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DOE/CS/20205--

THRESHOLD EVALUATION DATA REVISION AND
COMPUTER PROGRAM ENHANCEMENT
FINAL REPORT

MASTER

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Prepared for:

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February 27, 1979

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Task 49

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MGW

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February 28, 1979

Mr. Bill Dapkus
Division of Buildings & Community Systems
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Room 2248
20 Massachusetts Avenue, N.W.
Washington, D.C. 20545

Dear Bill:

We are pleased to submit the enclosed report, "Threshold Evaluation Data Revision and Computer Program Enhancement," as the final product of BCS Task 049. This task was completed in accordance with Contract No. EC-77-C-03-1697.

Sincerely,

Roberta L. Laccetti

Roberta L. Laccetti
Project Manager

RLL/ce

cc: Ron Benz
Robert Reid

Enclosure

TABLE OF CONTENTS

	<u>Page</u>
1. INTRODUCTION	1
2. DATA DEVELOPMENT	2
2.1 General Approach.	2
2.2 Data Development Activities in Each BCS Branch	4
2.2.1 Consumer Products Branch	4
2.2.2 Consumer Motivation Branch	5
2.2.3 Urban Waste Technology Branch	6
2.2.4 Legislatively Mandated Projects	12
2.2.5 Community Systems Branch	13
2.2.6 Architecture/Engineering Branch.	14
3. IMPROVEMENTS TO THE METHODOLOGY AND COMPUTER PROGRAMS.	16
3.1 Years of Analysis Extended to 2000.	16
3.2 Fuel Prices	16
3.3 Calculation of Net Savings.	16
3.4 Other Changes	18
4. FUTURE WORK.	19
4.1 Continued Upgrading of the System	19
4.2 Development of Link to ORNL Models.	19
4.3 In-depth Study of Some Branches	20
4.4 Evaluation of Motivational Projects	20

APPENDICES

Appendix A-Data Derived from ORNL Runs

A.1 Building Inventory-Residential	22
A.2 Building Inventory-Commercial	23
A.3 Fuel Distributions	25
A.4 Unit Energy Consumption Tables	26

TABLE OF CONTENTS (Continued)

	<u>Page</u>
APPENDIX B-Description of Threshold Methodology	
B.1 Public Sector Criteria	58
B.2 Private Sector Criteria.	62
B.3 Project Data Required to Perform Threshold Evaluation.	63
APPENDIX C-Computer Program Description and Listing	
C.1 System Flow Diagrams	65
C.1.1 Program Definitions	65
C.1.2 File Definitions.	65
C.2 Variable Lists	69
C.3 Program Listings	75
APPENDIX D-Project Evaluation Sheets and Branch Summary Tables	
D.1 Consumer Products Branch	(Second Volume)
D.2 Legislatively Mandated Projects.	(Second Volume)
D.3 Architectural/Engineering Branch	(Second Volume)
D.4 Consumer Motivation Branch	(Second Volume)
D.5 Urban Waste Technology Branch.	(Second Volume)
D.6 Community Systems Branch	(Second Volume)

1. INTRODUCTION

The Threshold Evaluation System was developed to assist the Division of Buildings and Community Systems of the Department of Energy in performing preliminary evaluation of projects being considered for funding. In addition, the evaluation has been applied to on-going projects, because information obtained through RD&D may alter the expected benefits and costs of a project, making it necessary to reevaluate project funding.

The system evaluates each project according to its expected energy savings and costs. A number of public and private sector criteria are calculated, upon which comparisons between projects may be based. A summary of the methodology is given in Appendix B.

The purpose of this task was to upgrade both the quality of the data used for input to the system and the usefulness and efficiency of the computer program used to perform the analysis. The modifications required to produce a better, more consistent set of data were fairly major, and will be described in Section 2. Program changes that have had a significant impact on the methodology will be discussed in Section 3, while those that affected only the computer code will be presented as a system flow diagram and program listing in Appendix C.

These improvements in the project evaluation methodology and data will provide BCS with a more efficient and comprehensive management tool. The direction of future work will be toward integrating this system with a large scale (at Oak Ridge National Laboratories) so that information used by both systems may be stored in a common data base. A discussion of this, and other unresolved problems is given in Section 4.

2. DATA DEVELOPMENT

2.1 GENERAL APPROACH

In the past, data used for input to the threshold evaluation system came from one or more of a number of sources, including DOE project managers, proposers, national labs, and outside consultants. As a result, estimates for individual projects were often based on different assumptions and were usually not comparable. When data revision activities for this task began, it became apparent that it would be impossible to derive consistent data for all projects without a common set of information, including projections of building stock and average energy consumption by conventional units. This would then provide a basis for estimates of market penetration as well as the expected energy consumption of the new technologies.

After inspecting several large-scale models, including BECOM (at Brookhaven National Laboratory), it was determined that the information provided by the engineering/economic models of the residential and commercial sectors done at Oak Ridge National Laboratories would be most useful. Although this data is still very rough, it does provide a consistent basis for performing the analysis. And, as the quality of the ORNL data improves, so should the reliability of the numbers we need.

This data is presented in Appendix A. The tables give energy consumption estimates by end-use demand for "average" new and existing buildings of each type. Two energy use scenarios over the period of 1970-2000 are defined. In the first scenario fuel prices continue to rise, but there is no government intervention in conservation activities (i.e., no NEA). This projection gives consumption figures of conventional systems to which those projects that fall under the recent legislation may be

compared. The second scenario includes the NEA, and therefore presents lower consumption figures. Those projects that are not included in the legislation are then compared to this lowered unit consumption. This distinction was made so that savings accomplished by the NEA are not attributed to developmental products entering the market after its enactment.

Each new technology is now compared to the appropriate conventional system to determine the expected energy savings per unit. Other data, such as capital costs and installation time still come from outside estimates, but in cases where two or more projects are being compared to the same conventional system, these parameters are specified to reflect that relationship.

In order to make market penetration estimates for the new technologies, each project is characterized by the sector(s), building type(s), and end use(s) to which it can be applied. The number of units that will exist each year in the market group defined here is derived from ORNL estimates of building stock (Appendix A). This number is identified as the potential market for the product. Where factors exist that further limit the applicability of a project, the potential market is reduced by an appropriate amount. For example, the market for a project that affects existing oil-fired space heating systems would equal 26 percent (see fuel distribution table in Appendix A) of the number of units built before the year of introduction. This potential market would decrease each year, according to the number of buildings that are scrapped. The reason new buildings are not included in this market is that builders are likely to install new, more efficient equipment models that are on the market, rather than a conventional system requiring a retrofit technology.

Penetration curves are then defined, based on estimates of the market entry year, the maximum market penetration as a percent of the total potential market, and the year that that maximum is reached. In most

cases it was assumed that the rate of penetration of a technology will follow an 'S-shaped' curve, and that at most, it will capture 25 percent of its potential market.

2.2 DATA DEVELOPMENT ACTIVITIES IN EACH BCS BRANCH

Although our goal was to evaluate all BCS projects consistently, it was necessary to make some modifications in the methodology to deal with problems encountered in each branch. These special considerations are discussed below.

In all cases, the branch chiefs were contacted to get status updates, and better definitions of the projects that are on the system. Those projects which have been completed or are no longer being considered for funding were deleted.

2.2.1 Consumer Products Branch

The objective of the Consumer Products Branch is to encourage the use of more energy efficient technologies in both the commercial and residential sectors. These technologies effect space heating and cooling systems, windows and lighting, appliances and appliance controls, and efficiency testing equipment. Both newly developed technologies and commercially available technologies are being considered. For example, many of the energy efficient heat pumps are already on the market, whereas a "40 KW Fuel Cell" is in the development stages. To demonstrate and actually implement some of the new technologies, Federal investment may be required to overcome fears of associated high risks and high first costs.

The market for each project was easily identified due to the specific size and application of each device. On the whole, more projects are aimed toward new residences or buildings, but the retrofit market is considered where costs are not so high as to rule it out.

After reviewing the energy use figures for the comparable conventional system and studying each new technology in terms of its actual function and impact on these energy use figures, we made assumptions about the energy savings potential of each project. We also assumed that with adequate financing and development, each project could penetrate a good portion of its applicable market. Maximum market penetration percentages by the year 2000 averaged 25 percent.

In order to keep our files current, four projects have been deleted from the branch. "Apartment Submetering" is not presently being considered, and "Feedback Meters," "Appliances with Storage," and "Other Residential Appliances" are all completed studies.

2.2.2 Consumer Motivation Branch

In addition to the need for development and demonstration of energy efficient measures, there is the need to motivate the consumer to take note and make use of these measures. Information, education, incentives, and implementation are the key factors considered in the Consumer Motivation Branch. Both commercial establishments and homeowners lack sufficient information on the energy saving potential of various conservation measures. Educating the public will abate many fears of risk and high cost and encourage the implementation of new technologies.

Some elements of the analysis of this branch are rather difficult in that they are subjective and ambiguous. Whether to charge the cost of the information services, or the cost of the new technology to the consumer, posed a problem. In each project we assumed that the consumer was charged the incremental cost of the new technology. For example, in "Energy Cost of Ownership," the cost was the increment in the price of buying a new energy efficient device as opposed to a conventional device.

The conventional system was often difficult to define but was viewed consistently as the present technology that serviced the same specific end uses as the new system. Attributing energy savings to motivational projects could be viewed on various levels. Educating and motivating the public to employ more energy efficient technologies could represent a vast ultimate savings, but to recognize a savings in each project, we had to make assumptions about the particular motivation methods and the potential impact of each technology on energy use.

Market sizes were implied by the specific application available to the technologies being encouraged. Market penetration levels were estimated to be greater than the potential of the technology without the increased education and incentives. Institutional barriers do exist in implementing some of these technologies, but the Consumer Motivation Branch strives to overcome these barriers through the encouragement of co-operation. Consumer motivation is centered around voluntary cooperation by financial institutions ("Financing First Mortgage Lenders"), retail merchants ("Small Business Program"), and utilities ("Tenant Information/Incentives") in developing approaches that will successfully motivate consumers to implement energy efficient technologies.

2.2.3 Urban Waste Technology Branch

Because we began this task with so little data on the projects in this branch, some background research was required. The information that was gathered is summarized in the rest of this section.

An alternative energy source for the U.S. exists in recovering energy from urban wastes. Dry, solid wastes and sewage can be treated and processed in order to utilize their organic content and burnable fibers

FIGURE 1
URBAN WASTE PROCESSES/PRODUCTS

as potential sources of energy. Urban waste now pollutes our environment in several ways: (1) poor removal and disposal techniques, (2) air and land pollution from landfills, (3) air pollution from incinerators, and (4) continued disposal of waste in our waters. Disposal of wastes at energy recovery plants may provide suitable remedies to each of these environmental problems. Economic benefits in the short run will derive from more efficient waste removal and disposal and more available land. In the long run, however, the economy may benefit from lower energy costs and abundant energy sources. Using waste as a source of energy will allow conservation of scarce fuels and electricity that are now in great demand.

In order to use the Threshold System to evaluate the potential impact of resource recovery from waste, a good understanding of each new technology and its commercial feasibility, economic viability, and energy savings potential is necessary. The three major processes for recovering energy from wastes presently represented on the Threshold System are: Anaerobic Digestion, Waterwall Incineration, and Enzymatic Hydrolysis. These processes are outlined in Figure 1, and a description of each is given below.

Anaerobic Digestion

Anaerobic digestion is a biological process that occurs in the absence of air. Given a high concentration of wastes in a large container with no air infiltration, bacteria grow rapidly and decompose the organic fraction of the wastes. The break down of the organic wastes causes the formation of a methane rich gas which can satisfy multiple end uses.

There are preliminary steps to this process which allow the actual digestion to occur more readily. Wastes delivered to the plant are

separated into organic and inorganic groupings with only the organic fraction being used in the digestive process itself. The inorganic wastes can be further separated to recover the materials that may be sent to recycling plants. Organic wastes are then compressed, or reduced in size, and forced through a shredder. Shredding the wastes into smaller pieces aids in both the bacterial decomposition and the disposal of the residues. After the preliminary steps have been completed, the anaerobic process may require up to twelve days to digest all the waste.

The process is rather slow, but once completed methane is available to provide energy for a number of possible uses. The gas can be used internally to heat the process itself and to heat the buildings of the plant; it can be exported as a gas for community use; it can be used as a fuel to power turbines that generate electricity, or it can be flared and not used to produce any energy. There are four projects currently being funded by the Department of Energy that demonstrate all, or part, of the anaerobic digestive process: "Pompano Beach, Florida - 1000 TPD Plant," "ANFLOW," "Activated Carbon Enhancement," and "Innovative Size Reduction-Biometh".

Incineration

Another method that can recover energy from urban wastes is incineration with heat recovery. Currently, much emphasis is placed on incineration as a method of volume reduction, but there has been increased interest in heat recovery (steam or hot water) from the energy available in the combustible fraction of the solid waste. Approximately sixty five percent (65%) of urban wastes are burnable fiber, so this may allow for considerable heat recovery through incineration. There are two basic

types of incinerators that are now operable and are being further developed in the United States. They are: (1) air controlled incinerators, which produce hot exhaust gasses that are passed through a heat recovery unit where either steam or hot water can be produced and (2) waterwall incinerators, which burn waste in a single chamber with heat recovery units installed on its walls. The end uses for the recovered heat are multiple, and include: internal use for process and space heating and cooling the buildings of the plants, export to industry for process steam, and fueling turbines that generate electricity. Europe has operated waterwall incinerators to produce usable steam for over twenty years, so the technique is generally considered to be proven and commercially available.

There are two projects that involve incinerators with steam recovery now being funded by the Department of Energy. These are the "Combined MSW/Sewage Treatment Plant," and "Small Scale Incinerator Systems."

Enzymatic Hydrolysis

This technique requires protein catalysts and water to aid in the decomposition of the cellulosic fraction of wastes. Through the addition of certain chemicals and natural biological processes, the cellulose is converted to glucose which is then fermented to produce ethanol or methane. The production of ethanol is more common in this process and its major use is as an automotive fuel. Gasoline mixed with ten percent (10%) ethanol produces gasohol which is a usable liquid fuel for automobiles. This process, like anaerobic digestion, is rather time consuming and therefore costly. Only one project, "Enzymatic Hydrolysis." is being funded at present by the Department of Energy.

In order to derive any type of energy use or energy savings figures for these projects it was necessary to compare each of the new technologies

to a conventional system. The conventional sewage waste treatment plant is an activated sludge system with some amount of incineration. Dry, solid wastes are usually disposed of either in a landfill or in an incinerator. Some of the new technologies handle both sewage and dry waste disposal at the same plant, so they must be compared to a combination of conventional systems. In identifying the conventional system that is replaced, we obtained information on the costs and energy use of the appropriate method of waste disposal and treatment. This information was then applied to the new system in terms of costs, energy use, and energy savings. Since most of the new technologies are self-supporting, the energy that would have to be supplied to a comparable conventional system is recognized as the energy savings.

