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Operating Experience with Leap from the Perspective of the Computing Applications Analyst

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Special

OPERATING EXPERIENCE WITH LEAP FROM THE PERSPECTIVE OF THE COMPUTING APPLICATIONS ANALYST

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C. C. Webster of the ORNL staff executed the programs to produce the microfiche listing of the LEAP source program and the LEAP subroutine flowcharts. L. M. Petrie provided the undocumented program used to produce the flowcharts.

D. Brogan, DOE/ORO Telecommunication Management Specialist, made the arrangements for the ORNL-FCF computing link.

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ABSTRACT

In conjunction with the Energy Information Administration's interest in forecasting the long-range impact of new technologies, the Long-Term Energy Analysis Program (LEAP), which was used for the energy price-quantity projections in the 1978 Annual Report to Congress (ARC '78), was used in an ORNL research program to develop and demonstrate a procedure for evaluating energy-economic modeling computer codes and the important results derived therefrom. The LEAP system used in the ORNL research, the mechanics of executing LEAP, and the personnel skills required to execute the system are described. In addition, a LEAP sample problem, subroutine hierarchical flowcharts, and input tables for the ARC '78 energy-economic model are included. Results of a study to test the capability of the LEAP system used in the ORNL research to reproduce the ARC '78 results credited to LEAP are presented. This document is one report in a series of reports which describe the ORNL LEAP-related research program.

OPERATING EXPERIENCE WITH LEAP FROM THE PERSPECTIVE
OF THE COMPUTING APPLICATIONS ANALYST

I. INTRODUCTION

The Office of Energy Information Validation (OEIV) of the Energy Information Administration (EIA), U. S. Department of Energy (DOE), is sponsoring a research program at Oak Ridge National Laboratory (ORNL) to develop and demonstrate a procedure for evaluating energy-economic models (i.e., modeling computer codes) and the important results derived from these models.[a] Such models and associated results provide useful information to decision makers about the potential impact of existing and proposed energy policies and research and development programs on the long-term supply of energy.

As part of the ORNL research program, Weisbin et al. have developed a set of guidelines for evaluating energy-economy models.[1] The eight essential elements of the ORNL approach to model evaluation are as follows:

- Identify the model users and the results these users require of the model.
- Review and develop documentation associated with the use of the model.
- Document the evaluator's own experience in actual operation of the model.
- Analyze and report on the rationale and suitability of the model specification.

[a]The research program is sometimes referred to as the ORNL Model Evaluation Program (MEP).

- Verify that the computer model runs as intended.
- Conduct a comprehensive sensitivity analysis.
- Assess the model input data.
- Conduct and document an overall model performance evaluation.

In conjunction with EIA's interest in forecasting the long-range impact of new technologies and energy research and development on future energy use, the version of the energy-economy modeling code LEAP,[2] and the generalized equilibrium model which were used by EIA for long-term energy price-quantity projections in the DOE EIA 1978 Annual Report to Congress (ARC '78)[3] were chosen as the initial focus for the ORNL research.

In support of the comprehensive ORNL model evaluation research program, a computing applications staff has been formed; a computing link has been established between ORNL and the DOE EIA Washington, D.C., computing facilities; and ORNL computing applications analysts have acquired extensive "hands-on" experience with LEAP. Thus, the purpose of this report is twofold: (1) to document the MEP computing procedures, and (2) to document the third element of the ORNL approach to the evaluation of LEAP, viz., document the evaluator's (ORNL's) experience in actual operation of the ARC '78 LEAP model from the perspective of the computing applications analyst.

In order to achieve the purpose of this report, it is necessary to provide a thumbnail sketch of the development of the LEAP code (given in Subsection A) and the LEAP-related energy-economic models which are used at ORNL (Subsections B and C). Progress made at ORNL, from January through October 1979, toward development and demonstration of a methodology for evaluating energy-economic modeling codes and important results derived from these codes was described in an interim report - Ref. 4. Other ORNL documents pertaining to the evaluation of ARC '78 LEAP are identified in Subsection D.

Tasks involved with documenting the evaluator's "hands-on" experience with a model include examining the following:[1]

- Model access.
- Precise model specification.
- Experience in obtaining solutions and replicating results.
- Facts about the cost of executing the model, computer requirements, model running time, and learning investment.
- Model transportability.
- Model maintenance.
- Development of sample problems.

The tasks as related to the evaluation of LEAP are documented in Chapters II through V below. Specifically, the LEAP system used in the ORNL research, the mechanics of executing LEAP, and the personnel skills required to execute the system are described in Chapter II. The version of the code and the energy-economy model being studied are discussed in Chapter III. A LEAP sample problem is described in Chapter IV. The experience of the ORNL staff in using "the" evaluation version of the LEAP system and energy-economy model to replicate long-term energy price-quality projections in ARC '78 is described in Chapter V. Conclusions from the perspective of the computing applications analyst relating to the evaluation of LEAP are summarized in Chapter VI. LEAP subroutine flowcharts are included in Appendix A and input tables for the ARC '78 energy-economy model are included in Appendix B.

A. DEVELOPMENT OF LEAP

The Stanford Research Institute (SRI) National Energy Model[5] was the starting point for the ultimate development of the Long-Term Energy Analysis Program (LEAP). The SRI model was originally developed by the Stanford Corporation to analyze Gulf Oil Corporation's proposed investments in alternative synthetic fuels facilities. Cazalet[6] has described the SRI model in detail, indicating 1973 as the date of original development. Cazalet[7] recently described the use of results from the SRI model in an analysis of President Ford's proposed synthetic fuels program by an interagency Synthetic Fuels Task Force. The data base was shared with an ongoing study sponsored by the Council on Environmental Quality.[8] The SRI National Energy Model was also used to produce a documented set of fuel and energy price forecasts for Electric Power Research Institute (EPRI).[9] Work has continued on the SRI model at Decision Focus, Inc. (DFI).

In 1978, DFI delivered a working version of an Energy-Economy Modeling System (EEMS) to the EIA's Office of Applied Analysis (OAA). An initial demonstration model of the energy portions of the U. S. economy was given as an example in DFI's document which described their energy-economy modeling system (Ref. 10). The document includes plausibility arguments for the equations used in the code which simulate the portions of the economy that are important to the energy flows. The process equations seem similar to those of the SRI National Energy Model, but the software framework may differ greatly because of DFI's efforts to enhance flexibility. Although the demonstration model was often informally referred to as LEAP, one must recognize that the specific demonstration model was formulated before EIA's own modeling efforts using the DFI system. The EEMS delivered to EIA used a commercial data base management system (System 2000).[11]

A group led by John Pearson of the EIA's OAA modified the DFI system in numerous ways. For example, options were added for on-line modification of parameters used in a particular computer run. The EIA LEAP Energy Modeling System (LEAP-EMS) also differs from the DFI EEMS in that some of the specifications within the process subroutines have been modified. These changes have not been generally documented for public distribution by the EIA staff.

Pearson's version of LEAP was used to generate the long-range price quantity projections in the ARC '78. This version of the code is used in the ORNL LEAP-related project.

B. DEVELOPMENT OF MODEL 22C

As described in Ref. 10, a generalized equilibrium model is a mathematical representation of some economic or natural system. It is composed of three basic elements, viz., 1) processes representing functions within such a system, 2) a network representing interactions between processes, and 3) an algorithm for determining numerical values for all the variables in the model. A process is composed of a set of mathematical equations which may be econometric (statistically derived), subjective (judgmentally derived), or a combination of both. Two types of process relations can generally be defined as physical, describing how physical flows interact over time, and behavioral, describing human and behavioral interactions. The network simply defines the links between the processes, representing prices and quantities of energy products. The algorithm solves the model by finding the set of variables which satisfy the relations in the processes and the interrelationships among the processes. Generally, an iterative technique must be used to converge upon a solution since an explicit solution may be impossible due to the complexity of the model.

Model 22C of LEAP was developed by EIA's OAA as a demonstration of the evolving LEAP-EMS system and to provide "in-house" projections of energy flows and prices suitable for inclusion in ARC '78. The chosen input assumptions were to be consistent with concurrent mid-range base case scenario output (from another EIA energy-economy modeling system) which was also to be described in ARC '78. An important advantage of LEAP is its capability to model the changes in patterns of facility construction and energy use expected to be induced by changes in relative price traceable to resource depletion and development of new energy conversion processes. Economic activity is treated as exogenous information and there is no feedback from energy use or cost to the postulated level or pattern of economic activity (except via a "calibration" method).

Model 22C is defined by the Model Input Tables (MITs), which are input to LEAP-EMS by the modeler to determine the model network of energy flows, identify the computer subroutines chosen to represent the various energy-economy activities, and give numerical values for all the input parameters. These tables are accessed from the LEAP data base storage system (DBSS) via the EXECUTIVE program supplied by DFI. (Model 22C MITs are further discussed in Chapter III and are included in Appendix B.)

Figure I-1 illustrates an edited version of the overall sector design of the Model 22C supplied ORNL by OAA.[4,12,13] The model is an energy market forecast model for the United States. The market is represented by ten sectors, viz., residential, industry, distribution, utilities, uranium, coal/synthetics, oil/gas, transportation, commercial, and imports/exports. Lines joining the several sectors represent intersectoral links along which the model estimates energy commodity and payment flows for each of ten time points, viz., 1975, 1980, ..., 2020.

To illustrate the internal design of a sector, the network diagram for the residential sector of Model 22C is shown in Fig. I-2.[4,12,13] numbered rectangular boxes in the figure represent aggregate national energy-related economic activities, and the lines represent the links between the activities along which the model estimates energy commodity and payment flows for time points 1975 through 2020. Links are numbered in accord with the model input and output tables. Each link represents a commodity (usually energy) flow, the corresponding dollar flow, and

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LEAP MODEL 22 INTERSECTORAL LINKS

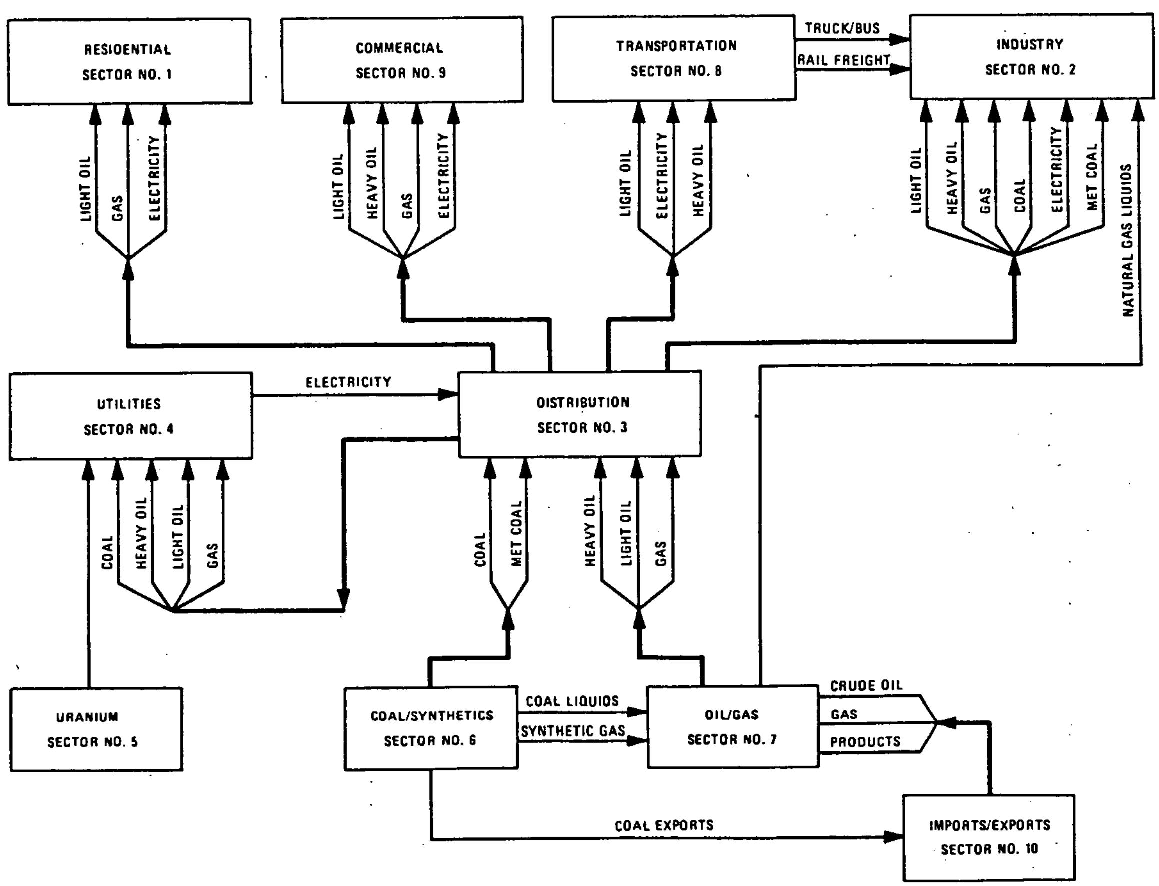

Fig. I-1. Overall Network Diagram for LEAP Model 22C.[4,12,13]

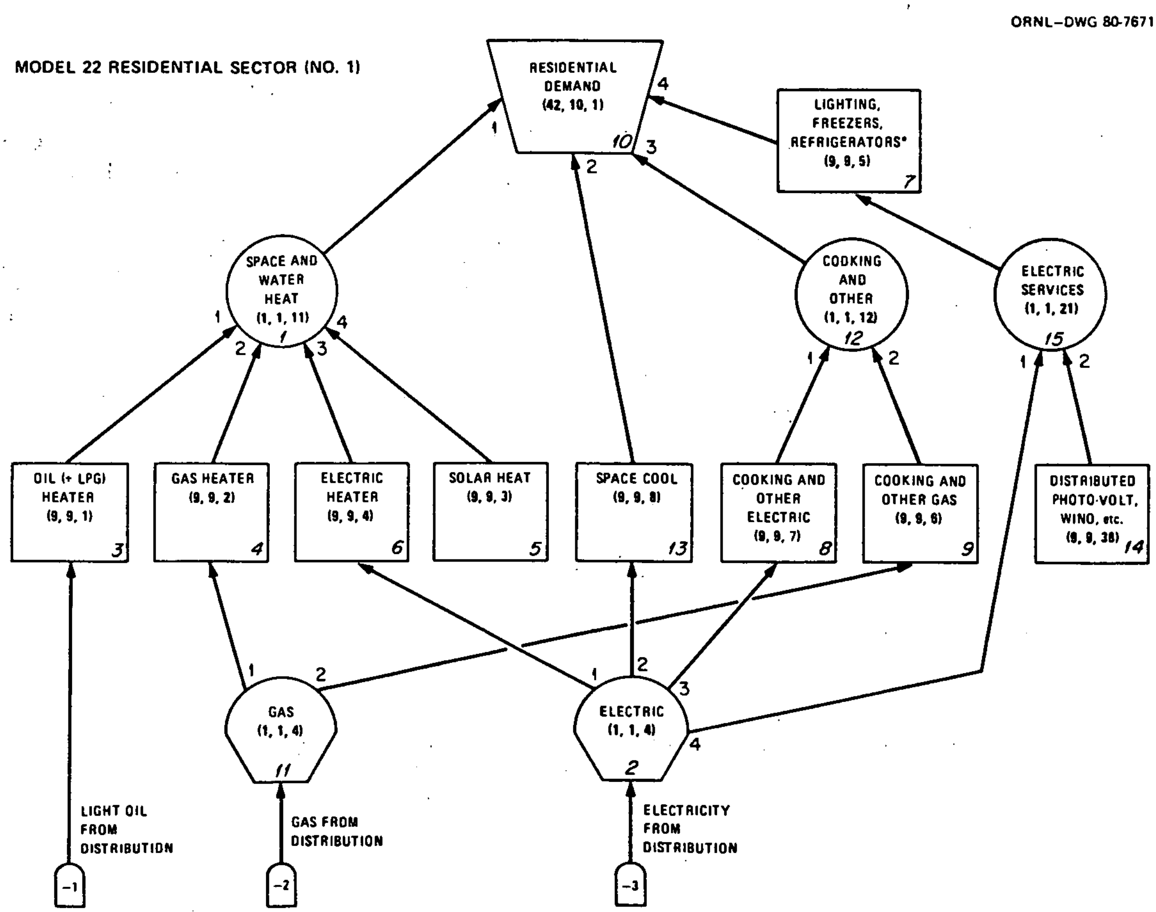

Fig. I-2. Network Diagram for the Residential Sector of LEAP Model 22C.[4,12,13]

the "shadow" dollar flow for each of the time points. The shadow price always corresponds to the free-market "clearing" price, but the transaction price may differ if the market is controlled. (In Model 22C there is no difference between the two prices.) The circles represent the process of allocation of demand among two or more competing suppliers. Detailed diagrams for all Model 22C sectors are given in Ref. 4.

For each resource and energy conversion activity, Model 22C requires the technical and cost data that are needed to estimate, at each model time point, the present discounted value of the stream of future net dollar flows associated with the model energy flows. The real allocation processes require the relative energy flows (market shares) of the various inputs for the initial model year (1975) and the parameters modeling the price- and time-dependent market penetration dynamics for all model time points. The demand activities require for each link the indices of activity (taken as projected GNP), sensitivities of each individual end use demand to these activity indices, and price elasticities. Energy import prices, hydroelectric production and price, and metallurgical coal export quantity and price are required for each time point. Most parameter values are independent of time because of assumption of dollars of fixed value for labor, materials, and cost of capital.

To determine values for all the Model 22C input parameters, OAA used economic data, previous model descriptions of economic behavior, process cost estimates, and the outputs of other models.[3,13] These models included macroeconomic projections, outputs from the EIA Mid-Term Economic Forecasting System for year 1995, and a variety of more informal models. Parameters were not taken directly from the macroeconomic model output, but were determined indirectly from the mid-term models through a process of parameter adjustment to cause Model 22C results to give about the same results through 1995. Although the use of intermodel calibration makes evaluation of Model 22C relatively difficult, the process can be reasonable if (1) the mid-term models include relevant considerations that are not handled by LEAP, and (2) the implied LEAP parameter values are consistent with independent information.

Model 22C was used by the EIA to produce results in Chapter 5 of ARC '78. Consequently, this model was one of the models studied in the ORNL LEAP-related program. As noted above, the mechanics of executing Model 22C from ORNL on the EIA computing facility in Washington, D. C., a Model 22C sample problem, and the OAA Model 22C MITs are described in Chapter II and IV and Appendix B, respectively. The experience of ORNL staff in using "the" evaluation version of LEAP and Model 22C to replicate long-term energy price-quantity projections in ARC '78 is described in Chapter V.

C. DEVELOPMENT OF MODEL 82

The modular structure of LEAP allows construction of very simple generalized equilibrium models which, even though much less complex than Model 22C, still contain the main features of the LEAP system. A simple model is beneficial in understanding LEAP and is essential for developing model validation methodology because it can be executed in a relatively small amount of computing time.

Prior to ORNL's involvement with the LEAP project, Pearson's OAA group had developed a simple LEAP model, Model 88. As a first step in understanding LEAP and LEAP models, the ORNL staff developed a simple two-sector LEAP model, Model 82. Model 88 served as a guide for the development of Model 82. Input to the model was taken from Model 22C MITs.

A block diagram of Model 82 is shown in Fig. I-3. The numbers to the left of the boxes, called node visitation numbers, indicate the order in which nodes are visited by the up-down pass algorithm in LEAP. Each node number corresponds to a series of indices in the LEAP computer code; this series of indices in turn determines the calculations that are done at each node. The arrows that join the various nodes in Fig. I-3 are called links; arrows entering a node from below are called input links to a process, whereas arrows emerging from a process or node are called output links of that node. The mechanics of executing Model 82 and a Model 82 sample problem are described in Chapter II. A detailed description of the model is given in Ref. 4.

D. ACCOMPLISHMENTS OF THE ORNL LEAP-RELATED RESEARCH PROGRAM

Accomplishments of the LEAP-related research program are described in a series of ORNL reports. Subjects of the reports are as follows:

- A set of guidelines was developed for evaluation of energy-economy models; the components of a thorough model evaluation were defined in an operational manner. The ORNL approach to evaluating models was described in Ref. 1.
- A comparison study of LEAP results as given in ARC '78 versus the results given in the 1979 Annual Report to Congress (ARC '78) was performed. Results of the study are documented in Ref. 15.

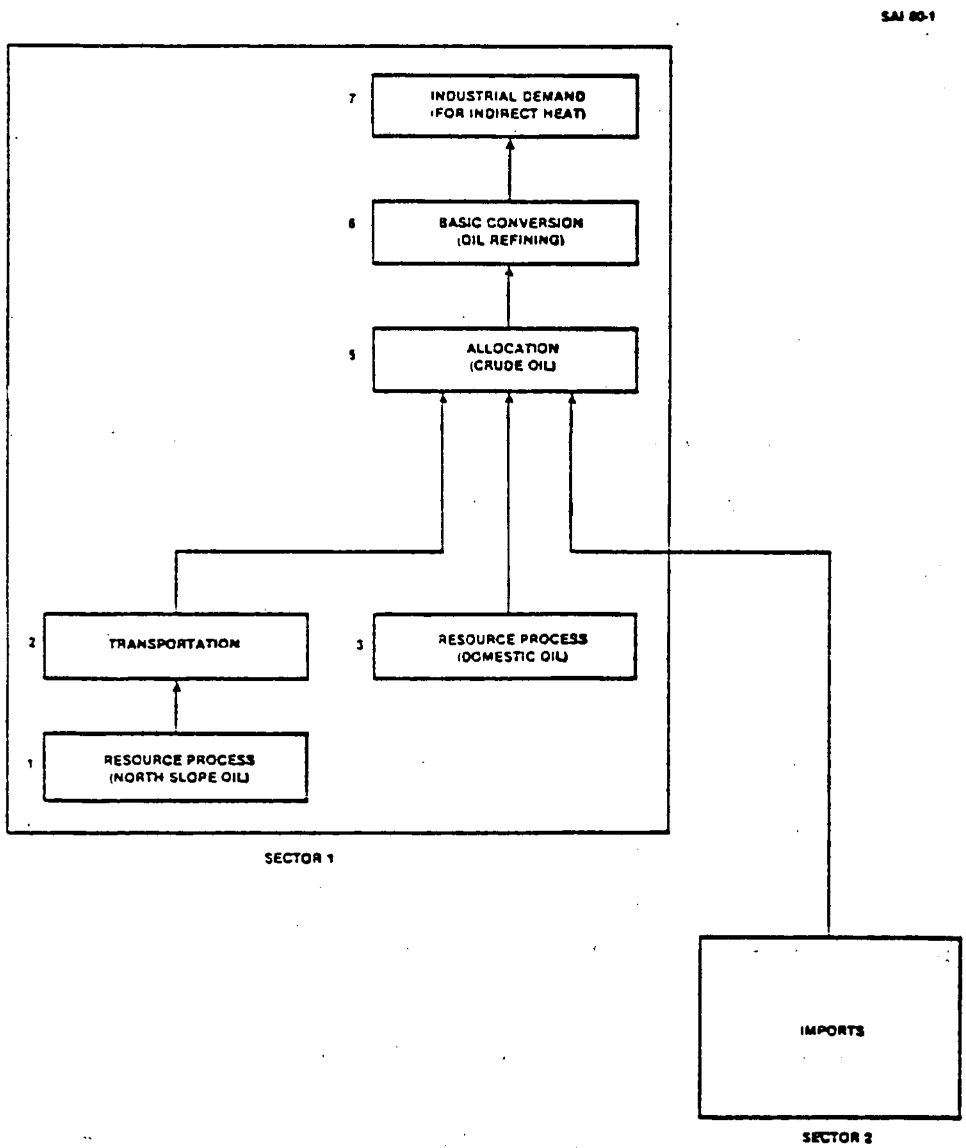

Fig.I-3. Block Diagram of Model 82.

- A detailed analysis of the mathematical structure of the ARC '78 LEAP code was made. Emphasis was placed on identifying the equations which comprise the code and the iterative numerical algorithm used to achieve a converged solution. An ORNL report describing the analysis was published - Ref. 16.

- A study to identify the equilibrium equations of each of the processes contained in the ARC '78 LEAP Model 22C was performed. The equations were specified and the interrelations of the various equations were identified. Results of the study are documented in Ref. 17.

- A detailed analysis of the economic foundations of LEAP Model 22C as used to produce the energy sector forecasts which were incorporated into ARC '78 was made. Objectives of the analysis were to delineate and examine the economic assumptions and behavioral patterns that underline the ARC '78 version of LEAP. An ORNL report describing the analysis was published - Ref. 18.

- An analysis of the screening method for determining objective approximate values for the sensitivity coefficients of the output of a computer code to the input data was made. An estimator proposed to solve such problems was used to investigate one of the outputs of a simplified model of LEAP. An ORNL report describing the analysis was published - Ref. 19.

- Adjoint perturbation theory was used to produce the sensitivities of ARC '78 LEAP Model 22C output parameters to all input parameters. Application of the sensitivity analysis theory and the LEAP-related results were documented in an ORNL report - Ref. 20.

- Data values and assumptions, as well as individual data sources, that were used in ARC '78 LEAP Model 22C, were identified. Data definitions, units, associated model parameters and translations equations for the model input parameters were also identified. This work was documented in an ORNL report - Ref. 21.

II. THE LEAP SYSTEM AS UTILIZED AT ORNL

The LEAP system consists of the LEAP computer code, a data transfer system, a data base storage system, and a data editing and display system. The system resides in the Long-Term Energy Analysis Division (LTEAD) of the Integrative Analysis Group in the Office of Applied Analysis, EIA, DOE. To support the Model Evaluation Project, personnel at ORNL execute LEAP on the EIA's computer facility.

Although the LEAP code and models were still being developed, LTEAD made the LEAP system and the data base for energy-economy Models 22C and 88 available to ORNL on the EIA computer facility in March 1979. The LEAP program and Model 22C were subsequently "frozen" by LTEAD in May 1979. Data sets that comprise the DOE/EIA LEAP system (i.e., the LEAP source deck, the LEAP load module, the data base for the various energy-economy models, etc.) are maintained by LTEAD on on-line disks at the EIA facility. The EIA data sets that have been used by ORNL during the course of the project are identified in Table II-1. Note that comments relating to experience with the various data sets are included in the table.

As noted in Chapter I, the LEAP data base is accessed by the LEAP code via a commercial data base management system—System 2000 (S2K). S2K is leased by DOE/EIA and is provided as a software package on the EIA computer facility. The proprietary nature of the LEAP data base management system is one of the principal detrimental factors affecting transportability of the LEAP system.

A. ORNL-EIA COMPUTING LINK

Through February 1980, Optimum Systems, Inc., operated an EIA computer facility at Rockville, Maryland. The Rockville facility consisted of two IBM 370/168 central processing units connected in multiprocessor mode.[22] Verbal authorization for an ORNL-EIA Rockville Computing Facility link for ORNL model evaluation computing requirements

Table II-1. DOE/EIA Data Sets Used in the ORNL Model Evaluation Project

Data Set	Date Received	Recommended By	Copied from EIA DSNAME	Experience
88[a]	3/10/79	R. Heilbron	CN6424.PRJ.LEAP.MODEL88.STRING.DATA	Would not converge; C. Cornett indicated the model was out of date
88[a]	4/10/79	S. Cohen	CN6132.SC2.CC2.M88.DATA	Would not set up
88[a]	4/16/79	C. Cornett	CN6132.CC2.MODSTR.M88.SUSAN.DATA	Initially would not set up. Title changed from 21 to 24 characters; converged 4/5/79
22C[a]	5/5/79	S. Cohen	Transferred by S. Cohen	Converged 6/11/79
22C[a]	5/24/79	C. Cornett	CN6132.JP3.STRING.DATA	"Frozen" input tables obtained; case converged 6/21/79
LEAP Source	3/10/79 4/11/79	R. Heilbron S. Cohen	CN6424.PRJ.LEAP.FORTRAN CN6132.PRJ.LEAP.FORT	Not complete - subroutines missing; Pearson informed ORNL that source was out of date 4/18/79
	5/7/79	S. Cohen	Transferred by S. Cohen	Source complete, but did not correspond to 4/11/79 load module
	6/7/79	S. Cohen	Transferred by S. Cohen	"Frozen" source and derived load module transferred together
LEAP Load Module	4/11/79	S. Cohen	CN6132.PRJ.LEAP.V2.LOAD	Have been executing from this load module with no problems
	6/7/79	S. Cohen	Transferred by S. Cohen	Transferred to ORNL with LEAP source (it works); source corresponds to load module
S2K Utility Package	3/12/79	S. Cohen		Have used the following functions: LOAD S DELETE LOAD L SHOW UNLOAD RELOAD
LEAP.CLIST	3/10/79	R. Heilbron		Documented in memo from S. Cohen 10/23/78
				Document: Draft of Pearson memo on executing LEAP interactively, 1/24/79
				S. Cohen is working on updating the documentation (first draft received 6/26/79; second draft received 10/26/79)[b]
EXEC.CLIST	3/12/79	S. Cohen		Have been able to make changes to the data base, display tables, etc., interactively and in batch mode

[a]Model string file.

[b]Refers to Ref. 2.

was granted by the Manager of Data Communications, DOE Office of ADP Services, Washington, D.C. The initial authorization, granted in March 1979, was for 1.5 h of interaction time during normal working hours. In response to an ORNL request in November 1979, ADP Services authorized an increase in the ORNL-Rockville interaction time to 4+ h/day.

During late 1979 and early 1980, EIA installed two IBM 3033 computers and associated hardware and software in the Forrestal Building in Washington, D.C. In February 1980, the EIA computing was changed from the Rockville facility to the new Forrestal Computing Facility (FCF). Authorization for ORNL utilization of the FCF was arranged by the DOE Telecommunications Management Specialist at the DOE Oak Ridge Operations Office (ORO).

ORNL's Engineering Physics Division (EPD) has two DATA 100 Model 78 Remote Job Entry (RJE) terminals which are located in Building 6025 at the National Laboratory. The terminals are used to support the DOE/EIA Model Evaluation Project and other EPD projects. Both DATA 100 terminals have existing software to emulate a HASP work station as required by the EIA computing facility. As depicted in Fig. II-1, the DATA 100 terminals and local remote "desk" terminals were initially "linked" to the EIA facility via commercial or FTS phone lines.

In anticipation of the relocation of the EIA computer facility, approval was requested in November 1979 for use of General Services Administration (GSA) data transmission service (i.e., Telpak or Tymnet

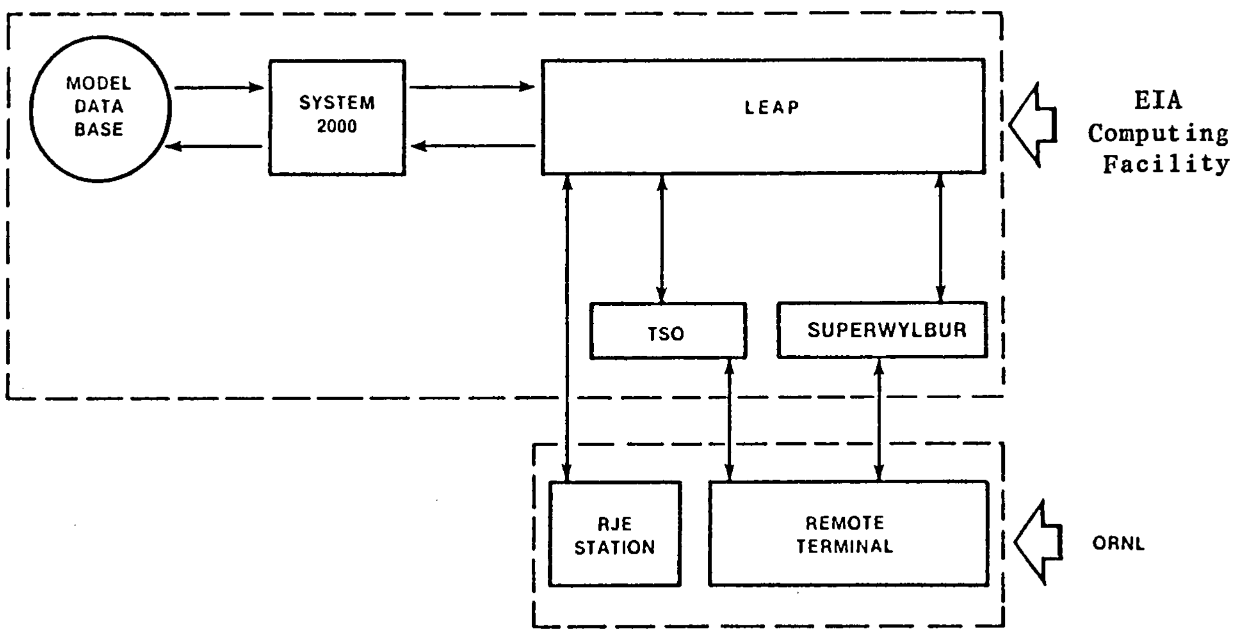

Fig. II-1. ORNL/EIA Commercial Phone/FTS Communication Link for Model Evaluation Program.

service) between ORNL and the FCF. The request was made through the DOE Telecommunications Management Specialist at ORO. When making the request, the projected March 1980 project computing needs were expected to be 5 h/day via remote terminals and 4 h/day via an RJE terminal. (By September 1980, the project ORNL-FCF computing usage was 10 h/day via remote terminals and 4 h/day via RJE terminal.)

Installation of the Telpak data transmission service between ORNL and the FCF was completed in May 1980. In conjunction with the installation of the direct ORNL-FCF line, DOE/GSA installed Codex Model 920 Multiplex Terminals (MUXs) in ORNL Building 6025 and at the Forrestal site. The resulting network is shown in Fig. II-2. The MUX system has a 32-channel capability, i.e., a maximum combination of 32 remote terminals and/or RJE stations could be connected to the ORNL/EIA system. At the present time, data transmission rate to the RJE station is 7200 bps and to the MUX is 2400 bps. Local telephone companies maintain the Telpak service, GSA maintains the MUXs, and ORNL personnel maintain the RJE station and remote terminals.

B. ORNL MEP COMPUTING PERSONNEL

An ORNL operational staff to support the Model Evaluation Project was assembled during January and February 1979. Additional personnel have been added to the staff as computing needs have increased. Personnel with extensive experience in computer applications are selected to

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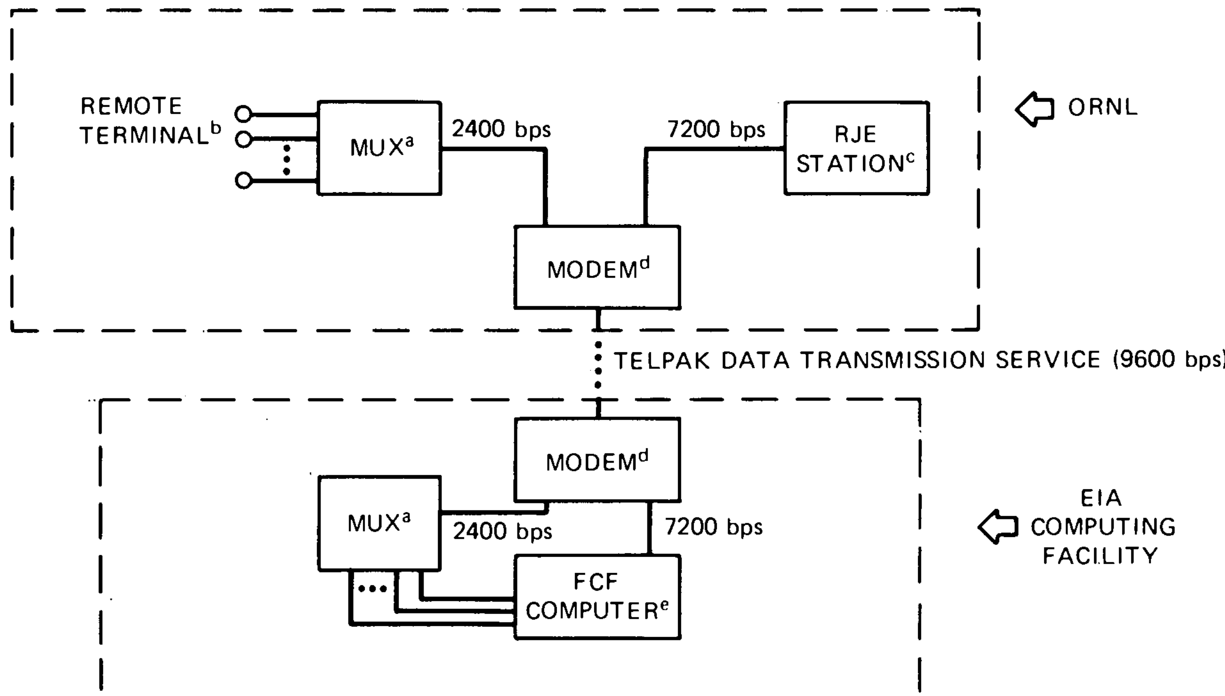

[a]CODEX MODEL 920 TIME DIVISION MULTIPLEXER
[b]SOROC IQ120 TERMINAL OR EQUIVALENT
[c]DATA 100 MODEL 78, 1250 LPM PRINTER, 1000 CPM CARD READER
[d]BELL 209A MODEM
[e]TWO IBM 3033 MULTIPROCESSING COMPUTER SYSTEMS.

Fig. II-2. ORNL/EIA Telpak Communication Link for Model Evaluation Program.

execute LEAP. Without adequate documentation and without readily accessible personnel available to train the computing staff in the execution of the LEAP system, the initial learning experience was essentially a "learn by trial and error" endeavor. With ORNL staff members available to answer questions relating to the execution of LEAP, it now takes approximately one month for an individual with no prior LEAP experience to gain expertise in running a LEAP problem independently using the the ORNL-FCF computing link.

LEAP is executed via batch mode or interactively through a combination of IBM Time Sharing Option (TSO) and SUPERWYLBUR - Program Language Interfaces. In the early phases of the project, selected project personnel attended the "Introduction to SUPERWYLBUR" and "SUPERWYLBUR Text Editing" courses which were taught by Optimum Systems, Inc., in Washington, D.C. Having extensively used ORNL in-house IBM computing equipment, project personnel had no problem with the mechanics of executing on the EIA IBM computers.

Project personnel adhere to the EIA computer system security and privacy policy as stated in Sect. 7 of the ODS Standards and Procedures Manual. Each user of the EIA computing system has a user identification and a keyword which must be used with each computing job. To enhance the security system, the DOE Office of ADP Services changes the keywords periodically. In addition, the EIA utilizes software to provide computer users with enhanced security for their data--the ACF2 Access Control Facility.

As with most major code systems, the process of acquiring the necessary operational familiarity with the LEAP system represented a formidable challenge to project personnel. In the early phases of the Model Evaluation Project, the only LEAP documentation was the DFI reports describing the energy-economy modeling system and the computer modeling software (Refs. 10 and 11, respectively). Although LEAP was developed within the context of the DFI system, the DFI documents did not describe the specific generic models that were linked together to form the hierarchical energy-economy networks for Models 22C and 88, nor did they describe how a user controls the LEAP simulation system during the solution and reporting processes. Also, the DFI documents did not identify where many of the equations inherent in the generic process models were programmed in the LEAP source subprograms. Likewise, there was incomplete documentation of the FORTRAN names that represented the parameters in the equations or the labeled commons used to pass parameters between subprograms. To add to the challenge, the LEAP code and the data bases for Models 22C and 88 were still being modified by EIA during the early phases of the ORNL project.

Throughout the Model Evaluation Project, the personnel of EIA's Long-Term Energy Analysis Division have provided invaluable assistance to ORNL personnel. (Specific individuals are identified in the Acknowledgments section of this report.) The LTEAD staff has unselfishly shared LEAP source decks, load modules, and data bases, responded to innumerable questions, provided draft copies of evolving EIA LEAP documents, and provided "CLISTs"[a] for the LEAP system. A draft copy of Cohen and Pearson's users' manual,[2] which explains how to execute LEAP, if given a predefined energy-economy model generated by the S2K data basing system, has proved to be an invaluable guide to project operating personnel. (As noted in the abstract of Ref. 2, the report is intended for users who understand the LEAP methodology and the EIA computer facility; it is not intended as a LEAP primer.)

C. LEAP - A THUMBNAIL SKETCH FROM THE OPERATOR'S PERSPECTIVE

To describe the ORNL operating experience with LEAP, we must define LEAP terminology by presenting a "thumbnail sketch" of the mechanics of executing LEAP. Material for this section was taken from Refs. 10, 11, and 22.

As noted in Chapter I, LEAP comprises a set of generic models linked together in such a manner that an energy-economy network is formed. The data transfer system acts as an interface between the code's logic and the data base storage system. The storage system stores data in a hierarchical fashion in an attempt to provide flexibility with respect to model changes. The data editing and display system (the EXECUTIVE) provides a link between the user and the LEAP system. Complete editing of both input and output data files is possible through

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[a]A CLIST is a sequence of TSO commands in an executable format. CLISTs are a convenient method for executing a series of frequently used TSO commands.

execution of the EXECUTIVE utility program. Familiarity with the LEAP methodology and the data base management system (S2K) is necessary to effectively execute the LEAP load module.

A model can be executed in either batch mode or interactive mode using TSO. Data files required for batch or interactive execution of LEAP are the same. The commands to specify the LEAP solution strategy, the diagnostics to be generated during problem execution, and the required results--commands defined in Ref. 2--can be used in both modes of executing LEAP.

Input data for an energy-economy model is passed to the LEAP load module as a "string file."[a] The network structure of the model, input parameters, and initial guesses of model results are contained in the string file. A string file is created from the data base by "unloading" a model with the S2KUTIL CLIST. The model can then be executed with the LEAP load module. In general, one would READ the string file, SETUP the problem, SOLVE the problem, and WRITE the resulting string file. (Note that the solutions to a LEAP problem are placed in a string file.) The resulting string file can then be "loaded" into the data base.

Input parameters, network structure, and model results can be displayed in tables by using the S2K EXECUTIVE. The EXECUTIVE, which is written in Programming Language Interface (PLI), produces two-dimensional "slices" of the data base in an easily interpretable format. The EXECUTIVE can be executed interactively or in batch mode.

---

[a]A string file is defined in Appendix B.

Other methods used to obtain an edit of input parameters and model results are the REPORT and PERUSE functions and the DATA/REPORT subcommands of the SOLVE function. The DATA/REPORT subcommands of the SOLVE function and the REPORT function are used in batch mode. The PERUSE function allows displaying of parameters in batch or interactive mode. PERUSE can also be used to display model results at selected output links.

Changes to parameters or network structure of a model can be made by using the EXECUTIVE. Changes to parameters can also be made by using the PERUSE function. If the EXECUTIVE is being used to invoke changes, a new string file must subsequently be created, and the problem must be set up and solved.

PERUSE is most useful for temporary modifications to parameters. The function is used during the execution phase of LEAP and does not require the a priori steps of interacting with the data base and creating a new string file. However, some changes (i.e., network structure) cannot be made with PERUSE. Not all changes can be made with either the EXECUTIVE or PERUSE. If a change in the dimensional structure of the model is desired (e.g., changing a particular parameter from a specific to a generic process), then the LEAP source, load module, and data base must all be modified.

D. ORNL OPERATING EXPERIENCE WITH MODEL 82

As described in Chapter I, Model 82 is simply Model 88, with more representative data from Model 22C used as input. The actual process of changing the Model 88 parameters was performed by using the LEAP-EMS simulation system and the DFI Computer Modeling Software (CMS) system. Use of different systems to prepare a model illustrates the versatility needed by LEAP operators. The LEAP-EMS system edits string files with more ease and convenience than does the CMS system. The cumbersome CMS system was used to change integer parameters in the data base because the LEAP-EMS system lacks such capability.

After establishing a communication link for data transmission with the EIA facility, Model 82 is executed in batch mode with the job input listed in Fig. II-3. The example in the figure shows the execution of Model 82 on the EIA FCF starting with an S2K string file on Logical Unit 2.

Subsequent executions of Model 82 could begin from the saved file on Logical Unit 3 by using the command RESTORE, which restores the problem already set up from the point where it was saved. For example, if the solution was saved after the 25th iteration, then RESTORE would restore the model in the condition it was in at the completion of Iteration 25. A subsequent SOLVE would be starting the 26th iteration.

