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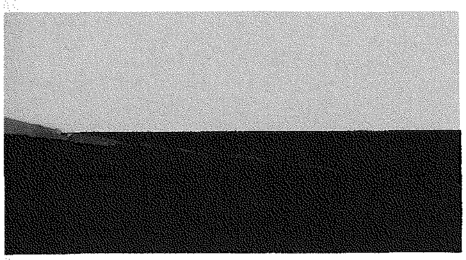

COPE: Cogeneration Options Evaluation.

Volume 2. User's Manual

EPRI-EM--3126-CCM-Vol.2

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Prepared by
Synergic Resources Corporation
Bala Cynwyd, Pennsylvania

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EM-3126-CCM, Volume 2
Research Project 1276-8

Computer Code Manual, June 1983

Prepared by

SYNERGIC RESOURCES CORPORATION
Three Bala Plaza East, Suite 555
Bala Cynwyd, Pennsylvania 19004-3406

Principal Investigators
B. Venkateshwara
D. R. Limaye

Prepared for

Electric Power Research Institute
3412 Hillview Avenue
Palo Alto, California 94304

EPRI Project Managers
S. Hu
R. Mauro

Industrial Program
Energy Management and Utilization Division

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Prepared by
Synergic Resources Corporation
Bala Cynwyd, Pennsylvania

ABSTRACT

A number of computer evaluation tools have been developed as part of RP1276, an EPRI project to comprehensively evaluate the applications of dual-energy-use systems. One of the tools, Cogeneration Options Evaluation (COPE), is a computer model that deals with the institutional and regulatory implications of specific projects.

COPE can help management examine attractive cogeneration options and choose an option that is best suited for a specific site, given the relevant tax and fuel use regulations. An "option" here refers not only to different technologies, but also to different ownership structures and/or operating modes. For each option under consideration, COPE provides an analysis of the project's impact on the utility, the industry, and where appropriate, a third party.

This document provides detailed instructions for conducting site-specific studies using COPE.

EPRI PERSPECTIVE

PROJECT DESCRIPTION

This two-volume progress report for RP1276-8, Technical Studies of Dual Energy Use Systems (DEUS), is entitled COPE Computer Model and presents the manuals for the Cogeneration Options Evaluation Computer Model that is available for evaluation of utility options in owning cogeneration systems. Volume 1 is the program descriptive manual, and Volume 2 is the program user's manual. The descriptive manual explains the model's structure, applications, and methodology; the user's manual describes how to access the model, to prepare data for analyzing financing options, and to interpret results.

RP1276-8 is one project in the RP1276 series, which is concerned with cogeneration and district heating. The project has been used to identify utility concerns in cogeneration development, to provide technical service to utilities, and to coordinate activities under the project. The COPE model was thus developed as a result of this effort.

PROJECT OBJECTIVES

The three main objectives of this project are to provide technical support to utilities for using computer programs, conceptual designs, and methodology developed under RP1276; to develop data bases; and to identify issues of concern to utilities.

PROJECT RESULTS

Technical service has been provided to more than 20 utilities, enabling them to use the DEUS computer program (EPRI Final Report EM-2776, Volumes 1 and 2). The COPE model has also been distributed to more than 15 utilities. The model is a computer simulation program written in standard FORTRAN. Using performance and cost data of cogeneration systems designed by architect-engineers or engineering models (e.g., DEUS Computer Model), the COPE model evaluates the impact of various cogeneration financing and ownership arrangements on utilities. The model also computes levelized annual revenue requirements, levelized busbar cost of electricity, first-year revenue requirement, and first-year busbar cost of electricity. A number of utility-industry partnership options can be considered and compared to 100% industry ownership. The utility's share of initial capital outlays is fixed at less than 50% owing to the Public Utilities Regulatory Policies Act regulations. The utility's profit share can then be varied to identify an optimal combination of partnerships that can both increase the industry's rate of return and lower the utility's cost of electricity delivered from the cogeneration plant.

The COPE model is available to electric utilities and the public. Public service organizations or government agencies that wish to obtain the COPE software should contact EPRI directly at Patents and Licensing, EPRI, 3412 Hillview Avenue, P.O. Box 10412, Palo Alto, California 94303, (415) 855-2866.

EPRI member utilities and other potential users should contact the Electric Power Software Center, University Computing Company, 1930 Hi Line Drive, Dallas, Texas 75207, (214) 655-8883.

S. David Hu, Project Manager
Energy Management and Utilization Division

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CONTENTS

ILLUSTRATIONS

TABLES

SUMMARY

INTRODUCTION

In 1979, the Electric Power Research Institute (EPRI) initiated RP1276, a project to evaluate the applications of dual energy use systems, giving explicit consideration to utility roles, perspectives and impacts. Under RP1276, a methodological framework to evaluate cogeneration systems was developed. Computer tools to implement the methodology were also developed.

The methodology for evaluating cogeneration systems consists of two steps. In the first step, the aggregate benefits, costs and impacts are calculated. This computation is unaffected by the distribution of costs and benefits among the parties involved. The allocation of such costs and benefits depends on institutional, regulatory and ownership arrangements. It is accounted for in the second step of the methodology, which is implemented through a computer model, "Cogeneration Options Evaluation (COPE)."

OVERVIEW OF COPE

COPE is an evaluation tool that can help management examine attractive cogeneration options and choose an option that is best suited for a specific site, given the relevant tax and fuel use regulations. An "option" here refers not only to different technologies, but also to different ownership structures and/or operating modes. For each option under consideration, COPE requires cost and performance information as input, and provides, as output, an analysis of the project's impact on the utility, the industry, and where appropriate, a third party. The cost and performance information may come from site-specific engineering studies or from other design-oriented computer models.

COPE OBJECTIVES

The objectives of COPE are to:

- Evaluate, based on after-tax cash flows from cogeneration ventures, the financial and regulatory implications for the utility, the industry, and where relevant, third parties, for all practically feasible combinations of ownership and operating mode.
- Trace, in terms of important dollar flows, the impacts of cogeneration ventures on the utility and the industry for all practically feasible combinations of ownership and operating mode.
- Provide information to potential project participants to identify mutually beneficial institutional arrangements for implementing cogeneration projects.

APPLICATIONS OF COPE

COPE's principal strength is that the after-tax cash flow analysis is based on detailed site-specific information. For instance, the initial capital outlay is divided into eight categories that can be distinguished for tax purposes. Energy tax credits are determined on the basis of facility status and fuels used. Institutional and regulatory factors such as back-up and buyback rates, operating mode, and ownership structure are taken into account in determining the distribution of after-tax costs and benefits among parties.

Using these after-tax costs and benefits, a financial analysis is performed for each party. Specifically, COPE computes on an after-tax basis, the net present value, the internal rate of return, the payback and the debt-coverage ratio for each project participant. In addition, a pro forma income statement for the project is presented. Thus, for a given implementation mechanism, COPE can be used to judge the impact on the project participants. Conversely, sensitivity analyses can be performed to identify implementation mechanisms that would benefit all parties. Implementation mechanisms that can be readily examined include: 100% ownership by a utility or an industry or a third party; and joint ventures involving any combination of a utility, an industry, and a third party.

Sensitivity analyses can also be used to answer a number of other questions, such as: What PURPA price profile (for electricity) will give an industrial owner a specified rate of return on the project? Alternatively, at given electricity and steam prices, COPE could be used to determine the maximum input fuel cost which would give an industrial owner a desired project rate of return. Similarly, for new technologies, COPE can be used to determine a "maximum allowable total installed cost."

Since COPE maintains separate accounts for three distinct project participants--the utility, the industry, and a third party--a number of innovative schemes involving transfers between parties can be represented. For instance, a scheme in which an industry sells the cogeneration plant to a utility after owning and operating it for a fixed number of years can be represented. COPE can be used to analyze the impact of these transactions on each participant for each year of useful project life. Similarly, a leasing arrangement can be handled by using the third party's account to represent the lessor's inflows and outflows. Thus COPE can be used to analyze the impact of a leasing arrangement for the lessor as well as the lessee.

OUTPUTS OF COPE

The output from COPE consists of a series of reports. Reports 1,2,3 and 4 display the inputs used in COPE. Report 1 contains the project schedule. Report 2 summarizes ownership and operating information. Specifically, Report 2 describes the ownership structure, the dispatch arrangement, the electricity sales arrangement and annual average system performance. In Report 3, a number of details related to fuel use and other regulatory issues are provided. Price and cost information is presented in Report 4. An important feature of Report 4 is that the variation of prices/costs/rates over project life is displayed. Thus, the pattern of escalation is evident to the user.

Report 5 contains the results of the analysis performed by COPE. Section A of Report 5 describes the economic inputs used in the analysis. Such details as the financial structure, cost and type of debt, and partnership arrangements are presented in Section A. Section B displays after-tax cash flow accounts for each participant during construction and during operation. In addition, Section B presents, for each participant, the net present value (NPV), the rate of return (ROR), the payback period (P_b) and the debt coverage ratio. In the case of industry ownership COPE can be set up so as to perform financial analyses based on incremental investment, i.e., investment over and above that required for a conventional boiler. In the case of the utility, COPE displays both the first year busbar cost and the levelized busbar cost.

Finally, Section C of Report 5 contains the additional impacts, if any, on the utility and the industry. These impacts are presented as dollar values for each year of project life.

SOFTWARE AND DOCUMENTATION

The software for COPE is written in FORTRAN and comprises more than 2000 lines. The software itself is made up of analytical modules each of which is a FORTRAN subroutine.

This two-volume progress report for RP1276-8, Technical Studies of Dual Energy Use Systems (DEUS), is entitled COPE Computer Model and presents the manuals for the Cogeneration Options Evaluation Computer Model that is available for evaluation of utility options in owning cogeneration systems. Volume 1 is the program descriptive manual, and Volume 2 is the program user's manual. The descriptive manual explains the model's structure, applications, and methodology; the user's manual describes how to access the model, to prepare data for analyzing financing options, and to interpret results.

This document provides detailed instructions for conducting site-specific studies using COPE. The instructions in Section 3 are written for NCSS users of COPE. Users interested in implementing COPE on other computer systems will find Sections 4 and 5 very helpful. It is recommended that the user read "Cogeneration Options Evaluation (COPE): Program Description Manual," before using the program.

Section 1

INTRODUCTION

BACKGROUND

Dual Energy Use Systems (DEUS) have been the subject of many recent studies, which have addressed the technical, economic and institutional issues relevant to the implementation of such systems. However, most of these studies, particularly cogeneration assessments sponsored by the Department of Energy, have focused on industry-owned and -operated systems. Insufficient attention has been paid to the perspectives and potential roles of electric utilities, and the possible industry-utility cooperative efforts and interactions vis-a-vis DEUS implementation. Similarly, many public sector studies of district heating (and integrated community energy systems or ICES) have given insufficient attention to the role and perspective of the local electric utility.

The Electric Power Research Institute therefore initiated a project to evaluate dual energy use systems applications, giving explicit consideration to utility roles, perspectives and impacts. This project, RP 1276, was initiated in early 1979 and numerous activities are currently underway.*

The methodology for evaluating cogeneration projects consists of two steps. In the first step, the aggregate benefits, costs and impacts of cogeneration are calculated, taking into account the impacts on the utility, the industry and society. This calculation is based on the value of electric and thermal energy used, the costs of producing this energy, and the related social and environmental considerations. Institutional and regulatory considerations such as standby and buy-back rates (PURPA rates), tax credits, and alternative ownership and operation arrangements do not affect the overall benefits of cogeneration from the systems viewpoint; they determine how the benefits, costs and impacts are shared by the various parties affected.

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*See Synergic Resources Corporation, Evaluation of Dual Energy-Use Systems, Interim Report, Volume 2, EPRI EM-2695, Palo Alto, California, October 1982.

These factors are therefore considered in the second step, which evaluates the optimum negotiated position of each party relative to the cogeneration venture through the use of Cogeneration Options Evaluation (COPE), a computer model.

COPE

Cogeneration Options Evaluation (COPE) is a computer model designed to address the institutional and regulatory issues raised by cogeneration. It is an evaluation tool that can help management examine attractive cogeneration options and choose an option that is best suited for a specific site, given the relevant tax and fuel use regulations. An "option" here refers not only to different technologies, but also to different ownership structures and/or operating modes. For each option under consideration, COPE requires cost and performance information as input, and provides, as output, an analysis of the project's impact on the utility, the industry, and where appropriate, a third party. The cost and performance information may come from site-specific engineering studies or from other design-oriented computer models.

The objectives of COPE are to:

- Evaluate, based on after-tax cash flows from cogeneration ventures, the financial and regulatory implications for the utility, the industry, and where relevant, third parties, for all practically feasible combinations of ownership and operating mode.
- Trace, in terms of important dollar flows, the impacts of cogeneration ventures on the utility and the industry for all practically feasible combinations of ownership and operating mode.
- Provide information to potential project participants, identifying mutually beneficial institutional arrangements for implementing cogeneration projects.

COPE's principal strength is that the after-tax cash flow analysis is based on detailed site-specific information. For instance, the initial capital outlay is divided into eight categories that can be distinguished for tax purposes. Energy tax credits are determined on the basis of facility status and fuels used. Institutional and regulatory factors such as back-up and buyback rates, operating mode, and ownership structure are taken into account in determining the distribution of after-tax costs and benefits among parties.

MODEL CAPABILITIES

A number of case studies were conducted in cooperation with utilities to test and demonstrate the capabilities of COPE. Selected cases are discussed in Section 4. A summary of the potential applications for COPE is presented here.

The ownership arrangement that is used to implement a cogeneration project determines the after-tax returns that different project participants realize. This is because the ownership arrangement affects the magnitude and distribution of after-tax cash flows in two ways. First, if a cogeneration facility is a qualifying facility under the Public Utility Regulatory Policies Act (PURPA), it is free from public utility regulation. Thus, the electricity from the facility can be sold at PURPA rates (which are based on utility avoided costs). If the utility participates as an "investor" in a qualifying facility (less than 50% utility ownership under current legislation), it can obtain a share of the revenues based on the PURPA rates. The treatment of these revenues by the regulatory commission will determine whether the utility derives any significant benefits from such participation. Second, if a facility is a "qualified facility" under PURPA, it is not deemed "public utility property" for legal purposes, even if it produces electricity for sale. As a result, certain portions of the capital investment could qualify for energy tax credits. Thus, for instance, a coal cogeneration facility would qualify as alternative energy property, and energy tax credits of 10% would be available on fuel handling equipment, boiler(s), pollution control equipment, and specialized buildings or structures. COPE incorporates investment and energy tax credits as part of the cash flow analysis.

In the past, a common assumption was that a cogeneration system is owned entirely either by an industry or a utility. With the increased interest in cogeneration, a number of innovative arrangements are being considered. For example, joint ventures among industry, utility and third parties may offer benefits to all the participants. One arrangement to form a joint venture is to create a separate corporation for the sole purpose of owning and operating the cogeneration project. In this arrangement, the cogeneration project would be taxed as a corporation.

The partnership arrangement can also be used to form joint ventures. Partnerships do not pay a federal tax on earnings comparable to the corporate earnings tax; however, each partner pays federal tax on his share of earnings from the partnership. Also, partnerships enjoy a degree of flexibility in the apportionment of tax and depreciation benefits as well as profits (or losses) among partners. It is possible, therefore, to design partnership arrangements so as to attract private (or "third party") investors by offering them substantial tax-related benefits. At the same time, third parties, having no site-specific thermal or electric requirements, are unlikely to insist on specific operating modes. Thus, partnerships between utilities, industries and "third parties" can often be mutually beneficial.

Any one of the following ownership arrangements can be analyzed by COPE. The utility can be either an investor-owned or a tax-exempt utility.

- 100% Ownership
  - 100% Utility Ownership
  - 100% Industry Ownership
  - 100% Third Party Ownership (or Separate Corporation).
- Joint Ventures
  - Partnership: Utility/Industry
  - Partnership: Utility/Third Party
  - Partnership: Industry/Third Party
  - Partnership: Utility/Industry/Third Party.

COPE uses information about the ownership structure, the cogeneration system and the operating mode to simulate initial and operating cash flows over the project's useful economic life. Subsequently, these cash flows are apportioned among the project participants and each participant's cash flow is computed. Finally, these cash flows are used to compute the net present value, the internal rate of return, the payback and the debt-coverage ratio for each participant. In addition, a pro forma income statement for the project is presented.

For a given implementation mechanism, therefore, COPE can be used to judge the impact on the project participants. Conversely, sensitivity analyses can be performed to identify implementation mechanisms that would benefit all participants. Sensitivity analyses can also be used to answer a number of other questions, such as: What PURPA price profile (for electricity) will give an industrial owner a specified rate of return on the project? Alternatively, at given electricity and steam prices, COPE can be used to determine the maximum input fuel cost which would give an industrial owner a desired project rate of return. Similarly, for new technologies, COPE can be used to determine a "maximum allowable total installed cost."

Since COPE maintains separate accounts for three distinct project participants--the utility, the industry, and a third party--a number of innovative schemes involving transfers between parties can be represented. For instance, a scheme in which an industry sells the cogeneration plant to a utility after owning and operating it for a fixed number of years can be represented. COPE can be used to analyze the impact of such transactions on each participant for each year of useful project life. Similarly, a leasing arrangement can be handled by using the third party's account to represent the lessor's inflows and outflows. Thus COPE can be used to analyze the impact of a leasing arrangement for the lessor as well as the lessee.

The output from COPE consists of a series of reports. Reports 1,2,3 and 4 display the inputs used in COPE. Report 5 presents the outputs from the analysis. Examples of these reports are presented in Section 4 of this report.

The software for COPE is written in FORTRAN and comprises more than 2000 lines. The software itself is made up of analytical modules each of which is a FORTRAN subroutine.

This document provides detailed instructions for conducting site-specific studies using COPE. The instructions in Section 3 are written for NCSS users of COPE. Users interested in implementing COPE on other computer systems will find Sections 4 and 5 very helpful. It is recommended that the user read "Cogeneration Options Evaluation (COPE): Program Description Manual," before using the program.

Section 2

SUMMARY OF PROGRAM CAPABILITIES

COPE

This section presents a summary of the computations performed by COPE. A more detailed description of these computations is presented in "Cogeneration Options Evaluation (COPE): Program Description Manual." Since COPE can evaluate different operating modes and/or ownership structures, the manner in which each is characterized is first discussed. Later in this section, the evaluation procedure is summarized.

OPERATION OF COGENERATION UNITS

The manner in which cogeneration units are operated determines the mix of outputs (i.e., steam and electricity) delivered. Moreover, the operating mode has important implications--practical and financial--for the parties involved. The operating mode can be characterized by two features:

- The dispatch arrangement
- The electricity sales arrangement.

The Dispatch Arrangement

- **Thermal Dispatch**

In this dispatch arrangement, the cogeneration unit is sized so as to maximize fuel utilization efficiency, subject to the constraint that the thermal demand under peak conditions is met. If auxiliary boilers are specified as part of the system, it is assumed that they will be utilized in meeting peaks. The system is dispatched so that in every time interval the thermal demand is exactly met. The electric output of the unit corresponding to this condition is the power generated by the system.

- **Economic Dispatch**

As the name suggests, economic dispatch relates plant operations to economic criteria. Under this dispatch arrangement, the cogeneration unit size is chosen by the parties involved. Indeed, the size of the unit itself may be determined to a large extent by economic criteria. Once the unit is chosen, the manner in which it is dispatched is also determined by economic criteria. Specifically, the system is dispatched so that in every time interval the net operating income (i.e., revenues minus costs) is maximized, subject to the constraint that the thermal output from the unit be at least as large as the thermal demand. Of course, the size of the unit (which is specified by the parties involved) places an upper limit on the electric output from the unit.

The Electricity Sales Arrangement

The electricity sales arrangement is an important feature of a cogeneration system, since it determines the amount of electricity that is sold to the utility.

- **Simultaneous-Buy-Sell**

Under this arrangement, the entire electric output from the cogeneration system is sold to the utility. The electricity that is required for the operation of the cogeneration system itself (i.e., the auxiliary power) is bought from the local electric utility. Also, whatever on-site process power is required is bought from the local electric utility.

- **Buy-Shortage-Sell-Excess**

Under the buy-shortage-sell-excess arrangement, the electric output from the system is first used in each time interval to meet the auxiliary and process power requirements respectively. If, after meeting these requirements, excess power is available, it is sold to the local utility. If, on the other hand, the power requirements in a time interval exceed the system's electric output, the deficit is met by buying power from the utility.

Performance Characteristics

The performance of a cogeneration system under a given operating mode can be characterized by the following physical flows:

- Gross power output from system in kW
- Power required by auxiliaries in kW

- Process power demand (if relevant*) in kW
- Thermal output from system in Million Btu/hr
- Fuel(s) use by the system in Million Btu/hr.

Each of these performance descriptors can be expressed either on an average annual basis or on a period-by-period basis. In the latter case, the periods may correspond to the local utility's PURPA periods. Expressing performance characteristics by PURPA period could be of considerable importance to the economic analysis in situations where PURPA prices vary significantly from period to period.

COPE treats the performance descriptors mentioned above as inputs. These inputs may come from site-specific engineering calculations or from other, design-oriented computer models.

OWNERSHIP OF COGENERATION SYSTEMS

The magnitude and distribution of after-tax costs and benefits from a cogeneration venture determined both by the operating mode and the ownership structure. The are ownership structure need not necessarily determine the operating mode, although certain combinations of ownership and operating mode are unlikely. For instance, it is unlikely that a utility owned system would be operated under thermal dispatch. In COPE, the operating mode and the ownership arrangement are independent, user-specified inputs. COPE can examine the following ownership structures:

- 100% ownership
  - 100% utility owned
  - 100% industry owned
  - 100% third party owned.

Under 100% ownership, all the costs and benefits from the project flow to a single party. Under PURPA the ownership structure influences both tax-related benefits and project revenues. With regard to the utility, the user can specify whether the utility is investor-owned or tax exempt.

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*Although the process power demand is not a system characteristic, it is necessary in order to calculate (i) the extra back-up cost, if any, under simultaneous-buy-sell, or (ii) the net power, under buy-shortage-sell-excess.

- Joint Ventures
  - separate corporation
  - partnerships involving any combination of the utility, the industry and a third party.

Two methods can be used to implement joint ventures: a separate corporation and a partnership. In both cases, project costs and benefits flow to project participants. There are, however, important differences between the two arrangements.

In the case of a separate corporation, each project participant has an interest in a corporation which, in turn, owns the assets that make up the cogeneration plant. Under this arrangement, we can view the project participants as shareholders in a corporation that is in the cogeneration business. From a managerial standpoint, this has two important implications. First, the "cogeneration corporation" would have to pay a corporate tax on earnings like any other corporation. Second, in providing debt to the corporation, the capital markets would rate the corporation as a whole. This second point may not lower the corporation's cost of debt, since lenders would have no indicators of past financial performance to make judgements. The cost of debt and the cost of equity for the new corporation are of great importance in evaluating this ownership structure. Indeed, for modeling purposes, evaluating a cogeneration venture from the standpoint of the newly formed corporation is no different from evaluating a project for 100% third party ownership, so long as the appropriate costs of debt and equity are used.

In the partnership arrangement, each project participant holds an undivided interest in the partnership's assets. Commonly, partnerships have a general partner and a number of limited partners. From a managerial standpoint, there are three noteworthy features of this arrangement. First, all project costs and benefits are shared among project participants by a predetermined formula that is mutually agreed to by the partners. The "benefits" referred to here include not only project revenues, but also tax credits and depreciation allowances. "Costs," in this context, include both initial outlays and operating costs. Partnerships have a degree of flexibility in apportioning costs and benefits. The partnership agreement also includes the extent of exposure of each partner in the event that the project is not completed. Second, the mode of operation of the plant would also be determined by mutual consent of the partners. Third, the partnership itself is not subject to a federal tax comparable to a corporate tax. Each partner is, however, taxed based on his share of profits (or losses) from the venture.