Each pound of urban waste can provide approximately 5000 Btu of energy. This was the figure used in determining the "value" of any energy exported from a new plant, or used internally. This also gives us some idea of the amount of energy that can potentially be captured from a daily generation of 4.33 pounds of waste per person in the United States.

By viewing the population and the potential generation of wastes by this population, we determined the maximum number of waste treatment plants that could be required. To limit this to the actual market for waste plants through the year 2000, we evaluated the plants now in operation to determine the existing demand, and narrowed our expectations in terms of the economic viability and commercial feasibility of these new technologies.

The Department of Energy is also currently funding two loan programs in the Urban Waste Technology Branch, the "Revolving Loan Program," and the "Urban Waste Loan Guarantee/Demo Program." Both projects are concerned

with the implementation of new urban waste recovery technologies. The government is offering incentives and motivation to consumers, industries, and utilities in the form of loans and loan guarantees. It is hoped that these loan programs will help overcome the barriers of risk and high first cost and therefore encourage replacement of conventional systems with new urban waste energy recovery systems.

2.2.4 Legislatively Mandated Projects

After the National Energy Act was passed in 1978, those projects in threshold that dealt with its provisions were placed in this new branch. The purpose of the projects in this branch is to meet the standards mandated by the Act in the most economic and efficient manner, through joint efforts of the Federal government and the private sector.

The goals for reduced consumption set forth in the legislation were used as the expected energy savings for each project. The total potential market size was determined for each, based on the projected inventory of each building type. It is assumed that the market penetration will reach 100 percent by 1985, due to the fact that neither institutional nor economic barriers have to be taken into account.

The "Appliance Standards" project and the two "Federal Energy Management Program" projects were both transferred to the Legislatively Mandated Projects group from the Consumer Motivation Branch, and the two "BEPS" projects and the "Residential Retrofit" program were transferred from the Architecture/Engineering Branch. These are the only projects currently on the threshold system that are directly related to the NEA. Those that have been undertaken in support of the Act, either to provide background information or demonstration facilities, have been left in their assigned branches.

2.2.5 Community Systems Branch

The Community Systems Branch is designed to encourage efficiency in energy utilization in communities. The goal of the branch is to provide a community with all of its energy needs from one integrated energy system. This single system would replace a number of utility systems that currently lose a substantial amount of their generated energy as waste heat. An integrated community energy system would combine many different energy sources and provide demanded energy directly to the community in an effort to recover energy that could be lost in generation, storage, and transportation.

The critical element in the analysis of this branch was the definition of our market unit, the 'community'. Each community system project was viewed in terms of its electrical generation capacity and the number of people that could be served by such capacity. Once the size of the community that could be served by each project was determined, the Statistical Abstracts - 1977 was consulted for the number of communities of that particular size in the U.S. A one percent annual growth rate was applied to approximate the number of new communities that would be built each year. This number was used as the total potential market for each community system project.

The conventional system was defined as a combination of systems (usually including a power plant) that would be replaced by one new system. Assumptions had to be made about the potential energy savings of this new system because the actual figure would be based on a number of variables, such as, the specific requirements of a community, the combination of technologies in each plant, and the amount of waste heat generated by the conventional system.

Two projects, "Thermal Transmission ICES," and "Solar Centered ICES" have been deleted from the branch because they are completed studies.

2.2.6 Architecture/Engineering Branch

The major concern of the Architecture/Engineering Branch is to reduce energy consumption in residential, commercial, and public buildings. The reduction is sought through improved building design, materials, construction, and energy use behavior. Essential to the success of this branch in achieving its objectives is the cooperation of the building industry, the materials manufacturers, the architects, and the government.

One difficulty encountered was in assessing the market for each project. It was not always clear whether the applicable buildings were only new, only retrofit, or both. In some cases, the cost of the new technology was the only determinant as to whether or not the project would be applied to the retrofit market. The market sizes used were taken from the ORNL building stock figures. Market penetration was assumed to be substantial for those projects whose costs were not exorbitant, and in cases where both the retrofit and new markets were considered, the new market was usually penetrated at a higher rate. This was due to the fact that most of the projects would rather easily be adapted into the plans of a new home, but were rather complex and costly to adapt to an older home. The energy savings that could be attributed to the new systems, as compared to conventional buildings, were specified in terms of the end-uses that would be affected and the percentage reduction that could be expected. The capital cost assigned to each project is the incremental cost of the more energy efficient materials and designs.

Some of the projects that were in the Architecture/Engineering Branch prior to the passage of the National Energy Act in 1978 were included in the Act's provisions, so that their implementation became mandatory. These

projects, "Building Energy Performance Standards," (Commercial and Residential), and "Residential Retrofit" were transferred to the group of Legislatively Mandated Projects. Two projects in the Architecture/-Engineering Branch were completed: "Retrofit Multi-Family Buildings - NYC," and "Retrofit Municipal Buildings;" and five new projects were added to the branch. The new projects deal with energy conservation measures in schools and hospitals and were based on information provided by Lawrence Berkley Laboratories.

3. IMPROVEMENTS TO THE METHODOLOGY AND COMPUTER PROGRAMS

A number of changes have been made to the threshold evaluation system computer program. Those that significantly effect the methodology are described below. Others that have dealt only with the computer code may be examined in the new system flow diagram and program listing in Appendix B.

3.1 YEARS OF ANALYSIS EXTENDED TO 2000

Many of the projects funded by BCS are not likely to enter the market before the late 1980's. In order to evaluate these projects properly, it was necessary to modify the program to comprehend market penetration data through 2000 (rather than 1990). Also, the methodology now requires estimates of total market size throughout the same time period so that the penetration estimates can be compared to some maximum possible level.

3.2 FUEL PRICES

Operating costs (and savings) are now calculated using projected yearly fuel prices. The current runs of the model are based on EIA prices (January 1978), given for the medium oil price scenario (Table 1). This change gives credit to projects that save fuel in later years, according to the higher fuel prices in those years. In most cases, this results in higher benefits being attributed to each project.

3.3 CALCULATION OF NET SAVINGS

A new index of project worth, "Benefits-Costs" has been added to the evaluation, to give an idea of what the net effect of a project is. The

TABLE 1
FUEL PRICES - EIA (PIES RUN, JANUARY 1978)
(1978 Dollars Per Million Btu)

<u>YEAR</u>	<u>GAS</u>	<u>OIL</u>	<u>COAL</u>	<u>ELEC *</u>
1976	1.92	2.98	1.53	3.55
1977	2.02	3.05	1.56	3.57
1978	2.12	3.12	1.59	3.60
1979	2.23	3.20	1.62	3.63
1980	2.36	3.27	1.65	3.65
1981	2.48	3.35	1.68	3.68
1982	2.61	3.43	1.72	3.71
1983	2.75	3.51	1.75	3.74
1984	2.90	3.59	1.79	3.78
1985	3.05	3.68	1.82	3.80
1986	3.17	3.71	1.84	3.82
1987	3.30	3.75	1.86	3.84
1988	3.44	3.78	1.88	3.86
1989	3.58	3.81	1.90	3.89
1990	3.72	3.85	1.92	3.91
1991	3.81	3.95	1.90	3.94
1992	3.91	4.06	1.88	3.97
1993	4.00	4.17	1.87	4.00
1994	4.11	4.28	1.85	4.04
1995	4.21	4.39	1.83	4.07
1996	4.35	4.50	1.88	4.08
1997	4.50	4.60	1.92	4.09
1998	4.66	4.71	1.97	4.10
1999	4.82	4.83	2.02	4.11
2000	4.98	4.94	2.07	4.12

*Electricity prices have been multiplied by .314 (based on 10500 primary Btu/kWh) to maintain consistency with the threshold program in calculating use in terms of primary fuels.

calculation involves subtracting the present value of the costs (research costs, and capital costs of the marginal units sold due to Federal involvement) from the present value of the benefits (energy savings attributable to the marginal units). This measure is different than the efficiency indices (MEI, ETI) because it takes into account the absolute level of the benefits and costs rather than just the ratio between the two. Projects have been ranked in order of this index within each branch on the summary sheets (Appendix D).

3.4 OTHER CHANGES

- Operating costs have been disaggregated into fuel and non-fuel (operating and maintenance) costs.
- The program has been rewritten in the form of sub-routines to increase execution efficiency (see Appendix C)
- Energy use and market figures are expressed in terms of 'square feet' in the commercial sector and 'housing units' in the residential sector
- A new sector has been added, 'R/C/I' to represent those community-scale projects that may effect the residential, commercial, and industrial sectors. The unit used to describe these projects is usually 'community', and the energy use expressed in '10⁶ Btu's/unit'.
- A new group has been defined to contain those programs that are included in the NEA provisions.

4. FUTURE WORK

4.1 CONTINUED UPGRADING OF THE SYSTEM

In developing the data for this task, a great deal of effort was put into standardizing the assumptions and procedures used to define target markets and baseline energy consumption. Often, some very gross estimates had to be made of capital costs of new systems and energy savings potential. There is still a need to spend some time with project managers and national lab affiliates to obtain better estimates of these parameters for each project. A new input data worksheet has been developed that is compatible with the ORNL data and follows the methodology described earlier in this report. The information that is required from the project managers, and others, to complete this worksheet is of a different nature than that requested on the old data forms. For this reason, it will be important to design a new questionnaire before further collection activities begin.

Among the project data that we still need to update is the anticipated level of Federal funding. The files now contain figures that are likely to be incorrect in light of the latest budget statements.

Finally, an examination of the "BCS Project Data Summaries-1979," has revealed several projects that are currently funded, and are of a nature that is appropriate for threshold analysis, but are not on the system. It would be beneficial to spend some time adding these projects, so that the coverage would be complete.

4.2 DEVELOPMENT OF LINK TO ORNL MODELS

The conversion of the data supplied by ORNL into a form that was usable for threshold input (Appendix A) required a large number of calculations.

For this exercise, the calculations were done manually, but in the future, the pertinent information could be converted within the model and sent to us with the output. It is also possible to design a data base to receive this information. Threshold inputs could then specify the markets and end-uses that are affected by each project, while the actual quantities would be read from the data base.

This data base would be fairly large, including building stock and energy consumption figures by sector, building type, end use, and vintage (new or existing) for each year. Once established, however, it would assure consistency between the data used by ORNL, Threshold, and the Resource Allocation Methodology (RAM). The operational link between Threshold and RAM is currently being developed, and this common data link between the three models would complete the system.

4.3 IN-DEPTH STUDY OF SOME BRANCHES

Earlier in this section, the need for more information from project managers was discussed. For some projects, however, more extensive research will be required. Specifically, the Urban Waste Technology and Community Energy Systems Branches contain projects about which very little information is available. It seems critical that in-depth studies of the market and energy savings potential of these projects be undertaken before further changes are made in the data.

4.4 EVALUATION OF MOTIVATIONAL PROJECTS

Although each branch has peculiarities that make it difficult to apply the threshold analysis, the one that seems to 'fit' least well in the current framework is the Consumer Motivation Branch. The goal of many of the projects in this branch is to promote the acceptance of the

products developed in other branches. It is, then, difficult to decide how many of the costs and savings of these products should be attributed to the motivational program. Because the actual cost of such a program, both to the government and to the consumer, is extremely low, and the energy savings which result from the use of the product is high, it does not seem reasonable to compare the two.

Several different approaches to this problem have been considered, and the one we have used for this task was described in Section 2. Further development of a consistent scheme to apply to these projects seems warranted.

APPENDIX A

DATA DERIVED FROM ORNL RUNS

A.1

BUILDING INVENTORY - RESIDENTIAL (10⁶ UNITS)

Building Type	Year					
	1975	1980	1985	1990	1995	2000
All Types						
Total Stock	71.24	79.86	87.78	95.11	100.99	106.47
New Stock	11.82	11.50	10.85	10.50	10.10	-
Scrappage	3.20	3.58	3.52	4.62	4.62	-
Single Family						
Total Stock	47.74	51.89	55.74	59.32	62.37	65.11
New Stock	5.96	5.73	5.45	5.15	4.95	-
Scrappage	1.81	1.88	1.87	2.10	2.21	-
Multi-family						
Total Stock	20.70	24.33	27.54	30.42	32.49	34.49
New Stock	4.36	4.06	3.55	3.35	3.05	-
Scrappage	.73	.85	.67	1.28	1.05	-
Mobile Homes						
Total Stock	2.80	3.65	4.50	5.37	6.13	6.87
New Stock	1.49	1.76	1.90	2.00	2.10	-
Scrappage	.64	.91	1.03	1.24	1.36	-

A.2

BUILDING INVENTORY - COMMERCIAL (10^6 ft²)

Building Type	Year					
	1975	1980	1985	1990	1995	2000
All Types						
Total Stock	27100	32409	38069	43760	50211	56080
New Stock	5889	6884	7378	8035	9096	-
Scrappage	580	1224	1687	1584	3225	-
Retail-Wholesale						
Total Stock	4579	5611	6698	7785	9022	10141
New Stock	1106	1286	1350	1453	1641	-
Scrappage	74	199	263	216	522	-
Offices						
Total Stock	3956	5253	6689	8197	10046	11805
New Stock	1276	1549	1696	1900	2268	-
Scrappage	21	113	188	51	509	-
Auto Repair						
Total Stock	511	535	566	596	621	641
New Stock	47	52	60	66	83	-
Scrappage	23	21	30	41	63	-
Warehouse						
Total Stock	2117	2724	3382	4059	4867	5620
New Stock	615	734	788	868	1012	-
Scrappage	8	76	111	60	259	-
Educ. Services						
Total Stock	6581	7460	8370	9247	10153	10936
New Stock	1058	1201	1276	1382	1528	-
Scrappage	179	291	399	476	745	-
Health						
Total Stock	1881	2158	2445	2723	3015	3269
New Stock	335	383	408	438	474	-
Scrappage	58	96	130	146	220	-

BUILDING INVENTORY - COMMERCIAL (Cont'd.)