The execution time for the job shown in Fig. II-3 was about 30 s (cpu). This time depends primarily on the number of iterations. To simply restore a converged solution and perform one additional iteration to get a DATA/REPORT requires about 5 s (cpu). However, if the solution is not converged, the cpu time required will depend on the number of

```
//QH5UMM82 JOB (6424,DO,1,50),'LEAP-FROGS',TIME=(1,10)
/*ROUTE PRINT REMOTE30 <--------------------------------------------------a
//SOLVE EXEC PGM=EXEC,REGION=2000K,TIME=60 <------------------------------b
//STEPLIB DD DSN=CN6424.QH5.LEAP.V2.LOAD,DISP=SHR <-----------------------c
//FT02F001 DD DSN=CN6424.QH5.LEAP.MODEL82.STRING.DATA,DISP=SHR <---------d
//FT04F001 DD DSN=CN6424.QH5.LEAP.MODELOT.DATA,DISP=(,CATLG),
// SPACE=(TRK,(30,10)),UNIT=DASD,DCB=(RECFM=FB,LRECL=80,BLKSIZE=1600) <--e
//FT03F001 DD DSN=CN6424.QH5.LEAP.SAVED.MODEL82.DATA,DISP=OLD,
// SPACE=(TRK,(420,70)),UNIT=DASD,DCB=(RECFM=VS,BLKSIZE=3200) <----------f
//FT06F001 DD SYSOUT=A
//FT05F001 DD *
READ                          */READ SYSTEM 2K STRING FILE FROM FT02F001 <---g
SETUP,NETWORK,ORDER           */SETS THE PROBLEM UP FOR SOLUTION
SOLVE,LOOP=25                 */EXECUTE 25 ITERATIONS OR UNTIL CONVERGENCE
SAVE                          */SAVES A BINARY STRING FILE ON FT03F001
SOLVE,LOOP=1,DATA,REPORT      */ONE MORE ITERATION TO PRINT FINAL RESULTS
END
/*
//
```

<u>NOTES</u>:

a. REMOTE30 is the ORNL RJE station.

b. EXEC is the member name for the LEAP load module in the partitioned data set (PDS) with the data set name CN6424.QH5.LEAP.V2.LOAD.

c. Cataloged LEAP load module.

d. String file created by an S2K UNLOAD used to pass data from the data base to the LEAP code.

e. An S2K string file created by LEAP with the command WRITE; this string file contains all model results as well as input data and can be LOADED into the data base.

f. A binary S2K string file created by LEAP; this file is used for restarting, if necessary.

g. The */ introduces a LEAP comment; all information following the */ is ignored by the code.

h. Job input to execute on the EIA Forrestal Computing Facility.

Fig. II-3. Input Deck for Batch Mode Execution of Model 82.[h]

iterations necessary to attain convergence (which could require multiple job submissions and user interaction).

To make changes to the data base and subsequently execute a model require significantly more effort. First, one must interact with the EXECUTIVE system as described in Ref. 11. Next, an S2K string file is created by performing an S2K "unload." This is the string file that is subsequently "read" from Logical Unit 2 (Fig. II-3).

As an example, the following steps would be required to change the initial resource cost for domestic oil in Model 82 and to execute the problem. Initial resource cost for domestic oil appears in Model 82, Table 5/3/, Row 2, Element 8. To change the value in the data base from the present 1.6 to 4.0, one would execute the EXECUTIVE. This step could be done in batch mode or interactively with Cohen's EXECUTIVE CLIST; the commands are the same, regardless of mode. At ORNL, changes of this nature are generally made interactively. The necessary commands are shown in Fig. II-4, and Table 5/3/ is shown in Table II-2. The interaction time (wall clock) for making this change is about 5 min.

```
EXEC EXEC.CLIST
GMOD,82
GTAB,5/3
C,E,2,8,4.00 <---------a
RTAB         <---------b
END
```

<u>NOTES</u>:

a. Change the element in Row 2, Column 8, to 4.0.

b. Return the table to the data base.

Fig. II-4. Sample LEAP Commands to Change a Parameter in Model 82 Table 5/3/.

Table II-2. Model 82 Table 5/3/.

SPECIFIC PROCESS DATA

ATTRIBUTE

GP: Supply		Planning Lead Time	Year Comm. Avail.	Capital Tech.Ch. Limit	Char. Facility Life	Tax Life	Debt Life	Equity Finance Fraction	Initial Resource Cost	Base Price
Specific Process		1	2	3	4	5	6	7	8	9
Oil-Supply 1	1	1	1975	1,0000	30	10	20	0.6500	1.2000	2.1699
Oil-Supply 2	2	1	1930	1,0000	30	10	20	0.6500	1.6000	

ATTRIBUTE

GP: Supply		Undisc. Recov.at Base PRC	New Res. at Twice Base PRC	Capital Cost Fraction	Deposit Decline Rate	Half-Dep Cost Mult.	Full-Dep Cost Mult.	Regula-tory Policy	Final/ Initial Cost
Specific Process		10	11	12	13	14	15	16	17
Oil-Supply	1	121,0000	186,2000	0.8000	0.0998	1.0000	1.0000	0	2.1600
Oil-Supply	2	308,0000	473,0000	0.8000	0.1338	1.0000	1.0000	0	1.8793

NOTE: Table 5/3/ (Specific Process Data)
Model 82 <1401 10/22/79> Prod to Access -2 0 -1 -3 0 0 0 0 0 0 0

The next step is to create an S2K string file by using Cohen's S2KUTIL CLIST. After the CLIST is executed, the command UNLOAD is given. The user is then prompted for all other necessary information (e.g., data set names). Time for UNLOADing a string file varies from about 2 min to 10 min (wall clock time), depending on computing system load and size of the model being unloaded.

The model is then executed in batch mode by using JCL commands as shown in Fig. II-3. Due to the computing region requirements for executing a LEAP model (approximately 2,000,000 bytes) and the computing time required to execute a typical case (generally greater than 2 min cpu), the EIA computing system places a LEAP job in a "job class" which usually results in the job being executed after normal working hours. An average LEAP job turn-around of 20 to 24 h is the result of (1) the time required to prepare the data and submit a LEAP job, (2) the "job class" limitation, and (3) the limited project access to in-house RJE equipment to retrieve the job printout.

III. THE VALIDATION VERSION OF LEAP AND MODEL 22C

The version of LEAP Model 22C for ARC'78 was designated by OEIV as being the code to be initially evaluated in the ORNL MEP. The LEAP program and Model 22C for ARC '78 were "frozen" by LTEAD in May 1979. As noted in Table II-1 above, the LEAP FORTRAN source program and corresponding LEAP load module were made available to ORNL on June 7, 1979. A listing of the LEAP source program, which consists of 211 subroutines, is included on the enclosed microfiche.

Frequently, it was necessary for the Model Evaluation Team to follow the computer programming through a LEAP calculational sequence. Consequently, an undocumented ORNL program was used to produce a subroutine hierarchical flowchart for the ARC '78 LEAP code. This flowchart is given in Appendix A.

For historical purposes, the Model 22C input tables are included in Appendix B. The tables are presented as provided to ORNL by EIA/OAA in June 1979.

IV. LEAP SAMPLE PROBLEM

In support of the ORNL program to develop and demonstrate a procedure for evaluating energy-economic modeling computer codes, LEAP is executed to investigate the effects of various alternate input assumptions, to support the development of the adjoint perturbation theory and the screening sensitivity theory, to evaluate computing algorithms in the code, etc. To illustrate a "typical procedure" for executing LEAP utilizing the ORNL-FCF link, the input, output, computing execution time, core storage requirements, etc., are described for a LEAP sample problem. This chapter is intended to augment by example the information in "The LEAP-EMS Users Manual" (Ref. 2) from the perspective of an ORNL LEAP user.

The objective of the LEAP sample problem was to determine the effect of a 10% decrease in the LEAP input parameter Resource Owners

Interest Rate (ROWN). By varying parameters like ROWN around the value used in LEAP Model 22C for Ref. 3 and observing changes in the model results, one can learn the importance of specific input parameters.

ROWN is a generic process parameter and is found in Table 11/0 of the Model 22C input tables (see Appendix B). The input value of ROWN (0.0798) is the same for all generic processes requiring the parameter. The procedure shown in Fig. IV-1 was used to RESTORE the base case, use the PERUSE function to modify ROWN, execute the model to convergence and generate a REPORT summary. The starting point (i.e., the base case) was a converged Model 22C binary string file on Logical Unit 1. ROWN was changed from 0.0798 to 0.0718 for the necessary generic processes (i.e., coal resources and oil resources). The model was then executed to convergence and the REPORT summary generated.

For this case the model converged in 21 iterations to a tolerance of 0.1%. The execution time on the IBM 3033 computer at the Forrestal Computing Facility was 7 min 35 s cpu. The core requirement was 2000K bytes. (The large core requirement to execute a Model 22C case is a detrimental factor affecting transportability of the LEAP system.)

A REPORT summary is shown in Table IV-1. A REPORT summary shows most of the more important LEAP Model 22C results which were reported in ARC '78. A comparison of these results with those from the base case can be made to determine the effect of the parameter changes. (For comparisons of various parameter changes see Refs. 21 and 23.)

```
//QH5UC27 JOB (6424,DO,1,50),'M22',TIME=(15)
/*ROUTE  PRINT REMOTE30
//SOLVE EXEC PGM=EXEC,REGION=2000K,TIME=60
//STEPLIB DD DSN=CN6424,QH5.LEAP.VER3.LOAD,DISP=SHR
//FT01F001 DD DSN=CN6424.QH5.PEELLE.BASE.DATA,DISP=SHR <----------------a
//FT11F001 DD DSN=  TOUTDATA,DISP=(NEW,DELETE),SPACE=(TRK,(10,5)),   <--b
// UNIT=SYSDA,DCB=(RECFM=FB,LRECL=109,BLKSIZE=1090)
//FT12F001 DD DSN=CN6424.QH5.ENBAL.DATA,DISP=SHR <----------------------c
//FT06F001 DD SYSOUT=A
//FT05F001 DD *
RESTORE,BASECASE,REC=2 <-----------------------------------------------d
PERUSE
IDV 0 0 0 0 LC 1 EL 88 D CH .001 D SA <--------------------------------e
GP 6 LC 19 EL 13 D
CH .0718 D SA
                     <-------------------------------------------------f
GP 11 LC 19 EL 13 D
CH .0718 D SA
END
SOLVE,LOOP=30
REPORT <---------------------------------------------------------------g
END
/*
//
```

---

[a]Binary string file saved during a prior run on Logical Unit 3. It will be restored with the "RESTORE,BASECASE" command from Logical Unit 1. The "BASECASE" keyword indicates the string file is on Logical Unit 1 as opposed to Logical Unit 3.

[b]Scratch space used to store quantities from each node for each model year (required if the REPORT command is used).

[c]Title page information and other data required if the command REPORT is used to generate a summary of important LEAP results. This data is listed at the end of the enclosed microfiche.

[d]Read the binary string file from Logical Unit 1.

[e]PERUSE instruction to display the convergence tolerance and then to change the tolerance to 0.001 for this run.

[f]The PERUSE instructions to change ROWN to 0.0718 in the two locations where ROWN is found.

[g]REPORT command requesting a nine-page summary of important LEAP results.

Fig. IV-1. LEAP Sample Problem Procedure.

Table IV-1. LEAP Sample Problem Output.

PRIMARY ENERGY

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
DOMESTIC OIL	19.995	19.658	18.466	17.406	15.915	13.675	11.576	9.676	8.088	6.730
NORTH SLOPE OIL	0.0	0.926	1.508	2.313	3.216	3.880	4.249	4.316	4.186	3.931
ENHANCED OIL RECOVERY	0.0	0.036	1.206	2.667	4.195	5.234	5.699	5.665	5.362	4.921
SHALE OIL	0.0	0.0	0.003	0.415	1.027	1.801	2.699	3.627	4.493	5.124
TOTAL DOMESTIC OIL..........	19.995	20.620	21.183	22.801	24.353	24.590	24.223	23.284	22.129	20.706
IMPORTED CRUDE	8.588	9.714	10.545	10.623	9.946	8.586	7.463	6.633	6.133	5.849
IMPORTED PRODUCTS	3.714	3.540	3.318	3.127	2.935	2.676	2.438	2.209	1.996	1.789
TOTAL OIL..................	32.297	33.874	35.046	36.551	37.234	35.852	34.124	32.126	30.258	28.344
DOMESTIC GAS	18.040	20.076	19.347	17.883	15.898	13.665	11.651	9.826	8.400	7.180
NORTH SLOPE GAS	0.0	0.023	0.546	1.199	1.743	2.008	2.031	1.884	1.690	1.474
ENHANCED GAS RECOVERY	0.0	0.003	0.523	1.409	2.513	3.340	3.674	3.603	3.365	3.026
TOTAL DOMESTIC GAS..........	18.040	20.102	20.416	20.491	20.154	19.013	17.356	15.313	13.455	11.680
IMPORTED GAS	0.901	1.126	1.645	1.720	1.474	1.123	0.916	0.836	0.858	0.915
TOTAL GAS..................	18.941	21.228	22.061	22.211	21.628	20.136	18.272	16.149	14.313	12.595
EASTERN LOW-SULFUR COAL	0.701	0.835	0.879	0.862	0.824	0.760	0.692	0.627	0.605	0.615
EASTERN M-HI SULFUR COAL	6.669	5.975	6.350	7.370	8.757	10.249	12.089	14.908	17.388	19.468
EASTERN PREMIUM COAL	1.902	2.891	3.769	4.310	4.766	5.036	5.307	5.491	5.630	5.781
WESTERN LOW-SULFUR COAL	1.018	2.208	4.016	6.283	8.876	11.483	14.358	17.087	19.574	22.126
WESTERN M-HI SULFUR COAL	0.769	0.955	1.590	2.919	5.577	9.009	12.134	14.319	15.386	15.263
MID CONTINENT COAL	3.132	5.120	6.522	7.701	8.839	9.991	11.458	12.218	13.214	14.571
TOTAL COAL.................	14.191	17.984	23.126	29.445	37.639	46.528	56.038	64.650	71.797	77.824
TOTAL FOSSIL FUELS..........	65.429	73.086	80.233	88.207	96.501	102.516	108.434	112.925	116.368	118.763
NUCLEAR.....................	1.847	3.428	6.291	8.688	12.401	17.107	22.484	29.176	36.271	42.958
BIOMASS(BASE)	0.0	0.0	0.0	0.198	0.318	0.393	0.432	0.465	0.495	0.558
BIOMASS(INT)	0.0	0.0	0.0	0.018	0.030	0.042	0.048	0.057	0.063	0.075
BIOMASS(PEAK)										
CENTRAL RENEWABLES(BASE)	0.0	0.0	0.0	0.0	0.162	0.351	0.549	0.783	1.038	1.437
CENTRAL RENEWABLES(INT)	0.0	0.0	0.0	0.0	0.006	0.012	0.021	0.033	0.045	0.060
CENTRAL RENEWABLES(PEAK)										
HYDRO(BASE)	2.907	2.982	3.051	3.177	3.297	3.660	3.660	3.660	3.660	3.660
HYDRO(INT)	0.237	0.243	0.249	0.261	0.270	0.300	0.300	0.300	0.300	0.300
HYDRO(PEAK)	0.024	0.024	0.024	0.027	0.027	0.030	0.030	0.030	0.030	0.030
TOTAL CENTRAL RENEWABLES....	3.168	3.249	3.324	3.681	4.110	4.788	5.040	5.328	5.631	6.120
SOLAR HEAT (RESIDENTIAL)	0.0	0.0	0.0	0.0	0.001	0.001	0.001	0.001	0.001	0.001
SOLAR HEAT (COMMERCIAL)										
SOLAR COOL (COMMERCIAL)										
GEOTHERMAL	0.0	0.002	0.011	0.035	0.095	0.205	0.370	0.587	0.889	1.228
PHOTO VOLTAIC,ETC.										
DISTRIBUTED ELECTRIC										
TOTAL END-USE RENEWABLES	0.0	0.002	0.011	0.035	0.096	0.206	0.371	0.588	0.890	1.229
TOTAL PRIMARY ENERGY........	70.444	79.765	89.859	100.611	113.108	124.617	136.329	148.017	159.160	169.070

Table IV-1. (Continued)

CONSUMPTION BY SECTOR

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
RESIDENTIAL										
OIL	3.069	3.290	3.203	3.132	2.823	2.457	2.145	1.865	1.645	1.451
GAS	5.723	6.231	6.051	5.863	5.270	4.586	4.000	3.460	3.040	2.646
ELECTRICITY	2.161	2.726	3.082	3.653	4.234	4.769	5.278	5.699	6.022	6.309
SOLAR HEAT	0.0	0.0	0.0	0.0	0.001	0.001	0.001	0.001	0.001	0.001
DISTRIBUTED ELECTRIC										
TOTAL......................	10.953	12.247	12.336	12.648	12.328	11.813	11.424	11.025	10.708	10.407
COMMERCIAL										
LIGHT OIL	1.003	0.974	0.854	0.765	0.656	0.542	0.440	0.350	0.294	0.253
HEAVY OIL	0.957	0.931	0.817	0.733	0.630	0.522	0.424	0.337	0.283	0.244
GAS	1.976	2.685	3.022	3.275	3.276	3.093	2.825	2.622	2.460	2.331
ELECTRICITY	1.484	1.892	2.287	2.772	3.283	3.783	4.359	4.983	5.629	6.325
SOLAR HEAT + GEO										
SOLAR COOL										
DISTRIBUTED ELECTRIC										
TOTAL......................	5.420	6.482	6.980	7.545	7.845	7.940	8.048	8.292	8.666	9.153
INDUSTRY										
LIGHT OIL	1.503	1.651	1.866	2.200	2.537	2.811	3.091	3.363	3.600	3.803
HEAVY OIL	2.364	2.692	3.098	3.398	3.787	3.997	4.151	4.254	4.289	4.298
LPG TO PETROCHEMICALS	0.913	1.191	1.477	1.864	2.307	2.696	3.087	3.467	3.804	4.100
REFINERY USE OF OIL	2.763	2.681	2.650	2.704	2.804	2.858	2.908	2.940	2.961	2.956
GAS	6.371	6.883	7.743	8.161	8.595	8.682	8.630	8.414	8.109	7.755
DOMESTIC GAS PRODUCTION	1.515	1.686	1.625	1.502	1.335	1.148	0.979	0.825	0.706	0.603
ENHANCED GAS RECOVERY	0.0	0.000	0.044	0.118	0.211	0.281	0.309	0.303	0.283	0.254
NORTH SLOPE GAS	0.0	0.002	0.046	0.101	0.146	0.169	0.171	0.158	0.142	0.124
ELECTRICITY	2.256	2.716	3.754	4.719	6.009	7.286	8.623	9.973	11.269	12.419
COAL	1.365	1.831	3.459	5.474	8.223	11.194	14.321	17.390	20.252	22.754
MET COAL	2.294	2.306	2.327	2.451	2.581	2.645	2.705	2.759	2.808	2.855
GEOTHERMAL	0.0	0.002	0.011	0.035	0.095	0.205	0.370	0.587	0.889	1.228
TOTAL......................	21.344	23.642	28.100	32.727	38.631	43.971	49.344	54.433	59.111	63.149
TRANSPORTATION										
LIGHT OIL	16.389	16.923	17.580	18.389	19.221	19.477	19.624	19.595	19.375	18.877
HEAVY OIL	0.614	0.957	1.291	1.522	1.736	1.875	1.995	2.095	2.182	2.267
ELECTRICITY										
GAS-PIPELINE TRANS	0.541	0.605	0.651	0.699	0.729	0.723	0.691	0.642	0.591	0.538
TOTAL......................	17.544	18.485	19.522	20.610	21.686	22.075	22.310	22.332	22.148	21.682
TOTAL CONSUMPTION...........	55.262	60.855	66.938	73.530	80.490	85.799	91.126	96.083	100.633	104.392
AUTOMOBILE MILES/GALLON	13.029	14.528	16.379	18.451	20.734	23.067	25.473	28.025	30.698	34.290

Table IV-1. (Continued)

CASE C 12/14/79-08:03:27--- 2 DOE ENERGY INFORMATION ADMINISTRATION PAGE...4

SOURCES OF LIQUID FUELS: HIST & C PROJ

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
CONVENTIONAL OIL AND NGL										
DOMESTIC CRUDE OIL	19.995	19.658	18.466	17.406	15.915	13.675	11.576	9.676	8.088	6.730
NORTH SLOPE OIL	0.0	0.926	1.508	2.313	3.216	3.880	4.249	4.316	4.186	3.931
TOTAL CONVENTIONAL OIL......	19.995	20.584	19.974	19.719	19.131	17.555	15.825	13.992	12.274	10.661
ENHANCED OIL RECOVERY.......	0.0	0.036	1.206	2.667	4.195	5.234	5.699	5.665	5.362	4.921
OIL FROM SHALE..............	0.0	0.0	0.003	0.415	1.027	1.801	2.699	3.627	4.493	5.124
SYNTHETIC COAL LIQUIDS......	0.0	0.0	0.0	0.0	0.809	2.648	4.799	7.022	8.979	10.652
TOTAL DOMESTIC PRODUCTION...	19.995	20.620	21.183	22.801	25.162	27.238	29.022	30.306	31.108	31.358
OIL IMPORTS										
CRUDE IMPORTS	8.588	9.714	10.545	10.623	9.946	8.586	7.463	6.633	6.133	5.849
PRODUCT IMPORTS	3.714	3.540	3.318	3.127	2.935	2.676	2.438	2.209	1.996	1.789
TOTAL IMPORTS...............	12.302	13.254	13.863	13.750	12.881	11.262	9.901	8.842	8.129	7.638
TOTAL LIQUIDS SUPPLY........	32.297	33.874	35.046	36.551	38.043	38.500	38.923	39.148	39.237	38.996

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SOURCES OF GASEOUS FUELS: HIST & C PROJ

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
CONVENTIONAL GAS										
DOMESTIC GAS	18.040	20.076	19.347	17.883	15.898	13.665	11.651	9.826	8.400	7.180
NORTH SLOPE GAS	0.0	0.023	0.546	1.199	1.743	2.008	2.031	1.884	1.690	1.474
TOTAL CONVENTIONAL GAS......	18.040	20.099	19.893	19.082	17.641	15.673	13.682	11.710	10.090	8.654
ENHANCED GAS RECOVERY.......	0.0	0.003	0.523	1.409	2.513	3.340	3.674	3.603	3.365	3.026
HI-BTU SYNTHETIC GAS........	0.0	0.0	0.0	0.0	0.082	0.349	0.849	1.524	2.064	2.535
TOTAL DOMESTIC PRODUCTION...	18.040	20.102	20.416	20.491	20.236	19.362	18.205	16.837	15.519	14.215
GAS IMPORTS.................	0.901	1.126	1.645	1.720	1.474	1.123	0.916	0.836	0.858	0.915
TOTAL GAS SUPPLY............	18.941	21.228	22.061	22.211	21.710	20.485	19.121	17.673	16.377	15.130

Table IV-1. (Continued)

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COAL DISPOSITION: HIST & C PROJ

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
DIRECT COAL USE										
COAL TO INDUSTRY	1.365	1.831	3.459	5.474	8.223	11.194	14.321	17.390	20.252	22.754
MET COAL TO INDUSTRY	2.294	2.306	2.327	2.451	2.581	2.645	2.705	2.759	2.808	2.855
TOTAL DIRECT USE............	3.659	4.137	5.786	7.925	10.804	13.839	17.026	20.149	23.060	25.609
ELECTRICAL GENERATION.......	8.752	11.687	14.648	18.661	22.535	25.320	27.770	29.038	29.622	29.950
SYNFUELS										
WESTERN LIQUIDS, LOW SULF	0.0	0.0	0.0	0.0	0.290	0.926	1.711	2.646	3.621	4.732
WESTERN SYNGAS, LOW SULF	0.0	0.0	0.0	0.0	0.036	0.154	0.377	0.685	0.936	1.165
WESTERN LIQUIDS, M-HI SULF	0.0	0.0	0.0	0.0	0.729	2.425	4.335	6.104	7.326	7.923
WESTERN SYNGAS, M-HI SULF	0.0	0.0	0.0	0.0	0.039	0.169	0.415	0.746	1.001	1.206
MID-CONTINENT LIQUIDS	0.0	0.0	0.0	0.0	0.088	0.282	0.532	0.817	1.169	1.573
MID-CONTINENT SYNGAS	0.0	0.0	0.0	0.0	0.021	0.089	0.215	0.381	0.516	0.637
APPALACH LIQUIDS, M-HI SULF	0.0	0.0	0.0	0.0	0.050	0.150	0.277	0.465	0.711	0.988
APPALACH SYNGAS, M-HI SULF	0.0	0.0	0.0	0.0	0.019	0.076	0.180	0.319	0.433	0.537
TOTAL COAL TO SYNFUELS......	0.0	0.0	0.0	0.0	1.272	4.271	8.042	12.163	15.713	18.761
COAL EXPORTS................	1.780	2.160	2.690	2.860	3.030	3.100	3.200	3.300	3.400	3.500
TOTAL COAL PRODUCTION.......	14.191	17.984	23.124	29.446	37.641	46.530	56.038	64.650	71.795	77.820

Table IV-1. (Continued)

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PRIMARY ELECTRICAL INPUT FUELS: HIST & C

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
COAL										
CONVENTIONAL BOILER	8.752	11.687	14.648	15.262	15.820	15.770	15.075	14.092	13.220	12.234
ATMOS FLUIDIZED BED	0.0	0.0	0.0	0.895	1.775	2.534	3.032	3.367	3.543	3.713
COMBINED CYCLE	0.0	0.0	0.0	2.504	4.941	7.016	8.347	9.208	9.670	10.071
MHD	0.0	0.0	0.0	0.0	0.0	0.0	1.317	2.372	3.189	3.934
TOTAL COAL INPUT............	8.752	11.687	14.648	18.661	22.536	25.320	27.771	29.039	29.622	29.952
OIL										
OIL BOILER	2.679	2.539	2.131	1.731	1.390	1.075	0.817	0.585	0.442	0.325
OIL TURBINE	0.042	0.044	0.051	0.056	0.059	0.059	0.063	0.072	0.072	0.072
FUEL CELL OIL	0.0	0.0	0.028	0.038	0.041	0.041	0.043	0.044	0.066	0.093
TOTAL OIL INPUT.............	2.721	2.583	2.210	1.825	1.490	1.175	0.923	0.701	0.580	0.490
GAS										
GAS BOILER	2.753	2.848	2.459	2.018	1.635	1.273	0.972	0.694	0.531	0.394
GAS TURBINE	0.042	0.262	0.385	0.435	0.483	0.519	0.552	0.587	0.567	0.549
TOTAL GAS INPUT.............	2.795	3.110	2.844	2.453	2.118	1.792	1.524	1.281	1.098	0.943
URANIUM										
LWR	1.847	3.428	6.291	8.688	12.401	17.107	22.484	29.145	36.205	42.848
BREEDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.031	0.066	0.109
TOTAL URANIUM INPUT.........	1.847	3.428	6.291	8.688	12.401	17.107	22.484	29.176	36.271	42.957
RENEWABLES										
HYDRO(BASE)	2.907	2.982	3.051	3.177	3.297	3.660	3.660	3.660	3.660	3.660
" (INT)	0.237	0.243	0.249	0.261	0.270	0.300	0.300	0.300	0.300	0.300
" (PEAK)	0.024	0.024	0.024	0.027	0.027	0.030	0.030	0.030	0.030	0.030
BIOMASS(BASE)	0.0	0.0	0.0	0.198	0.318	0.393	0.432	0.465	0.495	0.558
" (INT)	0.0	0.0	0.0	0.018	0.030	0.042	0.048	0.057	0.063	0.075
" (PEAK)										
CENTRAL RENEWABLES(BASE)	0.0	0.0	0.0	0.0	0.162	0.351	0.549	0.783	1.038	1.437
" " (INT)	0.0	0.0	0.0	0.0	0.006	0.012	0.021	0.033	0.045	0.060
" " (PEAK)										
TOTAL RENEWABLES............	3.168	3.249	3.324	3.681	4.110	4.788	5.040	5.328	5.631	6.120
TOTAL GROSS INPUTS..........	19.283	24.057	29.317	35.308	42.655	50.182	57.742	65.525	73.202	80.462
AVERAGE EFFICIENCY.......... (NET/GROSS ELECTRICITY)	0.340	0.339	0.346	0.351	0.352	0.351	0.351	0.350	0.348	0.346
NET GENERATION	6.557	8.149	10.136	12.383	15.029	17.598	20.290	22.949	25.467	27.837
LINE LOSS	0.656	0.815	1.013	1.238	1.503	1.760	2.029	2.295	2.547	2.784
(NET GENERATION MINUS ELECTRICITY TO DEMAND)	5.901	7.334	9.123	11.145	13.526	15.838	18.261	20.654	22.920	25.053
TOTAL ELECTRICITY........... (AVAILABLE TO CONSUMERS)	5.901	7.334	9.123	11.145	13.526	15.838	18.261	20.654	22.920	25.053

Table IV-1. (Continued)

EMERGING TECHNOLOGY SUMMARY:HIST & C

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
OIL										
ENHANCED OIL RECOVERY	0.0	0.036	1.206	2.667	4.195	5.234	5.699	5.665	5.362	4.921
SHALE OIL	0.0	0.0	0.003	0.415	1.027	1.801	2.699	3.627	4.493	5.124
COAL LIQUIDS	0.0	0.0	0.0	0.0	0.809	2.648	4.799	7.022	8.979	10.652
TOTAL OIL..................	0.0	0.036	1.209	3.082	6.031	9.683	13.197	16.314	18.834	20.697
GAS										
ENHANCED GAS RECOVERY	0.0	0.003	0.523	1.409	2.513	3.340	3.674	3.603	3.365	3.026
HI BTU GAS FROM COAL	0.0	0.0	0.0	0.0	0.082	0.349	0.849	1.524	2.064	2.535
TOTAL GAS..................	0.0	0.003	0.523	1.409	2.595	3.689	4.523	5.127	5.429	5.561
ELECTRICITY(PRIMARY)										
COMBINED CYCLE (BASE)	0.0	0.0	0.0	0.887	1.742	2.462	2.910	3.188	3.326	3.445
" " (INT)	0.0	0.0	0.0	0.065	0.136	0.204	0.262	0.311	0.347	0.380
" " (PEAK)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.001	0.002	0.002
ATMOS FLUID BED (BASE)	0.0	0.0	0.0	0.282	0.557	0.789	0.937	1.030	1.076	1.119
" " " (INT)	0.0	0.0	0.0	0.031	0.064	0.097	0.124	0.146	0.162	0.177
" " " (PEAK)	0.0	0.0	0.0	0.0	0.0	0.0	0.001	0.001	0.002	0.003
FUEL CELLS (BASE)	0.0	0.0	0.007	0.009	0.010	0.009	0.008	0.007	0.006	0.006
" " (INT)	0.0	0.0	0.003	0.004	0.004	0.004	0.004	0.004	0.003	0.003
" " (PEAK)	0.0	0.0	0.0	0.001	0.001	0.003	0.005	0.007	0.017	0.029
MHD (BASE)	0.0	0.0	0.0	0.0	0.0	0.0	0.558	1.002	1.343	1.653
" (INT)	0.0	0.0	0.0	0.0	0.0	0.0	0.034	0.065	0.092	0.117
" (PEAK)										
BIOMASS (BASE)	0.0	0.0	0.0	0.066	0.106	0.131	0.144	0.155	0.165	0.186
" (INT)	0.0	0.0	0.0	0.006	0.010	0.014	0.016	0.019	0.021	0.025
" (PEAK)										
CENTRAL RENEWABLES(BASE)	0.0	0.0	0.0	0.0	0.054	0.117	0.183	0.261	0.346	0.479
" " (INT)	0.0	0.0	0.0	0.0	0.002	0.004	0.007	0.011	0.015	0.020
" " (PEAK)										
TOTAL ELECTRICITY...........	0.0	0.0	0.010	1.351	2.686	3.834	5.193	6.208	6.923	7.644
DECENTRALIZED RENEWABLES										
SOLAR HEAT(RES)	0.0	0.0	0.0	0.0	0.001	0.001	0.001	0.001	0.001	0.001
DIST ELECTRIC(RES)										
SOLAR HEAR(COMM)										
SOLAR COOL(COMM)										
DIST ELECTRIC(COMM)										
GEOTHERMAL	0.0	0.002	0.011	0.035	0.095	0.205	0.370	0.587	0.889	1.228
TOTAL DECENTRAL RENEWS......	0.0	0.002	0.011	0.035	0.096	0.206	0.371	0.588	0.890	1.229
TOTAL END-USE...............	0.0	0.041	1.753	5.877	11.408	17.412	23.284	28.237	32.076	35.131

Table IV-1. (Continued)

CONSUMPTION BY FUEL

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
LIGHT OIL										
RESIDENTIAL	3.069	3.290	3.203	3.132	2.823	2.457	2.145	1.865	1.645	1.451
COMMERCIAL	1.003	0.974	0.854	0.765	0.656	0.542	0.440	0.350	0.294	0.253
INDUSTRY	1.503	1.651	1.866	2.200	2.537	2.811	3.091	3.363	3.600	3.803
TRANSPORTATION	16.389	16.923	17.580	18.389	19.221	19.477	19.624	19.595	19.375	18.877
TOTAL......................	21.964	22.838	23.503	24.486	25.237	25.287	25.300	25.173	24.914	24.384
HEAVY OIL										
COMMERCIAL	0.957	0.931	0.817	0.733	0.630	0.522	0.424	0.337	0.283	0.244
INDUSTRY	2.364	2.692	3.098	3.398	3.787	3.997	4.151	4.254	4.289	4.298
TRANSPORTATION	0.614	0.957	1.291	1.522	1.736	1.875	1.995	2.095	2.182	2.267
REFINERY USE	2.763	2.681	2.650	2.704	2.804	2.858	2.908	2.940	2.961	2.956
TOTAL......................	6.698	7.261	7.856	8.357	8.957	9.252	9.478	9.626	9.715	9.765
GAS										
RESIDENTIAL	5.723	6.231	6.051	5.863	5.270	4.586	4.000	3.460	3.040	2.646
COMMERCIAL	1.976	2.685	3.022	3.275	3.276	3.093	2.825	2.622	2.460	2.331
INDUSTRY	6.371	6.883	7.743	8.161	8.595	8.682	8.630	8.414	8.109	7.755
PIPELINE TRANSMISSION	0.541	0.605	0.651	0.699	0.729	0.723	0.691	0.642	0.591	0.538
LPG TO INDUSTRY	0.913	1.191	1.477	1.864	2.307	2.696	3.087	3.467	3.804	4.100
FIELD USE	1.515	1.689	1.715	1.721	1.693	1.597	1.458	1.286	1.130	0.981
TOTAL......................	17.040	19.283	20.659	21.583	21.870	21.377	20.691	19.892	19.134	18.352
COAL										
INDUSTRY	1.365	1.831	3.459	5.474	8.223	11.194	14.321	17.390	20.252	22.754
MET COAL TO INDUSTRY	2.294	2.306	2.327	2.451	2.581	2.645	2.705	2.759	2.808	2.855
TOTAL......................	3.659	4.137	5.786	7.925	10.804	13.839	17.026	20.149	23.060	25.609
ELECTRICITY										
RESIDENTIAL	2.161	2.726	3.082	3.653	4.234	4.769	5.278	5.699	6.022	6.309
COMMERCIAL	1.484	1.892	2.287	2.772	3.283	3.783	4.359	4.983	5.629	6.325
INDUSTRY	2.256	2.716	3.754	4.719	6.009	7.286	8.623	9.973	11.269	12.419
TRANSPORTATION										
TOTAL......................	5.901	7.334	9.123	11.144	13.526	15.838	18.260	20.655	22.920	25.053
RENEWABLES										
SOLAR HEAT (RESIDENTIAL)	0.0	0.0	0.0	0.0	0.001	0.001	0.001	0.001	0.001	0.001
DISTRIBUTED ELECTRIC (RES)										
SOLAR HEAT (COMMERCIAL)										
SOLAR COOL (COMMERCIAL)										
DISTRIBUTED ELECTRIC (COMM)										
TOTAL......................	0.0	0.0	0.0	0.0	0.001	0.001	0.001	0.001	0.001	0.001
OTHER										
GEOTHERMAL (INDUSTRY)	0.0	0.002	0.011	0.035	0.095	0.205	0.370	0.587	0.889	1.228
TOTAL CONSUMPTION...........	55.262	60.855	66.938	73.530	80.490	85.799	91.126	96.083	100.633	104.391

Table IV-1. (Continued)

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SUMMARY PAGE

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
DEMAND										
RESIDENTIAL	10.953	12.247	12.336	12.648	12.328	11.813	11.424	11.025	10.708	10.407
COMMERCIAL	5.420	6.482	6.980	7.545	7.845	7.940	8.048	8.292	8.666	9.153
INDUSTRIAL	21.344	23.642	28.100	32.727	38.631	43.971	49.344	54.433	59.111	63.149
TRANSPORTATION	17.544	18.485	19.522	20.610	21.686	22.075	22.310	22.332	22.148	21.682
TOTAL DEMAND	55.262	60.855	66.938	73.530	80.490	85.799	91.126	96.083	100.633	104.392
SUPPLY										
OIL	32.297	33.874	35.046	36.551	37.234	35.852	34.124	32.126	30.258	28.344
GAS	18.941	21.228	22.061	22.211	21.628	20.136	18.272	16.149	14.313	12.595
COAL	14.191	17.984	23.126	29.445	37.639	46.528	56.038	64.650	71.797	77.824
NUCLEAR	1.847	3.428	6.291	8.688	12.401	17.107	22.484	29.176	36.271	42.958
CENTRAL RENEWABLES	3.168	3.249	3.324	3.681	4.110	4.788	5.040	5.328	5.631	6.120
END-USE RENEWABLES	0.0	0.002	0.011	0.035	0.096	0.206	0.371	0.588	0.890	1.229
TOTAL SUPPLY	70.444	79.765	89.859	100.611	113.108	124.617	136.329	148.017	159.160	169.070
LOSSES	15.182	18.910	22.921	27.081	32.618	38.818	45.203	51.934	58.527	64.678

Other LEAP options which are useful in this type of scenario are SAVE, WRITE, and PERUSE. SAVE will write a binary representation of the resulting string file onto Logical Unit 3, which can later be "restored" without requiring 21 iterations to reach the converged point. WRITE places a card image string file with the converged solution on Logical Unit 4, which can subsequently be "loaded" into the S2K data base for inspection of various model results in Model 22C output tables. The PERUSE function can be used to inspect the prices, quantities, and capacity additions out of any node of interest.

Execution time for Model 22C depends largely on the number of iterations. Model runs through ten iterations require about 3 min 45 s (cpu). A rough rule-of-thumb for estimating maximum cpu time for execution of Model 22C is 25 s per iteration starting from a RESTORE.

V. REPLICATION OF ARC '78 RESULTS[a]

Can the ARC '78 LEAP system and Model 22C evaluated in the ORNL research program replicate the long-term energy price-quantity projections credited to LEAP in Chapter 5 of the DOE EIA 1978 Annual Report to Congress? A replication study was made to answer this question. With only a few exceptions, all LEAP-calculated prices and quantities in Chapter 5 can be replicated within "accepted agreement criteria" defined below. Results of the replication study are described in this chapter.

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[a]The first replication study by R. W. Peelle and K. E. Tech of the ORNL group was reported in Refs. 4 and 24. Many of their observations relating to data acquisition and comparisons are restated herein.

ARC '78 presents projections of energy production, consumption, and prices, in addition to their economic and other related consequences. The report includes projections for various assumptions underlying energy supply and demand, and for various time periods, viz., short term (1979 and 1980), midterm (1985, 1990, and 1995), and long term (1995 to 2020).

Chapter 5 of ARC '78, entitled "Long-Term Energy Supply and Demand," presents projections based on EIA OAA LEAP calculations and independent calculations made by four other energy forecasting groups, thus offering a range of possible energy futures. Projections were based on defined assumptions, i.e., a specific scenario. The key assumptions for the scenario are given on pp. 56-57 of Ref. 3 and are identified therein as the "Series C" scenario. Among the long term projections in Chapter 5 are projections of energy consumption, conversion, and supply.

To obtain LEAP results for the replication study, the Model 22C stringfile identified by LTEAD as "the" stringfile to be used by ORNL in the MEP evaluation of LEAP was executed by ORNL personnel on the DOE FCF. Input deck for the case is listed in Fig. V-1. The case was started with a "cold" start and converged to 0.0005 $\left(\text{i.e., } \frac{Q_{new} - Q_{old}}{Q_{old}} = 0.0005\right)$ or 0.1 quad. The resulting Model 22C results (i.e., report summary) are shown in Table V-1.

Two separate LEAP cases will produce identical results only if the same input stringfile, LEAP-related software, number of iterations,

```
//QH5UC00 JOB (6424,DO,1,50),'M22',TIME=(40)
***ROUTE  PRINT REMOTE30
//SOLVE EXEC PGM=EXEC,REGION=2000K,TIME=60
//STEPLIB DD DSN=CN6424.QH5.LEAP.VER3.LOAD,DISP=SHR[a]
//FT01F001 DD DSN=CN6424.QH5.LEAP.SAVED.MODEL22.DATA,DISP=SHR
//FT11F001 DD DSN=  TOUTDATA,DISP=(NEW,DELETE),SPACE=(TRK,(10,5)),
// UNIT=SYSDA,DCB=(RECFM=FB,LRECL=109,BLKSIZE=1090)
//FT12F001 DD DSN=CN6424.QH5.ENBAL.DATA,DISP=SHR
//FT06F001 DD SYSOUT=A
//FT05F001 DD *
RESTORE,BASECASE,REC=1
PERUSE
IDV  0 0 0 0  LC 1  EL 88  CH  .0005  D  SA
END
SOLVE,LOOP=60
REPORT
END
//
```

Figure V-1. Input Deck for LEAP Model 22C Base Case

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[a]LTEAD supplied LEAP load module (see Table II-1) with ORNL modifications to prevent relaxation on market shares and to use a constant (0.5) relaxation coefficient.

Table V-1. LEAP Base Case Model 22C Output.