FINANCIAL IMPLICATIONS OF OWNERSHIP

The ownership arrangement affects the magnitude and distribution of after-tax cash flows in two ways. First, if a cogeneration facility is a qualifying facility under PURPA, it is free from public utility regulation. Thus, the electricity from the facility can be sold at PURPA rates (which are based on utility avoided costs). If the utility participates as an "investor" in a qualifying facility (less than 50% utility ownership under current legislation), it can obtain a share of the revenues based on the PURPA rates. The treatment of these revenues by the regulatory commission determines whether the utility derives any significant benefits from such participation.

Second, if a facility is a "qualified facility" under PURPA, it is not deemed "public utility property" for legal purposes, even if it produces electricity for sale. As a result, certain portions of the capital investment could be eligible for energy tax credits. There are important details regarding the determination of the magnitude of energy tax credits that can legally be claimed. Figure 2-1 presents a logic diagram describing the procedure used for energy tax credit computation in COPE. Figure 2-2 and Table 2-1 provide additional details. Investment tax credits and depreciation computations based on the Economic Recovery Tax Act (ERTA), 1981 are considered in similar detail.*

SIMULATION OF PROJECT ECONOMICS

For a given cogeneration system and operating mode, COPE performs simulations of (i) initial cash flows, (ii) operating cash flows over the project's useful economic life, and (iii) cash flows accruing to each party, as well as investment analyses for each party. Figure 2-3 provides an overview of COPE.

In the first stage of the analysis, COPE processes information about the project as a whole and does not apportion initial expenditures among parties. The total installed cost of the system and the distribution of cash outflows over the construction period are important inputs. COPE also requires a breakdown of initial costs for eight specific items that can be distinguished for tax purposes (see Table 2-1).

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*A complete description of the tax credit and depreciation computations can be found in "Cogeneration Options Evaluation (COPE): Program Descriptive Manual."

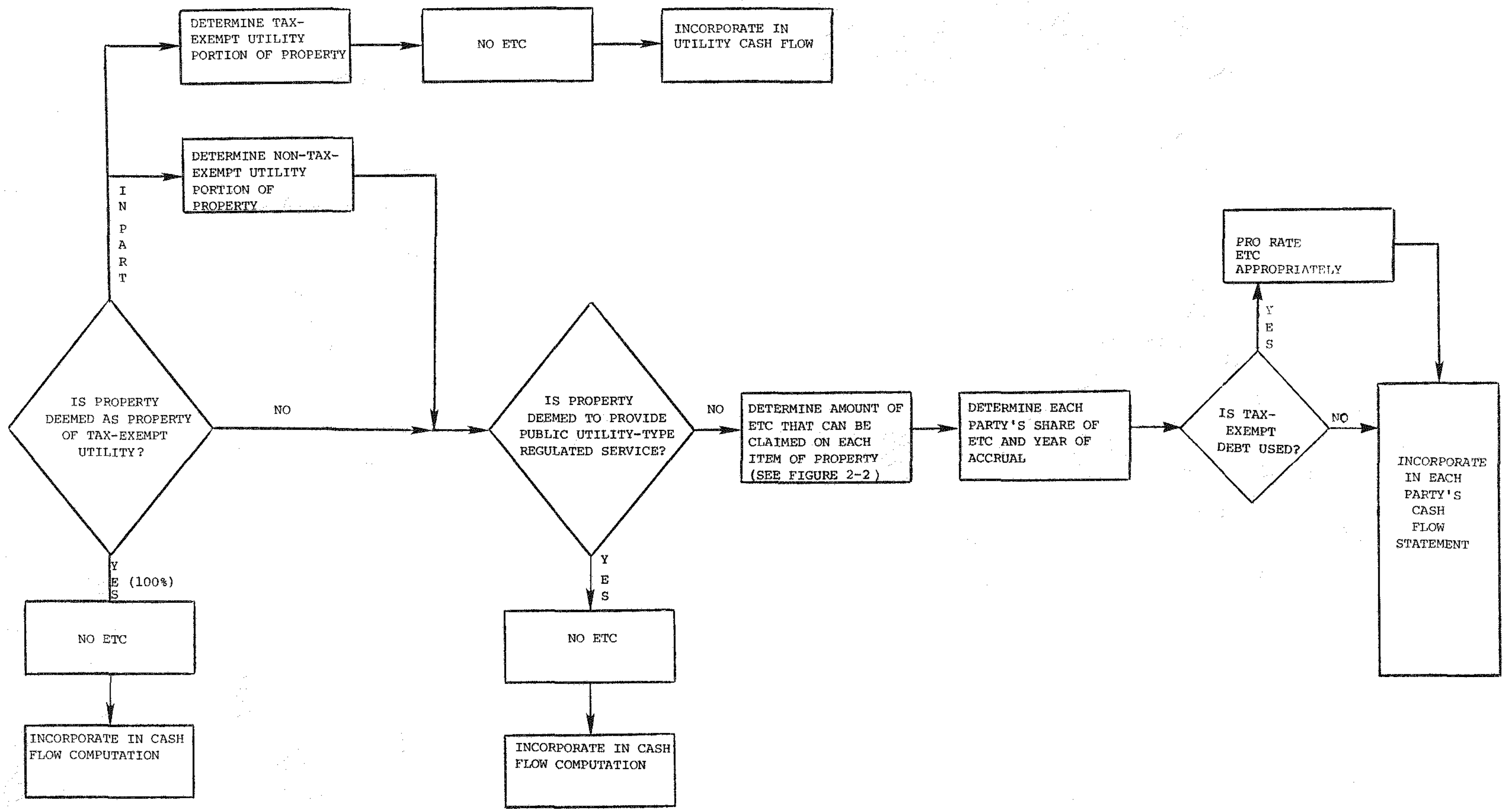

Figure 2-1. Logic Diagram to Determine Energy Tax Credits (ETC).

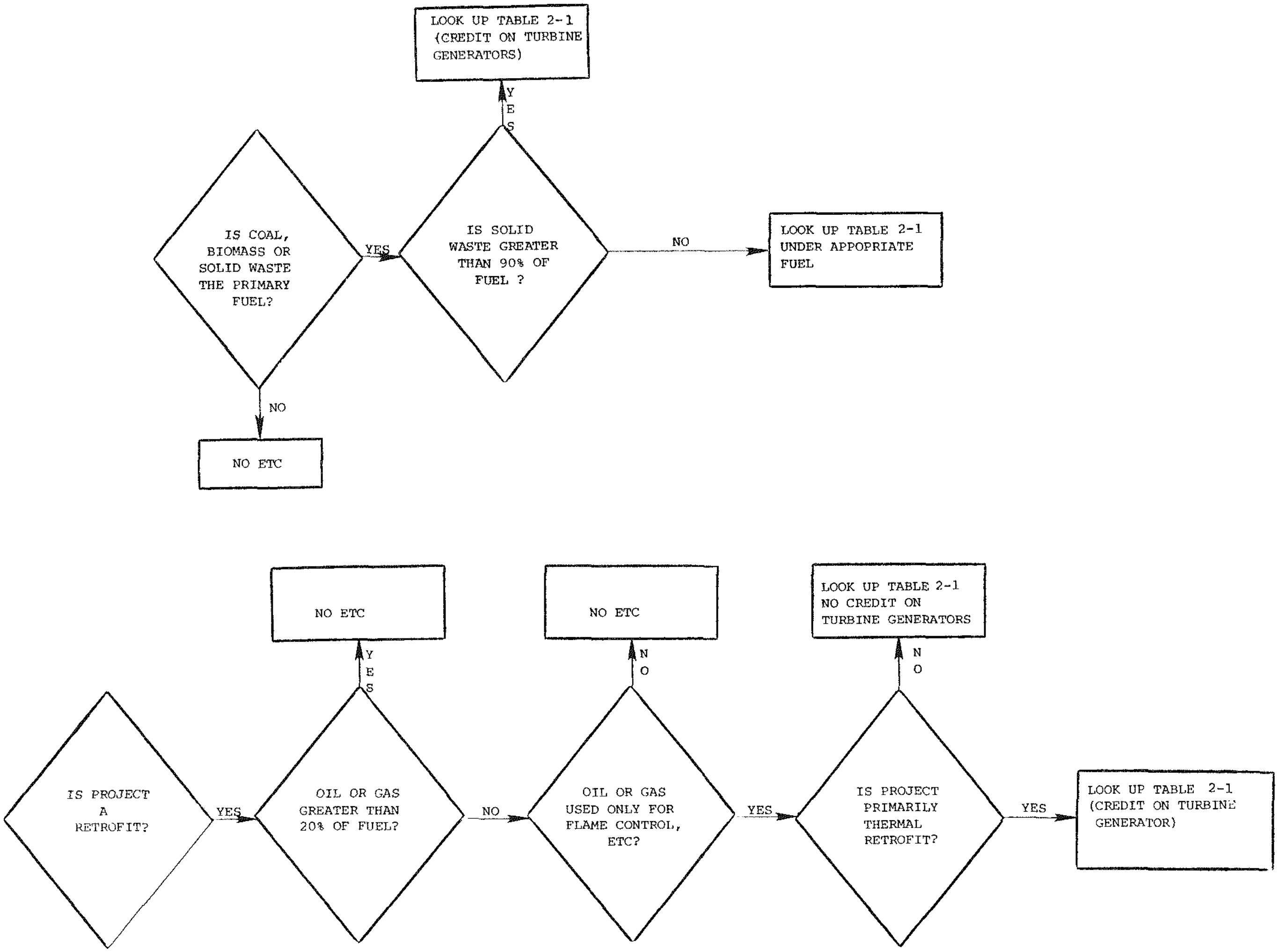

Figure 2-2. Details For Energy Tax Credits (ETC).

Table 2-1

APPLICABLE TAX CREDIT RATES

AND DEPRECIATION CATEGORIES

Property Category	Investment Tax Credit	Energy Tax Credit				Depreciation Yrs (ACRS)†		
		Coal	Biomass	Solid Waste	Retrofit	Utility Property (SE/CC)	Utility Property (NUC./CT)	Non-Utility Property
Fuel Handling Equipment	0.1	0.1	0.1	0.1	0.1	15	10	5
Boiler	0.1/0.0*	0.1	0.1	0.1	0.1	15	10	5
Pollution Control Equipment	0.1	0.1	0.1	0.1	0.1	15	10	5
Turbine Generators	0.1	0.0	0.0	0.1	0.0/0.1**	15	10	5
Heat Distribution Equipment	0.1	0.0	0.0	0.0	0.1	15	10	5
Specialized Buildings	0.1	0.1	0.1	0.1	0.1	15	10	5
General Purpose Buildings	0.0	0.0	0.0	0.0	0.0	15	15	15
Land	0.0	0.0	0.0	0.0	0.0	N.A.	N.A.	N.A.

* 0.0 applies to oil/gas boilers only

** 0.1 applies only if retrofit is primarily thermal

\+ Depreciation is based on accelerated cost recovery system (ACRS)

SE: steam electric

CC: combined cycle

NUC: nuclear

CT: combustion turbine

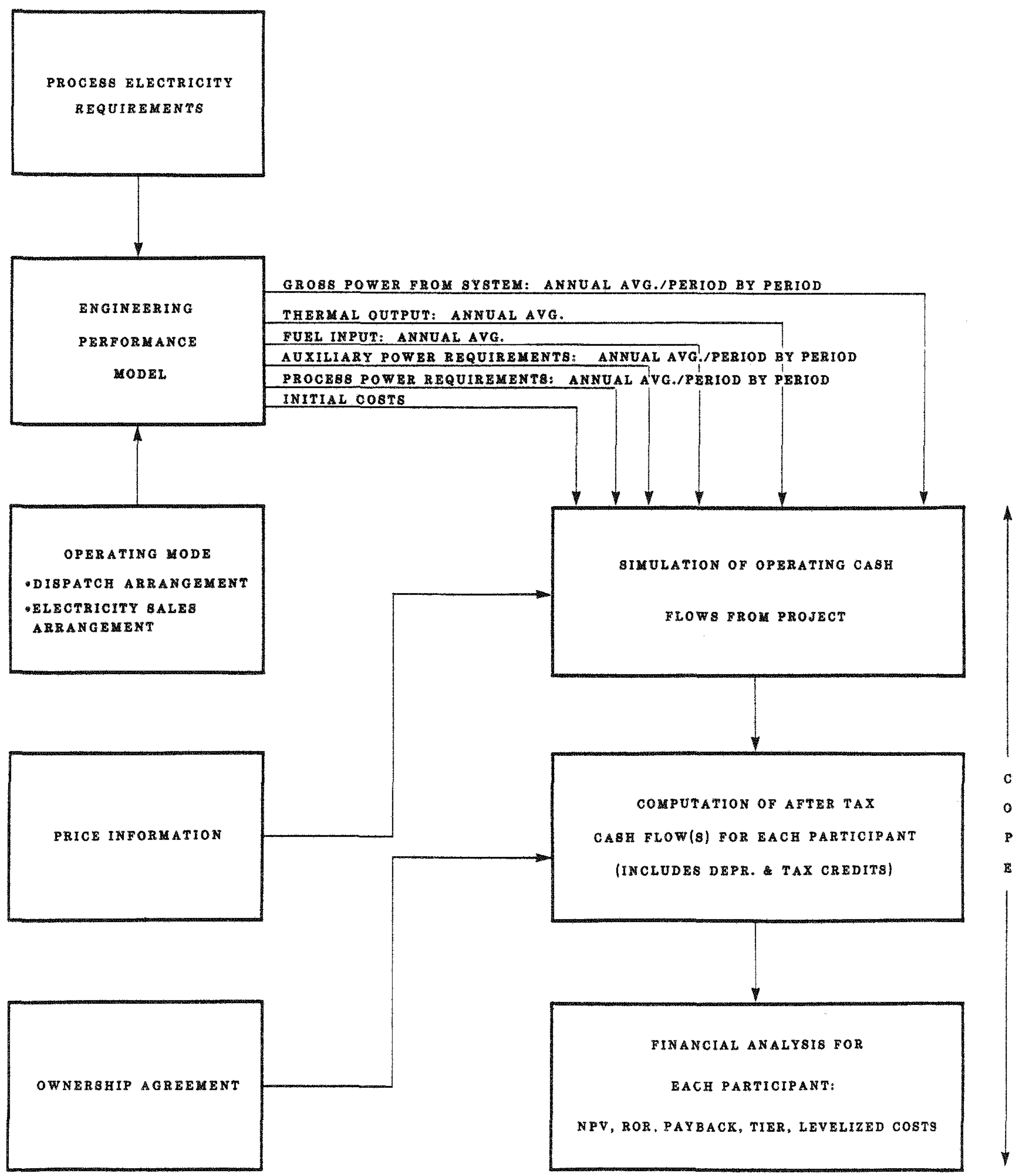

Figure 2-3. Overview of Cogeneration Option Evaluation (COPE).

Figure 2-4 graphically presents the steps involved in the simulation of <u>initial cash flows</u>. At the start of construction, an amount equal to the planned expenditures in the first year is borrowed on a short-term basis. At the beginning of subsequent years during construction, borrowings equal to the sum of planned expenditures during the ensuing year and the interest payment for the previous year are made on a short term basis. During the final year, the long-term financing strategy is implemented and, at the start of operations, all the short-term borrowing is repaid with interest. At this point, the project is financed by a combination of long-term project debt and corporate funds contributed by the parties involved.

Initial outlay estimates are provided to COPE in the form of a data base and are expressed in base year dollars. These costs are then appropriately escalated to arrive at the actual outlays during construction. COPE can perform the entire analysis in constant dollars or in nominal dollars. In order to change from constant to nominal dollars, it is imperative that <u>all</u> rates--capital cost escalation, fuel escalation, O&M escalation, costs of capital and the GNP deflator--be changed from real to nominal terms.

The simulation of <u>operating cash flows</u> involves the simulation of revenues from and costs of operating the entire system. It is important to point out here that the revenues derived from operating the system depend on the price at which electricity is sold, which in turn depends on the status of the facility vis-a-vis PURPA. By choosing an appropriate combination of multipliers and escalation rates, COPE can create any input price profile.

The central step in the simulation of operating cash flows is to translate performance characteristics into revenue and cost streams. As was pointed out before, this can be done either on an average annual basis or on a period-by-period basis. Specifically, COPE first computes the net electric revenues by properly accounting for revenues from electricity sales, revenues attributable to electricity savings, electricity used by (or bought for) auxiliaries, and extra electricity back-up costs. It then accounts for steam revenues, fuel costs, O&M costs and G&A costs to arrive at a net operating income.

The computation of <u>after-tax cash flows</u> involves apportionment of the following: initial outlays, profits (or losses), energy and investment tax credits, deductions for project debt, and depreciation. The output of this part of the analysis is an after-tax cash flow stream over project life for each participant. This after-tax

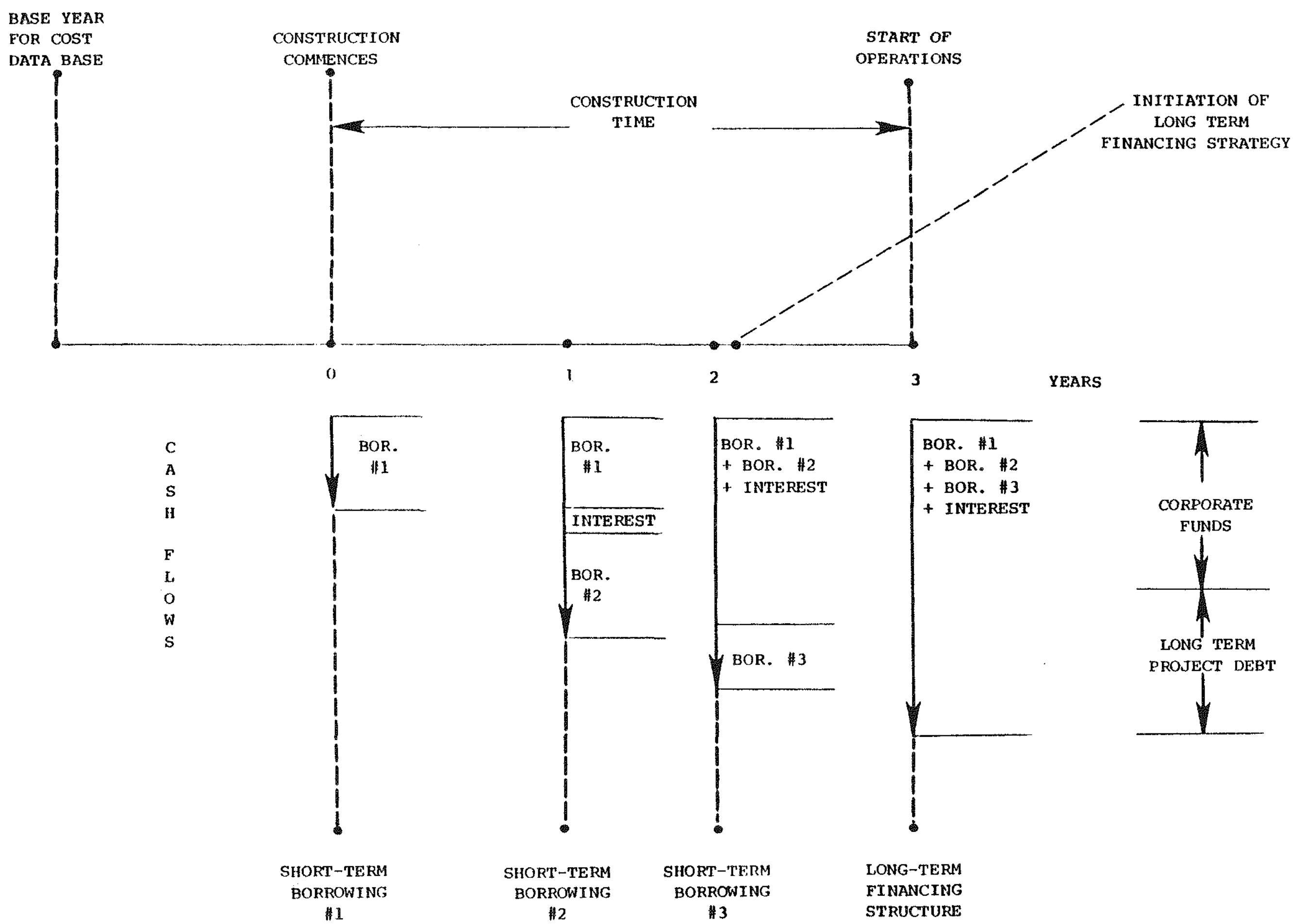

Figure 2-4. Scheme for Initial Outlays.

flow stream is used to compute, for each participant, the net present value (NPV), the rate of return (ROR), the payback period (P_b), and the first year debt-coverage ratio. In the case of industry ownership, the user can use COPE to conduct an incremental investment as well, i.e., the investment that is made over and above the investment necessary for a boiler. Also, in the case of the utility, COPE computes the levelized busbar cost of electricity and the annual busbar cost profile. It must be noted that the cost of electricity to the utility is computed both in the case of 100% utility ownership and in the case of a partnership. In the latter case, the costs incurred by the utility to purchase power and its share of project costs and benefits are properly accounted for.

COPE Output

The output from COPE consists of a series of reports. Reports 1, 2, 3 and 4 deal with the inputs used in the analysis. Report 1 describes the project schedule; report 2 provides the ownership arrangement and operating mode; report 3 deals with regulatory and fuel use information; report 4 describes the input price profiles. Report 5 contains the details of the analysis performed by COPE. After-tax cash flow statements are provided for each party both during construction and operation. Separate financial analyses are also presented for each party.

COPE also traces the impacts of the venture on the utility and the industry in terms of important dollar flows. In particular, it calculates the net cost to the utility, taking into account both the costs of purchased and displaced power, and the benefits attributable to avoided generation costs. For industry, COPE calculates the net benefits from cogenerated steam by weighing the savings in avoided steam generation costs against the costs of buying cogenerated steam. These benefits are especially relevant to situations where third parties can offer industry steam at an attractive price.

Section 3

EXECUTING COPE INTERACTIVELY: AN EXAMPLE ON NCSS

This section provides user information to run COPE interactively on NCSS. For users interested in implementing COPE on in-house computers, information on program structure and batch operation is provided in Sections 4 and 5. The discussion in this section may also be helpful to such users in developing an interactive format on in-house computers.

Running COPE in the interactive mode enables the user to reduce the burden associated with creating properly structured and formatted input files. When COPE is run interactively, the default data files DAT, ECO, and ENG (described in Section 4) are first opened with an execute command. If incremental investment analyses are desired or the case corresponds to the boiler, the user is reminded by the program to open appropriate files for boiler data. If either of these options are not desired, the data file, BXX, described in Section 4 is automatically opened. When COPE is executed, the user invokes the option to modify data and appropriately modifies the values already read in through DAT, ECO, ENG, etc. Using the interactive mode to modify data does not allow the user to change the following:

- Investment and energy tax credit rates.
- Depreciation rules
- The utility's marginal production and capacity cost. (They are automatically set equal to the PURPA avoided energy and capacity cost respectively.)
- The cost of steam from alternative sources. (This is automatically set equal to the user-specified price of steam)
- The utility's back-up energy and capacity charge for a cogenerator. (They are automatically set equal to the industrial energy and capacity charge respectively.

Using the Interactive Mode

It is recommended that the user put together all relevant information in writing before using the interactive mode. The information that can be entered through the interactive mode is divided into 4 logical segments: (i) Project Timing, Fuel Use and Regulatory Data, (ii) Capital Cost, Structure and Tax Data, (iii) Performance Data, and (iv) Price and Cost Data.