Building Type	Year					
	1975	1980	1985	1990	1995	2000
Public Buildings						
Total Stock	1051	1095	1150	1204	1247	1283
New Stock	106	118	131	138	141	-
Scrappage	62	63	77	95	105	-
Religious Services						
Total Stock	1456	1623	1797	1965	2133	2276
New Stock	212	239	257	282	312	-
Scrappage	45	65	89	114	169	-
Hotel Buildings						
Total Stock	1539	1802	2075	2342	2631	2885
New Stock	323	366	381	400	432	-
Scrappage	60	93	114	111	178	-
Miscellaneous						
Total Stock	3428	4148	4898	5640	6477	7228
New Stock	811	954	1028	1108	1218	-
Scrappage	91	204	286	271	467	-

A.3 Fuel Distributions (Fractions)

Residential (1980)

Space Heat

Gas	.52
Oil	.26
Elec.	.22

Water Heat

Gas.	.37
Oil	.06
Elec.	.58

Cooking

Gas	.34
Elec.	.66

Space Heat and Cool

Gas	.44
Oil	.22
Elec.	.33

All End Uses

Gas	.32
Oil	.13
Elec.	.54

Commercial (1980)

Space Heat

Gas	.47
Oil	.43
Elec.	.10

Water Heat

Gas	.36
Oil	.39
Elec.	.25

Space Heat and Cool

Gas	.29
Oil	.26
Elec.	.45

All End Uses

Gas.	.21
Oil	.17
Elec.	.62

A.4 UNIT ENERGY CONSUMPTION TABLES DERIVED FROM ORNL RUNS

The Btu consumption of the average existing unit of each type was determined by dividing the total consumption of all buildings of that type by the number of units. The average consumption of a new unit in a given year was calculated by subtracting the buildings that were scrapped during the previous five years from the total stock to determine the surviving stock, multiplying that stock by the average per unit (existing) consumption, subtracting that product from the total consumption to find the Btu's consumed by all new units, and then dividing by the number of new units.

This approximation method sometimes produced numbers that were unreasonably low, or, in some cases, negative. When this happened, we made a more likely estimate based on the observable trends. These estimates have been added to the tables below the original estimates and are enclosed in parentheses. It is expected that this sort of problem will be alleviated as the link between the output of ORNL runs and the numbers that we need for these tables becomes more direct.

For example, one of the assumptions that we had to make in order to determine the consumption of new buildings is that the consumption of those that are scrapped is equal to that of the average existing unit. In fact, the older buildings which are being scrapped are likely to be less energy efficient, thus consuming more than the average. This assumption is probably the reason that the energy use by new buildings tends to be too low in the first ten years, and fluctuates so greatly thereafter. When the ORNL model is used to do these calculations, some adjustments can be made in the energy use of the scrapped buildings, based upon their age.

The following tables give average consumption estimates for each building type in the residential (single-family, multi-family, and mobile homes) and commercial (retail-wholesale, office, auto repair, warehouse, educational services, health facilities, public buildings, religious services, hotel buildings, and miscellaneous) sectors, for each scenario (with and without NEA), in 1975, 1980, 1985, 1990, 1995 and 2000.

UNIT ENERGY CONSUMPTION

Residential Sector

Scenario-without NEA

All Building Types

Average Existing Unit (10⁶ Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	115	104	100	99	97	95
Air-conditioning	15	18	21	24	26	28
Water heating	33	32	32	32	33	33
Refrigeration	13	13	13	13	12	12
Freezers	5	6	6	7	7	7
Cooking	11	11	11	11	11	11
Lighting	13	13	13	14	14	15
Other	21	23	25	26	27	28
Total	226	221	222	226	229	230

Average New Unit (10⁶ Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	44 (65)	75	92 (80)	79	77	-
Air-conditioning	36	43	46	48	48	-
Water heating	29	32	34	34	38	-
Refrigeration	13	12	11	11	12	-
Freezers	9	9	10	9	8	-
Cooking	11	11	12	12	11	-
Lighting	13	16	18	18	18	-
Other	31	35	36	36	37	-
Total	189 (210)	235	258 (246)	246	249	-

UNIT ENERGY CONSUMPTION

Residential Sector

Scenario-with NEA

All Building Types

Average Existing Unit (10^6 Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	114	96	86	86	85	84
Air-conditioning	15	16	18	20	22	24
Water heating	33	31	31	31	31	32
Refrigeration	13	12	12	11	11	11
Freezers	5	6	6	6	6	7
Cooking	11	11	11	11	11	11
Lighting	13	13	13	14	14	15
Other	21	23	24	25	26	27
Total	<u>226</u>	<u>209</u>	<u>201</u>	<u>205</u>	<u>207</u>	<u>209</u>

Average New Unit (10^6 Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	- (90)	26 (85)	88	72	70	-
Air-conditioning	24	27	36	39	39	-
Water heating	23	26	32	33	36	-
Refrigeration	9	7	7	9	9	-
Freezers	9	7	8	8	9	-
Cooking	11	11	12	12	11	-
Lighting	13	17	17	20	18	-
Other	31	31	34	35	36	-
Total	<u>108</u> (210)	<u>152</u> (211)	<u>235</u>	<u>225</u>	<u>223</u>	<u>-</u>

UNIT ENERGY CONSUMPTION

Residential Sector

Scenario-without NEA

Single Family

Average Existing Unit (10⁶ Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	140	127	123	122	120	117
Air-conditioning	18	22	26	29	32	35
Water heating	33	32	33	33	34	34
Refrigeration	13	13	13	13	12	12
Freezers	7	8	8	8	9	9
Cooking	12	12	12	12	12	12
Lighting	15	15	16	16	17	17
Other	21	23	24	26	27	28
Total	<u>257</u>	<u>251</u>	<u>254</u>	<u>260</u>	<u>262</u>	<u>265</u>

Average New Unit (10⁶ Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	32 (80)	85	116 (95)	90	90	-
Air-conditioning	51	63	64	68	65	-
Water heating	30	35	37	37	39	-
Refrigeration	12	11	12	11	12	-
Freezers	12	13	12	11	12	-
Cooking	12	12	13	11	13	-
Lighting	16	22	22	24	24	-
Other	37	39	38	40	40	-
Total	<u>206</u> (254)	<u>281</u>	<u>315</u> (294)	<u>289</u>	<u>293</u>	-

UNIT ENERGY CONSUMPTION

Residential Sector

Scenario-with NEA

Single Family

Average Existing Unit (10^6 Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	139	116	104	105	104	102
Air-conditioning	18	19	21	23	26	28
Water heating	33	32	31	31	32	32
Refrigeration	13	12	12	11	11	11
Freezers	7	8	8	8	8	9
Cooking	12	12	12	12	12	12
Lighting	15	15	15	16	17	17
Other	21	23	24	25	26	27
Total	257	236	227	232	235	237

Average New Unit (10^6 Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	- (85)	5 (95)	115	84	78	-
Air-conditioning	29	34	51	52	50	-
Water heating	22	28	33	33	36	-
Refrigeration	9	6	6	7	7	-
Freezers	12	10	12	9	12	-
Cooking	12	12	13	11	13	-
Lighting	16	20	24	22	22	-
Other	35	34	34	35	38	-
Total	75 (220)	147 (237)	287	264	258	-

UNIT ENERGY CONSUMPTION

Residential Sector

Scenario-without NEA

Multi-family

Average Existing Unit (10⁶ Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	60	57	55	54	54	53
Air-conditioning	8	10	12	13	14	15
Water heating	31	30	30	30	30	30
Refrigeration	13	13	13	13	13	12
Freezers	2	2	3	3	3	3
Cooking	11	11	10	10	10	10
Lighting	10	10	10	11	11	12
Other	21	23	25	26	27	28
Total	157	156	158	161	162	164

Average New Unit (10⁶ Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	42	46	50	48	45	-
Air-Conditioning	20	22	22	29	25	-
Water heating	26	26	31	26	33	-
Refrigeration	14	10	14	11	11	-
Freezers	5	5	3	7	4	-
Cooking	11	10	10	10	10	-
Lighting	11	14	13	13	17	-
Other	33	34	36	34	39	-
Total	152	168	184	175	184	-

UNIT ENERGY CONSUMPTION

Residential Sector

Scenario-with NEA

Multi-family

Average Existing Unit (10⁶ Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	60	53	49	48	47	46
Air-conditioning	8	9	10	12	13	14
Water heating	31	30	29	29	28	29
Refrigeration	13	12	12	11	11	11
Freezers	2	2	2	3	3	3
Cooking	11	11	10	10	10	10
Lighting	10	10	10	11	11	12
Other	21	23	24	25	26	27
Total	157	150	147	149	150	152

Average New Unit (10⁶ Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	22	23	43	39	36	-
Air-Conditioning	17	17	19	25	24	-
Water heating	21	26	25	26	33	-
Refrigeration	9	8	8	7	10	-
Freezers	5	3	6	4	8	-
Cooking	11	10	10	10	10	-
Lighting	11	12	16	16	14	-
Other	33	30	33	34	35	-
Total	120	130	163	162	163	-

UNIT ENERGY CONSUMPTION

Residential Sector

Scenario-without NEA

Mobile Homes

Average Existing Unit (10^6 Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	100	96	100	100	101	102
Air-conditioning	14	19	22	24	28	30
Water heating	36	41	40	41	41	42
Refrigeration	14	14	13	13	13	12
Freezers	4	5	7	6	6	6
Cooking	7	8	7	9	10	10
Lighting	7	8	7	7	8	9
Other	21	25	27	28	28	28
Total	207	211	220	229	235	240

Average New Unit (10^6 Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	90	106	102	102	104	-
Air-conditioning	26	27	28	35	37	-
Water heating	49	38	43	40	45	-
Refrigeration	13	13	12	13	8	-
Freezers	8	8	4	8	4	-
Cooking	10	4	14	11	11	-
		(10)				
Lighting	10	4	9	10	10	-
Other	30	30	30	27	27	-
Total	216	234	245	247	252	-
		(240)				

UNIT ENERGY CONSUMPTION

Residential Sector

Scenario-with NEA

Mobile Homes

Average Existing Unit (10^6 Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	100	90	93	99	96	99
Air-conditioning	14	19	20	24	24	28
Water heating	36	38	38	39	39	39
Refrigeration	14	14	11	11	11	10
Freezers	4	5	7	6	6	6
Cooking	7	8	7	9	10	10
Lighting	7	8	7	7	8	9
Other	21	22	27	26	26	28
Total	207	205	211	218	223	228

Average New Unit (10^6 Btu/unit)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Space heating	76	98	108	91	105	-
Air-conditioning	26	21	32	25	35	-
Water heating	42	37	42	39	40	-
Refrigeration	13	7	11	12	7	-
Freezers	8	9	4	8	4	-
Cooking	10	4	14	11	11	-
Lighting	10	4	9	10	10	-
Other	23	34	25	26	31	-
Total	203	220	230	235	240	-

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-without NEA

All Building Types

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	130	118	108	104	96	90
Cooling	71	74	76	78	80	80
Water heating	7	6	6	5	5	5
Lighting	76	73	71	70	68	66
Other	28	31	32	32	31	30
Total	313	303	294	289	280	272

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	60	69	80	56	59	-
Cooling	87	86	89	88	83	-
Water heating	2	3	4	4	3	-
Lighting	60	61	64	58	58	-
Other	45	36	28	26	25	-
Total	258	253	265	232	229	-

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-with NEA

All Building Types

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	130	114	98	88	77	69
Cooling	71	73	72	73	73	73
Water Heating	7	6	6	5	5	4
Lighting	76	73	69	67	64	62
Other	28	32	32	32	31	30
Total	313	297	277	265	250	238

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	39	28 (40)	40	20 (30)	26	-
Cooling	80	70	76	75	72	-
Water Heating	2	2	3	2	3	-
Lighting	59	51	55	51	51	-
Other	45	36	28	25	25	-
Total	225	188 (200)	203	173 (183)	177	-

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-without NEA

Retail-Wholesale

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	140	126	118	113	105	97
Cooling	92	94	97	100	102	102
Water Heating	3	3	3	3	2	2
Lighting	100	96	92	90	88	86
Other	81	82	82	80	76	74
Total	<u>417</u>	<u>403</u>	<u>393</u>	<u>385</u>	<u>374</u>	<u>362</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	73	82	90	65	64	-
Cooling	106	108	115	111	99	-
Water heating	1	2	2	2	2	-
Lighting	79	77	77	75	76	-
Other	87	83	68	76	61	-
Total	<u>344</u>	<u>350</u>	<u>350</u>	<u>312</u>	<u>302</u>	<u>-</u>

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-with NEA

Retail-Wholesale

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	140	125	109	99	88	79
Cooling	91	95	97	100	102	104
Water heating	3	3	3	2	2	2
Lighting	100	95	89	86	82	79
Other	80	82	82	79	76	74
Total	<u>414</u>	<u>400</u>	<u>380</u>	<u>367</u>	<u>351</u>	<u>339</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	65	40	52	29	36	-
Cooling	110	108	116	111	116	-
Water heating	2	1	2	1	2	-
Lighting	76	65	70	64	64	-
Other	91	80	67	60	61	-
Total	<u>345</u>	<u>293</u>	<u>307</u>	<u>266</u>	<u>279</u>	<u>-</u>

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-without NEA

Office Buildings

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	136	124	114	108	100	95
Cooling	78	82	84	87	88	87
Water Heating	7	6	6	5	5	5
Lighting	94	88	85	83	81	79
Other	20	23	24	24	23	23
Total	<u>336</u>	<u>322</u>	<u>312</u>	<u>307</u>	<u>297</u>	<u>289</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	84	80	89	66	71	-
Cooling	93	90	98	92	86	-
Water heating	3	4	4	4	4	-
Lighting	69	77	74	71	71	-
Other	31	28	26	16	23	-
Total	<u>276</u>	<u>282</u>	<u>288</u>	<u>250</u>	<u>256</u>	<u>-</u>

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-with NEA

Office Buildings

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	146	120	98	85	72	62
Cooling	78	81	79	78	78	77
Water heating	7	6	5	5	5	4
Lighting	93	88	82	79	76	73
Other	20	23	24	24	23	22
Total	<u>344</u>	<u>318</u>	<u>289</u>	<u>271</u>	<u>253</u>	<u>239</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	37	26	34	16	24	-
Cooling	92	71	76	75	72	-
Water heating	3	3	4	3	3	-
Lighting	73	63	67	62	62	-
Other	33	28	22	20	20	-
Total	<u>239</u>	<u>191</u>	<u>203</u>	<u>176</u>	<u>182</u>	<u>-</u>

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-without NEA

Auto Repair

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	62	57	53	49	47	44
Cooling	32	32	32	33	36	34
Water heating	.6	.6	.4	.3	.3	.3
Lighting	37	36	35	34	33	33
Other	7	9	9	9	9	8
Total	<u>139</u>	<u>134</u>	<u>129</u>	<u>126</u>	<u>124</u>	<u>120</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	3	13	16	30	25	-
	(12)					
Cooling	32	34	41	42	25	-
Water heating	.3	.2	.3	.3	.4	-
Lighting	26	24	29	26	27	-
Other	24	13	8	6	6	-
Total	<u>81</u>	<u>85</u>	<u>95</u>	<u>104</u>	<u>97</u>	<u>-</u>
	(94)					

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-with NEA

Auto Repair

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	61	56	50	47	42	38
Cooling	32	31	30	31	31	31
Water heating	.6	.6	.4	.3	.3	.3
Lighting	37	36	34	34	32	31
Other	7	9	9	9	9	8
Total	<u>138</u>	<u>133</u>	<u>125</u>	<u>120</u>	<u>114</u>	<u>109</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	9 (30)	- (25)	14	.3 (20)	6 (15)	-
Cooling	28	24	32	33	32	-
Water heating	.3	- (.2)	.2	.2	.2	-
Lighting	20	20	26	22	22	-
Other	23	13	8	6	6	-
Total	<u>81</u> (102)	<u>49</u> (82)	<u>80</u>	<u>61</u> (81)	<u>66</u> (75)	<u>-</u>

