may now be changed, if desired, or exit this menu.
    SELECT STUDY IDENTIFICATION BLOCK Choices
I = Re-enter All Study Identification Block Data
T = Specify Project Title
L = Specify Installation Name
P = Specify Project Number
F = Specify Fiscal Year
A = Name of Analyst
D = Design Feature
<cr> = exit SELECT STUDY IDENTIFICATION BLOCK
   You may keep the project data entered earlier by typing
   <cr> or change any or all of them by typing the appropriate
   letter. Type I to begin entering title data on new studies that
   will not be using data from a previous study.

U:  CR
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
   If this is a new study not based upon an existing study complete
   all menu items. If this is a study which reuses data input from a
   previous study type the letter corresponding to the parameters, if
   any, that you want change. The input parameters may be called up in
   any order.

U:  CR
    MAIN MENU CHOICES
S = Select Study Parameters
R = Select Non-fuel Cost Growth Values
A = Define / Change Alternatives
N = Select Next Study
<cr> = exit PROGRAM
```

```
==MAIN MENU MODE==
   After Study Parameters have been defined, you may begin entering
   your alternative data by choosing the A selection.  If the R choice
   is displayed, you may optionally define escalation schedules for
   nonenergy costs.  After defining your alternative data, you will
   be able to calculate life cycle costs and create reports from this
   Menu.  Or you may choose N to revise, define, or report on another
   Study. Entering <cr> will exit the program, saving the study data
   so far.

U:a
    DEFINE / CHANGE ALTERNATIVES Choices
L = List Alternatives by Title
S = Define / Change Alternative Values
D = Delete an Alternative
R = Resequence Alternative Identifiers
O = Put Alternative Identifiers in Ascending Order
<cr> = exit DEFINE / CHANGE ALTERNATIVES
   Under this menu you will be asked to provide data pertaining
   to one or more economic alternatives you are comparing. If this is
   a new study, type S to begin defining these alternatives.

U:s
Enter Alternative identifier or title.
Enter LIST to see defined Alternatives by Title
<cr> to exit Alternative Selection
   Enter A, B, C, etc. as the identifier of a specific alternative
   you will be comparing against another.  Use the other letters
   as new alternatives are entered.  Keep track of the alternatives
   entered on paper or by typing LIST at this point.

U:a
New Alternative; Identifier A
Enter Alternative Title
(Enter <cr> if you do not want to define a new Alternative)
   Just in case you didn't really want to define this alternative,
   LCCID gives you a chance to change your mind. Type <cr> if you
   didn't really mean to define a new alternative.

U:prescriptive building
Invoking Auto-save of Study File, please wait a second.
LCC Study file EXAM1.LC successfully saved.
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
```

```
   Under this menu you will be entering the various costs and or
   benefits associated with the selected alternative. You do
   not have to enter something under each menu item shown.
   Type the letter corresponding to the cost or benefit you
   want to enter. They may be entered in any order.
   Once you have entered all the values desired, type <cr> to return
   to the next highest menu.

U:v
Initial Costs Settings, All must be entered.
0.0 is a valid entry.
Enter Full INVESTMENT  (+) Cost
Input in 10**0 Dollars --
   For Air Force and Army projects, enter the estimated cost for con-
   structing this alternative in today's dollars. Do not inflate costs.
   Enter costs in the units selected earlier; e.g. thousands of dollars.

U:1000000
Enter date of incurred Cost
Assumed value is JAN 1987
   If you want to change this date, enter a new date by typing
   a month, year. The date initially indicated by the program
   is the midpoint of construction that you entered earlier.

U:  CR
    INVESTMENT COSTS Choices
V = Specify Investment Cost and Related Information
<cr> = exit INVESTMENT COSTS
   Input the applicable data for the costs or benefits indicated
   by typing the letter(s) shown. Helps are provided to explain
   each selection.

U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
   Under this menu you will be entering the various costs and or
   benefits associated with the selected alternative. You do
   not have to enter something under each menu item shown.
   Type the letter corresponding to the cost or benefit you
   want to enter. They may be entered in any order.
   Once you have entered all the values desired, type <cr> to return
   to the next highest menu.

U:e
You will now be prompted for consumption of each fuel for which a price
has been entered.  If not applicable to this alternative,
```

```
enter 0.0 as the consumption value.
Enter Average Annual Consumption for ELECT in Million(s) Btus
   If the displayed energy consumption is not stated in the
   units above please convert to these units.

U:500
Does this consumption continue through
the end of the analysis period?
   If the average annual consumption for this fuel type is constant
   for the alternative, enter Y.  If the alternative has different
   consumptions for this fuel type over the facility life span, enter
   N and you will then be requested to enter up to three different
   average annual consumptions for this fuel type.

U:y
Enter Average Annual Consumption for NAT G in Million(s) Btus
   If the displayed energy consumption is not stated in the
   units above please convert to these units.

U:200
Does this consumption continue through
the end of the analysis period?
   If the average annual consumption for this fuel type is constant
   for the alternative, enter Y.  If the alternative has different
   consumptions for this fuel type over the facility life span, enter
   N and you will then be requested to enter up to three different
   average annual consumptions for this fuel type.

U:y
Enter Electric Demand Cost (first annual) in  Dollars
Current Annual Electrical Consumption is     500.00 Million Btus
Specify Annual Electric Demand Cost for JAN 89 through JAN 14
   Enter the peak electrical load in the energy units selected earlier.
   This value will be used with the demand charge price entered
   previously to calculate the demand charge costs for this alternative.

U:0
    SPECIFY ENERGY USAGE VALUES
 1 = Specify Average Annual Consumption for ELECT
 2 = Specify Average Annual Consumption for DIST
 3 = Specify Average Annual Consumption for RESID
 4 = Specify Average Annual Consumption for NAT G
 5 = Specify Average Annual Consumption for COAL
 P = Specify Annual Electric Demand Cost Values
<cr> = exit SPECIFY ENERGY USAGE VALUES
   For each alternative you will enter the consumption for
   each of the fuels used by this alternative. The consumption
   you enter will be multiplied by the energy costs per fuel
   that you entered earlier. Select the fuels in any order
   by typing the appropriate number.

U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
```

```
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
   Under this menu you will be entering the various costs and or
   benefits associated with the selected alternative. You do
   not have to enter something under each menu item shown.
   Type the letter corresponding to the cost or benefit you
   want to enter. They may be entered in any order.
   Once you have entered all the values desired, type <cr> to return
   to the next highest menu.

U:m
Begin entering values for M&R and Custodial Costs
    SPECIFY ANNUAL VALUES Choices
L = List Annual Values for this Alternative by Title
S = Define /air) or custodial costs associated with the given
   alternative.  To enter a new cost item, type S.  To delete an existing
   cost item, type D.  To view the cost items already entered, type L.
   Type <cr> to exit this menu.

U:s
Annual Value for Alternative PRESCRIPTIVE BUILDING
Enter Existing Annual Value number or title.
Enter LIST to see defined Annual Values by Title
Enter 0 to begin defining a new Annual Value
<cr> to exit entering Annual Values
   Begin entering the Maintenance and Repair or Custodial Costs
   or savings for this alternative. Do not include one time
   replacement cost or other nonannual costs or savings under
   this menu selection.

U:0
New Annual Value; Number  1
Enter Annual Value Title
(Enter <cr> if you do not want to define a new Annual Value)
   Enter the title of the new Maintenance & Repair or Custodial
   Cost, such as clean furnaces.

U:m&r
Enter Annual Value   ( + => Cost, - => Savings).
Input in 10**0 Dollars --
   Enter the Maintenance & Repair or Custodial Cost in the units you
   selected earlier, i.e., thousands of dollars/yr. If the value is
   a cost item enter the number with no sign. If the value
   is a savings enter the number preceded by a minus sign.

U:100000
    SPECIFY ANNUAL VALUES Choices
L = List Annual Values for this Alternative by Title
```

```
S = Define / Change Annual Values
D = Delete an Annual Value
<cr> = exit SPECIFY ANNUAL VALUES
   In this menu you may enter one or more annually recurring M&R
   (maintenance & repair) or custodial costs associated with the given
   alternative.  To enter a new cost item, type S.  To delete an existing
   cost item, type D.  To view the cost items already entered, type L.
   Type <cr> to exit this menu.

U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
   Under this menu you will be entering the various costs and or
   benefits associated with the selected alternative. You do
   not have to enter something under each menu item shown.
   Type the letter corresponding to the cost or benefit you
   want to enter. They may be entered in any order.
   Once you have entered all the values desired, type <cr> to return
   to the next highest menu.

U:r
Begin entering values for Major Repair & Replacement Costs
Select type of Values to be entered
 1 = One time values
 2 = Non-annual Recurring (Periodic) Values
   For HVAC systems and other building features some periodic or one-time
   costs may be required such as a boiler retubing every eighth
   year (periodic) or an engine replacement after 15 years (one-time).
   Enter the number of the selected type of cost at this point.

U:1
    SPECIFY ONE-TIME VALUES Choices
L = List One-time Values for this Alternative by Title
S = Define / Change One-time Values
D = Delete an One-time Value
<cr> = exit SPECIFY ONE-TIME VALUES
   Begin entering the costs or savings items that are expected to
   occur only once in the economic life of this alternative.
   When menu item is complete, type <cr> to return to the previous menu.

U:s
One-time Value for Alternative PRESCRIPTIVE BUILDING
Enter Existing One-time Value number or title.
Enter LIST to see defined One-time Values by Title
Enter 0 to begin defining a new One-time Value
<cr> to exit entering One-time Values
```

```
   To describe this cost or savings you will need to enter the
   title, one time cost in today's dollars (use dollar units selected
   earlier), and the date or number of years into the life of the
   alternative that this one time cost or savings occcurs.

U:0
New One-time Value; Number  1
Enter One-time Value Title
(Enter <cr> if you do not want to define a new One-time Value)
   Enter the word description of the one-time value as you want it to
   appear on the report.

U:replace fan system
Enter One-time Value  ( + => Cost, - => Savings)
Input in 10**0 Dollars --
   Enter costs in today's dollars. Do not inflate.  The dollar multiplier
   selected earlier is shown here.