Tables 3-1, 3-2, 3-3, and 3-4 show how logical segments 1, 2, 3 and 4 respectively can be modifed in the interactive mode. Tables 3-5, 3-6, 3-7 and 3-8 document the variables that make up each logical segment. If the interactive mode is used, all the variables in a logical segment have to be assigned appropriate values. The user can, however, choose to bypass an entire logical segment. After all the logical segments in the interactive mode have either been bypassed or suitably modified, COPE uses these changed values and completes a single run. At the end of this run, the user is allowed the option of making another run by changing the variables in any segment. The user must note the following points about making additional runs: (i) If a logical segment is bypassed during an additional run, the values assigned to the variables in that logical segment will correspond to those of the previous run. (ii) If a logical segment is bypassed during the first run, the values assigned to the variables in that segment will correspond to the default values (i.e., the values in DAT, ECO and ENG presented in Section 4). (iii) If the user answers "NO" to the query on additional runs, the user leaves the program. If the user subsequently desires to create the inputs previously used, he has to make all changes in every logical segment again.

- **Consistency and Data Formats**

Except for variables that are explicitly identified as integers, all variables can be read in the interactive mode with "free format". The "free format" option leaves the user with considerable flexibility. For instance, for a variable with two real elements, the following data entries are identical and acceptable:

```
629.90, 0.03
629.900, 0.030
6239.9, 0.0300
```

It is important that the user enter a logically consistent set of inputs. For instance, if the construction period, ITIME (1), is specified as three years, then the fraction of total expenditures during each year of construction, FYE (ITIME (1)), should contain three elements.

Table 3-1

INTERACTIVE INPUT FOR LOGICAL SEGMENT 1

```
10.57.01 >EXEC COPE

$$$$$$EXECUTION:
$$TIME TO MODIFY YOUR DATA, FELLA.....

DO YOU WISH TO MODIFY THE DEFAULT VALUES?
 (YES = 1; NO = 2)
>1

HOW MANY PERIODS IS THE ANNUAL PERFORMANCE
CHARACTERIZED BY?
>1

DO YOU WISH TO MODIFY PROJECT TIMING, FUEL USE OR
REGULATORY INFORMATION?  (YES = 1; NO = 2)
>1

PROVIDE THE CONSTRUCTION PERIOD IN YEARS:
>3

PROVIDE THE ECONOMIC LIFE IN YEARS:
>10

PROVIDE THE BASE YEAR FOR COST AND PRICE DATA
(END OF YEAR TERMS):
>1980

PROVIDE THE DATE FOR COMMENCEMENT OF OPERATIONS
(BEGINNING OF YEAR TERMS):
>1985

IS EQUIPMENT COST BREAKDOWN (IN THOUSANDS OF BASE
YEAR $) AVAILABLE BY CATEGORIES?  (YES = 1; NO = 2)
>2

PROVIDE THE TYPE OF GENERATING EQUIPMENT:
1 = STEAM ELECTRIC; 2 = COMBINED CYCLE; 3 = NUCLEAR;
4 = GAS TURBINE
>2

IS THIS PROJECT A RETROFIT?  (YES = 1; NO = 2)
>2

IS IT PRIMARILY A THERMAL RETROFIT?  (YES = 1; NO = 2)
>2

IS THIS PROJECT PURPA QUALIFIED?  (YES = 1; NO = 2)
>1

PROVIDE THE TYPE OF OWNERSHIP STRUCTURE:
1 = 100% UTILITY; 2 = 100% INDUSTRY; 3 = 100% THIRD' PARTY;
4 = UTILITY AND INDUSTRY; 5 = UTILITY AND' THIRD PARTY;
6 = INDUSTRY AND THIRD PARTY; 7 =' UTILITY, INDUSTRY
AND THIRD PARTY
>3
```

Table 3-1

INTERACTIVE INPUT FOR LOGICAL SEGMENT 1

(Continued)

```
WOULD YOU LIKE INCREMENTAL INVESTMENT ANALYSIS
FOR INDUSTRY?  (YES = 1; NO = 2)
>2

IS THE UTILITY INVESTOR-OWNED?  (YES = 1; NO = 2)
>1

WHAT IS THE PRIMARY FUEL?  (>50% OF INPUT)
1 = COAL; 2 = BIOMASS; 3 = SOLID WASTE; 4 = OIL/GAS
>4

PROVIDE THE NUMBER OF INPUT FUELS USED:
>1
```

Table 3-2

INTERACTIVE INPUT FOR LOGICAL SEGMENT 2

```
DO YOU WISH TO MODIFY CAPITAL COST, STRUCTURE OR
TAX INFORMATION?  (YES = 1; NO = 2)
>1

PROVIDE THE TOTAL INSTALLED COST (THOUSANDS OF BASE
YEAR DOLLARS)
>24825.14

PROVIDE THE CAPITAL COST ESCALATION:
>0.10

PROVIDE THE APPROXIMATE BREAKDOWN OF COST CATEGORIES
(FRACTIONS):  1 = FUEL HANDLING; 2 = BOILER;
3 = POLLUTION CONTROL; 4 = TURBINES; 5 = HEAT
DISTRIBUTION; 6 = SPECIALIZED BUILDINGS; 7 = GENERAL
BUILDINGS; 8 = LAND
>0.04,0.01,0.00,0.875,0.00,0.075,0.00,0.00

PROVIDE THE FRACTION OF INSTALLED COSTS EXPENDED IN
EACH YEAR OF CONSTRUCTION:
>0.2,0.4,0.4

PROVIDE THE INTEREST RATE ON SHORT-TERM BORROWING
DURING CONSTRUCTION:
>0.14

PROVIDE THE INTEREST RATE ON LONG-TERM DEBT:
>0.181

PROVIDE THE TYPE OF LONG-TERM DEBT (REGULAR = 1;
TAX PREFERENCE = 2):
>1

PROVIDE THE TERM OF LONG-TERM DEBT (IN YEARS):
>5

PROVIDE THE REAL ESTATE TAX AND INSURANCE RATE
(FRACTION OF PROPERTY VALUE):
>0.0015,0.0015,0.0015

PROVIDE THE FEDERAL TAX RATE (FRACTION):
>0.50,0.50,0.50

PROVIDE THE MODE OF DEBT SERVICE (ANNUITY = 1;
SINKING FUND = 2):
>1

DO YOU WISH TO TAKE TAX DEDUCTIONS ON SHORT-TERM
BORROWING OR CAPITALIZE INTEREST DURING CONSTRUCTION?
(TAX DEDUCTIONS = 1; CAPITALIZE = 2)
>2
```

Table 3-3

INTERACTIVE INPUT FOR LOGICAL SEGMENT 3

(Continued)

```
PROVIDE THE SHARE(S) OF DEPRECIATION BENEFITS' FOR EACH PARTY:
>0.0,0.0,1.0

PROVIDE THE SHARE(S) OF CAPITAL CONTRIBUTION' FOR EACH PARTY:
>0.0,0.0,1.0

PROVIDE THE SHARE(S) OF PROFITS AND TAX CREDITS' FOR EACH PARTY:
>0.0,0.0,1.0

PROVIDE THE SHARE(S) OF INTEREST DEDUCTIONS ON
LONG-TERM DEBT FOR EACH PARTY:
>0.0,0.0,1.0

PROVIDE THE FRACTION OF LONG-TERM PROJECT DEBT:
0.29
>0.29

DO CAPITAL CONTRIBUTIONS COME FROM COPORATE EQUITY
OR A COMBINATION OF DEBT AND EQUITY?  (DEBT AND
EQUITY = 1; EQUITY ONLY = 2)
>2

PROVIDE THE COST OF CORPORATE DEBT FOR EACH PARTY:
>0.12,0.12,0.12

PROVIDE THE COST OF CORPORATE EQUITY FOR EACH PARTY:
>0.16,0.16,0.20

PROVIDE THE CORPORATE DEBT FRACTION FOR EACH PARTY:
>0.5,0.3,0.1

PROVIDE THE ANNUAL FIXED CHARGE PROFILE OF THE UTILITY
FOR PLANT LIFE
>0.20,.19,.18,.17,.16,.14,.14,.14,.14,.14,.123C

>0.20,.19,.18,.17,.16,.14,.14,.14,.14,.14,.12,.12,.12,.12,.12

>.08,.08,.08,.08,0.08,.08,.08,.08,.08,.08,.08,.08,.08,.08,.08

PROVIDE FOUR COMPONENTS FOR DETERMINING THE LEVELIZED
FIXED CHARGE RATE FOR THE UTILITY:
>0.02,0.06,0.00,-0.03
```

Table 3-3

INTERACTIVE INPUT FOR LOGICAL SEGMENT 3

```
DO YOU WISH TO MODIFY THE PERFORMANCE DATA?
 (YES = 1; NO = 2)
>1

PROVIDE THE FIRST YEAR O&M EXPENDITURES (BASE YEAR $):
>1822300.0

PROVIDE THE CAPACITY (KW) FOR WHICH CAPACITY CREDITS
ARE AVAILABLE ON AN ANNUAL BASIS:
>55200.0

PROVIDE THE GENERAL AND ADMINISTRATIVE COSTS
(FRACTION OF O&M):
>0.0

WHAT IS THE DISPACH MODE? (THERMAL MATCH = 1;
ECONOMIC DISPATCH = 2)
>1

PROVIDE THE TYPE OF ELECTRICITY SALES ARRANGEMENT
(SIMULTANEOUS BUY/SELL = 1; SELL EXCESS, BUY SHORTAGE
= 2):
>1

PROVIDE THE TYPE OF COGENERATION TECHNOLOGY:
1 = NO COGENERATION; 2 =LP STEAM ELECTRIC; 3 = MP
STEAM ELECTRIC; 4 = MP STEAM ELECTRIC (AFB);
5 = COMBINED CYCLE COAL GASIFICATION; 6 = FUEL CELL;
7 = GAS TURBINE; 8 = COMBINED CYCLE; 9 = DIESEL HEAT
PUMP
>5

PROVIDE THE GROSS POWER FROM COGENERATION UNIT (KW):
>55200.0

PROVIDE THE AUXILIARY POWER REQUIREMENT (KW):
>0.0

PROVIDE THE PROCESS POWER REQUIREMENT (KW):
>0.0

PROVIDE THE PEAK TO AVERAGE RATIO FOR PROCESS
POWER (FRACTION):
>1.0

PROVIDE THE PROCESS PRESSURE REQUIREMENTS (PSI):
>200.0,220.0,240.

PROVIDE THE PROCESS THERMAL REQUIREMENTS
(MILLION BTU/HOUR):
>173.8,0.0,0.0
```

Table 3-2

INTERACTIVE INPUT FOR LOGICAL SEGMENT 2

(Continued)

```
PROVIDE FUEL(S) USAGE (MILLION BTU/HOUR):
>589.4,0.0,0.0

PROVIDE THE NUMBER OF ANNUAL OPERATING HOURS:
>8760.0
```

Table 3-4

INTERACTIVE INPUT FOR LOGICAL SEGMENT 4

```
DO YOU WISH TO MODIFY THE PRICE AND COST INFORMATION?
 (YES = 1; NO = 2)
>1

PROVIDE THE PURPA AVOIDED ENERGY COST
(BASE YEAR $/KW/YEAR):
>4.70

PROVIDE THE CONSTANT ANNUAL ESCALATION RATE FOR THE
PURPA AVOIDED ENERGY COST (FRACTION):
>0.10

IS THERE ANY ADJUSTMENT THROUGH MULTIPLIERS?
(YES = 1; NO = 2)
>2

PROVIDE THE PURPA CAPACITY COST (BASE YEAR
$/KW/YEAR):
>0.0

PROVIDE THE CONSTANT ANNUAL ESCALATION RATE FOR THE
PURPA CAPACITY PRICE (FRACTION):
>0.0

IS THERE ANY ADJUSTMENT THROUGH MULTIPLIERS?
(YES = 1; NO = 2)
>2

PROVIDE THE INDUSTRIAL ENERGY CHARGE
(BASE YEAR CENTS/KW-HR):
>2.401

PROVIDE THE CONSTANT ANNUAL ESCALATION RATE FOR THE
INDUSTRIAL ENERGY CHARGE (FRACTION):
>0.10

IS THERE ANY ADJUSTMENT THROUGH MULTIPLIERS?
(YES = 1; NO = 2)
>2

PROVIDE THE INDUSTRIAL CAPACITY CHARGE
(BASE YEAR CENTS/KW-HR):
>73.10

PROVIDE THE CONSTANT ANNUAL ESCALATION RATE FOR THE
INDUSTRIAL CAPACITY CHARGE (FRACTION):
>0.0

IS THERE ANY ADJUSTMENT THROUGH MULTIPLIERS?
(YES = 1; NO = 2)
>2
```

Table 3-4

INTERACTIVE INPUT FOR LOGICAL SEGMENT 4

(Continued)

```
PROVIDE FUEL PRICES (BASE YEAR $/MILLION BTU):
>4.082,0.0,0.0

PROVIDE CONSTANT ANNUAL ESCALATION RATES FOR
FUEL (FRACTIONS):
>0.087

>0.0,0.0

IS THERE ANY ADJUSTMENT THROUGH MULTIPLIERS?
(YES = 1; NO = 2)
>2

PROVIDE THE STEAM PRICE AT MINIMUM STEAM PRESSURE
(BASE YEAR $/MBTU):
>5.98

PROVIDE THE MINIMUM STEAM PRESSURE (PSI):
>100.0

PROVIDE THE STEAM PRICE AT MAXIMUM STEAM PRESSURE
(BASE YEAR $/MBTU):
>6.02

PROVIDE THE MAXIMUM STEAM PRESSURE (PSI):
>300.0

PROVIDE THE CONSTANT ANNUAL ESCALATION RATE FOR
STEAM (FRACTION):
>0.0

IS THERE ANY ADJUSTMENT THROUGH MULTIPLIERS?
(YES = 1; NO = 2)
>2

PROVIDE THE DESIRED FREQUENCY OF CASH FLOW DISPLAY:
(FOR 10 YEAR PROJECTS, MINIMUM = 3;
 FOR 20 YEAR PROJECTS, MINIMUM = 5)
>3

WOULD YOU LIKE ABRIDGED OUTPUT?' (1,2,2,2,2=ALL REPORTS;
2,1,2,2,2=ONLY REPORT 5;' 2,2,1,2,2=ONLY B. OF REPORT 5)
>2,2,1,2,2

$
```

Table 3-5

LOGICAL SEGMENT 1

PROJECT TIMING, FUEL USE AND REGULATORY DATA

The following information is required in Segment 1 under the INTERACTIVE mode. The user can match the description given below with the description, variable name, file name and line # in Section 4.

INFORMATION REQUIRED	FILE NAME; LINE #
Construction Period Economic Life Base Year for Costs/Prices Project Start Year	DAT; Line 1
Breakdown (by category) for total installed cost?	DAT; Line 2
Types of Generating Eqpt? Retrofit? Primarily Thermal Retrofit? PURPA qualified?	DAT; Line 3
Ownership Structure?	DAT; Line 4
Desire Incremental Analysis?	DAT; Line 5
Type of Utility?	DAT; Line 19
Primary Fuel?	DAT; Line 25
Oil/Gas Usage?	DAT; Line 24
Number of input fuels?	DAT; Line 26

Table 3-6

LOGICAL SEGMENT 2

CAPITAL COST, STRUCTURE AND TAX DATA

The following information is required in Segment 2 under the INTERACTIVE mode. As in Segment 1, the user can use the reference in the second column to match the description with the file documentation provided in Section 4.

INFORMATION REQUIRED	FILE NAME; LINE #
Capital Cost by eqpt. category, if available.	DAT; Line 7
Total Installed Cost (TIC); Capital Cost Escalation	DAT; Line 6
Approximate cost (by category) as fraction of TIC	DAT; Line 8
Fraction of TIC spent in each year of construction	DAT; Line 9
Interest rate on construction borrowing Fraction of long-term debt. Type of long-term debt	DAT; Line 10
Term of long-term debt	DAT; Line 12
Local Tax Rates for each party	DAT; Line 13
Federal Tax Rates for each party	DAT; Line 18
Mode of Debt Service; Sinking Fund Rate	DAT; Line 61
Capitalize interest during construction?	DAT; Line 11
Partnership Shares: Depreciation Capital Contributions Profit Ratio & Tax Credits Interest Deductions.	DAT; Lines 13 - 16

Table 3-6

LOGICAL SEGMENT 2

CAPITAL COST, STRUCTURE AND TAX DATA

(Continued)

INFORMATION REQUIRED	FILE NAME; LINE #
Composition of Capital Contribution	ECO; Line 126
Before-Tax Cost of Debt for each Party	ECO; Line 115
Corporate debt fraction for each Party	ECO; Line 121
Utility Fixed Charge Profile	ECO; Line 123-125
Components of Levelized Fixed Charge Rate	ECO; Line 122

Table 3-7

LOGICAL SEGMENT 3

PERFORMANCE DATA

The following information is required in Segment 3 under the INTERACTIVE mode. As before, the filename and line # is provided as reference.

It must be noted again that if the year is characterized by more than 1 period, the user must provide appropriate information for segments 3 and 4.

INFORMATION REQUIRED	FILE NAME; LINE #
Annual O&M Cost (Base Year Terms)	ENG; Line 50
Number of kW that qualify for capacity credits	ENG; Line 49
General & Administrative (fraction of O&M)	ENG; Line 58
Dispatch Mode	ENG; Line 53
Electricity Sales Agreement	ENG; Line 52
DEUS #	ENG; Line 55
Gross Power Produced* Auxiliary Power Used* Process Power Required*	ENG; Lines 3-10 OR ENG; Line 47
Peak-to-Average Ratio for Process Electricity*	ECO; Lines 31-32 OR ENG; Line 56
Fuel(s) Usage for three possible input fuels*	ENG; Lines 11-46 or ENG; Line 48
Hours per Period	ECO; Lines 13-15 or ENG; Line 57

Table 3-7

LOGICAL SEGMENT 3

PERFORMANCE DATA

(Continued)

INFORMATION REQUIRED	FILE NAME; LINE #
Steam Delivery Pressures	ENG; Line 1
Quantity Steam Delivered (Annual Basis)	ENG; Line 2

*If more than one period is involved, values have to be provided for every period.

Table 3-8

LOGICAL SEGMENT 4

PRICE/COST DATA

The following information is required in Segment 4 under the INTERACTIVE mode. As before, the filename and line # is provided as reference.

INFORMATION REQUIRED	FILE NAME; LINE #
PURPA Avoided Cost	
Energy (¢/kWh)*	ECO; Lines 9-12
Constant Annual Escalation	ECO; Line 77
Multipliers, if needed**	ECO; lines 52-76
PURPA Avoided Cost	
Capacity ($/kW/period)*	ECO: Lines 16-18
Constant Annual Escalation	ECO; Line 77
Multipliers, if needed**	ECO; Lines 52-76
Industrial Charge	
Energy (¢/kWh)*	ECO; Lines 19-21
Constant Annual Escalation	ECO; Line 77
Multipliers, if needed**	ECO; Lines 52-76
Industrial Charge	
Capacity ($/kW/period)*	ECO: Lines 22-24
Constant Annual Escalation	ECO: Line 77
Multipliers, if needed**	ECO: Lines 52-56
Fuel Cost	
Fuel #1 ($/million Btu)	ECO: Line 51
Fuel #2 ($/million Btu)	ECO; Line 51
Fuel #3 ($/million Btu)	ECO: Line 51
Constant Annual Escalation	ECO; Line 77
Multipliers, if needed**	ECO; Lines 52-76

Table 3-8

LOGICAL SEGMENT 4

PRICE/COST DATA

(Continued)

INFORMATION REQUIRED	FILE NAME; LINE #
Steam Price	
At minimum pressure ($/million Btu)	ECO; Line 34
Minimum pressure (psi)	ECO; Line 33
At maximum pressure ($/million Btu)	ECO; Line 34
Maximum pressure (psi)	ECO; Line 33
Constant Annual Escalation	ECO; Line 77
Multipliers, if needed**	ECO: Lines 52-76

*If more than one period is involved, values have to be provided for every period.

**If multipliers are provided, 25 elements (one for each year of project life) have to be provided.

If less than three elements are entered, the computer returns with a " " and does not move to the next question. This is a sign that the computer expects more elements as input.

Also, if the performance is characterized by more than one period per year, all prices/costs have to be provided for the same number of periods. This is true even if the prices/costs do not change from period to period. Indeed, if the number of periods per year is greater than 1, the user does not have a choice between changing variables in segments 3 or 4. If segment 3 is invoked, segment 4 is automatically invoked.

Finally, in cases where the year is characterized by more than 18 periods, the user should enter no more than 18 elements on a single line.

- **NCSS Commands**

It is recommended that the user read the following NCSS documents: (i) Programmers Introduction to VP/CSS, and (ii) VP/CSS Fortran Users Guide. A description of key NCSS features can be found in Appendix B.

The first step to use the Interactive Mode on NCSS is to type the following command:

```
> EXEC    GETSET
```

The user will be asked a number of questions, and his response will determine which of the following is executed:

(1) If the user does not wish to modify existing files, the program will issue a reminder to open appropriate INPUT/OUTPUT files (see discussion under "BATCH MODE" in Section 5).

(2) If the user wishes to use existing files, is not interested in the boiler as an investment, and is not interested in incremental investment analyses for industry, then all the necessary input files are automatically opened and the user is ready for the next step.

(3) If the user wishes to examine the boiler as an investment, he is reminded to open an output file where after-tax cash flows can be stored.

(4) If the user desires incremental investment analyses for industry, he is reminded to open an appropriate boiler file.

The user is also given the option of creating a file called "OUT" for output or displaying it at the terminal.

The next step is to invoke the appropriate NCSS compiler with the following command:

> EXEC   ATTACH

This will invoke the necessary compiler.

The third step is to execute COPE with the following:

> EXEC   COPE

The user will now be given the option of modifying data. Since the user has chosen the interactive mode, an affirmative response should be given. The user is then given the option of changing variables in segments 1, 2, 3, etc., in sequence. Once the user decides to change the variables in a segment, the program asks for the values for each variable. The values must be entered in free format when the computer returns with a " ".

After all the inputs have been appropriately changed, COPE performs the analysis and either displays the output on the terminal or writes it to a file. The user is then given the option of making additional runs. If the user reponds with a "YES," he is allowed to change all or parts of the inputs used in the previous run.

Section 4

STRUCTURE OF COMPUTER CODE AND INPUT DATA REQUIREMENTS

COPE

The next two sections present the structure of the computer code for COPE and the method to implement the batch mode. Such information is very important to users interested in making COPE operational on in-house computers.

STRUCTURE OF COMPUTER CODE

The overall structure of the computer program is shown in Figure 4-1. As can be seen from Figure 4-1, the computer program for COPE consists of a main program called "DRIVER" which executes 13 subroutines in sequence. Each subroutine is a logical module and performs a specific function. The use of logical modules greatly enhances COPE's flexibility as an evaluation tool.

The modular structure also facilitates verification and program modification, if desired.

Subroutines

An overview of each subroutine is provided in Figures 4-2 through 4-13. A brief description of the function performed by each subroutine is provided below.

- INPUT - Subroutine INPUT reads in the data required by COPE. All data is stored in variables that are placed in distinct common blocks (see Figure 4-2).

- CDATA - Subroutine CDATA enables the user to interactively modify a significant part of the data provided in subroutine INPUT. The user can choose to bypass subroutine CDATA entirely (see Figure 4-3).

- OUTLAY - Subroutine OUTLAY computes each project participant's share of capital contribution and long-term debt. Based on a user-option, it either determines the tax benefits from deductions on short-term borrowings or capitalizes interest during construction (see Figure 4-4).

- TCRED - Subroutine TCRED determines the investment tax credits available to each project participant and the year of accrual (see Figure 4-5).