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-without NEA

Warehouse

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	60	54	50	47	44	41
Cooling	32	34	35	36	36	36
Water heating	.5	.5	.4	.4	.4	.4
Lighting	32	30	30	29	28	27
Other	8	9	9	9	9	8
Total	<u>133</u>	<u>128</u>	<u>123</u>	<u>121</u>	<u>117</u>	<u>118</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	31	34	38	29	30	-
Cooling	40	38	39	38	36	-
Water heating	.3	.3	.3	.2	.3	-
Lighting	26	25	26	24	24	-
Other	13	10	8	7	7	-
Total	<u>110</u>	<u>108</u>	<u>112</u>	<u>100</u>	<u>98</u>	<u>-</u>

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-with NEA

Warehouse

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	60	53	45	41	36	33
Cooling	32	34	32	32	32	32
Water heating	.5	.5	.4	.4	.4	.3
Lighting	32	30	28	27	26	25
Other	8	9	9	9	9	8
Total	<u>133</u>	<u>126</u>	<u>116</u>	<u>110</u>	<u>103</u>	<u>98</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	37	18	23	15	18	-
Cooling	38	29	31	30	30	-
Water heating	.3	.2	.3	.2	.2	-
Lighting	25	22	22	22	21	-
Other	13	10	8	7	7	-
Total	<u>103</u>	<u>79</u>	<u>84</u>	<u>75</u>	<u>76</u>	<u>-</u>

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-without NEA

Educational Services

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	116	106	99	94	88	82
Cooling	59	60	61	63	65	66
Water heating	7	6	6	5	5	5
Lighting	62	60	58	57	56	54
Other	15	17	18	18	17	17
Total	<u>259</u>	<u>250</u>	<u>230</u>	<u>238</u>	<u>230</u>	<u>224</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	45	55	68	45	48	-
Cooling	69	69	75	75	71	-
Water heating	1	3	4	3	3	-
Lighting	46	46	50	46	45	-
Other	32	23	16	14	14	-
Total	<u>194</u>	<u>112</u>	<u>286</u>	<u>184</u>	<u>182</u>	<u>-</u>

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-with NEA

Educational Services

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	116	98	87	80	71	64
Cooling	59	58	57	57	57	57
Water heating	7	6	5	5	4	4
Lighting	62	60	57	55	53	51
Other	15	17	18	18	17	17
Total	259	239	225	215	203	193

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	-	23	36	14	19	-
	(30)		(30)			
Cooling	52	53	58	57	55	-
Water heating	1	1	3	2	2	-
Lighting	44	39	44	39	39	-
Other	32	21	18	14	14	-
Total	119	137	158	127	129	-
	(159)		(152)			

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-without NEA

Health Facilities

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	216	197	182	174	162	152
Cooling	113	117	120	123	126	127
Water heating	33	29	27	26	24	23
Lighting	101	97	93	92	89	87
Other	60	70	73	72	70	68
Total	<u>524</u>	<u>510</u>	<u>495</u>	<u>486</u>	<u>471</u>	<u>457</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	91	105	124	90	93	-
Cooling	136	134	140	143	135	-
Water heating	8	14	19	14	16	-
Lighting	76	75	79	74	73	-
Other	<u>122</u>	<u>90</u>	<u>62</u>	<u>84</u>	<u>57</u>	<u>-</u>
Total	<u>434</u>	<u>418</u>	<u>425</u>	<u>380</u>	<u>374</u>	<u>-</u>

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-with NEA

Health Facilities

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	216	182	158	142	124	109
Cooling	113	113	115	117	119	120
Water heating	33	29	26	25	23	22
Lighting	98	96	91	88	85	82
Other	60	70	73	72	70	68
Total	<u>524</u>	<u>490</u>	<u>464</u>	<u>444</u>	<u>420</u>	<u>401</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	-	32	51	17	23	-
	(25)		(30)			
Cooling	110	126	130	130	125	-
Water heating	8	12	17	13	15	-
Lighting	86	64	71	65	64	-
Other	122	90	64	57	57	-
Total	<u>306</u>	<u>324</u>	<u>334</u>	<u>280</u>	<u>284</u>	<u>-</u>
	(351)		(355)			

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-without NEA

Public Buildings

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	137	122	116	112	104	97
Cooling	72	72	74	76	78	80
Water heating	7	6	6	5	5	5
Lighting	93	90	87	85	83	81
Other	20	23	24	24	23	23
Total	<u>329</u>	<u>317</u>	<u>307</u>	<u>302</u>	<u>293</u>	<u>285</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	-	71	72	41	42	-
	(70)					
Cooling	74	84	95	94	92	-
Water heating	-	2	3	2	2	-
	(2)					
Lighting	60	61	73	67	63	-
Other	54	34	20	17	17	-
Total	<u>201</u>	<u>220</u>	<u>264</u>	<u>221</u>	<u>218</u>	<u>-</u>
	(260)					

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-with NEA

Public Buildings

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	137	124	110	100	88	77
Cooling	72	72	71	72	73	73
Water heating	7	6	5	5	5	4
Lighting	93	89	85	83	80	77
Other	20	23	24	24	23	23
Total	329	315	296	284	268	254

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	1 (60)	- (55)	17 (50)	- (45)	- (40)	-
Cooling	71	65	77	78	75	-
Water heating	- (2)	- (2)	3	1	1	-
Lighting	57	51	64	57	55	-
Other	54	34	20	17	17	-
Total	182 (224)	133 (207)	182 (214)	144 (198)	138 (188)	-

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-without NEA

Religious Services

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	92	84	79	75	70	66
Cooling	42	43	44	45	47	47
Water heating	1	1	.9	.8	.8	.8
Lighting	36	34	33	33	32	31
Other	5	6	6	6	6	6
Total	<u>176</u>	<u>171</u>	<u>163</u>	<u>160</u>	<u>155</u>	<u>150</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	33	41	54	34	37	-
Cooling	48	50	54	54	52	-
Water heating	.2	.3	.3	.4	1	-
Lighting	26	26	29	26	26	-
Other	11	8	5	4	5	-
Total	<u>137</u>	<u>109</u>	<u>143</u>	<u>120</u>	<u>120</u>	<u>-</u>

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-with NEA

Religious Services

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	92	83	74	68	60	54
Cooling	42	43	42	42	42	42
Water heating	1	1	1	.8	.8	.7
Lighting	36	34	33	32	30	29
Other	5	6	6	6	6	6
Total	176	167	156	148	139	132

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	26	13	27	9	14	-
		(18)		(17)		
Cooling	45	36	43	43	42	-
Water heating	8	.3	.3	.3	.4	-
	(.5)					
Lighting	24	22	24	22	22	-
Other	11	8	5	4	5	-
Total	107	79	100	80	83	-
	(106)	(84)		(88)		

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-without NEA

Hotel Buildings

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	210	185	170	162	151	142
Cooling	93	97	99	102	104	105
Water heating	12	10	9	9	8	8
Lighting	37	35	34	33	32	32
Other	10	12	12	12	12	11
Total	<u>362</u>	<u>339</u>	<u>325</u>	<u>318</u>	<u>308</u>	<u>298</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	73	97	122	88	91	-
Cooling	112	112	117	115	109	-
Water heating	5	5	8	5	6	-
Lighting	29	28	30	28	27	-
Other	19	14	11	10	9	-
Total	<u>237</u>	<u>257</u>	<u>287</u>	<u>246</u>	<u>241</u>	<u>-</u>

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-with NEA

Hotel Buildings

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	208	184	161	149	135	124
Cooling	93	95	90	87	85	82
Water heating	12	10	9	8	7	7
Lighting	37	35	34	33	32	31
Other	10	12	12	12	12	11
Total	<u>362</u>	<u>335</u>	<u>309</u>	<u>289</u>	<u>270</u>	<u>255</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	92	56	86	55	60	-
Cooling	102	67	75	72	68	-
Water heating	3	2	4	3	3	-
Lighting	25	29	28	26	26	-
Other	19	14	11	10	9	-
Total	<u>214</u>	<u>188</u>	<u>186</u>	<u>166</u>	<u>168</u>	<u>-</u>

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-without NEA

Miscellaneous

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	121	110	102	97	90	85
Cooling	69	72	75	77	79	79
Water heating	6	5	4	4	4	4
Lighting	98	94	91	89	86	84
Other	15	17	18	18	17	17
Total	<u>310</u>	<u>299</u>	<u>290</u>	<u>285</u>	<u>277</u>	<u>269</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	63	68	76	57	58	-
Cooling	84	86	87	86	81	-
Water heating	2	3	2	4	3	-
Lighting	78	76	80	74	72	-
Other	26	22	16	16	14	-
Total	<u>255</u>	<u>254</u>	<u>260</u>	<u>238</u>	<u>229</u>	<u>-</u>

UNIT ENERGY CONSUMPTION

Commercial Sector

Scenario-with NEA

Miscellaneous

Average Existing Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	121	108	94	84	74	67
Cooling	69	72	70	70	70	69
Water heating	6	5	4	4	4	4
Lighting	98	94	88	84	81	78
Other	15	17	18	18	17	17
Total	<u>310</u>	<u>296</u>	<u>274</u>	<u>261</u>	<u>245</u>	<u>234</u>

Average New Unit (10^3 Btu/ft²)

<u>End Use</u>	<u>Year</u>					
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Heating	77	33	42	24	30	-
Cooling	80	64	69	68	65	-
Water heating	2	2	3	2	2	-
Lighting	75	64	69	64	64	-
Other	27	21	16	15	15	-
Total	<u>238</u>	<u>186</u>	<u>200</u>	<u>172</u>	<u>176</u>	<u>-</u>

APPENDIX B
DESCRIPTION OF THRESHOLD EVALUATION METHODOLOGY

The threshold evaluation system is designed to assist the Office of Conservation and Solar Applications in managing its research, development and demonstration program. Its purpose is to examine incoming projects, to be certain that those selected for funding represent the best Federally supported research opportunities. To accomplish this objective, projects are evaluated relative to: (1) private and public sector investment criteria and (2) public sector energy benefit criteria. The criteria should also be applied at later stages in the development process to insure that as additional information is obtained, it is integrated into the management framework.

B.1 PUBLIC SECTOR CRITERIA

While it is clear that many energy conserving technologies could eventually become commercialized without Federal intervention, it is assumed that this intervention will accelerate their introduction into the marketplace and allow realization of the corresponding energy savings sooner than otherwise expected. The public sector project evaluation criteria are therefore designed to measure the marginal value of the energy savings resulting from acceleration of these projects.

This effect is illustrated in Figure 1. The area under curve B represents the energy benefits afforded by a hypothetical project over time, assuming no Federal intervention. The energy benefits are dependent on the market penetration rate of the technology because the overall savings attributable to a technology is equal to the savings per unit times the number of units in use. It is assumed that the rate of this penetration, and therefore the energy benefits follows an 'S' shaped curve. Acceleration results in shifting the penetration curve to the left (Curve A). The difference between these curves, shown by the shaded area in the figure, represents the actual energy savings potential of the Federal dollars.

Figure 1

In the threshold system, three indices (ETI, MEI, B-C) are used to measure the effectiveness of the Federal program. The efficiency of the total investment (ETI) is a comparison between the total energy benefits resulting from the Federal program (the total area under Curve A in Figure 1) and the total Federal and private RD&D expenditures required to achieve the projected energy savings. The equation used to calculate the ETI is as follows:

$$ETI = \frac{\sum_{t=1}^n \left(\sum_{i=1}^e P_{it} E_{it} \right) / (1+r)^{t-1}}{\sum_{t=1}^n (FI_t + PI_t) / (1+r)^{t-1}}$$

where:

FI = Federal RD&D Investment

PI = Private RD&D Investment

P = Average Fuel Price (\$/MMBtu)

E = Total Annual Energy Savings, based on estimated rate of
market penetration

r = Discount Rate (assumed to be 10%)

i = Fuel Type

t = Year

The second index, the Marginal Efficiency Index (MEI) is a measure of the Efficiency of the Federal RD&D dollars in accelerating the implementation of a particular technology. It compares the total incremental energy benefits realized as a result of the Federal program (the area between curves A and B in Figure 1) to the total Federal RD&D dollars invested in the project. The equation used to calculate the MEI is as follows:

$$MEI = \left[\frac{\sum_{t=1}^b \left[\left(\sum_{i=1}^e P_{it} E_{it} \right) / (1+r)^{t-1} \right]}{\sum_{t=1}^n \left[FI_t / (1+r)^{t-1} \right]} \right] +$$

$$\left[\frac{\sum_{t=1+b}^n \left[\sum_{i=1}^e P_{it} (E_{it} - E_{i(t-b)}) \right] / (1+r)^{t-1}}{\sum_{t=1}^n \left(FI_t / (1+r)^{t-1} \right)} \right]$$

where in addition to the previous notations:

b = years accelerated

A third index (B-C) has been defined to represent the net present value of each technology. It is calculated as the difference between the energy savings attributable to the marginal units (the area between curves A and B in Figure 1) and the cost of these units (capital cost plus Federal RD&D investment)

The equation for B-C is as follows:

$$\begin{aligned}
 B-C = & \left[\left(\sum_{t=1}^b \left(\sum_{i=1}^e P_{it} E_{it} \right) / (1+r)^{t-1} \right) + \right. \\
 & \left. \left(\sum_{t=1+b}^n \left(\sum_{i=1}^e P_{it} (E_{it} - E_{i(t-b)}) \right) / (1+r)^{t-1} \right) \right] \\
 & - \left[CC \left(\sum_{t=1}^b U_t + \sum_{t=1+b}^n (U_t - U_{t-b}) \right) \right]
 \end{aligned}$$

where, in addition to the previous notations:

CC = Incremental capital cost of technology (difference between the cost of the new technology and the conventional system it replaced)

U = Units in use, based on estimated rate of market penetration

B.2 PRIVATE SECTOR CRITERIA

The public sector criteria discussed in the previous section are all based on the assumption that the technology being evaluated will achieve a certain level of market penetration. In order for this penetration to occur, the product must compete against others already on the market. If it is to succeed, the product must be perceived as a good investment. In the threshold system, the product's internal rate of return is used as one measure of its commercialization potential. It is determined by solving for that rate of return that would make the present value of the cash flow from the investment equal to zero, according to the following formulas:

Residential

$$PV = \frac{\sum_{t=1}^n (R_t - C_t - K_t)}{(1 + r)^t}$$

Commercial

$$PV = \sum_{t=1}^n \frac{(1-T)(R_t - C_t - D_t) + D_t + S_t - K_t}{(1 + r)^t}$$

where:

- K = Capital and Installation Cost
- R = Gross Revenue
- T = Applicable Tax Rate (assumed to equal 50%)
- C = Operating Costs
- D = Annual Rate of Depreciation
- S = Scrap Value
- t = Year

n = Useful Life of Investment

r = Discount Rate (equals the internal rate of return when PV equals zero)

The threshold model uses a slightly modified version of these basic formulas, measuring the revenue as the operating costs savings resulting from the decreased energy use of the system under consideration.