U:150000
When does this value occur?
   If this cost or savings will occur in say 15 years you
   may enter this value as 15 or by the month year that 15
   years translates to. For non-FEMP studies the economic
   life of this alternative begins with the beneficial
   occupancy date. For FEMP studies the economic life begins
   on the analysis base date (July 1981 or the date associated with
   the latest DOE issue of differential escalation rates for fuels).

U:15
Calculated Month/Year JAN 2004?
   If this date is incorrect, enter N to reenter the proper value.
   To accept this date, enter Y or <cr>.

U:y
    SPECIFY ONE-TIME VALUES Choices
L = List One-time Values for this Alternative by Title
S = Define / Change One-time Values
D = Delete an One-time Value
<cr> = exit SPECIFY ONE-TIME VALUES
   Begin entering the costs or savings items that are expected to
   occur only once in the economic life of this alternative.
   When menu item is complete, type <cr> to return to the previous menu.

U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
```

```
   Under this menu you will be entering the various costs and or
   benefits associated with the selected alternative. You do
   not have to enter something under each menu item shown.
   Type the letter corresponding to the cost or benefit you
   want to enter. They may be entered in any order.
   Once you have entered all the values desired, type <cr> to return
   to the next highest menu.

U:s
Residual Value (-) at end of analysis period, if any.
Salvage Income (-) at end of analysis period, if any.
Demolition and/or other disposal costs (+) at end of analysis period, if any.
Input in 10**0 Dollars --
Current value is       0.0; <cr> to keep
   This cost/benefit is more commonly known as SALVAGE. The net
   cost or benefit of salvaging or reclaiming an item consists
   of the amount you can sell the item for (-)entry, the real
   value of the item if it is retained at the end of the study
   life or RESIDUAL VALUE,(-)entry, and the cost of removing and/or
   sell the item DISPOSAL COSTS, (+)entry.
   The program will calculate the net amount based upon you
   input and then discount this value to the appropriate beginning
   point.

U:0
Enter date of incurred Cost
Current value is  JAN 2014
   If you want to change this date, enter a new date by typing
   a month, year. The date initially indicated by the program
   is the end of economic life that you entered earlier.
U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
   Under this menu you will be entering the various costs and or
   benefits associated with the selected alternative. You do
   not have to enter something under each menu item shown.
   Type the letter corresponding to the cost or benefit you
   want to enter. They may be entered in any order.
   Once you have entered all the values desired, type <cr> to return
   to the next highest menu.

U:o
Begin entering values for Other Costs & Monetary Benefits
Select type of Values to be entered
 1 = One time values
 2 = Non-annual Recurring (Periodic) Values
 3 = Annually Recurring Values
```

```
   This other category of costs or savings permits you to enter items not
   easily classified into the other menu selections.  These items will be
   displayed in the output in the "other" column.  The choice is given
   here to select from several types of costs or benefits from a timing
   standpoint.

U:1
    SPECIFY ONE-TIME VALUES Choices
L = List One-time Values for this Alternative by Title
S = Define / Change One-time Values
D = Delete an One-time Value
<cr> = exit SPECIFY ONE-TIME VALUES
   Type S to begin defining a one-time cost or benefit.  Type <cr>
   when done with this menu item, to return to the SELECT
   ALTERNATIVE VALUES menu.

U:s
One-time Value for Alternative PRESCRIPTIVE BUILDING
Enter Existing One-time Value number or title.
Enter LIST to see defined One-time Values by Title
Enter 0 to begin defining a new One-time Value
<cr> to exit entering One-time Values
   Select a word or numerical title by typing same at this time.

U:0
New One-time Value; Number  1
Enter One-time Value Title
(Enter <cr> if you do not want to define a new One-time Value)
   Enter the word description of the one-time value as you want it to
   appear on the report.

U:bonus
Enter One-time Value  ( + => Cost, - => Savings)
Input in 10**0 Dollars --
   Enter the total cost or benefit for this one-time value.
   The total cost is entered with the dollar multiplier indicated.

U:-20000
When does this value occur?
   Enter the number of years or decimal fractions of years from the
   beginning of the economic life until the date of occurrence of this
   cost/benefit.  Since this is a one-time cost/benefit it will
   only enter the calculations once.  For FEMP studies including
   ECIP the occurrence will be timed beginning with the date of the
   DOE fuel escalation tables on which the study is being run.

U:5
Calculated Month/Year JAN 1994?
   If this date is incorrect, enter N to reenter the proper value.
   To accept this date, enter Y or <cr>.

U:Y
    SPECIFY ONE-TIME VALUES Choices
L = List One-time Values for this Alternative by Title
```

```
S = Define / Change One-time Values
D = Delete an One-time Value
<cr> = exit SPECIFY ONE-TIME VALUES
   Type S to begin defining a one-time cost or benefit.  Type <cr>
   when done with this menu item, to return to the SELECT
   ALTERNATIVE VALUES menu.

U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
   Under this menu you will be entering the various costs and or
   benefits associated with the selected alternative. You do
   not have to enter something under each menu item shown.
   Type the letter corresponding to the cost or benefit you
   want to enter. They may be entered in any order.
   Once you have entered all the values desired, type <cr> to return
   to the next highest menu.

U:1
Alternative A with title= PRESCRIPTIVE BUILDING
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
   Under this menu you will be entering the various costs and or
   benefits associated with the selected alternative. You do
   not have to enter something under each menu item shown.
   Type the letter corresponding to the cost or benefit you
   want to enter. They may be entered in any order.
   Once you have entered all the values desired, type <cr> to return
   to the next highest menu.

U:  CR
    DEFINE / CHANGE ALTERNATIVES Choices
L = List Alternatives by Title
S = Define / Change Alternative Values
D = Delete an Alternative
R = Resequence Alternative Identifiers
O = Put Alternative Identifiers in Ascending Order
<cr> = exit DEFINE / CHANGE ALTERNATIVES
```

```
   Under this menu you will be asked to provide data pertaining
   to one or more economic alternatives you are comparing. If this is
   a new study, type S to begin defining these alternatives.

U:  CR
    MAIN MENU CHOICES
S = Select Study Parameters
R = Select Non-fuel Cost Growth Values
A = Define / Change Alternatives
C = Calculate & Report Life Cycle Costs
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
   This is the full menu of choices.  The S selection may be used to
   revise the current study parameters.  If R is displayed, it may be
   optionally used to define differential escalation values for non-
   energy costs.  The A selection may be used to revise existing
   alternatives or to define more alternatives for this study.
   The C selection is used to calculate the life cycle
   costs of the alternatives and create reports.
   Or you may choose N to revise, define, or report on another
   Study. Entering <cr> will exit the program, saving the study data
   so far.

U:  CR
LCC Study file EXAM1.LC successfully saved.
STOP
```

EXAMPLE 2:

```
Instructions ?
U:N
Enter LCC Study Code>
U:EXAM1
LCC Study file EXAM1.LC retrieved. Last written on 17 OCT 85  at  12:07:42
    MAIN MENU CHOICES
S = Select Study Parameters
R = Select Non-fuel Cost Growth Values
A = Define / Change Alternatives
C = Calculate & Report Life Cycle Costs
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
U:A
    DEFINE / CHANGE ALTERNATIVES Choices
L = List Alternatives by Title
S = Define / Change Alternative Values
D = Delete an Alternative
R = Resequence Alternative Identifiers
O = Put Alternative Identifiers in Ascending Order
<cr> = exit DEFINE / CHANGE ALTERNATIVES
U:L
 List of Defined Alternatives
 A = PRESCRIPTIVE BUILDING
    DEFINE / CHANGE ALTERNATIVES Choices
L = List Alternatives by Title
S = Define / Change Alternative Values
D = Delete an Alternative
R = Resequence Alternative Identifiers
O = Put Alternative Identifiers in Ascending Order
<cr> = exit DEFINE / CHANGE ALTERNATIVES
U:S
Enter Alternative identifier or title.
Enter LIST to see defined Alternatives by Title
<cr> to exit Alternative Selection
U:B
New Alternative; Identifier B
Enter Alternative Title
(Enter <cr> if you do not want to define a new Alternative)
U:new building
Enter existing Alternative Identifier to start with
  or press return if none
U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
```

```
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:v
Initial Costs Settings, All must be entered.
0.0 is a valid entry.
Enter Full INVESTMENT  (+) Cost
Input in 10**0 Dollars --
U:1250000
Enter date of incurred Cost
Assumed value is JAN 1987
U:  CR
    INVESTMENT COSTS Choices
V = Specify Investment Cost and Related Information
<cr> = exit INVESTMENT COSTS
U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:e
You will now be prompted for consumption of each fuel for which a price
has been entered.  If not applicable to this alternative,
enter 0.0 as the consumption value.
Enter Average Annual Consumption for ELECT in Million(s) Btus
U:250
Does this consumption continue through
the end of the analysis period?
U:y
Enter Average Annual Consumption for NAT G in Million(s) Btus
U:200
Does this consumption continue through
the end of the analysis period?
U:y
Enter Electric Demand Cost (first annual) in  Dollars
Current Annual Electrical Consumption is     250.00 Million Btus
Specify Annual Electric Demand Cost for JAN 89 through JAN 14
U:  CR
    SPECIFY ENERGY USAGE VALUES
 1 = Specify Average Annual Consumption for ELECT
 2 = Specify Average Annual Consumption for DIST
 3 = Specify Average Annual Consumption for RESID
 4 = Specify Average Annual Consumption for NAT G
 5 = Specify Average Annual Consumption for COAL
 P = Specify Annual Electric Demand Cost Values
<cr> = exit SPECIFY ENERGY USAGE VALUES
U:  CR
```