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PRIMARY ENERGY

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
DOMESTIC OIL	19.995	19.816	18.683	17.635	16.134	13.847	11.681	9.714	8.075	6.692
NORTH SLOPE OIL	0.0	0.942	1.549	2.378	3.297	3.962	4.316	4.349	4.178	3.888
ENHANCED OIL RECOVERY	0.0	0.034	1.268	2.783	4.345	5.375	5.793	5.690	5.319	4.828
SHALE OIL	0.0	0.0	0.003	0.403	1.003	1.783	2.703	3.658	4.538	5.164
TOTAL DOMESTIC OIL..........	19.995	20.792	21.503	23.199	24.779	24.967	24.493	23.411	22.110	20.572
IMPORTED CRUDE	8.588	9.535	10.228	10.237	9.568	8.253	7.160	6.360	5.895	5.656
IMPORTED PRODUCTS	3.714	3.539	3.318	3.128	2.937	2.677	2.437	2.206	1.991	1.784
TOTAL OIL..................	32.297	33.866	35.049	36.564	37.284	35.897	34.090	31.977	29.996	28.012
DOMESTIC GAS	18.042	20.332	19.736	18.206	16.093	13.756	11.653	9.747	8.258	7.002
NORTH SLOPE GAS	0.0	0.020	0.559	1.248	1.808	2.065	2.064	1.888	1.671	1.441
ENHANCED GAS RECOVERY	0.0	0.002	0.515	1.436	2.606	3.452	3.751	3.632	3.355	2.992
TOTAL DOMESTIC GAS..........	18.042	20.354	20.810	20.890	20.507	19.273	17.468	15.267	13.284	11.435
IMPORTED GAS	0.901	1.062	1.504	1.572	1.354	1.036	0.856	0.798	0.839	0.911
TOTAL GAS..................	18.943	21.416	22.314	22.462	21.861	20.309	18.324	16.065	14.123	12.346
EASTERN LOW-SULFUR COAL	0.701	0.844	0.887	0.868	0.829	0.764	0.695	0.623	0.600	0.612
EASTERN M-HI SULFUR COAL	6.670	5.895	6.280	7.320	8.715	10.228	12.102	15.013	17.560	19.632
EASTERN PREMIUM COAL	1.902	2.884	3.762	4.302	4.759	5.032	5.309	5.498	5.637	5.788
WESTERN LOW-SULFUR COAL	1.018	2.201	4.036	6.332	8.920	11.536	14.460	17.228	19.712	22.261
WESTERN M-HI SULFUR COAL	0.769	0.928	1.547	2.905	5.634	9.147	12.331	14.536	15.560	15.320
MID CONTINENT COAL	3.133	5.170	6.580	7.749	8.869	10.030	11.533	12.271	13.259	14.627
TOTAL COAL.................	14.193	17.922	23.092	29.476	37.726	46.737	56.430	65.169	72.328	78.240
TOTAL FOSSIL FUELS..........	65.433	73.204	80.455	88.502	96.871	102.943	108.844	113.211	116.447	118.598
NUCLEAR.....................	1.847	3.329	6.079	8.395	12.016	16.654	22.052	28.879	36.188	43.076
BIOMASS(BASE)	0.0	0.0	0.0	0.189	0.303	0.375	0.414	0.447	0.477	0.543
BIOMASS(INT)	0.0	0.0	0.0	0.018	0.030	0.039	0.048	0.054	0.063	0.075
BIOMASS(PEAK)										
CENTRAL RENEWABLES(BASE)	0.0	0.0	0.0	0.0	0.153	0.336	0.525	0.753	1.005	1.407
CENTRAL RENEWABLES(INT)	0.0	0.0	0.0	0.0	0.006	0.012	0.021	0.033	0.042	0.060
CENTRAL RENEWABLES(PEAK)										
HYDRO(BASE)	2.907	2.982	3.051	3.177	3.297	3.660	3.660	3.660	3.660	3.660
HYDRO(INT)	0.237	0.243	0.249	0.261	0.270	0.300	0.300	0.300	0.300	0.300
HYDRO(PEAK)	0.024	0.024	0.024	0.027	0.027	0.030	0.030	0.030	0.030	0.030
TOTAL CENTRAL RENEWABLES....	3.168	3.249	3.324	3.672	4.086	4.752	4.998	5.277	5.577	6.075
SOLAR HEAT (RESIDENTIAL)	0.0	0.0	0.0	0.0	0.001	0.001	0.001	0.001	0.001	0.001
SOLAR HEAT (COMMERCIAL)										
SOLAR COOL (COMMERCIAL)										
GEOTHERMAL	0.0	0.002	0.010	0.032	0.089	0.195	0.358	0.575	0.880	1.229
PHOTO VOLTAIC,ETC.										
DISTRIBUTED ELECTRIC										
TOTAL END-USE RENEWABLES	0.0	0.002	0.010	0.032	0.090	0.196	0.359	0.576	0.881	1.230
TOTAL PRIMARY ENERGY........	70.448	79.784	89.868	100.601	113.063	124.545	136.253	147.943	159.093	168.979

Table V-1. (Continued)

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CONSUMPTION BY SECTOR

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
RESIDENTIAL										
OIL	3.069	3.283	3.197	3.130	2.824	2.459	2.146	1.863	1.642	1.446
GAS	5.723	6.253	6.082	5.896	5.299	4.605	4.008	3.459	3.031	2.634
ELECTRICITY	2.161	2.716	3.065	3.634	4.216	4.756	5.270	5.695	6.021	6.309
SOLAR HEAT	0.0	0.0	0.0	0.0	0.001	0.001	0.001	0.001	0.001	0.001
DISTRIBUTED ELECTRIC										
TOTAL......................	10.953	12.252	12.344	12.660	12.340	11.821	11.425	11.018	10.695	10.390
COMMERCIAL										
LIGHT OIL	1.003	0.974	0.854	0.765	0.656	0.542	0.440	0.350	0.294	0.253
HEAVY OIL	0.957	0.931	0.817	0.733	0.630	0.522	0.424	0.337	0.283	0.244
GAS	1.976	2.692	3.036	3.294	3.296	3.110	2.834	2.623	2.454	2.321
ELECTRICITY	1.484	1.888	2.279	2.762	3.273	3.775	4.353	4.978	5.627	6.322
SOLAR HEAT + GEO										
SOLAR COOL										
DISTRIBUTED ELECTRIC										
TOTAL......................	5.420	6.485	6.986	7.554	7.855	7.949	8.051	8.288	8.658	9.140
INDUSTRY										
LIGHT OIL	1.503	1.649	1.864	2.198	2.537	2.812	3.090	3.359	3.593	3.793
HEAVY OIL	2.364	2.693	3.105	3.410	3.800	4.009	4.158	4.255	4.283	4.285
LPG TO PETROCHEMICALS	0.913	1.190	1.476	1.863	2.307	2.697	3.086	3.463	3.797	4.089
REFINERY USE OF OIL	2.763	2.681	2.650	2.705	2.806	2.859	2.907	2.937	2.955	2.947
GAS	6.372	6.921	7.806	8.231	8.664	8.740	8.669	8.432	8.108	7.738
DOMESTIC GAS PRODUCTION	1.516	1.708	1.658	1.529	1.352	1.156	0.979	0.819	0.694	0.588
ENHANCED GAS RECOVERY	0.0	0.000	0.043	0.121	0.219	0.290	0.315	0.305	0.282	0.251
NORTH SLOPE GAS	0.0	0.002	0.047	0.105	0.152	0.173	0.173	0.159	0.140	0.121
ELECTRICITY	2.256	2.714	3.750	4.714	6.003	7.279	8.614	9.963	11.257	12.405
COAL	1.365	1.801	3.403	5.410	8.163	11.147	14.288	17.364	20.221	22.703
MET COAL	2.294	2.306	2.327	2.451	2.581	2.645	2.705	2.759	2.806	2.851
GEOTHERMAL	0.0	0.002	0.010	0.032	0.089	0.195	0.358	0.575	0.880	1.229
TOTAL......................	21.345	23.667	28.139	32.769	38.673	44.002	49.342	54.389	59.016	63.001
TRANSPORTATION										
LIGHT OIL	16.389	16.924	17.581	18.390	19.222	19.472	19.609	19.565	19.330	18.821
HEAVY OIL	0.614	0.957	1.291	1.522	1.736	1.875	1.993	2.090	2.175	2.258
ELECTRICITY										
GAS-PIPELINE TRANS	0.541	0.612	0.663	0.714	0.744	0.735	0.699	0.645	0.591	0.535
TOTAL......................	17.544	18.493	19.535	20.626	21.702	22.082	22.301	22.300	22.095	21.614
TOTAL CONSUMPTION...........	55.263	60.897	67.004	73.609	80.570	85.853	91.119	95.996	100.464	104.145
AUTOMOBILE MILES/GALLON	13.029	14.526	16.378	18.450	20.732	23.072	25.475	28.020	30.692	34.288

Table V-1. (Continued)

SOURCES OF LIQUID FUELS: HIST & C PROJ

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
CONVENTIONAL OIL AND NGL										
DOMESTIC CRUDE OIL	19.995	19.816	18.683	17.635	16.134	13.847	11.681	9.714	8.075	6.692
NORTH SLOPE OIL	0.0	0.942	1.549	2.378	3.297	3.962	4.316	4.349	4.178	3.888
TOTAL CONVENTIONAL OIL......	19.995	20.758	20.232	20.013	19.431	17.809	15.997	14.063	12.253	10.580
ENHANCED OIL RECOVERY.......	0.0	0.034	1.268	2.783	4.345	5.375	5.793	5.690	5.319	4.828
OIL FROM SHALE..............	0.0	0.0	0.003	0.403	1.003	1.783	2.703	3.658	4.538	5.164
SYNTHETIC COAL LIQUIDS......	0.0	0.0	0.0	0.0	0.778	2.618	4.826	7.128	9.163	10.875
TOTAL DOMESTIC PRODUCTION...	19.995	20.792	21.503	23.199	25.557	27.585	29.319	30.539	31.273	31.447
OIL IMPORTS										
CRUDE IMPORTS	8.588	9.535	10.228	10.237	9.568	8.253	7.160	6.360	5.895	5.656
PRODUCT IMPORTS	3.714	3.539	3.318	3.128	2.937	2.677	2.437	2.206	1.991	1.784
TOTAL IMPORTS...............	12.302	13.074	13.546	13.365	12.505	10.930	9.597	8.566	7.886	7.440
TOTAL LIQUIDS SUPPLY........	32.297	33.866	35.049	36.564	38.062	38.515	38.916	39.105	39.159	38.887

Table V-1. (Continued)

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SOURCES OF GASEOUS FUELS: HIST & C PROJ

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
CONVENTIONAL GAS										
DOMESTIC GAS	18.042	20.332	19.736	18.206	16.093	13.756	11.653	9.747	8.258	7.002
NORTH SLOPE GAS	0.0	0.020	0.559	1.248	1.808	2.065	2.064	1.888	1.671	1.441
TOTAL CONVENTIONAL GAS......	18.042	20.352	20.295	19.454	17.901	15.821	13.717	11.635	9.929	8.443
ENHANCED GAS RECOVERY.......	0.0	0.002	0.515	1.436	2.606	3.452	3.751	3.632	3.355	2.992
HI-BTU SYNTHETIC GAS........	0.0	0.0	0.0	0.0	0.080	0.357	0.906	1.650	2.237	2.726
TOTAL DOMESTIC PRODUCTION...	18.042	20.354	20.810	20.890	20.587	19.630	18.374	16.917	15.521	14.161
GAS IMPORTS.................	0.901	1.062	1.504	1.572	1.354	1.036	0.856	0.798	0.839	0.911
TOTAL GAS SUPPLY............	18.943	21.416	22.314	22.462	21.941	20.666	19.230	17.715	16.360	15.072

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COAL DISPOSITION: HIST & C PROJ

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
DIRECT COAL USE										
COAL TO INDUSTRY	1.365	1.801	3.403	5.410	8.163	11.147	14.288	17.364	20.221	22.703
MET COAL TO INDUSTRY	2.294	2.306	2.327	2.451	2.581	2.645	2.705	2.759	2.806	2.851
TOTAL DIRECT USE............	3.659	4.107	5.730	7.861	10.744	13.792	16.993	20.123	23.027	25.554
ELECTRICAL GENERATION.......	8.753	11.656	14.671	18.755	22.730	25.607	28.076	29.259	29.683	29.838
SYNFUELS										
WESTERN LIQUIDS, LOW SULF	0.0	0.0	0.0	0.0	0.277	0.908	1.711	2.681	3.702	4.865
WESTERN SYNGAS, LOW SULF	0.0	0.0	0.0	0.0	0.035	0.157	0.403	0.742	1.016	1.254
WESTERN LIQUIDS, M-HI SULF	0.0	0.0	0.0	0.0	0.704	2.412	4.381	6.212	7.468	8.029
WESTERN SYNGAS, M-HI SULF	0.0	0.0	0.0	0.0	0.038	0.173	0.444	0.808	1.085	1.295
MID-CONTINENT LIQUIDS	0.0	0.0	0.0	0.0	0.083	0.274	0.528	0.822	1.192	1.619
MID-CONTINENT SYNGAS	0.0	0.0	0.0	0.0	0.021	0.091	0.229	0.412	0.558	0.685
APPALACH LIQUIDS, M-HI SULF	0.0	0.0	0.0	0.0	0.047	0.145	0.274	0.468	0.728	1.022
APPALACH SYNGAS, M-HI SULF	0.0	0.0	0.0	0.0	0.018	0.077	0.191	0.345	0.469	0.577
TOTAL COAL TO SYNFUELS......	0.0	0.0	0.0	0.0	1.223	4.237	8.161	12.490	16.218	19.346
COAL EXPORTS................	1.780	2.160	2.690	2.860	3.030	3.100	3.200	3.300	3.400	3.500
TOTAL COAL PRODUCTION.......	14.192	17.923	23.091	29.476	37.727	46.736	56.430	65.172	72.328	78.238

Table V-1. (Continued)

PRIMARY ELECTRICAL INPUT FUELS: HIST & C

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
COAL										
CONVENTIONAL BOILER	8.753	11.656	14.670	15.323	15.933	15.927	15.236	14.217	13.282	12.231
ATMOS FLUIDIZED BED	0.0	0.0	0.0	0.902	1.794	2.565	3.067	3.392	3.549	3.696
COMBINED CYCLE	0.0	0.0	0.0	2.529	5.003	7.115	8.455	9.288	9.693	10.029
MHD	0.0	0.0	0.0	0.0	0.0	0.0	1.317	2.362	3.158	3.882
TOTAL COAL INPUT............	8.753	11.656	14.670	18.754	22.730	25.607	28.075	29.259	29.682	29.838
OIL										
OIL BOILER	2.680	2.539	2.132	1.731	1.391	1.076	0.819	0.586	0.443	0.326
OIL TURBINE	0.042	0.044	0.052	0.056	0.059	0.060	0.063	0.072	0.072	0.073
FUEL CELL OIL	0.0	0.0	0.030	0.041	0.044	0.043	0.044	0.045	0.067	0.094
TOTAL OIL INPUT.............	2.722	2.583	2.214	1.828	1.494	1.179	0.926	0.703	0.582	0.493
GAS										
GAS BOILER	2.754	2.897	2.508	2.059	1.668	1.299	0.991	0.709	0.542	0.402
GAS TURBINE	0.042	0.308	0.437	0.480	0.519	0.547	0.574	0.602	0.576	0.553
TOTAL GAS INPUT.............	2.796	3.205	2.945	2.539	2.187	1.846	1.565	1.311	1.118	0.955
URANIUM										
LWR	1.847	3.329	6.079	8.395	12.016	16.654	22.052	28.849	36.123	42.968
BREEDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.030	0.065	0.109
TOTAL URANIUM INPUT.........	1.847	3.329	6.079	8.395	12.016	16.654	22.052	28.879	36.188	43.077
RENEWABLES										
HYDRO(BASE)	2.907	2.982	3.051	3.177	3.297	3.660	3.660	3.660	3.660	3.660
" (INT)	0.237	0.243	0.249	0.261	0.270	0.300	0.300	0.300	0.300	0.300
" (PEAK)	0.024	0.024	0.024	0.027	0.027	0.030	0.030	0.030	0.030	0.030
BIOMASS(BASE)	0.0	0.0	0.0	0.189	0.303	0.375	0.414	0.447	0.477	0.543
" (INT)	0.0	0.0	0.0	0.018	0.030	0.039	0.048	0.054	0.063	0.075
" (PEAK)										
CENTRAL RENEWABLES(BASE)	0.0	0.0	0.0	0.0	0.153	0.336	0.525	0.753	1.005	1.407
" " (INT)	0.0	0.0	0.0	0.0	0.006	0.012	0.021	0.033	0.042	0.060
" " (PEAK)										
TOTAL RENEWABLES............	3.168	3.249	3.324	3.672	4.086	4.752	4.998	5.277	5.577	6.075
TOTAL GROSS INPUTS..........	19.286	24.022	29.232	35.188	42.513	50.038	57.616	65.429	73.147	80.438
AVERAGE EFFICIENCY.......... (NET/GROSS ELECTRICITY)	0.340	0.338	0.346	0.351	0.353	0.351	0.352	0.350	0.348	0.346
NET GENERATION	6.557	8.131	10.105	12.345	14.991	17.565	20.264	22.929	25.450	27.818
LINE LOSS	0.656	0.813	1.011	1.234	1.499	1.756	2.026	2.293	2.545	2.782
(NET GENERATION MINUS ELECTRICITY TO DEMAND)	5.901	7.318	9.094	11.111	13.492	15.809	18.238	20.636	22.905	25.036
TOTAL ELECTRICITY........... (AVAILABLE TO CONSUMERS)	5.901	7.318	9.094	11.111	13.492	15.809	18.238	20.636	22.905	25.036

Table V-1. (Continued)

EMERGING TECHNOLOGY SUMMARY:HIST & C

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
OIL										
ENHANCED OIL RECOVERY	0.0	0.034	1.268	2.783	4.345	5.375	5.793	5.690	5.319	4.828
SHALE OIL	0.0	0.0	0.003	0.403	1.003	1.783	2.703	3.658	4.538	5.164
COAL LIQUIDS	0.0	0.0	0.0	0.0	0.778	2.618	4.826	7.128	9.163	10.875
TOTAL OIL..................	0.0	0.034	1.271	3.186	6.126	9.776	13.322	16.476	19.020	20.867
GAS										
ENHANCED GAS RECOVERY	0.0	0.002	0.515	1.436	2.606	3.452	3.751	3.632	3.355	2.992
HI BTU GAS FROM COAL	0.0	0.0	0.0	0.0	0.080	0.357	0.906	1.650	2.237	2.726
TOTAL GAS..................	0.0	0.002	0.515	1.436	2.686	3.809	4.657	5.282	5.592	5.718
ELECTRICITY(PRIMARY)										
COMBINED CYCLE (BASE)	0.0	0.0	0.0	0.896	1.765	2.499	2.950	3.217	3.335	3.430
" " (INT)	0.0	0.0	0.0	0.065	0.136	0.205	0.263	0.311	0.347	0.379
" " (PEAK)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.001	0.002	0.002
ATMOS FLUID BED (BASE)	0.0	0.0	0.0	0.285	0.563	0.800	0.948	1.039	1.078	1.114
" " " (INT)	0.0	0.0	0.0	0.031	0.064	0.097	0.124	0.147	0.162	0.176
" " " (PEAK)	0.0	0.0	0.0	0.0	0.0	0.0	0.001	0.001	0.002	0.003
FUEL CELLS (BASE)	0.0	0.0	0.008	0.010	0.010	0.009	0.008	0.007	0.006	0.006
" " (INT)	0.0	0.0	0.003	0.004	0.004	0.004	0.004	0.004	0.003	0.003
" " (PEAK)	0.0	0.0	0.0	0.001	0.001	0.003	0.005	0.007	0.017	0.029
MHD (BASE)	0.0	0.0	0.0	0.0	0.0	0.0	0.558	0.998	1.330	1.631
" (INT)	0.0	0.0	0.0	0.0	0.0	0.0	0.034	0.065	0.091	0.116
" (PEAK)										
BIOMASS (BASE)	0.0	0.0	0.0	0.063	0.101	0.125	0.138	0.149	0.159	0.181
" (INT)	0.0	0.0	0.0	0.006	0.010	0.013	0.016	0.018	0.021	0.025
" (PEAK)										
CENTRAL RENEWABLES(BASE)	0.0	0.0	0.0	0.0	0.051	0.112	0.175	0.251	0.335	0.469
" " (INT)	0.0	0.0	0.0	0.0	0.002	0.004	0.007	0.011	0.014	0.020
" " (PEAK)										
TOTAL ELECTRICITY...........	0.0	0.0	0.011	1.361	2.707	3.871	5.231	6.226	6.902	7.584
DECENTRALIZED RENEWABLES										
SOLAR HEAT(RES)	0.0	0.0	0.0	0.0	0.001	0.001	0.001	0.001	0.001	0.001
DIST ELECTRIC(RES)										
SOLAR HEAR(COMM)										
SOLAR COOL(COMM)										
DIST ELECTRIC(COMM)										
GEOTHERMAL	0.0	0.002	0.010	0.032	0.089	0.195	0.358	0.575	0.880	1.229
TOTAL DECENTRAL RENEWS......	0.0	0.002	0.010	0.032	0.090	0.196	0.359	0.576	0.881	1.230
TOTAL END-USE...............	0.0	0.038	1.807	6.015	11.609	17.652	23.569	28.560	32.395	35.399

Table V-1. (Continued)

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DOE ENERGY INFORMATION ADMINISTRATION

CONSUMPTION BY FUEL

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
LIGHT OIL										
RESIDENTIAL	3.069	3.283	3.197	3.130	2.824	2.459	2.146	1.863	1.642	1.446
COMMERCIAL	1.003	0.974	0.854	0.765	0.656	0.542	0.440	0.350	0.294	0.253
INDUSTRY	1.503	1.649	1.864	2.198	2.537	2.812	3.090	3.359	3.593	3.793
TRANSPORTATION	16.389	16.924	17.581	18.390	19.222	19.472	19.609	19.565	19.330	18.821
TOTAL......................	21.964	22.830	23.496	24.483	25.239	25.285	25.285	25.137	24.859	24.313
HEAVY OIL										
COMMERCIAL	0.957	0.931	0.817	0.733	0.630	0.522	0.424	0.337	0.283	0.244
INDUSTRY	2.364	2.693	3.105	3.410	3.800	4.009	4.158	4.255	4.283	4.285
TRANSPORTATION	0.614	0.957	1.291	1.522	1.736	1.875	1.993	2.090	2.175	2.258
REFINERY USE	2.763	2.681	2.650	2.705	2.806	2.859	2.907	2.937	2.955	2.947
TOTAL......................	6.698	7.262	7.863	8.370	8.972	9.265	9.482	9.619	9.696	9.734
GAS										
RESIDENTIAL	5.723	6.253	6.082	5.896	5.299	4.605	4.008	3.459	3.031	2.634
COMMERCIAL	1.976	2.692	3.036	3.294	3.296	3.110	2.834	2.623	2.454	2.321
INDUSTRY	6.372	6.921	7.806	8.231	8.664	8.740	8.669	8.432	8.108	7.738
PIPELINE TRANSMISSION	0.541	0.612	0.663	0.714	0.744	0.735	0.699	0.645	0.591	0.535
LPG TO INDUSTRY	0.913	1.190	1.476	1.863	2.307	2.697	3.086	3.463	3.797	4.089
FIELD USE	1.516	1.710	1.748	1.755	1.723	1.619	1.467	1.282	1.116	0.961
TOTAL......................	17.041	19.378	20.811	21.753	22.033	21.506	20.763	19.905	19.096	18.278
COAL										
INDUSTRY	1.365	1.801	3.403	5.410	8.163	11.147	14.288	17.364	20.221	22.703
MET COAL TO INDUSTRY	2.294	2.306	2.327	2.451	2.581	2.645	2.705	2.759	2.806	2.851
TOTAL......................	3.659	4.107	5.730	7.861	10.744	13.792	16.993	20.123	23.027	25.554
ELECTRICITY										
RESIDENTIAL	2.161	2.716	3.065	3.634	4.216	4.756	5.270	5.695	6.021	6.309
COMMERCIAL	1.484	1.888	2.279	2.762	3.273	3.775	4.353	4.978	5.627	6.322
INDUSTRY	2.256	2.714	3.750	4.714	6.003	7.279	8.614	9.963	11.257	12.405
TRANSPORTATION										
TOTAL......................	5.901	7.318	9.094	11.110	13.492	15.810	18.237	20.636	22.905	25.036
RENEWABLES										
SOLAR HEAT (RESIDENTIAL)	0.0	0.0	0.0	0.0	0.001	0.001	0.001	0.001	0.001	0.001
DISTRIBUTED ELECTRIC (RES)										
SOLAR HEAT (COMMERCIAL)										
SOLAR COOL (COMMERCIAL)										
DISTRIBUTED ELECTRIC (COMM)										
TOTAL......................	0.0	0.0	0.0	0.0	0.001	0.001	0.001	0.001	0.001	0.001
OTHER										
GEOTHERMAL (INDUSTRY)	0.0	0.002	0.010	0.032	0.089	0.195	0.358	0.575	0.880	1.229
TOTAL CONSUMPTION...........	55.263	60.897	67.004	73.609	80.570	85.853	91.119	95.996	100.464	104.145

Table V-1. (Continued)

SUMMARY PAGE

	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
DEMAND										
RESIDENTIAL	10.953	12.252	12.344	12.660	12.340	11.821	11.425	11.018	10.695	10.390
COMMERCIAL	5.420	6.485	6.986	7.554	7.855	7.949	8.051	8.288	8.658	9.140
INDUSTRIAL	21.345	23.667	28.139	32.769	38.673	44.002	49.342	54.389	59.016	63.001
TRANSPORTATION	17.544	18.493	19.535	20.626	21.702	22.082	22.301	22.300	22.095	21.614
TOTAL DEMAND	55.263	60.897	67.004	73.609	80.570	85.853	91.119	95.996	100.464	104.145
SUPPLY										
OIL	32.297	33.866	35.049	36.564	37.284	35.897	34.090	31.977	29.996	28.012
GAS	18.943	21.416	22.314	22.462	21.861	20.309	18.324	16.065	14.123	12.346
COAL	14.193	17.922	23.092	29.476	37.726	46.737	56.430	65.169	72.328	78.240
NUCLEAR	1.847	3.329	6.079	8.395	12.016	16.654	22.052	28.879	36.188	43.076
CENTRAL RENEWABLES	3.168	3.249	3.324	3.672	4.086	4.752	4.998	5.277	5.577	6.075
END-USE RENEWABLES	0.0	0.002	0.010	0.032	0.090	0.196	0.359	0.576	0.881	1.230
TOTAL SUPPLY	70.448	79.784	89.868	100.601	113.063	124.545	136.253	147.943	159.093	168.979
LOSSES	15.185	18.887	22.863	26.992	32.493	38.691	45.134	51.947	58.629	64.834

convergence criteria, etc., are used. Noting that the "ARC '78" LEAP system evaluated in the ORNL research program was not archived by DOE OAA and that the number of iterations, convergence criteria, etc., used by DOE OAA to obtain the ARC '78 LEAP-related results were not documented, there is the possibility that a slightly different version of LEAP and a different number of iterations, convergence criteria, etc., were used by OAA and the MET. Therefore, the ORNL MEP results were considered to replicate the ARC '78 Chapter 5 results if data were within 3 percent or 0.1 quad. The 0.1 quad criterion is used where quantities are relatively small and percentage differences are not indicative of accurate replication.

Most of the numbers credited to LEAP in ARC '78 Chapter 5 are found verbatim in the Model 22C report summary. However, DOE OAA obtained some numbers in ARC '78 by using LEAP results to calculate required data, i.e., "hand-calculated data." The logic used by DOE OAA in the calculations is not documented; therefore, the "hand-calculated data" were addressed in the replication study only when the logic used to obtain the final values was available to the MET.

Included among the 15 tables in ARC '78 Chapter 5 were nine tables which contained detailed energy projection data credited to LEAP, and thus, were candidates for an ORNL replication study — Tables 5.2, 5.3, and 5.6-5.12. Results of the replication study for each of these tables are presented below. No comparisons were made for the data in Tables 5.1, 5.5, and 5.13-5.15 because the data were either irrelevant to a replication study or repeated from other tables.

The footnote on Table 5.4 of Ref. 3 indicates that the tabulated primary energy prices were determined at a point in the network as close to the resource point as possible, and evaluated using a weighted average (based on output quantity). In the case of crude oil prices, this note must be understood to imply that prices were taken at the crude oil allocation node in the oil/gas sector and that they include transportation costs. Price increments are found in specific process data for Generic Process 5. Imported oil is excluded from these average prices.[25] Due to the undocumented logic used to calculate the prices, no replication study comparisons are made for the data in Table 5.4.

ARC '78 Table 5.2. Energy Supply and Disposition, Series C

ARC '78 Table 5.2 includes LEAP-calculated data for domestic sectorial (e.g., coal, gas, etc.) supply and disposition (e.g., residential, commercial, etc.) for the years 1995, 2000, 2010, and 2020. Most of the long-term data were taken directly from pp. 20, 24, and 28 of the Model 22C report summary (see Table V-1). A side-by-side comparison of the ARC '78 data and the Model 22C data is given in Table V-2. Percent differences between the Model 22C and ARC '78 data, rounded to the nearest percent, are shown in the table. All comparable data are within the accepted agreement criteria.

Values for sectoral energy disposition were not generally measured at the inputs to the sectoral end-use DEMAND activities as one might assume. The tabulated results are, in fact, the sum of all the inputs

Table V-2. Comparison of LEAP Model 22C and ARC '78 Table 5.2 LEAP-Related Results — Energy Supply and Disposition (Quadrillion Btu)

	Year 1995			Year 2000			Year 2010			Year 2020		
	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]
Domestic Supply												
Coal	38.0	37.7	-1	46.9	46.7	0	65.2	65.2	0	78.0	78.2	0
Gas	20.5	20.5	0	19.3	19.3	0	15.3	15.3	0	11.4	11.4	0
Nuclear	12.2	12.0	-2	16.9	16.7	-1	29.2	28.9	-1	43.6	42.4	-3
Oil	24.8	24.8	0	24.9	25.0	0	23.2	23.4	1	20.3	20.6	1
Other	4.2	4.2	0	5.0	5.0	0	5.9	5.9	0	7.4	7.3	-1
Total Domestic Supply	99.7	99.1	-1	113.0	112.7	0	138.8	138.7	0	160.7	159.9	0
Net Gas Imports	1.4	1.4	0	1.0	1.0	0	0.8	0.8	0	0.9	0.9	0
Net Oil Imports	12.6	12.5	-1	11.0	10.9	-1	8.6	8.6	0	7.4	7.4	0
Total Supply	113.6	113.1	0	125.0	124.5	0	148.2	147.9	0	169.1	169.0	0
Disposition												
Residential	12.3	12.3	0	11.8	11.8	0	11.0	11.0	0	10.4	10.4	0
Commercial	7.9	7.9	0	7.9	7.9	0	8.3	8.3	0	9.1	9.1	0
Industrial	38.6	38.7	0	43.9	44.0	0	54.1	54.4	1	62.6	63.0	1
Transportation	21.7	21.7	0	22.0	22.1	0	22.2	22.3	0	21.5	21.6	0
Total End-Use Consumption	80.5	80.6	0	85.7	85.9	0	95.7	96.0	0	103.6	104.1	0
Conversion Loss[b]	30.1	29.5[c]	-2	36.1	35.5[c]	-2	49.2	48.6[c]	-1	62.0	61.4[c]	-1
Coal Exports	3.0	3.0	0	3.1	3.1	0	3.3	3.3	0	3.5	3.5	0

[a] $\Delta\% \equiv \frac{\text{LEAP Model 22C} - \text{ARC '78 Chpt. 5}}{\text{ARC '78 Chpt. 5}} \times 100.$

[b] Includes conversion loss due to utility and synthetics.

[c] Conversion Loss = Total Supply - (Total End-Use Consumption) - Coal Exports.

Note: Columns may not add to totals due to rounding.

into each demand sector (as at the bottom of Fig. I-1 for the residential sector) plus any energy generated within the sector (i.e., solar, geothermal, etc.). Industrial sector use also includes energy used to refine oil in the oil/gas sector.[4]

The utility conversion losses include all the heat energy losses in electricity production from coal, oil, or other fuels; plus, for example, the conversion loss that would occur if hydroelectric energy were produced by burning fossil fuel (efficiency = 1/3). The tabulated synthetic fuel conversion loss includes losses in making synthetic gas from coal in the coal sector, but not the losses in making low Btu gas in the industrial sector.[4]

ARC '78 Table 5.3. Energy Supply/Demand Trends: History and Projections, Series C, 1960-2020

ARC '78 Table 5.3 includes energy supply and demand trends expressed in growth rates per year for four time intervals, viz., 1960-1977, 1977-1995, 2000-2010, and 2010-2020. The growth rates for the last two time intervals were hand-calculated using LEAP Model 22C data. The MET assumed that LTEAD determined the supply and disposition growth rates by calculating the ten-year percentage growth from LEAP-produced energy supply and disposition data in ARC '78 Table 5.2 and then taking the tenth roots of the results to find yearly growth rates. Average growth rates were assumed to have been calculated in the same manner using total end-use consumption quantities. A side-by-side comparison of the ARC '78 data and the data calculated in the replication study is given in Table V-3. Since results were not

Table V-3. Comparison of ARC '78 Table 5.3 Results and Results Derived from LEAP Model 22C — Energy Supply/Demand Trends[a] (Growth Rates per Year)

	Year 2000-2010			Year 2010-2020		
	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[b]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[b]
Domestic Supply						
Coal	3.4	3.4	0	1.8	1.8	0
Natural Gas	-2.3	-2.3	0	-2.9	-2.9	0
Nuclear	5.7	5.7	0	4.1	4.1	0
Crude Oil	-0.7	-0.6	14	-1.3	-1.3	0
Domestic Disposition						
Coal	3.8	3.9	0	2.4	2.4	0
Electricity	2.7	2.7	0	1.9	2.0	5
All Gases	-0.8	-0.8	0	-0.9	-0.8	11
All Liquids	0.04	0.06	50	-0.2	-0.2	0
Average Growth	1.1	1.1	0	0.8	0.8	0

[a]ARC '78 Table 5.3 also included growth rate data for the years 1960-1977 and 1977-1995. Data for these years were not based entirely on LEAP results and, therefore, were not considered in the replication study.

[b] $\Delta\% \equiv \frac{\text{LEAP Model 22C} - \text{ARC '78 Chpt. 5}}{\text{ARC '78 Chpt. 5}} \times 100.$

taken directly from the LEAP output, the comparison is made without comment.

ARC '78 Table 5.6. Energy Consumption by Sector: History and Projections, Series C

ARC '78 Table 5.6 includes long-term projections of energy consumption by the residential, commercial, industrial, and transportation sectors for 1995, 2000, 2010, and 2020. The long-term results were taken from p. 21 of the Model 22C report summary (Table V-1). A side-by-side comparison of the ARC '78 and Model 22C data is given in Table V-4. Except for solar consumption in the residential sector, all comparable data are within the accepted agreement criteria.

Table V-4. Comparison of LEAP Model 22C and ARC '78 Table 5.6 LEAP-Related Results--
Energy Consumption by Sector (Quadrillion Btu)

	Year 1995			Year 2000			Year 2010			Year 2020		
	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]
Residential												
Electricity	4.2	4.2	0	4.7	4.8	2	5.3	5.7	7	5.6	6.3	12
Gas[b]	5.3	5.3	0	4.6	4.6	0	3.5	3.5	0	2.6	2.6	0
Light Oil	2.8	2.8	0	2.5	2.5	0	1.9	1.9	0	1.4	1.4	0
Solar	0.0	---	---	0.1	---	---	0.4	---	---	0.7	---	---
Commercial												
Electricity	3.3	3.3	0	3.8	3.8	0	5.0	5.0	0	6.3	6.3	0
Gas[b]	3.3	3.3	0	3.1	3.1	0	2.6	2.6	0	2.3	2.3	0
Light Oil	0.7	0.7	0	0.5	0.5	0	0.3	0.3	0	0.3	0.3	0
Heavy Oil	0.6	0.6	0	0.5	0.5	0	0.3	0.4	33[c]	0.2	0.2	0
Industrial												
Coal	10.7	10.7	0	13.8	13.8	0	20.0	20.1	1	25.4	25.6	1
Electricity	6.0	6.0	0	7.3	7.3	0	9.9	10.0	1	12.3	12.4	1
Gas[b]	10.4	10.4	0	10.3	10.4	1	9.7	9.7	0	8.7	8.7	0
Light Oil	4.8	4.8	0	5.5	5.5	0	6.8	6.8	0	7.8	7.9	1
Heavy Oil	6.6	6.6	0	6.8	6.9	1	7.2	7.2	0	7.2	7.2	0
Solar/Geothermal	0.1	0.1	0	0.2	0.2	0	0.6	0.6	0	1.3	1.2	-8[c]
Transportation												
Light Oil	19.2	19.2	0	19.4	19.5	1	19.5	19.6	1	18.8	18.8	0
Heavy Oil	1.7	1.7	0	1.9	1.9	0	2.1	2.1	0	2.3	2.3	0
Gas[b]	0.7	0.7	0	0.7	0.7	0	0.6	0.6	0	0.5	0.5	0
Total End-Use Consumption[d]	80.5	80.6	0	85.7	85.9	0	95.7	96.0	0	103.6	104.1	0

[a] $\Delta\% \equiv \dfrac{\text{LEAP Model 22C} - \text{ARC '78 Chpt. 5}}{\text{ARC '78 Chpt. 5}} \times 100.$

[b] Gas refers to all high-Btu gaseous fuels and excludes low-Btu gas.

[c] Less than 0.1 quad difference.

[d] Columns may not add to totals due to rounding.

Values for solar energy end-use consumption in the residential sector are not found in the Model 22C output for the solar heat activity; likewise, values for electrical energy usage are less than the value given in the model output by a corresponding amount. Diedrich et al.[26] indicate that the lack of adequate data on solar installations led the OAA to "drop" that node and correct the electric heater node to cover the combined input. A November 1979 communication from John Pearson[27] clarified that the model node for residential electric heat accounted for a combination of resistance heating, heat pumps, and solar heating. Details were given of an off-line analysis, which indicated that the presence and assumed use of the solar option had reduced the required electric input (for the given demand) by the amounts shown in the ARC '78 "Solar" entries.[4]

<u>ARC '78 Table 5.7. Energy Prices by Sector: History and Projections, Series C</u>

ARC '78 Table 5.7 includes long-term projections of energy prices for the residential, commercial, transportation, and industrial sectors. The price projections are not directly available in the Model 22C output; however, using conversion factors and a price inflator, the energy prices can be calculated from data accessible in the LEAP results. Prices are obtained from the corresponding output links of each energy source in the distribution sector (Nodes 66, 75, 89, 90, and 122) and are converted from \$/MMBtu in 1975 to various unit prices in 1975 dollars with the following conversion factors:

$$\text{Electric: } \frac{\$1}{\text{MMBtu}} = \frac{\$0.3412}{\text{kwH}}$$

$$\text{Light Oil: } \frac{\$1}{\text{MMBtu}} = \frac{\$0.1381}{\text{gal}}$$

$$\text{Heavy Oil: } \frac{\$1}{\text{MMBtu}} = \frac{\$6.30}{\text{bbl}}$$

$$\text{Coal: } \frac{\$1}{\text{MMBtu}} = \frac{\$22.70}{\text{short ton}}$$

Use of a price inflator of 1.19 (e.g., 1975 dollars x 1.19 = 1978 dollars) with the converted prices from the output links gave the Model 22C price projections which are compared with the ARC '78 data in Table V-5. The procedure used to obtain "Raw Material" price projections shown in ARC '78 was not known; thus, no comparisons were made for these data. All comparable data are within the accepted agreement criteria.

ARC '78 Table 5.8. Primary Electrical Input Fuels: History and Projections, Series C

ARC '78 Table 5.8 includes projections for primary electrical input fuels for five years including 2000, 2010, and 2020. Model 22C data for the replication study were taken from p. 25 of the report summary (see Table V-1). A side-by-side comparison of the ARC '78 data and the Model 22C data is given in Table V-6. All comparable data are within the accepted agreement criteria.

Table V-5. Comparison of LEAP Model 22C and ARC '78 Table 5.7 LEAP-Related Results — Energy Prices by Sector (1978 Dollars)

National Average	Year 2000 ARC '78 Chpt. 5	Year 2000 LEAP Model 22C	Year 2000 Δ%[a]	Year 2010 ARC '78 Chpt. 5	Year 2010 LEAP Model 22C	Year 2010 Δ%[a]	Year 2020 ARC '78 Chpt. 5	Year 2020 LEAP Model 22C	Year 2020 Δ%[a]
Residential									
Electricity (¢/kwH)	4.62	4.62	0	4.68	4.67	0	4.78	4.78	0
Light Oil ($/gal)	0.93	0.94	1	1.02	1.03	1	1.11	1.11	0
Gas[b] ($/mmBtu)	5.09	5.09	0	5.89	5.89	0	6.43	6.43	0
Commercial									
Electricity (¢/kwH)	4.63	4.62	0	4.68	4.67	-1	4.80	4.78	0
Light Oil ($/gal)	0.89	0.89	0	0.99	0.99	0	1.06	1.07	1
Heavy Oil ($/bbl)	34.49	35.17	2	38.75	39.52	2	42.34	43.13	2
Gas ($/mmBtu)	4.59	4.59	0	5.39	5.38	0	5.93	5.93	0
Transportation									
Light Oil ($/gal)	1.05	1.05	0	1.14	1.15	1	1.23	1.22	-1
Heavy Oil ($/bbl)	33.75	34.42	2	38.01	38.77	2	41.60	42.38	2
Industrial									
Electricity (¢/kwH)	3.46	3.46	0	3.52	3.52	0	3.63	3.62	0
Light Oil ($/gal)	0.89	0.89	0	0.99	0.99	0	1.07	1.07	0
Heavy Oil ($/bbl)	34.33	35.02	2	38.59	39.37	2	42.19	42.98	2
Coal ($/short ton)	45.17	45.56	1	50.03	50.49	1	55.39	55.92	1
Natural Gas ($/mmBtu)	4.69	4.69	0	5.49	5.4	0	6.02	6.02	0

[a] $\Delta\% \equiv \dfrac{\text{LEAP Model 22C} - \text{ARC '78 Chpt. 5}}{\text{ARC '78 Chpt. 5}} \times 100.$

[b] Gas refers to all high-Btu gaseous fuels and excludes low-Btu gas.

Table V-6. Comparison of LEAP Model 22C and ARC '78 Table 5.8 LEAP-Related Results -- Primary Electrical Input Fuels (Quadrillion Btu)

	Year 2000			Year 2010			Year 2020		
	ARC '78 Chpt. 5	LEAP Model 22C	Δ%a	ARC '78 Chpt. 5	LEAP Model 22C	Δ%a	ARC '78 Chpt. 5	LEAP Model 22C	Δ%a
Coal	25.8	25.6	-1	29.4	29.2	-1	29.7	30.0	1
Conventional	16.1	15.9	-1	14.3	14.2	-1	12.2	12.2	0
AFB	2.6	2.6	0	3.4	3.4	0	3.7	3.7	0
Combined Cycle	7.1	7.1	0	9.3	9.3	0	10.0	10.0	0
MHD	0	0	0	2.4	2.4	0	3.9	3.9	0
Oil and Gas	3.1	3.0	-3	2.0	2.0	0	1.5	1.5	0
Oil	1.2	1.2	0[b]	0.7	0.7	0	0.5	0.5	0
Gas	1.9	1.8	-5[b]	1.3	1.3	0	1.0	1.0	0
Nuclear	16.9	16.7	-1	29.2	28.9	-1	43.6	43.1	-1
Renewables	4.8	4.8	0	5.3	5.3	0	6.1	6.1	0
Hydro/Geothermal	4.0	4.0	0	4.0	4.0	0	4.0	4.0	0
Other	0.8	0.8	0	1.3	1.3	0	2.1	2.1	0
Total Gross Inputs	50.5	50.0	1	65.9	65.4	-1	80.8	80.4	-1
Net Generation	17.5	17.6	1	22.8	22.9	0	27.7	27.8	0
Transmission and Distribution Losses	1.8	1.8	0	2.3	2.3	0	2.8	2.8	0
Electricity Available to Consumers	15.8	15.8	0	20.6	20.6	0	24.9	25.0	0

[a] $\Delta\% \equiv \frac{\text{LEAP Model 22C} - \text{ARC '78 Chpt. 5}}{\text{ARC '78 Chpt. 5}} \times 100.$

[b] Less than 0.1 quad difference.

Note: Columns may not add to totals due to rounding.

<u>ARC '78 Table 5.9. Emerging Technology Summary: History and Projections, Series C</u>

ARC '78 Table 5.9 displays the trends in synthetic crude and high Btu gas production for 2000, 2010, and 2020. The long-term projections were taken from p. 26 of the Model 22C report summary (Table V-1). Side-by-side comparisons of the ARC '78 and Model 22C data are given in Table V-7. Except for residential solar in decentralized renewables and low Btu (industrial) gas, all data are within the accepted agreement criteria. Model 22C does not project a substantial amount of solar energy consumption for the period 1995-2020; thus, there were no data to compare to the ARC '78 data.

The low Btu gas is not available in any form in the Model 22C summary report printout. Clarification from Mary Hutzler described the low-med Btu with combined cycle activity in the electrical sector as part of the industrial process. Therefore, part of the energy output could be counted within the constraints of Table 5.9. An off-line determination was made concerning the share of energy that would be counted as low Btu gas production.

<u>ARC '78 Table 5.10. Coal Disposition: History and Projections, Series C</u>

ARC '78 Table 5.10 includes long-term projections of coal disposition (use) for 2000, 2010, and 2020. Data in the table illustrate how the patterns of coal consumption are expected to change. The long-term data were taken directly from p. 24 of the Model 22C

Table V-7. Comparison of LEAP Model 22C and ARC '78 Table 5.9 LEAP-Related Results -- Emerging Technology Summary (Quadrillion Btu)

	Year 2000			Year 2010			Year 2020		
	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]
Oil	9.8	9.8	0	16.4	16.5	1	20.9	20.9	0
Enhanced	5.4	5.4	0	5.7	5.7	0	4.8	4.8	0
Shale	1.8	1.8	0	3.6	3.7	3	5.1	5.2	2
Coal Liquids	2.6	2.6	0	7.2	7.1	1	11.0	10.9	1
Gas	7.9			12.1			14.8		
Enhanced	3.5	3.5	0	3.6	3.6	0	3.0	3.0	0
High Btu	0.4	0.4	0	1.6	1.7	6[c]	2.7	2.7	0
Low Btu (industrial)[b]	4.1			6.8			9.1		
Electricity (secondary)	3.9	3.9	0	6.2	6.2	0	7.6	7.6	0
Combined Cycle	2.7	2.7	0	3.5	3.5	0	3.8	3.8	0
AFB	0.9	0.9	0	1.2	1.2	0	1.3	1.3	0
Fuel Cells	0.02	0.02	0	0.02	0.02	0	0.04	0.04	0
MHD	0	0	0	1.1	1.1	0	1.7	1.7	0
Other	0.3	0.3	0	0.4	0.4	0	0.7	0.7	0
Decentralized Renewables	0.3	0.2	-33	1.0	0.6	-40	1.9	1.2	-37
Residential Solar	0.1	---	---	0.4	---	---	0.7	---	---
Industrial Geothermal	0.2	0.2	0	0.6	0.6	0	1.3	1.2	-7[c]

[a] $\Delta\% \equiv \frac{\text{LEAP Model 22C} - \text{ARC '78 Chpt. 5}}{\text{ARC '78 Chpt. 5}} \times 100.$

[b] Shown as coal in all other tables.

[c] Less than 0.1 quad difference.

Note: Columns may not add to totals due to rounding.

report summary (see Table V-1). A side-by-side comparison of the ARC '78 data and the Model 22C data is given in Table V-8. All comparable data are within the accepted agreement criteria.

ARC '78 Table 5.11. Sources of Gaseous Fuels: History and Projections, Series C

ARC '78 Table 5.11 includes long-term projections of the sources of gaseous fuels for 2000, 2010, and 2020. The data were taken directly from p. 23 of the Model 22C report summary. Side-by-side data comparisons are shown in Table V-9. All comparable data are within the accepted agreement criteria.