Another private sector criterion, the payback period, is defined as the ratio of the initial costs (capital and installation) to operating cost savings.

B.3 PROJECT DATA REQUIRED TO PERFORM THRESHOLD EVALUATION

- (1) Acceleration of Market Entry - The number of years by which market entry of the technology is accelerated due to the DOE research program.
- (2) Capital Cost - The expected cost of purchasing and installing the technology once it has achieved full commercial development.
- (3) Years to Install - Time from day of capital investment to day of full operation.
- (4) Energy Use/Unit - Btu value of fuels used in normal year of operation. (Electricity converted to primary Btu's at 10,500 Btu/kWh.)
- (5) Non-fuel Operating and Maintenance Costs - All other costs required to operate system during a normal year.

- (6) System's Useful Life - Average operating life.
- (7) Scrappage - Value of equipment upon retirement as fraction of initial capital cost.
- (8) Market Penetration - Projected number of units in use each year, through 2000.
- (9) Federal RD&D Funding - The time stream of all Federal dollars associated with the project.
- (10) Private RD&D Funding - The time stream of all private sector dollars associated with the development of the technology.

APPENDIX C
COMPUTER PROGRAM DESCRIPTION AND LISTING

C.1 SYSTEM FLOW DIAGRAMS

The threshold evaluation system consists of essentially eight programs. The relationships between these programs and the data files that are input to each are described by the two diagrams that follow.

The names entered on the diagrams are the actual file and program names. The activities they correspond to are given below.

C.1.1 Program Definitions

- THRESHB - Main program, performs calculations of all criteria and energy savings. Includes six subroutines which are defined in the variable lists.
- HSUMB - Produces summary sheets for each branch
- DATASHB - Prints out input data sheets for each project
- WRITDESC - Makes changes in description file
- ASSIGNB - Makes changes in branch file
- WRITERB - Enters new project data
- READB - Prints out a listing of data values as they exist in BIGFILEB
- ERRORB - Used to change data entries

C.1.2 File Definitions

- BIGFILEB - Contains project data (80 entries) pertaining to costs, lifetimes, energy use, market size and penetration, RD&D funding, and acceleration of market entry

- RISKDATA - Contains data for risk model (not currently active)
- SCORDATA - Contains data for scoring model (not currently active)
- HIGHFUND,
LOWFUND - Contains different Federal funding scenarios (not currently active)
- DESCRIPB - Contains descriptions of each project
- PROJNAMB - Contains project names
- PRICES - Contains fuel prices for each year (1975-2000) according to four different scenarios
- SPREDB - Stores data (temporarily) so that it may be used to compute and print out summary sheets

MAIN SYSTEM

DATA VERIFICATION AND REVISION OPTIONS

C.2 VARIABLE LISTS

THRESHB VARIABLES

<u>Variable</u>	<u>Description</u>
BRANCH (5,12)	- Branch title
PNAME (5)	- Project name
CC (2)	- Capital cost of technology
PDESC (25)	- Project description
CMA (2)	- Installation cost of technology
COP (65,2)	- Operating costs
SCP (2)	- Scrappage value fraction
IYST (2)	- Years to install
CE (2,6)	- Energy consumption/saving for technology and fuel type
IYRL (2)	- Years of useful life
RNFOM (2)	- Nonfuel operating and maintenance costs
FED (10)	- Federal investment (RD&D)
UMAR (25)	- Marginal units sold each year due to acceleration
PRIN (10)	- Private investment (RD&D)
TEVDM (6)	- Total discounted value of marginal energy savings (\$)
EPR (5)	- BIGFILEB energy prices (proposers estimates)
CMKT (25)	- Units in use each year (Market penetration)
MMS (50)	- Project number array
NFED (25)	- Years of the analysis (1976, 1977, etc.)
UNIT (25)	- Number of units in market
TMKT (6)	- Total market in '80, 85, 90, 95, 2000
CFED (25)	- Federal investment (in actual units)
PRIV (25)	- Private investment (in actual units)
TCE (6)	- Cumulative energy savings (10^{12} Btu)
TEV (6)	- Actual total energy savings (dollars)
TEVD (6)	- Discounted total energy savings
EMP (25,5)	- Fuel prices
RAW (2,14)	- Risk scores for projects
PC (2)	- Probability of commercial success
PI (2)	- Probability of institutional success
PT (2)	- Probability of technical success
PB (2)	- Probability of success overall
WT (14)	- Risk/ROR sub element weights
WTD (2,14)	- Weighted Risk/ROR scores
QF (2)	- Weighted commercial feasibility risk score
EF (2)	- Weighted institutional feasibility risk score
TF (2)	- Weighted technical feasibility risk score
RORB (2)	- Risk adjusted rates of return

ANSWERS TO QUESTIONS

MM, MD, MY	Date?
KSCRN	Risk?
KRSM	Screening?
KSCOR	Scoring?
ISPRD	Spread sheet file?
IENX	Delivered energy price scenario?
ICALC	Calculate COP using time series?
ICYC	Series of runs?
JSEQTL	Sequential, non-sequential?
MPROJ etc.	Number of projects, and numbers?
IST, IEND	Starting and ending projects for sequential run?
ISPC	Specific branch?
KODE	Specific branch code if wanted?

OTHERS

PRJ	- Project number on risk file
RAWTOT	- Sum of subelements of risk scores
IFY	- First year of Federal investment for array
IPY	- First year of private investment for array
BNO	- Percent of market penetration in 1985
KBRCH	- Branch designation for project
KSCTR	- Buildings/industry branch designation
IB	- Technology type 1=new 2=substitute
IS	- Sector
IAC	- Number of years accelerated
IP	- Market number in units in use, or sold (always equal to 1)
IYRST	- Year of project installation
IYREND	- Year of end of useful life of project
OPCOST	- Fuel operating costs for project
FUEL	- Energy prices
LIM	- Limit of number of years of consideration (25 years)
SYRS	- Sum of years of life for RI calculations
PVP	- Present value from previous iteration
PAYBAC	- Payback period
RI	- Rate of return
MSG	- Message number
PV	- Present value
TCDT	- Tax credit
RIL	- Lower RI value for given test for convergence
RIH	- Higher RI value for given test for convergence

DPV	-	Absolute value of difference in present value iterations
DP	-	Absolute value of present value
SYRS1	-	Sum of years for conventional technology
SYRS2	-	Sum of years for new technology
PV1	-	Present value for conventional technology
PV2	-	Present value for substitute technology
IIY1	-	Last year of analysis of conventional technology
IIY2	-	Last year of analysis of substitute technology
TFI	-	Total actual Federal RD&D investment
PIV	-	Total actual private RD&D investment
TFID	-	Discounted Federal RD&D investment
TFPID	-	Total discounted private and Federal RD&D investment
PIVD	-	Discounted private RD&D investment
DC	-	Difference in capital cost of conventional and substitute systems
TPID	-	Total discounted private capital investment
TCIDM	-	Total discounted Federal RD&D investment and capital investment (marginal units)
TPI	-	Total private capital investment
TI	-	Total capital and Federal and private RD&D investment
TID	-	Discounted total capital and RD&D investment
EI	-	Efficiency of investment
EIM	-	Marginal efficiency of investment
ES85	-	Energy savings in 1985 (10^{12} Btu)
ES90	-	Energy savings in 1990 (10^{12} Btu)
ES2000	-	Energy savings in 2000 (10^{12} Btu)
OE85	-	Oil equivalent energy savings in 1985 (MB/DOE)
OE90	-	Oil equivalent energy savings in 1990 (MB/DOE)
OE2000	-	Oil equivalent energy savings in 2000 (MB/DOE)
OEUM	-	Oil equivalent savings cumulative through 2000
PVB	-	Present dollar value of cumulative energy savings of marginal units
PVC	-	Present value of total capital investment (marginal units) and Federal investment
BENCST	-	Difference between PVB and PVC
M	-	Calculated year in array for rate of return calculation
CSHFL	-	Cashflow in each year
SYD	-	Sum of years of life
PVADJ	-	Adjustment factor due to differing lifetimes of project, new and substitute
CRF	-	Capital recovery factor
ADDL	-	Adjustment in rate of return due to differing project lifetimes
MORE	-	Difference in life times of conventional and new technology for project

Subroutines

PKRSM	-	Prints Screening Model Outputs
PKSCOR	-	Prints Scoring Model Outputs
PKSCRN	-	Prints Risk Model Outputs
PISPRD	-	Writes to SPREDB (spread sheet file)
RICALC	-	Calculates present value (for RI calculation)
ADJUST	-	Calculates present value adjustment for project having different life times

HSUMB VARIABLES

<u>Variable</u>		<u>Description</u>
PRJNAM	-	Project name
PNAME	-	Project name
BRANCH	-	Branch number for project
TFI	-	Actual Federal investment
PIV	-	Actual private RD&D investment
TPI	-	Total private capital investment
TI	-	Total capital and Federal and private RD&D investment
TCE	-	Cumulative energy savings for fuels
MEYR	-	Market entry year
IAC	-	Years accelerated
TEV	-	Actual total energy savings
TEVD	-	Discounted total energy savings
TOT4	-	Sum of TFI for branch
TOT5	-	Sum of PIV for branch
TOT6	-	Sum of TPI for branch
TOT7	-	Sum of TI for branch
TOT8	-	Sum of TEV for branch
TOT9	-	Sum of TEVD for branch
DATA (27)	-	Information received from SPREDB, 27 variables
RI	-	Rate of return
BNO	-	Market penetration in 1985 (%)
OE85	-	Oil equivalent energy savings in 1985
OE2000	-	Oil equivalent energy savings in 2000
EI	-	Efficiency of investment
ETI	-	Efficiency of total investment

BENCST	-	Difference between present dollar value of cumulative energy savings of marginal units and present value of total capital investment and Federal investment
NPRJ	-	Number of projects under a branch
NBRCH	-	Branch of project
NUM	-	Project number
MEI	-	Marginal efficiency of investment
TOT 15	-	Sum of BENCST for branch
JSBR	-	Desired branch for spread sheet
XNBRCH (IBRCH)	-	Branch of project
TCET	-	Total cumulative energy savings (all fuels)
TOT 1	-	Sum of TCET for branch
TOT 2	-	Sum of OE85 for branch
TOT 3	-	Sum of OE2000 for branch

DATASHB VARIABLES

<u>Variable</u>		<u>Description</u>
PRJNAM (5)	-	Project name
NAME (2)	-	"In use or sold" specification for market penetration
BBB (2), BB	-	"Units or square feet" specification for market penetration
BRANCH (5,12)	-	Branch name
PRCNAM (3,3)	-	Name of price file used in calculating operating costs
AAA (4,4), A1(4)	-	Specification for operating cost units
PDESC(25)	-	Project description
SECTOR (3,5)	-	Sector name
DELP (25, 5)	-	Delivered energy price
FED (10), CFED (25)	-	Federal funding
PRI (10), PRIV (25)	-	Private funding
DATA (80)	-	Project information read from BIGFILEB
MMS (50)	-	Project numbers to be run array
COP (2)	-	Total operating cost/saving
TEV (2)	-	Energy cost/savings
IENX	-	Price scenario number?
ISER	-	Series of runs?
ISEQ	-	Sequential or non-sequential?
MPROJ	-	Number of projects to be run?
NSTART, NPROJ	-	Starting and ending project numbers for sequential runs?

IIM/IID/IIY	-	Date?
BRCH	-	Branch designation
MEYR	-	Market entry year
N1	-	Original project number
N	-	Project number
NSEC	-	Sector designation
INAM	-	Basis of analysis units sold or in use
IFY	-	First year of Federal investment
IPY	-	First year of private investment
IYEAR	-	Every 5 years, total market counter
BNO	-	Market penetration in 1985

C.3 PROGRAM LISTINGS

Most of the calculations in the threshold analysis are performed in the program 'THRESHB'. It is divided into a main section, 'MAIN1', and five subroutines, 'THRESUB1', 'THRESUB2', 'THRESUB3', 'THRESUB4', 'THRESUB5'.