```
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:m
Begin entering values for M&R and Custodial Costs
    SPECIFY ANNUAL VALUES Choices
L = List Annual Values for this Alternative by Title
S = Define / Change Annual Values
D = Delete an Annual Value
<cr> = exit SPECIFY ANNUAL VALUES
U:s
Annual Value for Alternative NEW BUILDING
Enter Existing Annual Value number or title.
Enter LIST to see defined Annual Values by Title
Enter 0 to begin defining a new Annual Value
<cr> to exit entering Annual Values
U:0
New Annual Value; Number  1
Enter Annual Value Title
(Enter <cr> if you do not want to define a new Annual Value)
U:m&r
Enter Annual Value   ( + => Cost, - => Savings).
Input in 10**0 Dollars --
U:12000
    SPECIFY ANNUAL VALUES Choices
L = List Annual Values for this Alternative by Title
S = Define / Change Annual Values
D = Delete an Annual Value
<cr> = exit SPECIFY ANNUAL VALUES
U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:r
Begin entering values for Major Repair & Replacement Costs
Select type of Values to be entered
 1 = One time values
 2 = Non-annual Recurring (Periodic) Values
U:2
```

```
    SPECIFY NON-ANNUAL RECURRING VALUES Choices
L = List Non-annual Recurring Values for this Alternative by Title
S = Define / Change Non-annual Recurring Values
D = Delete an Non-annual Recurring Value
<cr> = exit SPECIFY NON-ANNUAL RECURRING VALUES
U:s
Non-annual Recurring Value for Alternative NEW BUIDING
Enter Existing Non-annual Recurring Value number or title.
Enter LIST to see defined Non-annual Recurring Values by Title
Enter 0 to begin defining a new Non-annual Recurring Value
<cr> to exit entering Non-annual Recurring Values
U:0
New Non-annual Recurring Value; Number  1
Enter Non-annual Recurring Value Title
(Enter <cr> if you do not want to define a new Non-annual Recurring Value)
U:replace equip
Enter Non-annual Recurring Value  ( + => Cost, - => Savings)
Input in 10**0 Dollars --
U:150000
When does this value first occur?
U:10
Calculated Month/Year JAN 1999?
U:  CR
How often does this value recur (years)?
U:10
    SPECIFY NON-ANNUAL RECURRING VALUES Choices
L = List Non-annual Recurring Values for this Alternative by Title
S = Define / Change Non-annual Recurring Values
D = Delete an Non-annual Recurring Value
<cr> = exit SPECIFY NON-ANNUAL RECURRING VALUES
U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:o
Begin entering values for Other Costs & Monetary Benefits
Select type of Values to be entered
 1 = One time values
 2 = Non-annual Recurring (Periodic) Values
 3 = Annually Recurring Values
U:1
    SPECIFY ONE-TIME VALUES Choices
L = List One-time Values for this Alternative by Title
S = Define / Change One-time Values
D = Delete an One-time Value
<cr> = exit SPECIFY ONE-TIME VALUES
U:s
```

```
One-time Value for Alternative NEW BUILDING
Enter Existing One-time Value number or title.
Enter LIST to see defined One-time Values by Title
Enter 0 to begin defining a new One-time Value
<cr> to exit entering One-time Values
U:0
New One-time Value; Number  1
Enter One-time Value Title
(Enter <cr> if you do not want to define a new One-time Value)
U:bonus
Enter One-time Value  ( + => Cost, - => Savings)
Input in 10**0 Dollars --
U:-25000
When does this value occur?
U:10
Calculated Month/Year JAN 1999?
U:  CR
    SPECIFY ONE-TIME VALUES Choices
L = List One-time Values for this Alternative by Title
S = Define / Change One-time Values
D = Delete an One-time Value
<cr> = exit SPECIFY ONE-TIME VALUES
U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:  CR
    DEFINE / CHANGE ALTERNATIVES Choices
L = List Alternatives by Title
S = Define / Change Alternative Values
D = Delete an Alternative
R = Resequence Alternative Identifiers
O = Put Alternative Identifiers in Ascending Order
<cr> = exit DEFINE / CHANGE ALTERNATIVES
U:1
 List of Defined Alternatives
 A = PRESCRIPTIVE BUILDING
 B = NEW BUILDING
    DEFINE / CHANGE ALTERNATIVES Choices
L = List Alternatives by Title
S = Define / Change Alternative Values
D = Delete an Alternative
R = Resequence Alternative Identifiers
O = Put Alternative Identifiers in Ascending Order
<cr> = exit DEFINE / CHANGE ALTERNATIVES
U:  CR
```