ARC '78 Table 5.12. Sources of Liquid Fuels: History and Projections, Series C

ARC'78 Table 5.12 includes long-term projections of the sources of liquid fuels for 2000, 2010, and 2020. Data were taken directly from p. 22 of the Model 22C report summary. Side-by-side comparisons are shown in Table V-10. All comparable data are within the accepted agreement criteria.

VI. CONCLUSIONS

Lack of adequate documentation to describe "the" theory embodied in LEAP and Model 22C, the size and complexity of the LEAP source code, the changes being made to the economic model during the early phases of the project, and difficulties encountered in establishing an ORNL-Washington computing link combined to initially make the LEAP system a complicated system from the perspective of the MEP computing support staff. Cohen

Table V-8. Comparison of LEAP Model 22C and ARC '78 Table 5.10 LEAP-Related Results--Coal Disposition (Quadrillion Btu)

	Year 2000			Year 2010			Year 2020		
	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]
Direct Use	13.8	13.8	0	20.0	20.1	1	25.4	25.6	1
Electrical Generation	25.8	25.6	-1	29.4	29.3	0	29.7	29.8	0
Synfuels	4.2	4.2	0	12.5	12.5	0	19.4	19.3	-1
Net Exports	3.1	3.1	0	3.3	3.3	0	3.5	3.5	0
Total Production	46.9	46.7	0	65.2	65.2	0	78.0	78.2	0

[a] $\Delta\% \equiv \frac{\text{LEAP Model 22C} - \text{ARC '78 Chpt. 5}}{\text{ARC '78 Chpt. 5}} \times 100.$

Table V-9. Comparison of LEAP Model 22C and ARC '78 Table 5.11 LEAP-Related Results - Sources of Gaseous Fuels (Quadrillion Btu)

	Year 2000			Year 2010			Year 2020		
	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]
Conventional Gas									
Continental United States	13.7	13.8	1	9.7	9.7	0	7.0	7.0	0
Alaska	2.1	2.1	0	1.9	1.9	0	1.4	1.4	0
Unconventional Gas[b]	3.4	3.5	3	3.6	3.6	0	3.0	3.0	0
Gas Synthetics									
High Btu	0.4	0.4	0	1.6	1.7	6[d]	2.7	2.7	0
Total Domestic Production	19.6	19.6	0	16.9	16.9	0	14.1	14.2	1
Net Gas Imports	1.0	1.0	0	0.8	0.8	0	0.9	0.9	0
Total Gas Consumption[c]	20.6	20.7	0	17.7	17.7	0	15.0	15.1	1

[a] $\Delta\% \equiv \frac{\text{LEAP Model 22C} - \text{ARC '78 Chpt. 5}}{\text{ARC '78 Chpt. 5}} \times 100.$

[b] Same as Enhanced Gas Recovery in Model 22C report summary (see Table V-1).

[c] Same as Total Gas Supply in Model 22C report summary (see Table V-1).

[d] Within 0.1 quad.

Table V-10. Comparison of LEAP Model 22C and ARC '78 Table 5.12 LEAP-Related Results--
Sources of Liquid Fuels (Quadrillion Btu)

	Year 2000			Year 2010			Year 2020		
	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]	ARC '78 Chpt. 5	LEAP Model 22C	Δ%[a]
Conventional Oil & NGL									
Continental U.S.	13.8	13.8	0	9.6	9.7	1	6.6	6.7	2
Alaska	4.0	4.0	0	4.3	4.3	0	3.9	3.9	0
Enhanced Oil Recovery	5.4	5.4	0	5.7	5.7	0	4.8	4.8	0
Oil From Shale	1.8	1.8	0	3.6	3.7	3	5.1	5.2	2
Synthetic Coal Liquids	2.6	2.6	0	7.2	7.1	-1	11.0	10.9	-1
Total Domestic Production	27.5	27.6	0	30.4	30.5	0	31.3	31.4	0
Net Oil Imports	11.0	10.9	-1	8.6	8.6	0	7.4	7.4	0
Total Liquids Supply	38.5	38.5	0	39.0	39.1	0	38.7	38.9	1

[a] $\Delta\% \equiv \frac{\text{LEAP Model 22C} - \text{ARC '78 Chpt. 5}}{\text{ARC '78 Chpt. 5}} \times 100.$

and Pearson's LEAP Users' Manual (circa late 1979),[2] the LTEAD CLISTs, and the advice of the LTEAD staff contributed significantly to the LEAP operational expertise that is now claimed by the ORNL staff. In addition, the MEP team now has a thorough understanding of the LEAP source code and Model 22C. When all support and computing equipment is functioning satisfactorily, the present ORNL-FCF communication link is proving to be an adequate system for the current project computational level.

The LEAP system is not currently transportable. To put the code system in the public domain, the data base management system, which is proprietary, needs to be replaced, and core memory requirements (two megabytes for the ARC '78 Model 22C version) need to be significantly reduced.

A simplified benchmark problem (Model 82) was developed at ORNL to facilitate the understanding of LEAP and to serve as a testbed for methodology development. The LEAP source included herein and other ORNL documents for the MEP provide a fully reliable guide to detailed model formulation. Input data for the model, which were not previously documented, were obtainable by listing the Model 22C MITs. A Model 22C base case was used as a sample problem for in-house personnel training. With the experience that the Model Evaluation Team now has, it takes approximately one month to train an individual without prior SUPERWYLBUR or LEAP experience to execute a LEAP problem with expertise.

In support of the Model Evaluation Program, the ORNL staff has used the LEAP system to produce many alternative Model 22C scenarios under widely varying assumptions. With the experience, the Model Evaluation Team can now effectively utilize the LEAP system as a modeling tool. With only a few exceptions, all LEAP-calculated prices and quantities in Chapter 5 of ARC '78 can be replicated within "accepted agreement criteria."

There is now a policy to archive versions of codes and data sets used in the generation of supporting material for the Annual Report to Congress. Archiving of LEAP requires detailed information because it is evidently common practice to stop the calculation during execution, make a change (e.g., in a relaxation parameter), and restart. This archiving was formally instituted after the ARC '78 effort. Although testing of the archiving process is not yet completed, it is undoubtedly an important step toward assuring that the entire calculation process could be reproduced.

In the future, it would be desirable to take steps to make LEAP generally available because critical review and use by the public sector (e.g., universities, laboratories, industry) might add considerably to the credibility and improvement of LEAP. The documentation developed in the course of this project should help in this regard. However, a non-proprietary data base management system and considerably reduced core requirements seem to be essential development requirements. Through January 1981, the LEAP system has been maintained and used for projections in at least two more EIA Annual Reports to Congress (ARC '79 and ARC '80).

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APPENDIX A

SUBROUTINE HIERARCHICAL FLOWCHART OF THE ARC '78 LEAP PROGRAM

The FORTRAN source program for the version of LEAP used to prepare data for ARC '78 was made available to ORNL on June 7, 1979. An undocumented ORNL program was used to produce the subroutine hierarchical flowchart of the code shown in Figs. A-1 through A-12. The flowchart lists the subprograms called by the different subprograms in LEAP in a step-type fashion with the steps identified as levels in Figs. A-1 through A-12.

LEAP consists of 210 subprograms plus the MAIN program. Figure A-1 shows which subroutines are called by the MAIN program. A numbered circle at the right of a subprogram name identifies the figure containing the flowchart for that subprogram, e.g., a SUBA n indicates that the flowchart of the subprograms called by SUBA is given in Fig. A-n. If a subprogram calls enough other subprograms to require two flowcharts, two numbered circles appear after the subprogram name.

Depending on the type of problem and options required, the call for a subprogram or for a group of subprograms may occur many times in a particular subprogram. For these cases, the called subprograms are listed only once in the figures and are listed in alphabetical order in the subprogram flowchart.

APPENDICES

ORNL-DWG 80-18601

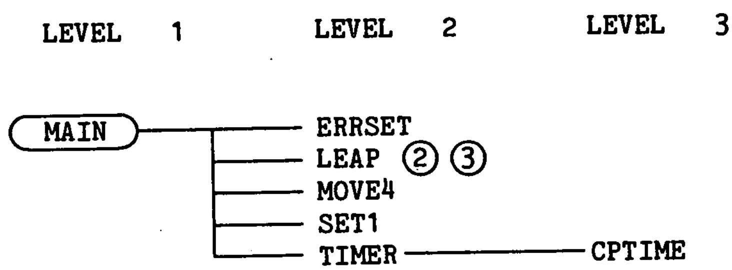

Fig. A-1. Subroutine Flowchart for LEAP MAIN Program.

ORNL-DWG 80-18602

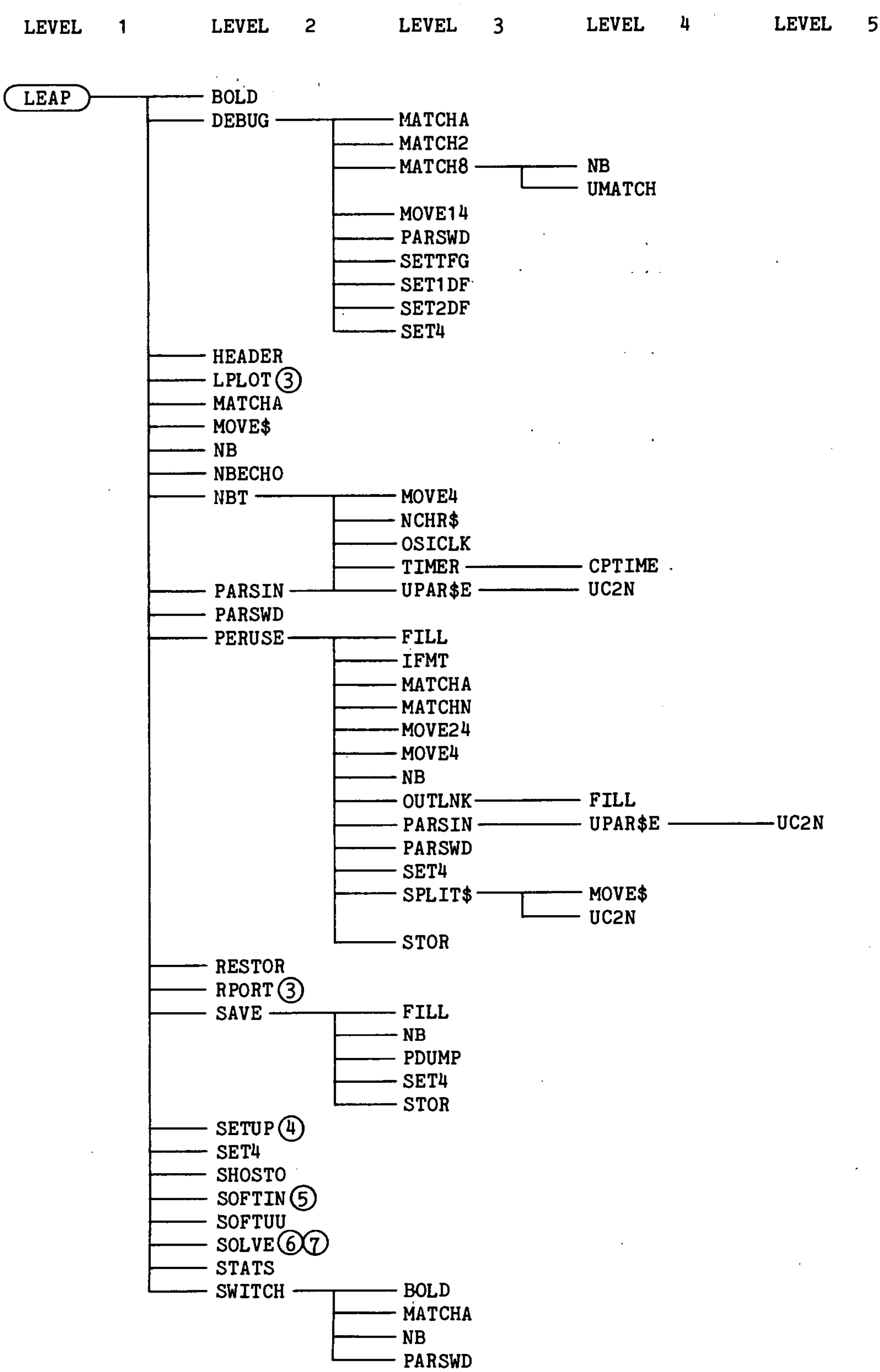

Fig. A-2. First Subroutine Flowchart for LEAP Subprogram LEAP.

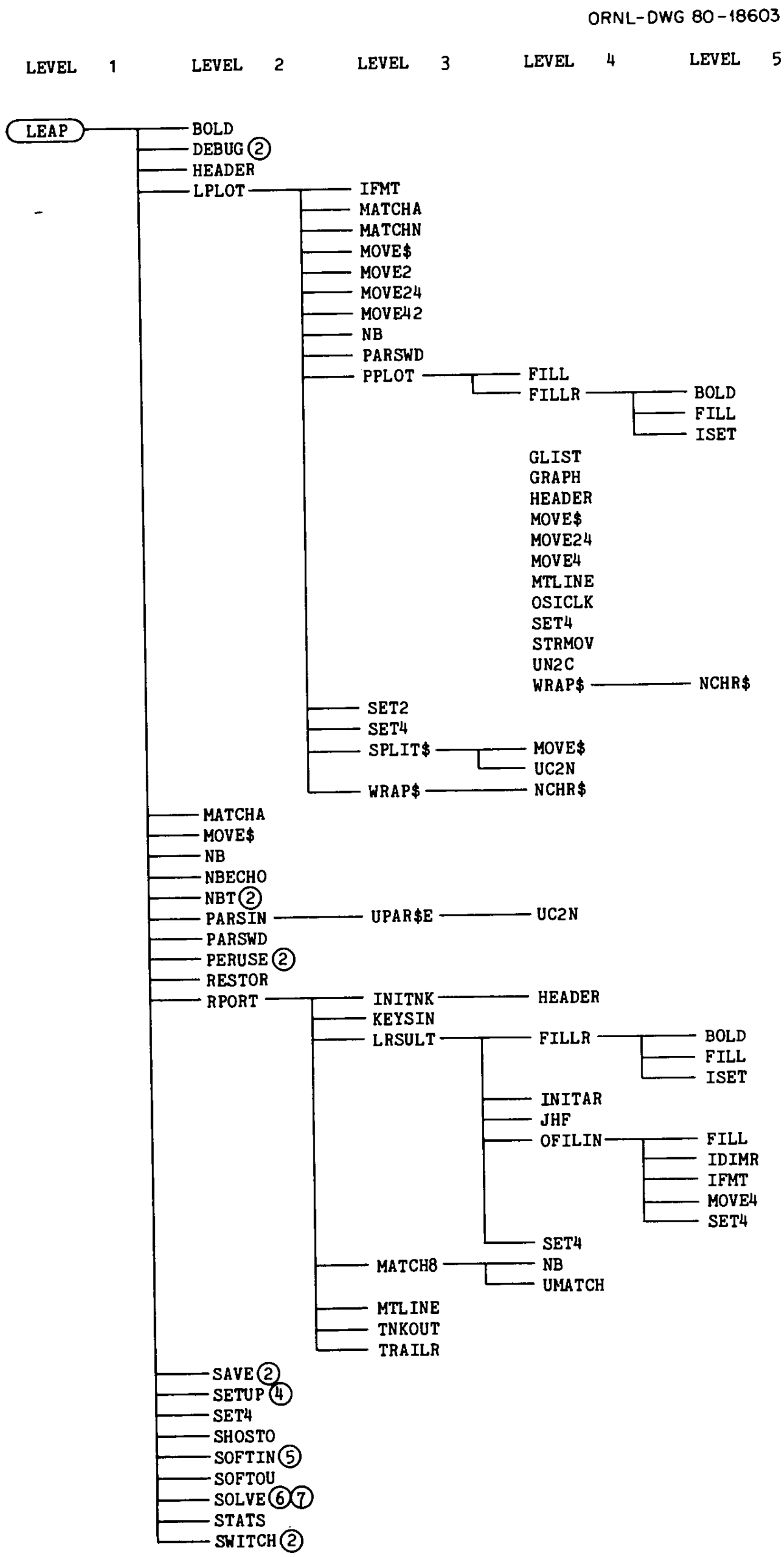

Fig. A-3. Second Subroutine Flowchart for LEAP Subprogram LEAP.

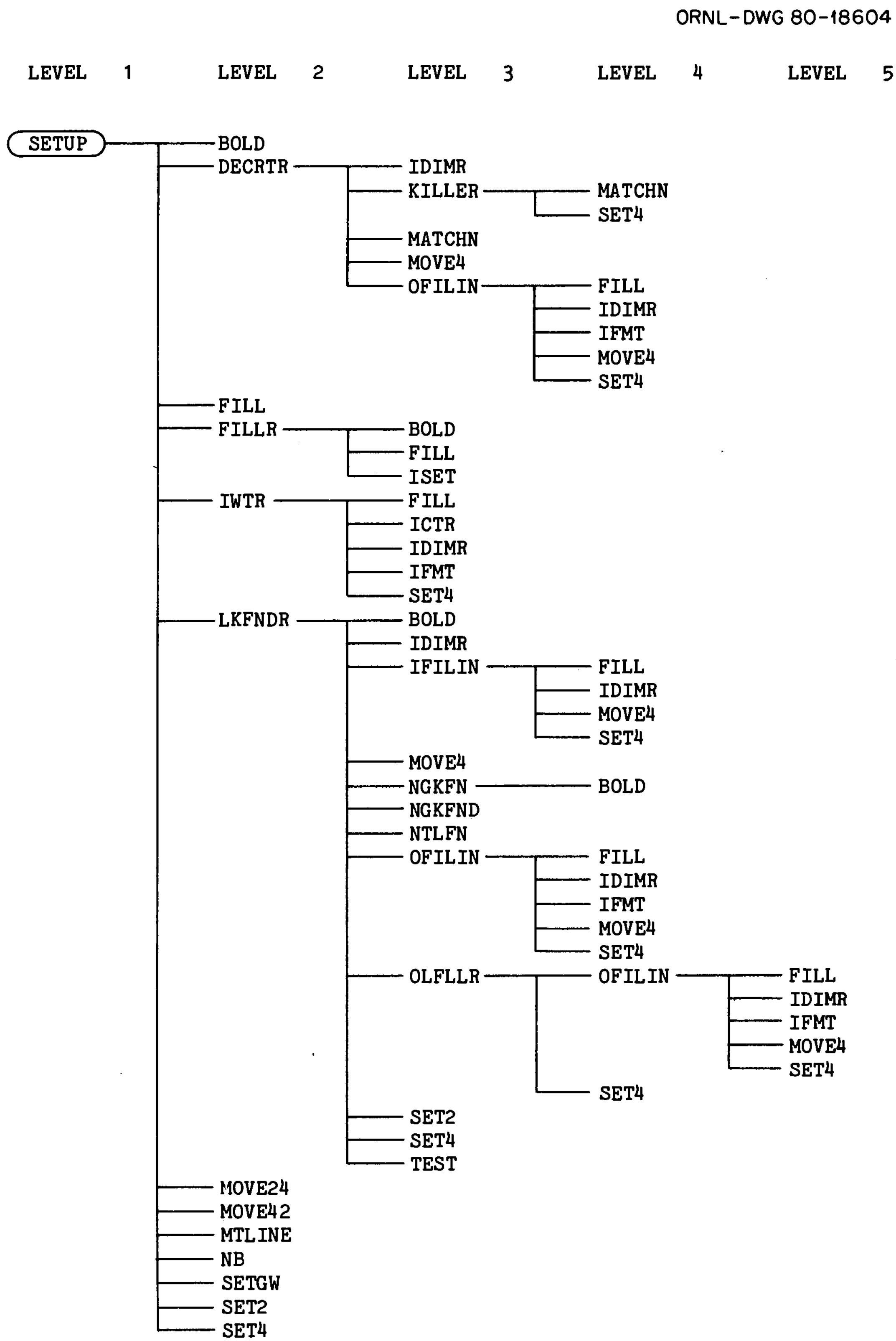

Fig. A-4. Subroutine Flowchart for LEAP Subprogram SETUP.

ORNL-DWG 80-18605

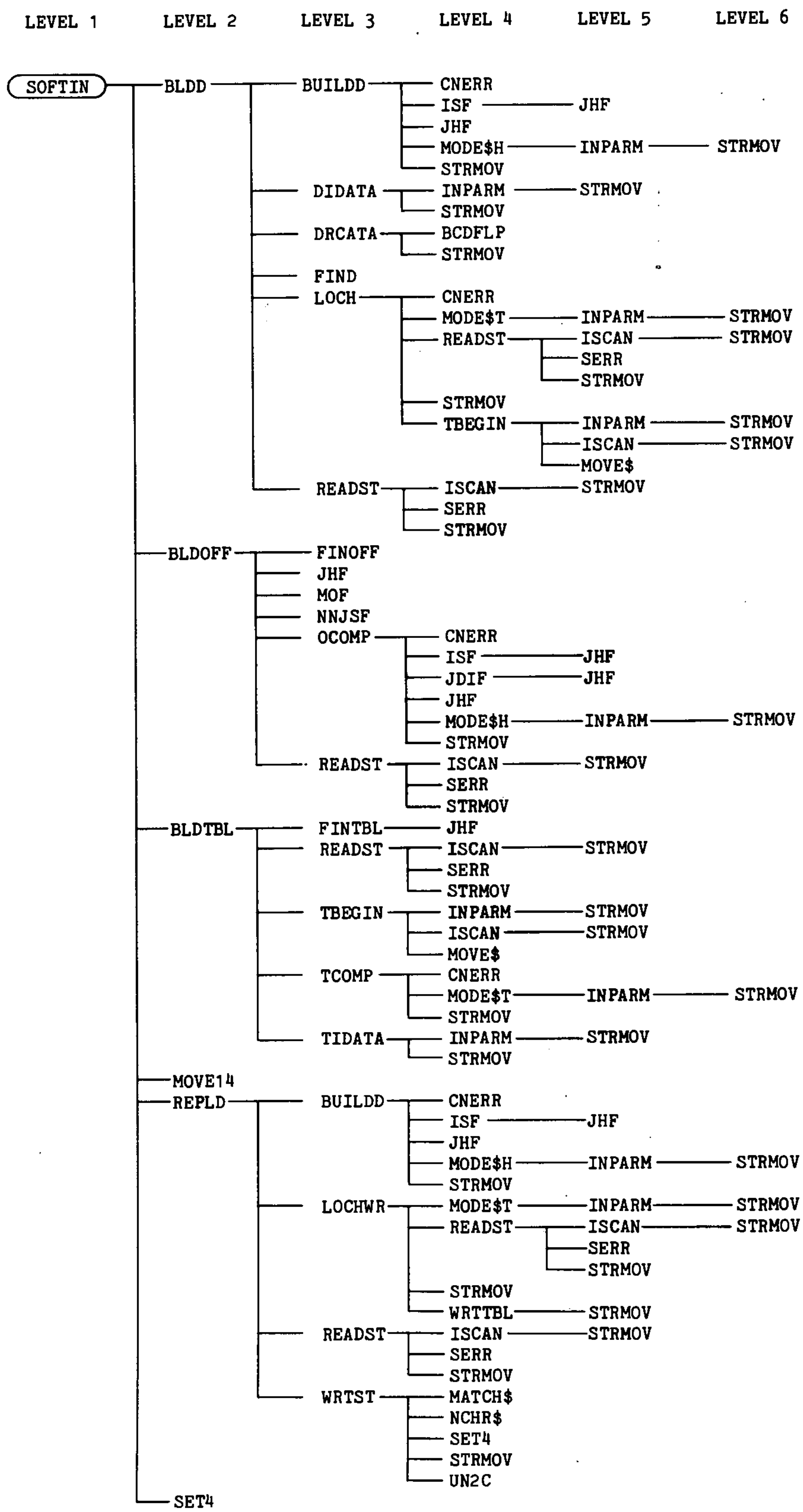

Fig. A-5. Subroutine Flowchart for LEAP Subprogram SOFTIN.

ORNL-DWG 80-18606

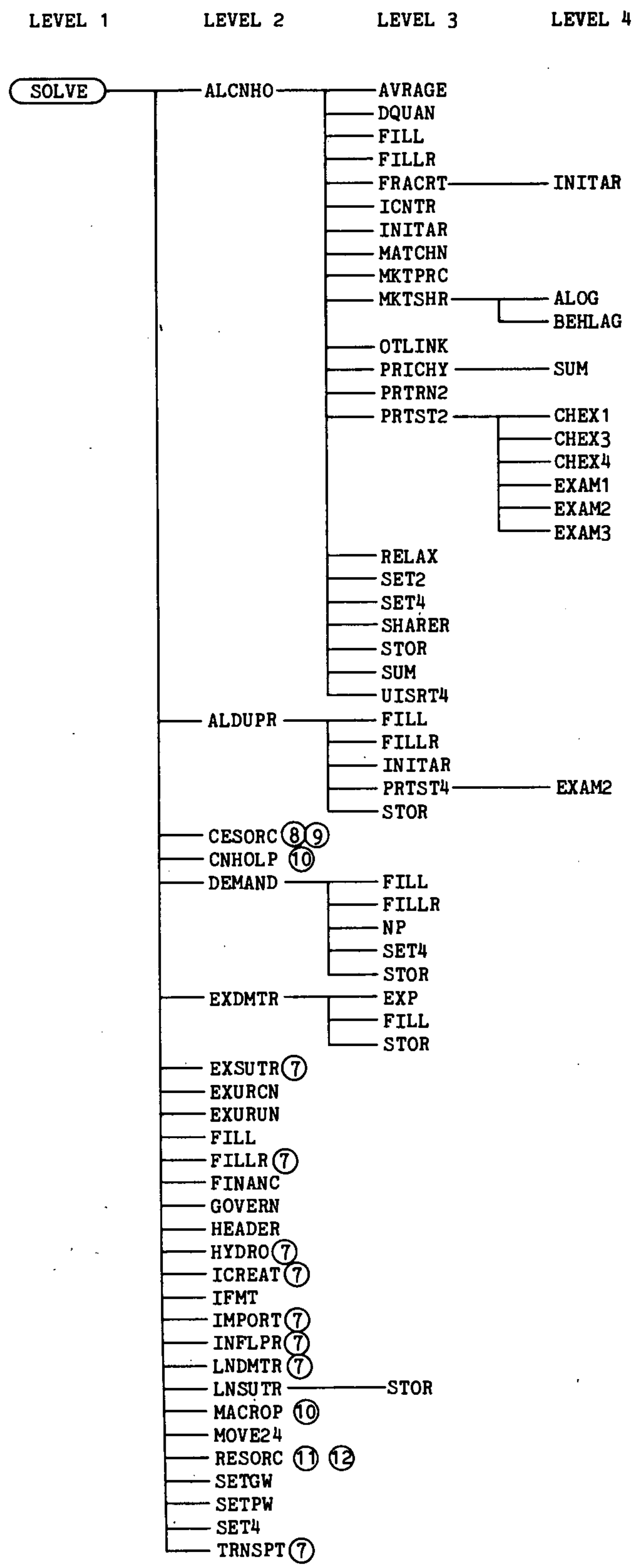

Fig. A-6. First Subroutine Flowchart for LEAP Subprogram SOLVE.

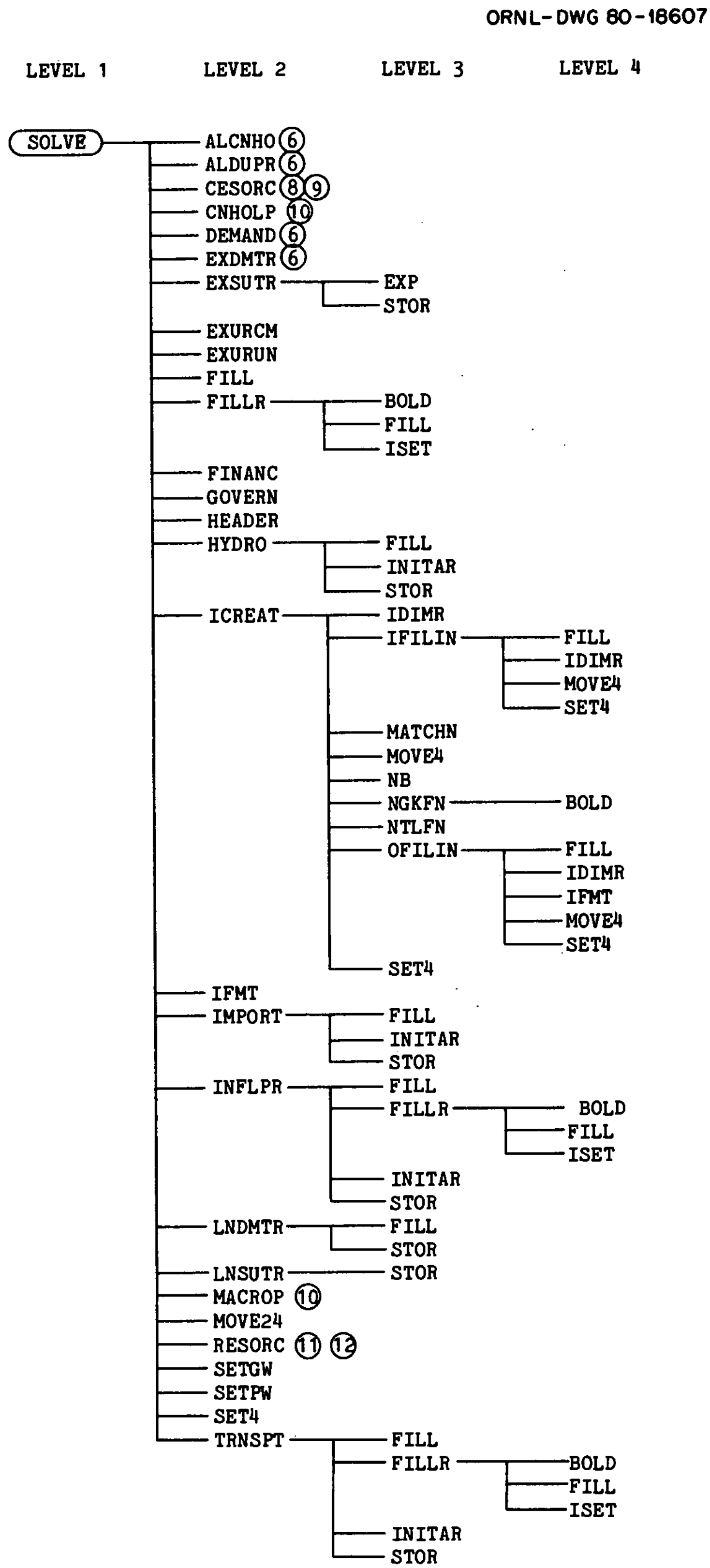

Fig. A-7. Second Subroutine Flowchart for LEAP Subprogram SOLVE.

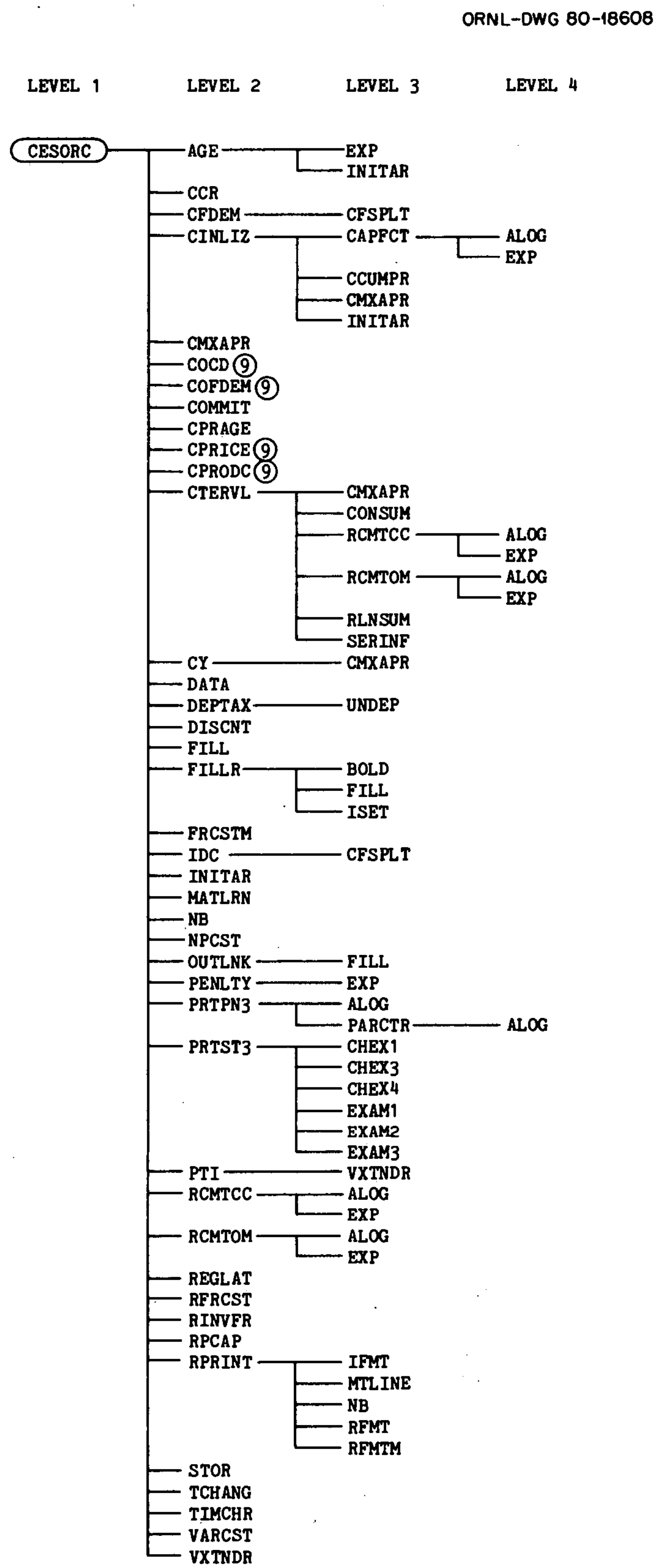

Fig. A-8. First Subroutine Flowchart for LEAP Subprogram CESORC.

ORNL-DWG 80-18609

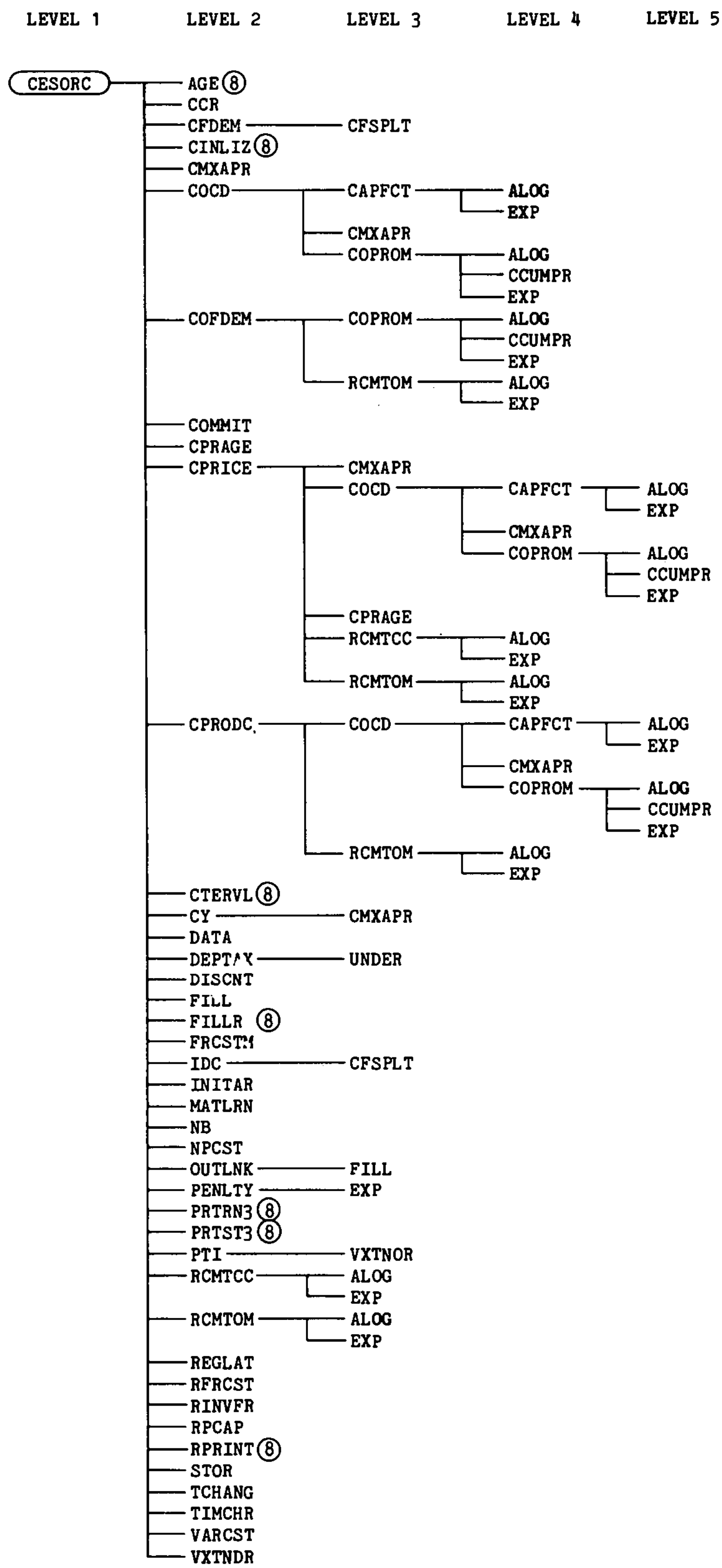

Fig. A-9. Second Subroutine Flowchart for LEAP Subprogram CESORC.

ORNL-DWG 80-18640

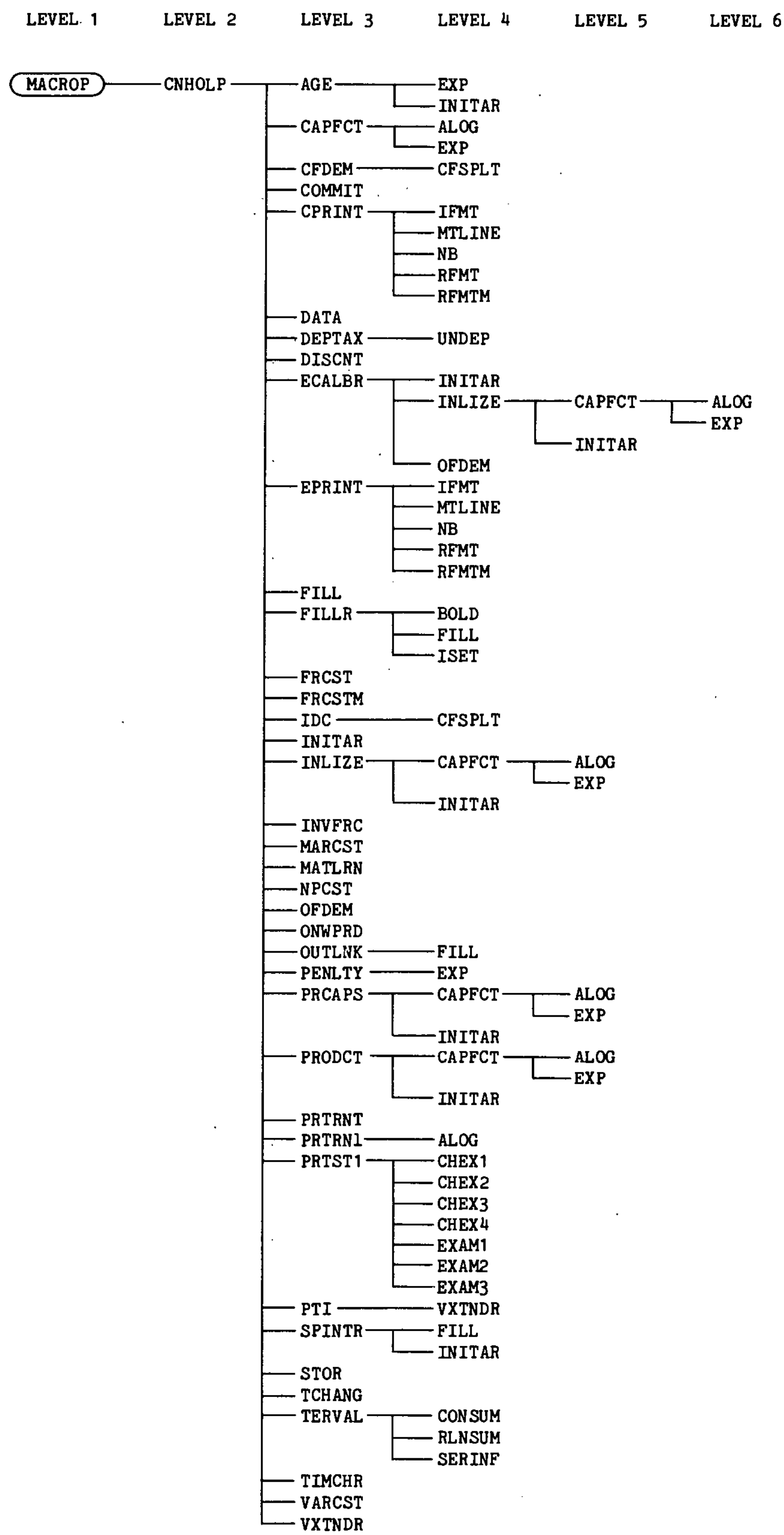

Fig. A-10. Subroutine Flowchart for LEAP Subprogram MACROP.

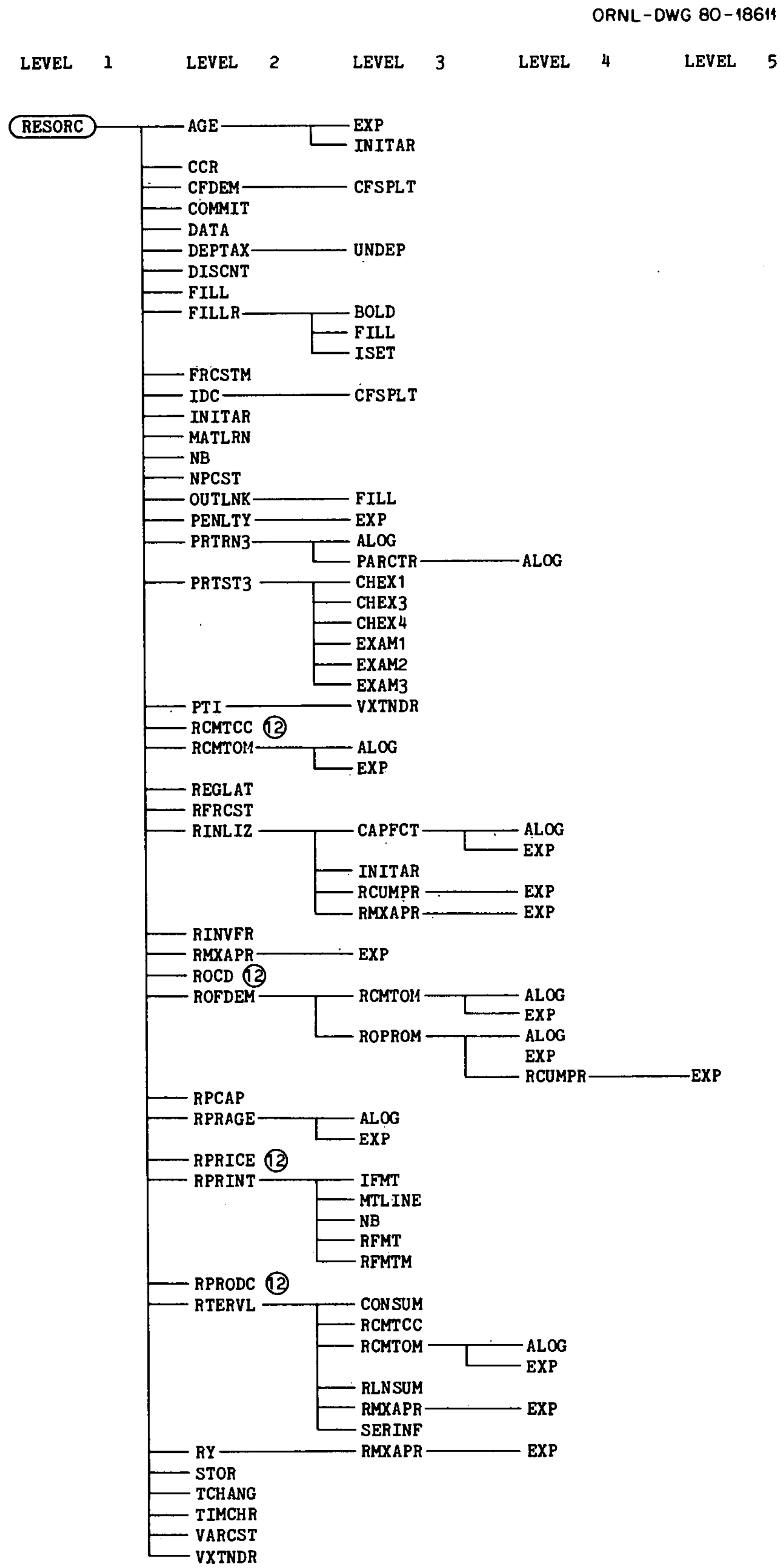

Fig. A-11. First Subroutine Flowchart for LEAP Subprogram RESORC.