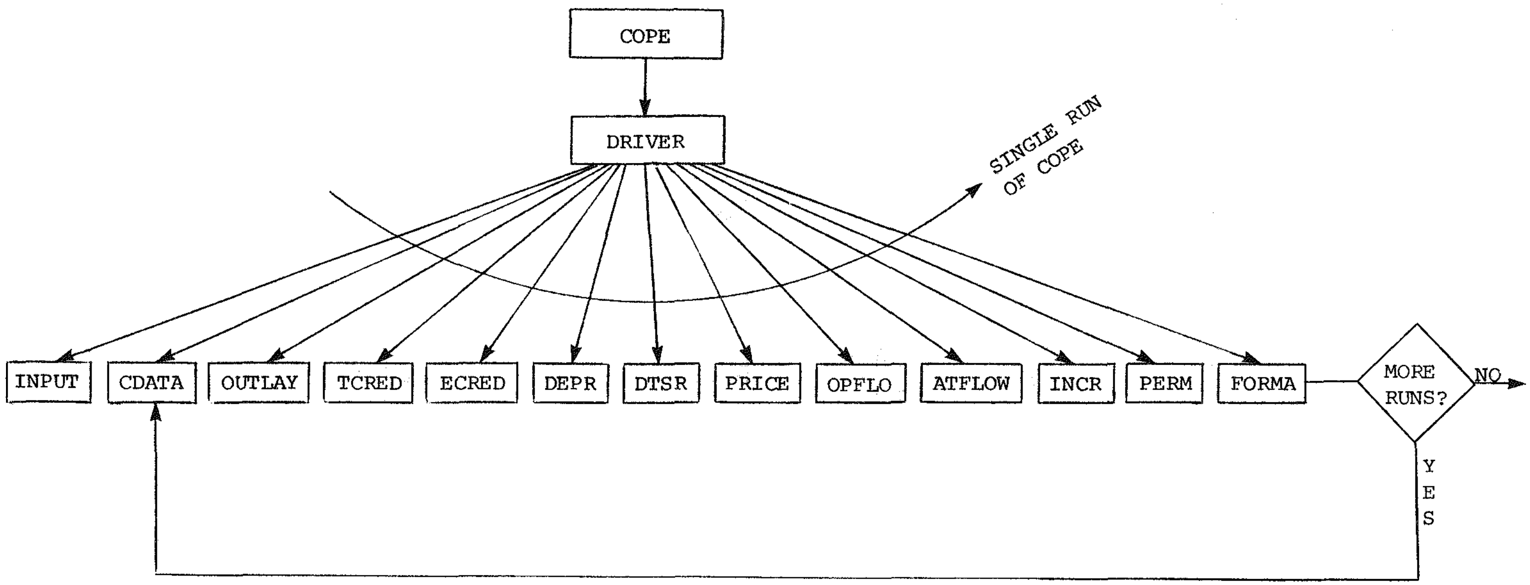

Figure 4-1. Overall Structure of COPE.

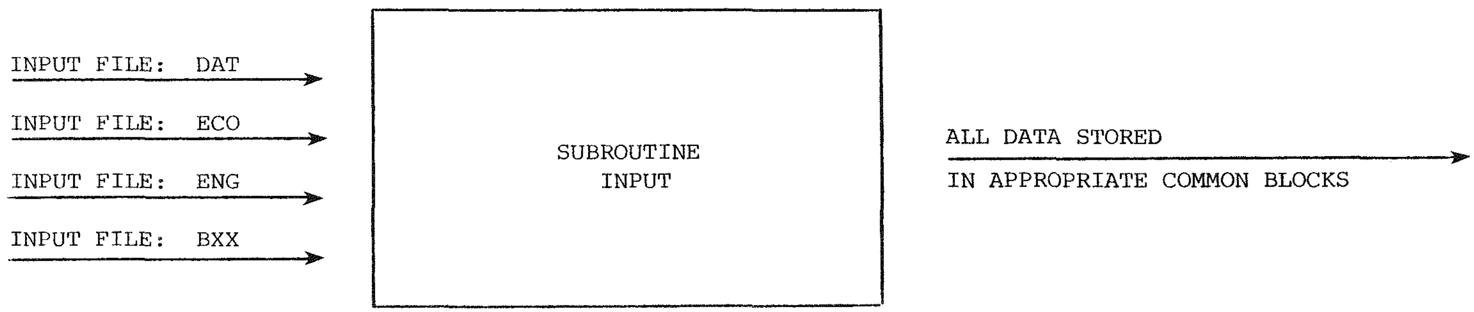

Figure 4-2. Overview of Subroutine INPUT.

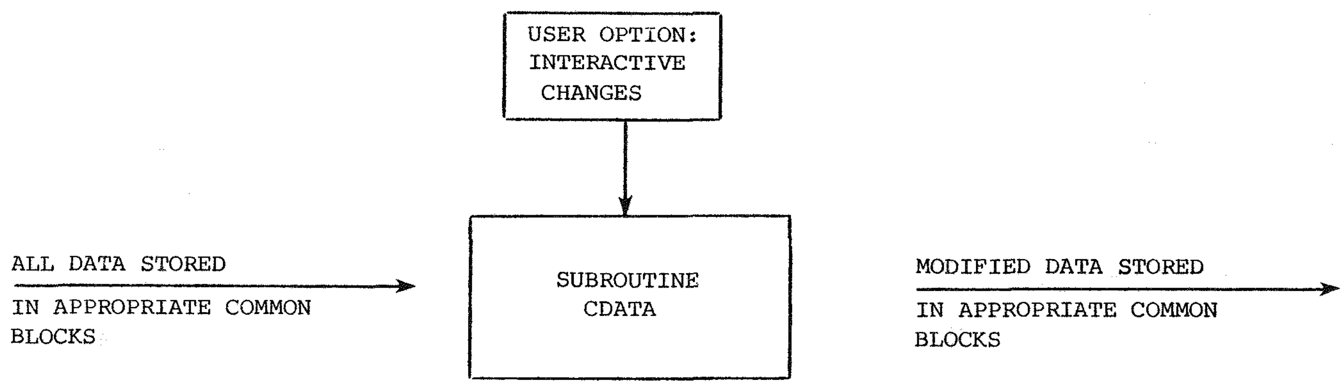

Figure 4-3. Overview of Subroutine CDATA.

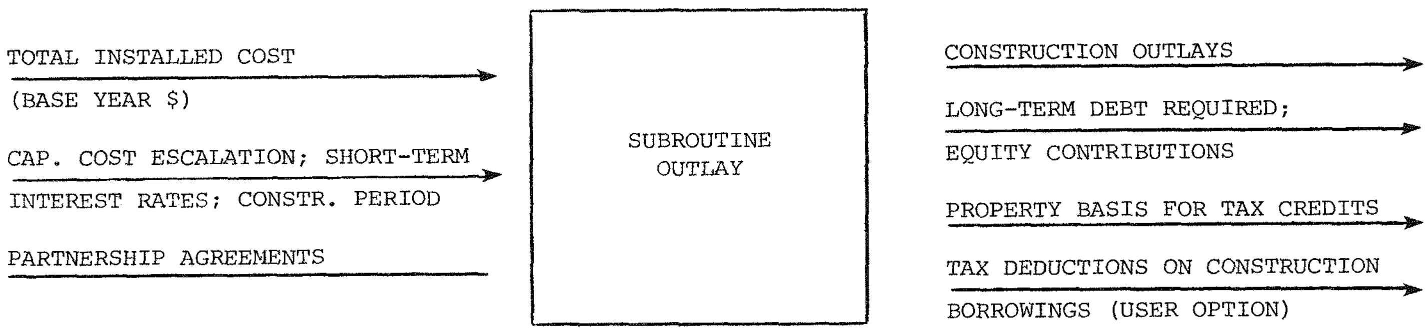

Figure 4-4. Overview of Subroutine OUTLAY.

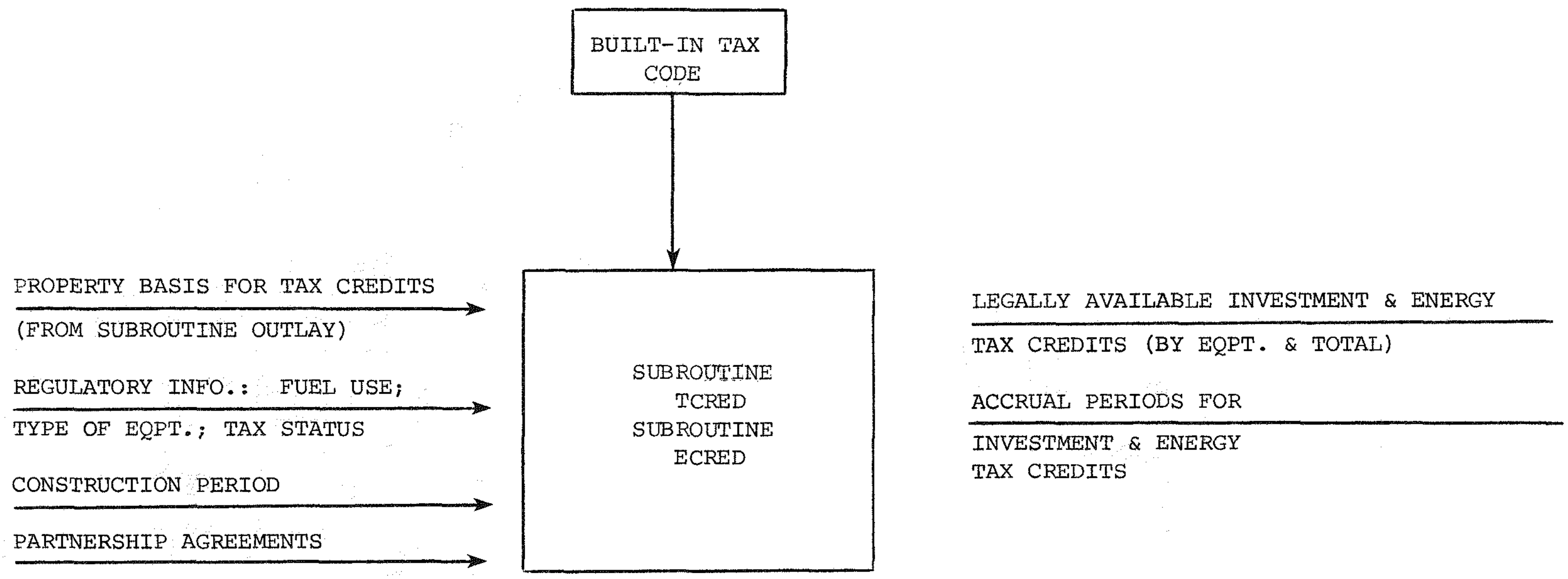

Figure 4-5. Overview of Subroutines TCRED and ECRED.

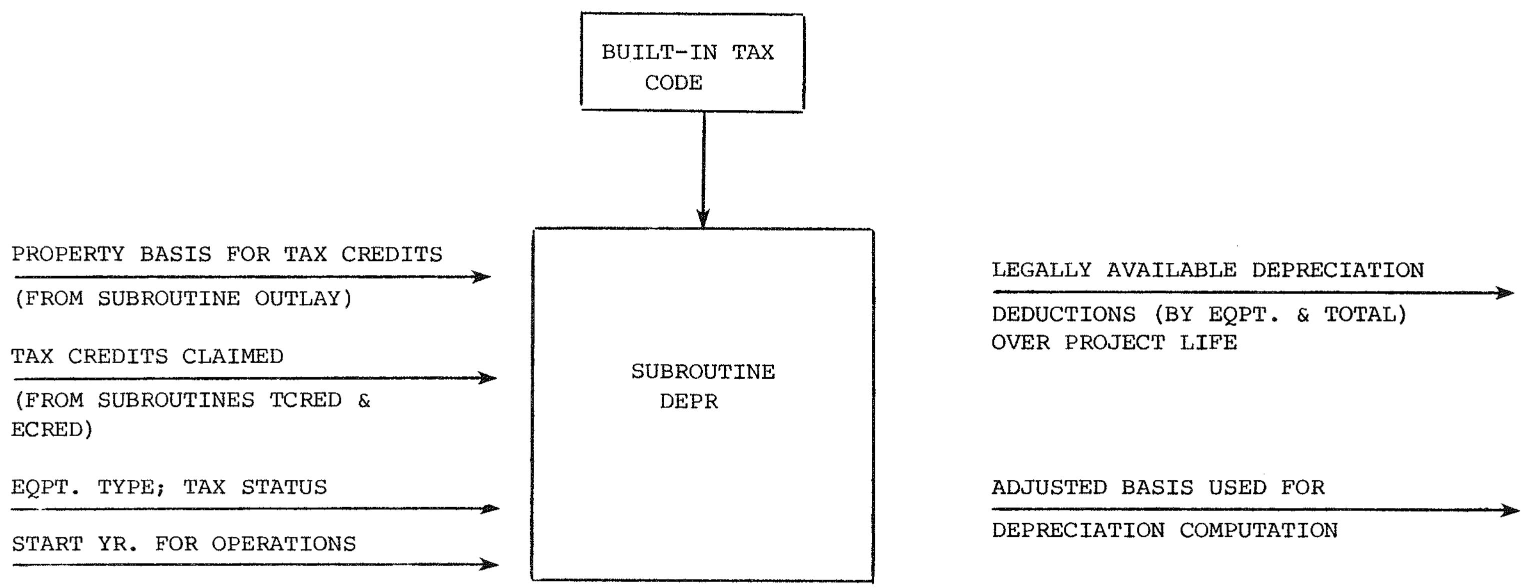

Figure 4-6. Overview of Subroutine DEPR.

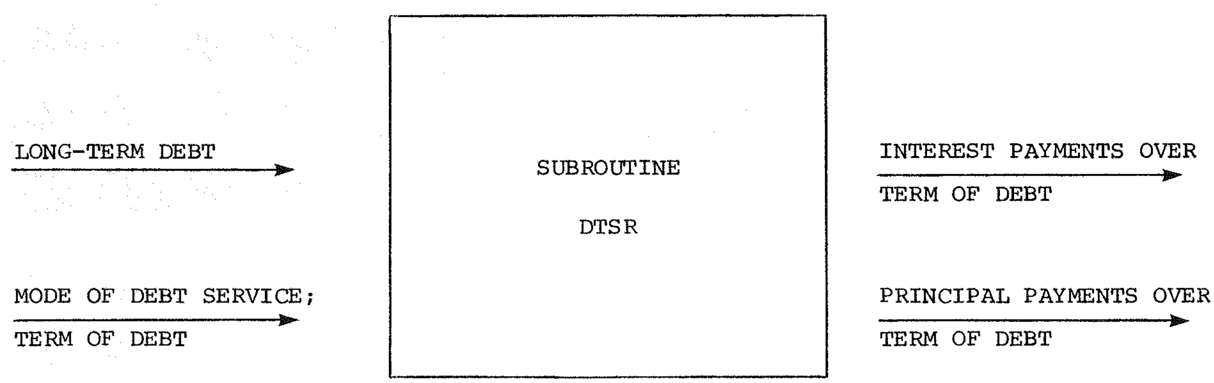

Figure 4-7. Overview of Subroutine DTSR.

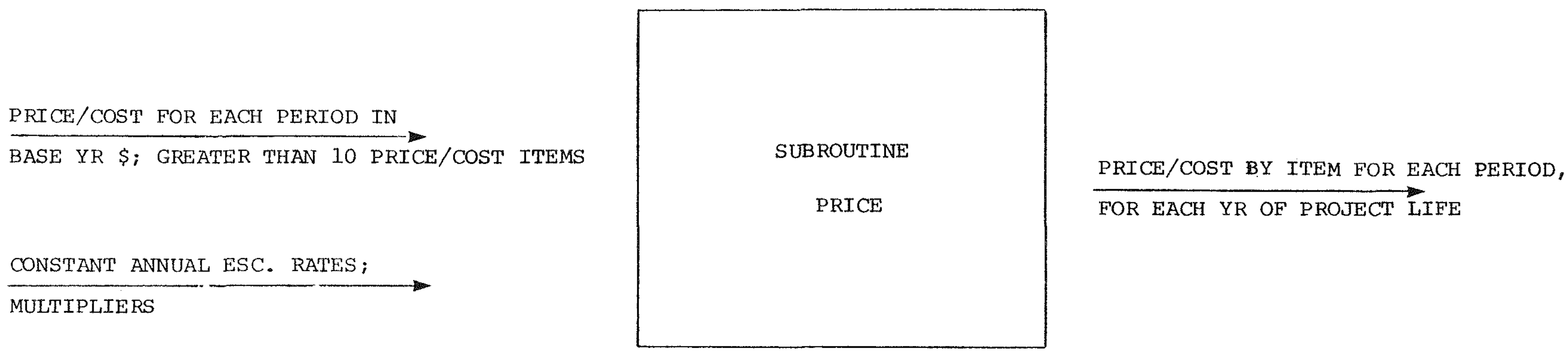

Figure 4-8. Overview of Subroutine PRICE.

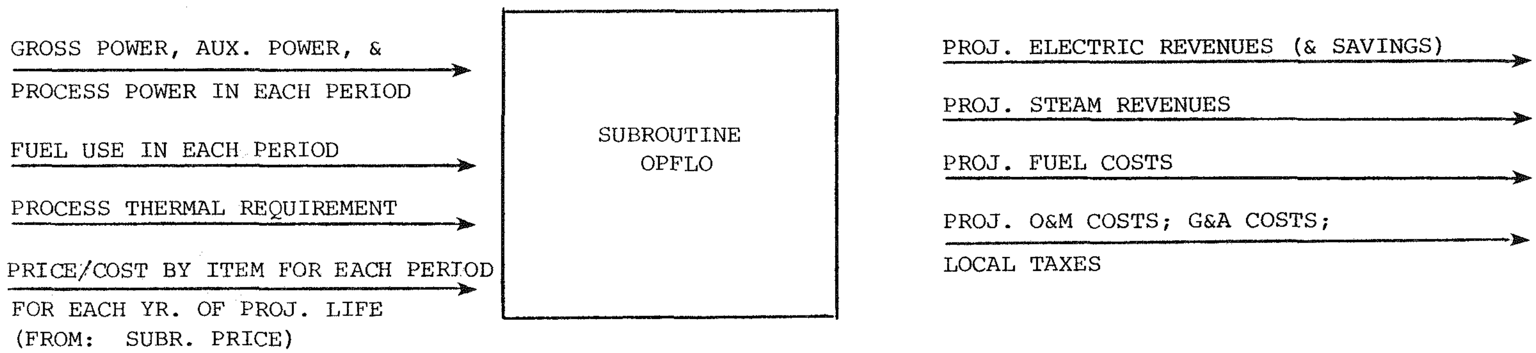

Figure 4-9. Overview of Subroutine OPFLO.

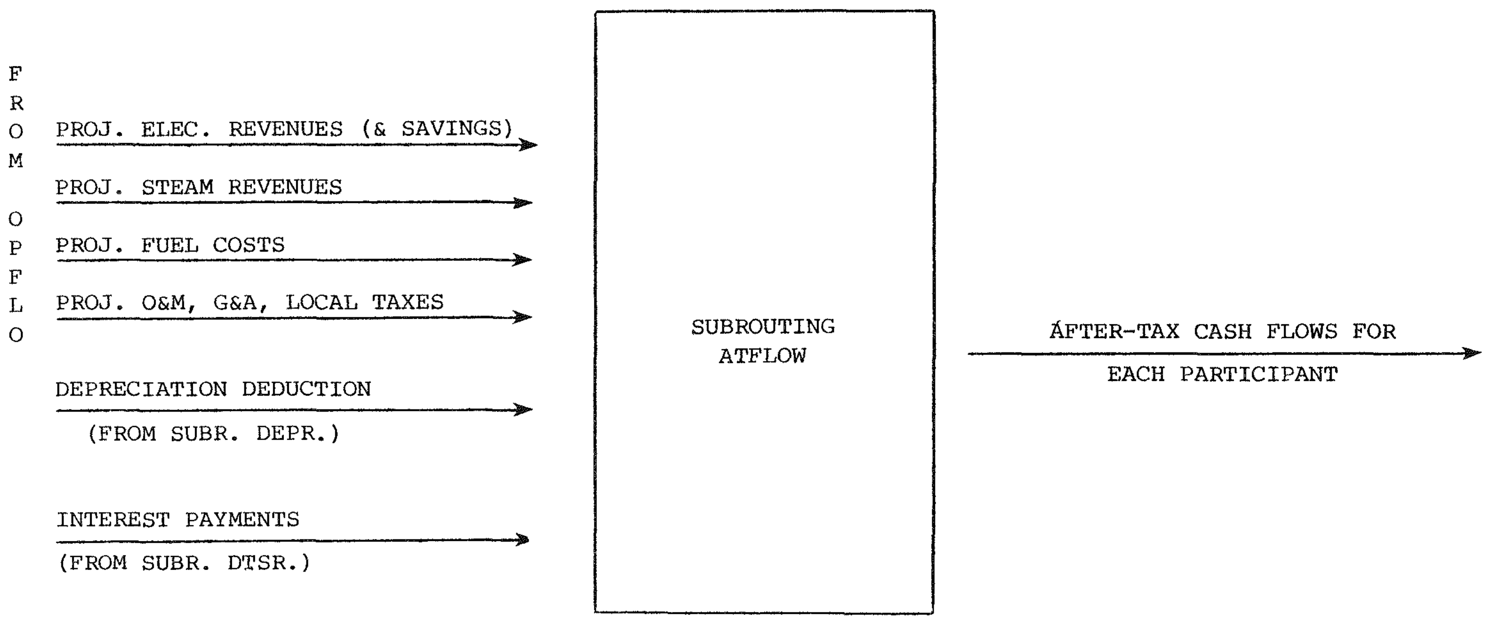

Figure 4-10. Overview of Subroutine ATFLOW.

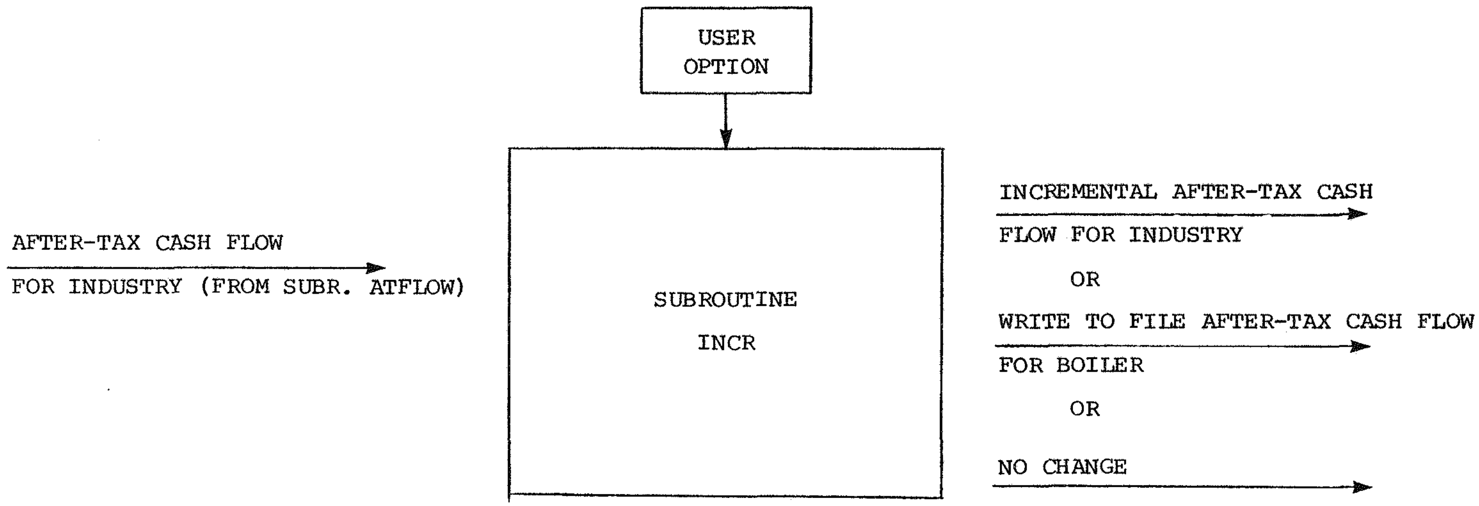

Figure 4-11. Overview of Subroutine INCR.