```
    MAIN MENU CHOICES
S = Select Study Parameters
R = Select Non-fuel Cost Growth Values
A = Define / Change Alternatives
C = Calculate & Report Life Cycle Costs
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
U:c
    CALCULATE & REPORT LIFE CYCLE COSTS Choices
B = Select the Baseline Alternative
I = Individual Alternative Summary Reports
<cr> = exit CALCULATE & REPORT LIFE CYCLE COSTS
The lowest initial cost alternative is being selected
as the baseline alternative.  Enter B to choose a
different alternative for your baseline.
U:i
Enter Existing Alternative identifier or title for the report.
Enter 0 to report on ALL ALternatives.
Enter LIST to see defined Alternatives by Title
<cr> to exit Input Summary Reports
U:0
Invoking Auto-save of Study File, please wait a second.
LCC Study file EXAM1.LC successfully saved.
Enter Y to display optional escalation values report.
U:n
Enter Y to display optional yearly values report.
U:y
Output report to Terminal?
U:y
Output report to standard file (printer format)?
U:n
Set paper to top line of page, Press Return when ready.
U:  CR
```

User positions printer to top of page. User causes printer to begin logging all text coming to screen.

LIFE CYCLE COST ANALYSIS STUDY: EXAM1

LCCID 1.000 DATE/TIME: 17 OCT 85 12:44:44
PROJECT NO., FY, & TITLE: PN 776 FY 1987 ADMINISTRATION BUILDING
INSTALLATION & LOCATION: FT. LEONARD WOOD MISSOURI
DESIGN FEATURE: BUILDING ENVELOPE
ALT. ID. A; TITLE: PRESCRIPTIVE BUILDING
NAME OF DESIGNER: JOE DESIGNER

BASIC INPUT DATA SUMMARY

CRITERIA REFERENCE:FEDS/A-94 (Army ETL 1110-3-332, Part I)
DISCOUNT RATE: 10%

KEY PROJECT-CALENDAR & ANALYSIS-TIMING-FRAMEWORK INFORMATION

KEY PROJECT CALENDAR INFORMATION (DATES PER ACTUAL PROJECTIONS)		ANALYSIS-TIMING-FRAMEWORK INFORMATION (DATES ASSUMED FOR ANALYSIS)	
DATE OF STUDY (DOS)	OCT 85	ANALYSIS BASE (ABD)	OCT 85
MIDPOINT CONSTRUCTION (MPC)	JAN 87	MIDPOINT CONSTRUCTION (MPC)	JAN 87
BENEFICIAL OCCUPANCY (BOD)	JAN 89	BENEFICIAL OCCUPANCY (BOD)	JAN 89
END OF FACILITY LIFE (FLED)	JAN 14	ANALYSIS END (AED)	JAN 14

TYPE OF COST/BENEFIT				TIME(S) COST INCURRED*	
COST CODE	COST / BENEFIT DESCRIPTION	COST IN ABD $ ($ X 10**0)	EQUIVALENT UNIFORM DIFFERENTIAL ESCALATION RATE (% PER YEAR)	ACTUAL PROJECTED PAYMENT DATES	PAYMENT DATES FOR ANALYSIS
II	INVESTMENT	1000000.00	0.00	JAN 87	JAN 87
EN	ELECTRICITY	9500.00	******	JUL89-JUL13	JUL89-JUL13
EN	ELECT DEMAND	0.00	******	JUL89-JUL13	JUL89-JUL13
EN	NATURAL GAS	900.00	******	JUL89-JUL13	JUL89-JUL13
MR	M&R	100000.00	0.00	JUL89-JUL13	JUL89-JUL13
RR	REPLACE FAN SYSTEM	150000.00	0.00	JAN 04	JAN 04
OT	BONUS	-20000.00	0.00	JAN 94	JAN 94

OTHER KEY INPUT DATA

DOE REGION - MISSOURI NO: 7
RATES FOR INDUSTRIAL SECTOR.

ENERGY PRICES AND ESCALATION VALUES:

ENERGY TYPE	$ / MBTU	84-85	85-90	90-**
ELECT	19.00	6.77	-1.42	-1.03

ENERGY TYPE	$ / MBTU	84-85	85-90	90-95	95- 0	0- 5	5-**
NAT G	4.50	-0.25	4.19	9.42	3.91	4.69	2.97

ENERGY USAGE: 10**6 BTUS ELECTRIC DEMAND: 10**0 DOLLARS

ENERGY TYPE	AMOUNT	ELECT. DEMAND	PROJECTED DATES
ELECT	500.00	0.00	JAN89-JAN14
NAT G	200.00		JAN89-JAN14

LIFE CYCLE COST ANALYSIS STUDY: EXAM1

LCCID 1.000 DATE/TIME: 17 OCT 85 12:44:44

PROJECT NO., FY, & TITLE: PN 776 FY 1987 ADMINISTRATION BUILDING

INSTALLATION & LOCATION: FT. LEONARD WOOD MISSOURI

DESIGN FEATURE: BUILDING ENVELOPE

ALT. ID. A; TITLE: PRESCRIPTIVE BUILDING

NAME OF DESIGNER: JOE DESIGNER

LIFE CYCLE COST TOTALS*

INITIAL INVESTMENT COSTS		887686.
ENERGY COSTS:		
ELECTRICITY	58130.	
NATURAL GAS	12310.	
TOTAL ENERGY COSTS		70439.
RECURRING M&R/CUSTODIAL COSTS		698416.
MAJOR REPAIR/REPLACEMENT COSTS		26344.
OTHER COSTS & MONETARY BENEFITS		-9110.
DISPOSAL COSTS/RETENTION VALUE		0.
LCC OF ALL COSTS/BENEFITS (NET PW)		1673774.

*NET PW EQUIVALENTS ON OCT85; IN 10**0 DOLLARS; IN CONSTANT OCT85 DOLLARS

LIFE CYCLE COST ANALYSIS STUDY: EXAM1

LCCID 1.000 DATE/TIME: 17 OCT 85 12:44:44
PROJECT NO., FY, & TITLE: PN 776 FY 1987 ADMINISTRATION BUILDING
INSTALLATION & LOCATION: FT. LEONARD WOOD MISSOURI
DESIGN FEATURE: BUILDING ENVELOPE
ALT. ID. A; TITLE: PRESCRIPTIVE BUILDING
NAME OF DESIGNER: JOE DESIGNER

YEAR-BY-YEAR BREAKDOWN OF LIFE CYCLE COSTS*

DOLLARS IN 10**0

BENEFICIAL OCCUPANCY DATE: JAN89
ACTUAL ANNUAL PAYMENTS OCCUR: JUL89 THROUGH JUL13
ANNUAL PAYMENTS FOR ANALYSIS OCCUR: JUL89 THROUGH JUL13

I PAY I	ELECT I	NAT G I	M & R I	R / R I	OTHER I
I 1 I	6298.I	734.I	69948.I	0.I	0.I
I 2 I	5644.I	696.I	63589.I	0.I	0.I
I 3 I	5078.I	692.I	57809.I	0.I	0.I
I 4 I	4569.I	688.I	52553.I	0.I	0.I
I 5 I	4111.I	685.I	47776.I	0.I	-9110.I
I 6 I	3699.I	681.I	43432.I	0.I	0.I
I 7 I	3328.I	677.I	39484.I	0.I	0.I
I 8 I	2994.I	640.I	35895.I	0.I	0.I
I 9 I	2694.I	604.I	32631.I	0.I	0.I
I 10 I	2424.I	571.I	29665.I	0.I	0.I
I 11 I	2181.I	539.I	26968.I	0.I	0.I
I 12 I	1962.I	510.I	24516.I	0.I	0.I
I 13 I	1765.I	485.I	22288.I	0.I	0.I
I 14 I	1588.I	461.I	20262.I	0.I	0.I
I 15 I	1429.I	439.I	18420.I	26344.I	0.I
I 16 I	1286.I	418.I	16745.I	0.I	0.I
I 17 I	1157.I	398.I	15223.I	0.I	0.I
I 18 I	1041.I	372.I	13839.I	0.I	0.I
I 19 I	936.I	349.I	12581.I	0.I	0.I
I 20 I	843.I	326.I	11437.I	0.I	0.I
I 21 I	758.I	305.I	10397.I	0.I	0.I
I 22 I	682.I	286.I	9452.I	0.I	0.I
I 23 I	614.I	268.I	8593.I	0.I	0.I
I 24 I	552.I	251.I	7812.I	0.I	0.I
I 25 I	497.I	235.I	7102.I	0.I	0.I
I ** I	58130.I	12310.I	698416.I	26344.I	-9110.I

*NET PW EQUIVALENTS ON OCT85; IN 10**0 DOLLARS; IN CONSTANT OCT85 DOLLARS

LIFE CYCLE COST ANALYSIS STUDY: EXAM1

LCCID 1.000 DATE/TIME: 17 OCT 85 12:44:44
PROJECT NO., FY, & TITLE: PN 776 FY 1987 ADMINISTRATION BUILDING
INSTALLATION & LOCATION: FT. LEONARD WOOD MISSOURI
DESIGN FEATURE: BUILDING ENVELOPE
ALT. ID. B; TITLE: NEW BUILDING
NAME OF DESIGNER: JOE DESIGNER

BASIC INPUT DATA SUMMARY

CRITERIA REFERENCE:FEDS/A-94 (Army ETL 1110-3-332, Part I)
DISCOUNT RATE: 10%

KEY PROJECT-CALENDAR & ANALYSIS-TIMING-FRAMEWORK INFORMATION

KEY PROJECT CALENDAR INFORMATION (DATES PER ACTUAL PROJECTIONS)		ANALYSIS-TIMING-FRAMEWORK INFORMATION (DATES ASSUMED FOR ANALYSIS)	
DATE OF STUDY (DOS)	OCT 85	ANALYSIS BASE (ABD)	OCT 85
MIDPOINT CONSTRUCTION (MPC)	JAN 87	MIDPOINT CONSTRUCTION (MPC)	JAN 87
BENEFICIAL OCCUPANCY (BOD)	JAN 89	BENEFICIAL OCCUPANCY (BOD)	JAN 89
END OF FACILITY LIFE (FLED)	JAN 14	ANALYSIS END (AED)	JAN 14

TYPE OF COST/BENEFIT			EQUIVALENT UNIFORM	TIME(S) COST INCURRED*	
COST CODE	COST / BENEFIT DESCRIPTION	COST IN ABD $ ($ X 10**0)	DIFFERENTIAL ESCALATION RATE (% PER YEAR)	ACTUAL PROJECTED PAYMENT DATES	PAYMENT DATES FOR ANALYSIS
II	INVESTMENT	1250000.00	0.00	JAN 87	JAN 87
EN	ELECTRICITY	4750.00	******	JUL89-JUL13	JUL89-JUL13
EN	ELECT DEMAND	0.00	******	JUL89-JUL13	JUL89-JUL13
EN	NATURAL GAS	900.00	******	JUL89-JUL13	JUL89-JUL13
MR	M&R	12000.00	0.00	JUL89-JUL13	JUL89-JUL13
RR	REPLACE EQUIP	150000.00	******	JAN99-JAN09	JAN99-JAN09
OT	BONUS	-25000.00	0.00	JAN 99	JAN 99

OTHER KEY INPUT DATA

DOE REGION - MISSOURI NO: 7
RATES FOR INDUSTRIAL SECTOR.

ENERGY PRICES AND ESCALATION VALUES:

ENERGY TYPE	$ / MBTU	84-85	85-90	90-**
ELECT	19.00	6.77	-1.42	-1.03

ENERGY TYPE	$ / MBTU	84-85	85-90	90-95	95- 0	0- 5	5-**
NAT G	4.50	-0.25	4.19	9.42	3.91	4.69	2.97

ENERGY USAGE: 10**6 BTUS ELECTRIC DEMAND: 10**0 DOLLARS

ENERGY TYPE	AMOUNT	ELECT. DEMAND	PROJECTED DATES
ELECT	250.00	0.00	JAN89-JAN14
NAT G	200.00		JAN89-JAN14

LIFE CYCLE COST ANALYSIS STUDY: EXAM1

LCCID 1.000 DATE/TIME: 17 OCT 85 12:44:44
PROJECT NO., FY, & TITLE: PN 776 FY 1987 ADMINISTRATION BUILDING
INSTALLATION & LOCATION: FT. LEONARD WOOD MISSOURI
DESIGN FEATURE: BUILDING ENVELOPE
ALT. ID. B; TITLE: NEW BUILDING
NAME OF DESIGNER: JOE DESIGNER

LIFE CYCLE COST TOTALS*

INITIAL INVESTMENT COSTS		1109607.
ENERGY COSTS:		
ELECTRICITY	29065.	
NATURAL GAS	12310.	
TOTAL ENERGY COSTS		41375.
RECURRING M&R/CUSTODIAL COSTS		83810.
MAJOR REPAIR/REPLACEMENT COSTS		58784.
OTHER COSTS & MONETARY BENEFITS		-7071.
DISPOSAL COSTS/RETENTION VALUE		0.
LCC OF ALL COSTS/BENEFITS (NET PW)		1286504.

*NET PW EQUIVALENTS ON OCT85; IN 10**0 DOLLARS; IN CONSTANT OCT85 DOLLARS

LIFE CYCLE COST ANALYSIS STUDY: EXAM1

LCCID 1.000 DATE/TIME: 17 OCT 85 12:44:44

PROJECT NO., FY, & TITLE: PN 776 FY 1987 ADMINISTRATION BUILDING

INSTALLATION & LOCATION: FT. LEONARD WOOD MISSOURI

DESIGN FEATURE: BUILDING ENVELOPE

ALT. ID. B; TITLE: NEW BUILDING

NAME OF DESIGNER: JOE DESIGNER

YEAR-BY-YEAR BREAKDOWN OF LIFE CYCLE COSTS*

DOLLARS IN 10**0

BENEFICIAL OCCUPANCY DATE: JAN89

ACTUAL ANNUAL PAYMENTS OCCUR: JUL89 THROUGH JUL13

ANNUAL PAYMENTS FOR ANALYSIS OCCUR: JUL89 THROUGH JUL13

I PAY I	ELECT I	NAT G I	M & R I	R / R I	OTHER I
I 1 I	3149.I	734.I	8394.I	0.I	0.I
I 2 I	2822.I	696.I	7631.I	0.I	0.I
I 3 I	2539.I	692.I	6937.I	0.I	0.I
I 4 I	2285.I	688.I	6306.I	0.I	0.I
I 5 I	2055.I	685.I	5733.I	0.I	0.I
I 6 I	1849.I	681.I	5212.I	0.I	0.I
I 7 I	1664.I	677.I	4738.I	0.I	0.I
I 8 I	1497.I	640.I	4307.I	0.I	0.I
I 9 I	1347.I	604.I	3916.I	0.I	0.I
I 10 I	1212.I	571.I	3560.I	42427.I	-7071.I
I 11 I	1090.I	539.I	3236.I	0.I	0.I
I 12 I	981.I	510.I	2942.I	0.I	0.I
I 13 I	883.I	485.I	2675.I	0.I	0.I
I 14 I	794.I	461.I	2431.I	0.I	0.I
I 15 I	715.I	439.I	2210.I	0.I	0.I
I 16 I	643.I	418.I	2009.I	0.I	0.I
I 17 I	578.I	398.I	1827.I	0.I	0.I
I 18 I	520.I	372.I	1661.I	0.I	0.I
I 19 I	468.I	349.I	1510.I	0.I	0.I
I 20 I	421.I	326.I	1372.I	16357.I	0.I
I 21 I	379.I	305.I	1248.I	0.I	0.I
I 22 I	341.I	286.I	1134.I	0.I	0.I
I 23 I	307.I	268.I	1031.I	0.I	0.I
I 24 I	276.I	251.I	937.I	0.I	0.I
I 25 I	248.I	235.I	852.I	0.I	0.I
I ** I	29065.I	12310.I	83810.I	58784.I	-7071.I

*NET PW EQUIVALENTS ON OCT85; IN 10**0 DOLLARS; IN CONSTANT OCT85 DOLLARS

```
Enter Existing Alternative identifier or title for the report.
Enter 0 to report on ALL ALternatives.
Enter LIST to see defined Alternatives by Title
<cr> to exit Input Summary Reports
U:  CR
```
User causes printer logging to cease.