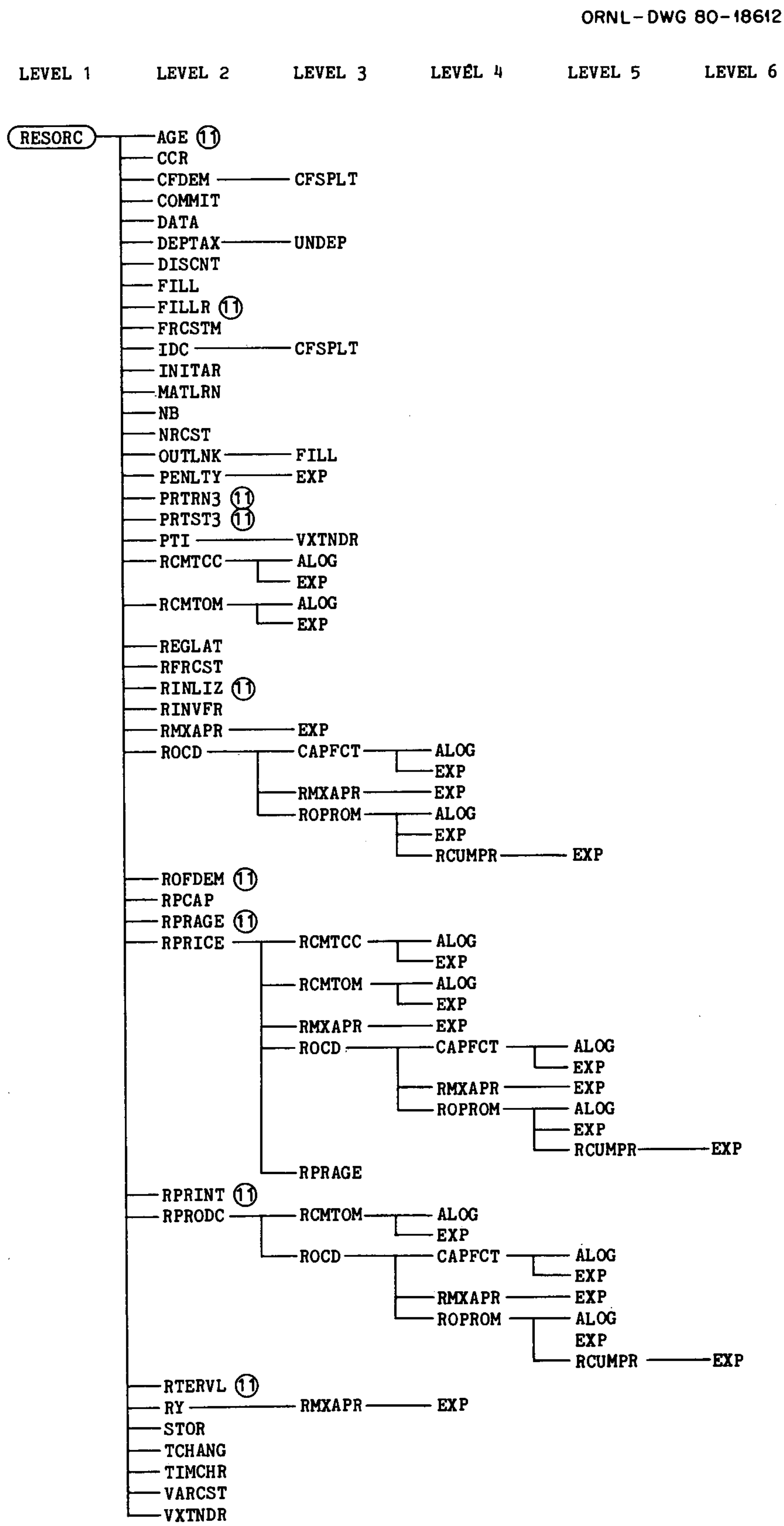

Fig. A-12. Second Subroutine Flowchart for LEAP Subprogram RESORC.

APPENDIX B

MODEL 22C INPUT TABLES

"The DFI Energy-Economy Modeling System embodies a structural approach to economic modeling. A structural approach emphasizes the identification of the relationships among basic economic activities and variables describing these activities. These relationships are made explicit through use of flow diagrams and behavioral models that employ meaningful parameters."* In the LEAP system, parameters (input data) are stored in the data base storage system. A data transfer system is used to transfer input data from the DBSS to the energy-economy model logic. This collection of data for a specific model is known as a "string file" for the model.

As noted in Chapter II, EIA/OAA made the "frozen" string file for Model 22C available to ORNL on May 24, 1979. The EXECUTIVE program of the LEAP system can be used to structure a model data base and enter, edit, and display input and output data in tabular form. To provide a historical record of the Model 22C input data, the EXECUTIVE was used to produce the following "input tables" from the frozen Model 22C string file:

---

* Quoted from p. I-3 of Ref. 4.

Model 22C Input Tables

Table Number[a]	Table Title[a]	Shown on Pages
N/A	Input/Output	B-3
N/A	Labeled Common Size	B-4
N/A	Labeled Common Order	B-5
N/A	Name Conditionality	B-6
N/A	Storage Conditionality	
1	(no table)	
2	(no table)	
3	Input Links Table	B-7
4	Output Links Table	B-8
5	Network Table - Links	B-9
6	Activity Output Links	B-31
7	Activity Pointer Table	B-51
8	Global Region Data	B-62
9	Local Region Data	B-63
10	Time-Dependent Parameters	B-64
11	Generic Process Data	B-65
12	Specific Process Data	B-66
13	Demand Inports Indexes	B-78
14	Availabilities and Energy Fractions (Loading)	B-83
15	Load Factors	B-87
16	Load Factors for Electricity	B-88
17	(no table)	
18	Flags	B-89
19	Fractions at Equal Prices for Allocation	B-91
20	(no table)	
21	Initial Conditions	B-93
22	Initial Conditions - Electricity Sector	B-129

The input data parameters are defined with proper units in Ref. 21, a companion report to this series. The data are further correlated with the equations in LEAP in Ref. 13, another companion report.

[a]Table number and table title as specified by the EXECUTIVE. "N/A" designates tables which were not numbered by the EXECUTIVE.

INPUT/OUTPUT

		AT	TM	SP	GP	SL	IL	OL	AC	SC	LR	GR
		1	2	3	4	5	6	7	8	9	10	11
GR INPUT LINKS	1	1	0	0	0	0	-2	0	0	0	0	-1
GR OUTPUT LINKS	2	1	0	0	0	0	0	-2	0	0	0	-1
SECTOR INPUT LINKS	3	1	0	0	0	0	-2	0	0	-1	1	1
SECTOR OUTPUT LINKS	4	1	0	0	0	0	0	-2	0	-1	1	1
ACTIVITY INPUT LINKS	5	-4	0	0	0	0	-2	0	-1	-3	1	1
ACTIVITY OUTPT LINKS	6	-4	0	0	0	0	0	-2	-1	-3	1	1
ACT. POINTER TABLE	7	-2	0	0	0	0	0	0	-1	-3	1	-4
GLOBAL REGION DATA	8	-2	0	0	0	0	0	0	0	0	0	-1
LOCAL REGION DATA	9	-2	0	0	0	0	0	0	0	-1	1	-3
TIME PARAMETERS	10	-2	-1	0	0	0	0	0	0	0	0	0
GENERIC PROCESS DATA	11	-2	0	0	-1	0	0	0	0	0	0	0
SPECIFIC PROCESS DAT	12	-2	0	-1	-3	0	0	0	0	0	0	0
DEMAND/IMPORT INDEXS	13	-2	-1	0	0	0	0	0	0	-3	1	1
AVAIL. & ENERGY LOAD	14	1	0	-2	-1	-3	0	0	0	0	0	0
LOAD FACTORS	15	1	0	0	-1	-2	0	0	0	0	0	0
LOAD FACTORS-ELECTRI	16	2	0	-1	3	-2	0	0	0	0	0	0
	17	-2	0	0	0	0	0	0	0	0	-1	0
WRITE FLAGS	18	-1	0	0	0	0	0	0	0	0	0	0
ALLOC INPUT LINK DAT	19	1	0	-2	-3	1	-1	0	0	0	0	0
DUMMY TABLE	20	0	0	0	0	0	0	0	0	0	0	0
INITIAL CONDS-1ST SL	21	-2	0	0	0	1	0	-3	-1	-4	1	1
INITIAL CONDS.-ELECT	22	-3	0	0	0	-2	0	1	-1	4	1	1
IC-DEBT IN SECTORS	23	****	****	****	****	****	****	****	****	****	****	****
IC-DEBT/FIN. SEC.	24	****	****	****	****	****	****	****	****	****	****	****
	25	****	****	****	****	****	****	****	****	****	****	****
OUTPUTS-1ST SL	26	-2	-1	0	0	1	0	-3	-4	-5	1	-6
OUTPUTS-ELECT	27	-2	-1	0	0	-3	0	1	-4	4	1	1
	28	0	0	0	0	0	0	0	0	0	0	0
	29	1	-1	0	0	1	0	-2	3	1	1	2
REGD RESOURCE PRICE	30	2	-1	0	0	-4	0	0	-2	-3	1	1
OUTPUTS-DEBT	31	-2	-1	0	0	2	0	-3	-4	-5	1	-6
OUTPUTS BY ACTIVITY	32	-2	-1	0	0	-3	0	-4	-5	-6	1	1
OUTPT QUANT. BY ACT	33	1	-1	0	0	1	0	1	-2	-3	1	-4
OUTPUT PRICES BY ACT	34	2	-1	0	0	1	0	1	-2	-3	1	-4
OUTPUT-CAP. ADDITION	35	1	-1	0	0	-4	0	0	-2	-3	1	1
LR NAMES	36	-2	-3	0	0	-4	0	-5	-6	-7	-1	-8
SC NAMES	37	-2	-3	0	0	-4	0	-5	-6	-1	-7	-8
AC NAMES	38	-2	-3	0	0	-4	0	-5	-1	-6	-7	-8
OL NAMES	39	-2	-3	0	0	-4	0	-1	-5	-6	-7	-8
SL NAMES	40	-2	-3	0	0	-1	0	-4	-5	-6	-7	-8
SL NAMES	41	1	1	0	0	-1	0	-2	-3	-4	1	-5
NEW CAP NAMES	42	-1	1	0	0	-5	0	0	-2	-3	1	-4

LABELED COMMON SIZE

		AT 1	TM 2	SP 3	GP 4	SL 5	IL 6	OL 7	AC 8	SC 9	LR 10	GR 11
MODEL1	1	100	0	0	0	0	0	0	0	0	0	0
TIME2	2	6	50	0	0	0	0	0	0	0	0	0
GR3	3	6	0	0	0	0	0	0	0	0	0	0
GRAC4	4	4	0	0	0	0	0	0	0	0	0	0
GRSC5	5	4	0	0	0	0	0	0	0	0	0	0
SCAC6	6	4	0	0	0	0	0	0	0	0	0	0
LR7	7	4	0	0	0	0	0	0	0	0	0	0
LRAC8	8	4	0	0	0	0	0	0	0	0	0	0
SC9	9	8	0	0	0	0	0	0	0	0	0	0
AC10	10	6	0	0	0	0	0	0	0	0	0	0
GROL11	11	2	0	0	0	0	0	20	0	0	0	0
GRIL12	12	2	0	0	0	0	20	0	0	0	0	0
LROL13	13	2	0	0	0	0	0	20	0	0	0	0
LRIL14	14	2	0	0	0	0	20	0	0	0	0	0
SCOL15	15	2	0	0	0	0	0	25	0	0	0	0
SCIL16	16	2	0	0	0	0	25	0	0	0	0	0
ACOL17	17	2	0	0	0	0	0	40	0	0	0	0
ACIL18	18	2	0	0	0	0	30	0	0	0	0	0
GPAT19	19	16	0	0	0	0	0	0	0	0	0	0
SPAT20	20	20	0	0	0	0	0	0	0	0	0	0
PRST21	21	2	50	0	0	5	0	0	0	0	0	0
PROT22	22	3	50	0	0	5	0	0	0	0	0	0
PRIT23	23	5	50	0	0	5	0	0	0	0	0	0
OTSL24	24	4	0	0	0	5	0	0	0	0	0	0
ILSP25	25	2	0	0	0	0	30	0	0	0	0	0
GPSL26	26	2	0	0	0	5	0	0	0	0	0	0
SPSL27	27	2	0	0	0	5	0	0	0	0	0	0
PRON28	28	3	50	0	0	0	0	40	0	0	0	0
PRIN29	29	5	50	0	0	0	0	0	0	0	0	0
TMAT30	30	5	50	0	0	0	0	0	0	0	0	0
SLAT31	31	15	0	0	0	20	0	0	0	0	0	0
ATGP32	32	30	0	0	0	0	0	0	0	0	0	0
TMAT33	33	25	50	0	0	0	0	0	0	0	0	0

LABELED COMMON ORDER

		AT 1	TM 2	SP 3	GP 4	SL 5	IL 6	OL 7	AC 8	SC 9	LR 10	GR 11
MODEL1	1	1	0	0	0	0	0	0	0	0	0	0
TIME2	2	2	1	0	0	0	0	0	0	0	0	0
GR3	3	1	0	0	0	0	0	0	0	0	0	-2
GRAC4	4	1	0	0	0	0	0	0	-2	0	0	-3
GRSC5	5	1	0	0	0	0	0	0	0	-2	0	-3
SCAC6	6	1	0	0	0	0	0	0	-2	-3	0	-4
LR7	7	1	0	0	0	0	0	0	0	0	-2	-3
LRAC8	8	1	0	0	0	0	0	0	-2	0	-3	-4
SC9	9	1	0	0	0	0	0	0	0	-2	-3	-4
AC10	10	1	0	0	0	0	0	0	-2	-3	-4	-5
GROL11	11	2	0	0	0	0	0	1	0	0	0	-3
GRIL12	12	2	0	0	0	0	1	0	0	0	0	-3
LROL13	13	2	0	0	0	0	0	1	0	0	-3	-4
LRIL14	14	2	0	0	0	0	1	0	0	0	-3	-4
SCOL15	15	2	0	0	0	0	0	1	0	-3	-4	-5
SCIL16	16	2	0	0	0	0	1	0	0	-3	-4	-5
ACOL17	17	2	0	0	0	0	0	1	-3	-4	-5	-6
ACIL18	18	2	0	0	0	0	1	0	-3	-4	-5	-6
GPAT19	19	1	0	0	-2	0	0	0	0	0	0	0
SPAT20	20	1	0	-2	-3	0	0	0	0	0	0	0
PRST21	21	3	2	0	0	1	0	0	-4	-5	-6	-7
PROT22	22	3	2	0	0	1	0	-4	-5	-6	-7	-8
PRIT23	23	3	2	0	0	1	0	-4	-5	-6	-7	-8
OTSL24	24	2	0	0	0	1	0	-3	-4	-5	-6	-7
ILSP25	25	2	0	-3	-4	-5	1	0	0	0	0	0
GPSL26	26	2	0	0	-3	1	0	0	0	0	0	0
SPSL27	27	2	0	-3	-4	1	0	0	0	0	0	0
PRON28	28	3	2	0	0	-4	0	1	-5	-6	-7	-8
PRIN29	29	2	1	0	0	-3	0	-4	-5	-6	-7	-8
TMAT30	30	2	1	0	-3	0	0	0	0	0	-4	-5
SLAT31	31	2	0	0	-3	1	0	0	0	0	-4	-5
ATGP32	32	1	0	0	-2	0	0	0	0	0	-3	-4
TMAT33	33	2	1	0	0	0	0	0	0	-3	-4	-5

NAME CONDITIONALITY

		AT	TM	SP	GP	SL	IL	OL	AC	SC	LR	GR
		1	2	3	4	5	6	7	8	9	10	11
ATTRIBUTE	1	1	0	1	1	1	1	1	1	1	1	1
TIME	2	0	1	0	0	0	0	0	0	0	0	0
SPECIFIC PROCESS	3	0	0	1	1	0	0	0	0	0	0	0
GENERIC PROCESS	4	0	0	0	1	0	0	0	0	0	0	0
SUBLINK	5	0	0	0	0	1	1	1	1	1	1	1
INPUT LINK	6	0	0	0	0	0	1	0	1	1	1	1
OUTPUT LINK	7	0	0	0	0	0	0	1	1	1	1	1
ACTIVITY	8	0	0	0	0	0	0	0	1	1	0	1
SECTOR	9	0	0	0	0	0	0	0	0	1	0	1
LOCAL REGION	10	0	0	0	0	0	0	0	0	0	1	1
GLOBAL REGION	11	0	0	0	0	0	0	0	0	0	0	1

TABLE # 3

INPUT LINKS TAP'.E

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES AT :1 (INDEX)		INPUT LINK LINK ONE	LINK TWO	LINK THREE	LINK FOUR	LINK FIVE	LINK SIX	LINK SEVEN		
SECTOR		1	2	3	4	5	6	7	8	9
RESIDENTIAL SECTOR	1	3	3	3						
INDUSTRIAL SECTOR	2	3	3	3	3	3	7	3	8	8
DISTRIBUTION SECTOR	3	7	7	7	4	6	6			
ELECTRICITY SECTOR	4	5	3	3	3	3				
NUCLEAR SECTOR	5									
COAL SECTOR	6									
OIL-GAS SECTOR	7	10	10	10	6	6				
TRANSPORTATION SECTOR	8	3	3	3						
COMMERCIAL SECTOR	9	3	3	3	3					
IMPORT-EXPORT SECTOR	10	6								

TABLE 3/ 0/ (INPUT LINKS TABLE)
MODEL 2 < 1137 12/08/80 > FROM IO ACCESS 1 0 0 0 0 -2 0 0 -1 1 1

TABLE #4 OUTPUT LINKS TABLE

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
AT :

SECTOR		OUTPUT LINK 1	2	3	4	5	6	7	8	9
RESIDENTIAL SECTOR	1									
INDUSTRIAL SECTOR	2									
DISTRIBUTION SECTOR	3	4	1	9	2	8	4	2	8	4
ELECTRICITY SECTOR	4	3								
NUCLEAR SECTOR	5	4								
COAL SECTOR	6	3	7	7	3	10				
OIL-GAS SECTOR	7	3	3	2	3					
TRANSPORTATION SECTOR	8	2	2							
COMMERCIAL SECTOR	9									
IMPORT-EXPORT SECTOR	10	7	7	7						

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
AT :

SECTOR		OUTPUT LINK 10	11	12	13	14	15	16	17	18
RESIDENTIAL SECTOR	1									
INDUSTRIAL SECTOR	2									
DISTRIBUTION SECTOR	3	1	9	2	1	9	2	8	4	2
ELECTRICITY SECTOR	4									
NUCLEAR SECTOR	5									
COAL SECTOR	6									
OIL-GAS SECTOR	7									
TRANSPORTATION SECTOR	8									
COMMERCIAL SECTOR	9									
IMPORT-EXPORT SECTOR	10									

OUTPUT LINK

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
AT :

SECTOR		19	20
RESIDENTIAL SECTOR	1		
INDUSTRIAL SECTOR	2		
DISTRIBUTION SECTOR	3	2	9
ELECTRICITY SECTOR	4		
NUCLEAR SECTOR	5		
COAL SECTOR	6		
OIL-GAS SECTOR	7		
TRANSPORTATION SECTOR	8		
COMMERCIAL SECTOR	9		
IMPORT-EXPORT SECTOR	10		

TABLE 4/ 0/ (OUTPUT LINKS TABLE)
MODEL 2 < 1137 12/08/80 > FROM IO ACCESS 1 0 0 0 0 0 -2 0 -1 1 1

TABLE #5 NETWORK TABLE-LINKS

INPUT LINK

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :RESIDENTIAL SECTOR
AT :1 (INDEX)

		LINK ONE	LINK TWO	LINK THREE	LINK FOUR
ACTIVITY		1	2	3	4
HEAT ALLOCATION	1	3	4	6	5
ELECTRICITY ALLOCATION	2	-3			
OIL HEATER	3	-1			
GAS HEATER	4	11			
SOLAR HEATER	5				
ELECTRIC HEATER	6	2			
LIGHTING & ELEC. APPL.	7	15			
COOKING & OTHER ELECTRIC	8	2			
COOKING & OTHER GAS	9	11			
CONSUMER DEMAND	10	1	13	12	7
GAS ALLOCATION	11	-2			
COOKING & OTHER ALLOC	12	8	9		
SPACE COOLING	13	2			
DIST PHOTO VOLT-WIND	14				
ELEC SERVICE DEMAND	15	2	14		

TABLE 5/ 1, 1/ (NETWORK TABLE-LINKS)
MODEL 2 < 1137 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :RESIDENTIAL SECTOR
AT :2 (INDEX)

		INPUT LINK			
		LINK ONE	LINK TWO	LINK THREE	LINK FOUR
ACTIVITY		1	2	3	4
HEAT ALLOCATION	1	1	1	1	1
ELECTRICITY ALLOCATION	2	1			
OIL HEATER	3	1			
GAS HEATER	4	1			
SOLAR HEATER	5				
ELECTRIC HEATER	6	1			
LIGHTING & ELEC. APPL.	7	1			
COOKING & OTHER ELECTRIC	8	1			
COOKING & OTHER GAS	9	1			
CONSUMER DEMAND	10	1	1	1	1
GAS ALLOCATION	11	1			
COOKING & OTHER ALLOC	12	1	1		
SPACE COOLING	13	1			
DIST PHOTO VOLT-WIND	14				
ELEC SERVICE DEMAND	15	1	1		

TABLE 5/ 1, 2/ (NETWORK TABLE-LINKS)
MODEL 2 < 1140 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :INDUSTRIAL SECTOR
AT :2 (INDEX)

ACTIVITY		INPUT LINK 1	2	3	4	5	6	7	8

INDUSTRY ENERGY DEMAND	1	1	1	1	1	1	1	1	1
DIR HEAT CONSERVE ALLOC	2	1							
LOW BTU GAS-INDIR	3	1							
DIRECT HEAT ALLOCATION	4	1	1	1	1				
INDIRECT HEAT ALLOCATION	5	1	1	1	1	1	1	1	
INDIR HEAT-GEO ALLOCATIO	6	1	1						
ELEC SERVICE ALLOCATION	7	1	1						
FEEDSTOCK ALLOCATION	8	1	1	1					
DIR HEAT CONSERVATION	9								
DIRECT HEAT-OIL	10	1							
INDIRECT HEAT-OIL	11	1							
DIRECT HEAT-GAS	12	1							
INDIRECT HEAT-GAS	13	1							
LOW BTU GAS-DIRECT	14	1							
DIRECT HEAT-COAL	15	1							
INDIRECT HEAT-COAL	16	1							
AFB-COAL	17	1							
SOLAR-OIL BACKUP	18	1							
ELEC HEAT-HEAT PUMP	19	1							
INDIR HEAT-CONSERVE	20								
GEOTHERMAL	21								
ELEC AUTO-GENERATION	22	1							
LIGHT OIL ALLOCATION	23	1							
HEAVY OIL ALLOCATION	24	1							
HIGH BTU GAS ALLOC	25	1							
INDUST COAL ALLOC	26	1							
INDUST ELEC ALLOC	27	1							
ELECT GENERATION ALLOC	28	1	1	1					

TABLE 5/ 2, 2/ (NETWORK TABLE-LINKS)
MODEL 2 < 1140 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :DISTRIBUTION SECTOR
AT :2 (INDEX)

ACTIVITY		INPUT LINK 1

LIGHT OIL DISTRIBUTION	1	1
HEAVY OIL DISTRIBUTION	2	1
GAS DISTRIBUTION	3	1
ELECTRICITY DISTRIBUTION	4	1
COAL DISTRIBUTION	5	1
ELECTRIC LINE LOSS	6	1
TRANSPORTATION-MET COAL	7	1

TABLE 5/ 3, 2/ (NETWORK TABLE-LINKS)
MODEL 2 < 1140 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :ELECTRICITY SECTOR
AT :2 (INDEX)

		INPUT LINK								
ACTIVITY		1	2	3	4	5	6	7	8	9
ELECTRICITY ALLOC	1	1	1	1	1	1	1	1	1	1
NUCLEAR FUEL ALLOC	2	1								
OIL ALLOCATION	3	1								
GAS ALLOCATION	4	1								
ELECTR. POWER LOADING	5	1								
ADVANCED NUCLEAR (FBR)	6	1								
CONVNTIONAL NUCLEAR(LWR)	7	1								
COAL BOILER	8	1								
OIL BOILER	9	1								
OIL TURBINE	10	1								
GAS BOILER	11	1								
GAS TURBINE	12	1								
CENTRAL RENEWABLES	13									
COAL ALLOCATION	14	1								
SYN GAS-COMB. CYCLE	15	1								
ATMOS. FLUIDIZED BED	16	1								
FUEL CELL. OIL	17	1								
HYDRO	18									
BIOMASS	19									
MHD	20	1								

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :ELECTRICITY SECTOR
AT :2 (INDEX)

ACTIVITY		INPUT LINK 10	11	12	13	14
ELECTRICITY ALLOC	1	1	1	1	1	1
NUCLEAR FUEL ALLOC	2					
OIL ALLOCATION	3					
GAS ALLOCATION	4					
ELECTR. POWER LOADING	5					
ADVANCED NUCLEAR (FBR)	6					
CONVNTIONAL NUCLEAR(LWR)	7					
COAL BOILER	8					
OIL BOILER	9					
OIL TURBINE	10					
GAS BOILER	11					
GAS TURBINE	12					
CENTRAL RENEWABLES	13					
COAL ALLOCATION	14					
SYN GAS-COMB. CYCLE	15					
ATMOS. FLUIDIZED BED	16					
FUEL CELL. OIL	17					
HYDRO	18					
BIOMASS	19					
MHD	20					

TABLE 5/ 4, 2/ (NETWORK TABLE-LINKS)
MODEL 2 < 1140 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :NUCLEAR SECTOR
AT :

ACTIVITY		INPUT LINK LINK ONE 1
MINING & MILLING	1	
ENRICHMENT/WASTE DISP	2	1

TABLE 5/ 5, 2/ (NETWORK TABLE-LINKS)
MODEL 2 < 1140 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COAL SECTOR
AT :2 (INDEX)

ACTIVITY		INPUT LINK 1	2	3	4	5
COAL ALLOCATION	1	1	1	1	1	1
COAL LIQUIDS ALLOC	2	1	1	1	1	
HI BTU SYNGAS ALLOC	3	1	1	1	1	
WEST LO-SULF COAL ALLOC	4	1				
APP HI-SULF COAL ALLOC	5	1				
MID-CONT. COAL ALLOC	6	1				
TRANS-MID CONT. HI GAS	7	1				
TRANS-WEST LO-SULF HI GA	8	1				
TRANS-EAST HI GAS	9	1				
LIQUIDS-MID CONT.	10	1				
HI BTU GAS-MID CONT.	11	1				
LIQUIDS-LO-SULF WEST	12	1				
HI BTU GAS-WEST(LO-SULF)	13	1				
LIQUIDS-APPAL HI-SULF	14	1				
HI BTU GAS-EAST(HI SULF)	15	1				
WESTERN LO-SULF COAL	16					
APPAL HI-SULF COAL	17					
MID-CONTINENTAL COAL	18					
APPAL LO-SULF COAL	19					
APPAL. LO-SUL COAL ALLOC	20	1				
WEST HI-SULF COAL ALLOC	21	1				
HIGH QUALITY COAL ALLOC	22	1	1	1		
WESTERN HI-SULF COAL	23					
APPAL PREMIUM COAL	24					
LIQUIDS-WEST HI-SULF	25	1				
HI BTU GAS-WEST(HI SULF)	26	1				
TRANS-WEST HI GAS HI-SUL	27	1				

TABLE 5/ 6, 2/ (NETWORK TABLE-LINKS)
MODEL 2 < 1140 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :OIL-GAS SECTOR
AT :2 (INDEX)

ACTIVITY		INPUT LINK 1	2	3	4	5
OIL PRODUCTS ALLOC	1	1	1			
DRY GAS ALLOCATION	2	1	1	1	1	
CRUDE OIL ALLOCATION	3	1	1	1	1	1
OIL REFINERY	4	1				
NATURAL GAS LIQ. ALLOC	5					
ENHANCED OIL RECOVERY	6					
ENHANCED GAS RECOVERY	7					
SYNTHETIC OIL PENETRATIO	8	1	1			
SYNTHETIC GAS PENETRATIO	9	1	1			
SHALE OIL MINE	10					
N. SLOPE OIL PROD (+NGL)	11					
DOM OIL & ASSO GAS PROD	12					
NORTH SLOPE GAS	13					
DOMESTIC GAS PRODUCTION	14					
NON-ASSO GAS PLANT ALLOC	15					
SHALE OIL UPGRADE	16	1				
TRANS-N. SLOPE OIL	17	1				
TRANS-ENH. GAS RECOV	18	1				
TRANS-N. SLOPE GAS	19	1				
TRANS-IMPORTED GAS	20	1				
TRANS-ASSOCIATED GAS	21					
TRANS-DOMESTIC GAS	22	1				

TABLE 5/ 7, 2/ (NETWORK TABLE-LINKS)
MODEL 2 < 1141 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :TRANSPORTATION SECTOR
AT :2 (INDEX)

ACTIVITY		INPUT LINK 1	2
AIRCRAFT+MILITARY	1	1	
AUTOMOBILE-OIL	2	1	
TRUCK,BUS-DIESEL	3	1	
LIGHT OIL ALLOCATION	4	1	
TRANS DEMAND-PERSONAL	5	1	1
AUTO-ELECTRIC	6	1	
RAIL,BARGE-FREIGHT	7	1	
VEHICLE MILE ALLOCATION	8	1	1
FREIGHT FUEL ALLOCATION	9	1	1

TABLE 5/ 8, 2/ (NETWORK TABLE-LINKS)
MODEL 2 < 1141 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

INPUT LINK

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COMMERCIAL SECTOR
AT :2 (INDEX)

ACTIVITY		1	2	3	4	5
HEAT & WATER ALLOCATION	1	1	1	1	1	1
COMM ELEC ALLOC	2	1				
LIGHT OIL HEATER	3	1				
GAS HEATER	4	1				
SOLAR HEAT & GEOTHERM	5					
ELECTRIC HEATER	6	1				
LIGHT	7	1				
OTHER ELECTRIC	8	1				
OTHER GAS	9	1				
COMMERCIAL DEMAND	10	1	1	1	1	1
GAS ALLOCATION	11	1				
----	12					
ELECTRIC COOLING	13	1				
SOLAR COOLING	14					
COOLING ALLOCATION	15	1	1			
DISTRIBUTED ELECTRIC	16					
ELEC SERVICE ALLOC	17	1	1			
HEAVY OIL HEATER	18	1				

TABLE 5/ 9, 2/ (NETWORK TABLE-LINKS)
MODEL 2 < 1141 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

INPUT LINK

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :IMPORT-EXPORT SECTOR
AT :

ACTIVITY		1
IMPORTS-OIL/GAS(FIX P)	1	
EXPORTS-COAL(FIXED Q)	2	1

TABLE 5/10, 2/ (NETWORK TABLE-LINKS)
MODEL 2 < 1141 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :INDUSTRIAL SECTOR
AT :1 (INDEX)

		INPUT LINK							
ACTIVITY		1	2	3	4	5	6	7	8
INDUSTRY ENERGY DEMAND	1	2	6	7	8	-7	24	-8	-9
DIR HEAT CONSERVE ALLOC	2	4							
LOW BTU GAS-INDIR	3	26							
DIRECT HEAT ALLOCATION	4	10	12	14	15				
INDIRECT HEAT ALLOCATION	5	11	13	3	16	17	18	19	
INDIR HEAT-GEO ALLOCATIO	6	5	21						
ELEC SERVICE ALLOCATION	7	27	22						
FEEDSTOCK ALLOCATION	8	23	25	-6					
DIR HEAT CONSERVATION	9								
DIRECT HEAT-OIL	10	23							
INDIRECT HEAT-OIL	11	24							
DIRECT HEAT-GAS	12	25							
INDIRECT HEAT-GAS	13	25							
LOW BTU GAS-DIRECT	14	26							
DIRECT HEAT-COAL	15	26							
INDIRECT HEAT-COAL	16	26							
AFB-COAL	17	26							
SOLAR-OIL BACKUP	18	24							
ELEC HEAT-HEAT PUMP	19	27							
INDIR HEAT-CONSERVE	20								
GEOTHERMAL	21								
ELEC AUTO-GENERATION	22	28							
LIGHT OIL ALLOCATION	23	-1							
HEAVY OIL ALLOCATION	24	-2							
HIGH BTU GAS ALLOC	25	-3							
INDUST COAL ALLOC	26	-4							
INDUST ELEC ALLOC	27	-5							
ELECT GENERATION ALLOC	28	23	25	26					

TABLE 5/ 2, 1/ (NETWORK TABLE-LINKS)
MODEL 2 < 1137 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :DISTRIBUTION SECTOR AT :1 (INDEX)		INPUT LINK ----
ACTIVITY		1
LIGHT OIL DISTRIBUTION	1	-1
HEAVY OIL DISTRIBUTION	2	-2
GAS DISTRIBUTION	3	-3
ELECTRICITY DISTRIBUTION	4	6
COAL DISTRIBUTION	5	-5
ELECTRIC LINE LOSS	6	-4
TRANSPORTATION-MET COAL	7	-6

TABLE 5/ 3, 1/ (NETWORK TABLE-LINKS)
MODEL 2 < 1137 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :ELECTRICITY SECTOR AT :1 (INDEX)		INPUT LINK								
ACTIVITY		1	2	3	4	5	6	7	8	9
ELECTRICITY ALLOC	1	7	6	8	15	16	20	9	10	17
NUCLEAR FUEL ALLOC	2	-1								
OIL ALLOCATION	3	-4								
GAS ALLOCATION	4	-5								
ELECTR. POWER LOADING	5	1								
ADVANCED NUCLEAR (FBR)	6	2								
CONVNTIONAL NUCLEAR(LWR)	7	2								
COAL BOILER	8	14								
OIL BOILER	9	-3								
OIL TURBINE	10	3								
GAS BOILER	11	4								
GAS TURBINE	12	4								
CENTRAL RENEWABLES	13									
COAL ALLOCATION	14	-2								
SYN GAS-COMB. CYCLE	15	14								
ATMOS. FLUIDIZED BED	16	14								
FUEL CELL. OIL	17	3								
HYDRO	18									
BIOMASS	19									
MHD	20	14								

INPUT LINK

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :ELECTRICITY SECTOR AT :1 (INDEX)						
ACTIVITY		10	11	12	13	14
ELECTRICITY ALLOC	1	11	12	19	13	18
NUCLEAR FUEL ALLOC	2					
OIL ALLOCATION	3					
GAS ALLOCATION	4					
ELECTR. POWER LOADING	5					
ADVANCED NUCLEAR (FBR)	6					
CONVNTIONAL NUCLEAR(LWR)	7					
COAL BOILER	8					
OIL BOILER	9					
OIL TURBINE	10					
GAS BOILER	11					
GAS TURBINE	12					
CENTRAL RENEWABLES	13					
COAL ALLOCATION	14					
SYN GAS-COMB. CYCLE	15					
ATMOS. FLUIDIZED BED	16					
FUEL CELL. OIL	17					
HYDRO	18					
BIOMASS	19					
MHD	20					

TABLE 5/ 4, 1/ (NETWORK TABLE-LINKS)
MODEL 2 < 1137 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

INPUT LINK

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :NUCLEAR SECTOR AT :		LINK ONE
ACTIVITY		1
MINING & MILLING	1	
ENRICHMENT/WASTE DISP	2	1

TABLE 5/ 5, 1/ (NETWORK TABLE-LINKS)
MODEL 2 < 1137 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COAL SECTOR
AT :1 (INDEX)

ACTIVITY		INPUT LINK 1	2	3	4	5
COAL ALLOCATION	1	4	21	6	5	20
COAL LIQUIDS ALLOC	2	12	25	10	14	
HI BTU SYNGAS ALLOC	3	8	27	7	9	
WEST LO-SULF COAL ALLOC	4	16				
APP HI-SULF COAL ALLOC	5	17				
MID-CONT. COAL ALLOC	6	18				
TRANS-MID CONT. HI GAS	7	11				
TRANS-WEST LO-SULF HI GA	8	13				
TRANS-EAST HI GAS	9	15				
LIQUIDS-MID CONT.	10	6				
HI BTU GAS-MID CONT.	11	6				
LIQUIDS-LO-SULF WEST	12	4				
HI BTU GAS-WEST(LO-SULF)	13	4				
LIQUIDS-APPAL HI-SULF	14	5				
HI BTU GAS-EAST(HI SULF)	15	5				
WESTERN LO-SULF COAL	16					
APPAL HI-SULF COAL	17					
MID-CONTINENTAL COAL	18					
APPAL LO-SULF COAL	19					
APPAL. LO-SUL COAL ALLOC	20	19				
WEST HI-SULF COAL ALLOC	21	23				
HIGH QUALITY COAL ALLOC	22	24	20	5		
WESTERN HI-SULF COAL	23					
APPAL PREMIUM COAL	24					
LIQUIDS-WEST HI-SULF	25	21				
HI BTU GAS-WEST(HI SULF)	26	21				
TRANS-WEST HI GAS HI-SUL	27	26				

TABLE 5/ 6, 1/ (NETWORK TABLE-LINKS)
MODEL 2 < 1137 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :OIL-GAS SECTOR
AT :1 (INDEX)

ACTIVITY		INPUT LINK 1	2	3	4	5
OIL PRODUCTS ALLOC	1	4	-3			
DRY GAS ALLOCATION	2	22	18	19	20	
CRUDE OIL ALLOCATION	3	16	17	6	-1	12
OIL REFINERY	4	8				
NATURAL GAS LIQ. ALLOC	5					
ENHANCED OIL RECOVERY	6					
ENHANCED GAS RECOVERY	7					
SYNTHETIC OIL PENETRATIO	8	-5	3			
SYNTHETIC GAS PENETRATIO	9	2	-4			
SHALE OIL MINE	10					
N. SLOPE OIL PROD (+NGL)	11					
DOM OIL & ASSO GAS PROD	12					
NORTH SLOPE GAS	13					
DOMESTIC GAS PRODUCTION	14					
NON-ASSO GAS PLANT ALLOC	15					
SHALE OIL UPGRADE	16	10				
TRANS-N. SLOPE OIL	17	11				
TRANS-ENH. GAS RECOV	18	7				
TRANS-N. SLOPE GAS	19	13				
TRANS-IMPORTED GAS	20	-2				
TRANS-ASSOCIATED GAS	21					
TRANS-DOMESTIC GAS	22	14				

TABLE 5/ 7, 1/ (NETWORK TABLE-LINKS)
MODEL 2 < 1137 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :TRANSPORTATION SECTOR
AT :1 (INDEX)

ACTIVITY		INPUT LINK 1	2
AIRCRAFT+MILITARY	1	4	
AUTOMOBILE-OIL	2	4	
TRUCK,BUS-DIESEL	3	4	
LIGHT OIL ALLOCATION	4	-1	
TRANS DEMAND-PERSONAL	5	1	8
AUTO-ELECTRIC	6	-2	
RAIL,BARGE-FREIGHT	7	9	
VEHICLE MILE ALLOCATION	8	2	6
FREIGHT FUEL ALLOCATION	9	-3	4

TABLE 5/ 8, 1/ (NETWORK TABLE-LINKS)
MODEL 2 < 1137 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COMMERCIAL SECTOR
AT :1 (INDEX)

ACTIVITY		INPUT LINK 1	2	3	4	5
HEAT & WATER ALLOCATION	1	3	4	6	5	18
COMM ELEC ALLOC	2	-3				
LIGHT OIL HEATER	3	-1				
GAS HEATER	4	11				
SOLAR HEAT & GEOTHERM	5					
ELECTRIC HEATER	6	2				
LIGHT	7	17				
OTHER ELECTRIC	8	2				
OTHER GAS	9	11				
COMMERCIAL DEMAND	10	1	15	7	8	9
GAS ALLOCATION	11	-2				
----	12					
ELECTRIC COOLING	13	2				
SOLAR COOLING	14					
COOLING ALLOCATION	15	13	14			
DISTRIBUTED ELECTRIC	16					
ELEC SERVICE ALLOC	17	2	16			
HEAVY OIL HEATER	18	-4				

TABLE 5/ 9, 1/ (NETWORK TABLE-LINKS)
MODEL 2 < 1137 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #5 NETWORK TABLE-LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :IMPORT-EXPORT SECTOR
AT :

ACTIVITY		INPUT LINK 1
IMPORTS-OIL/GAS(FIX P)	1	
EXPORTS-COAL(FIXED Q)	2	-1

TABLE 5/10, 1/ (NETWORK TABLE-LINKS)
MODEL. 2 < 1138 12/08/80 > FROM IO ACCESS -4 0 0 0 0 -2 0 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

OUTPUT LINK

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :RESIDENTIAL SECTOR
AT :1 (INDEX)

ACTIVITY		1	2	3	4
HEAT ALLOCATION	1	10			
ELECTRICITY ALLOCATION	2	6	13	8	15
OIL HEATER	3	1			
GAS HEATER	4	1			
SOLAR HEATER	5	1			
ELECTRIC HEATER	6	1			
LIGHTING & ELEC. APPL.	7	10			
COOKING & OTHER ELECTRIC	8	12			
COOKING & OTHER GAS	9	12			
CONSUMER DEMAND	10				
GAS ALLOCATION	11	4	9		
COOKING & OTHER ALLOC	12	10			
SPACE COOLING	13	10			
DIST PHOTO VOLT-WIND	14	15			
ELEC SERVICE DEMAND	15	7			

TABLE 6/ 1, 1/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1141 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

OUTPUT LINK

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :INDUSTRIAL SECTOR
AT :

ACTIVITY		1	2	3	4	5	6
INDUSTRY ENERGY DEMAND	1						
DIR HEAT CONSERVE ALLOC	2	1					
LOW BTU GAS-INDIR	3	5					
DIRECT HEAT ALLOCATION	4	2					
INDIRECT HEAT ALLOCATION	5	6					
INDIR HEAT-GEO ALLOCATIO	6	1					
ELEC SERVICE ALLOCATION	7	1					
FEEDSTOCK ALLOCATION	8	1					
DIR HEAT CONSERVATION	9						
DIRECT HEAT-OIL	10	4					
INDIRECT HEAT-OIL	11	5					
DIRECT HEAT-GAS	12	4					
INDIRECT HEAT-GAS	13	5					
LOW BTU GAS-DIRECT	14	4					
DIRECT HEAT-COAL	15	4					
INDIRECT HEAT-COAL	16	5					
AFB-COAL	17	5					
SOLAR-OIL BACKUP	18	5					
ELEC HEAT-HEAT PUMP	19	5					
INDIR HEAT-CONSERVE	20						
GEOTHERMAL	21	6					
ELEC AUTO-GENERATION	22	7					
LIGHT OIL ALLOCATION	23	10	28	8			
HEAVY OIL ALLOCATION	24	11	18	1			
HIGH BTU GAS ALLOC	25	12	13	28	8		
INDUST COAL ALLOC	26	14	15	16	17	28	3
INDUST ELEC ALLOC	27	19	7				
ELECT GENERATION ALLOC	28	22					

TABLE 6/ 2, 1/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1141 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :DISTRIBUTION SECTOR
AT :1 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3	4	5
LIGHT OIL DISTRIBUTION	1	-9	-2	-3	-4	-5
HEAVY OIL DISTRIBUTION	2	-6	-7	-16	-20	
GAS DISTRIBUTION	3	-17	-10	-11	-12	
ELECTRICITY DISTRIBUTION	4	-13	-14	-18	-8	
COAL DISTRIBUTION	5	-1	-15			
ELECTRIC LINE LOSS	6	4				
TRANSPORTATION-MET COAL	7	-19				

TABLE 6/ 3, 1/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1141 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :ELECTRICITY SECTOR
AT :1 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3	4
ELECTRICITY ALLOC	1	5			
NUCLEAR FUEL ALLOC	2	6	7		
OIL ALLOCATION	3	10	17		
GAS ALLOCATION	4	11	12		
ELECTR. POWER LOADING	5	-1			
ADVANCED NUCLEAR (FBR)	6	1			
CONVNTIONAL NUCLEAR(LWR)	7	1			
COAL BOILER	8	1			
OIL BOILER	9	1			
OIL TURBINE	10	1			
GAS BOILER	11	1			
GAS TURBINE	12	1			
CENTRAL RENEWABLES	13	1			
COAL ALLOCATION	14	8	15	16	20
SYN GAS-COMB. CYCLE	15	1			
ATMOS. FLUIDIZED BED	16	1			
FUEL CELL. OIL	17	1			
HYDRO	18	1			
BIOMASS	19	1			
MHD	20	1			