The following programs have also been included: 'HSUMB', 'DATASHB', 'WRITERB', 'WRITDESC', 'ERRORB', 'READB'. The functions of each of those programs and the relations between them were discussed in section C.1

```
C THIS PROGRAM PERFORMS PROJECT THRESHOLD CRITERIA EVALUATIONS MA100010
C FOR THE ENDA OFFICE OF CONSERVATION, IT ALSO PERFORMS THE MA100020
C RISK, RATE OF RETURN ANALYSIS AND PRINTS OUT ALL THE INPUT DAT MA100030
C RA MA100040
C FOR EACH EVALUATION, MA100050
C MA100060
C MA100070
C MA100080
C PROGRAMMED BY EEA, INC. MA100090
C LAST MODIFIED BY JILL CHEN ON 10/30/78 MA100100
C ***** MA100110
C DIMENSION AND DATA INITIALIZATION STATEMENTS MA100120
C MA100130
C MA100140
C DEFINE FILE 2(150,830,E,1DUM),3(150,54,E,1DUM),9(500,60,E,1DUM) MA100150
C DEFINE FILE 10(150,6,E,1DUM),7(60,504,E,1DUM) MA100160
C COMMON /AA/BRANCH(5,12),PNAME(5) MA100170
C COMMON /A1/CC(2),PDESC(25),CHA(2),CUP(65,2),SCP(2),IYST(2) MA100180
C COMMON /A2/CE(2,6),X(2),IYRL(2),CF(25),RNFOH(2),FED(10),UMAR(25) MA100190
C COMMON /A3/PRIN(15),TEVDM(6),EPR(5) MA100200
C COMMON /BH/CHKT(25),IFED(11),MHS(400),BUX(4,3),DELP(4) MA100210
C COMMON /B1/KSCRN,KRSM,KSCOR,1SPRD MA100220
C COMMON /DD/1PROJ,HM,MO,MY,MEYR,NFED(25) MA100230
C COMMON /D1/UNIT(25),THKT(6),CFED(25) MA100240
C COMMON /D2/PRIV(25),TCE(6),TEV(6),TEVD(6),EER,EMP(25,5) MA100250
C COMMON /EE/RAW(2,14),SCORE(8) MA100260
C COMMON /FF/XR(2),WEIGHT(2,12),PRODOC(12),WT(14),WTD(2,14),QF(2) MA100270
C COMMON /F1/EF(2),TF(2),RDNB(2) MA100280
C COMMON /GG/COLVAL(12),SKOR(20),N123(12),TEMP(12),H(8),HT(8) MA100290
C COMMON /HH/HIS(8),PC(2),PI(2),PT(2),PB(2) MA100300
C REAL*8 PNAME MA100310
C REAL*4 PDFSC MA100320
C REAL*4 SCORE MA100330
C REAL*4 BLANK MA100340
C REAL*4 SPAC MA100350
C DATA BLANK/1 MA100360
C REAL*8 BRANCH MA100370
C REAL*4 XR MA100380
C THKT(2)=0,0 MA100390
C JJJ=1 MA100400
C IPASS=0 MA100410
C TCDI=,1 MA100420
C ADJ=10500,3413, MA100430
C MA100440
C OPEN ALL READ AND WRITE FILES MA100450
C MA100460
C FILE 1 - SPHROB DATA A1 ,... SEQUENTIAL MA100470
C FILE 2 - BIGFILEB DTA A1 ,... DIRECT ACCESS MA100480
C FILE 3 - PROJNAME DATA A1 ,... DIRECT ACCESS MA100490
C FILE 4 - RISKDATA DATA A1 ,... SEQUENTIAL MA100500
C FILE 7 - PRICES DATA A1 ,... DIRECT ACCESS MA100510
C FILE 8 - DESCRIPB DATA A1 ,... SEQUENTIAL MA100520
C MA100530
C REQUEST THE PARAMETERS OF THE CURRENT RUN OF MODEL MA100540
C MA100550
```

```
100 WRITE(6,9913) MA100560
9913 FORMAT(1X,'ENTER TODAY'S DATE (MM/DD/YY)') MA100570
      READ(5,A) MM,MD,MY MA100580
      WRITE(6,5561) MA100590
5561 FORMAT(1X,'DO YOU WANT RISK/RDR OUTPUTS') MA100600
      WRITE(6,5544) MA100610
5544 FORMAT(1X,'ANSWER 1=YES, 0=NO') MA100620
      READ(5,A) KSCRN MA100630
777 FORMAT(1I) MA100640
      WRITE(6,5564) MA100650
5564 FORMAT(1X,'DO YOU WANT SCREENING MODEL OUTPUTS') MA100660
      WRITE(6,5544) MA100670
      READ(5,A) KRSM MA100680
      WRITE(6,5444) MA100690
5444 FORMAT(1X,'DO YOU WANT SCORING MODEL OUTPUTS') MA100700
      WRITE(6,5544) MA100710
      READ(5,A) KSCOR MA100720
      WRITE(6,5668) MA100730
5668 FORMAT(1X,'DO YOU WANT TO ADD THIS DATA TO SPREAD SHEET FILE') MA100740
      K) MA100750
      WRITE(6,5544) MA100760
      READ(5,A) ISPRD MA100770
5563 CONTINUE MA100780
3 CONTINUE MA100790
      WRITE(6,4734) MA100800
4734 FORMAT(1X,'SELECT DELIVERED-ENERGY PRICES: 1=, 2X, MA100810
      &1=CURRENT EEA, 2=APAE F2, 3=APAE F4, 4=REVISED EEA', MA100820
      &1, 2X, '5=NSA=MODERATE, 6=BESON=MODERATE, 7=EIA 0178F', MA100830
      &1, 2X, '8=EIA 0178C') MA100840
      READ(5,A) IENX MA100850
      READ(7,IENX,2996) ((EMP(KYR,KFUEL),KYR=1,25),KFUEL=1,4) MA100860
2996 FORMAT(100F5,2) MA100870
      WRITE(6,9911) MA100880
9911 FORMAT(1X,'DO YOU WANT TO CALCULATE OPERATING 1, MA100890
      &1=COSTS USING TIME SERIES 1=YES 0=NO') MA100900
      READ(5,A) ICALC MA100910
      WRITE(6,7772) MA100920
7772 FORMAT(1X,'DO YOU WANT TO MAKE A SERIES OF RUNS',/, MA100930
      &1X,'ANSWER 1=YES, 0=NO') MA100940
      READ(5,A) ICYC MA100950
      IF(ICYC.EQ.0) GO TO 7888 MA100960
      WRITE(6,4144) MA100970
4144 FORMAT(1X,'1=SEQUENTIAL, 2=NON-SEQUENTIAL') MA100980
      READ(5,A) JSEFQL MA100990
      IF(JSEFQL.EQ.1) GO TO 4145 MA101000
      WRITE(6,4146) MA101010
4146 FORMAT(1X,'ENTER NO OF PROJECTS TO BE RUN, FOLLOWED BY THEIR', MA101020
      &1 NUMBERS') MA101030
      READ(5,A) MPROJ, (MNS(MP),MP=1,MPROJ) MA101040
      GO TO 4147 MA101050
4145 CONTINUE MA101060
      WRITE(6,8882) MA101070
8882 FORMAT(1X,'ENTER THE STARTING AND ENDING PROJECT NUMBERS') MA101080
      READ(5,A) ISI,IEND MA101090
      WRITE(6,8666) MA101100
```

```
8666 FORMAT(IX,'DO YOU WANT TO SPECIFY A PARTICULAR BRANCH CODE',//
      &IX,'(ANWER 1=YES, 0=NO)')
      READ(5,*) ISPC
      IF(IISPC.EQ.0) GO TO 8677
      WRITE(6,8668)
8668 FORMAT(IX,'ENTER CODE')
      READ(5,*) KODE
8677 CONTINUE
      NPROJ=IEND-IST+1
      DO 7717 IIRK=1,NPROJ
      MHS(IIRK)=IIS1+IIRK-1
7717 CONTINUE
4147 CONTINUE
336 DO 370 IIRANGE=1,NPROJ
      IPROJ=MHS(IIRANGE)
      GO TO 7898
7888 CONTINUE
      WRITE(6,4449)
4449 FORMAT(//,IX,'ENTER PROJECT NUMBER')
      READ(5,*) IPROJ
7898 CONTINUE
      IF(JJJ.EQ.1)PAUSE
      JJJ=2
      IPASQ=1
      RAWTOT=1.0
C
C READ DETAIL RECORD FOR THE PROJECT FROM BIGFILE
C
      READ(2,IPROJ,2000)RIB,RIS,AC,CC(1),CHA(1),YST1,(CE(1,J),J=1,5),
      &RNFUN(1),NPROJ,
      &YRL1,SCP(1),CC(2),CHA(2),YSTR,(CE(2,J),J=1,5),RNPON(2),
      &YRL2,SCP(2),RIP,EYR,CM,CD,CY,RIFYR,
      &(FED(J),J=1,10),RIPYR,(PRIN(L),L=1,10),
      &(CMKT(J),J=1,17),(THKT(I),I=1,5),(EPR(K),K=1,5)
2000 FORMAT(80F10.4)
      MEYR=EYR
      I1=MEYR-1975
      DO 1905 I=1,25
      EMP(I,5)=EPR(5)*EXP(.025*(I-1))
      IF (IENX.EQ.5) EMP(I,4)=EMP(I,4)*3413./10500.
1905 CONTINUE
C
C READ RISK SCORE FROM RISK8CUR
C
      REWIND 4
      IPROJ=IPROJ
3100 CONTINUE
      READ(4,*,END=4100) PRJ
      DO 2229 N=1,14
      READ(4,*,END=4100) (RAW(K,N),K=1,2)
2229 CONTINUE
      IF (PRJ.NE.IPROJ)GO TO 3100
      GO TO 4101
4100 CONTINUE
```

MA101110
MA101120
MA101130
MA101140
MA101150
MA101160
MA101170
MA101180
MA101190
MA101200
MA101210
MA101220
MA101230
MA101240
MA101250
MA101260
MA101270
MA101280
MA101290
MA101300
MA101310
MA101320
MA101330
MA101340
MA101350
MA101360
MA101370
MA101380
MA101390
MA101400
MA101410
MA101420
MA101430
MA101440
MA101450
MA101460
MA101470
MA101480
MA101490
MA101500
MA101510
MA101520
MA101530
MA101540
MA101550
MA101560
MA101570
MA101580
MA101590
MA101600
MA101610
MA101620
MA101630
MA101640
MA101650

```
      RAWTOT=0.0
4101 CONTINUE
C
C      SHIFT FUNDING INFORMATION INTO ARRAY CFED,PRIV,
C      ADJUST CFED TO ACTUAL DOLLARS,
C
      IFY=RIFYR-1976,
      IPY=RIPYR-1976,
      DO 1904 I=1,25
      CFED(I)=0
      PRIV(I)=0
1904 CONTINUE
      DO 1901 I=1,10
C
C      CALCULATE THE % OF MARKET PENETRATION IN 1985
C
      CFED(I*FY+1)=FED(I)
      PRIV(I*PY+1)=PRIN(I)
1901 CONTINUE
      IF (TMKT(2).EQ.0.0) GO TO 19191
      BND=CHKT(10)/TMKT(2)
      GO TO 19192
19191 BND=0.0
19192 CONTINUE
C
C      READ BRANCH DESIGNATION FROM BRANCHB
C
      READ(10,IPROJ,2998) RKBRCH
2998 FORMAT(F3.0)
      KBRCH=RKBRCH
      IF (KBRCH.GT.11) KBRCH=KBRCH-11
      IF (ISPC.EQ.1.AND.KODE.NE.KBRCH) GO TO 370
      KSCIR=1
      IF (KBRCH.GT.5) KSCIR=2
C
C      READ PROJECT DESCRIPTIONS FROM DESCRIB
C
      IF (KPSM.EQ.0.AND.KBCRN.EQ.0) -- GO TO 3755
      REWIND 8
3753 CONTINUE
      READ(8,2267,END=3754) LPROJ,(PDEBC(LL),LL=1,25)
2267 FORMAT(14,1X,25A4)
      IF (LPROJ.EQ.IPROJ) GO TO 3755
      GO TO 3753
3754 CONTINUE
      REWIND 8
      DO 7 I=1,100
7      PDESC(I)=BLANK
3755 CONTINUE
C
C      CHANGE REAL VARIABLES TO INTEGER VALUES
C
      IH=RIH
      IS=RIIS
      IAC=AC
```

```
MA101660
MA101670
MA101680
MA101690
MA101700
MA101710
MA101720
MA101730
MA101740
MA101750
MA101760
MA101770
MA101780
MA101790
MA101800
MA101810
MA101820
MA101830
MA101840
MA101850
MA101860
MA101870
MA101880
MA101890
MA101900
MA101910
MA101920
MA101930
MA101940
MA101950
MA101960
MA101970
MA101980
MA101990
MA102000
MA102010
MA102020
MA102030
MA102040
MA102050
MA102060
MA102070
MA102080
MA102090
MA102100
MA102110
MA102120
MA102130
MA102140
MA102150
MA102160
MA102170
MA102180
MA102190
MA102200
```

IF(IAC.GT,25) IAC=25

IYST(1)=YST1

IF(IYST(1).EQ,0,AND,IB,EQ,2) YST1=1

IF(1R,EQ,2,AND,IYST(1),EQ,0) IYST(1)=1

IYST(2)=YST2

IF(IYST(2).EQ,0) YST2=1

IF(IYST(2).EQ,0) IYST(2)=1

IYRL(1)=YRL1

IYRL(2)=YRL2

IP=RTIP

C
C
C
CALCULATE OPERATING COSTS USING YEARLY PRICE DATA

DO 2559 J=1,2

IYRS1=MYR-1975

IYREND=IYRL(J)+MEYR-1975-1

DO 1193 KY=IYRS1,IYREND

NPER=0,0

NPCOST=0,0

DO 2558 L=1,5

IF(KY.GT,25)GO TO 94

FUEL=EMP(KY,L)

GO TO 195

94 FUEL=EMP(25,L)

195 CONTINUE

IF(ICALC.(0,0)FUEL=EMP(MEYR-1975,L)

UPCOST=NPCOST+CE(J,L)+FUEL/1,E6

2558 CONTINUE

COP(KY,J)=NPCOST+RNFCOM(J)

1193 CONTINUE

2559 CONTINUE

C
C
C
READ PROJECT NAME FROM PROJNAM8

READ(3,IPROJ,44)(PNAME(L),L=1,5)

44 FORMAT(5A8)

8112 CONTINUE

C
C
C
INTERPOLATE UNITS IN USE FOR 1991-1999

DO 60 K=1,25

CF(K)=0,

UMAR(K)=0,

UNIT(K)=0,

6 CONTINUE

2 CONTINUE

C
DO 60 I=1,25

CF(I)=CFED(I)+1,0E+6

60 CONTINUE

LIM=25

UNIT(20)=CMKT(16)

UNIT(25)=CMKT(17)

DO 82 I=1,15

UNIT(I)=CMKT(I)