```
    CALCULATE & REPORT LIFE CYCLE COSTS Choices
B = Select the Baseline Alternative
I = Individual Alternative Summary Reports
C = Alternative Comparison Summary Reports
<cr> = exit CALCULATE & REPORT LIFE CYCLE COSTS
U:c
Output report to Terminal?
U:y
Output report to standard file (printer format)?
U:n
Would you like to display comparisons with your selected baseline?
U:n
Enter Y to display optional DPP for comparisons.
U:y
Enter Y to display detailed DPP and SIR calculations.
U:y
Note that the detailed DPP calculation report will
not be produced when the SIR < 1.05
Set paper to top line of page, Press Return when ready.
U:  CR
```

User positions printer to top of page. User causes printer to begin logging all text coming to screen.

LIFE CYCLE COST ANALYSIS STUDY: EXAM1

LCCID 1.000 DATE/TIME: 17 OCT 85 12:45:57
PROJECT NO., FY, & TITLE: PN 776 FY 1987 ADMINISTRATION BUILDING
INSTALLATION & LOCATION: FT. LEONARD WOOD MISSOURI
DESIGN FEATURE: BUILDING ENVELOPE
NAME OF DESIGNER: JOE DESIGNER

SUMMARY REPORT

CRITERIA REFERENCE:FEDS/A-94 (Army ETL 1110-3-332, Part I)

DISCOUNT RATE: 10%

ALT ID.	ALTERNATIVES ANALYZED DESCRIPTION/TITLE	LCC (NET PW) ($ X 10**0)	INITIAL COST ($ X 10**0)	AVG. ANNUAL ENERGY USE (10**6 BTUS)
A	PRESCRIPTIVE BUILDIN	1673774	887686	700
B	NEW BUILDING	1286504	1109607	450

TABLE I. KEY DATA FOR ECONOMIC RANKING PURPOSES

ALT ID.	INITIAL INVEST-MENT COSTS	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLCE-MENT COSTS	OTH O&M COSTS & MONETRY BENEFTS	DISPOSL COSTS OR RETENTN VALUE	TOTAL
A	887686	70439	698416	26344	-9110	0	1673774
B	1109607	41375	83810	58784	-7071	0	1286504

TABLE II. LIFE CYCLE COST COMPARISON (ACTUAL NET PW VALUES)*

LIFE CYCLE COST ANALYSIS STUDY: EXAM1

LCCID 1.000 DATE/TIME: 17 OCT 85 12:45:57

PROJECT NO., FY, & TITLE: PN 776 FY 1987 ADMINISTRATION BUILDING

INSTALLATION & LOCATION: FT. LEONARD WOOD MISSOURI

DESIGN FEATURE: BUILDING ENVELOPE

NAME OF DESIGNER: JOE DESIGNER

SUMMARY REPORT

ALT ID.	INITIAL INVEST-MENT COSTS	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLCE-MENT COSTS	OTH O&M COSTS & MONETRY BENEFTS	DISPOSL COSTS OR RETENTN VALUE	TOTAL	SIR	DPP
A	BASELINE ALTERNATIVE: ALTERNATIVE LOWEST IN INITIAL INVESTMENT COST								
B	221921	-29065	-614606	32440	2039	0	-387270	2.5	5

TABLE III.A INCREMENTAL LIFE CYCLE COSTS* (RELATIVE TO BASELINE)

*NET PW EQUIVALENTS ON OCT85; IN 10**0 DOLLARS; IN CONSTANT OCT85 DOLLARS

LIFE CYCLE COST ANALYSIS STUDY: EXAM1

LCCID 1.000 DATE/TIME: 17 OCT 85 12:45:57

PROJECT NO., FY, & TITLE: PN 776 FY 1987 ADMINISTRATION BUILDING

INSTALLATION & LOCATION: FT. LEONARD WOOD MISSOURI

DESIGN FEATURE: BUILDING ENVELOPE

NAME OF DESIGNER: JOE DESIGNER

DETAILED DISCOUNTED PAYBACK PERIOD

BASELINE ALTERNATIVE: A - PRESCRIPTIVE BUILDING

INVESTMENT ALTERNATIVE: B - NEW BUILDING

DPP N	SIR	A D	B E	C F	OPERATING BASE ($ X 10**0)	OPERATING INVEST ($ X 10**0)	CAPITAL BASE ($ X 10**0)	CAPITAL INVEST ($ X 10**0)
25.0	2.5	1.5	2.5	0.60				
		-25.0	-15.0	10.0	768856	125185	904919	1161320
10.0	1.6	0.6	-0.9	-0.73				
		15.0	-11.0	0.0	520289	83821	878575	1144962
0.0	0.0	-1.0	-1.6	0.61				
		10.0	6.1	6.0	0	0	887686	1109607
6.0	1.3	0.3	1.3	0.25				
		-6.0	-1.5	5.0	368682	59088	878575	1109607
5.0	1.2	0.2	-0.2	-0.96				
		1.0	-1.0	5.0	320870	51346	878575	1109607

A = THIS SIR - 1.0

B = THIS SIR - LAST SIR

C = RATIO OF A TO B

D = LAST N - THIS N

E = PRODUCT OF C & D

F = NEXT N = THIS N + E

---

* IN FIRST TRIAL, LAST SIR = LAST N = 0

```
    CALCULATE & REPORT LIFE CYCLE COSTS Choices
B = Select the Baseline Alternative
I = Individual Alternative Summary Reports
C = Alternative Comparison Summary Reports
<cr> = exit CALCULATE & REPORT LIFE CYCLE COSTS
U:  CR
```

User cause printer logging to cease.

```
    MAIN MENU CHOICES
S = Select Study Parameters
R = Select Non-fuel Cost Growth Values
A = Define / Change Alternatives
C = Calculate & Report Life Cycle Costs
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
U:  CR
LCC Study file EXAM1.LC successfully saved.
STOP
U:  CR
```

EXAMPLE 3.

```
Instructions ?
U:n
Enter LCC Study Code>
U:invst
New LCC Study?
U:y
Enter existing LCC Study code to start with
  or press return if none
U:  CR
    MAIN MENU CHOICES
S = Select Study Parameters
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
U:s
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
<cr> = exit SELECT STUDY PARAMETERS
U:c
Criteria Package Selection

Enter Project Type of the Study.
 1 = Military Construction Army (MCA)
 2 = Military Construction Navy (MCN)
 3 = Military Construction Air Force (MCAF)
 4 = Non-DOD Construction (NON-DOD)
U:1

Enter Significance of Energy on the Feature being studied.
 1 = Energy Effects Significant or Primary (SIGNIFICANT)
 2 = Energy Effects Incidental (INCIDENTAL)
 3 = Energy Effects Not Applicable (NONE)
U:1

Enter Primary Study Objective.
 1 = Selection of Best Conventional Design (CONVENTIONAL)
 2 = Special Directed Design Study (SPECIAL DIRECTED)
 3 = Retrofit Energy Conservation Investment Program (ECIP)
U:1
This study is based on a project type of MCA
The effect on energy of this study is SIGNIFICANT
The primary study objective is the Selection of
the Best Conventional Design.
The Life Cycle Costs for this study will be calculated
based on the FEDS/A-94 criteria - the standard federal
criteria package specified in OMB circular A-94.
(Army ETL 1110-3-332, Part I)
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
```

```
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
U:d
** Begin date initialization procedure.
   Enter actual dates for your building. **

Enter Date of Study (Month Year)
U:10 85
Enter Midpoint of Construction (Month Year)
U:10 87
Enter Beneficial Occupancy Date (Month Year)
U:10 89
Enter Economic Life of Building (Years from BOD)
U:25
Calculated Month/Year OCT 2014?
U:y

** Initialization of dates complete.
Dates can now be changed, if desired, or exit this menu.
    SELECT PROJECT DATES Choices
I = Re-initialize All Dates
S = Date of Study
M = Midpoint of Construction
B = Beneficial Occupancy Date
L = Economic Life of Building
<cr> = exit SELECT PROJECT DATES
U:  CR
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
U:e
    SELECT ENERGY RELATED STUDY INPUT Choices
S = Select DOE Region
U = Select Energy Input Units
K = Select Energy Input Multiplier
<cr> = exit SELECT ENERGY RELATED STUDY INPUT
U:s
Enter study location (State)
U:ill
DOE Region  5 assigned. -- ILLINOIS
Is above assignment correct?  Y or <cr>
U:y
There are two energy escalation rate files available.
 1 = Escalation values from July 1981
 2 = Escalation values from July 1984
<cr> = July 1984 values