TABLE 6/ 4, 1/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1142 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :NUCLEAR SECTOR
AT :1 (INDEX)

ACTIVITY		OUTPUT LINK 1
MINING & MILLING	1	2
ENRICHMENT/WASTE DISP	2	-1

TABLE 6/ 5, 1/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1142 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COAL SECTOR
AT :1 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3	4
COAL ALLOCATION	1	-1			
COAL LIQUIDS ALLOC	2	-3			
HI BTU SYNGAS ALLOC	3	-2			
WEST LO-SULF COAL ALLOC	4	1	12	13	
APP HI-SULF COAL ALLOC	5	1	14	15	22
MID-CONT. COAL ALLOC	6	1	10	11	
TRANS-MID CONT. HI GAS	7	3			
TRANS-WEST LO-SULF HI GA	8	3			
TRANS-EAST HI GAS	9	3			
LIQUIDS-MID CONT.	10	2			
HI BTU GAS-MID CONT.	11	7			
LIQUIDS-LO-SULF WEST	12	2			
HI BTU GAS-WEST(LO-SULF)	13	8			
LIQUIDS-APPAL HI-SULF	14	2			
HI BTU GAS-EAST(HI SULF)	15	9			
WESTERN LO-SULF COAL	16	4			
APPAL HI-SULF COAL	17	5			
MID-CONTINENTAL COAL	18	6			
APPAL LO-SULF COAL	19	20			
APPAL. LO-SUL COAL ALLOC	20	1	22		
WEST HI-SULF COAL ALLOC	21	1	25	26	
HIGH QUALITY COAL ALLOC	22	-4	-5		
WESTERN HI-SULF COAL	23	21			
APPAL PREMIUM COAL	24	22			
LIQUIDS-WEST HI-SULF	25	2			
HI BTU GAS-WEST(HI SULF)	26	27			
TRANS-WEST HI GAS HI-SUL	27	3			

TABLE 6/ 6, 1/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1142 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :OIL-GAS SECTOR
AT :1 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3
OIL PRODUCTS ALLOC	1	-2	-1	-3
DRY GAS ALLOCATION	2	9		
CRUDE OIL ALLOCATION	3	8		
OIL REFINERY	4	1		
NATURAL GAS LIQ. ALLOC	5			
ENHANCED OIL RECOVERY	6	3		
ENHANCED GAS RECOVERY	7	18		
SYNTHETIC OIL PENETRATIO	8	4		
SYNTHETIC GAS PENETRATIO	9	-4		
SHALE OIL MINE	10	16		
N. SLOPE OIL PROD (+NGL)	11	17		
DOM OIL & ASSO GAS PROD	12	3		
NORTH SLOPE GAS	13	19		
DOMESTIC GAS PRODUCTION	14	22		
NON-ASSO GAS PLANT ALLOC	15			
SHALE OIL UPGRADE	16	3		
TRANS-N. SLOPE OIL	17	3		
TRANS-ENH. GAS RECOV	18	2		
TRANS-N. SLOPE GAS	19	2		
TRANS-IMPORTED GAS	20	2		
TRANS-ASSOCIATED GAS	21			
TRANS-DOMESTIC GAS	22	2		

TABLE 6/ 7, 1/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1142 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :TRANSPORTATION SECTOR
AT :1 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3	4
AIRCRAFT+MILITARY	1	5			
AUTOMOBILE-OIL	2	8			
TRUCK,BUS-DIESEL	3	-1			
LIGHT OIL ALLOCATION	4	1	2	3	9
TRANS DEMAND-PERSONAL	5				
AUTO-ELECTRIC	6	8			
RAIL,BARGE-FREIGHT	7	-2			
VEHICLE MILE ALLOCATION	8	5			
FREIGHT FUEL ALLOCATION	9	7			

TABLE 6/ 8, 1/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1142 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COMMERCIAL SECTOR
AT :1 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3	4
HEAT & WATER ALLOCATION	1	10			
COMM ELEC ALLOC	2	6	13	17	8
LIGHT OIL HEATER	3	1			
GAS HEATER	4	1			
SOLAR HEAT & GEOTHERM	5	1			
ELECTRIC HEATER	6	1			
LIGHT	7	10			
OTHER ELECTRIC	8	10			
OTHER GAS	9	10			
COMMERCIAL DEMAND	10				
GAS ALLOCATION	11	4	9		
----	12				
ELECTRIC COOLING	13	15			
SOLAR COOLING	14	15			
COOLING ALLOCATION	15	10			
DISTRIBUTED ELECTRIC	16	17			
ELEC SERVICE ALLOC	17	7			
HEAVY OIL HEATER	18	1			

TABLE 6/ 9, 1/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1142 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :IMPORT-EXPORT SECTOR
AT :1 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3
IMPORTS-OIL/GAS(FIX P)	1	-1	-2	-3

TABLE 6/10, 1/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1142 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :RESIDENTIAL SECTOR
AT :2 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3	4
HEAT ALLOCATION	1	1			
ELECTRICITY ALLOCATION	2	1	1	1	1
OIL HEATER	3	1			
GAS HEATER	4	1			
SOLAR HEATER	5	1			
ELECTRIC HEATER	6	1			
LIGHTING & ELEC. APPL.	7	1			
COOKING & OTHER ELECTRIC	8	1			
COOKING & OTHER GAS	9	1			
CONSUMER DEMAND	10				
GAS ALLOCATION	11	1	1		
COOKING & OTHER ALLOC	12	1			
SPACE COOLING	13	1			
DIST PHOTO VOLT-WIND	14	1			
ELEC SERVICE DEMAND	15	1			

TABLE 6/ 1, 2/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1143 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :INDUSTRIAL SECTOR
AT :

ACTIVITY		OUTPUT LINK 1	2	3	4	5	6
INDUSTRY ENERGY DEMAND	1						
DIR HEAT CONSERVE ALLOC	2	1					
LOW BTU GAS-INDIR	3	1					
DIRECT HEAT ALLOCATION	4	1					
INDIRECT HEAT ALLOCATION	5	1					
INDIR HEAT-GEO ALLOCATIO	6	1					
ELEC SERVICE ALLOCATION	7	1					
FEEDSTOCK ALLOCATION	8	1					
DIR HEAT CONSERVATION	9						
DIRECT HEAT-OIL	10	1					
INDIRECT HEAT-OIL	11	1					
DIRECT HEAT-GAS	12	1					
INDIRECT HEAT-GAS	13	1					
LOW BTU GAS-DIRECT	14	1					
DIRECT HEAT-COAL	15	1					
INDIRECT HEAT-COAL	16	1					
AFB-COAL	17	1					
SOLAR-OIL BACKUP	18	1					
ELEC HEAT-HEAT PUMP	19	1					
INDIR HEAT-CONSERVE	20						
GEOTHERMAL	21	1					
ELEC AUTO-GENERATION	22	1					
LIGHT OIL ALLOCATION	23	1	1	1			
HEAVY OIL ALLOCATION	24	1	1	1			
HIGH BTU GAS ALLOC	25	1	1	1	1		
INDUST COAL ALLOC	26	1	1	1	1	1	1
INDUST ELEC ALLOC	27	1	1				
ELECT GENERATION ALLOC	28	1					

TABLE 6/ 2, 2/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1143 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :DISTRIBUTION SECTOR
AT :2 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3	4	5
LIGHT OIL DISTRIBUTION	1	1	1	1	1	1
HEAVY OIL DISTRIBUTION	2	1	1	1	1	
GAS DISTRIBUTION	3	1	1	1	1	
ELECTRICITY DISTRIBUTION	4	1	1	1	1	
COAL DISTRIBUTION	5	1	1			
ELECTRIC LINE LOSS	6	1				
TRANSPORTATION-MET COAL	7	1				

TABLE 6/ 3, 2/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1143 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :ELECTRICITY SECTOR
AT :2 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3	4
ELECTRICITY ALLOC	1	1			
NUCLEAR FUEL ALLOC	2	1	1		
OIL ALLOCATION	3	1	1		
GAS ALLOCATION	4	1	1		
ELECTR. POWER LOADING	5	1			
ADVANCED NUCLEAR (FBR)	6	1			
CONVNTIONAL NUCLEAR(LWR)	7	1			
COAL BOILER	8	1			
OIL BOILER	9	1			
OIL TURBINE	10	1			
GAS BOILER	11	1			
GAS TURBINE	12	1			
CENTRAL RENEWABLES	13	1			
COAL ALLOCATION	14	1	1	1	1
SYN GAS-COMB. CYCLE	15	1			
ATMOS. FLUIDIZED BED	16	1			
FUEL CELL. OIL	17	1			
HYDRO	18	1			
BIOMASS	19	1			
MHD	20	1			

TABLE 6/ 4, 2/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1143 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :NUCLEAR SECTOR
AT :2 (INDEX)

ACTIVITY		OUTPUT LINK 1
MINING & MILLING	1	1
ENRICHMENT/WASTE DISP	2	1

TABLE 6/ 5, 2/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1143 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COAL SECTOR
AT :2 (INDEX)

		OUTPUT LINK			
ACTIVITY		1	2	3	4
COAL ALLOCATION	1	1			
COAL LIQUIDS ALLOC	2	1			
HI BTU SYNGAS ALLOC	3	1			
WEST LO-SULF COAL ALLOC	4	1	1	1	
APP HI-SULF COAL ALLOC	5	1	1	1	1
MID-CONT. COAL ALLOC	6	1	1	1	
TRANS-MID CONT. HI GAS	7	1			
TRANS-WEST LO-SULF HI GA	8	1			
TRANS-EAST HI GAS	9	1			
LIQUIDS-MID CONT.	10	1			
HI BTU GAS-MID CONT.	11	1			
LIQUIDS-LO-SULF WEST	12	1			
HI BTU GAS-WEST(LO-SULF)	13	1			
LIQUIDS-APPAL HI-SULF	14	1			
HI BTU GAS-EAST(HI SULF)	15	1			
WESTERN LO-SULF COAL	16	1			
APPAL HI-SULF COAL	17	1			
MID-CONTINENTAL COAL	18	1			
APPAL LO-SULF COAL	19	1			
APPAL. LO-SUL COAL ALLOC	20	1	1		
WEST HI-SULF COAL ALLOC	21	1	1	1	
HIGH QUALITY COAL ALLOC	22	1	1		
WESTERN HI-SULF COAL	23	1			
APPAL PREMIUM COAL	24	1			
LIQUIDS-WEST HI-SULF	25	1			
HI BTU GAS-WEST(HI SULF)	26	1			
TRANS-WEST HI GAS HI-SUL	27	1			

TABLE 6/ 6, 2/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1144 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :OIL-GAS SECTOR
AT :2 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3
OIL PRODUCTS ALLOC	1	1	1	1
DRY GAS ALLOCATION	2	1		
CRUDE OIL ALLOCATION	3	1		
OIL REFINERY	4	1		
NATURAL GAS LIQ. ALLOC	5			
ENHANCED OIL RECOVERY	6	1		
ENHANCED GAS RECOVERY	7	1		
SYNTHETIC OIL PENETRATIO	8	1		
SYNTHETIC GAS PENETRATIO	9	1		
SHALE OIL MINE	10	1		
N. SLOPE OIL PROD (+NGL)	11	1		
DOM OIL & ASSO GAS PROD	12	1		
NORTH SLOPE GAS	13	1		
DOMESTIC GAS PRODUCTION	14	1		
NON-ASSO GAS PLANT ALLOC	15			
SHALE OIL UPGRADE	16	1		
TRANS-N. SLOPE OIL	17	1		
TRANS-ENH. GAS RECOV	18	1		
TRANS-N. SLOPE GAS	19	1		
TRANS-IMPORTED GAS	20	1		
TRANS-ASSOCIATED GAS	21			
TRANS-DOMESTIC GAS	22	1		

TABLE 6/ 7, 2/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1144 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :TRANSPORTATION SECTOR
AT :2 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3	4
AIRCRAFT+MILITARY	1	1			
AUTOMOBILE-OIL	2	1			
TRUCK, BUS-DIESEL	3	1			
LIGHT OIL ALLOCATION	4	1	1	1	1
TRANS DEMAND-PERSONAL	5				
AUTO-ELECTRIC	6	1			
RAIL, BARGE-FREIGHT	7	1			
VEHICLE MILE ALLOCATION	8	1			
FREIGHT FUEL ALLOCATION	9	1			

TABLE 6/ 8, 2/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1144 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COMMERCIAL SECTOR
AT :2 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3	4
HEAT & WATER ALLOCATION	1	1			
COMM ELEC ALLOC	2	1	1	1	1
LIGHT OIL HEATER	3	1			
GAS HEATER	4	1			
SOLAR HEAT & GEOTHERM	5	1			
ELECTRIC HEATER	6	1			
LIGHT	7	1			
OTHER ELECTRIC	8	1			
OTHER GAS	9	1			
COMMERCIAL DEMAND	10				
GAS ALLOCATION	11	1	1		
----	12				
ELECTRIC COOLING	13	1			
SOLAR COOLING	14	1			
COOLING ALLOCATION	15	1			
DISTRIBUTED ELECTRIC	16	1			
ELEC SERVICE ALLOC	17	1			
HEAVY OIL HEATER	18	1			

TABLE 6/ 9, 2/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1144 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #6 ACTIVITY OUTPUT LINKS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :IMPORT-EXPORT SECTOR
AT :2 (INDEX)

ACTIVITY		OUTPUT LINK 1	2	3
IMPORTS-OIL/GAS(FIX P)	1	1	1	1

TABLE 6/10, 2/ (ACTIVITY OUTPUT LINKS)
MODEL 2 < 1144 12/08/80 > FROM IO ACCESS -4 0 0 0 0 0 -2 -1 -3 1 1

TABLE #7   ACTIVITY POINTER TABLE

		ATTRIBUTE		
GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :RESIDENTIAL SECTOR		LOGICAL KIND NUMBER	GENERIC PROCESS TYPE	SPECIFIC PROCESS TYPE
ACTIVITY		1	2	3
HEAT ALLOCATION	1	1	1	11
ELECTRICITY ALLOCATION	2	1	1	4
OIL HEATER	3	9	9	1
GAS HEATER	4	9	9	2
SOLAR HEATER	5	9	9	3
ELECTRIC HEATER	6	9	9	4
LIGHTING & ELEC. APPL.	7	9	9	5
COOKING & OTHER ELECTRIC	8	9	9	7
COOKING & OTHER GAS	9	9	9	6
CONSUMER DEMAND	10	42	10	1
GAS ALLOCATION	11	1	1	4
COOKING & OTHER ALLOC	12	1	1	12
SPACE COOLING	13	9	9	8
DIST PHOTO VOLT-WIND	14	9	9	38
ELEC SERVICE DEMAND	15	1	1	21

TABLE 7/ 1, 1/ (ACTIVITY POINTER TABLE)
MODEL 2 < 1145 12/08/80 > FROM IO ACCESS -2 0 0 0 0 0 0 -1 -3 1 -4

TABLE # 7 ACTIVITY POINTER TABLE

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :INDUSTRIAL SECTOR		ATTRIBUTE LOGICAL KIND NUMBER	GENERIC PROCESS TYPE	SPECIFIC PROCESS TYPE
ACTIVITY		1	2	3
INDUSTRY ENERGY DEMAND	1	42	10	2
DIR HEAT CONSERVE ALLOC	2	1	1	4
LOW BTU GAS-INDIR	3	9	9	41
DIRECT HEAT ALLOCATION	4	1	1	16
INDIRECT HEAT ALLOCATION	5	1	1	17
INDIR HEAT-GEO ALLOCATIO	6	1	1	22
ELEC SERVICE ALLOCATION	7	1	1	13
FEEDSTOCK ALLOCATION	8	7	5	12
DIR HEAT CONSERVATION	9	9	9	24
DIRECT HEAT-OIL	10	9	9	25
INDIRECT HEAT-OIL	11	9	9	26
DIRECT HEAT-GAS	12	9	9	27
INDIRECT HEAT-GAS	13	9	9	28
LOW BTU GAS-DIRECT	14	9	9	29
DIRECT HEAT-COAL	15	9	9	30
INDIRECT HEAT-COAL	16	9	9	31
AFB-COAL	17	9	9	32
SOLAR-OIL BACKUP	18	9	9	33
ELEC HEAT-HEAT PUMP	19	9	9	34
INDIR HEAT-CONSERVE	20	9	9	35
GEOTHERMAL	21	9	9	36
ELEC AUTO-GENERATION	22	9	9	37
LIGHT OIL ALLOCATION	23	1	1	4
HEAVY OIL ALLOCATION	24	1	1	4
HIGH BTU GAS ALLOC	25	1	1	4
INDUST COAL ALLOC	26	1	1	4
INDUST ELEC ALLOC	27	1	1	4
ELECT GENERATION ALLOC	28	1	1	19

TABLE 7/ 2, 1/ (ACTIVITY POINTER TABLE)
MODEL 2 < 1146 12/08/80 > FROM IO ACCESS -2 0 0 0 0 0 0 -1 -3 1 -4

TABLE # 7 ACTIVITY POINTER TABLE

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :DISTRIBUTION SECTOR

ACTIVITY		LOGICAL KIND NUMBER	GENERIC PROCESS TYPE	SPECIFIC PROCESS TYPE
		1	2	3
LIGHT OIL DISTRIBUTION	1	8	5	1
HEAVY OIL DISTRIBUTION	2	8	5	2
GAS DISTRIBUTION	3	8	5	3
ELECTRICITY DISTRIBUTION	4	8	5	4
COAL DISTRIBUTION	5	8	5	5
ELECTRIC LINE LOSS	6	39	8	11
TRANSPORTATION-MET COAL	7	39	8	10

TABLE 7/ 3, 1/ (ACTIVITY POINTER TABLE)
MODEL 2 < 1146 12/08/80 > FROM IO ACCESS -2 0 0 0 0 0 0 -1 -3 1 -4

TABLE # 7 ACTIVITY POINTER TABLE

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :ELECTRICITY SECTOR

ACTIVITY		LOGICAL KIND NUMBER	GENERIC PROCESS TYPE	SPECIFIC PROCESS TYPE
		1	2	3
ELECTRICITY ALLOC	1	4	1	2
NUCLEAR FUEL ALLOC	2	1	1	10
OIL ALLOCATION	3	1	1	4
GAS ALLOCATION	4	1	1	4
ELECTR. POWER LOADING	5	5	4	1
ADVANCED NUCLEAR (FBR)	6	11	3	1
CONVNTIONAL NUCLEAR(LWR)	7	11	3	2
COAL BOILER	8	11	3	3
OIL BOILER	9	11	3	4
OIL TURBINE	10	11	3	5
GAS BOILER	11	11	3	6
GAS TURBINE	12	11	3	7
CENTRAL RENEWABLES	13	11	3	8
COAL ALLOCATION	14	1	1	4
SYN GAS-COMB. CYCLE	15	11	3	9
ATMOS. FLUIDIZED BED	16	11	3	10
FUEL CELL. OIL	17	11	3	11
HYDRO	18	17	3	12
BIOMASS	19	11	3	13
MHD	20	11	3	14

TABLE 7/ 4, 1/ (ACTIVITY POINTER TABLE)
MODEL 2 < 1146 12/08/80 > FROM IO ACCESS -2 0 0 0 0 0 0 -1 -3 1 -4

TABLE # 7 ACTIVITY POINTER TABLE

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :NUCLEAR SECTOR		ATTRIBUTE LOGICAL KIND NUMBER	 GENERIC PROCESS TYPE	 SPECIFIC PROCESS TYPE
ACTIVITY		1	2	3
MINING & MILLING	1	22	11	8
ENRICHMENT/WASTE DISP	2	39	8	12

TABLE 7/ 5, 1/ (ACTIVITY POINTER TABLE)
MODEL 2 < 1146 12/08/80 > FROM IO ACCESS -2 0 0 0 0 0 0 -1 -3 1 -4

TABLE # 7 ACTIVITY POINTER TABLE

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :COAL SECTOR		ATTRIBUTE LOGICAL KIND NUMBER	 GENERIC PROCESS TYPE	 SPECIFIC PROCESS TYPE
ACTIVITY		1	2	3
COAL ALLOCATION	1	7	5	6
COAL LIQUIDS ALLOC	2	7	5	7
HI BTU SYNGAS ALLOC	3	1	1	4
WEST LO-SULF COAL ALLOC	4	1	1	4
APP HI-SULF COAL ALLOC	5	1	1	4
MID-CONT. COAL ALLOC	6	1	1	4
TRANS-MID CONT. HI GAS	7	39	8	13
TRANS-WEST LO-SULF HI GA	8	39	8	14
TRANS-EAST HI GAS	9	39	8	15
LIQUIDS-MID CONT.	10	9	2	1
HI BTU GAS-MID CONT.	11	9	2	2
LIQUIDS-LO-SULF WEST	12	9	2	3
HI BTU GAS-WEST(LO-SULF)	13	9	2	4
LIQUIDS-APPAL HI-SULF	14	9	2	5
HI BTU GAS-EAST(HI SULF)	15	9	2	6
WESTERN LO-SULF COAL	16	22	11	1
APPAL HI-SULF COAL	17	22	11	2
MID-CONTINENTAL COAL	18	22	11	4
APPAL LO-SULF COAL	19	22	11	3
APPAL. LO-SUL COAL ALLOC	20	7	5	8
WEST HI-SULF COAL ALLOC	21	1	1	4
HIGH QUALITY COAL ALLOC	22	7	5	13
WESTERN HI-SULF COAL	23	22	11	5
APPAL PREMIUM COAL	24	22	11	6
LIQUIDS-WEST HI-SULF	25	9	2	8
HI BTU GAS-WEST(HI SULF)	26	9	2	9
TRANS-WEST HI GAS HI-SUL	27	39	8	21

TABLE 7/ 6, 1/ (ACTIVITY POINTER TABLE)
MODEL 2 < 1146 12/08/80 > FROM IO ACCESS -2 0 0 0 0 0 0 -1 -3 1 -4

TABLE # 7 ACTIVITY POINTER TABLE

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :OIL-GAS SECTOR		ATTRIBUTE LOGICAL KIND NUMBER	GENERIC PROCESS TYPE	SPECIFIC PROCESS TYPE	PROCESS WEIGHT	DIST-ANCE
ACTIVITY		1	2	3	4	5
OIL PRODUCTS ALLOC	1	8	5	11		
DRY GAS ALLOCATION	2	1	1	24		
CRUDE OIL ALLOCATION	3	7	5	9		
OIL REFINERY	4	9	2	7		
NATURAL GAS LIQ. ALLOC	5	17	5	10		
ENHANCED OIL RECOVERY	6	20	6	8		
ENHANCED GAS RECOVERY	7	20	6	11		
SYNTHETIC OIL PENETRATIO	8	7	5	14		
SYNTHETIC GAS PENETRATIO	9	7	5	15		
SHALE OIL MINE	10	22	11	7		
N. SLOPE OIL PROD (+NGL)	11	20	6	6		
DOM OIL & ASSO GAS PROD	12	20	6	7		
NORTH SLOPE GAS	13	20	6	9		
DOMESTIC GAS PRODUCTION	14	20	6	10		
NON-ASSO GAS PLANT ALLOC	15	17	1	9		
SHALE OIL UPGRADE	16	39	8	16		
TRANS-N. SLOPE OIL	17	38	7	5		1.0000
TRANS-ENH. GAS RECOV	18	39	8	17		
TRANS-N. SLOPE GAS	19	38	[illegible]	6		1.0000
TRANS-IMPORTED GAS	20	39	8	18		
TRANS-ASSOCIATED GAS	21	17	8	19		
TRANS-DOMESTIC GAS	22	39	8	20		

TABLE 7/ 7, 1/ (ACTIVITY POINTER TABLE)
MODEL 2 < 1146 12/08/80 > FROM IO ACCESS -2 0 0 0 0 0 0 -1 -3 1 -4

TABLE # 7 ACTIVITY POINTER TABLE

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :TRANSPORTATION SECTOR		ATTRIBUTE LOGICAL KIND NUMBER	GENERIC PROCESS TYPE	SPECIFIC PROCESS TYPE
ACTIVITY		1	2	3
AIRCRAFT+MILITARY	1	9	9	18
AUTOMOBILE-OIL	2	9	9	19
TRUCK,BUS-DIESEL	3	9	9	20
LIGHT OIL ALLOCATION	4	1	1	4
TRANS DEMAND-PERSONAL	5	42	10	3
AUTO-ELECTRIC	6	9	9	23
RAIL,BARGE-FREIGHT	7	9	9	21
VEHICLE MILE ALLOCATION	8	1	1	15
FREIGHT FUEL ALLOCATION	9	1	1	20

TABLE 7/ 8, 1/ (ACTIVITY POINTER TABLE)
MODEL 2 < 1146 12/08/80 > FROM IO ACCESS -2 0 0 0 0 0 0 -1 -3 1 -4

TABLE # 7 ACTIVITY POINTER TABLE

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COMMERCIAL SECTOR

ACTIVITY		LOGICAL KIND NUMBER (ATTRIBUTE 1)	GENERIC PROCESS TYPE (ATTRIBUTE 2)	SPECIFIC PROCESS TYPE (ATTRIBUTE 3)
HEAT & WATER ALLOCATION	1	1	1	14
COMM ELEC ALLOC	2	1	1	4
LIGHT OIL HEATER	3	9	9	9
GAS HEATER	4	9	9	10
SOLAR HEAT & GEOTHERM	5	9	9	11
ELECTRIC HEATER	6	9	9	12
LIGHT	7	9	9	13
OTHER ELECTRIC	8	9	9	14
OTHER GAS	9	9	9	15
COMMERCIAL DEMAND	10	42	10	4
GAS ALLOCATION	11	1	1	4
----	12	1	1	4
ELECTRIC COOLING	13	9	9	16
SOLAR COOLING	14	9	9	17
COOLING ALLOCATION	15	1	1	23
DISTRIBUTED ELECTRIC	16	9	9	39
ELEC SERVICE ALLOC	17	1	1	21
HEAVY OIL HEATER	18	9	9	40

TABLE 7/ 9, 1/ (ACTIVITY POINTER TABLE)
MODEL 2 < 1146 12/08/80 > FROM IO ACCESS -2 0 0 0 0 0 0 -1 -3 1 -4

TABLE # 7 ACTIVITY POINTER TABLE

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :IMPORT-EXPORT SECTOR		ATTRIBUTE LOGICAL KIND NUMBER
ACTIVITY		1
IMPORTS-OIL/GAS(FIX P)	1	40
EXPORTS-COAL(FIXED Q)	2	17

TABLE 7/10, 1/ (ACTIVITY POINTER TABLE)
MODEL 2 < 1146 12/08/80 > FROM IO ACCESS -2 0 0 0 0 0 0 -1 -3 1 -4

TABLE # 8 GLOBAL REGION DATA

		ATTRIBUTE LOGICAL KIND NUMBER	GENERIC PROCESS	SPECIFIC PROCESS	PRIOR INFLTION RATE	TERMINAL INFLTION RATE
GLOBAL REGION		1	2	3	4	5
ENERGY SYSTEM NETWORK	1	0	0	0	0.0000	0.0000

TABLE 8/ 0/ (GLOBAL REGION DATA)
MODEL 2 < 1146 12/08/80 > FROM IO ACCESS -2 0 0 0 0 0 0 0 0 0 -1

TABLE # 9 LOCAL REGION DATA

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES		LOGICAL KIND NUMBER	GENERIC PROCESS	SPECIFIC PROCESS	INCOME TAX RATE	INVSTMNT TAX CRED RATE	PROPERTY TAX RATE	FORECAST PERFEC-TION
SECTOR		1	2	3	4	5	6	7
RESIDENTIAL SECTOR	1	0	0	0	0.2498	0.0000	0.0000	1.0000
INDUSTRIAL SECTOR	2	0	0	0	0.5200	0.0998	0.0198	1.0000
DISTRIBUTION SECTOR	3	0	0	0	0.5200	0.0998	0.0198	1.0000
ELECTRICITY SECTOR	4	0	0	0	0.5200	0.0998	0.0198	1.0000
NUCLEAR SECTOR	5	0	0	0	0.5200	0.0998	0.0198	1.0000
COAL SECTOR	6	0	0	0	0.5200	0.0998	0.0198	1.0000
OIL-GAS SECTOR	7	0	0	0	0.5200	0.0998	0.0198	1.0000
TRANSPORTATION SECTOR	8	0	0	0	0.5200	0.0998	0.0198	1.0000
COMMERCIAL SECTOR	9	0	0	0	0.5200	0.0998	0.0198	1.0000
IMPORT-EXPORT SECTOR	10	0	0	0	0.5200	0.0998	0.0198	1.0000

TABLE 9/ 1/ (LOCAL REGION DATA)
MODEL 2 < 1146 12/08/80 > FROM IO ACCESS -2 0 0 0 0 0 0 0 -1 1 -3

TABLE # 10 TIME-DEPENDENT PARAMETERS

		YEAR	PROPERTY TAX INFLATOR	PRICE OF LABOR	PRICE OF MATERIAL	RETURN ON EQUITY	RETURN ON DEBT
TIME		1	2	3	4	5	6
YEAR 1975	1	1975.0000	1.0000	1.0000	1.0000	0.0998	0.0398
YEAR 1980	2	1980.0000	1.0000	1.0000	1.0000	0.0998	0.0398
YEAR 1985	3	1985.0000	1.0000	1.0000	1.0000	0.0998	0.0398
YEAR 1990	4	1990.0000	1.0000	1.0000	1.0000	0.0998	0.0398
YEAR 1995	5	1995.0000	1.0000	1.0000	1.0000	0.0998	0.0398
YEAR 2000	6	2000.0000	1.0000	1.0000	1.0000	0.0998	0.0398
YEAR 2005	7	2005.0000	1.0000	1.0000	1.0000	0.0998	0.0398
YEAR 2010	8	2010.0000	1.0000	1.0000	1.0000	0.0998	0.0398
YEAR 2015	9	2015.0000	1.0000	1.0000	1.0000	0.0998	0.0398
YEAR 2020	10	2020.0000	1.0000	1.0000	1.0000	0.0998	0.0398

TABLE 10/ 0/ (TIME-DEPENDENT PARAMETER)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 -1 0 0 0 0 0 0 0 0 0

TABLE # 11 GENERIC PROCESS DATA

GENERIC PROCESS		ATTRIBUTE CAPITAL LABOR FRACTION 1	OPERATE LABOR FRACTION 2	CAPITAL LEADTIME RATIO 3	CAPTEK CH RT R- ROE CONV 4	VAROPCST TEKCHRT- RD CONV 5	VAR OPER COST AGE RATE 6	CONSTTEK CH LIMIT RESOURCE 7	OP PROD TECH.CH. LIMIT 8	EARLY INTRO PENALTY 9
BASIC ALLOCATION	1									
SYNTHETICS CONVERSION	2	0.3998	0.3998	0.1698			3.0000		1.0000	0.0998
ELECTRIC POWER	3	0.3998	0.3998	0.1668	0.0998	0.0398	3.0000		1.0000	0.0998
ELECTRIC LOADING	4									
ALLOC+TRANS DIFFERENTIAL	5									
OIL+GAS+OTHER RESOURCES	6	0.0000	0.3998	0.1668	0.0000	0.0000	3.0000	1.0000	1.0000	0.0998
TRANSPORTATION	7	0.3998	0.3998	0.1668					1.0000	0.0998
DISTRIBUTION	8	0.3998	0.3998	0.1668					1.0000	0.0998
END-USE CONVERSION	9	0.3998	0.3998	0.1668			3.0000		1.0000	0.0998
SERVICE DEMANDS	10									
COAL+OTHER RESOURCES	11	0.3700	0.6100	0.1698	0.0698	0.0000	3.0000	1.0000	1.0000	0.0998

GENERIC PROCESS		ATTRIBUTE NEW ADDITION FLEX. 10	CAPACITY FACTOR MULT. 11	CAP.FAC. PRICE SENS. 12	RESOURCE OWNER INT.RATE 13
BASIC ALLOCATION	1				
SYNTHETICS CONVERSION	2	0.0098	1.0000	1.3398	
ELECTRIC POWER	3	0.0098	1.0000	1.3398	
ELECTRIC LOADING	4				
ALLOC+TRANS DIFFERENTIAL	5				
OIL+GAS+OTHER RESOURCES	6	0.0098	1.0000	1.3398	0.0798
TRANSPORTATION	7	0.0098	1.0000	1.3398	
DISTRIBUTION	8	0.0098	1.0000	1.3398	
END-USE CONVERSION	9	0.0098	1.0000	1.3398	
SERVICE DEMANDS	10				
COAL+OTHER RESOURCES	11	0.0098	1.0000	1.3398	0.0798

TABLE 11/ 0/ (GENERIC PROCESS DATA)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 0 0 -1 0 0 0 0 0 0 0

TABLE # 12 SPECIFIC PROCESS DATA

GP :BASIC ALLOCATION		ATTRIBUTE: SHARE PRICE SENS.	ATTRIBUTE: BEHAVIOR LAG- PER YEAR
SPECIFIC PROCESS		1	2
HIGHLY SENSITIVE	1	12.5000	3.0000
SENSITIVE	2	10.0000	5.0000
MODERATELY SENSITIVE	3	7.4998	7.0000
INSENSITIVE	4	5.0000	9.0000
HIGHLY INSENSITIVE	5	2.4998	11.0000
SENSITIVE-NO LAG	6	10.0000	0.0998
ASSO. GAS ALLOCATION	7	10.0000	5.0000
OIL+WET GAS ALLOCATION	8	10.0000	5.0000
NON-ASSO GAS ALLOCATION	9	10.0000	5.0000
NUCLEAR FUEL ALLOCATION	10	10.0000	5.0000
HEAT ALLOC-RESIDENTIAL	11	5.0000	9.0000
COOKING ALLOC-RES	12	2.5000	3.0000
ELECTRIC SERVICES-INDS	13	5.0000	9.0000
HEAT ALLOC-COMM	14	5.0000	9.0000
VEHICLE MILE ALLOC-TRANS	15	10.0000	10.0000
DIRECT HEAT ALLOC-INDS	16	2.5000	11.0000
INDIR HEAT ALLOC-INDS	17	5.0000	9.0000
MET COAL ALLOCATION	18	10.0000	5.0000
ELECT GENERATION ALLOC	19	5.0000	9.0000
FREIGHT FUEL ALLOC-TRANS	20	10.0000	5.0000
ELEC SERVICE ALLOC-RES	21	5.0000	9.0000
INDIR HEAT-GEO ALLOC-IND	22	5.0000	9.0000
COOLING ALLOC-COMM	23	5.0000	9.0000
DRY GAS ALLOCATION	24	5.0000	7.0000

TABLE 12/ 1/ (SPECIFIC PROCESS DATA)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 0 -1 -3 0 0 0 0 0 0 0

TABLE # 12 SPECIFIC PROCESS DATA

GP :SYNTHETICS CONVERSION		ATTRIBUTE SPECIFIC CAPITAL COST	VARIABLE OPER. COST	THERMAL EFFIC-IENCY	PLANNING LEAD TIME	YEAR COMM. AVAIL	CAPITAL TECH.CH. LIMIT	EFFIC. TECH.CH. LIMIT	CHAR. FACILITY LIFE	TAX LIFE
SPECIFIC PROCESS		1	2	3	4	5	6	7	8	9
LIQUIDS MID-CONTINENT	1	10.7600	0.9200	0.7000	8	1995	1.0000	1.0000	20	16
HI BTU GAS MID-CONT	2	11.6800	1.2398	0.7200	8	1995	1.0000	1.0000	20	16
LIQUIDS-WEST LO-SULF	3	11.0100	1.1798	0.7000	8	1995	1.0000	1.0000	20	16
HI BTU GAS-WEST LO-SULF	4	10.8900	1.2900	0.7500	8	1995	1.0000	1.0000	20	16
LIQUIDS -EAST	5	10.7600	0.9200	0.7000	8	1995	1.0000	1.0000	20	16
HI BTU GAS -EAST	6	11.6800	1.2398	0.7200	8	1995	1.0000	1.0000	20	16
OIL REFINERY	7	1.5098	0.0999	0.9200	8	1930	1.0000	1.0000	20	16
LIQUIDS-WEST HI-SULF	8	10.7600	1.1798	0.7000	8	1995	1.0000	1.0000	20	16
HI BTU GAS-WEST HI-SULF	9	11.6800	1.2900	0.7500	8	1995	1.0000	1.0000	20	16

GP :SYNTHETICS CONVERSION		ATTRIBUTE DEBT LIFE	EQUITY FINANCE FRACTION	CAPITAL TECH. CH RATE	EFFIC. TECH. CH RATE	CONSTR. TECH. CH . LIMIT
SPECIFIC PROCESS		10	11	12	13	14
LIQUIDS MID-CONTINENT	1	20	0.6000	0.0498	0.0000	1.0000
HI BTU GAS MID-CONT	2	20	0.4500	0.0498	0.0000	1.0000
LIQUIDS-WEST LO-SULF	3	20	0.6000	0.0498	0.0000	1.0000
HI BTU GAS-WEST LO-SULF	4	20	0.4500	0.0498	0.0000	1.0000
LIQUIDS -EAST	5	20	0.6000	0.0498	0.0000	1.0000
HI BTU GAS -EAST	6	20	0.4500	0.0498	0.0000	1.0000
OIL REFINERY	7	20	0.6000	0.0298	0.0000	1.0000
LIQUIDS-WEST HI-SULF	8	20	0.6000	0.0498	0.0000	1.0000
HI BTU GAS-WEST HI-SULF	9	20	0.4500	0.0498	0.0000	1.0000

TABLE 12/ 2/ (SPECIFIC PROCESS DATA)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 0 -1 -3 0 0 0 0 0 0 0

TABLE # 12 SPECIFIC PROCESS DATA

GP :ELECTRIC POWER		SPECIFIC CAPITAL COST	VARIABLE OPER. COST	THERMAL EFFIC-IENCY	PLANNING LEAD TIME	YEAR COMM. AVAIL	CAPITAL TECH.CH. LIMIT	EFFIC. TECH.CH. LIMIT	CHAR. FACILITY LIFE	TAX LIFE
		ATTRIBUTE								
SPECIFIC PROCESS		1	2	3	4	5	6	7	8	9
ADVANCED NUCLEAR(FBR)	1	47.6998	0.9700	0.3998	15	2010	0.9000	1.0000	30	16
CONVENTIONAL NUCLEAR(LWR	2	24.3198	0.6800	0.3198	13	1970	0.9000	1.0000	30	16
COAL BOILER	3	14.1900	1.0298	0.3700	12	1930	1.2498	0.9500	30	24
OIL BOILER	4	11.5100	1.0000	0.3599	12	1930	2.0000	1.2098	30	24
OIL TURBINE	5	4.7598	0.5000	0.2398	4	1950	1.0000	1.2398	30	24
GAS BOILER	6	8.5098	1.5000	0.3599	12	1945	2.0000	1.2100	30	24
GAS TURBINE	7	4.7598	0.5000	0.2398	4	1950	1.0000	1.2398	30	24
CENTRAL RENEWABLES	8	35.6397	4.0000	0.3599	12	1995	1.0000	1.0000	30	24
SYN GAS-COMB. CYCLE	9	19.5898	0.5299	0.3800	10	1990	1.0000	1.0000	30	24
ATMOS FLUIDIZED BED	10	18.1498	1.3198	0.3498	10	1990	1.0000	1.0000	30	24
FUEL CELL. OIL	11	10.8300	0.7600	0.3599	4	1985	1.0000	1.2296	30	24
HYDRO	12	14.2400	2.0000	0.3998	10	1990	0.9000	1.0997	30	24
BIOMASS	13	27.3398	5.5698	0.3098	8	1990	0.8000	1.0000	30	24
MHD	14	18.3698	0.5600	0.4500	18	2005	1.0000	1.0000	30	24

GP :ELECTRIC POWER		DEBT LIFE	EQUITY FINANCE FRACTION	CAPITAL TECH. CH RATE	EFFIC. TECH. CH RATE	CONSTR. TECH. CH LIMIT
		ATTRIBUTE				
SPECIFIC PROCESS		10	11	12	13	14
ADVANCED NUCLEAR(FBR)	1	30	0.4500	0.0298	0.0000	1.0000
CONVENTIONAL NUCLEAR(LWR	2	30	0.4500	0.0298	0.0000	1.0000
COAL BOILER	3	30	0.4500	0.0198	0.0098	1.2500
OIL BOILER	4	30	0.4500	0.1000	0.0098	1.2500
OIL TURBINE	5	30	0.4500	0.0000	0.0198	1.0000
GAS BOILER	6	30	0.4500	0.1000	0.0100	1.2500
GAS TURBINE	7	30	0.4500	0.0000	0.0200	1.0000
CENTRAL RENEWABLES	8	30	0.4500	0.0000	0.1000	1.0000
SYN GAS-COMB. CYCLE	9	30	0.4500	0.0000	0.0000	1.0000
ATMOS FLUIDIZED BED	10	30	0.4500	0.0000	0.0000	1.0000
FUEL CELL. OIL	11	30	0.4500	0.0000	0.0398	1.0000
HYDRO	12	30	0.4500	0.0398	0.0198	1.0000
BIOMASS	13	30	0.4500	0.0198	0.0500	1.4000
MHD	14	30	0.4500	0.0000	0.0000	1.0000

TABLE 12/ 3/ (SPECIFIC PROCESS DATA)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 0 -1 -3 0 0 0 0 0 0 0

TABLE # 12 SPECIFIC PROCESS DATA

GP :ALLOC+TRANS DIFFERENTIAL		ATTRIBUTE: SHARE PRICE SENS.	BEHAVIOR LAG (YEARS)	LINK DIFFER-ENTIAL 1	LINK DIFFER-ENTIAL 2	LINK DIFFER-ENTIAL 3	LINK DIFFER-ENTIAL 4	LINK DIFFER-ENTIAL 5
SPECIFIC PROCESS		1	2	3	4	5	6	7
DIST-LT OIL TO SECTORS	1	12.5000	3.0000	0.0000	0.8100	0.5500	0.5600	1.5099
DIST-HVY OIL TO SECTORS	2	12.5000	3.0000	0.0000	0.2600	0.1800	0.2800	
DIST-GAS TO SECTORS	3	12.5000	3.0000	0.0000	0.6600	0.2400	0.3200	
DIST-ELECT. TO SECTORS	4	12.5000	3.0000	1.8200	1.8300	-1.0200	1.9800	
DIST-COAL TO SECTORS	5	12.5000	3.0000	0.0000	0.2199			
COAL ALLOCATION	6	12.5000	3.0000	0.8000	0.9300	0.3400	0.1900	0.0000
COAL LIQUIDS ALLOC	7	12.5000	3.0000	0.0798	0.0798	0.0298	0.0298	
APP LOW-SULF COAL ALLOC	8	12.5000	3.0000	0.0000				
CRUDE OIL ALLOCATION	9	5.0000	15.0000	0.1100	0.2300	0.0600	0.0100	0.0700
NGL ALLOCATION	10	12.5000	3.0000	0.0498	0.4900			
OIL PRODUCTS ALLOCATION	11	5.0000	20.0000	-0.1900	0.2800	0.8700		
FEEDSTOCK ALLOCATION	12	2.5000	11.0000	0.7600	1.7500	0.7300		
HIGH QUALITY COAL ALLOC	13	12.5000	3.0000	0.5400	0.5800	0.9600		
SYN CRUDE PENETRATION	14	5.0000	15.0000	0.1500	0.0000			
SYN GAS PENETRATION	15	7.5000	7.0000	0.0000	0.0000			

TABLE 12/ 5/ (SPECIFIC PROCESS DATA)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 0 -1 -3 0 0 0 0 0 0 0

TABLE # 12 SPECIFIC PROCESS DATA

GP :OIL+GAS+OTHER RESOURCES		ATTRIBUTE PLANNING LEAD TIME	YEAR COMM. AVAIL	CAPITAL TECH.CH. LIMIT	CHAR. FACILITY LIFE	TAX LIFE	DEBT LIFE	EQUITY FINANCE FRACTION	INITIAL RESOURCE COST	BASE PRICE
SPECIFIC PROCESS		1	2	3	4	5	6	7	8	9
WESTERN COAL	1	8	1930	1.1095	25	15	15	0.6500	0.3538	0.4419
MED-HI SULF APPAL. COAL	2	8	1930	1.1998	30	15	15	0.6500	0.7940	0.9920
LOW-SULF APPAL. COAL	3	8	1930	1.1998	30	15	15	0.6500	0.8960	1.1198
MID-CONTINENT COAL	4	8	1930	1.1998	30	15	15	0.6500	0.5580	0.6970
SHALE OIL (+UPGRADE)	5	8	1985	1.0000	30	15	15	0.6500	2.5498	3.0999
NORTH SLOPE OIL(+NGL)	6	1	1975	1.0000	30	10	20	0.6500	1.2000	2.1700
DOMESTIC OIL(+NGL)	7	1	1930	1.0000	30	10	20	0.6500	1.6000	2.1700
EOR CRUDE OIL	8	1	1985	1.0000	15	8	10	0.6500	1.8500	2.1700
NORTH SLOPE GAS	9	1	1985	1.0000	30	10	20	0.6500	1.0000	2.1000
DOMESTIC GAS(AS+NONAS)	10	1	1945	1.0000	30	10	20	0.6500	0.9517	2.1220
EGR(ENHANCED GAS RECOV)	11	1	1985	1.0000	40	14	27	0.6500	1.7500	1.9400
URANIUM (+MILLING)	12	8	1955	1.0000	20	15	15	0.6500	0.3198	0.5000
WESTERN HI-SULF COAL	13	8	1930	1.1095	25	15	15	0.6500	0.3278	0.4098
APPAL PREMIUM COAL	14	8	1930	1.1998	30	15	15	0.6500	0.9640	1.2048