MA102210

MA102220

MA102230

MA102240

MA102250

MA102260

MA102270

MA102280

MA102290

MA102300

MA102310

MA102320

MA102330

MA102340

MA102350

MA102360

MA102370

MA102380

MA102390

MA102400

MA102410

MA102420

MA102430

MA102440

MA102450

MA102460

MA102470

MA102480

MA102490

MA102500

MA102510

MA102520

MA102530

MA102540

MA102550

MA102560

MA102570

MA102580

MA102590

MA102600

MA102610

MA102620

MA102630

MA102640

MA102650

MA102660

MA102670

MA102680

MA102690

MA102700

MA102710

MA102720

MA102730

MA102740

MA102750

```
82 CONTINUE
DO 1902 I=1,2
J1=16+5*(I-1)
J2=J1+3
A=ALOG(CMKT(15+I)/CMKT(14+I))/5,
R=EXP(A)-1
DO 1903 J=J1,J2
UNIT(J)=UNIT(J-1)*(1+R)+.5
1903 CONTINUE
1902 CONTINUE
IF (IP, EQ, 1) GO TO 90
DO 85 I=2, LIM
UNIT(I)=UNIT(I)+UNIT(I-1)
85 CONTINUE
C CALCULATE MARGINAL UNITS (DUE TO ACCELERATION
C OF MARKET ENTRY)
C
90 CONTINUE
JAC=IAC+1
DO 91 I=JAC, LIM
UMAR(I)=UNIT(I)-UNIT(I-IAC)
91 CONTINUE
DO 93 I=1, IAC
UMAR(I)=UNIT(I)
93 CONTINUE
8229 CONTINUE
C *****
C
C BEGIN RATE OF RETURN COMPUTATION SECTION
C FOR NEW TECHNOLOGY ONLY
C
C CALCULATE PAYBACK PERIOD AND SUM OF YEARS OF LIFE
C
92 CONTINUE
IF (IP, EQ, 2) GO TO 150
N3G=0
SYRS=0.0
I2=IYRL(2)
DO 1995 INY=1, I2
SYRS=SYRS+INY
1995 CONTINUE
PVP=0.0
PAYBAC=(CC(2)+CHA(2))/COP(IYRST,2)
RI=.5/PAYBAC
IF (IS, EQ, 1) RI=2.*RI
IF (PAYBAC, GT, IYRL(2)) GO TO 4876
IF (PAYBAC, LT, 0.) RI=100,
GO TO 4888
4876 CONTINUE
RI=0.0
GO TO 300
4888 CONTINUE
95 CONTINUE
```

```
MA102760
MA102770
MA102780
MA102790
MA102800
MA102810
MA102820
MA102830
MA102840
MA102850
MA102860
MA102870
MA102880
MA102890
MA102900
MA102910
MA102920
MA102930
MA102940
MA102950
MA102960
MA102970
MA102980
MA102990
MA103000
MA103010
MA103020
MA103030
MA103040
MA103050
MA103060
MA103070
MA103080
MA103090
MA103100
MA103110
MA103120
MA103130
MA103140
MA103150
MA103160
MA103170
MA103180
MA103190
MA103200
MA103210
MA103220
MA103230
MA103240
MA103250
MA103260
MA103270
MA103280
MA103290
MA103300
```

```
IF (CC(2),GE,0,0) GO TO 1234
MSG=1
RI=9,E20
GO TO 300
1234 CONTINUE
PV=0,0
IY2=IYRL(2)+IYST(2)

C
C TEST FOR MINIMUM RATE OF RETURN OF ZERO AND
C MAXIMUM OF TWO HUNDRED PERCENT
C
DO A JK=1,2
IF (JK,EQ,1) RI=2,0
IF (JK,EQ,2) RI=0,0
CALL RICALC (2,IY2,ICDT, Y8T2,8YD,8YRS,PV,IS,RI,1)
IF (JK,LT,1,AND,PV,GT,0,0) RI=9,E20
IF ((JK,LT,2),AND,(PV,LT,0,0)) GO TO 300
IF ((JK,EQ,1),AND,(PV,GT,0,0)) GO TO 300
CONTINUE

B
C RI CALCULATION LOOP FOR NEW TECHNOLOGY
C
RIL=0,0
RIH=2,0
DO 17 JJ=1,13
RI=(RIH-RIL)/2,+RIL
CALL RICALC (2,IY2,ICDT, Y8T2,8YD,8YRS,PV,IS,RI,1)
DPV=ABS(PVP-PV)
DP=ABS(PV)
IF (DPV/10.,GT,DP) GO TO 300
IF (PV,GT,0,0) RIL=RI
IF (PV,LT,0,0) RIH=RI
PVP=PV
17 CONTINUE
GO TO 300

C
C *****
C
C BEGIN RATE OF RETURN COMPUTATION SECTION FOR
C SUBSTITUTE TECHNOLOGY ONLY
C
150 CONTINUE
MSG=0
SYRS1=0,0
I2 =IYRL(1)
DO 1996 INY=1,12
SYRS1=SYRS1+INY
CONTINUE
1996 SYRS2=0,0
I2=IYRL(2)
DO 1997 JNY=1,12
HJNY=JNY
SYRS2=SYRS2+HJNY
1997 CONTINUE
IF (CC(2)+CHA(2),GE,CC(1)+CHA(1)) GO TO 2345
```

```
MA103310
MA103320
MA103330
MA103340
MA103350
MA103360
MA103370
MA103380
MA103390
MA103400
MA103410
MA103420
MA103430
MA103440
MA103450
MA103460
MA103470
MA103480
MA103490
MA103500
MA103510
MA103520
MA103530
MA103540
MA103550
MA103560
MA103570
MA103580
MA103590
MA103600
MA103610
MA103620
MA103630
MA103640
MA103650
MA103660
MA103670
MA103680
MA103690
MA103700
MA103710
MA103720
MA103730
MA103740
MA103750
MA103760
MA103770
MA103780
MA103790
MA103800
MA103810
MA103820
MA103830
MA103840
MA103850
```



```

      MSG=1
      RI=9.E20
      GO TO 300
2345  CONTINUE
      PVP=0,
      PAYBAC=(CC(2)+CHA(2)-CC(1)-CHA(1))/(COP(1YRST,1)-COP(1YRST,2)
      &1)
      IF (PAYBAC.GT.1YRL(1).AND.PAYBAC.GT.1YRL(2)) GO TO 9876
      GO TO 9888
9876  CONTINUE
      RI=0,0
      GO TO 300
9888  CONTINUE
      C
      C      TEST FOR MINIMUM RATE OF RETURN OF ZERO
      C      AND MAXIMUM OF TWO HUNDRED PERCENT ADJUSTING
      C      PRESENT VALUES FOR PROJECTS HAVING UNEQUAL
      C      PHYSICAL LIFETIMES
      C
      DO 61 JJ=1,2
      IF (JJ.EQ.1) RI=2,0
      IF (JJ.EQ.2) RI=0,0
      PVI=0,0
      PV2=0,0
      I1Y2=1YRL(2)+1YST(2)
      I1Y1=1YRL(1)+1YST(1)
3678  CONTINUE
      CALL RICALC(1,I1Y1,TCDT, YST1,SYD1,SYRS1,PVI,19,RI,2)
      CALL RICALC(2,I1Y2,TCDT, YST2,SYD2,SYRS2,PV2,19,RI,2)
      CALL ADJUST(YRL1,YRL2,PV,PVI,PV2,RI,I1Y1,I1Y2)
      IF (JJ.EQ.1.AND.PV.GT.0,0) RI=9.E20
      IF (JJ.EQ.1.AND.PV.GT.0,0) GO TO 300
      IF (JJ.EQ.2.AND.PV.LT.0,0) GO TO 300
61    CONTINUE
      C
      C      CALCULATE RATE OF RETURN USING BINARY SEARCH
      C      APPROACH (ADJUST FOR DIFFERENT LIFETIMES),
      C
      RIH=0,0
      RIL=2,0
      DO 71 JJ=1,13
      PVI=0,0
      PV2=0,0
      RI=(RIH+RIL)/2,+RIL
      CALL RICALC(1,I1Y1,TCDT, YST1,SYD1,SYRS1,PVI,19,RI,2)
      CALL RICALC(2,I1Y2,TCDT, YST2,SYD2,SYRS2,PV2,19,RI,2)
      CALL ADJUST(YRL1,YRL2,PV,PVI,PV2,RI,I1Y1,I1Y2)
      DPV=ABS(PVP-PV)
      DP=ABS(PV)
      IF (DPV/10.,GT.DP) GO TO 300
      IF (PV.GT.0,0) RIL=RI
      IF (PV.LT.0,0) RIH=RI
      PVP=PV
71    CONTINUE
      C

```

```

      MA103860
      MA103870
      MA103880
      MA103890
      MA103900
      MA103910
      MA103920
      MA103930
      MA103940
      MA103950
      MA103960
      MA103970
      MA103980
      MA103990
      MA104000
      MA104010
      MA104020
      MA104030
      MA104040
      MA104050
      MA104060
      MA104070
      MA104080
      MA104090
      MA104100
      MA104110
      MA104120
      MA104130
      MA104140
      MA104150
      MA104160
      MA104170
      MA104180
      MA104190
      MA104200
      MA104210
      MA104220
      MA104230
      MA104240
      MA104250
      MA104260
      MA104270
      MA104280
      MA104290
      MA104300
      MA104310
      MA104320
      MA104330
      MA104340
      MA104350
      MA104360
      MA104370
      MA104380
      MA104390
      MA104400

```

```

C *****
C REGIM COMPUTING TOTAL AND DISCOUNTED INVESTMENTS
C
300 CONTINUE
    IF I=0,0
    PIV=0,
    TFPID=0,
    PIVD=0,
    DL=CC(2)-CC(1)
    TPID=UNIT(1)*DC
    IF ID=0,
    DO 310 I=1,LIM
    IF I=TI+CF(1)
    PIV=PIV+PRIV(1)
    J=I-3
    TFPID=TFPID+CF(1)/1,1+AJ
    TFPID=TFPID+(PRIV(1)+CF(1))/1,1+AJ
    PIVD=PIVD+PRIV(1)/1,1+AJ
    IF (I.EQ.1) GO TO 310
    TPID=TPID+(UNIT(1)-UNIT(I-1))*DC/1,1+AJ
310 CONTINUE
    TEVDM(6)=0,
    TCE(6)=0,
    TEV(6)=0,
    TCIDM=0,
    TFPD(6)=0,
    DO 316 I=1,5
    TEVD(I)=0,
    TEVDM(I)=0,
    TCE(I)=0,
    TFPV(I)=0,
    DO 315 J=1,LIM
    IF (JDEL.EQ.5.AND,I.EQ.4) EMP(J,I)=EMP(J,I)/ADJ
    TEVDM(I)=TEVDM(I)+UMAR(J)*(CE(2,I)-CE(1,I))*EMP(J,I)*1,0E+06/
    &(1,1)+AJ-3)
    TCE(I)=UNIT(J)*(CE(2,I)-CE(1,I))+TCE(I)
    TEV(I)=UNIT(J)*(CE(2,I)-CE(1,I))*EMP(J,I)*1,0E+06+TEV(I)
    TEVD(I)=TEVD(I)+UNIT(J)*(CE(2,I)-CE(1,I))*EMP(J,I)*1,0E+06/(1
    &,1)
    &AJ-3)
315 CONTINUE
    TEVDM(6)=TEVDM(6)+TEVDM(1)
    TEV(6)=TEV(6)+TEV(1)
    TCE(6)=TCE(6)+TCE(1)
    TEVD(6)=TEVD(6)+TEVD(1)
316 CONTINUE
C
C CALCULATE MARGINAL SAVINGS DUE TO FEDERAL INVESTMENT
C
    DO 9900 I=2,LIM
    TCIDM=TCIDM+((UMAR(I)-UMAR(I-1))*DC)/1,1+(I-3)
9900 CONTINUE
C
C RESUME TOTAL AND DISCOUNTED INVESTMENTS CALCULATIONS

```

```

MA104410
MA104420
MA104430
MA104440
MA104450
MA104460
MA104470
MA104480
MA104490
MA104500
MA104510
MA104520
MA104530
MA104540
MA104550
MA104560
MA104570
MA104580
MA104590
MA104600
MA104610
MA104620
MA104630
MA104640
MA104650
MA104660
MA104670
MA104680
MA104690
MA104700
MA104710
MA104720
MA104730
MA104740
MA104750
MA104760
MA104770
MA104780
MA104790
MA104800
MA104810
MA104820
MA104830
MA104840
MA104850
MA104860
MA104870
MA104880
MA104890
MA104900
MA104910
MA104920
MA104930
MA104940
MA104950

```

C	IF (IR,NE,2) GO TO 317	MA104960
	DO 313 I=1,6	MA104970
	TCE(I)=-TCE(I)	MA104980
315	CONTINUE	MA104990
	TEVDH(6)=-TEVDH(6)	MA105000
	TEVD(6)=-TEVD(6)	MA105010
	TEV(6)=-TEV(6)	MA105020
317	TP1=(CC(2)-CC(1))*UNIT(LIM)	MA105030
	T1=TP1+IFI+PIV	MA105040
	TID=IFID+PIVD+TPID	MA105050
320	E1=TEVD(6)/TFID	MA105060
	E1H=TEVDH(6)/TFID	MA105070
	E805=0.	MA105080
	DO 321 I=1,5	MA105090
	E805=(CE(1,I)-CE(2,I))+E805	MA105100
321	CONTINUE	MA105110
	IF (IH,EQ,1) E805=-E805	MA105120
	E82000=E805*UNIT(25)+1,E=12	MA105130
	E890=E805*UNIT(15)+1,E=12	MA105140
	E885=E805*UNIT(10)+1,E=12	MA105150
	DE85=E805+1,E3/(5,8+365,)	MA105160
	DE2000=(82000+1,E3/(5,8+365,))	MA105170
	DE90=E890+1,E3/(5,8+365,)	MA105180
	DECUH=TCE(6)+1,E=9/(5,8+365,)	MA105190
	ETI=TEVD(6)/TFPID	MA105200
	DO 433 I=1,6	MA105210
433	TCE(I)=TCE(I)+1,E=12	MA105220
	PVB=TEVDH(6)/IE6	MA105230
	PVC=TCIDH/IF6+TFID/IE6	MA105240
	HENCSI=PVB-PVC	MA105250
C		MA105260
C	BEGIN RISK/RATE OF RETURN COMPUTATIONS	MA105270
C		MA105280
	IF (RAWTOT,LT,0.001) GO TO 6996	MA105290
	DO 44101 I=1,2	MA105300
	QF(I)=0.0	MA105310
	EF(I)=0.0	MA105320
	TF(I)=0.0	MA105330
44101	CONTINUE	MA105340
	RORN=RI*100.	MA105350
	DO 3105 N=1,14	MA105360
	DO 3105 K=1,2	MA105370
	WID(K,N)=WT(N)*RAW(K,N)	MA105380
3105	CONTINUE	MA105390
	DO 3106 I=1,2	MA105400
	DO 3107 K=1,5	MA105410
	QF(I)=QF(I)+WID(I,K)	MA105420
3107	CONTINUE	MA105430
	DO 3108 K=6,9	MA105440
	EF(I)=EF(I)+WID(I,K)	MA105450
3108	CONTINUE	MA105460
	DO 3109 K=10,14	MA105470
	TF(I)=TF(I)+WID(I,K)	MA105480
3109	CONTINUE	MA105490
		MA105500

```

PC(1)=(11,=10,*(5=DF(1)/4,))/10,
PI(1)=(11,=10,*(5=EF(1)/4,))/10,
PT(1)=(11,=10,*(5=TF(1)/4,))/10,
PB(1)=PC(1)*PI(1)*PT(1)
RORB(1)=RORN*(PB(1)+*(1,/,45))
IF(PC(1),EQ,1,0) PC(1)=PC(1)+,01
IF(PI(1),EQ,1,0) PI(1)=PI(1)+,01
IF(PT(1),EQ,1,0) PT(1)=PT(1)+,01
3106 CONTINUE
GO TO 6997
6996 CONTINUE
RORB(1)=0,0
RORB(2)=0,0
6997 CONTINUE
RRT=RORB(1)/100,
IF(RORB(1),EQ,RORB(2)) RORB(1)=0,0
IF(KRSH ,EQ,1)CALL PKRSH(TFI,PIV,TPI,TI,TFID,PIVD,TPID,TID,
BESB5,ES2000,DE85,DE2000,M8G, PAYBAC,RI,BRI,PRI,
&E11,ETM,BND,IAC,KBRCH,IENX,PVB,PVC,HENCST)
IF (KSCOR ,EQ, 1) CALL PKSCOR (RAWTOT,TRED,TFI,
&I1,IN,KSCTR,PIV,ETI,IAC)
IF (KSCRN ,EQ, 1) CALL PKSCRN (PFRSC,KBRCH,RAWTOT,RURN)
IF (ISPRD ,EQ, 1)CALL PISPRD(BPROJ,DE85,DE2000,BND,BEYR,BAC,
&RI,EI,ETI,ETM,TFI,PIV,TPI,TI,DE90,DECUM,ICVC,IAC,BENCST)
370 CONTINUE
WRITE(6,350)
350 FORMAT (/// ' ANOTHER RUN? (N,Y,0=N)')
READ(5,4) IX
IF (IX,EQ,1) GO TO 3
8989 CONTINUE
WRITE(6,502)
502 FORMAT(/////, ' END1')
STOP
END