July 1984 values become effective on 1 March 1985.
```

```
U:2
    SELECT ENERGY RELATED STUDY INPUT Choices
S = Select DOE Region
U = Select Energy Input Units
K = Select Energy Input Multiplier
P = Select Energy Prices
<cr> = exit SELECT ENERGY RELATED STUDY INPUT
U:p
    SELECT ENERGY PRICES Choices
 0 = Initialize All Energy Type Prices
 1 = Select Prices of ELECT
 2 = Select Prices of DIST
 3 = Select Prices of RESID
 4 = Select Prices of NAT G
 5 = Select Prices of COAL
 <cr> exit SELECT ENERGY PRICES
U:1
Prices are specified in $ / MBtu, as of Date of Study
Entering Cost for ELECT
U:list
Cost from DOE is  17.51 $ / MBtu, in FEMP ABD (JUL 1984) Dollars.
Cost from DOE is  17.72 $ / MBtu, in ABD (OCT 1985) Dollars.
Entering Cost for ELECT
U:18.00
    SELECT ENERGY PRICES Choices
 0 = Initialize All Energy Type Prices
 1 = Select Prices of ELECT
 2 = Select Prices of DIST
 3 = Select Prices of RESID
 4 = Select Prices of NAT G
 5 = Select Prices of COAL
 <cr> exit SELECT ENERGY PRICES
U:4
Prices are specified in $ / MBtu, as of Date of Study
Entering Cost for NAT G
U:list
Cost from DOE is   4.89 $ / MBtu, in FEMP ABD (JUL 1984) Dollars.
Cost from DOE is   5.10 $ / MBtu, in ABD (OCT 1985) Dollars.
Entering Cost for NAT G
U:5.00
    SELECT ENERGY PRICES Choices
 0 = Initialize All Energy Type Prices
 1 = Select Prices of ELECT
 2 = Select Prices of DIST
 3 = Select Prices of RESID
 4 = Select Prices of NAT G
 5 = Select Prices of COAL
 <cr> exit SELECT ENERGY PRICES
U:  CR
    SELECT ENERGY RELATED STUDY INPUT Choices
S = Select DOE Region
U = Select Energy Input Units
K = Select Energy Input Multiplier
P = Select Energy Prices
```

```
<cr> = exit SELECT ENERGY RELATED STUDY INPUT
U:  CR
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
U:t
** Begin Study Identification Block Initialization
Enter descriptive titles or appropriate values.
Enter Project Number
U:pn 777
Enter Fiscal Year
U:1987
Enter Project Title
U:example of investment alternatives
Enter Installation Name
U:usa-cerl
Enter Name of Person Preparing Study.
U:linda lawrie
Enter Design Feature of Study.
U:zero cost initial investment alternative

** Study Identification Block initialization complete.
Data may now be changed, if desired, or exit this menu.
    SELECT STUDY IDENTIFICATION BLOCK Choices
I = Re-enter All Study Identification Block Data
T = Specify Project Title
L = Specify Installation Name
P = Specify Project Number
F = Specify Fiscal Year
A = Name of Analyst
D = Design Feature
<cr> = exit SELECT STUDY IDENTIFICATION BLOCK
U:  CR
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
U:  CR
    MAIN MENU CHOICES
S = Select Study Parameters
R = Select Non-fuel Cost Growth Values
A = Define / Change Alternatives
N = Select Next Study
<cr> = exit PROGRAM
```

```
==MAIN MENU MODE==
U:a
    DEFINE / CHANGE ALTERNATIVES Choices
L = List Alternatives by Title
S = Define / Change Alternative Values
D = Delete an Alternative
R = Resequence Alternative Identifiers
O = Put Alternative Identifiers in Ascending Order
<cr> = exit DEFINE / CHANGE ALTERNATIVES
U:s
Enter Alternative identifier or title.
Enter LIST to see defined Alternatives by Title
<cr> to exit Alternative Selection
U:a
New Alternative; Identifier A
Enter Alternative Title
(Enter <cr> if you do not want to define a new Alternative)
U:baseline case
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:v
Initial Costs Settings, All must be entered.
0.0 is a valid entry.
Enter Full INVESTMENT  (+) Cost
Input in 10**3 Dollars --  THOUSANDS
U:0
Enter date of incurred Cost
Assumed value is OCT 1987
U:  CR
    INVESTMENT COSTS Choices
V = Specify Investment Cost and Related Information
<cr> = exit INVESTMENT COSTS
U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:  CR
```

```
    DEFINE / CHANGE ALTERNATIVES Choices
L = List Alternatives by Title
S = Define / Change Alternative Values
D = Delete an Alternative
R = Resequence Alternative Identifiers
O = Put Alternative Identifiers in Ascending Order
<cr> = exit DEFINE / CHANGE ALTERNATIVES
U:s
Enter Alternative identifier or title.
Enter LIST to see defined Alternatives by Title
<cr> to exit Alternative Selection
U:b
Invoking Auto-save of Study File, please wait a second.
LCC Study file INVST.LC successfully saved.
New Alternative; Identifier B
Enter Alternative Title
(Enter <cr> if you do not want to define a new Alternative)
U:investment 1
Enter existing Alternative Identifier to start with
  or press return if none
U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:v
Initial Costs Settings, All must be entered.
0.0 is a valid entry.
Enter Full INVESTMENT  (+) Cost
Input in 10**3 Dollars --  THOUSANDS
U:500
Enter date of incurred Cost
Assumed value is OCT 1987
U:  CR
    INVESTMENT COSTS Choices
V = Specify Investment Cost and Related Information
<cr> = exit INVESTMENT COSTS
U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
```

```
U:e
You will now be prompted for consumption of each fuel for which a price
has been entered.  If not applicable to this alternative,
enter 0.0 as the consumption value.
Enter Average Annual Consumption for ELECT in Thousand(s) Btus
U:help
   If the displayed energy consumption is not stated in the
   units above please convert to these units.

Enter Average Annual Consumption for ELECT in Thousand(s) Btus
U:-20000
Does this consumption continue through
the end of the analysis period?
U:y
Enter Average Annual Consumption for NAT G in Thousand(s) Btus
U:-1000
Does this consumption continue through
the end of the analysis period?
U:y
Enter Electric Demand Cost (first annual) in  THOUSANDS Dollars
Current Annual Electrical Consumption is  -20000.00 Thousand Btus
Specify Annual Electric Demand Cost for OCT 89 through OCT 14
U:0
    SPECIFY ENERGY USAGE VALUES
 1 = Specify Average Annual Consumption for ELECT
 2 = Specify Average Annual Consumption for DIST
 3 = Specify Average Annual Consumption for RESID
 4 = Specify Average Annual Consumption for NAT G
 5 = Specify Average Annual Consumption for COAL
 P = Specify Annual Electric Demand Cost Values
<cr> = exit SPECIFY ENERGY USAGE VALUES
U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:m
Begin entering values for M&R and Custodial Costs
    SPECIFY ANNUAL VALUES Choices
L = List Annual Values for this Alternative by Title
S = Define / Change Annual Values
D = Delete an Annual Value
<cr> = exit SPECIFY ANNUAL VALUES
U:s
Annual Value for Alternative INVESTMENT 1
Enter Existing Annual Value number or title.
Enter LIST to see defined Annual Values by Title
Enter 0 to begin defining a new Annual Value
```

```
<cr> to exit entering Annual Values
U:0
New Annual Value; Number  1
Enter Annual Value Title
(Enter <cr> if you do not want to define a new Annual Value)
U:m&r
Enter Annual Value   ( + => Cost, - => Savings).
Input in 10**3 Dollars --  THOUSANDS
U:100
    SPECIFY ANNUAL VALUES Choices
L = List Annual Values for this Alternative by Title
S = Define / Change Annual Values
D = Delete an Annual Value
<cr> = exit SPECIFY ANNUAL VALUES
U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:  CR
    DEFINE / CHANGE ALTERNATIVES Choices
L = List Alternatives by Title
S = Define / Change Alternative Values
D = Delete an Alternative
R = Resequence Alternative Identifiers
O = Put Alternative Identifiers in Ascending Order
<cr> = exit DEFINE / CHANGE ALTERNATIVES
U:  CR
    MAIN MENU CHOICES
S = Select Study Parameters
R = Select Non-fuel Cost Growth Values
A = Define / Change Alternatives
C = Calculate & Report Life Cycle Costs
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
U:c
    CALCULATE & REPORT LIFE CYCLE COSTS Choices
B = Select the Baseline Alternative
I = Individual Alternative Summary Reports
<cr> = exit CALCULATE & REPORT LIFE CYCLE COSTS
The lowest initial cost alternative is being selected
as the baseline alternative.  Enter B to choose a
different alternative for your baseline.
U:b
Please enter the identifier of the Baseline Alternative.
Current Baseline is A = BASELINE CASE
```

```
  <cr> to retain the current value.
U:  CR
    CALCULATE & REPORT LIFE CYCLE COSTS Choices
B = Select the Baseline Alternative
I = Individual Alternative Summary Reports
C = Alternative Comparison Summary Reports
<cr> = exit CALCULATE & REPORT LIFE CYCLE COSTS
U:c
Output report to Terminal?
U:y
Output report to standard file (printer format)?
U:n
Would you like to display comparisons with your selected baseline?
U:n
Enter Y to display optional DPP for comparisons.
U:y
Enter Y to display detailed DPP and SIR calculations.
U:y
Note that the detailed DPP calculation report will
not be produced when the SIR < 1.05
Set paper to top line of page, Press Return when ready.
U:  CR
```

User positions printer to top of page. User causes printer to begin logging all text coming to screen.

LIFE CYCLE COST ANALYSIS STUDY: INVST

LCCID 1.000 DATE/TIME: 17 OCT 85 12:54:28

PROJECT NO., FY, & TITLE: PN 777 FY 1987 EXAMPLE OF INVESTMENT ALTERNATIVES

INSTALLATION & LOCATION: USA-CERL ILLINOIS

DESIGN FEATURE: ZERO COST INITIAL INVESTMENT ALTERNATIVE

NAME OF DESIGNER: LINDA LAWRIE

SUMMARY REPORT

CRITERIA REFERENCE:FEDS/A-94 (Army ETL 1110-3-332, Part I)

DISCOUNT RATE: 10%

ALT ID.	ALTERNATIVES ANALYZED DESCRIPTION/TITLE	LCC (NET PW) ($ X 10**3)	INITIAL COST ($ X 10**3)	AVG. ANNUAL ENERGY USE (10**3 BTUS)
A	BASELINE CASE	0	0	0
B	INVESTMENT 1	1061	413	-21000

TABLE I. KEY DATA FOR ECONOMIC RANKING PURPOSES

ALT ID.	INITIAL INVEST-MENT COSTS	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLCE-MENT COSTS	OTH O&M COSTS & MONETRY BENEFTS	DISPOSL COSTS OR RETENTN VALUE	TOTAL
A	0	0	0	0	0	0	0
B	413	-2	650	0	0	0	1061

TABLE II. LIFE CYCLE COST COMPARISON (ACTUAL NET PW VALUES)*

LIFE CYCLE COST ANALYSIS STUDY: INVST

LCCID 1.000 DATE/TIME: 17 OCT 85 12:54:28

PROJECT NO., FY, & TITLE: PN 777 FY 1987 EXAMPLE OF INVESTMENT ALTERNATIVES

INSTALLATION & LOCATION: USA-CERL ILLINOIS

DESIGN FEATURE: ZERO COST INITIAL INVESTMENT ALTERNATIVE

NAME OF DESIGNER: LINDA LAWRIE

SUMMARY REPORT

ALT ID.	INITIAL INVEST-MENT COSTS	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLCE-MENT COSTS	OTH O&M COSTS & MONETRY BENEFTS	DISPOSL COSTS OR RETENTN VALUE	TOTAL	SIR	DPP
A	BASELINE ALTERNATIVE: ALTERNATIVE LOWEST IN INITIAL INVESTMENT COST								
B	413	-2	650	0	0	0	1061	N/A	***

TABLE III.A INCREMENTAL LIFE CYCLE COSTS* (RELATIVE TO BASELINE)

*NET PW EQUIVALENTS ON OCT85; IN 10**3 DOLLARS; IN CONSTANT OCT85 DOLLARS