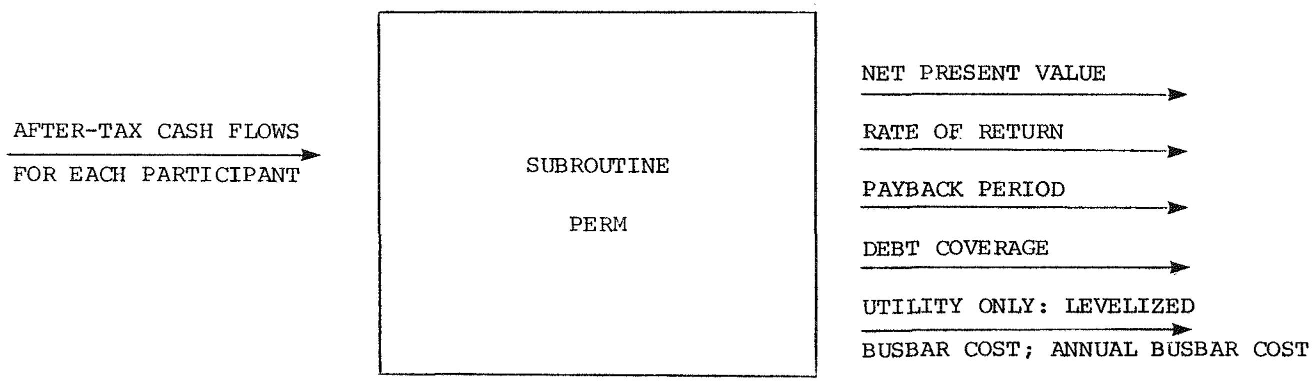

Figure 4-12. Overview of Subroutine PERM.

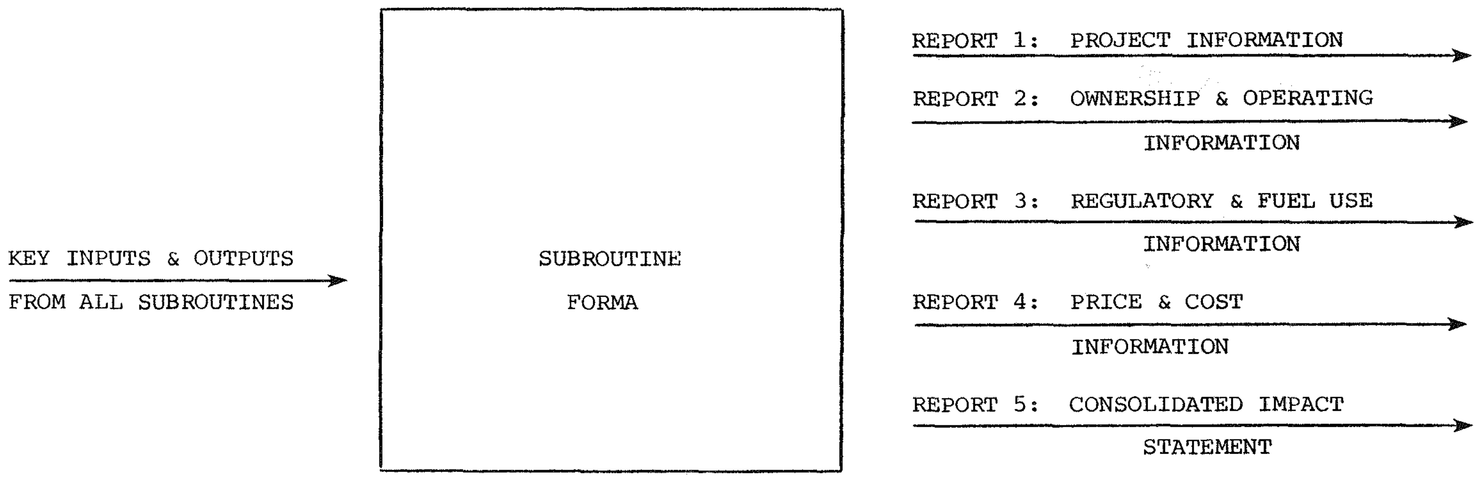

Figure 4-13. Overview of Subroutine FORMA.

- ECRED - Subroutine ECRED determines the maximum energy tax credits available to each project participant and the year of accrual (see Figure 4-5).

- DEPR - Subroutine DEPR determines the amount of depreciation that each project participant can claim in each year of project life (see Figure 4-6).

- DTSR - Subroutine DTSR schedules the debt and principal payments on project long term debt. The user can choose to schedule these payments as an annuity or can use a sinking fund (see Figure 4-7).

- PRICE - Subroutine PRICE generates the price/cost for a number of items for each year of project life. User-specified escalation rates and multipliers are used in this subroutine to reproduce the desired price/cost profile over time. The price/cost items include: PURPA avoided energy and capacity cost; industrial energy and capacity cost; utility marginal production and capacity cost; steam price; and fuel cost. In addition, appropriate escalation factors for operation and maintenance costs, real estate and local taxes and general and administrative costs are calculated (see Figure 4-8).

- OPFLO - Subroutine OPFLO determines the annual cash flows generated by the project during operations for each year of project life. These cash flows include: electric revenues and savings; auxiliary costs; steam revenues; fuel costs; operation and maintenance costs; general and administrative costs; and real estate and local taxes (see Figure 4-9).

- ATFLOW - Subroutine ATFLOW computes the after-tax cash flow accruing to each project participant for every year of project life. The after-tax cash flow computation includes the impact of federal taxes and deductions for depreciation and interest expenses (see Figure 4-10).

- INCR - Subroutine INCR is triggered either if the investment being examined is a boiler or if incremental investment analyses are desired. In the former case, subroutine INCR stores the after-tax cash flows from the investment in a separate file. In the latter case, it determines, for industry, the incremental after-tax cash flows (see Figure 4-11).

- PERM - Subroutine PERM performs all of the investment analysis generating, in all cases, the net present value, the internal rate of return, the payback period and debt coverage ratio. In addition, this subroutine generates, in the case of utility ownership, the levelized busbar cost of power from the system and the annual busbar cost of power over project life (see Figure 4-12).

- FORMA - Subroutine FORMA generates the five reports that make up the output from COPE (see Figure 4-13).

INPUT DATA REQUIREMENTS

The input data required to run COPE are arranged in four input files which will now be described. It is clear from the documentation of each input file (on the following pages) that all the inputs are not used for a given case. However, values must be read in for all the inputs defined in the input files. Evidently, the actual magnitudes that are read in for inputs that are not used are irrelevant.

The four input files are described in this section. The files are:

- DAT - used primarily to store information on project timing, regulatory status, fuel use and depreciation allowances.
- ECO - used primarily to store price/cost information (including escalation rates and multipliers) and costs of capital.
- ENG - used primarily to store engineering performance information.
- BXX - used <u>entirely</u> to store after-tax cash flows from investment in a boiler, and the total installed cost of a boiler in base year dollars.

A line by line printout of each file can be found in Appendix A. Tables 4-1, 4-2, 4-3 and 4-4 provide a description of each file.

<u>Data Format</u>

Except for variables that are explicitly identified in the description as integers, all elements of each input file are in "free format." That is, the user can enter real numbers in any convenient format. Also, all real numbers do not have to be read in with a consistent format. For instance, the following lines are all identical and any one of them is acceptable in "free format."

```
342.73, 0.76
342.730, .76
342.7300, 0.7600
342.73, 0.760
```

Table 4-1

FILENAME: DAT

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
1	ITIME (1...4)	All elements of ITIME (1...4) are <u>integers</u>. They represent: ITIME (1): construction period (in years) ITIME (2): useful economic life (in years) ITIME (3): base year for price/cost information in end-of-year terms. Enter the year, e.g., 1980 ITIME (4): year of commencement of operations in beginning of year terms.	3,10,1980,1985
2	ICLASS (1...3)	All elements of ICLASS (1...3) are <u>integers</u>. They are coded as: ICLASS (1): 1 = cost of equipment is available by category, e.g., fuel handling, boilers, etc. 2 = only total installed cost is available ICLASS (2): Not used; always enter 1 ICLASS (3): Not used; always enter 2	2,1,2
3	IEQP (1...4)	All elements of IEQP are <u>integers</u>. They are coded as follows: IEQP (1): Type of generating equipment 1 = steam electric 2 = combined cycle 3 = nuclear 4 = combustion turbine	2,2,1,2

Table 4-1

FILENAME: DAT

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
		IEQP (2): 1 = retrofit 2 = greenfield IEQP (3): 1 = PURPA qualified 2 = Not PURPA qualified IEQP (4): 1 = Primarily thermal retrofit 2 = Not primarily thermal retrofit	
4	IOWN	IOWN is an integer that codes ownership structure. It is coded as: 1 = 100% utility owned 2 = 100% industry owned 3 = 100% third party owned 4 = Partnership: Utility/Industry 5 = Partnership: Utility/Third Party 6 = Partnership: Industry/Third Party 7 = Partnership: Utility/Industry/Third Party	3
5	IANS	IANS is an integer that triggers incremental investment analysis for industry. It is coded as: 1 = incremental investment analyses for industry 2 = total investment analyses for industry	2
6	CAPTOT, CESC	CAPTOT is the total installed cost in thousands of base year dollars. Used only if ICLASS (1) = 2 see Line 2). CESC is the capital cost escalation during construction.	24825.14, 0.10
7	CAPEQP (1...8)	CAPEQP (1...8) provides installed cost in thousands of base year dollars for eight specific equipment categories (for description see Line 8). Used only if ICLASS (1) = 1 (see Line 2).	0.00, 0.00, 0.00, 20700.0, 5635.0, 3105.0, 0.00, 3450.0

Table 4-1

FILENAME: DAT

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
8	CAPFRA (1...8)	CAPFRA (1...8) provides cost for eight specific equipment categories as approximate fraction of total installed cost. Used only if ICLASS (1) = 2 (see Line 2). The eight categories are: CAPFRA (1): Fuel Handling Equipment CAPFRA (2): Boilers CAPFRA (3): Pollution Control Equipment CAPFRA (4): Turbine Generators CAPFRA (5): Heat Distribution Equipment CAPFRA (6): Specialized Buildings and Structures CAPFRA (7): General Purpose Buildings CAPFRA (8): Land	0.04, 0.01, 0.00, 0.875, 0.00, 0.075, 0.00, 0.00
9	FYE (1...ITIME (1)	FYE (1...ITIME (1)) provides the fraction of total installed cost that is spent in each year during construction.	0.2, 0.4, 0.4
10	FNC (1...4)	FNC (1...4) provides the following financial information: FNC (1): interest rate on construction borrowings (expressed as decimal) FNC (2): fraction of total project cost financed by project debt FNC (3): interest rate on long-term debt FNC (4): 1 = regular (long-term) debt 2 = tax preference (long-term) debt	0.14, 0.29, 0.181, 1

Table 4-1

FILENAME: DAT

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
11	IDCAP	IDCAP is an integer to code a user option: 1 = tax deduction on short-term borrowing; 2 = capitalize short-term borrowing	2
12	DBS (1...8)	Only DBS (1) is used. DBS (1) provides term (in years) of long-term debt	5., 0., 0., 0., 0., 0., 0., 0.
13-16	PARM (1...3, 1...3), PARM1 (1...3)	The elements on each of the lines 13 through 16 represent shares for each party in a partnership arrangement. They represent the following: PARM (1...3, 1): Shares for depreciation benefits PARM (1...3, 2): Shares for corporate contributions PARM (1...3, 3): Shares for profits (or losses) PARM1 (1...3): Shares for interest deductions 1 = utility; 2 = industry; 3 = third party e.g. PARM (1, 1) = utility share of depreciation benefits	0.0, 0.0, 1.0 0.0, 0.0, 1.0 0.0, 0.0, 1.0 0.0, 0.0, 1.0
17	TAX (1...3, 1)	Each element represents the local and real estate tax rate (as fraction of property value) for each party. 1 = utility; 2 = industry, 3 = third party e.g. TAX (3, 1) = third party's local and real estate tax rate	0.0015, 0.0015, 0.0015

Table 4-1

FILENAME: DAT

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
18	TAX (1...3, 2)	Each element represents the federal tax rate for each party (expressed as decimal) 1 = utility; 2 = industry; 3 = third party e.g. TAX (2, 2) = industry's federal tax rate	0.50, 0.50, 0.50
19	UTYPE	UTYPE is an integer used to code the utility type. 1 = investor-owned utility 2 = tax-exempt utility	1
20-23	ITC, ETCRT, ETCABC, ETCASW	These variables represent the investment and energy tax credit rate available on each of eight equipment categories under a number of provisions of current law.	0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.0, 0.0, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.0, 0.0, 0.1, 0.1, 0.1, 0.0, 0.0, 0.1, 0.0, 0.0, 0.1, 0.1, 0.1, 0.0, 0.0, 0.1, 0.0, 0.0
24	OGS (1...2)	Both elements of OGS (1...2) are integers used to code oil/gas use. OGS (1): 1 = oil/gas is primary fuel 2 = oil/gas is not primary fuel OGS (2): 1 = oil/gas used only for flame control 2 = oil/gas not restricted to flame control	1,2

Table 4-1

FILENAME: DAT

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
25	IPF	IPF is an integer used to code the primary fuel: 1 = Coal 2 = Biomass 3 = Solid Waste 4 = Oil/Gas	4
26	NFUEL	NFUEL is an integer that specifies the total number of fuel types used during system operation.	1
27-30	TXLNP (1...8) TXLPP1 (1...8) TXLPP2 (1...8) TXLPP3 (1...8)	These 4 variables are made of integers that code the depreciation status of each of eight equipment categories under different depreciation classification. The code is: TXLNP: non public utility property TXLPP1: public utility property (steam electric/combined cycle) TXLPP2: public utility property (nuclear/combustion turbine) TXLPP3: tax-exempt utility property 1 = 5 yr property 2 = 10 yr property 3 = 15 yr property 4 = non-depreciable 5 = straight line depreciation e.g. TXLPP1: (3, 3, ...4)	1,1,1,1,1,1,1,4, 3,3,3,3,3,3,3,4, 3,2,2,2,2,2,3,4, 5,5,5,5,5,5,5,4

Table 4-1

FILENAME: DAT

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
		means that the property is public utility property with steam electric or combined cycle generating equipment. The first equipment category (i.e., fuel handling) has a 15 year ACRS life. The eighth equipment category (i.e., land) is not depreciable.	
31-60		These are the built-in depreciation fractions under ACRS.	For listing see Appendix A, Table A-1
61	MDTS, SFRR	MDTS is an <u>integer</u> that codes the type of debt service: 1 = annuity; 2 = sinking fund. SFRR is the sinking fund reinvestment rate. Used only if MDTS = 2.	1, 0.125
62	IPRINT (1...12)	IPRINT (1...12) is the print selector. IPRINT (12) determines the frequency of cash flow printouts, 3 means every three years. IPRINT (6...11) are not used. Different printout options are coded as: (1,2,2,2,2,1,1,1,1,1,1,3): complete printout (2,1,2,2,2,1,1,1,1,1,1,3): only Report 5 (2,2,1,2,2,1,1,1,1,1,1,3): only B. of Report 5	1,2,2,2,2,1,1,1,1,1,1,3

Table 4-2

FILENAME: ECO

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
1- 8	TMDAT (1...36, 1...4)	NOT USED ANYWHERE	...
9-12	TMDAT (1...36, 5)	PURPA avoided energy cost in each of 36 periods in base year cents/kWh.	4.700, 5.53, 4.93 5.53, 4.93, 5.85, 5.53, 4.93, 5.85, 5.53, 4.93, 5.53, 4.93, 5.85, 5.53, 4.93, 6.08, 5.85, 5.05, 5.85, 5.05, 6.08, 5.85, 5.05, 6.08, 5.85, 5.05, 5.85, 5.05, 6.08, 5.85, 5.05, 0., 0., 0., 0.
13-15	TMDAT (1...36, 6)	Hours per period for 36 periods	168., 504., 336., 240., 48., 144., 96., 204., 612., 408., 350., 250., 52., 156., 104., 312., 416., 520., 378., 270., 78., 104., 130., 312., 416., 520., 378., 270., 78., 104., 130., 312., 0., 0., 0., 0.
16-18	TMDAT (1...36, 7)	PURPA avoided capacity cost in each of 36 periods in base year $/kW/period.	00., 0., 0., 0., 0., 0., 0., 0., 12., 0., 0., 0., 0., 0., 0., 0., 24., 0., 0., 0., 0., 0., 0., 0., 20., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.

Table 4-2

FILENAME: ECO

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
19-21	TMDAT (1...36, 8)	Industrial energy charge in each of 36 periods in base years cents/kWh.	2.401, 4.71, 4.42, 4.71, 4.42, 4.97, 4.71, 4.42, 4.97, 4.71, 4.42, 4.71, 4.42, 4.97, 4.71, 4.42, 4.97, 4.71, 4.42, 4.71, 4.42, 4.97, 4.71, 4.42, 4.97, 4.71, 4.42, 4.71, 4.42, 4.97, 4.71, 4.42, 0., 0., 0., 0.
22-24	TMDAT (1...36, 9)	Industrial capacity charge in each of 36 periods in base year $/kW/period.	73.1, 0.5, 0., 0.5, 0., 2.99, 0.5, 0., 2.99, 0.5, 0., 0.5, 0., 2.99, 0.5, 0., 4.34, 0.5, 0., 0.5, 0., 4.34, 0.5, 0., 4.34, 0.5, 0., 0.5, 0., 4.34, 0.5, 0., 0., 0., 0., 0.
25-27	TMDAT (1...36, 10)	Utility marginal production cost in each of 36 periods in base year cents/kWh.	4.700, 5.53, 4.93, 5.53, 4.93, 5.85, 5.53, 4.93, 5.85, 5.53, 4.93, 5.53, 4.93, 5.85, 5.53, 4.93, 6.08, 5.85, 5.05, 5.85, 5.05, 6.08, 5.85, 5.05, 6.08, 5.85, 5.05,

Table 4-2

FILENAME: ECO

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
			5.85, 5.05, 6.08, 5.85, 5.05, 0., 0., 0., 0.
28-30	TMDAT (1...36, 11)	Utility marginal capacity cost in each of 36 periods in base year $/kW period.	0.0, 0., 0., 0., 0., 0., 0., 0., 12., 0., 0., 0., 0., 0., 0., 0., 24., 0., 0., 0., 0., 0., 0., 0., 20., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.
31-32	TMDAT (1...36, 12)	Peak to average ratio in each of 36 periods for process electricity requirements.	1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1.,
33	STBP (1...2, 1)	STBP (1,1) is the minimum steam pressure and STBP (2,1) is the maximum steam pressure; steam price is specified at each of these pressures.	100.0, 300.0
34	STBP (1...2, 2)	STBP (1,2) and STBP (2,2) represent steam price in base year $/million Btu at minimum and maximum pressure respectively.	5.98, 6.02

Table 4-2

FILENAME: ECO

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
35-36	PIBU (1...36, 1)	Cogenerator's back-up energy charge in each of 36 periods in base year cents/kWh	2.401, 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5., 5.
37-38	PIBU (1...36, 2)	Cogenerator's back-up capacity charge in each of 36 periods in base year $/kW/period.	73.1, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.
39-44	PDIESL (1...36, 1...3)	Used only if PURPA avoided energy cost has to be changed in mid-life. PDIESL (1...36, 1), PDIESL (1...36, 2) and PDIESL (1...36, 3) represent the changed energy cost in cents/kWh for each of 36 periods in the sixth, eleventh and sixteenth year respectively.	13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 13., 10., 20., 20., 20., 20., 20., 20., 20.,

Table 4-2

FILENAME: ECO

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
			20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 20., 15., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30., 30.
45-50	PDICSL (1...36, 1...3)	Applies only if PURPA avoided capacity cost has to be changed in mid-life. PDICSL (1...36, 1), PDICSL (1...36, 2) and PDICSL (1...36, 3) represent the changed capacity cost in $/kW/period for each of 36 periods in the sixth, eleventh and sixteenth year respectively.	0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,

Table 4-2

FILENAME: ECO

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
			0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.
51	PIFC (1...3)	Price of each of 3 input fuels in base year $/million Btu.	4.082, 0., 0.
52-76	XMULT (1...13, 1...25)	Line 52 represents multipliers for different price/cost categories in the first year of project life. Line 53 through 76 represent multipliers for the same price/cost categories for each of the remaining years of project life. Lines 52 through 76 have 13 elements each, of which only 10 are utilized in the program. On each line (from 52 through 76) the elements represent the following: Element #1: multiplier for PURPA avoided energy cost Element #2: multiplier for PURPA avoided capacity cost Element #3: multiplier for industrial energy charge Element #4: multiplier for industrial capacity charge Element #5: multiplier for cogenerator's back-up energy charge	All multipliers in this file are set equal to 1.0. See Appendix A, Table A-2.

Table 4-2

FILENAME: ECO

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
		Element #6: multiplier for cogenerator's back-up capacity charge Element #10: multiplier for adjusting inflation in future periods. Element #11: multiplier for operation and maintenance cost Element #12: multiplier for input fuel(s) cost Element #13: multiplier for steam price	
77	EESC (1...12)	Constant annual escalators (expressed as decimals): EESC (1): PURPA avoided energy cost EESC (2): PURPA avoided capacity cost EESC (3): Industrial energy charge EESC (4): Industrial capacity charge EESC (5): Cogenerator's back-up energy EESC (6): Cogenerator's back-up capacity EESC (7): Steam price EESC (8): Input fuel #1 EESC (9): Input fuel #2 EESC (10): Input fuel #3 EESC (11): Operation & Maintenance Cost EESC (12): GNP Deflator (Core Inflation)	0.10, 0.0, 0.10, 0.0, 0.10, 0.0, 0.0, 0.0, 0.087, 0.0, 0.0, 0.10, 0.08
78	MPESL, MPCSL, MPEID MPCID, MPEBU, MPCBU	Each variable in this list is an <u>integer</u>, and serves as an index. If the year is characterized by more than one period, the program prints (as output) price/cost information that corresponds to the period provided in the index. If the index is 4, for instance, price/cost information corresponding to the fourth period is printed.	1,1,1,1,1,1

Table 4-2

FILENAME: ECO

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
		If the year is characterized by only one period, the program uses this index to choose the appropriate element in TMDAT (1...36, *), PIBU (1...36, *) for computational purposes. For instance, if there is only one period, and the indices are set equal to 1, only TMDAT (1,5), TMDAT (1,7) PIBU (1,1) etc. are used. To facilitate data changes, It is useful to set the indices to 1 when only 1 period is involved. Each element in Line 78 corresponds to different price/cost categories: MPESL: PURPA avoided energy cost MPCSL: PURPA avoided capacity cost MPEID: Industrial energy charge MPCID: Industrial capacity charge MPEBU: Cogenerator's back-up energy charge MPCBU: Cogenerator's back-up capacity charge	
79	IPRICE	IPRICE is an integer that allows the user to change the PURPA energy and capacity charge in sixth, eleventh and sixteenth years (see Lines 39 through 44 above). If IPRICE = 1, no mid-life change If IPRICE = 2, mid-life change is triggered	1
80-82	CDUBU(1...36, 1)	Utility energy cost of providing back-up to cogenerator in each of 36 periods in base year cents/kWh.	2.401, 5.53, 4.93, 5.53, 4.93, 5.85, 5.53, 4.93, 5.85, 5.53, 4.93, 5.53,

Table 4-2

FILENAME: ECO

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
			4.93, 5.85, 5.53, 4.93, 6.08, 5.85, 5.05, 5.85, 5.05, 6.08, 5.85, 5.05, 6.08, 5.85, 5.05, 5.85, 5.05, 6.08, 5.85, 5.05, 0., 0., 0.
83-85	CDUBU (1...36, 2)	Utility capacity cost of providing back-up to cogenerator in each of 36 periods in base year $/kW/period.	73.1, 0., 0., 0., 0., 0., 0., 0., 12., 0., 0., 0., 0., 0., 0., 0., 24., 0., 0., 0., 0., 0., 0., 0., 20., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.
86	STBCST (1...2,1)	STBCST (1,1) and STBCST (2,1) represent the minimum and maximum steam pressures at which the cost of steam from alternative sources is provided.	100.0, 300.0
87	STBCST (1...2,2)	STBCST (1,2) and STBCST (2,2) represent the cost of steam from alternative sources in base year $/million Btu at minimum and maximum pressure respectively.	5.98, 6.02

Table 4-2

FILENAME: ECO

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
88-112	XCMULT (1...13, 1...25)	XCMULT (1...13, 1...25) is very similar to XMULT (1...13, 1...25) except that the multipliers apply to different price/cost items. As before, each of the lines represents multipliers for different years; all of the elements on a line are not used. The elements that are used represent the following: Element #1: multiplier for utility marginal production cost Element #2: multiplier for utility marginal capacity cost Element #3: multiplier for utility back-up energy cost Element #4: multiplier for utility back-up capacity cost Element #9: multiplier for cost of steam from alternative sources	All multipliers in this file are set equal to 1.0. See Appendix A, Table A-2.
113	CSTESC (1...12)	Constant annual escalators (expressed as decimals). Again, not all elements are used: CSTESC (1): utility marginal production cost CSTESC (2): utility marginal capacity cost CSTESC (3): utility back-up energy cost CSTESC (4): utility back-up capacity cost CSTESC (5): cost of steam from alternatives sources.	0.10, 0.00, 0.10, 0.00, 0.00, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0.