GP :OIL+GAS+OTHER RESOURCES		ATTRIBUTE UNDISC. RECOV.AT BASE PRC	NEW RES. AT TWICE BASE PRC	CAPITAL COST FRACTION	DEPOSIT DECLINE RATE	HALF-DEP COST MULT	FULL-DEP COST MULT	REGULA-TORY POLICY	FINAL/ INITIAL COST
SPECIFIC PROCESS		10	11	12	13	14	15	16	17
WESTERN COAL	1	4383.6797	.7446E+05	0.5000	0.0498	1.0000	1.0000	0	1.5998
MED-HI SULF APPAL. COAL	2	1441.0979	.9160E+05	0.5000	0.0498	1.0000	1.0000	0	1.2498
LOW-SULF APPAL. COAL	3	159.9000	281.7986	0.5000	0.0498	1.0000	1.0000	0	2.0000
MID-CONTINENT COAL	4	133.0998	.1000E+07	0.5000	0.0498	1.0000	1.0000	0	1.2498
SHALE OIL (+UPGRADE)	5	382.7991	464.0000	0.7000	0.0498	1.0000	1.0000	0	1.4699
NORTH SLOPE OIL(+NGL)	6	121.0000	186.2000	0.8000	0.0998	1.0000	1.0000	0	2.1600
DOMESTIC OIL(+NGL)	7	308.0000	473.0000	0.8000	0.1338	1.0000	1.0000	0	1.8800
EOR CRUDE OIL	8	86.0000	182.0000	0.5000	0.2000	1.0000	1.0000	0	1.4000
NORTH SLOPE GAS	9	57.5000	88.5000	0.8000	0.0998	1.0000	1.0000	0	3.8200
DOMESTIC GAS(AS+NONAS)	10	361.0000	555.0000	0.8000	0.1148	1.0000	1.0000	0	3.8200
EGR(ENHANCED GAS RECOV)	11	84.0000	173.0000	0.6000	0.0500	1.0000	1.0000	0	1.7199
URANIUM (+MILLING)	12	1310.0000	1750.0000	0.5000	0.0498	1.0000	1.0000	0	2.1998
WESTERN HI-SULF COAL	13	7391.4922	.2669E+05	0.5000	0.0498	1.0000	1.0000	0	1.5998
APPAL PREMIUM COAL	14	1152.8979	.4380E+05	0.5000	0.0498	1.0000	1.0000	0	1.2498

TABLE 12/ 6/ (SPECIFIC PROCESS DATA)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 0 -1 -3 0 0 0 0 0 0 0

TABLE # 12 SPECIFIC PROCESS DATA

GP :TRANSPORTATION		ATTRIBUTE: SPECIFIC CAPITAL COST	VARIABLE OPER. COST	THERMAL EFFIC-IENCY	PLANNING LEAD TIME	YEAR COMM. AVAIL	CAPITAL TECH.CH. LIMIT	EFFIC. TECH.CH. LIMIT	CHAR. FACILITY LIFE	TAX LIFE
SPECIFIC PROCESS		1	2	3	4	5	6	7	8	9
WESTERN UNIT TRAIN-COAL	1	0.4138	0.4710	1.0000	2	1975	1.7498	1.0000	25	11
CRUDE OIL PIPELINE	2	0.3238	0.0208	1.0000	4	1975	1.1896	1.0000	50	17
HIGH BTU GAS PIPELINE	3	1.9428	0.0588	0.9400	4	1975	1.1896	1.0000	50	17
EASTERN UNIT TRAIN-COAL	4	0.3599	0.4038	1.0000	2	1975	1.1198	1.0000	25	11
TRANS-NORTH SLOPE OIL	5	2.6300	0.7200	1.0000	6	1977	0.8500	1.0000	50	17
TRANS-NORTH SLOPE GAS	6	4.0498	0.7000	0.8160	6	1985	1.0898	1.0000	50	17

GP :TRANSPORTATION		ATTRIBUTE: DEBT LIFE	EQUITY FINANCE FRACTION	CAPITAL TECH. CH RATE	EFFIC. TECH. CH RATE	CONSTR. TECH. CH LIMIT
SPECIFIC PROCESS		10	11	12	13	14
WESTERN UNIT TRAIN-COAL	1	17	0.7000	0.0698	0.0000	1.0000
CRUDE OIL PIPELINE	2	35	0.1098	0.0698	0.0000	1.0000
HIGH BTU GAS PIPELINE	3	35	0.3998	0.0698	0.0000	1.0000
EASTERN UNIT TRAIN-COAL	4	17	0.7000	0.0598	0.0000	1.0000
TRANS-NORTH SLOPE OIL	5	35	0.1098	0.0698	0.0000	1.0000
TRANS-NORTH SLOPE GAS	6	35	0.3998	0.0698	0.0000	1.0000

TABLE 12/ 7/ (SPECIFIC PROCESS DATA)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 0 -1 -3 0 0 0 0 0 0 0

TABLE # 12 SPECIFIC PROCESS DATA

GP :DISTRIBUTION		ATTRIBUTE: SPECIFIC CAPITAL COST	VARIABLE OPER. COST	THERMAL EFFIC-IENCY	PLANNING LEAD TIME	YEAR COMM. YEAR	CAPITAL TECH.CH. LIMIT	EFFIC. TECH.CH. LIMIT	CHAR. FACILITY LIFE	TAX LIFE
SPECIFIC PROCESS		1	2	3	4	5	6	7	8	9
R/C OIL DISTRIBUTION	1	0.0000	0.9000	1.0000	2	1975	1.0000	1.0000	15	17
R/C GAS DISTRIBUTION	2	4.2398	0.6700	1.0000	6	1975	1.0000	1.0000	50	17
R/C ELECTRICITY DISTR.	3	13.4700	2.1898	0.9300	6	1975	1.4998	1.0000	50	24
JET FUEL DISTRIBUTION	4	0.0000	0.0000	1.0000	2	1975	1.0000	1.0000	15	17
GASOLINE/DIESEL DISTRIBU	5	0.0000	0.8800	1.0000	2	1975	1.0000	1.0000	15	17
INDUSTRIAL OIL DISTR.	6	0.0000	0.0598	1.0000	2	1975	1.0000	1.0000	15	17
INDUSTRIAL GAS DISTR.	7	0.8700	0.1298	1.0000	6	1975	1.0000	1.0000	50	17
INDUSTRIAL COAL DISTR.	8	0.0000	0.2898	1.0000	2	1975	1.0000	1.0000	15	17
INDUSTRIAL ELECT. DISTR.	9	3.1498	0.1598	0.9300	6	1975	1.4998	1.0000	50	24
METALLURGICAL COAL DIST.	10	0.0000	0.3098	1.0000	2	1975	1.0000	1.0000	15	17
ELECTRIC LINE LOSS	11	2.0000	0.0000	0.9000	4	1975	1.0000	1.0000	20	17
URANIUM ENRICHMENT	12	2.0000	0.6400	1.0000	4	1975	1.0000	1.0000	20	17
HI BTU GAS MID-CONT.	13	2.0000	0.0868	0.9800	4	1975	1.0000	1.0000	20	17
HI BTU GAS-WEST LO-SULF	14	2.0000	0.2908	0.9600	4	1975	1.0000	1.0000	20	17
HI BTU GAS -APPAL.	15	2.0000	0.0868	0.9800	4	1975	1.0000	1.0000	20	17
SHALE OIL UPGRADE	16	2.0000	0.4500	0.9500	4	1975	1.0000	1.0000	20	17
EGR(ENHANCED GAS RECOV)	17	2.0000	0.2400	0.8860	4	1975	1.0000	1.0000	20	17
IMPORTED GAS	18	2.0000	0.0000	0.9780	4	1975	1.0000	1.0000	20	17
ASSOCIATED GAS	19	2.0000	-0.1598	0.9800	4	1975	1.0000	1.0000	20	17
NON-ASSOCIATED GAS	20	2.0000	0.2600	0.8860	4	1975	1.0000	1.0000	20	17
HI BTU GAS-WEST HI SULF	21	2.0000	0.2908	0.9600	4	1975	1.0000	1.0000	20	17

TABLE # 12 SPECIFIC PROCESS DATA

GP :DISTRIBUTION		ATTRIBUTE: DEBT LIFE	EQUITY FINANCE FRACTION	CAPITAL TECH. CH RATE	EFFIC. TECH. CH RATE	CONST. T ECH. CH LIMIT
SPECIFIC PROCESS		10	11	12	13	14
R/C OIL DISTRIBUTION	1	5	1.0000	0.0000	0.0000	1.0000
R/C GAS DISTRIBUTION	2	35	0.3498	0.0198	0.0000	1.0000
R/C ELECTRICITY DISTR.	3	30	0.3498	0.0398	0.0000	1.0000
JET FUEL DISTRIBUTION	4	5	0.3498	0.0000	0.0000	1.0000
GASOLINE/DIESEL DISTRIBU	5	5	0.3498	0.0000	0.0000	1.0000
INDUSTRIAL OIL DISTR.	6	5	1.0000	0.0000	0.0000	1.0000
INDUSTRIAL GAS DISTR.	7	35	0.3498	0.0198	0.0000	1.0000
INDUSTRIAL COAL DISTR.	8	5	1.0000	0.0000	0.0000	1.0000
INDUSTRIAL ELECT. DISTR.	9	30	0.3498	0.0398	0.0000	1.0000
METALLURGICAL COAL DIST.	10	5	1.0000	0.0000	0.0000	1.0000
ELECTRIC LINE LOSS	11	10	0.5000	0.0298	0.0000	1.0000
URANIUM ENRICHMENT	12	10	0.5000	0.0298	0.0000	1.0000
HI BTU GAS MID-CONT.	13	10	0.5000	0.0298	0.0000	1.0000
HI BTU GAS-WEST LO-SULF	14	10	0.5000	0.0298	0.0000	1.0000
HI BTU GAS -APPAL.	15	10	0.5000	0.0298	0.0000	1.0000
SHALE OIL UPGRADE	16	10	0.5000	0.0298	0.0000	1.0000
EGR(ENHANCED GAS RECOV)	17	10	0.5000	0.0298	0.0000	1.0000
IMPORTED GAS	18	10	0.5000	0.0298	0.0000	1.0000
ASSOCIATED GAS	19	10	0.5000	0.0298	0.0000	1.0000
NON-ASSOCIATED GAS	20	10	0.5000	0.0298	0.0000	1.0000
HI BTU GAS-WEST HI SULF	21	10	0.5000	0.0298	0.0000	1.0000

TABLE 12/ 8/ (SPECIFIC PROCESS DATA)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 0 -1 -3 0 0 0 0 0 0 0

TABLE # 12 SPECIFIC PROCESS DATA

GP :END-USE CONVERSION		ATTRIBUTE SPECIFIC CAPITAL COST	VARIABLE OPER. COST	THERMAL EFFICIEN -CY 1975	PLANNING LEAD TIME	YEAR COMM. AVAIL	CAPITAL TECH.CH. LIMIT	EFFIC. TECH.CH. LIMIT	CHAR. FACILITY LIFE	TAX LIFE
SPECIFIC PROCESS		1	2	3	4	5	6	7	8	9
RES OIL HEATER	1	51.0198	0.8800	0.6320	3	1930	1.0000	1.2898	15	0
RES GAS HEATER	2	38.3498	0.6800	0.6000	3	1930	1.0000	1.3800	15	0
RES SOLAR HEATER	3	149.0000	1.1798	4.0000	5	1975	1.0000	1.0997	15	0
RES ELECTRIC HEATER	4	36.7197	0.5900	0.9560	3	1930	1.0000	2.5000	15	0
RES LIGHT+ELEC APPL	5	0.0000	0.0000	0.2998	3	1930	1.0000	1.1798	14	0
RES COOKING+OTHER GAS	6	20.2697	0.0000	0.6940	2	1930	1.0000	1.3398	10	0
RES COOKING+OTHER ELEC.	7	18.0197	0.0000	1.0000	3	1930	1.0000	1.1698	10	0
RES SPACE COOLING	8	46.4898	0.3998	2.1098	2	1965	1.0000	1.3996	10	0
COMM LIGHT OIL HEATER	9	31.1498	0.7100	0.6480	3	1930	1.0000	1.2598	30	24
COMM GAS HEATER	10	24.9397	0.5800	0.6080	3	1930	1.0000	1.3498	20	16
COMM SOLAR HEATER	11	165.4700	1.2098	4.0000	6	1975	1.0000	1.0997	20	16
COMM ELEC HEATER	12	10.8700	0.4900	1.0498	3	1930	1.0000	1.6098	20	16
COMM LIGHTING	13	0.0000	0.0000	1.0000	3	1930	1.0000	1.0000	20	16
COMM OTHER ELEC	14	18.0197	0.0000	1.0000	3	1930	1.0000	1.0000	20	16
COMM OTHER GAS	15	20.2697	0.0000	1.0000	3	1930	1.0000	1.0000	20	16
COMM ELEC COOLING	16	37.8398	0.3398	2.3998	3	1965	1.0000	1.3298	20	16
COMM SOLAR COOLING	17	200.0000	1.2998	2.0000	6	1985	1.0000	1.0498	20	16
TRANS AIRCRAFT	18	0.1608	0.0128	0.1228	5	1950	1.0000	1.4397	15	10
TRANS AUTO-OIL	19	0.5299	0.1798	0.1043	2	1930	1.0000	4.5000	10	5
TRUCK,BUS-DIESEL	20	6.6198	4.0000	0.0668	4	1930	1.0000	1.5098	15	10
RAIL-BARGE(FREIGHT)	21	0.0898	0.0298	0.9980	4	1930	1.0000	1.0997	25	17
----	22									
TRANS AUTO-ELEC	23	0.7700	0.0998	0.2000	7	2000	1.0000	1.1998	10	5
IND DIR HEAT CONSERVE	24	40.0000	1.0000	0.3298	3	1975	1.0000	1.0000	20	16
IND DIRECT HEAT OIL	25	0.2098	0.0198	0.2918	6	1930	1.0000	1.1298	25	20
IND INDIR HEAT OIL	26	3.1998	0.2298	0.7500	6	1930	1.0000	1.0398	25	20
IND DIRECT HEAT GAS	27	0.1498	0.0198	0.2968	6	1930	1.0000	1.1798	25	20
IND INDIR HEAT GAS	28	2.8598	0.1798	0.7500	6	1930	1.0000	1.0398	25	20
LOW-BTU GAS DIRECT	29	6.5398	0.4500	0.2379	8	1985	1.0000	1.1759	20	16
IND DIRECT HEAT COAL	30	0.5900	0.0598	0.2998	8	1930	1.0000	1.1397	25	20
IND INDIR HEAT COAL	31	6.8498	0.3800	0.8200	8	1930	1.0000	1.0000	25	20
IND AFB (COAL)	32	17.4397	1.5098	0.8200	10	1985	1.0000	1.0000	25	20
IND SOLAR-OIL BACKUP	33	52.0098	1.5698	2.6799	6	1980	1.0000	1.0000	20	16
IND ELEC HEAT PUMP	34	1.6698	0.0198	1.0000	4	1960	1.0000	2.0000	20	16
IND INDIR HEAT CONSRV	35	40.0000	1.0000	0.6000	3	1975	1.0000	1.0000	20	16
IND GEOTHERMAL	36	28.3797	1.5098	1.0000	8	1980	1.0000	1.0000	30	24
IND ELEC AUTO-GENERATE	37	8.2698	0.4900	0.3440	3	1930	1.0000	1.7500	25	20
RES DIST PHOTO-WIND,ETC	38	208.0000	0.7400	1.0000	5	1985	1.0000	1.0000	25	20
COMM DIST ELECTRICITY	39	208.0000	0.7400	1.0000	5	1985	1.0000	1.0000	25	20
COMM HEAVY OIL HEATER	40	31.1498	0.7100	0.6480	3	1930	1.0000	1.2598	30	24
LOW-BTU GAS INDIRECT	41	9.3598	0.6100	0.6000	8	1985	1.0000	1.0399	20	16

TABLE # 12 SPECIFIC PROCESS DATA

GP :END-USE CONVERSION

SPECIFIC PROCESS		DEBT LIFE 10	EQUITY FINANCE FRACTION 11	CAPITAL TECH. CH RATE 12	CONSTR. TECH. CH RATE 13	CONSTR. TECH CH. LIMIT 14
RES OIL HEATER	1	5	0.0998	0.0098	0.0700	1.0000
RES GAS HEATER	2	5	0.0998	0.0098	0.0799	1.0000
RES SOLAR HEATER	3	5	0.0998	0.0498	0.0099	1.0000
RES ELECTRIC HEATER	4	5	0.0998	0.0000	0.0500	1.0000
RES LIGHT+ELEC APPL	5	1	1.0000	0.0000	0.1700	1.0000
RES COOKING+OTHER GAS	6	1	1.0000	0.0000	0.2000	1.0000
RES COOKING+OTHER ELEC.	7	1	1.0000	0.0098	0.1700	1.0000
RES SPACE COOLING	8	5	0.0998	0.0000	0.0900	1.0000
COMM LIGHT OIL HEATER	9	30	0.6000	0.0098	0.1500	1.0000
COMM GAS HEATER	10	20	0.6000	0.0098	0.1000	1.0000
COMM SOLAR HEATER	11	20	0.6000	0.0498	0.0100	1.0000
COMM ELEC HEATER	12	20	0.6000	0.0098	0.0900	1.0000
COMM LIGHTING	13	20	0.6000	0.0098	0.0100	1.0000
COMM OTHER ELEC	14	20	0.6000	0.0098	0.0100	1.0000
COMM OTHER GAS	15	20	0.6000	0.0098	0.0100	1.0000
COMM ELEC COOLING	16	20	0.6000	0.0098	0.1200	1.0000
COMM SOLAR COOLING	17	20	0.6000	0.0098	0.0098	1.0000
TRANS AIRCRAFT	18	15	0.1998	0.0098	0.0598	1.0000
TRANS AUTO-OIL	19	3	0.0998	0.0098	0.0350	1.0000
TRUCK,BUS-DIESEL	20	5	0.7000	0.0098	0.0828	1.0000
RAIL-BARGE(FREIGHT)	21	25	0.5000	0.0098	0.0198	1.0000
----	22					
TRANS AUTO-ELEC	23	3	0.0998	0.0198	0.0298	1.0000
IND DIR HEAT CONSERVE	24	20	0.6000	0.0098	0.0098	1.0000
IND DIRECT HEAT OIL	25	25	0.6000	0.0098	0.0299	1.0000
IND INDIR HEAT OIL	26	25	0.6000	0.0098	0.0300	1.0000
IND DIRECT HEAT GAS	27	25	0.6000	0.0098	0.0800	1.0000
IND INDIR HEAT GAS	28	25	0.6000	0.0098	0.0500	1.0000
LOW-BTU GAS DIRECT	29	20	0.6000	0.0098	0.0800	1.0000
IND DIRECT HEAT COAL	30	25	0.6000	0.0098	0.0700	1.0000
IND INDIR HEAT COAL	31	25	0.6000	0.0098	0.0098	1.0000
IND AFB (COAL)	32	25	0.6000	0.0098	0.0198	1.0000
IND SOLAR-OIL BACKUP	33	20	0.6000	0.0198	0.0098	1.0000
IND ELEC HEAT PUMP	34	20	0.6000	0.0098	0.7000	1.0000
IND INDIR HEAT CONSRV	35	20	0.6000	0.0098	0.0098	1.0000
IND GEOTHERMAL	36	30	0.6000	0.0298	0.0098	1.0000
IND ELEC AUTO-GENERATE	37	25	0.6000	0.0098	0.0600	1.0000
RES DIST PHOTO-WIND,ETC	38	25	0.6000	0.0498	0.0098	1.0000
COMM DIST ELECTRICITY	39	25	0.6000	0.0198	0.0098	1.0000
COMM HEAVY OIL HEATER	40	30	0.6000	0.0098	0.1500	1.0000
LOW-BTU GAS INDIRECT	41	20	0.6000	0.0098	0.0500	1.0000

TABLE 12/ 9/ (SPECIFIC PROCESS DATA)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 0 -1 -3 0 0 0 0 0 0 0

TABLE # 12 SPECIFIC PROCESS DATA

GP :SERVICE DEMANDS		ATTRIBUTE: ALPHA- THE LAG PARAM	BETA PRICE ELASTCTY	END-USE CONSERVE FACTOR
SPECIFIC PROCESS		1	2	3
RESIDENTIAL DEMAND	1	0.8000	-0.1000	0.9976
INDUSTRIAL DEMAND	2	0.8000	-0.1000	0.9976
TRANSPORTATION DEMAND	3	0.8000	-0.1000	0.9976
COMMERCIAL DEMAND	4	0.8000	-0.1000	0.9976

TABLE 12/10/ (SPECIFIC PROCESS DATA)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 0 -1 -3 0 0 0 0 0 0 0

TABLE # 12 SPECIFIC PROCESS DATA

GP :COAL+OTHER RESOURCES		ATTRIBUTE: PLANNING LEAD TIME	YEAR COMM. AVAIL	CAPITAL TECH. CH LIMIT	CHAR. FACILITY LIFE	TAX LIFE	DEBT LIFE	EQUITY FINANCE FRACTION	INITIAL RESOURCE COST	BASE PRICE
SPECIFIC PROCESS		1	2	3	4	5	6	7	8	9
WEST LO-SULF COAL	1	8	1930	1.1095	25	15	15	0.6500	0.3538	0.4419
APP HI-SULF COAL	2	8	1930	1.1998	30	15	15	0.6500	0.9780	0.9920
APP LO-SULF COAL	3	8	1930	1.1998	30	15	15	0.6500	1.0600	1.2500
MID-CONTINENTAL COAL	4	8	1930	1.1998	30	15	15	0.6500	0.6860	0.7780
WEST HI-SULF COAL	5	8	1930	1.1095	25	15	15	0.6500	0.3278	0.4098
APPAL PREMIUM	6	8	1930	1.1998	30	15	15	0.6500	1.1749	1.3560
SHALE OIL(+UPGRADE)	7	8	1990	1.0000	30	15	15	0.6500	2.1400	2.5700
URANIUM (+MILLING)	8	8	1955	1.0000	20	15	15	0.6500	0.3198	0.5000

GP :COAL+OTHER RESOURCES		ATTRIBUTE: UNDISC. RECOV AT BASE PRC	NEW RES AT TWICE BASE PRC	CAPITAL COST FRACTION	DEPOSIT DECLINE RATE	HALF-DEP COST MULT	FULL-DEP COST MULT	REGULA- TORY POLICY	FINAL- INITIAL COST
SPECIFIC PROCESS		10	11	12	13	14	15	16	17
WEST LO-SULF COAL	1	131.5110	630.3997	0.5000	0.0498	1.0000	1.0000	0	3.8000
APP HI-SULF COAL	2	43.2000	1200.0000	0.5000	0.0498	1.0000	1.0000	0	1.8000
APP LO-SULF COAL	3	12.6000	46.5000	0.5000	0.0498	1.0000	1.0000	0	6.0000
MID-CONTINENTAL COAL	4	90.0000	750.0000	0.5000	0.0498	1.0000	1.0000	0	2.5000
WEST HI-SULF COAL	5	221.7450	451.2000	0.5000	0.0498	1.0000	1.0000	0	4.2000
APPAL PREMIUM	6	150.0000	510.0000	0.5000	0.0498	1.0000	1.0000	0	1.9000
SHALE OIL(+UPGRADE)	7	58.0000	464.0000	0.7000	0.0498	1.0000	1.0000	0	1.2500
URANIUM (+MILLING)	8	1310.0000	1750.0000	0.5000	0.0498	1.0000	1.0000	0	2.1998

TABLE 12/11/ (SPECIFIC PROCESS DATA)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 0 -1 -3 0 0 0 0 0 0 0

TABLE # 13 DEMAND/IMPORTS INDEXES

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :RESIDENTIAL SECTOR		SECTORAL INDEX	DEMAND SENS LK1 SPACE HT	PRICE PATH LK1 SPACE HT	DEMAND SENS LK2 SPACE CL	PRICE PATH LK2 SPACE CL	DEMAND SENS LK3 COOKING+	PRICE PATH LK3 COOKING+	DEMAND SENS LK4 LITE,ETC
TIME		1	2	3	4	5	6	7	8
YEAR 1975	1	0.0000	0.9870		1.0860		1.0152		1.0161
YEAR 1980	2	4.6000	0.4997		1.8755		1.0614		1.1205
YEAR 1985	3	3.5000	0.1720		1.5175		0.6244		0.4441
YEAR 1990	4	3.0000	0.5193		1.7862		0.7493		0.7803
YEAR 1995	5	2.9000	0.2498		1.3893		0.5785		0.6892
YEAR 2000	6	2.4000	0.1138		1.2115		0.4304		0.5371
YEAR 2005	7	2.4000							
YEAR 2010	8	2.4000							
YEAR 2015	9	2.4000							
YEAR 2020	10	2.4000	0.1827		0.1827		0.1827		0.1827

TABLE 13/ 1/ (DEMAND/IMPORTS INDEXES)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 -1 0 0 0 0 0 0 -3 1 1

TABLE # 13 DEMAND/IMPORTS INDEXES

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :INDUSTRIAL SECTOR		ATTRIBUTE SECTORAL INDEX	DEMAND SENS LK1 HT CNSRV	PRICE PATH LK1 HT CNSRV	DEMAND SENS LK2 INDIR HT	PRICE PATH LK2 INDIR HT	DEMAND SENS LK3 ELECSERV	PRICE PATH LK3 ELECSERV	DEMAND SENS LK4 FEEDSTCK	PRICE PATH LK4 FEEDSTCK
TIME		1	2	3	4	5	6	7	8	9
YEAR 1975	1	0.0000	1.0000		1.0000		1.0040		1.0000	
YEAR 1980	2	4.6000	0.4770		0.8863		0.6589		1.1728	
YEAR 1985	3	3.5000	0.8521		2.2655		1.7393		1.2070	
YEAR 1990	4	3.0000	1.6180		1.2402		1.4086		1.5527	
YEAR 1995	5	2.9000	1.0000		1.7501		1.5715		1.5000	
YEAR 2000	6	2.4000	0.8993		1.6977		1.5076		1.4310	
YEAR 2005	7	2.4000								
YEAR 2010	8	2.4000								
YEAR 2015	9	2.4000								
YEAR 2020	10	2.4000	0.4967		0.8753		0.7849		0.7462	

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :INDUSTRIAL SECTOR		ATTRIBUTE DEMAND SENS LK5 MET COAL	PRICE PATH LK5 MET COAL	DEMAND SENS LK6 LUBE,ETC	PRICE PATH LK6 LUBE,ETC	DEMAND SENS LK7 TRUCK MI	PRICE PATH LK7 TRUCK MI	DEMAND SENS LK8 FRGHT TM
TIME		10	11	12	13	14	15	16
YEAR 1975	1	1.0000		1.0000		1.0000		1.0000
YEAR 1980	2	0.0222		0.5338		0.2951		0.5225
YEAR 1985	3	0.0537		0.3938		0.4381		0.7930
YEAR 1990	4	0.3476		0.8798		0.6566		0.4850
YEAR 1995	5	0.3570		0.9178		0.4999		0.5356
YEAR 2000	6	0.2257		0.8116		0.3977		0.4408
YEAR 2005	7							
YEAR 2010	8							
YEAR 2015	9							
YEAR 2020	10	0.2257		0.4537		0.3977		0.4408

TABLE 13/ 2/ (DEMAND/IMPORTS INDEXES)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 -1 0 0 0 0 0 0 -3 1 1

TABLE # 13 DEMAND/IMPORTS INDEXES

GR :ENERGY SYSTEM NETWORK LR :UNITED STATES SC :TRANSPORTATION SECTOR		SECTORAL INDEX	DEMAND SENS LK1 AIRMILES	PRICE PATH LK1 AIRMILES	DEMAND SENS LK2 CARMILES
TIME		1	2	3	4
YEAR 1975	1	0.0000	1.0000		1.0000
YEAR 1980	2	4.6000	0.5907		0.7726
YEAR 1985	3	3.5000	0.7338		1.0828
YEAR 1990	4	3.0000	0.7253		1.2059
YEAR 1995	5	2.9000	0.4999		1.2500
YEAR 2000	6	2.4000	0.3977		1.0773
YEAR 2005	7	2.4000			
YEAR 2010	8	2.4000			
YEAR 2015	9	2.4000			
YEAR 2020	10	2.4000	0.3977		0.1827

TABLE 13/ 8/ (DEMAND/IMPORTS INDEXES)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 -1 0 0 0 0 0 0 -3 1 1

TABLE # 13 DEMAND/IMPORTS INDEXES

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COMMERCIAL SECTOR

TIME		ATTRIBUTE: SECTORAL INDEX	DEMAND SENS LK1 SPACE HT	PRICE PATH LK1 SPACE HT	DEMAND SENS LK2 SPACE CL	PRICE PATH LK2 SPACE CL	DEMAND SENS LK3 ELECLITE	PRICE PATH LK3 ELECLITE	DEMAND SENS LK4 ELECMACH	PRICE PATH LK4 ELECMACH
		1	2	3	4	5	6	7	8	9
YEAR 1975	1	0.0000	0.9406		1.0124		1.0091		1.0215	
YEAR 1980	2	4.6000	0.9090		1.0568		0.6998		1.6208	
YEAR 1985	3	3.5000	0.5357		1.1862		0.5919		1.2365	
YEAR 1990	4	3.0000	0.8627		1.3982		0.8386		1.0412	
YEAR 1995	5	2.9000	0.6213		1.1250		0.7357		0.9035	
YEAR 2000	6	2.4000	0.5638		1.0490		0.7453		0.9071	
YEAR 2005	7	2.4000								
YEAR 2010	8	2.4000								
YEAR 2015	9	2.4000								
YEAR 2020	10	2.4000	0.6429		0.6429		1.0000		1.0000	

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COMMERCIAL SECTOR

TIME		ATTRIBUTE: DEMAND SENS LK5 OTHERGAS
		10
YEAR 1975	1	0.9904
YEAR 1980	2	0.8931
YEAR 1985	3	0.5002
YEAR 1990	4	0.2790
YEAR 1995	5	0.1570
YEAR 2000	6	-0.0152
YEAR 2005	7	
YEAR 2010	8	
YEAR 2015	9	
YEAR 2020	10	-0.0152

TABLE 13/ 9/ (DEMAND/IMPORTS INDEXES)
MODEL 2 < 1147 12/08/80 > FROM IO ACCESS -2 -1 0 0 0 0 0 0 -3 1 1

TABLE # 13 DEMAND/IMPORTS INDEXES

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :IMPORT-EXPORT SECTOR

		ATTRIBUTE					
		PRICE OF IMPORTED CRUDEOIL	QUANTITY IMPORTED CRUDEOIL	PRICE OF IMPORTED GAS	QUANTITY IMPORTED GAS	PRICE OF IMPORTED OIL PROD	QUANTITY IMPORTED OIL PROD
TIME		1	2	3	4	5	6
YEAR 1975	1	2.0200	0.0000	2.0200	0.0000	2.6200	0.0000
YEAR 1980	2	2.1700	0.0000	2.1700	0.0000	2.7700	0.0000
YEAR 1985	3	2.1700	0.0000	2.1700	0.0000	2.7700	0.0000
YEAR 1990	4	2.6800	0.0000	2.6800	0.0000	3.2800	0.0000
YEAR 1995	5	3.4000	0.0000	3.4000	0.0000	4.0000	0.0000
YEAR 2000	6	4.2800	0.0000	4.2800	0.0000	4.8800	0.0000
YEAR 2005	7	4.3500	0.0000	4.3500	0.0000	4.9500	0.0000
YEAR 2010	8	4.3500	0.0000	4.3500	0.0000	4.9500	0.0000
YEAR 2015	9	4.3500	0.0000	4.3500	0.0000	4.9500	0.0000
YEAR 2020	10	4.3500	0.0000	4.3500	0.0000	4.9500	0.0000

TABLE 13/10/ (DEMAND/IMPORTS INDEXES)
MODEL 2 < 1148 12/08/80 > FROM IO ACCESS -2 -1 0 0 0 0 0 0 -3 1 1

TABLE # 14 AVAILABILITIES AND ENERGY FRACTIONS (LOADING)

SL : BASE LOAD AT :		SPECIFIC PROCESS #1	SPECIFIC PROCESS #2	SPECIFIC PROCESS #3	SPECIFIC PROCESS #4	SPECIFIC PROCESS #5				
GENERIC PROCESS		1	2	3	4	5	6	7	8	9
BASIC ALLOCATION	1									
SYNTHETICS CONVERSION	2	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
ELECTRIC POWER CONV.	3	0.7000	0.8000	0.7900	0.8000	0.8900	0.8000	0.8900	0.8500	0.7800
ELECTRIC LOADING	4	0.9174								
ALLOC+TRANS DIFFERENTIAL	5									
OIL+GAS+OTHER RESOURCES	6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
TRANSPORTATION	7	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000			
DISTRIBUTION	8	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
END-USE CONVERSION	9	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
SERVICE DEMANDS	10	0.9000	0.9000	0.9000	0.9000					
COAL+OTHER RESOURCES	11	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	

SPECIFIC PROCESS

SL : BASE LOAD AT :										
GENERIC PROCESS		10	11	12	13	14	15	16	17	18
BASIC ALLOCATION	1									
SYNTHETICS CONVERSION	2									
ELECTRIC POWER CONV.	3	0.7800	0.9200	0.9500	0.8000	0.6600				
ELECTRIC LOADING	4									
ALLOC+TRANS DIFFERENTIAL	5									
OIL+GAS+OTHER RESOURCES	6	1.0000	1.0000	0.8000	1.0000	1.0000				
TRANSPORTATION	7									
DISTRIBUTION	8	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
END-USE CONVERSION	9	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
SERVICE DEMANDS	10									
COAL+OTHER RESOURCES	11									

TABLE # 14 AVAILABILITIES AND ENERGY FRACTIONS (LOADING) (continued)

SL : BASE LOAD
AT :

GENERIC PROCESS		SPECIFIC PROCESS 19	20	21	22	23	24	25	26	27
BASIC ALLOCATION	1									
SYNTHETICS CONVERSION	2									
ELECTRIC POWER CONV.	3									
ELECTRIC LOADING	4									
ALLOC+TRANS DIFFERENTIAL	5									
OIL+GAS+OTHER RESOURCES	6									
TRANSPORTATION	7									
DISTRIBUTION	8	0.9000	0.9000	0.9000						
END-USE CONVERSION	9	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
SERVICE DEMANDS	10									
COAL+OTHER RESOURCES	11									

SL : BASE LOAD
AT :

GENERIC PROCESS		SPECIFIC PROCESS 28	29	30
BASIC ALLOCATION	1			
SYNTHETICS CONVERSION	2			
ELECTRIC POWER CONV.	3			
ELECTRIC LOADING	4			
ALLOC+TRANS DIFFERENTIAL	5			
OIL+GAS+OTHER RESOURCES	6			
TRANSPORTATION	7			
DISTRIBUTION	8			
END-USE CONVERSION	9	0.9000	0.9000	0.9000
SERVICE DEMANDS	10			
COAL+OTHER RESOURCES	11			

TABLE 14/ 1/ (AVAILABILITIES AND ENERG)
MODEL 2 < 1148 12/08/80 > FROM IO ACCESS 1 0 -2 -1 -3 0 0 0 0 0 0

TABLE # 14 AVAILABILITIES AND ENERGY FRACTIONS (LOADING)

SPECIFIC PROCESS

SL : INTER. LOAD AT :		SPECIFIC PROCESS #1	SPECIFIC PROCESS #2	SPECIFIC PROCESS #3	SPECIFIC PROCESS #4	SPECIFIC PROCESS #5				
GENERIC PROCESS		1	2	3	4	5	6	7	8	9
BASIC ALLOCATION	1									
SYNTHETICS CONVERSION	2									
ELECTRIC POWER CONV.	3	0.7000	0.8000	0.7900	0.8000	0.8900	0.8000	0.8900	0.8500	0.7800
ELECTRIC LOADING	4	0.0749								

SPECIFIC PROCESS

SL : INTER. LOAD AT :						
GENERIC PROCESS		10	11	12	13	14
BASIC ALLOCATION	1					
SYNTHETICS CONVERSION	2					
ELECTRIC POWER CONV.	3	0.7800	0.9200	0.9500	0.8000	0.6600
ELECTRIC LOADING	4					

TABLE 14/ 2/ (AVAILABILITIES AND ENERG)
MODEL 2 < 1148 12/08/80 > FROM IO ACCESS 1 0 -2 -1 -3 0 0 0 0 0 0

TABLE # 14 AVAILABILITIES AND ENERGY FRACTIONS (LOADING)

SL : PEAK LOAD AT :		SPECIFIC PROCESS #1	SPECIFIC PROCESS #2	SPECIFIC PROCESS #3	SPECIFIC PROCESS #4	SPECIFIC PROCESS #5				
GENERIC PROCESS		1	2	3	4	5	6	7	8	9
BASIC ALLOCATION	1									
SYNTHETICS CONVERSION	2									
ELECTRIC POWER CONV.	3	0.7000	0.8000	0.7900	0.8000	0.8900	0.8000	0.8900	0.8500	0.7800
ELECTRIC LOADING	4	0.0075								

SPECIFIC PROCESS

SL : PEAK LOAD AT :						
GENERIC PROCESS		10	11	12	13	14
BASIC ALLOCATION	1					
SYNTHETICS CONVERSION	2					
ELECTRIC POWER CONV.	3	0.7800	0.9200	0.9500	0.8000	0.6600
ELECTRIC LOADING	4					

TABLE 14/ 3/ (AVAILABILITIES AND ENERG)
MODEL 2 < 1148 12/08/80 > FROM IO ACCESS 1 0 -2 -1 -3 0 0 0 0 0 0

TABLE # 15 LOAD FACTORS

SUBLINK

AT :		BASE LOAD	INTER. LOAD	PEAK LOAD
GENERIC PROCESS		1	2	3
BASIC ALLOCATION	1			
SYNTHETICS CONVERSION	2	1.0000		
ELECTRIC POWER CONV.	3	0.8100	0.5000	0.0898
ELECTRIC LOADING	4	0.8800	0.5000	0.1598
ALLOC+TRANS DIFFERENTIAL	5			
OIL+GAS+OTHER RESOURCES	6	1.0000		
TRANSPORTATION	7	1.0000		
DISTRIBUTION	8	1.0000		
END-USE CONVERSION	9	1.0000		
SERVICE DEMANDS	10	1.0000		

TABLE 15/ 0/ (LOAD FACTORS)
MODEL 2 < 1148 12/0 /80 > FROM IO ACCESS 1 0 0 -1 -2 0 0 0 0 0 0

TABLE # 16 LOAD FACTORS FOR ELECTRICITY

GP :ELECTRIC POWER CONV. AT :2 (INDEX)	SUBLINK	BASE LOAD	INTER. LOAD	PEAK LOAD
SPECIFIC PROCESS		1	2	3
ADVANCED NUCLEAR	1	0.8800	0.0498	0.0498
CONVENTIONAL NUCLEAR	2	0.8800	0.5000	0.0498
COAL BOILER	3	0.8100	0.5000	0.0898
OIL BOILER	4	0.8100	0.5000	0.0900
OIL TURBINE	5	0.8100	0.5000	0.0898
GAS BOILER	6	0.8100	0.5000	0.0900
GAS TURBINE	7	0.8100	0.5000	0.0898
CENTRAL RENEWABLES	8	0.8100	0.5000	0.0898
SYN GAS-COMB. CYCLE	9	0.8100	0.5000	0.0898
ATMOS FLUIDIZED BED	10	0.8100	0.5000	0.0898
FUEL CELL. OIL	11	0.8100	0.5000	0.0898
HYDRO	12	0.8100	0.5000	0.0898
BIOMASS	13	0.8100	0.5000	0.0898
MHD	14	0.8100	0.5000	0.0898

TABLE 16/ 0/ (LOAD FACTORS FOR ELECTRI)
MODEL 2 < 1148 12/08/80 > FROM IO ACCESS 2 0 -1 3 -2 0 0 0 0 0 0

TABLE # 18 FLAGS

ATTRIBUTE		NULLNULL NULLNULL NULLNULL
		1
WRITE FLAGS	1	0
----	2	0
----	3	0
----	4	0
----	5	0
----	6	0
----	7	0
----	8	0
----	9	0
----	10	0
----	11	0
----	12	0
----	13	0
----	14	0
----	15	0
----	16	0
----	17	0
----	18	0
----	19	0
----	20	0
----	21	0
----	22	0
----	23	0
----	24	0
----	25	0
----	26	0
----	27	0
----	28	0
----	29	0
----	30	0
----	31	0
----	32	0
----	33	0
----	34	0
----	35	0
----	36	0
----	37	0
----	38	0
----	39	0
----	40	0
----	41	0
----	42	0
----	43	0
----	44	0
----	45	0
----	46	0
----	47	0
----	48	0
----	49	0
----	50	0
----	51	0
----	52	0
----	53	0
----	54	0
----	55	0
----	56	0
----	57	0
----	58	0
----	59	0
----	60	0
----	61	0
----	62	0
----	63	0
----	64	0
----	65	0
----	66	0
----	67	0
----	68	0
----	69	0
----	70	0
----	71	0
----	72	0
----	73	0
----	74	0
----	75	0
----	76	0
----	77	0
----	78	0
----	79	0
----	80	0
MODE	81	0
ITER	82	0
NUMITR	83	30
COLD	84	-1
NPOINT	85	10
DEL	86	5.0000
NSHORT	87	1
STPERR	88	0.0300

TABLE 18/ 0/ (FLAGS)
MODEL 2 < 1148 12/08/80 > FROM IO ACCESS -1 0 0 0 0 0 0 0 0 0 0

TABLE # 19 FRACTIONS AT EQUAL PRICES FOR ALLOCATION

SPECIFIC PROCESS

SL :FIRST LOAD CATEGORY GP :1 (INDEX) AT :		HIGHLY SENSI- TIVE	SENSI- TIVE	MODERATE LY SENSI TIVE	INSENSI- TIVE	HIGHLY INSENSI- TIVE	SENSI- TIVE- NO LAG	ASSO.GAS ALLOC	OIL+ WET GAS ALLOC	NON-ASSO GAS ALLOC
INPUT LINK		1	2	3	4	5	6	7	8	9
FIRST INPUT LINK	1							1.0000	1.0000	1.0000
SECOND INPUT LINK	2									
THIRD INPUT LINK	3									
FOURTH INPUT LINK	4									
FIFTH INPUT LINK	5									
SIXTH INPUT LINK	6									
SEVENTH INPUT LINK	7									

SPECIFIC PROCESS

SL :FIRST LOAD CATEGORY GP :1 (INDEX) AT :		NUCLEAR FUEL ALLOC	RES HEAT ALLOC	RES COOKING ALLOC	IND ELEC SERVICE ALLOC	COMM HEAT ALLOC	VEHICLE MILE ALLOC	DIRECT HEAT ALLOC	INDIRECT HEAT ALLOC	HI QUAL- ITY COAL ALLOC
INPUT LINK		10	11	12	13	14	15	16	17	18
FIRST INPUT LINK	1	0.5000	0.3650	0.9750	0.9600	0.0020	0.8500	0.0005	0.1000	0.7000
SECOND INPUT LINK	2	0.5000	0.0900	0.0250	0.0400	0.2160	0.1500	0.4650	0.0800	0.0998
THIRD INPUT LINK	3		0.5350			0.7800		0.4795	0.1800	0.1998
FOURTH INPUT LINK	4		0.0100			0.0001		0.0550	0.0200	
FIFTH INPUT LINK	5					0.0020			0.5900	
SIXTH INPUT LINK	6								0.0100	
SEVENTH INPUT LINK	7								0.0200	

SPECIFIC PROCESS

SL :FIRST LOAD CATEGORY GP :1 (INDEX) AT :		ELECTRIC GENERATN ALLOC	FREIGHT FUEL ALLOC	ELEC SERVICES RES.	INDIRECT HEAT-GEO ALLOC	COOLING COMMER- CIAL	DRY GAS ALLOCA- TION
INPUT LINK		19	20	21	22	23	24
FIRST INPUT LINK	1	0.6698	0.4500	0.9000	0.9000	0.9000	0.7410
SECOND INPUT LINK	2	0.3300	0.5500	0.0999	0.0999	0.0999	0.1000
THIRD INPUT LINK	3	0.0002					0.0750
FOURTH INPUT LINK	4						0.0840
FIFTH INPUT LINK	5						
SIXTH INPUT LINK	6						
SEVENTH INPUT LINK	7						