```
    CALCULATE & REPORT LIFE CYCLE COSTS Choices
B = Select the Baseline Alternative
I = Individual Alternative Summary Reports
C = Alternative Comparison Summary Reports
<cr> = exit CALCULATE & REPORT LIFE CYCLE COSTS
U:  CR
```

User causes printer logging to cease.

```
    MAIN MENU CHOICES
S = Select Study Parameters
R = Select Non-fuel Cost Growth Values
A = Define / Change Alternatives
C = Calculate & Report Life Cycle Costs
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
U:  CR
LCC Study file INVST.LC successfully saved.
STOP
U:  CR
```

EXAMPLE 4.

```
Instructions ?
U:n
Enter LCC Study Code>
U:ecipx
New LCC Study?
U:y
Enter existing LCC Study code to start with
  or press return if none
U:  CR
    MAIN MENU CHOICES
S = Select Study Parameters
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
U:s
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
<cr> = exit SELECT STUDY PARAMETERS
U:c
Criteria Package Selection

Enter Project Type of the Study.
 1 = Military Construction Army (MCA)
 2 = Military Construction Navy (MCN)
 3 = Military Construction Air Force (MCAF)
 4 = Non-DOD Construction (NON-DOD)
U:1

Enter Significance of Energy on the Feature being studied.
 1 = Energy Effects Significant or Primary (SIGNIFICANT)
 2 = Energy Effects Incidental (INCIDENTAL)
 3 = Energy Effects Not Applicable (NONE)
U:1

Enter Primary Study Objective.
 1 = Selection of Best Conventional Design (CONVENTIONAL)
 2 = Special Directed Design Study (SPECIAL DIRECTED)
 3 = Retrofit Energy Conservation Investment Program (ECIP)
U:3
This study is based on a project type of MCA
The effect on energy of this study is SIGNIFICANT
This is a retrofit study for the Energy Conservation
Investment Program (ECIP).
The Life Cycle Costs for this study will be calculated
based on the FEMP/10CFR436A criteria package contained
in the code of federal regulations.
(Army ETL 1110-3-332, Part II)
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
```

```
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
U:d
Enter ECIP Economic Life. (Years)
U:25

** ECIP Economic Life Initialization complete.
Value can now be changed, if desired, or exit this menu.
    SELECT PROJECT DATES Choices
L = Economic Life of Building
<cr> = exit SELECT PROJECT DATES
U:  CR
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
U:e
    SELECT ENERGY RELATED STUDY INPUT Choices
S = Select DOE Region
<cr> = exit SELECT ENERGY RELATED STUDY INPUT
U:s
Enter study location (State)
U:maine
DOE Region  1 assigned. -- MAINE
Is above assignment correct?  Y or <cr>
U:  CR
There are two energy escalation rate files available.
 1 = Escalation values from July 1981
 2 = Escalation values from July 1984
<cr> = July 1984 values

July 1984 values become effective on 1 March 1985.
U:2
    SELECT ENERGY RELATED STUDY INPUT Choices
S = Select DOE Region
P = Select Energy Prices
<cr> = exit SELECT ENERGY RELATED STUDY INPUT
U:p
    SELECT ENERGY PRICES Choices
 0 = Initialize All Energy Type Prices
 1 = Select Prices of ELECT
 2 = Select Prices of DIST
 3 = Select Prices of RESID
 4 = Select Prices of NAT G
 5 = Select Prices of COAL
 <cr> exit SELECT ENERGY PRICES
U:1
Prices are specified in $ / MBtu, as of JUL 84 (FEMP Base Date)
Entering Cost for ELECT
U:10
```

```
    SELECT ENERGY PRICES Choices
 0 = Initialize All Energy Type Prices
 1 = Select Prices of ELECT
 2 = Select Prices of DIST
 3 = Select Prices of RESID
 4 = Select Prices of NAT G
 5 = Select Prices of COAL
 <cr> exit SELECT ENERGY PRICES
U:2
Prices are specified in $ / MBtu, as of JUL 84 (FEMP Base Date)
Entering Cost for DIST
U:20
    SELECT ENERGY PRICES Choices
 0 = Initialize All Energy Type Prices
 1 = Select Prices of ELECT
 2 = Select Prices of DIST
 3 = Select Prices of RESID
 4 = Select Prices of NAT G
 5 = Select Prices of COAL
 <cr> exit SELECT ENERGY PRICES
U:4
Prices are specified in $ / MBtu, as of JUL 84 (FEMP Base Date)
Entering Cost for NAT G
U:40
    SELECT ENERGY PRICES Choices
 0 = Initialize All Energy Type Prices
 1 = Select Prices of ELECT
 2 = Select Prices of DIST
 3 = Select Prices of RESID
 4 = Select Prices of NAT G
 5 = Select Prices of COAL
 <cr> exit SELECT ENERGY PRICES
U:  CR
    SELECT ENERGY RELATED STUDY INPUT Choices
S = Select DOE Region
P = Select Energy Prices
<cr> = exit SELECT ENERGY RELATED STUDY INPUT
U:  CR
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
U:t
** Begin Study Identification Block Initialization
Enter descriptive titles or appropriate values.
Enter Project Number
U:pn 888
Enter Fiscal Year
U:1985
Enter Project Title
U:ecip example
Enter Installation Name
```

```
U:usa-cerl
Enter Name of Person Preparing Study.
U:linda lawrie
Enter Design Feature of Study.
U:ecip illustration

** Study Identification Block initialization complete.
Data may now be changed, if desired, or exit this menu.
    SELECT STUDY IDENTIFICATION BLOCK Choices
I = Re-enter All Study Identification Block Data
T = Specify Project Title
L = Specify Installation Name
P = Specify Project Number
F = Specify Fiscal Year
A = Name of Analyst
D = Design Feature
<cr> = exit SELECT STUDY IDENTIFICATION BLOCK
U:  CR
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
U:  CR
    MAIN MENU CHOICES
S = Select Study Parameters
A = Define / Change Alternatives
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
U:a
    DEFINE / CHANGE ALTERNATIVES Choices
L = List Alternatives by Title
S = Define / Change Alternative Values
D = Delete an Alternative
R = Resequence Alternative Identifiers
O = Put Alternative Identifiers in Ascending Order
<cr> = exit DEFINE / CHANGE ALTERNATIVES
U:s
Enter Alternative identifier or title.
Enter LIST to see defined Alternatives by Title
<cr> to exit Alternative Selection
U:a
New Alternative; Identifier A
Enter Alternative Title
(Enter <cr> if you do not want to define a new Alternative)
U:ecip example
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
```

```
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:v
Initial Costs Settings, All must be entered.
0.0 is a valid entry.
Enter Full CONSTRUCTION  (+) Cost
Input in 10**0 Dollars --
U:1000000
Enter Full DESIGN  (+) Cost
Input in 10**0 Dollars --
U:60000
Enter Full SIOH  (+) Cost
Input in 10**0 Dollars --
U:60000
    INVESTMENT COSTS Choices
I = Initialize All Investment Costs for this Alternative
C = Specify Construction Cost and Related Information
D = Specify Design Cost and Related Information
O = Specify SIOH Cost and Related Information
<cr> = exit INVESTMENT COSTS
U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:e
You will now be prompted for consumption of each fuel for which a price
has been entered.  If not applicable to this alternative,
enter 0.0 as the consumption value.
Enter Average Annual Consumption for ELECT in Million(s) Btus
Energy Savings specified as positive.
U:10
Enter Average Annual Consumption for DIST in Million(s) Btus
Energy Savings specified as positive.
U:-5
Enter Average Annual Consumption for NAT G in Million(s) Btus
Energy Savings specified as positive.
U:30
    SPECIFY ENERGY USAGE VALUES
 1 = Specify Average Annual Consumption for ELECT
 2 = Specify Average Annual Consumption for DIST
 3 = Specify Average Annual Consumption for RESID
 4 = Specify Average Annual Consumption for NAT G
 5 = Specify Average Annual Consumption for COAL
<cr> = exit SPECIFY ENERGY USAGE VALUES
```