Table 4-2

FILENAME: ECO

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
114	MCEID, MCCID, MCEBU, MCCBU	These variables are integers and are exactly like like those on Line 78 except that they serve as indices for different cost/price categories (see below): MCEID: utility marginal production cost MCCID: utility marginal capacity cost MCEBU: utility back-up energy cost MCCBU: utility back-up capacity cost	1,1,1,1
115	BTCDTE (1...3)	Before tax cost of debt for each of three possible project participants: BTCDTE (1): utility BTCDTE (2): industry BTCDTE (3): third party	0.12, 0.12, 0.12
116	BTCEQE (1...3)	Cost of equity for each of three possible project participants: BTCEQE (1): utility BTCEQE (2): industry BTCEQE (3): third party	0.16, 0.16, 0.20
117-120		These are used only in a special case where the financial calculations have to reflect future reinvestment rates.	...
121	CDTE (1...3)	The fraction of corporate contributions that come from corporate debt, for each of three possible project participants:	0.5, 0.3, 0.1

Table 4-2

FILENAME: ECO

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
		CDTE (1): utility CDTE (2): industry CDTE (3): third party	
122	FCCOMP (1...4)	Components of the utility's levelized fixed charge rate in addition to the capital recovery factor: FCCOMP (1): allowance for retirement dispersal FCCOMP (2): allowance for federal taxes FCCOMP (3): allowance for local taxes & insurance FCCOMP (4): adjustment for accelerated depreciation and tax credits (negative)	0.02, 0.06, 0.00, -0.03
123-125	UNFCR (1...30)	Utility annual fixed charge rate profile. Based on allowed accounting/regulatory practices, the fixed charged fraction for each year of project life is provided.	0.20, 0.19, 0.18, 0.17, 0.16, 0.14, 0.14, 0.14, 0.14, 0.14, 0.12, 0.12, 0.12, 0.12, 0.12, 0.08, 0.08, 0.08, 0.08, 0.08, 0.08, 0.08, 0.08, 0.08, 0.08, 0.08, 0.08, 0.08, 0.08, 0.08

Table 4-2

FILENAME: ECO

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
126	IFIN (1...3)	These indices for financial computations are <u>integers</u>: IFIN (1): If IFIN (1) = 1, no project debt and capital contributions come from debt and equity If IFIN (2) = 2, project debt is regular debt and capital contributions come from equity If IFIN (1) = 3, project debt is tax preference debt and capital contributions come from debt and equity IFIN (2): Always set = 2 IFIN (3): If IFIN (3) = 1 or 3, discount rate for NPV calculation is the after-tax weighted average cost of capital. If IFIN (3) = 2, discount rate for NPV calculation is the cost of equity.	2,2,2

Table 4-3

FILENAME: ENG

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
1	STDEL (1...3, 1)	STDEL (1...3, 1) has 3 elements. Each element represents the pressure in psi of a process thermal stream.	200., 220., 240.
2	STDEL (1...3, 2)	STDEL (1...3, 2) has 3 elements. Each element represents the thermal energy delivered per unit time (million Btu/hr.) by a process thermal stream expresed on an annual average basis.	173.80, 0., 0.
3-5	PWGNG (1..36)	Gross power in kW produced by cogeneration system in each period. Maximum number of periods is 36.	300., 300.
6-7	PWAUX (1...36)	Auxiliary power in kW required by cogeneration system in each period. Maximum number of periods is 36. If auxiliary power is not bought and is produced by cogeneration system, enter 0.0 for PWAUX(.) and enter the "net power" for PWGNG(.)	15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15., 15.

Table 4-3

FILENAME: ENG

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
8-10	PWPRS (1...36)	Power required in kW by the process in each period. Maximum number of periods is 36.	100., 100.
11-46	FUSE (1...3, 1...36)	FUSE (1...3, 1...36) represents the flow of fuels to the cogeneration system. Each line represents the fuel flow (in million Btu/hr) for three possible input fuels in a single period. Maximum number of periods is 36.	250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0.,

Table 4-3

FILENAME: ENG

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
			250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0., 250., 10., 0.
47	TPWGNG, TPWAUX, TPWPRS	Used only if the year is characterized by 1 period. TPWGNG is the gross power (in kW) generated by the system; TPWAUX is the auxiliary power (in kW) required by the system; and TPWPRS is the power (in kW) required by the process.	55200., 0.0, 0.0
48	FCSUM (1...3)	Used only if the year is characterized by 1 period. FCSUM (1..3) is the fuel consumed (in million Btu/hr) for each of three possible input fuel streams.	589.4, 0.0, 0.0

Table 4-3

FILENAME: ENG

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
49	SIZE	The capacity (in kW) for which capacity credits are available	55200.
50	XOM	Annual operation and maintenance cost expressed in base year dollars.	1822300.
51	CF	CF is the contract fraction used to reflect special contractual arrangements. Capacity credits are computed based on a capacity given by (SIZE x CF) (see Line 49)	0.0
52	KBYSEL	KBYSEL is an integer used to code the electricity sales arrangement: 1 = simultaneous buy/sell 2 = sell-excess-buy-shortage	1
53	IDISP	IDISP is an integer used to code the dispatch mode: 1 = thermal dispatch 2 = economic dispatch	1
54	IPWCAL, IFCAL	IPWCAL is an integer used to code the characterization of power flows: 1 = greater than one period per year 2 = only one period per year.	2,2

Table 4-3

FILENAME: ENG

(Continued)

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
		IFCAL is an integer used to code the characterization of fuel flows: 1 = greater than one period per year 2 = only one period per year.	
55	NDEUS	NDEUS is an integer used to code the cogeneration technology: 1 = no cogeneration 2 = LP steam electric 3 = MP steam electric 4 = MP steam electric (AFB) 5 = combined cycle coal gasification 6 = fuel cell 7 = gas turbine 8 = combined cycle 9 = diesel heat pump	5
56	YPAVG (1...2)	Used only if year is characterized by one period YPAVG (1) is the annual peak to average ratio. Set YPAVG (2) equal to YPAVG (1).	1.0, 1.0
57	ANNCAP, PRSCAP, THCAP	Used only if year is characterized by one period. ANNCAP is the number of operating hours per year. Set PRSCAP and THCAP equal to ANNCAP.	8760., 8760., 8760.
58	GAFRAC, WKFRAC	GAFRAC is the general and administrative cost as a fraction of operation and maintenance cost. WKFRAC is the working capital cost expressed as a fraction of first year fuel cost.	0.0, 0.0

Table 4-4

FILENAME: BXX

LINE #(S) BOTH INCLUSIVE	VARIABLE NAME (S)	DESCRIPTION/COMMENTS	DATA ITEMS
1-5	CFBOIL (1...36)	The first 23 elements represent the after-tax cash flows from investment in a boiler. The actual number of elements with values will, of course, depend on the economic life of the investment. Note the negative cash flow in the third year (i.e., the last year of construction). The last element, CFBOIL (36), represents the total installed cost in base year dollarsfor a boiler.	00.00, 00.00, -89953.83, 29735.66, 9236.99, 11241.21, 13467.89, 12112.90, 8974.77, 10438.52, 12057.95, 13848.45, 15826.79, 18011.43, 20422.39, 23081.59, 26012.86, 29242.38, 32798.52, 36712.20, 41016.98, 45749.68, 50950.06, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.0, 0.00, 0.00, 0.00, 0.00, 0.00, 10000.00

Section 5

IMPLEMENTING THE BATCH MODE

To run COPE in the batch mode, the user has to create four files with the same structure and format as DAT, ECO, ENG and BXX respectively. Clearly, the data used will be case-specific. It is important that the user be very familiar with the structure of these files (see Section 4 and Appendix A). If the user is interested in incremental investment analyses for industry, BXX should contain actual after-tax cash flows generated by an investment in an appropriately sized boiler. If this is the case, the user can utilize COPE to compute the after-tax cash flows from an investment in a boiler. In particular, if NDEUS is set equal to 1, COPE writes the after-cash flows to a separate file. If the user does not desire incremental investment analyses, BXX, which is available on the NCSS system (and described in Section 4) can be used.

Using the Batch Mode

The first step is to create the required input/output files and open them with the following commands:

```
> FILEDEF   9    DSK   XXX    DATA
                       ...
(XXX should be substituted with the name of a file structured
and formatted as is DAT)

> FILEDEF  10    DSK   YYY    DATA
                       ...
(YYY should be substituted with the name of a file structured
and formatted as is ECO)

> FILEDEF  11    DSK   ZZZ    DATA
                       ...
(ZZZ should be substituted with the name of a file structured
and formatted as is ENG)

> FILEDEF 12     DSK   BBB    DATA
                       ...
(BBB should be substituted with the name of a file structured
and formatted as is BXX.)
```

The output can either be printed (or displayed) on the terminal or written to an output file. If output is to be written to a separate file the command is:

> FILEDEF 14 DSK OUT DATA LRECL 140 RECFM V

(OUT should be substituted with name chosen for the output file)

If output is to be sent to terminal, the command is:

> FILEDEF 14 CONO

Only if the case being examined corresponds to a boiler, a new file has to be opened with the following command:

> FILEDEF 13 DSK NBB DATA LRECL 80 RECFM F

(NBB should be substituted with name chosen for a new boiler file. NBB stores the after-tax cash flows generated by investing in a boiler. Recall discussion above.)

The "FILEDEF" command opens the necessary files. The next step is for the user to invoke the appropriate NCSS compiler as follows:

> EXEC ATTACH

The final step involves running COPE. This is done as follows:

> EXEC COPE

At this point the user is allowed the option of modifying data. Since appropriate input files have already been created, the user should bypass this option. When execution is complete, the output is either displayed on the terminal or is available as an output file which can be printed.

Section 6

SAMPLE RUNS

Sample runs of COPE using the INTERACTIVE mode on NCSS are presented in this section. These sample runs are based on case studies conducted in cooperation with utilities to test and demonstrate the capabilities of COPE.*

Two of the runs discussed here (Examples 1 and 2) are part of a large set of runs. The objective of the runs is to investigate alternative capital structures to finance a combined cycle cogeneration system. Example 3 of Section 7 is a simple numerical exercise to test different computational loops within the program.

Table 6-1 provides the plant characteristics that are used for the runs. Table 6-2 provides system performance for a combined cycle system designed to serve the plant. In Table 6-3, two capital structures are described. The results of the case study are summarized in Figure 6-1 and Table 6-4.

Figure 6-1 shows the familiar "leverage effect." As can be seen, the line that corresponds to capital structure B is steeper than that which corresponds to capital structure A. Therefore, if PURPA energy prices are high enough to yield a rate of return on total investment that exceeds the cost of debt, having more debt in the capital structure is advantageous. On the other hand, if PURPA energy prices fall so low as to decrease the rate of return on total investment below the cost of debt, greater debt fractions cut sharply into returns on equity. An interesting assumption of the analysis is that structure B, although it has a greater debt fraction, is made up of debt that is cheaper than that of structure A. In spite of this assumption, the first year debt coverage ratio under structure B is lowered sharply (see Table 6-4).

---

*For detailed discussions of these case studies see "Cogeneration Options Evaluation (COPE): Program Descriptive Manual."

Table 6-1

INDUSTRIAL PLANT CHARACTERISTICS

ELECTRIC DEMAND	
Average Electric Demand	1786 kW
Electric Demand Profile	flat
STEAM DEMAND	
Average Steam Demand*	
@ 250 psig	53,000 lb/hr.
@ 150 psig	112,000 lb/hr.
Steam Demand Profile	flat
OPERATING HOURS	
At 75% process steam demand	8760 hrs/yr.
FUEL CHOICE	
Natural Gas (23,860 BTU/lb)	
MAKEUP WATER	
Makeup Water Requirements	25% @ 210°F

*The two streams can be approximated by one stream delivering 173.8 million BTU/hr.

Table 6-2

COMBINED CYCLE SYSTEM PERFORMANCE

SYSTEM	TOTAL INSTALLED COST 1980 $ MILLION	FUEL FLOW @ 75% LOAD MILLION BTU/HR.	MW CAPACITY @ 75% LOAD
Combined Cycle with full condensing capacity	24.8	589	55.2

Table 6-3

ALTERNATIVE CAPITAL STRUCTURES

STRUCTURE A		
	Fraction	Rate
Common Equity:	71%	20%
Long Term Debt:	29%	18.1%

STRUCTURE B		
	Fraction	Rate
Common Equity:	50%	20%
Long Term Debt:	50%	12%

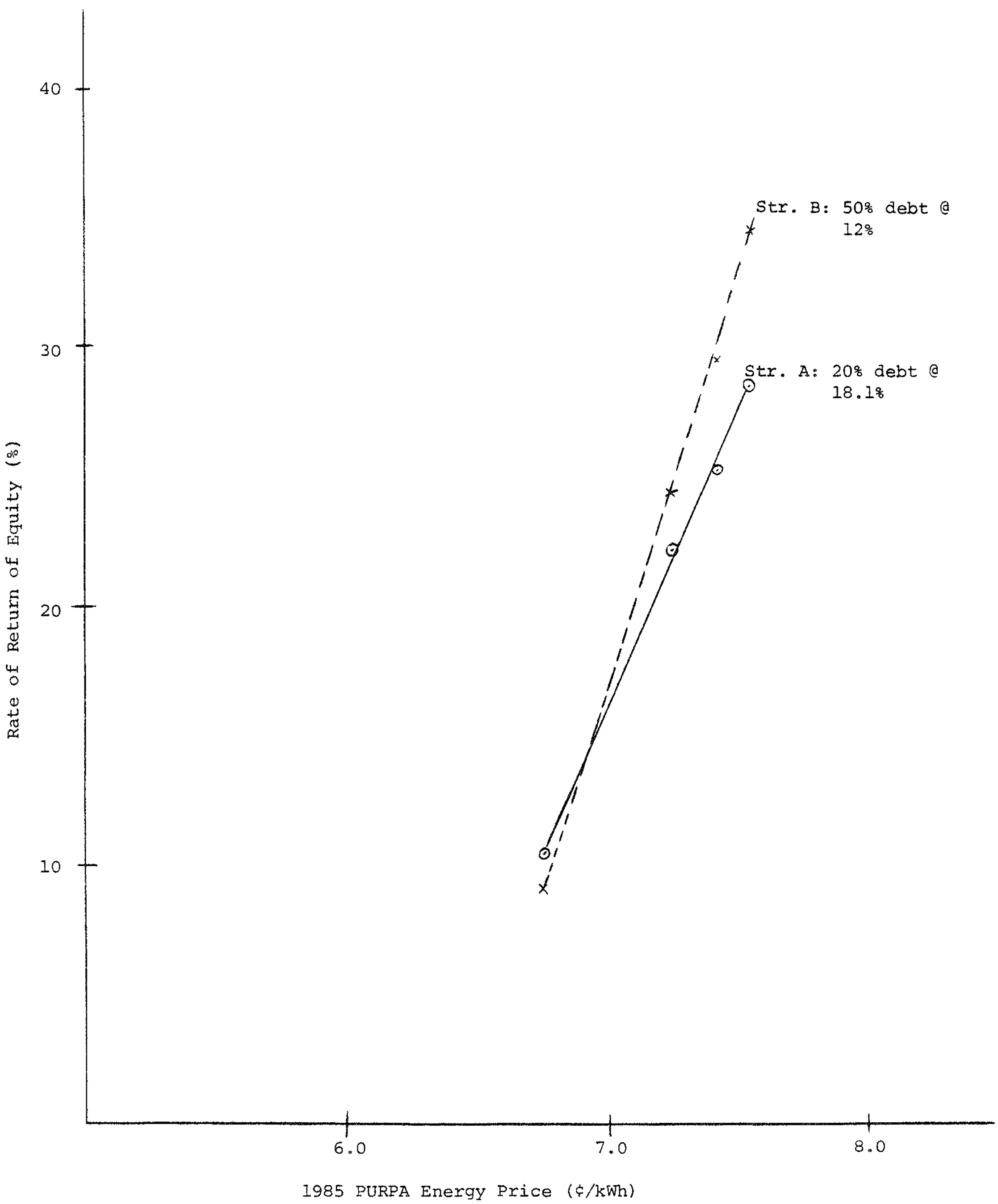

Figure 6-1. Alternative Capital Structures for a Combined Cycle System.

Table 6-4

IMPACT OF ALTERNATIVE CAPITAL STRUCTURES

SUMMARY

	STRUCTURE A 20% debt at 18.1%				STRUCTURE B 50% debt at 18.1%			
PURPA Energy Price in 1985 ¢ per kWh	NPV* $ Thou.	ROR(%)	Payback (yrs.)	First Yr. Debt Cov.	NPV* $ Thou.	ROR(%)	Payback (yrs.)	First Yr. Debt Cov.
6.76	-7504	10.3	6.61	1.50	-6926	8.8	7.54	0.87
7.25	1755	22.1	4.01	2.64	2564	24.2	5.05	1.53
7.41	4468	25.5	3.57	3.03	5721	29.5	3.60	1.76
7.57	7028	28.5	3.25	3.41	8535	34.3	2.99	1.98

*Net Present Value (NPV) is based on a discount rate of 20%.

To summarize, this case study shows that while a capital structure that is heavily debt-laden can yield very high returns on equity, such returns are very sensitive to the price profile for electricity buyback rates. Small changes in the buyback rate can seriously erode the rate of return on equity for heavily debt-laden structures.

The runs presented here as Example 1 and Example 2 (see following pages for computer printout) correspond to capital structures A and B respectively. For both runs the 1985 PURPA energy price is held at 7.57 ¢/kWh (see last row of Table 6-4).

The input values for Example 1 are contained in the default data files currently available on NCSS. A number of parts of the printout for examples 1 and 2 are encircled, and are of significance to the user:

- **#1**

  Note that the option to modify data is completely bypassed.

- **#2**

  The user can ask for all or for parts of the reports generated by COPE.

- **#3**

  This example is a case of 100% third party ownership and yields a rate of return of 28.5%. This rate of return (on equity) assumes 29% long-term debt at 18.1% interest.

  Example 2 involves only one change from the default data files: the amount of long-term debt is changed to 50%.

- **#4**

  The user can see that the option to make additional runs is being used.

- **#5**

  Note that while logical segment 1 is bypassed, <u>all</u> the variables in logical segment 2 have to be provided with values.

- **#6**

  Note that only B. of Report 5 is being asked for.

- **#7**

  Example 2 has a higher fraction of debt that is available at an interest rate lower than the total rate of return. Consequently, the rate of return on equity (when compared to Example 1) is higher. Also debt coverage is lower. This is the familiar "leverage" effect.

- **#8**

  The user is now out of the program.