TABLE 19/ 1/ (FRACTIONS AT EQUAL PRICE)
MODEL 2 < 1148 12/08/80 > FROM IO ACCESS 1 0 -2 -3 1 -1 0 0 0 0 0

TABLE # 19 FRACTIONS AT EQUAL PRICES FOR ALLOCATION

SPECIF ROCESS

SL :FIRST LOAD CATEGORY GP :5 (INDEX) AT :1 (INDEX)		DIST- LITE OIL	DIST- HEAVY OIL	DIST- GAS	DIST- ELECTRIC	DIST- COAL	COAL ALLOC	COAL LIQUIDS	APPAL LO-SULF COAL	CRUDE OIL ALLOC
INPUT LINK		1	2	3	4	5	6	7	8	9
FIRST INPUT LINK	1	0.1998	0.2498	0.2498	0.2498	0.5000	0.3158		0.5000	0.2000
SECOND INPUT LINK	2	0.1998	0.2498	0.2498	0.2498	0.5000	0.1998		0.5000	0.2000
THIRD INPUT LINK	3	0.1998	0.2498	0.2498	0.2498		0.2468			0.2000
FOURTH INPUT LINK	4	0.1998	0.2498	0.2498	0.2498		0.2138			0.2000
FIFTH INPUT LINK	5	0.1998					0.0218			0.2000

SPECIFIC PROCESS

SL :FIRST LOAD CATEGORY GP :5 (INDEX) AT :1 (INDEX)		NGL ALLOC	OIL PRODUCTS ALLOC	FEEDSTCK ALLOC	HI QUAL- ITY COAL ALLOC	SYNCRUDE PENETRA- TION	SYN GAS PENETRA- TION
INPUT LINK		10	11	12	13	14	15
FIRST INPUT LINK	1		1.0000	0.3700	0.7000	0.5000	0.5000
SECOND INPUT LINK	2		0.0001	0.1900	0.0998	0.5000	0.5000
THIRD INPUT LINK	3			0.4400	0.1998		
FOURTH INPUT LINK	4						
FIFTH INPUT LINK	5						

TABLE 19/ 5/ (FRACTIONS AT EQUAL PRICE)
MODEL 2 < 1148 12/08/80 > FROM IO ACCESS 1 0 -2 -3 1 -1 0 0 0 0 0

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :RESIDENTIAL SECTOR
OL :OUTPUT LINK #1
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE QUANTITY 1	PRICE 2	VINTAGE PROFILE RATIN 3	AVERAGE EFFIC-IENCY 4
HEAT ALLOCATION	1	5.6398	10.0000	0.0000	1.0000
ELECTRICITY ALLOCATION	2	0.7200	10.0000	0.0000	1.0000
OIL HEATER	3	1.9398	10.0000	0.0250	0.6320
GAS HEATER	4	3.0098	10.0000	0.0250	0.6000
SOLAR HEATER	5	0.0000	10.0000	0.0000	1.0000
ELECTRIC HEATER	6	0.6900	10.0000	0.0250	0.9560
LIGHTING & ELEC. APPL.	7	0.1998	10.0000	0.0333	0.2998
COOKING & OTHER ELECTRIC	8	0.4500	10.0000	0.0333	1.0000
COOKING & OTHER GAS	9	0.4900	10.0000	0.0333	0.6940
CONSUMER DEMAND	10		10.0000	0.0000	1.0000
GAS ALLOCATION	11	5.0098	10.0000	0.0000	1.0000
COOKING & OTHER ALLOC	12	0.9400	10.0000	0.0000	1.0000
SPACE COOLING	13	0.6800	10.0000	0.0333	2.1098
DIST PHOTO VOLT-WIND	14	0.0000	10.0000	0.0000	1.0000
ELEC SERVICE DEMAND	15	0.6700	10.0000	0.0000	1.0000

TABLE 21/ 1, 1/ (INITIAL CONDITIONS)
MODEL 2 < 1148 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :RESIDENTIAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
HEAT ALLOCATION	1	
ELECTRICITY ALLOCATION	2	0.3198
OIL HEATER	3	
GAS HEATER	4	
SOLAR HEATER	5	
ELECTRIC HEATER	6	
LIGHTING & ELEC. APPL.	7	
COOKING & OTHER ELECTRIC	8	
COOKING & OTHER GAS	9	
CONSUMER DEMAND	10	
GAS ALLOCATION	11	0.7000

TABLE 21/ 2, 1/ (INITIAL CONDITIONS)
MODEL 2 < 1148 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :RESIDENTIAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
HEAT ALLOCATION	1	
ELECTRICITY ALLOCATION	2	0.4500

TABLE 21/ 3, 1/ (INITIAL CONDITIONS)
MODEL 2 < 1148 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :RESIDENTIAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
HEAT ALLOCATION	1	
ELECTRICITY ALLOCATION	2	0.6700

TABLE 21/ 4, 1/ (INITIAL CONDITIONS)
MODEL 2 < 1148 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :INDUSTRIAL SECTOR
OL :
SL :1 (INDEX)

		ATTRIBUTE			
		QUANTITY	PRICE	VINTAGE PROFILE RATIN	AVERAGE EFFIC-IENCY
ACTIVITY		1	2	3	4
INDUSTRY ENERGY DEMAND	1		10.0000	0.0000	1.0000
DIR HEAT CONSERVE ALLOC	2	0.9560	10.0000	0.0000	1.0000
LOW BTU GAS-INDIR	3	0.0000	10.0000	0.0000	1.0000
DIRECT HEAT ALLOCATION	4	0.9560	10.0000	0.0000	1.0000
INDIRECT HEAT ALLOCATION	5	2.9868	10.0000	0.0000	1.0000
INDIR HEAT-GEO ALLOCATIO	6	2.9868	10.0000	0.0000	1.0000
ELEC SERVICE ALLOCATION	7	2.6598	10.0000	0.0000	1.0000
FEEDSTOCK ALLOCATION	8	2.2198	10.0000	0.0000	1.0000
DIR HEAT CONSERVATION	9	0.2168	10.0000	0.0000	0.3298
DIRECT HEAT-OIL	10	0.1748	10.0000	-0.0350	0.2908
INDIRECT HEAT-OIL	11	0.5880	10.0000	-0.0642	0.7080
DIRECT HEAT-GAS	12	0.7100	10.0000	-0.0348	0.2958
INDIRECT HEAT-GAS	13	1.7979	10.0000	-0.0844	0.6870
LOW BTU GAS-DIRECT	14	0.0000	10.0000	0.0000	1.0000
DIRECT HEAT-COAL	15	0.0708	10.0000	-0.0361	0.2988
INDIRECT HEAT-COAL	16	0.5830	10.0000	-0.0725	0.7000
AFB-COAL	17	0.0000	10.0000	0.0000	1.0000
SOLAR-OIL BACKUP	18	0.0000	10.0000	0.0000	1.0000
ELEC HEAT-HEAT PUMP	19	0.0178	10.0000	0.0200	0.9410
INDIR HEAT-CONSERVE	20	0.8770	10.0000	0.0000	0.6000
GEOTHERMAL	21	0.0000	10.0000	0.0000	1.0000
ELEC AUTO-GENERATION	22	0.4220	10.0000	0.0166	0.3440
LIGHT OIL ALLOCATION	23	0.6000	10.0000	0.0000	1.0000
HEAVY OIL ALLOCATION	24	0.8310	10.0000	0.0000	1.0000
HIGH BTU GAS ALLOC	25	2.3998	10.0000	0.0000	1.0000
INDUST COAL ALLOC	26	0.0000	10.0000	0.0000	1.0000
INDUST ELEC ALLOC	27	0.0188	10.0000	0.0000	1.0000
ELECT GENERATION ALLOC	28	1.2258	10.0000	0.0000	1.0000

TABLE 21/ 1, 2/ (INITIAL CONDITIONS)
MODEL 2 < 1149 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :INDUSTRIAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		QUANTITY
		1
INDUSTRY ENERGY DEMAND	1	
DIR HEAT CONSERVE ALLOC	2	
LOW BTU GAS-INDIR	3	
DIRECT HEAT ALLOCATION	4	
INDIRECT HEAT ALLOCATION	5	
INDIR HEAT-GEO ALLOCATIO	6	
ELEC SERVICE ALLOCATION	7	
FEEDSTOCK ALLOCATION	8	
DIR HEAT CONSERVATION	9	
DIRECT HEAT-OIL	10	
INDIRECT HEAT-OIL	11	
DIRECT HEAT-GAS	12	
INDIRECT HEAT-GAS	13	
LOW BTU GAS-DIRECT	14	
DIRECT HEAT-COAL	15	
INDIRECT HEAT-COAL	16	
AFB-COAL	17	
SOLAR-OIL BACKUP	18	
ELEC HEAT-HEAT PUMP	19	
INDIR HEAT-CONSERVE	20	
GEOTHERMAL	21	
ELEC AUTO-GENERATION	22	
LIGHT OIL ALLOCATION	23	0.1998
HEAVY OIL ALLOCATION	24	0.0000
HIGH BTU GAS ALLOC	25	2.6168
INDUST COAL ALLOC	26	0.2378
INDUST ELEC ALLOC	27	2.2378

TABLE 21/ 2, 2/ (INITIAL CONDITIONS)
MODEL 2 < 1149 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :INDUSTRIAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
INDUSTRY ENERGY DEMAND	1	
DIR HEAT CONSERVE ALLOC	2	
LOW BTU GAS-INDIR	3	
DIRECT HEAT ALLOCATION	4	
INDIRECT HEAT ALLOCATION	5	
INDIR HEAT-GEO ALLOCATIO	6	
ELEC SERVICE ALLOCATION	7	
FEEDSTOCK ALLOCATION	8	
DIR HEAT CONSERVATION	9	
DIRECT HEAT-OIL	10	
INDIRECT HEAT-OIL	11	
DIRECT HEAT-GAS	12	
INDIRECT HEAT-GAS	13	
LOW BTU GAS-DIRECT	14	
DIRECT HEAT-COAL	15	
INDIRECT HEAT-COAL	16	
AFB-COAL	17	
SOLAR-OIL BACKUP	18	
ELEC HEAT-HEAT PUMP	19	
INDIR HEAT-CONSERVE	20	
GEOTHERMAL	21	
ELEC AUTO-GENERATION	22	
LIGHT OIL ALLOCATION	23	0.7010
HEAVY OIL ALLOCATION	24	1.5298
HIGH BTU GAS ALLOC	25	0.7390
INDUST COAL ALLOC	26	0.8330

TABLE 21/ 3, 2/ (INITIAL CONDITIONS)
MODEL 2 < 1150 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :INDUSTRIAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
INDUSTRY ENERGY DEMAND	1	
DIR HEAT CONSERVE ALLOC	2	
LOW BTU GAS-INDIR	3	
DIRECT HEAT ALLOCATION	4	
INDIRECT HEAT ALLOCATION	5	
INDIR HEAT-GEO ALLOCATIO	6	
ELEC SERVICE ALLOCATION	7	
FEEDSTOCK ALLOCATION	8	
DIR HEAT CONSERVATION	9	
DIRECT HEAT-OIL	10	
INDIRECT HEAT-OIL	11	
DIRECT HEAT-GAS	12	
INDIRECT HEAT-GAS	13	
LOW BTU GAS-DIRECT	14	
DIRECT HEAT-COAL	15	
INDIRECT HEAT-COAL	16	
AFB-COAL	17	
SOLAR-OIL BACKUP	18	
ELEC HEAT-HEAT PUMP	19	
INDIR HEAT-CONSERVE	20	
GEOTHERMAL	21	
ELEC AUTO-GENERATION	22	
LIGHT OIL ALLOCATION	23	
HEAVY OIL ALLOCATION	24	
HIGH BTU GAS ALLOC	25	0.6060
INDUST COAL ALLOC	26	0.0000

TABLE 21/ 4, 2/ (INITIAL CONDITIONS)
MODEL 2 < 1150 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :INDUSTRIAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
INDUSTRY ENERGY DEMAND	1	
DIR HEAT CONSERVE ALLOC	2	
LOW BTU GAS-INDIR	3	
DIRECT HEAT ALLOCATION	4	
INDIRECT HEAT ALLOCATION	5	
INDIR HEAT-GEO ALLOCATIO	6	
ELEC SERVICE ALLOCATION	7	
FEEDSTOCK ALLOCATION	8	
DIR HEAT CONSERVATION	9	
DIRECT HEAT-OIL	10	
INDIRECT HEAT-OIL	11	
DIRECT HEAT-GAS	12	
INDIRECT HEAT-GAS	13	
LOW BTU GAS-DIRECT	14	
DIRECT HEAT-COAL	15	
INDIRECT HEAT-COAL	16	
AFB-COAL	17	
SOLAR-OIL BACKUP	18	
ELEC HEAT-HEAT PUMP	19	
INDIR HEAT-CONSERVE	20	
GEOTHERMAL	21	
ELEC AUTO-GENERATION	22	
LIGHT OIL ALLOCATION	23	
HEAVY OIL ALLOCATION	24	
HIGH BTU GAS ALLOC	25	
INDUST COAL ALLOC	26	0.2868

TABLE 21/ 5, 2/ (INITIAL CONDITIONS)
MODEL 2 < 1150 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :INDUSTRIAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
INDUSTRY ENERGY DEMAND	1	
DIR HEAT CONSERVE ALLOC	2	
LOW BTU GAS-INDIR	3	
DIRECT HEAT ALLOCATION	4	
INDIRECT HEAT ALLOCATION	5	
INDIR HEAT-GEO ALLOCATIO	6	
ELEC SERVICE ALLOCATION	7	
FEEDSTOCK ALLOCATION	8	
DIR HEAT CONSERVATION	9	
DIRECT HEAT-OIL	10	
INDIRECT HEAT-OIL	11	
DIRECT HEAT-GAS	12	
INDIRECT HEAT-GAS	13	
LOW BTU GAS-DIRECT	14	
DIRECT HEAT-COAL	15	
INDIRECT HEAT-COAL	16	
AFB-COAL	17	
SOLAR-OIL BACKUP	18	
ELEC HEAT-HEAT PUMP	19	
INDIR HEAT-CONSERVE	20	
GEOTHERMAL	21	
ELEC AUTO-GENERATION	22	
LIGHT OIL ALLOCATION	23	
HEAVY OIL ALLOCATION	24	
HIGH BTU GAS ALLOC	25	
INDUST COAL ALLOC	26	0.0000

TABLE 21/ 6, 2/ (INITIAL CONDITIONS)
MODEL 2 < 1150 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :DISTRIBUTION SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE: QUANTITY 1	PRICE 2	VINTAGE PROFILE RATIN 3	AVERAGE EFFIC-IENCY 4
LIGHT OIL DISTRIBUTION	1	0.0298		0.0000	1.0000
HEAVY OIL DISTRIBUTION	2	3.0898		0.0000	1.0000
GAS DISTRIBUTION	3	3.2398		0.0000	1.0000
ELECTRICITY DISTRIBUTION	4	2.1598		0.0000	1.0000
COAL DISTRIBUTION	5	8.2598		0.0000	1.0000
ELECTRIC LINE LOSS	6	5.9130	3.0000	0.0000	0.8970
TRANSPORTATION-MET COAL	7	2.2938	1.6897	0.0000	1.0000

TABLE 21/ 1, 3/ (INITIAL CONDITIONS)
MODEL 2 < 1150 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :DISTRIBUTION SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE: ---- 1
LIGHT OIL DISTRIBUTION	1	3.0698
HEAVY OIL DISTRIBUTION	2	2.3608
GAS DISTRIBUTION	3	5.7048
ELECTRICITY DISTRIBUTION	4	1.4808
COAL DISTRIBUTION	5	1.3578

TABLE 21/ 2, 3/ (INITIAL CONDITIONS)
MODEL 2 < 1150 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :DISTRIBUTION SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
LIGHT OIL DISTRIBUTION	1	1.0038
HEAVY OIL DISTRIBUTION	2	0.6130
GAS DISTRIBUTION	3	1.9749
ELECTRICITY DISTRIBUTION	4	2.2568

TABLE 21/ 3, 3/ (INITIAL CONDITIONS)
MODEL 2 < 1150 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :DISTRIBUTION SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
LIGHT OIL DISTRIBUTION	1	1.5007
HEAVY OIL DISTRIBUTION	2	0.9590
GAS DISTRIBUTION	3	6.3800
ELECTRICITY DISTRIBUTION	4	0.0148

TABLE 21/ 4, 3/ (INITIAL CONDITIONS)
MODEL 2 < 1150 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :DISTRIBUTION SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
LIGHT OIL DISTRIBUTION	1	16.6297

TABLE 21/ 5, 3/ (INITIAL CONDITIONS)
MODEL 2 < 1150 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :ELECTRICITY SECTOR
OL :
SL :SUBLINK ONE

ATTRIBUTE		QUANTITY	PRICE	VINTAGE PROFILE RATIN	AVERAGE EFFIC-IENCY
ACTIVITY		1	2	3	4
ELECTRICITY ALLOC	1	6.0419	100.0000	0.0000	1.0000
NUCLEAR FUEL ALLOC	2	0.0000		0.0000	1.0000
OIL ALLOCATION	3	0.0298		0.0000	1.0000
GAS ALLOCATION	4	3.1898		0.0000	1.0000
ELECTR. POWER LOADING	5	6.5900		0.0000	1.0000
ADVANCED NUCLEAR (FBR)	6	0.0000	10.0000	0.0000	1.0000
CONVNTIONAL NUCLEAR(LWR)	7	0.5900	5.0000	0.0142	0.3098
COAL BOILER	8	2.6499	6.0000	-0.0022	0.3308
OIL BOILER	9	0.9050	7.0000	0.0142	0.3198
OIL TURBINE	10	0.0000	10.0000	0.0000	0.2348
GAS BOILER	11	0.9330	7.0000	0.0142	0.3198
GAS TURBINE	12	0.0000	10.0000	0.0000	0.2348
CENTRAL RENEWABLES	13	0.0000	4.9798	0.0000	1.0000
COAL ALLOCATION	14	8.7799		0.0000	1.0000
SYN GAS-COMB. CYCLE	15	0.0000	10.0000	0.0000	1.0000
ATMOS. FLUIDIZED BED	16	0.0000	10.0000	0.0000	1.0000
FUEL CELL. OIL	17	0.0000	10.0000	0.0000	1.0000
HYDRO	18	0.9640	5.4998	0.0000	1.0000
BIOMASS	19	0.0000	10.0000	0.0000	1.0000
MHD	20	0.0000	10.0000	0.0000	1.0000

TABLE 21/ 1, 4/ (INITIAL CONDITIONS)
MODEL 2 < 1151 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :ELECTRICITY SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE: QUANTITY 1
ELECTRICITY ALLOC	1	
NUCLEAR FUEL ALLOC	2	1.8998
OIL ALLOCATION	3	0.0000
GAS ALLOCATION	4	0.0398
ELECTR. POWER LOADING	5	
ADVANCED NUCLEAR (FBR)	6	
CONVNTIONAL NUCLEAR(LWR)	7	
COAL BOILER	8	
OIL BOILER	9	
OIL TURBINE	10	
GAS BOILER	11	
GAS TURBINE	12	
CENTRAL RENEWABLES	13	
COAL ALLOCATION	14	0.0000

TABLE 21/ 2, 4/ (INITIAL CONDITIONS)
MODEL 2 < 1151 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :ELECTRICITY SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
ELECTRICITY ALLOC	1	
NUCLEAR FUEL ALLOC	2	
OIL ALLOCATION	3	
GAS ALLOCATION	4	
ELECTR. POWER LOADING	5	
ADVANCED NUCLEAR (FBR)	6	
CONVNTIONAL NUCLEAR(LWR)	7	
COAL BOILER	8	
OIL BOILER	9	
OIL TURBINE	10	
GAS BOILER	11	
GAS TURBINE	12	
CENTRAL RENEWABLES	13	
COAL ALLOCATION	14	0.0000

TABLE 21/ 3, 4/ (INITIAL CONDITIONS)
MODEL 2 < 1151 12/08 80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :ELECTRICITY SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
ELECTRICITY ALLOC	1	
NUCLEAR FUEL ALLOC	2	
OIL ALLOCATION	3	
GAS ALLOCATION	4	
ELECTR. POWER LOADING	5	
ADVANCED NUCLEAR (FBR)	6	
CONVNTIONAL NUCLEAR(LWR)	7	
COAL BOILER	8	
OIL BOILER	9	
OIL TURBINE	10	
GAS BOILER	11	
GAS TURBINE	12	
CENTRAL RENEWABLES	13	
COAL ALLOCATION	14	0.0000

TABLE 21/ 4, 4/ (INITIAL CONDITIONS)
MODEL 2 < 1151 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :NUCLEAR SECTOR
OL :
SL :1 (INDEX)

		ATTRIBUTE			
		QUANTITY	PRICE	VINTAGE PROFILE RATIN	AVERAGE EFFIC-IENCY
ACTIVITY		1	2	3	4
MINING & MILLING	1	1.8998	0.3498	0.0000	1.0000
ENRICHMENT/WASTE DISP	2	1.8998	0.3498	0.0000	1.0000

TABLE 21/ 1, 5/ (INITIAL CONDITIONS)
MODEL 2 < 1151 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		QUANTITY 1	PRICE 2	VINTAGE PROFILE RATIN 3	AVERAGE EFFIC-IENCY 4
COAL ALLOCATION	1	9.6200	10.0000	0.0000	1.0000
COAL LIQUIDS ALLOC	2	0.0000	10.0000	0.0000	1.0000
HI BTU SYNGAS ALLOC	3	0.0000	10.0000	0.0000	1.0000
WEST LO-SULF COAL ALLOC	4	1.0597	10.0000	1.0000	1.0000
APP HI-SULF COAL ALLOC	5	5.4098	10.0000	0.0208	1.0000
MID-CONT. COAL ALLOC	6	3.2598	10.0000	0.0228	1.0000
TRANS-MID CONT. HI GAS	7	0.0000	100.0000	0.0000	1.0000
TRANS-WEST LO-SULF HI GA	8	0.0000	100.0000	0.0000	1.0000
TRANS-EAST HI GAS	9	0.0000	100.0000	0.0000	1.0000
LIQUIDS-MID CONT.	10	0.0000	100.0000	0.0000	1.0000
HI BTU GAS-MID CONT.	11	0.0000	100.0000	0.0000	1.0000
LIQUIDS-LO-SULF WEST	12	0.0000	100.0000	0.0000	1.0000
HI BTU GAS-WEST(LO-SULF)	13	0.0000	100.0000	0.0000	1.0000
LIQUIDS-APPAL HI-SULF	14	0.0000	100.0000	0.0000	1.0000
HI BTU GAS-EAST(HI SULF)	15	0.0000	100.0000	0.0000	1.0000
WESTERN LO-SULF COAL	16	1.0597	10.0000	1.0000	1.0000
APPAL HI-SULF COAL	17	6.8800	10.0000	0.0211	1.0000
MID-CONTINENTAL COAL	18	3.2598	10.0000	0.0224	1.0000
APPAL LO-SULF COAL	19	0.7000	10.0000	0.0276	1.0000
APPAL. LO-SUL COAL ALLOC	20	0.0000	10.0000	0.0278	1.0000
WEST HI-SULF COAL ALLOC	21	0.8000	10.0000	0.0000	1.0000
HIGH QUALITY COAL ALLOC	22	2.2898	10.0000	0.0000	1.0000
WESTERN HI-SULF COAL	23	0.8000	10.0000	1.0000	1.0000
APPAL PREMIUM COAL	24	1.8998	10.0000	0.0258	1.0000
LIQUIDS-WEST HI-SULF	25	0.0000	10.0000	0.0000	1.0000
HI BTU GAS-WEST(HI SULF)	26	0.0000	10.0000	0.0000	1.0000
TRANS-WEST HI GAS HI-SUL	27	0.0000	10.0000	0.0000	1.0000

TABLE 21/ 1, 6/ (INITIAL CONDITIONS)
MODEL 2 < 1152 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE QUANTITY 1
COAL ALLOCATION	1	
COAL LIQUIDS ALLOC	2	
HI BTU SYNGAS ALLOC	3	
WEST LO-SULF COAL ALLOC	4	0.0000
APP HI-SULF COAL ALLOC	5	0.0000
MID-CONT. COAL ALLOC	6	0.0000
TRANS-MID CONT. HI GAS	7	
TRANS-WEST LO-SULF HI GA	8	
TRANS-EAST HI GAS	9	
LIQUIDS-MID CONT.	10	
HI BTU GAS-MID CONT.	11	
LIQUIDS-LO-SULF WEST	12	
HI BTU GAS-WEST(LO-SULF)	13	
LIQUIDS-APPAL HI-SULF	14	
HI BTU GAS-EAST(HI SULF)	15	
WESTERN LO-SULF COAL	16	
APPAL HI-SULF COAL	17	
MID-CONTINENTAL COAL	18	
APPAL LO-SULF COAL	19	
APPAL. LO-SUL COAL ALLOC	20	0.7000
WEST HI-SULF COAL ALLOC	21	0.0000
HIGH QUALITY COAL ALLOC	22	1.7798

TABLE 21/ 2, 6/ (INITIAL CONDITIONS)
MODEL 2 < 1152 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
COAL ALLOCATION	1	
COAL LIQUIDS ALLOC	2	
HI BTU SYNGAS ALLOC	3	
WEST LO-SULF COAL ALLOC	4	0.0000
APP HI-SULF COAL ALLOC	5	0.0000
MID-CONT. COAL ALLOC	6	0.0000
TRANS-MID CONT. HI GAS	7	
TRANS-WEST LO-SULF HI GA	8	
TRANS-EAST HI GAS	9	
LIQUIDS-MID CONT.	10	
HI BTU GAS-MID CONT.	11	
LIQUIDS-LO-SULF WEST	12	
HI BTU GAS-WEST(LO-SULF)	13	
LIQUIDS-APPAL HI-SULF	14	
HI BTU GAS-EAST(HI SULF)	15	
WESTERN LO-SULF COAL	16	
APPAL HI-SULF COAL	17	
MID-CONTINENTAL COAL	18	
APPAL LO-SULF COAL	19	
APPAL. LO-SUL COAL ALLOC	20	
WEST HI-SULF COAL ALLOC	21	0.0000

TABLE 21/ 3, 6/ (INITIAL CONDITIONS)
MODEL 2 < 1152 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
COAL ALLOCATION	1	
COAL LIQUIDS ALLOC	2	
HI BTU SYNGAS ALLOC	3	
WEST LO-SULF COAL ALLOC	4	
APP HI-SULF COAL ALLOC	5	1.4699

TABLE 21/ 4, 6/ (INITIAL CONDITIONS)
MODEL 2 < 1152 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :OIL-GAS SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		QUANTITY 1	PRICE 2	VINTAGE PROFILE RATIN 3	AVERAGE EFFIC-IENCY 4
OIL PRODUCTS ALLOC	1	7.0198	10.0000	0.0000	1.0000
DRY GAS ALLOCATION	2	17.2697	10.0000	0.0000	1.0000
CRUDE OIL ALLOCATION	3	28.8897	10.0000	0.0000	1.0000
OIL REFINERY	4	26.1397	10.0000	-0.0545	0.9050
NATURAL GAS LIQ. ALLOC	5			0.0000	1.0000
ENHANCED OIL RECOVERY	6	0.0000	10.0000	0.1998	1.0000
ENHANCED GAS RECOVERY	7	0.0000	10.0000	0.1998	1.0000
SYNTHETIC OIL PENETRATIO	8	28.8899	10.0000	0.0000	1.0000
SYNTHETIC GAS PENETRATIO	9	17.2699	10.0000	0.0000	1.0000
SHALE OIL MINE	10	0.0000	10.0000	0.0000	1.0000
N. SLOPE OIL PROD (+NGL)	11	0.0000	10.0000	0.1998	1.0000
DOM OIL & ASSO GAS PROD	12	20.2098	10.0000	0.1998	1.0000
NORTH SLOPE GAS	13	0.0000	10.0000	0.1998	1.0000
DOMESTIC GAS PRODUCTION	14	18.3888	10.0000	0.1998	1.0000
NON-ASSC GAS PLANT ALLOC	15		10.0000	0.0000	1.0000
SHALE OIL UPGRADE	16	0.0000	10.0000	0.0000	1.0000
TRANS-N. SLOPE OIL	17	0.0000	10.0000	0.0000	1.0000
TRANS-ENH. GAS RECOV	18	0.0000	10.0000	0.0000	1.0000
TRANS-N. SLOPE GAS	19	0.0000	10.0000	0.0000	1.0000
TRANS-IMPORTED GAS	20	0.9080	10.0000	0.0000	1.0000
TRANS-ASSOCIATED GAS	21		10.0000	0.0000	1.0000
TRANS-DOMESTIC GAS	22	16.4769	10.0000	0.0000	1.0000

TABLE 21/ 1, 7/ (INITIAL CONDITIONS)
MODEL 2 < 1152 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

```
TABLE # 21   INITIAL CONDITIONS

 GR :ENERGY SYSTEM NETWORK    ATTRIBUTE
 LR :UNITED STATES           +-----------+
 SC :OIL-GAS SECTOR          | ----      |
 OL :                        |           |
 SL :1    (INDEX)            |           |
-----------------------------+-----------+
  ACTIVITY                   |     1     |
------------------------+----+-----------+
OIL PRODUCTS ALLOC      |  1 |  21.9697  |

TABLE 21/ 2, 7/ (INITIAL CONDITIONS      )
MODEL  2 < 1153 12/08/80 > FROM IO ACCESS  -2  0  0  0  1  0 -3 -1 -4  1  1
```



```
TABLE # 21   INITIAL CONDITIONS

 GR :ENERGY SYSTEM NETWORK    ATTRIBUTE
 LR :UNITED STATES           +-----------+
 SC :OIL-GAS SECTOR          |           |
 OL :                        |           |
 SL :1    (INDEX)            |           |
-----------------------------+-----------+
  ACTIVITY                   |     1     |
------------------------+----+-----------+
OIL PRODUCTS ALLOC      |  1 |   0.9130  |

TABLE 21/ 3, 7/ (INITIAL CONDITIONS      )
MODEL  2 < 1153 12/08/80 > FROM IO ACCESS  -2  0  0  0  1  0 -3 -1 -4  1  1
```

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :TRANSPORTATION SECTOR
OL :
SL :1 (INDEX)

ATTRIBUTE

ACTIVITY		QUANTITY 1	PRICE 2	VINTAGE PROFILE RATIN 3	AVERAGE EFFIC- IENCY 4
AIRCRAFT+MILITARY	1	0.1626	3.3398	0.0250	0.1228
AUTOMOBILE-OIL	2	1.0503	4.5398	0.0333	0.1043
TRUCK,BUS-DIESEL	3	0.2808	4.1598	0.0250	0.0668
LIGHT OIL ALLOCATION	4	1.3198	10.0000	0.0000	1.0000
TRANS DEMAND-PERSONAL	5		10.0000	0.0000	1.0000
AUTO-ELECTRIC	6	0.0000	10.0000	0.0000	1.0000
RAIL,BARGE-FREIGHT	7	1.3268	2.7398	-0.0814	0.9460
VEHICLE MILE ALLOCATION	8	1.0503	10.0000	0.0000	1.0000
FREIGHT FUEL ALLOCATION	9	1.4028	10.0000	0.0000	1.0000

TABLE 21/ 1, 8/ (INITIAL CONDITIONS)
MODEL 2 < 1153 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :TRANSPORTATION SECTOR
OL :
SL :1 (INDEX)

ATTRIBUTE

ACTIVITY		1
AIRCRAFT+MILITARY	1	
AUTOMOBILE-OIL	2	
TRUCK,BUS-DIESEL	3	
LIGHT OIL ALLOCATION	4	10.0500

TABLE 21/ 2, 8/ (INITIAL CONDITIONS)
MODEL 2 < 1153 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

```
TABLE # 21   INITIAL CONDITIONS

 GR :ENERGY SYSTEM NETWORK    ATTRIBUTE
 LR :UNITED STATES           +----------+
 SC :TRANSPORTATION SECTOR   |          |
 OL :                        |          |
 SL :1    (INDEX)            |          |
-----------------------------+----------+
  ACTIVITY                   |    1     |
------------------------+----+----------+
AIRCRAFT+MILITARY       |  1 |          |
AUTOMOBILE-OIL          |  2 |          |
TRUCK,BUS-DIESEL        |  3 |          |
LIGHT OIL ALLOCATION    |  4 |   4.1998 |

TABLE 21/ 3, 8/ (INITIAL CONDITIONS      )
MODEL  2 < 1153 12/08/80 > FROM IO ACCESS  -2  0  0  0  1  0 -3 -1 -4  1  1
```

```
TABLE # 21   INITIAL CONDITIONS

 GR :ENERGY SYSTEM NETWORK    ATTRIBUTE
 LR :UNITED STATES           +----------+
 SC :TRANSPORTATION SECTOR   |          |
 OL :                        |          |
 SL :1    (INDEX)            |          |
-----------------------------+----------+
  ACTIVITY                   |    1     |
------------------------+----+----------+
AIRCRAFT+MILITARY       |  1 |          |
AUTOMOBILE-OIL          |  2 |          |
TRUCK,BUS-DIESEL        |  3 |          |
LIGHT OIL ALLOCATION    |  4 |   0.7900 |

TABLE 21/ 4, 8/ (INITIAL CONDITIONS      )
MODEL  2 < 1153 12/08/80 > FROM IO ACCESS  -2  0  0  0  1  0 -3 -1 -4  1  1
```

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COMMERCIAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		QUANTITY 1	PRICE 2	VINTAGE PROFILE RATIN 3	AVERAGE EFFIC-IENCY 4
HEAT & WATER ALLOCATION	1	2.4900	10.0000	0.0000	1.0000
COMM ELEC ALLOC	2	0.0998	10.0000	0.0000	1.0000
LIGHT OIL HEATER	3	0.6500	10.0000	0.0142	0.6480
GAS HEATER	4	1.1100	10.0000	0.0200	0.6080
SOLAR HEAT & GEOTHERM	5	0.0000	10.0000	0.0000	1.0000
ELECTRIC HEATER	6	0.1098	10.0000	0.0200	1.0498
LIGHT	7	0.6000	10.0000	0.0200	1.0000
OTHER ELECTRIC	8	0.1798	10.0000	0.0200	1.0000
OTHER GAS	9	0.1500	10.0000	0.0200	1.0000
COMMERCIAL DEMAND	10		10.0000	0.0000	1.0000
GAS ALLOCATION	11	1.8300	10.0000	0.0000	1.0000
----	12		10.0000	0.0000	1.0000
ELECTRIC COOLING	13	1.4397	10.0000	0.0200	2.3998
SOLAR COOLING	14	0.0000	10.0000	0.0000	1.0000
COOLING ALLOCATION	15	1.4397	10.0000	0.0000	1.0000
DISTRIBUTED ELECTRIC	16	0.0000	10.0000	0.0000	1.0000
ELEC SERVICE ALLOC	17	0.6000	10.0000	0.0000	1.0000
HEAVY OIL HEATER	18	0.6200	10.0000	0.0142	0.6480

TABLE 21/ 1, 9/ (INITIAL CONDITIONS)
MODEL 2 < 1154 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COMMERCIAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
HEAT & WATER ALLOCATION	1	
COMM ELEC ALLOC	2	0.6000
LIGHT OIL HEATER	3	
GAS HEATER	4	
SOLAR HEAT & GEOTHERM	5	
ELECTRIC HEATER	6	
LIGHT	7	
OTHER ELECTRIC	8	
OTHER GAS	9	
COMMERCIAL DEMAND	10	
GAS ALLOCATION	11	0.1500

TABLE 21/ 2, 9/ (INITIAL CONDITIONS)
MODEL 2 < 1154 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COMMERCIAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
HEAT & WATER ALLOCATION	1	
COMM ELEC ALLOC	2	0.6000

TABLE 21/ 3, 9/ (INITIAL CONDITIONS)
MODEL 2 < 1154 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :COMMERCIAL SECTOR
OL :
SL :1 (INDEX)

ACTIVITY		ATTRIBUTE 1
HEAT & WATER ALLOCATION	1	
COMM ELEC ALLOC	2	0.1798

TABLE 21/ 4, 9/ (INITIAL CONDITIONS)
MODEL 2 < 1154 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :IMPORT-EXPORT SECTOR
OL :
SL :1 (INDEX)

ATTRIBUTE		QUANTITY	PRICE	VINTAGE PROFILE RATIN	AVERAGE EFFIC- IENCY
ACTIVITY		1	2	3	4
IMPORTS-OIL/GAS(FIX P)	1	8.6799	2.1598	0.0000	1.0000

TABLE 21/ 1,10/ (INITIAL CONDITIONS)
MODEL 2 < 1154 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :IMPORT-EXPORT SECTOR
OL :
SL :1 (INDEX)

ATTRIBUTE		QUANTITY	PRICE	RATIN
ACTIVITY		1	2	3
IMPORTS-OIL/GAS(FIX P)	1	0.9080	2.1598	0.0000

TABLE 21/ 2,10/ (INITIAL CONDITIONS)
MODEL 2 < 1154 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 21 INITIAL CONDITIONS

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :IMPORT-EXPORT SECTOR
OL :
SL :1 (INDEX)

ATTRIBUTE		QUANTITY	PRICE	RATIN
ACTIVITY		1	2	3
IMPORTS-OIL/GAS(FIX P)	1	3.7598	3.1598	0.0000

TABLE 21/ 3,10/ (INITIAL CONDITIONS)
MODEL 2 < 1155 12/08/80 > FROM IO ACCESS -2 0 0 0 1 0 -3 -1 -4 1 1

TABLE # 22 INITIAL CONDITIONS - ELECTRICITY SECTOR

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :ELECTRICITY SECTOR
OL :
AT :QUANTITY

ACTIVITY		SUBLINK ONE 1	SUBLINK TWO 2	SUBLINK THREE 3
ELECTRICITY ALLOC	1	6.0419	0.4939	0.0499
NUCLEAR FUEL ALLOC	2	0.0000		
OIL ALLOCATION	3	0.0298		
GAS ALLOCATION	4	3.1898		
ELECTR. POWER LOADING	5	6.5900		
ADVANCED NUCLEAR (FBR)	6	0.0000	0.0000	0.0000
CONVNTIONAL NUCLEAR(LWR)	7	0.5900	0.0000	0.0000
COAL BOILER	8	2.6499	0.2399	0.0149
OIL BOILER	9	0.9050	0.0819	0.0049
OIL TURBINE	10	0.0000	0.0000	0.0098
GAS BOILER	11	0.9330	0.0849	0.0049
GAS TURBINE	12	0.0000	0.0000	0.0098
CENTRAL RENEWABLES	13	0.0000	0.0000	0.0000
COAL ALLOCATION	14	8.7799		
SYN GAS-COMB. CYCLE	15	0.0000	0.0000	0.0000
ATMOS. FLUIDIZED BED	16	0.0000	0.0000	0.0000
FUEL CELL. OIL	17	0.0000	0.0000	0.0000
HYDRO	18	0.9640	0.0869	0.0049
BIOMASS	19	0.0000	0.0000	0.0000
MHD	20	0.0000	0.0000	0.0000

TABLE 22/ 1/ (INITIAL CONDITIONS - ELE)
MODEL 2 < 1155 12/08/80 > FROM IO ACCESS -3 0 0 0 -2 0 1 -1 4 1 1

TABLE # 22 INITIAL CONDITIONS - ELECTRICITY SECTOR

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :ELECTRICITY SECTOR
OL :
AT : PRICE

		SUBLINK		
		SUBLINK ONE	SUBLINK TWO	SUBLINK THREE
ACTIVITY		1	2	3
ELECTRICITY ALLOC	1	100.0000	100.0000	100.0000
NUCLEAR FUEL ALLOC	2			
OIL ALLOCATION	3			
GAS ALLOCATION	4			
ELECTR. POWER LOADING	5			
ADVANCED NUCLEAR (FBR)	6	10.0000	10.0000	10.0000
CONVNTIONAL NUCLEAR(LWR)	7	5.0000	20.0000	20.0000
COAL BOILER	8	6.0000	10.0000	20.0000
OIL BOILER	9	7.0000	9.0000	15.0000
OIL TURBINE	10	10.0000	10.0000	12.0000
GAS BOILER	11	7.0000	9.0000	15.0000
GAS TURBINE	12	10.0000	11.0000	12.0000
CENTRAL RENEWABLES	13	4.9798	10.0000	10.0000
COAL ALLOCATION	14			
SYN GAS-COMB. CYCLE	15	10.0000	10.0000	10.0000
ATMOS. FLUIDIZED BED	16	10.0000	10.0000	10.0000
FUEL CELL: OIL	17	10.0000	10.0000	10.0000
HYDRO	18	5.4998	8.0000	12.0000
BIOMASS	19	10.0000	10.0000	10.0000
MHD	20	10.0000	10.0000	10.0000

TABLE 22/ 2/ (INITIAL CONDITIONS - ELE)
MODEL 2 < 1155 12/08/80 > FROM IO ACCESS -3 0 0 0 -2 0 1 -1 4 1 1

TABLE # 22 INITIAL CONDITIONS - ELECTRICITY SECTOR

GR :ENERGY SYSTEM NETWORK
LR :UNITED STATES
SC :ELECTRICITY SECTOR
OL :
AT :VINTAGE PROFILE RATIN

ACTIVITY		SUBLINK ONE 1	SUBLINK TWO 2	SUBLINK THREE 3
ELECTRICITY ALLOC	1	0.0000	0.0000	0.0000
NUCLEAR FUEL ALLOC	2	0.0000	0.0000	0.0000
OIL ALLOCATION	3	0.0000	0.0000	0.0000
GAS ALLOCATION	4	0.0000	0.0000	0.0000
ELECTR. POWER LOADING	5	0.0000	0.0000	0.0000
ADVANCED NUCLEAR (FBR)	6	0.0000	0.0000	0.0000
CONVNTIONAL NUCLEAR(LWR)	7	0.0142	0.0000	0.0000
COAL BOILER	8	-0.0022	0.0126	0.0134
OIL BOILER	9	0.0142	0.0142	0.0133
OIL TURBINE	10	0.0000	0.0000	-0.0671
GAS BOILER	11	0.0142	0.0142	0.0123
GAS TURBINE	12	0.0000	0.0000	-0.0671
CENTRAL RENEWABLES	13	0.0000	0.0000	0.0000
COAL ALLOCATION	14	0.0000	0.0000	0.0000
SYN GAS-COMB. CYCLE	15	0.0000	0.0000	0.0000
ATMOS. FLUIDIZED BED	16	0.0000	0.0000	0.0000
FUEL CELL. OIL	17	0.0000	0.0000	0.0000
HYDRO	18	0.0000	0.0000	0.0000
BIOMASS	19	0.0000	0.0000	0.0000
MHD	20	0.0000	0.0000	0.0000

TABLE 22/ 3/ (INITIAL CONDITIONS - ELE)
MODEL 2 < 1155 12/08/80 > FROM IO ACCESS -3 0 0 0 -2 0 1 -1 4 1 1

TABLE # 22 INITIAL CONDITIONS - ELECTRICITY SECTOR

```
 GR :ENERGY SYSTEM NETWORK    SUBLINK
 LR :UNITED STATES           +----------+
 SC :ELECTRICITY SECTOR      | SUBLINK  |
 OL :                        | ONE      |
 AT :AVERAGE EFFIC-   IENCY  |          |
-----------------------------+----------+
  ACTIVITY                   |    1     |
-----------------------+-----+----------+
ELECTRICITY ALLOC      |  1  |  1.0000  |
NUCLEAR FUEL ALLOC     |  2  |  1.0000  |
OIL ALLOCATION         |  3  |  1.0000  |
GAS ALLOCATION         |  4  |  1.0000  |
ELECTR. POWER LOADING  |  5  |  1.0000  |
ADVANCED NUCLEAR (FBR) |  6  |  1.0000  |
CONVNTIONAL NUCLEAR(LWR)| 7  |  0.3098  |
COAL BOILER            |  8  |  0.3308  |
OIL BOILER             |  9  |  0.3198  |
OIL TURBINE            | 10  |  0.2348  |
GAS BOILER             | 11  |  0.3198  |
GAS TURBINE            | 12  |  0.2348  |
CENTRAL RENEWABLES     | 13  |  1.0000  |
COAL ALLOCATION        | 14  |  1.0000  |
SYN GAS-COMB. CYCLE    | 15  |  1.0000  |
ATMOS. FLUIDIZED BED   | 16  |  1.0000  |
FUEL CELL. OIL         | 17  |  1.0000  |
HYDRO                  | 18  |  1.0000  |
BIOMASS                | 19  |  1.0000  |
MHD                    | 20  |  1.0000  |
```

TABLE 22/ 4/ (INITIAL CONDITIONS - ELE)
MODEL 2 < 1155 12/08/80 > FROM IO ACCESS -3 0 0 0 -2 0 1 -1 4 1 1

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