```
U:  CR
    DEFINE / CHANGE ALTERNATIVE VALUES
V = Specify Initial Investment Costs
E = Specify Energy Usage Values
M = Specify M&R and Custodial Costs
R = Specify Major Repair & Replacement Costs
S = Specify Net Disposal Cost or Retention Value
O = Specify Other Costs & Monetary Benefits
L = List this Alternative's Identifier and Title
D = Delete this Alternative
<cr> = exit DEFINE / CHANGE ALTERNATIVE VALUES
U:  CR
Invoking Auto-save of Study File, please wait a second.
LCC Study file ECIPX.LC successfully saved.
    DEFINE / CHANGE ALTERNATIVES Choices
L = List Alternatives by Title
S = Define / Change Alternative Values
D = Delete an Alternative
R = Resequence Alternative Identifiers
O = Put Alternative Identifiers in Ascending Order
<cr> = exit DEFINE / CHANGE ALTERNATIVES
U:  CR
    MAIN MENU CHOICES
S = Select Study Parameters
A = Define / Change Alternatives
C = Calculate & Report Life Cycle Costs
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
U:c
    CALCULATE & REPORT LIFE CYCLE COSTS Choices
I = Individual Alternative Summary Reports
<cr> = exit CALCULATE & REPORT LIFE CYCLE COSTS
U:i
Enter Existing Alternative identifier or title for the report.
Enter 0 to report on ALL ALternatives.
Enter LIST to see defined Alternatives by Title
<cr> to exit Input Summary Reports
U:0
Output report to Terminal?
U:y
Output report to standard file (printer format)?
U:n
Set paper to top line of page, Press Return when ready.
U:  CR
```

User positions printer to top of page. User causes printer to begin logging all text coming to screen.

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: ECIPX
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.000
INSTALLATION & LOCATION: USA-CERL — REGION NO. 1
PROJECT NO. & TITLE: PN 888 ECIP EXAMPLE
FISCAL YEAR 1985 DISCRETE PORTION NAME: ECIP ILLUSTRATION
ANALYSIS DATE: 17 OCT 85 — ECONOMIC LIFE 25 YEARS
PREPARED BY: LINDA LAWRIE — COSTS & SAVINGS IN DOLLARS

1. INVESTMENT

A. CONSTRUCTION COST	$ 1000000.
B. SIOH	$ 60000.
C. DESIGN COST	$ 60000.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$ 1008000.
E. SALVAGE VALUE COST	-$ 0.
F. TOTAL INVESTMENT (1D-1E)	$ 1008000.

2. ENERGY SAVINGS / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.00	10.	$ 100.	13.45	1345.
B. DIST	$ 20.00	-5.	$ -100.	18.19	-1819.
C. RESID	$ 0.00	0.	$ 0.	18.24	0.
D. NAT G	$ 40.00	30.	$ 1200.	21.18	25416.
E. COAL	$ 0.00	0.	$ 0.	14.71	0.
F. TOTAL		35.	$ 1200.		$ 24942.

3. NON ENERGY SAVINGS / COST (-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	11.65	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS / COST (-) (3A2+3BD4)		$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 8231.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= 0.03
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 1200.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 24942.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 0.02
(IF < 1 PROJECT DOES NOT QUALIFY)

```
Enter Existing Alternative identifier or title for the report.
Enter 0 to report on ALL ALternatives.
Enter LIST to see defined Alternatives by Title
<cr> to exit Input Summary Reports
U:  CR
```

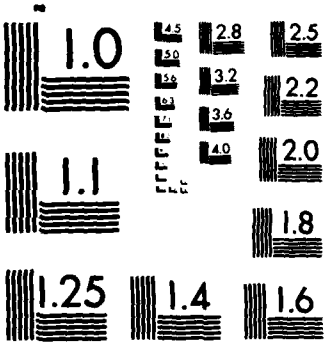
User causes printer logging to cease.

```
    CALCULATE & REPORT LIFE CYCLE COSTS Choices
I = Individual Alternative Summary Reports
<cr> = exit CALCULATE & REPORT LIFE CYCLE COSTS
U:  CR
    MAIN MENU CHOICES
S = Select Study Parameters
A = Define / Change Alternatives
C = Calculate & Report Life Cycle Costs
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
U:  CR
LCC Study file ECIPX.LC successfully saved.
STOP
U:  CR
```

AD-A162 522 DEVELOPMENT AND USE OF THE LIFE CYCLE COST IN DESIGN COMPUTER PROGRAM (LCCID)(U) CONSTRUCTION ENGINEERING RESEARCH LAB (ARMY) CHAMPAIGN IL L LAWRIE NOV 85 2/2

UNCLASSIFIED CERL-TR-E-85/07 F/G 9/2 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

EXAMPLE 5.

```
Instructions ?
U:n
Enter LCC Study Code>
U:solar
New LCC Study?
U:y
Enter existing LCC Study code to start with
  or press return if none
U:invst
LCC Study file INVST.LC retrieved. Last written on 17 OCT 85  at  12:54:55
    MAIN MENU CHOICES
S = Select Study Parameters
R = Select Non-fuel Cost Growth Values
A = Define / Change Alternatives
C = Calculate & Report Life Cycle Costs
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
U:s
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
U:c
Criteria Package Selection
This study is based on a project type of MCA
The effect on energy of this study is SIGNIFICANT
The primary study objective is the Selection of
the Best Conventional Design.
Do you wish to change criteria?
N or <cr> to retain current criteria.
U:y

Enter Project Type of the Study.
 1 = Military Construction Army (MCA)
 2 = Military Construction Navy (MCN)
 3 = Military Construction Air Force (MCAF)
 4 = Non-DOD Construction (NON-DOD)
U:1

Enter Significance of Energy on the Feature being studied.
 1 = Energy Effects Significant or Primary (SIGNIFICANT)
 2 = Energy Effects Incidental (INCIDENTAL)
 3 = Energy Effects Not Applicable (NONE)
U:1

Enter Primary Study Objective.
```

```
 1 = Selection of Best Conventional Design (CONVENTIONAL)
 2 = Special Directed Design Study (SPECIAL DIRECTED)
 3 = Retrofit Energy Conservation Investment Program (ECIP)
U:2

Enter Special Directed Study Type.
 1 = Design with Solar (SOLAR)
 2 = Non-Solar Design (NON-SOLAR)
U:1
This study is based on a project type of MCA
The effect on energy of this study is SIGNIFICANT
This study is a Special Directed Study of type - SOLAR
The Life Cycle Costs for this study will be calculated
based on the FEMP/10CFR436A criteria package contained
in the code of federal regulations.
(Army ETL 1110-3-332, Part II)
    SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS
U:  CR
    MAIN MENU CHOICES
S = Select Study Parameters
A = Define / Change Alternatives
C = Calculate & Report Life Cycle Costs
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
U:c
    CALCULATE & REPORT LIFE CYCLE COSTS Choices
B = Select the Baseline Alternative
I = Individual Alternative Summary Reports
C = Alternative Comparison Summary Reports
<cr> = exit CALCULATE & REPORT LIFE CYCLE COSTS
U:c
Output report to Terminal?
U:y
Output report to standard file (printer format)?
U:n
Would you like to display comparisons with your selected baseline?
U:n
Enter Y to display detailed DPP and SIR calculations.
U:y
Note that the detailed DPP calculation report will
not be produced when the SIR < 1.05
Set paper to top line of page, Press Return when ready.
U:  CR
```

User positions printer to top of page. User causes printer to begin logging all text coming to screen.

LIFE CYCLE COST ANALYSIS STUDY: SOLAR

LCCID 1.000 DATE/TIME: 17 OCT 85 16:12:25

PROJECT NO., FY, & TITLE: PN 777 FY 1987 EXAMPLE OF INVESTMENT ALTERNATIVES

INSTALLATION & LOCATION: USA-CERL ILLINOIS

DESIGN FEATURE: ZERO COST INITIAL INVESTMENT ALTERNATIVE

NAME OF DESIGNER: LINDA LAWRIE

SUMMARY REPORT

CRITERIA REFERENCE:FEMP/10CFR436A (Army ETL 1110-3-332, Part II)

DISCOUNT RATE: 7%

ALT ID.	ALTERNATIVES ANALYZED DESCRIPTION/TITLE	LCC (NET PW) ($ X 10**3)	INITIAL COST ($ X 10**3)	AVG. ANNUAL ENERGY USE (10**3 BTUS)
A	BASELINE CASE	0	0	0
B	INVESTMENT 1	1611	450	-21000

TABLE I. KEY DATA FOR ECONOMIC RANKING PURPOSES

ALT ID.	INITIAL INVEST-MENT COSTS	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLCE-MENT COSTS	OTH O&M COSTS & MONETRY BENEFTS	DISPOSL COSTS OR RETENTN VALUE	TOTAL
A	0	0	0	0	0	0	0
B	450	-4	1165	0	0	0	1611

TABLE II. LIFE CYCLE COST COMPARISON (ACTUAL NET PW VALUES)*

LIFE CYCLE COST ANALYSIS STUDY: SOLAR

LCCID 1.000 DATE/TIME: 17 OCT 85 16:12:25

PROJECT NO., FY, & TITLE: PN 777 FY 1987 EXAMPLE OF INVESTMENT ALTERNATIVES

INSTALLATION & LOCATION: USA-CERL ILLINOIS

DESIGN FEATURE: ZERO COST INITIAL INVESTMENT ALTERNATIVE

NAME OF DESIGNER: LINDA LAWRIE

SUMMARY REPORT

ALT ID.	INITIAL INVEST-MENT COSTS	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLCE-MENT COSTS	OTH O&M COSTS & MONETRY BENEFTS	DISPOSL COSTS OR RETENTN VALUE	TOTAL	SIR	DPP
A	BASELINE ALTERNATIVE: ALTERNATIVE LOWEST IN INITIAL INVESTMENT COST								
B	450	-4	1165	0	0	0	1611	N/A	***

TABLE III.A INCREMENTAL LIFE CYCLE COSTS* (RELATIVE TO BASELINE)

*NET PW EQUIVALENTS ON JUL84; IN 10**3 DOLLARS; IN CONSTANT JUL84 DOLLARS

```
    CALCULATE & REPORT LIFE CYCLE COSTS Choices
B = Select the Baseline Alternative
I = Individual Alternative Summary Reports
C = Alternative Comparison Summary Reports
<cr> = exit CALCULATE & REPORT LIFE CYCLE COSTS
U:  CR
```

User causes printer logging to cease.

```
    MAIN MENU CHOICES
S = Select Study Parameters
A = Define / Change Alternatives
C = Calculate & Report Life Cycle Costs
N = Select Next Study
<cr> = exit PROGRAM

==MAIN MENU MODE==
U:  CR
LCC Study file SOLAR.LC successfully saved.
STOP
U:  CR
```

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