Example 1

```
17.15.10 >EXEC GETSET

DO YOU WISH TO USE EXISTING DATA FILES? (YES/NO)
>YES

17.15.22 FILEDEF 9 DSK DAT DATA
17.15.22 FILEDEF 10 DSK ECO DATA
17.15.22 FILEDEF 11 DSK ENG DATA
DOES THIS RUN CORRESPOND TO THE BOILER? (YES/NO)
>NO

DO YOU NEED INCREMENTAL INVESTMENT ANALYSIS FOR INDUSTRY?(YES/NO)
>NO

17.15.35 FILEDEF 12 DSK BXX DATA

WOULD YOU LIKE THE OUTPUT ON THE TERMINAL OR IN A FILE?
(TERM/FILE)
>TERM

17.15.40 FILEDEF 14 CONO LRECL 140

17.15.40 >EXEC ATTACH

DEV T DETACHED
VSFORT   ATTACHED AS T-DISK

17.15.47 >EXEC COPE

$$$$$$EXECUTION:
$$TIME TO MODIFY YOUR DATA, FELLA.....

DO YOU WISH TO MODIFY THE DEFAULT VALUES?
 (YES = 1; NO = 2)
>2
```

Note #1

```
PROVIDE THE DESIRED FREQUENCY OF CASH FLOW DISPLAY:
(FOR 10 YEAR PROJECTS, MINIMUM = 3;
 FOR 20 YEAR PROJECTS, MINIMUM = 5)
>3

WOULD YOU LIKE ABRIDGED OUTPUT?' (1,2,2,2,2=ALL REPORTS;
2,1,2,2,2=ONLY REPORT 5;' 2,2,1,2,2=ONLY B. OF REPORT 5,
>1,2,2,2,2
```

Note #2

$ REPORT 1: PROJECT INFORMATION

TECHNOLOGY:	CGCC
DEUS #:	5
START OF CONSTRUCTION:	JANUARY 1982
START OF OPERATIONS:	JANUARY 1985
ECONOMIC LIFE OF PROJECT:	10 YEARS
BASE YEAR FOR COST AND PRICE DATA:	1980 (END-OF-YEAR)

REPORT 2: OWNERSHIP AND OPERATING INFORMATION

OWNERSHIP ARRANGEMENT: OWNED ENTIRELY BY THIRD PARTY

DISPATCH ARRANGEMENT: THERMAL FOLLOWING

ELECTRICITY SALES ARRANGEMENT: SIMULTANEOUS BUY-SELL

AVERAGE SYSTEM PERFORMANCE:

POWER FLOWS

GROSS POWER FROM SYSTEM (KW)	55200.0
AUXILIARY POWER REQUIREMENT (KW)	0.0
PROCESS POWER REQUIREMENT (KW)	0.0
CAPACITY CONTRACTED TO UTILITY (KW)	55200.0
CONTRACT FRACTION	0.0

USEFUL THERMAL OUTPUT

PROCESS STEAM AT 200. PSI (MILLION BTU/HR)	173.8

FUEL INPUT

STREAM #1 (MILLION BTU/HR)	589.4

REPORT 3: REGULATORY AND FUEL USE INFORMATION

PRIMARY FUEL USED:	OIL/GAS
FACILITY STATUS:	QUALIFIED UNDER PURPA
	GREENFIELD UNIT
OIL/GAS USE:	OIL/GAS USE EXCEEDS 20 PER CENT OF FUEL INPUT
	OIL/GAS USE NOT RESTRICTED TO BACK-UP,FLAME CONTROL OR FLAME STABILIZATION
TYPE OF GENERATING EQUIPMENT:	COMBINED CYCLE
DEPRECIATION:	
UTILITY(IOU):	ERTA 1981
INDUSTRY:	ERTA 1981
THIRD PARTY:	ERTA 1981

REPORT 4 : PRICE & COST INFORMATION

AVERAGE ELECTRICITY RATES AND COSTS:

	1985	1988	1991	1994
PURPA ENERGY PRICE (CENTS/KW-HR):	7.57	10.07	13.41	17.85
PURPA CAPACITY PRICE ($/KW/YEAR):	0.00	0.00	0.00	0.00
INDUSTRIAL ENERGY CHARGE (CENTS/KW-HR):	3.87	5.15	6.85	9.12
INDUSTRIAL CAPACITY CHARGE ($/KW/YEAR):	73.10	73.10	73.10	73.10
BACK-UP ENERGY CHARGE (CENTS/KW-HR):	3.87	5.15	6.85	9.12
BACK-UP CAPACITY CHARGE ($/KW/YEAR):	73.10	73.10	73.10	73.10
UTILITY MARGINAL ENERGY COST (CENTS/KW-HR):	7.57	10.07	13.41	17.85
UTILITY MARGINAL CAPACITY COST ($/KW/YEAR):	0.00	0.00	0.00	0.00
UTILITY MARGINAL BACK-UP ENERGY COST(CENTS/KW-HR):	3.87	5.15	6.85	9.12
UTILITY MARGINAL BACK-UP CAPACITY COST($/KW/YEAR):	73.10	73.10	73.10	73.10

AVERAGE STEAM PRICES AND COSTS:

	1985	1988	1991	1994
PRICE OF PROCESS STEAM AT 200. PSI($/MILLION BTU):	6.00	6.00	6.00	6.00
COST OF ALTERNATIVE STEAM AT 200. PSI($/MILLIONBTU):	6.00	6.00	6.00	6.00

INPUT FUEL COSTS:

	1985	1988	1991	1994
INPUT FUEL #1 ($/MILLION BTU):	6.19	7.96	10.22	13.12

CONSTANT ANNUAL ESCALATORS:

GNP DEFLATOR (CORE INFLATION):	0.080
CAPITAL COST ESCALATION:	0.100
OPERATION & MAINTENANCE COST ESCALATION:	0.100

REPORT 5: CONSOLIDATED IMPACT STATEMENT

A. PROJECT FINANCE

TOTAL INSTALLED COST OF SYSTEM (THOUSANDS OF BASE YEAR DOLLARS)	24825.14		

FINANCIAL STRUCTURE

SHORT TERM INTEREST RATE ON BORROWINGS DURING CONSTRUCTION:	0.14		
LONG TERM DEBT FRACTION:	.29		
LONG TERM DEBT INSTRUMENT:			
TYPE	REGULAR		
TERM	5 YEARS		
INTEREST RATE	.181		
MODE OF PAYMENT	ANNUITY		
CORPORATE CONTRIBUTION :	CORPORATE CONTRIBUTION COMES FROM EQUITY		
	UTILITY	INDUSTRY	THIRD PARTY
LEVELIZED FIXED CHARGE RATE:	0.24		
FIRST YEAR FIXED CHARGE RATE:	0.20		
COST OF NEW CORPORATE DEBT (BEFORE TAX):	0.12	0.12	0.12
COST OF NEW CORPORATE EQUITY:	0.16	0.16	0.20
TARGET CORPORATE DEBT FRACTION:	0.50	0.30	0.10
TARGET CORPORATE EQUITY FRACTION:	0.50	0.70	0.90
MARGINAL FEDERAL TAX RATE ON EARNINGS:	0.50	0.50	0.50

B. CASH FLOW STATEMENT

****
THIRD PARTY
****

DEPRECIATION AND TAX CREDITS

(THOUSANDS OF DOLLARS)

	BASIS (A)	PROPERTY STATUS (B)	DEPRECIATION METHOD (C)	FIRST YEAR DEPRECIATION	INVESTMENT TAX CREDIT (D)	ENERGY TAX CREDIT (D)
FUEL HANDLING EQUIPMENT	1473.41	NPP	1	265.21	155.10	0.00
BOILER	387.74	NPP	1	69.79	0.00	0.00
POLLUTION CONTROL EQUIPMENT	0.00	NPP	1	0.00	0.00	0.00
TURBINE GENERATORS	32230.79	NPP	1	5801.54	3392.72	0.00
HEAT DISTRIBUTION EQUIPMENT	0.00	NPP	1	0.00	0.00	0.00
SPECIALIZED BLDGS & STRUCTURES	2762.64	NPP	1	497.27	290.80	0.00
GENERAL PURPOSE BLDGS	0.00	NPP	1	0.00	0.00	0.00
LAND	0.00	NPP	4	0.00	0.00	0.00
	36854.57			6633.82	3838.61	0.00

(A) FOR DEPRECIATION;OPTION TO CAPITALIZE IDC
(B) NPP: NON PUBLIC-UTILITY PROPERTY; PP: PUBLIC UTILITY PROPERTY
(C) 1: 5 YR ACRS; 2: 10 YR ACRS; 3: 15 YRACRS; 4: NON-DEPRECIABLE; 5: ST. LINE
(D) TAX CREDITS ACCRUE IN FIRST YEAR OF OPERATION UNLESS CONSTR. PERIOD > 2 YRS

CASH FLOWS DURING CONSTRUCTION FOR THIRD PARTY

(END-OF-YEAR FLOWS IN THOUSANDS OF DOLLARS)

	1982	1983	1984
TAX BENEFITS ON S/T INTEREST PAYMENTS:	0.00	0.00	0.00
LONG TERM PROJECT OUTLAYS:	0.00	0.00	27529.45
INVESTMENT TAX CREDITS DURING CONSTRUCTION:	767.72	1535.45	1535.45
ENERGY TAX CREDITS DURING CONSTRUCTION:	0.00	0.00	0.00
NET AFTER TAX CASH FLOWS:	767.72	1535.45	-25994.00

CASH FLOWS FROM OPERATIONS FOR THIRD PARTY

(END-OF-YEAR FLOWS IN THOUSANDS OF DOLLARS)

	1985	1988	1991	1994
ELECTRIC OPERATIONS:				
ELECTRICITY SALES:	36601.81	48716.87	64841.97	86304.44
ELECTRICITY SAVED:	0.00	0.00	0.00	0.00
EXTRA BACK-UP COSTS:	0.00	0.00	0.00	0.00
AUXILIARY COSTS:	0.00	0.00	0.00	0.00
NET ELECTRIC REVENUES:	36601.81	48716.87	64841.97	86304.44
STEAM OPERATIONS:				
NET STEAM REVENUES:	9134.92	9134.92	9134.92	9134.92
OPERATING COSTS:				
FUEL COSTS:	31984.06	41079.16	52760.57	67763.75
OPERATION & MAINTENANCE:	2934.82	3906.23	5199.18	6920.09
OPERATING INCOME:	10817.85	12866.40	16017.11	20755.44
GENERAL & ADMINISTRATIVE:	0.00	0.00	0.00	0.00
LOCAL TAXES & INSURANCE:	81.23	102.32	128.90	162.37
DEPRECIATION:	6633.82	5896.73	0.00	0.00
INTEREST PAYMENTS:	2035.24	1020.00	0.00	0.00
NET TAXABLE INCOME:	2067.56	5847.34	15888.21	20593.06
FEDERAL TAX:	1033.78	2923.67	7944.11	10296.53
NET INCOME AFTER TAX:	1033.78	2923.67	7944.11	10296.53
PRINCIPAL PAID(-):	1568.63	2583.86	0.00	0.00
DEPRECIATION (+):	6633.82	5896.73	0.00	0.00
INVESTMENT TAX CREDITS:	0.00			
ENERGY TAX CREDITS:	0.00			
AFTER-TAX CASH FLOW:	6098.97	6236.53	7944.11	10296.53

FINANCIAL ANALYSIS BASED ON TOTAL INVESTMENT

ALL DOLLARS IN 1984 (END-OF-YEAR) TERMS:

NET PRESENT VALUE (THOUSANDS OF DOLLARS)	7027.63	
RATE OF RETURN	0.285	Note #3
PAYBACK (YEARS)	3.25	
FIRST YEAR DEBT COVERAGE RATIO	3.41	

C. ADDITIONAL IMPACTS

IMPACT ON UTILITY

(END-OF-YEAR FLOWS IN THOUSANDS OF DOLLARS)

	1985	1988	1991	1994
COST OF POWER PURCHASED UNDER PURPA:	36601.81	48716.87	64841.97	86304.44
COST OF DISPLACED POWER:	0.00	0.00	0.00	0.00
COST OF SERVING AUXILIARIES:	0.00	0.00	0.00	0.00
SAVINGS FROM AVOIDED GENERATION COSTS:				
DUE TO PURCHASED POWER:	36601.81	48716.87	64841.97	86304.44
DUE TO DISPLACED POWER:	0.00	0.00	0.00	0.00
REVENUES FROM AUXILIARIES:	0.00	0.00	0.00	0.00
REVENUES FROM DIFFERENTIAL BACK-UP RATES:	0.00	0.00	0.00	0.00
NET UTILITY COST:	0.00	0.00	0.00	0.00

IMPACT ON INDUSTRY

(END-OF-YEAR FLOWS IN THOUSANDS OF DOLLARS)

	1985	1988	1991	1994
SAVINGS FROM AVOIDED STEAM GENERATION:	9134.92	9134.92	9134.92	9134.92
COST OF PURCHASED STEAM:	9134.92	9134.92	9134.92	9134.92
NET INDUSTRY BENEFIT:	0.00	0.00	0.00	0.00

Example 2

```
DO YOU WANT TO RUN ADDITIONAL CASES?  (YES = 1; NO =2)
>1
```

Note #4

```
TIME TO MODIFY YOUR DATA, FELLA.....

DO YOU WISH TO MODIFY THE DEFAULT VALUES?
 (YES = 1; NO = 2)
>1

HOW MANY PERIODS IS THE ANNUAL PERFORMANCE
CHARACTERIZED BY?
>1

DO YOU WISH TO MODIFY PROJECT TIMING, FUEL USE OR
REGULATORY INFORMATION?  (YES = 1; NO = 2)
>2

DO YOU WISH TO MODIFY CAPITAL COST, STRUCTURE OR
TAX INFORMATION?  (YES = 1; NO = 2)
>1
```

Note #5

```
PROVIDE THE TOTAL INSTALLED COST (THOUSANDS OF BASE
YEAR DOLLARS)
>24825.14

PROVIDE THE CAPITAL COST ESCALATION:
>0.10

PROVIDE THE APPROXIMATE BREAKDOWN OF COST CATEGORIES
(FRACTIONS):  1 = FUEL HANDLING; 2 = BOILER;
3 = POLLUTION CONTROL; 4 = TURBINES; 5 = HEAT
DISTRIBUTION; 6 = SPECIALIZED BUILDINGS; 7 = GENERAL
BUILDINGS; 8 = LAND
>0.04,0.01,0.00,0.875,0.00,0.075,0.00,0.00

PROVIDE THE FRACTION OF INSTALLED COSTS EXPENDED IN
EACH YEAR OF CONSTRUCTION:
>0.2,0.4,0.4

PROVIDE THE INTEREST RATE ON SHORT-TERM BORROWING
DURING CONSTRUCTION:
>0.14

PROVIDE THE INTEREST RATE ON LONG-TERM DEBT:
>0.181

PROVIDE THE TYPE OF LONG-TERM DEBT (REGULAR = 1;
TAX PREFERENCE = 2):
>1

PROVIDE THE TERM OF LONG-TERM DEBT (IN YEARS):
>5.0

PROVIDE THE REAL ESTATE TAX AND INSURANCE RATE
(FRACTION OF PROPERTY VALUE):
>0.0015,0.0015,0.0015

PROVIDE THE FEDERAL TAX RATE (FRACTION):
>0.50,0.50,0.50
```

```
PROVIDE THE MODE OF DEBT SERVICE (ANNUITY = 1;
SINKING FUND = 2):
>1

DO YOU WISH TO TAKE TAX DEDUCTIONS ON SHORT-TERM
BORROWING OR CAPITALIZE INTEREST DURING CONSTRUCTION?
(TAX DEDUCTIONS = 1; CAPITALIZE = 2)
>2

PROVIDE THE SHARE(S) OF DEPRECIATION BENEFITS' FOR EACH PARTY:
>0.0,0.0,1.0

PROVIDE THE SHARE(S) OF CAPITAL CONTRIBUTION' FOR EACH PARTY:
>0.0,0.0,1.0

PROVIDE THE SHARE(S) OF PROFITS AND TAX CREDITS' FOR EACH PARTY:
>0.0,0.0,1.0

PROVIDE THE SHARE(S) OF INTEREST DEDUCTIONS ON
LONG-TERM DEBT FOR EACH PARTY:
>0.0,0.0,1.0

PROVIDE THE FRACTION OF LONG-TERM PROJECT DEBT:
>0.50

DO CAPITAL CONTRIBUTIONS COME FROM COPORATE EQUITY
OR A COMBINATION OF DEBT AND EQUITY?  (DEBT AND
EQUITY = 1; EQUITY ONLY = 2)
>2

PROVIDE THE COST OF CORPORATE DEBT FOR EACH PARTY:
>0.12,0.12,0.12

PROVIDE THE COST OF CORPORATE EQUITY FOR EACH PARTY:
>0.16,0.16,0.20

PROVIDE THE CORPORATE DEBT FRACTION FOR EACH PARTY:
>0.5,0.3,0.1

PROVIDE THE ANNUAL FIXED CHARGE PROFILE OF THE UTILITY
FOR PLANT LIFE
>0.20,0.19,0.18,.17,.16,.14,.14,.14,.14,.14,.12,.12,.12,.12,.12

>.08,.08,.08,.08,.08,.08,.08,.08,.08,.08,.08,.08,.08,.08,.08

PROVIDE FOUR COMPONENTS FOR DETERMINING THE LEVELIZED
FIXED CHARGE RATE FOR THE UTILITY:
>.02,.03,.00,[

>.02,.06,0.00,-0.03

DO YOU WISH TO MODIFY THE PERFORMANCE DATA?
 (YES = 1; NO = 2)
>2

DO YOU WISH TO MODIFY THE PRICE AND COST INFORMATION?
 (YES = 1; NO = 2)
>2

PROVIDE THE DESIRED FREQUENCY OF CASH FLOW DISPLAY:
(FOR 10 YEAR PROJECTS, MINIMUM = 3;
 FOR 20 YEAR PROJECTS, MINIMUM = 5)
>3

WOULD YOU LIKE ABRIDGED OUTPUT?' (1,2,2,2,2=ALL REPORTS;
2,1,2,2,2=ONLY REPORT 5;' 2,2,1,2,2=ONLY B. OF REPORT 5)
>2,2,1,2,2
$
```

Note #6

CASH FLOWS DURING CONSTRUCTION FOR THIRD PARTY

(END-OF-YEAR FLOWS IN THOUSANDS OF DOLLARS)

	1982	1983	1984
TAX BENEFITS ON S/T INTEREST PAYMENTS:	0.00	0.00	0.00
LONG TERM PROJECT OUTLAYS:	0.00	0.00	19386.94
INVESTMENT TAX CREDITS DURING CONSTRUCTION:	767.72	1535.45	1535.45
ENERGY TAX CREDITS DURING CONSTRUCTION:	0.00	0.00	0.00
NET AFTER TAX CASH FLOWS:	767.72	1535.45	-17851.49

CASH FLOWS FROM OPERATIONS FOR THIRD PARTY

(END-OF-YEAR FLOWS IN THOUSANDS OF DOLLARS)

	1985	1988	1991	1994
ELECTRIC OPERATIONS:				
ELECTRICITY SALES:	36601.81	48716.87	64841.97	86304.44
ELECTRICITY SAVED:	0.00	0.00	0.00	0.00
EXTRA BACK-UP COSTS:	0.00	0.00	0.00	0.00
AUXILIARY COSTS:	0.00	0.00	0.00	0.00
NET ELECTRIC REVENUES:	36601.81	48716.87	64841.97	86304.44
STEAM OPERATIONS:				
NET STEAM REVENUES:	9134.92	9134.92	9134.92	9134.92
OPERATING COSTS:				
FUEL COSTS:	31984.06	41079.16	52760.57	67763.75
OPERATION & MAINTENANCE:	2934.82	3906.23	5199.18	6920.09
OPERATING INCOME:	10817.85	12866.40	16017.11	20755.44
GENERAL & ADMINISTRATIVE:	0.00	0.00	0.00	0.00
LOCAL TAXES & INSURANCE:	81.23	102.32	128.90	162.37
DEPRECIATION:	6633.82	5896.73	0.00	0.00
INTEREST PAYMENTS:	3509.04	1758.63	0.00	0.00
NET TAXABLE INCOME:	593.77	5108.72	15888.21	20593.06
FEDERAL TAX:	296.88	2554.36	7944.11	10296.53
NET INCOME AFTER TAX:	296.88	2554.36	7944.11	10296.53
PRINCIPAL PAID(-):	2704.53	4454.93	0.00	0.00
DEPRECIATION (+):	6633.82	5896.73	0.00	0.00
INVESTMENT TAX CREDITS:	0.00			
ENERGY TAX CREDITS:	0.00			
AFTER-TAX CASH FLOW:	4226.17	3996.16	7944.11	10296.53

FINANCIAL ANALYSIS BASED ON TOTAL INVESTMENT

ALL DOLLARS IN 1984 (END-OF-YEAR) TERMS:

NET PRESENT VALUE (THOUSANDS OF DOLLARS)	8534.80	
RATE OF RETURN	0.343	Note #7
PAYBACK (YEARS)	2.77	
FIRST YEAR DEBT COVERAGE RATIO	1.98	

```
DO YOU WANT TO RUN ADDITIONAL CASES?  (YES = 1; NO =2)
>2

17.34.20 >
```

Note #8

Section 7

SETTING UP TEST CASES

It is recommended that users who implement COPE on in-house computers run a number of test cases to ensure that the computations performed are accurate. A convenient way to test the program is to set up input data files that are identical to those provided in Appendix A. A single COPE run using the data files in Appendix A should yield the results provided in Example 1 of Section 6.

A common problem that may arise is a mismatch between the format of the data as entered in the data files and that required by the program. To ensure compatibility, users should enter data according to the format specified in the Subroutine INPUT. Clearly, this would not apply of the program has been modified to handle data with a different format.

Example 3

The computational procedure in COPE is simplified considerably when the year is characterized by one period. To test the program, a one period case is redefined as a two period case with identical periods. Example 1 is a one period case with 8760 operating hours at 75% steam demand. In the following pages, a computer printout is presented of Example 1 modeled as a two period case. The computer printout shows that in the two period case, it is assumed that there are two identical periods of 4380 hours each. Further, as the inputs provided in the interactive mode (see printout) show, identical system performance and price/cost data are provided for each of two periods.

The results from this run are identical to those obtained earlier and presented in Example 1. The run shows that the computational loops in the program are accurate.

EXAMPLE 3

```
10.35.48 >EXEC COPE

$$$$$$EXECUTION:
$$TIME TO MODIFY YOUR DATA, FELLA.....

DO YOU WISH TO MODIFY THE DEFAULT VALUES?
 (YES = 1; NO = 2)
>1

HOW MANY PERIODS IS THE ANNUAL PERFORMANCE
CHARACTERIZED BY?
>2

DO YOU WISH TO MODIFY PROJECT TIMING, FUEL USE OR
REGULATORY INFORMATION?  (YES = 1; NO = 2)
>2

DO YOU WISH TO MODIFY CAPITAL COST, STRUCTURE OR
TAX INFORMATION?  (YES = 1; NO = 2)
>2

DO YOU WISH TO MODIFY THE PERFORMANCE DATA?
 (YES = 1; NO = 2)
>1

PROVIDE THE FIRST YEAR O&M EXPENDITURES (BASE YEAR $):
>1822300.0

PROVIDE THE CAPACITY (KW) FOR WHICH CAPACITY CREDITS
ARE AVAILABLE ON AN ANNUAL BASIS:
>55200.0

PROVIDE THE GENERAL AND ADMINISTRATIVE COSTS
(FRACTION OF O&M):
>0.0

WHAT IS THE DISPACH MODE? (THERMAL MATCH = 1;
ECONOMIC DISPATCH = 2)
>1

PROVIDE THE TYPE OF ELECTRICITY SALES ARRANGEMENT
(SIMULTANEOUS BUY/SELL = 1; SELL EXCESS, BUY SHORTAGE
= 2):
>1

PROVIDE THE TYPE OF COGENERATION TECHNOLOGY:
1 = NO COGENERATION; 2 =LP STEAM ELECTRIC; 3 = MP
STEAM ELECTRIC; 4 = MP STEAM ELECTRIC (AFB);
5 = COMBINED CYCLE COAL GASIFICATION; 6 = FUEL CELL;
7 = GAS TURBINE; 8 = COMBINED CYCLE; 9 = DIESEL HEAT
PUMP
>5
```

```
PROVIDE THE GROSS POWER FROM COGENERATION UNIT
BY PERIOD (IN KW):
>55200.0,55200.0

PROVIDE THE AUXILIARY POWER REQUIREMENTS FOR
COGENERATION UNIT BY PERIOD (IN KW):
>0.0,0.0

PROVIDE THE PROCESS POWER REQUIREMENTS FOR
COGENERATION UNIT BY PERIOD (IN KW):
>0.0,0.0

PROVIDE THE PEAK-TO-AVERAGE RATIO FOR PROCESS
POWER BY PERIOD (FRACTION):
>1.0,1.0

PROVIDE FUEL(S) USAGE BY PERIOD (MILLION BTU/HOUR):
FOR 3 FUELS:
>589.4,589.4

>0.0,0.0

>0.0,0.0

PROVIDE THE NUMBER OF HOURS IN EACH PERIOD:
>4380.0,4380.0

PROVIDE THE PROCESS PRESSURE REQUIREMENTS (PSI)
FOR 3 STREAMS:
>200.0,220.0,240.0

PROVIDE THE PROCESS THERMAL REQUIREMENTS (MILLION
BTU/HOUR) FROM 3 STREAMS:
>173.80,0.0,0.0

PROVIDE THE PURPA AVOIDED ENERGY COST FOR EACH
PERIOD (BASE YEAR CENTS/KW-HR):
>4.70,4.70

PROVIDE THE CONSTANT ANNUAL ESCALATION RATE FOR THE
PURPA AVOIDED ENERGY COST (FRACTION):
>0.10

IS THERE ANY ADJUSTMENT THROUGH MULTIPLIERS?
(YES = 1; NO = 2)
>2

PROVIDE THE PURPA CAPACITY COST FOR EACH
PERIOD ($/KW/PERIOD):
>0.0,0.0

PROVIDE THE CONSTANT ANNUAL ESCALATION RATE FOR THE
PURPA CAPACITY PRICE (FRACTION):
>0.0
```

```
IS THERE ANY ADJUSTMENT THROUGH MULTIPLIERS?
(YES = 1; NO = 2)
>2

PROVIDE THE INDUSTRIAL ENERGY CHARGE FOR EACH
PERIOD (CENTS/KW-HR):
>2.401,2.401

PROVIDE THE CONSTANT ANNUAL ESCALATION RATE FOR THE
INDUSTRIAL ENERGY CHARGE (FRACTION):
>0.10

IS THERE ANY ADJUSTMENT THROUGH MULTIPLIERS?
(YES = 1; NO = 2)
>2

PROVIDE THE INDUSTRIAL CAPACITY CHARGE FOR
EACH PERIOD ($/KW/PERIOD):
>36.55,36.55

PROVIDE THE CONSTANT ANNUAL ESCALATION RATE FOR THE
INDUSTRIAL CAPACITY CHARGE (FRACTION):
>0.0

IS THERE ANY ADJUSTMENT THROUGH MULTIPLIERS?
(YES = 1; NO = 2)
>2

PROVIDE FUEL PRICES (BASE YEAR $/MILLION BTU)
FOR 3 FUELS:
>4.082,0.0,0.0

PROVIDE CONSTANT ANNUAL ESCALATION RATES FOR
3 FUELS (FRACTIONS):
>0.087,0.0,0.0

IS THERE ANY ADJUSTMENT THROUGH MULTIPLIERS?
(YES = 1; NO = 2)
>2

PROVIDE THE STEAM PRICE AT MINIMUM STEAM PRESSURE
(BASE YEAR $/MBTU):
>5.98

PROVIDE THE MINIMUM STEAM PRESSURE (PSI):
>100.0

PROVIDE THE STEAM PRICE AT MAXIMUM STEAM PRESSURE
(BASE YEAR $/MBTU):
>6.02
```

```
PROVIDE THE MAXIMUM STEAM PRESSURE (PSI):
>300.0

PROVIDE THE CONSTANT ANNUAL ESCALATION RATE FOR
STEAM (FRACTION):
>0.0

IS THERE ANY ADJUSTMENT THROUGH MULTIPLIERS?
(YES = 1; NO = 2)
>2

PROVIDE THE DESIRED FREQUENCY OF CASH FLOW DISPLAY:
(FOR 10 YEAR PROJECTS, MINIMUM = 3;
 FOR 20 YEAR PROJECTS, MINIMUM = 5)
>3

WOULD YOU LIKE ABRIDGED OUTPUT?' (1,2,2,2,2=ALL REPORTS;
2,1,2,2,2=ONLY REPORT 5;' 2,2,1,2,2=ONLY B. OF REPORT 5)
>2,2,1,2,2

$
```

B. CASH FLOW STATEMENT

****
THIRD PARTY
****

DEPRECIATION AND TAX CREDITS

(THOUSANDS OF DOLLARS)

	BASIS (A)	PROPERTY STATUS (B)	DEPRECIATION METHOD (C)	FIRST YEAR DEPRECIATION	INVESTMENT TAX CREDIT (D)	ENERGY TAX CREDIT (D)
FUEL HANDLING EQUIPMENT	1473.41	NPP	1	265.21	155.10	0.00
BOILER	387.74	NPP	1	69.79	0.00	0.00
POLLUTION CONTROL EQUIPMENT	0.00	NPP	1	0.00	0.00	0.00
TURBINE GENERATORS	32230.79	NPP	1	5801.54	3392.72	0.00
HEAT DISTRIBUTION EQUIPMENT	0.00	NPP	1	0.00	0.00	0.00
SPECIALIZED BLDGS & STRUCTURES	2762.64	NPP	1	497.27	290.80	0.00
GENERAL PURPOSE BLDGS	0.00	NPP	1	0.00	0.00	0.00
LAND	0.00	NPP	4	0.00	0.00	0.00
	36854.57			6633.82	3838.61	0.00

(A) FOR DEPRECIATION;OPTION TO CAPITALIZE IDC
(B) NPP: NON PUBLIC-UTILITY PROPERTY; PP: PUBLIC UTILITY PROPERTY
(C) 1: 5 YR ACRS; 2: 10 YR ACRS; 3: 15 YRACRS; 4: NON-DEPRECIABLE; 5: ST. LINE
(D) TAX CREDITS ACCRUE IN FIRST YEAR OF OPERATION UNLESS CONSTR. PERIOD > 2 YRS

CASH FLOWS DURING CONSTRUCTION FOR THIRD PARTY

(END-OF-YEAR FLOWS IN THOUSANDS OF DOLLARS)

	1982	1983	1984
TAX BENEFITS ON S/T INTEREST PAYMENTS:	0.00	0.00	0.00
LONG TERM PROJECT OUTLAYS:	0.00	0.00	27529.45
INVESTMENT TAX CREDITS DURING CONSTRUCTION:	767.72	1535.45	1535.45
ENERGY TAX CREDITS DURING CONSTRUCTION:	0.00	0.00	0.00
NET AFTER TAX CASH FLOWS:	767.72	1535.45	-25994.00

CASH FLOWS FROM OPERATIONS FOR THIRD PARTY

(END-OF-YEAR FLOWS IN THOUSANDS OF DOLLARS)

	1985	1988	1991	1994
ELECTRIC OPERATIONS:				
ELECTRICITY SALES:	36601.81	48716.87	64841.97	86304.44
ELECTRICITY SAVED:	0.00	0.00	0.00	0.00
EXTRA BACK-UP COSTS:	0.00	0.00	0.00	0.00
AUXILIARY COSTS:	0.00	0.00	0.00	0.00
NET ELECTRIC REVENUES:	36601.81	48716.87	64841.97	86304.44
STEAM OPERATIONS:				
NET STEAM REVENUES:	9134.92	9134.92	9134.92	9134.92
OPERATING COSTS:				
FUEL COSTS:	31984.06	41079.16	52760.57	67763.75
OPERATION & MAINTENANCE:	2934.82	3906.23	5199.18	6920.09
OPERATING INCOME:	10817.85	12866.40	16017.11	20755.44
GENERAL & ADMINISTRATIVE:	0.00	0.00	0.00	0.00
LOCAL TAXES & INSURANCE:	81.23	102.32	128.90	162.37
DEPRECIATION:	6633.82	5896.73	0.00	0.00
INTEREST PAYMENTS:	2035.24	1020.00	0.00	0.00
NET TAXABLE INCOME:	2067.56	5847.34	15888.21	20593.06
FEDERAL TAX:	1033.78	2923.67	7944.11	10296.53
NET INCOME AFTER TAX:	1033.78	2923.67	7944.11	10296.53
PRINCIPAL PAID(-):	1568.63	2583.86	0.00	0.00
DEPRECIATION (+):	6633.82	5896.73	0.00	0.00
INVESTMENT TAX CREDITS:	0.00			
ENERGY TAX CREDITS:	0.00			
AFTER-TAX CASH FLOW:	6098.97	6236.53	7944.11	10296.53

FINANCIAL ANALYSIS BASED ON TOTAL INVESTMENT

ALL DOLLARS IN 1984 (END-OF-YEAR) TERMS:

NET PRESENT VALUE (THOUSANDS OF DOLLARS)	7027.63
RATE OF RETURN	0.285
PAYBACK (YEARS)	3.25
FIRST YEAR DEBT COVERAGE RATIO	3.41

APPENDIX A

LISTING OF DATA FILES

Table A-1

FILENAME: DAT

```
Line #

00001:    3,10,1980,1985
00002:    2,1,2
00003:    2,2,1,2
00004:    3
00005:    2
00006:    24825.14,0.1
00007:    0.00,0.00,0.00,20700.0,5635.0,3105.0,0.00,3450.0
00008:    0.04,0.01,0.00,0.875,0.00,0.075,0.00,0.00
00009:    0.2,0.4,0.4
00010:    0.14,0.29,0.181,1
00011:    2
00012:    5.,0.,0.,0.,0.,0.,0.,0.
00013:    0.0,0.0,1.0
00014:    0.0,0.0,1.0
00015:    0.0,0.0,1.0
00016:    0.0,0.0,1.0
00017:    0.0015,0.0015,0.0015
00018:    0.50,0.50,0.50
00019:    1
00020:    0.1,0.1,0.1,0.1,0.1,0.1,0.0,0.0
00021:    0.1,0.1,0.1,0.1,0.1,0.1,0.0,0.0
00022:    0.1,0.1,0.1,0.0,0.0,0.1,0.0,0.0
00023:    0.1,0.1,0.1,0.1,0.0,0.1,0.0,0.0
00024:    1,2
00025:    4
00026:    1
00027:    1,1,1,1,1,1,1,4
00028:    3,3,3,3,3,3,3,4
00029:    2,2,2,2,2,2,3,4
00030:    5,5,5,5,5,5,5,4
```

Table A-1

FILENAME: DAT

(Continued)

```
Line #

00031:    0.15,0.08,0.05,0.00, 0.22,0.14,0.10,0.00, 0.21,0.12,0.09,0.00,
00032:    0.21,0.10,0.08,0.00, 0.21,0.10,0.07,0.00, 0.00,0.10,0.07,0.00,
00033:    0.00,0.09,0.06,0.00, 0.00,0.09,0.06,0.00, 0.00,0.09,0.06,0.00,
00034:    0.00,0.09,0.06,0.00, 0.00,0.00,0.06,0.00, 0.00,0.00,0.06,0.00,
00035:    0.00,0.00,0.06,0.00, 0.00,0.00,0.06,0.00, 0.00,0.00,0.06,0.00,
00036:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00,
00037:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00,
00038:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00,
00039:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00,
00040:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00
00041:    0.20,0.10,0.07,0.00, 0.32,0.18,0.12,0.00, 0.24,0.16,0.12,0.00,
00042:    0.16,0.14,0.11,0.00, 0.08,0.12,0.10,0.00, 0.00,0.10,0.09,0.00,
00043:    0.00,0.08,0.08,0.00, 0.00,0.06,0.07,0.00, 0.00 0.04,0.06,0.00,
00044:    0.00,0.02,0.05,0.00, 0.00,0.00,0.04,0.00, 0.00,0.00,0.03,0.00,
00045:    0.00,0.00,0.03,0.00, 0.00,0.00,0.02,0.00, 0.00,0.00,0.01,0.00,
00046:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00,
00047:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00,
00048:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00,
00049:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00,
00050:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00
00051:    0.18,0.09,0.06,0.00, 0.33,0.19,0.12,0.00, 0.25,0.16,0.12,0.00,
00052:    0.16,0.14,0.11,0.00, 0.08,0.12,0.10,0.00, 0.00,0.10,0.09,0.00,
00053:    0.00,0.08,0.08,0.00, 0.00,0.06,0.07,0.00, 0.00,0.04,0.06,0.00,
00054:    0.00,0.02,0.05,0.00, 0.00,0.00,0.04,0.00, 0.00,0.00,0.04,0.00,
00055:    0.00,0.00,0.03,0.00, 0.00,0.00,0.02,0.00, 0.00,0.00,0.01,0.00,
00056:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00,
00057:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00,
00058:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00,
00059:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00,
00060:    0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00, 0.00,0.00,0.00,0.00
00061:    1,0.125
00062:    1,2,2,2,2,1,1,1,1,1,1,3
```

Table A-2

FILENAME: ECO

Line #

```
4.,8.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,
3.,7.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.                                      ,
0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,
0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.                                      ,
0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,
0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.                                      ,
3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,
3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.,3.                                      ,
4.700,5.53,4.93,5.53,4.93,5.85,5.53,4.93,5.85,5.53,4.93,5.53             ,
4.93,5.85,5.53,4.93,6.08,5.85                                            ,
5.05,5.85,5.05,6.08,5.85,5.05                                            ,
6.08,5.85,5.05,5.85,5.05,6.08,5.85,5.05,0.,0.,0.,0.                      ,
168.,504.,336.,240.,48.,144.,96.,204.,612.,408.,350.,250.                ,
52.,156.,104.,312.,416.,520.,378.,270.,78.,104.,130.,312.                ,
416.,520.,378.,270.,78.,104.,130.,312.,0.,0.,0.,0.                       ,
00.,0.,0.,0.,0.,0.,0.,0.,12.,0.,0.,0.                                    ,
0.,0.,0.,0.,24.,0.,0.,0.,0.,0.,0.,0.                                     ,
20.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.                                     ,
2.401,4.71,4.42,4.71,4.42,4.97,4.71,4.42,4.97,4.71,4.42,4.71             ,
4.42,4.97,4.71,4.42,4.97,4.71,4.42,4.71,4.42,4.97,4.71,4.42              ,
4.97,4.71,4.42,4.71,4.42,4.97,4.71,4.42,0.,0.,0.,0.                      ,
73.1,0.5,0.,0.5,0.,2.99,0.5,0.,2.99,0.5,0.,0.5                           ,
0.,2.99,0.5,0.,4.34,0.5,0.,0.5,0.,4.34,0.5,0.                            ,
4.34,0.5,0.,0.5,0.,4.34,0.5,0.,0.,0.,0.,0.                               ,
4.700,5.53,4.93,5.53,4.93,5.85,5.53,4.93,5.85,5.53,4.93,5.53             ,
4.93,5.85,5.53,4.93,6.08,5.85,5.05,5.85,5.05,6.08,5.85,5.05              ,
6.08,5.85,5.05,5.85,5.05,6.08,5.85,5.05,0.,0.,0.,0.                      ,
0.0,0.,0.,0.,0.,0.,0.,0.,12.,0.,0.,0.                                    ,
0.,0.,0.,0.,24.,0.,0.,0.,0.,0.,0.,0.                                     ,
20.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.                                     ,
1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,
1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.
100.0,300.0                                                              ,
5.96,6.02
2.401,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,
```

Table A-2

FILENAME: ECO

(Continued)

```
Line #

00036:    5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.,5.                                     ,
00037:    73.1,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0. ,
00038:    0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.
00039:    13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,
00040:    13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,13.,
00041:    10.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,
00042:    20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,20.,
00043:    15.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,
00044:    30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.,30.
00045:    0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.-0.,0.,0.,0.,0.,
00046:    0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.                                        ,
00047:    0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,
00048:    0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.                                        ,
00049:    0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,
00050:    0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.
00051:    4.082,0.,0.
00052:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.000,1.                                  ,
00053:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.000,1.                                  ,
00054:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.000,1.                                  ,
00055:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.000,1.                                  ,
00056:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.000,1.                                  ,
00057:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                     ,
00058:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                     ,
00059:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                     ,
00060:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                     ,
00061:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                     ,
00062:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                     ,
00063:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                     ,
00064:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                     ,
00065:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                     ,
00066:    1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                     ,
00067:    1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                 ,
00068:    1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                 ,
00069:    1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                 ,
00070:    1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                 ,
00071:    1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                 ,
00072:    1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                 ,
00073:    1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                 ,
00074:    1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                 ,
00075:    1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                 ,
00076:    1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.
00077:    0.10,0.0,0.10,0.0,0.10,0.0,0.0,0.087,0.0,0.0,0.10,0.08
00078:    1,1,1,1,1,1
00079:    1
00080:    2.401,5.53,4.93,5.53,4.93,5.85,5.53,4.93,5.85,5.53,4.93,5.53               ,
00081:    4.93,5.85,5.53,4.93,6.08,5.85,5.05,5.85,5.05,6.08,5.85,5.05                ,
00082:    6.08,5.85,5.05,5.85,5.05,6.08,5.85,5.05,0.,0.,0.,0.                        ,
00083:    73.1,0.,0.,0.,0.,0.,0.,0.,12.,0.,0.,0.                                     ,
00084:    0.,0.,0.,0.,24.,0.,0.,0.,0.,0.,0.,0.                                       ,
00085:    20.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.                                       ,
00086:    100.0,300.0                                                                ,
```

Table A-2

FILENAME: ECO

(Continued)

```
Line #


00087:     5.98,6.02
00088:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00089:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00090:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00091:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00092:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00093:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00094:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00095:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00096:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00097:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00098:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00099:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00100:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00101:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00102:     1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                                ,
00103:     1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                            ,
00104:     1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                            ,
00105:     1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                            ,
00106:     1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                            ,
00107:     1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                            ,
00108:     1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                            ,
00109:     1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                            ,
00110:     1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                            ,
00111:     1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.                            ,
00112:     1.0000,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.,1.
00113:     0.10,0.00,0.10,0.00,0.00,0.0,0.0,0.0,0.0,0.0,0.0,0.0
00114:     1,1,1,1
00115:     0.12,0.12,0.12
00116:     0.16,0.16,0.20
00117:     0.12,0.12,0.12
00118:     0.16,0.16,0.20
00119:     0.12,0.12,0.12
00120:     0.16,0.16,0.20
00121:     0.5,0.3,0.1
00122:     0.02,0.06,0.00,-0.03
00123:     0.20,0.19,0.18,0.17,0.16,0.14,0.14,0.14,0.14,0.14
00124:     0.12,0.12,0.12,0.12,0.12,0.08,0.08,0.08,0.08,0.08
00125:     0.08,0.08,0.08,0.08,0.08,0.08,0.08,0.08,0.08,0.08
00126:     2,2,2
```

Table A-3

FILENAME: ENG

```
Line #

00001:     200.,220.,240.
00002:     173.80,0.,0.
00003:     300.,300.,300.,300.,300.,300.,300.,300.,300.,300.,300.,300.,300.,300.,
00004:     300.,300.,300.,300.,300.,300.,300.,300.,300.,300.,300.,300.,300.,300.,
00005:     300.,300.,300.,300.,300.,300.,300.,300.
00006:     15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,
00007:     15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.,15.
00008:     100.,100.,100.,100.,100.,100.,100.,100.,100.,100.,100.,100.,100.,100.,
00009:     100.,100.,100.,100.,100.,100.,100.,100.,100.,100.,100.,100.,100.,100.,
00010:     100.,100.,100.,100.,100.,100.,100.,100.
00011:     250.,10.,0.
00012:     250.,10.,0.
00013:     250.,10.,0.
00014:     250.,10.,0.
00015:     250.,10.,0.
00016:     250.,10.,0.
00017:     250.,10.,0.
00018:     250.,10.,0.
00019:     250.,10.,0.
00020:     250.,10.,0.
00021:     250.,10.,0.
00022:     250.,10.,0.
00023:     250.,10.,0.
00024:     250.,10.,0.
00025:     250.,10.,0.
00026:     250.,10.,0.
00027:     250.,10.,0.
00028:     250.,10.,0.
00029:     250.,10.,0.
00030:     250.,10.,0.
00031:     250.,10.,0.
00032:     250.,10.,0.
00033:     250.,10.,0.
00034:     250.,10.,0.
00035:     250.,10.,0.
```

Table A-3

FILENAME: ENG

(Continued)

Line #	
00036:	250.,10.,0.
00037:	250.,10.,0.
00038:	250.,10.,0.
00039:	250.,10.,0.
00040:	250.,10.,0.
00041:	250.,10.,0.
00042:	250.,10.,0.
00043:	250.,10.,0.
00044:	250.,10.,0.
00045:	250.,10.,0.
00046:	250.,10.,0.
00047:	55200.,0.0,0.0
00048:	589.4,0.0,0.0
00049:	55200.
00050:	1822300.
00051:	0.0
00052:	1
00053:	1
00054:	2,2
00055:	5
00056:	1.0,1.0
00057:	8760.,8760.,8760.
00058:	0.0,0.0

Table A-4

FILENAME: BXX

```
00.00,00.00,-89953.83,29735.66,9236.99,11241.21,13467.89,
12112.90,8974.77,10438.52,12057.95,13848.45,15826.79,18011.43,
20422.39,23081.59,26012.86,29242.38,32798.52,36712.20,41016.98,
45749.68,50950.06,0.00,0.00,0.00,0.00,0.00,0.00,0.0,0.00,0.00,0.00,
0.00,0.00,10000.00
```

APPENDIX B

KEY NCSS COMMANDS

EDIT COMMANDS

@ (CHARACTER DELETE)

[OR ¢ (LINE DELETE)

A. CREATING A FILE

(1) KEYBOARD COMMAND

```
EDIT FILENAME FILETYPE(CR)
```

(2) SYSTEM RESPONSE

```
NEWFILE
INPUT:
>
  .
  .
  .
 TYPE NEW LINES
  .
  .
  .
>(CR)
EDIT
>FILE
```

B. <u>FILE MODIFICATION</u>

1. EDIT FILENAME FILETYPE(CR)

2. EDIT

   >

a).	PRINT 5 LINES:	P 5(CR)
b).	PRINT ALL LINES:	P *(CR)
c).	DOWN 2 LINES:	D 2(CR)
d).	UP 2 LINES:	U 2(CR)
e).	DELETE LINE:	DELETE(CR)
f).	INSERT (AFTER):	INSERT bb <u>STRING</u>(CR)
g).	CHANGE:	Cb/STRING1/STRING2/(CR)
h).	REPLACE:	REPLACE bb <u>STRING</u>(CR)
i).	LOCATE:	Lb/STRING/(CR)
j).	QUIT:	> QUIT(CR)
k).	SAVE FILE:	> FILE(CR)

C. <u>DELETE FILE</u>

ERASE FILENAME FILETYPE

APPENDIX C

GLOSSARY

ACRS - Accelerated Cost Recovery System. This refers to the depreciation rules established in 1981.

Avoided Cost - This phrase is used to describe the rate paid by a utility to buy power from a cogenerator under the provisions of the Public Utility Regulatory Policies Act (PURPA).

Buyback Rate - In this report, "avoided cost" and "buyback rate" are used interchangeably.

Buy-Shortage Sell-Excess - An operating arrangement for a cogeneration plant. Under the arrangement, all the electricity from the plant is used on-site if process demand exceeds system output; if system output falls short of process demand, power is bought from the utility.

Corporate Contributions - This phrase refers to corporate capital that flows into the project. Corporate capital could be made up of "corporate debt" and "corporate equity". However, "corporate debt" must be distinguished from "project debt", the latter being a project-related obligation.

Dispatch - This refers to the manner in which the cogeneration system is operated.

Economic Dispatch - Under this dispatch arrangement, the cogeneration system is operated so as to meet an economic criterion such as minimize total cost.

ERTA - Economic Recovery Tax Act (passed in 1981).

Operating Cash Flows - The cash flow generated during a period of system operation. In this model, operating cash flows are computed for each year of operation.

Performance - This work refers to the physical inputs and outputs from the cogeneration system, e.g., fuel input, power output, thermal output, etc.

Project Debt - This is used to refer to debt that is made available for the project in question. In general, such debt is not secured by revenues from non-project sources.

Project Participant - Any individual/corporation/entity that has an interest in the project. Also referred to as "party". In this model, the impact on three different parties can be evaluated: utility; industry; and third party.

PURPA Period - The year is divided into "periods" of identical characteristics. That is, for all the hours in a single period, identical conditions prevail. Since utility avoided costs under PURPA are established by period, it is referred to as the "PURPA period."

Simultaneous Buy-Sell - An operating arrangement for a cogeneration plant. Under the arrangement, all the electricity from the plant is sold to the utility; all requirements for process power are bought from the utility.

TEFRA - Tax Equity and Fiscal Responsibility Act (passed in 1982).

Thermal Dispatch - Under this dispatch arrangement, the cogeneration system is operated so as to always provide the required thermal energy.

C. ADDITIONAL IMPACTS

IMPACT ON UTILITY

(END-OF-YEAR FLOWS IN THOUSANDS OF DOLLARS)

	1985	1988	1991	1994
COST OF POWER PURCHASED UNDER PURPA:	36601.81	48716.87	64841.97	86304.44
COST OF DISPLACED POWER:	0.00	0.00	0.00	0.00
COST OF SERVING AUXILIARIES:	0.00	0.00	0.00	0.00
SAVINGS FROM AVOIDED GENERATION COSTS:				
DUE TO PURCHASED POWER:	36601.81	48716.87	64841.97	86304.44
DUE TO DISPLACED POWER:	0.00	0.00	0.00	0.00
REVENUES FROM AUXILIARIES:	0.00	0.00	0.00	0.00
REVENUES FROM DIFFERENTIAL BACK-UP RATES:	0.00	0.00	0.00	0.00
NET UTILITY COST:	0.00	0.00	0.00	0.00

IMPACT ON INDUSTRY

(END-OF-YEAR FLOWS IN THOUSANDS OF DOLLARS)

	1985	1988	1991	1994
SAVINGS FROM AVOIDED STEAM GENERATION:	9134.92	9134.92	9134.92	9134.92
COST OF PURCHASED STEAM:	9134.92	9134.92	9134.92	9134.92
NET INDUSTRY BENEFIT:	0.00	0.00	0.00	0.00