```

```

MA105510
MA105520
MA105530
MA105540
MA105550
MA105560
MA105570
MA105580
MA105590
MA105600
MA105610
MA105620
MA105630
MA105640
MA105650
MA105660
MA105670
MA105680
MA105690
MA105700
MA105710
MA105720
MA105730
MA105740
MA105750
MA105760
MA105770
MA105780
MA105790
MA105800
MA105810
MA105820
MA105830
MA105840

```



```
C *****
C
C THIS SUBROUTINE PRINTS OUT RESULTS OF THRESHOLD
C SCREENING MODEL
C
C SUBROUTINE PKRSH(TFI,PIV,TPI,TI,TFID,PIVD,TPID,TID,E30B,E3200
80,
80E85,DE2000,M3G, PAYBAC,RI,BRI,PRI,ETI,EIH,RNO,IAC,KBRCH,
81ENX,PVB,PVC,BENCST)
COMMON /AA/BRANCH(5,12),PNAME(5)
COMMON /A1/CC(2),PDESC(25),CMA(2),COP(65,2),8CP(2),IY8T(2)
COMMON /A2/CE(2,6),X(2),IYRL(2),CF(25),RNFUN(2),FED(10),UMAR(25)
COMMON /A3/PRIN(15),TEVDH(6),EPR(5)
COMMON /B0/CHKT(25),IFED(11),MMS(400),BUX(4,3),DELP(4)
COMMON /B1/KSCRN,KRSM,KSCOR,18PRD
COMMON /D0/1PROJ,MH,MD,MY,MEYR,NFED(25)
COMMON /D1/UNIT(25),TMKT(6),CFED(25)
COMMON /D2/PRIV(25),TCE(6),TEVD(6),EER,ENP(25,5)
COMMON /EE/RAW(2,14),SCORE(8)
COMMON /FF/XR(2),WEIGHT(2,12),PRUDUC(12),WT(14),WTD(2,14),GF(2)
COMMON /FI/EF(2),TF(2),RURB(2)
COMMON /GG/COLVAL(12),SKOR(20),N123(12),TEMP(12),H(8),HT(8)
COMMON /HH/HS(8),PC(2),PI(2),PT(2),PB(2)
DIMENSION ENAME(6),PRCNAM(5,8)
REAL*8 PNAME
REAL*4 PDESC
REAL*8 BRANCH
REAL*4 SCORE
REAL*4 XR
REAL*8 ENAME/IGAS , , ,OIL , , ,COAL , , ,ELECT , ,
B'OTHER , , ,TOTAL , ,
REAL*4 PRCNAM/URIG , , ,INAL , , ,EEA , , ,
8'APAC , , ,BRO , , ,OKHA , , ,VEN , , ,IF2 , ,
8'APAE , , ,BRO , , ,OKHA , , ,VEN , , ,IF4 , ,
8'REV1 , , ,BFD , , ,EEA , , ,
8'OSA , , ,MODE , , ,RATE , , ,
8'RESO , , ,M-HO , , ,DERA , , ,ITE , ,
8'ETA , , ,0178 , , ,F , , ,
8'ETA , , ,0178 , , ,C , , ,
WRITE(6,9936) 1PROJ,MH,MD,MY
9936 FORMAT(/,1X,'PROJECT NUMBER ',13,36X,'DATE ',12,1H/,12,1H/,12)
WRITE(6,2000)
2000 FORMAT(/,1X,20('---'),/)
WRITE(6,2223)(PNAME(L),L=1,5)
WRITE(6,2111)(BRANCH(L,KBRCH),
&L=1,5),(PDESC(L),L=1,25)
2223 FORMAT(6X,'PROJECT NAME ',5A8)
2111 FORMAT(6X,'BRANCH ',5A8,/,
&6X,'DESCRIPTION ',12A4,/,20X,13A4)
IF(KRSM,EQ,1,OR,KSCRN,EQ,1) WRITE(6,4431)
4431 FORMAT(1X,20('---'))
WRITE(6,50)
50 FORMAT(/,14X,'MARKET',11X,'TOTAL',4X,'FEDERAL RD&D',5X,
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8 'PRIVATE ROAD', THRO0560
8/,12X,'PENETRATION',7X,'MARKET',5X,'INVESTMENT',7X, THRO0570
8 'INVESTMENT', THRO0580
8/,3X,'YEAR',5X,'UNITS IN USE',7X,'SIZE',8X, THRO0590
8 '($1000)',10X,'($1000)',/, THRO0600
DD 88 IX=1,15 THRO0610
ID=IX/5 THRO0620
IF (IX.EQ.5.OR.IX.EQ.10.OR.IX.EQ.15) WRITE(6,52) THRO0630
8 NFED(IX),UNIT(IX),THKT(10),CFED(IX),PRIV(IX) THRO0640
52 FORMAT(3X,14,5X,F12,0,2X,F12,0,3X,3PF10,1,7X,=3PF10,1) THRO0650
IF (IX.EQ.5.OR.IX.EQ.10.OR.IX.EQ.15) GO TO 88 THRO0660
51 FORMAT(3X,14,5X,F12,0,17X,3PF10,1,7X,=3PF10,1) THRO0670
WRITE(6,51) NFED(IX),UNIT(IX),CFED(IX),PRIV(IX) THRO0680
88 CONTINUE THRO0690
II=1995 THRO0700
I2=2000 THRO0710
WRITE(6,652) II,UNIT(20),THKT(4),CFED(20),PRIV(20) THRO0720
WRITE(6,652) I2,UNIT(25),THKT(5),CFED(25),PRIV(25) THRO0730
652 FORMAT(/,3X,14,5X,F12,0,2X,F12,0,3X,3PF10,1,7X,=3PF10,1) THRO0740
WRITE(6,425) THRO0750
425 FORMAT(/,34X,'INVESTMENT',/,29X,'(MILLIONS OF DOLLARS)') THRO0760
WRITE(6,415) THRO0770
WRITE(6,420)TFI,PIV,TPI,TI,TFID,PIVO,TPID,TID THRO0780
415 FORMAT(18X,'RUSD INVESTMENT',7X,'CAPITAL', THRO0790
810X,'TOTAL',/,17X,'FEDERAL',3X,'PRIVATE',4X,2('INVESTMENT',6
8X)) THRO0800
420 FORMAT(8X,'ACTUAL',1X,2(=6PF8,4,2X),2(=6PF14,4,2X),/,4X, THRO0810
8'DISCOUNTED',1X, THRO0820
82(=6PF8,4,2X),2(=6PF14,4,2X)/- THRO0830
LYR=2000 THRO0840
WRITE(6,430) THRO0850
430 FORMAT(14X,'ENERGY SAVINGS',23X,'ENERGY SAVINGS',/, THRO0860
85X,'CUMULATIVE TO 2000 (TRILLION BTU)',12X,'1985',8X,'2000') THRO0870
WRITE(6,435)ENAME(1),TCE(1),ES85,ES2000,ENAME(2),TCE(2) THRO0880
8,DE85,DE2000,(ENAME(KK),TCE(KK),KK=3,6),PVB,PVC,BENC8T THRO0890
435 FORMAT(9X,A8,G12,5,5X,'TRILLION BTU',1X,F7,2,5X,F7,2,/, THRO0900
89X,A8,G12,5,11X,'MB/DOE',1X,F7,2,5X,F7,2, THRO0910
82(/,9X,A8,G12,5),19X, THRO0920
8'BENEFITS AND COSTS',/,9X,A8,G12,5,19X, THRO0930
8'(MILLIONS OF DOLLARS)',/, THRO0940
8/,9X,A8,3X,G12,5,16X,'BENEFITS',8X,F8,1,/, THRO0950
848X,'COSTS',11X,F8,1,/,48X,'BENEFITS-COST',3X,F8,1) THRO0960
WRITE(6,447) THRO0970
447 FORMAT(/13X,'ENERGY PRICES',22X,'SCREENING CRITERIA',/,16X, THRO0980
8'($/MMBTU)') THRO0990
DD 44443 IK=1,5 THRO1000
EPR(IK)=EMP(MEYR=1975,IK) THRO1010
44443 CONTINUE THRO1020
44444 CONTINUE THRO1030
DD 10 J=1,5 THRO1040
10 IF (TCE(J).EQ.0.00)EPR(J)=0.0 THRO1050
IF (MSG.EQ.1) GO TO 2346 THRO1060
WRITE(6,450) EPR(1),EPR(2),PAYBAC,RI,EPR(3) THRO1070
450 FORMAT(141X,'PAYBACK',10X,'RATE OF RETURN',/, THRO1080
86X,'GAS',20X,F5,2,8X,'PERIOD', THRO1090
THRO1100
```

87,6X,'OIL',20X,F5,2,7X,F7,3,12X,	THR01110
8F7,4,/,6X,'COAL',19X,F5,2)	THR01120
GO TO 2347	THR01130
2346 CONTINUE	THR01140
WRITE(6,2348) EPR(1),EPR(2),PAYBAC, EPR(3)	THR01150
2348 FORMAT(41X,'PAYBACK',5X,'PROJECT OFFERS CAPITAL ',	THR01160
87,6X,'GAS',20X,F5,2,8X,'PERIOD',6X,'COST SAVINGS FOR CAN'T	THR01170
8',	THR01180
87,6X,'OIL',20X,F5,2,7X,F7,3,4X,' BE CALCULATED',	THR01190
87,6X,'COAL',19X,F5,2)	THR01200
2347 CONTINUE	THR01210
WRITE(6,455) EPR(4),EPR(5),ETI,EIM	THR01220
455 FORMAT(6X,'ELECT (10500 BTU/KWH)',2X,F5,2,17X,'ETI'	THR01230
8,9X,'EIM',/,6X,'OTHER',18X,F5,2,13X,20(2,5)	THR01240
WRITE(6,460) BND	THR01250
460 FORMAT(/1X,'* ENERGY PRICES BASED ON',17X,	THR01260
8'MARKET PENETRATION (1985)*',2PF5,1,1X')	THR01270
WRITE(6,2468) (PRCNAM(JJ,IENX),JJ=1,5),IAC	THR01280
2468 FORMAT(2X,5A4,20X,'ACCELERATION *',12,' YEARS'/)	THR01290
RETURN	THR01300
END	THR01310

703	FORMAT(1X,20('---'),/,1X,'PROJECT',/,10A4,17X,'YEAR',/,14)	THR00540
	WRITE(6,199)(BLVDIND(L,KSGTH),L=1,5)	THR00570
199	FORMAT(1X,'CONSERVATION PROGRAM',/,5A4)	THR00580
	WRITE(6,704)	THR00590
704	FORMAT(1X,20('---'),/,6X,/, VALUE FACTORS',10X,	THR00600
	&' / SUCCESS/ FACTORS /',6X,'FEDERAL ROLE',5X,/,')	THR00610
	WRITE(6,708)	THR00620
	WRITE(6,706)	THR00630
706	FORMAT(1X,'ASD / ETI ENV CRS TIM SEC / CUM INS ',	THR00640
	&' IEC / GEO ACC AFF LEV /')	THR00650
	WRITE(6,707)	THR00660
707	FORMAT(1X,'IMP / IMP SUP INT IMP / FEA FEA ',	THR00670
	&' ICA / SIG ',17X,/,')	THR00680
	WRITE(6,708)	THR00690
708	FORMAT(1X,13('---p '))	THR00700
C		THR00710
C	BEGIN SCORING MODEL COMPUTATIONS	THR00720
C		THR00730
C	CALCULATING LEVERAGE COLUMN VALUE	THR00740
C		THR00750
	TRED=IF1/PIV	THR00760
	IFF=IF1/TRED	THR00770
	COLVAL(12)=8,	THR00780
	IF(IFF.GT.0.5) COLVAL(12)=4,	THR00790
	IF(IFF.GT.0.8) COLVAL(12)=2,	THR00800
	IF(IFF.GT.0.95) COLVAL(12)=1,	THR00810
	IF(E11.GT.100,)GO TO 6620	THR00820
	COLVAL(1)=2,	THR00830
	GO TO 6629	THR00840
6620	CONTINUE	THR00850
	IF(E11.GT.1000,) GO TO 6621	THR00860
	COLVAL(1)=4,	THR00870
	GO TO 6629	THR00880
6621	CONTINUE	THR00890
	COLVAL(1)=8,	THR00900
6629	CONTINUE	THR00910
	IF(IAC,GE,3) GO TO 6630	THR00920
	COLVAL(10)=1,	THR00930
	GO TO 6639	THR00940
6630	CONTINUE	THR00950
	IF(IAC,GE,7) GO TO 6631	THR00960
	COLVAL(10)=2,	THR00970
	GO TO 6639	THR00980
6631	CONTINUE	THR00990
	IF(IAC,GE,10) GO TO 6632	THR01000
	COLVAL(10)=4,	THR01010
	GO TO 6639	THR01020
6632	CONTINUE	THR01030
	COLVAL(10)=8,	THR01040
6639	CONTINUE	THR01050
	ITIM=MEYR-1976	THR01060
	IF(ITIM.GT.3) GO TO 2970	THR01070
	COLVAL(4)=8,	THR01080
	GO TO 2976	THR01090
2970	CONTINUE	THR01100

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IF (1114,GT,7) GO TO 2971      THRO1110
COLVAL(4)=4,                    THRO1120
GO TO 2976                      THRO1130
2971 CONTINUE                   THRO1140
IF (1114,GT,15) GO TO 2972     THRO1150
COLVAL(4)=2,                   THRO1160
GO TO 2976                     THRO1170
2972 CONTINUE                   THRO1180
COLVAL(4)=1,                   THRO1190
2976 CONTINUE                   THRO1200
COLVAL(2)=SKOR(1)+SKOR(2)+SKOR(3) THRO1210
COLVAL(5)=SKOR(4)+SKOR(5)+SKOR(6) THRO1220
DO 7744 MK=1,14                THRO1230
IF (RAW(2,MK),LE,-1,0) SKOR(MK+6)=4, THRO1240
IF (RAW(2,MK),GT,-1,0,AND,RAW(2,MK),LT,1,0) SKOR(MK+6)=0, THRO1250
IF (RAW(2,MK),GE,1,0) SKOR(MK+6)=4, THRO1260
7744 CONTINUE                   THRO1270
COLVAL(6)=0,0                  THRO1280
COLVAL(8)=0,0                  THRO1290
DO 6643 K=7,11                 THRO1300
COLVAL(6)=COLVAL(6)+SKOR(K)    THRO1310
COLVAL(8)=COLVAL(8)+SKOR(K+9)  THRO1320
6643 CONTINUE                   THRO1330
COLVAL(7)=SKOR(12)+SKOR(13)+SKOR(14)+SKOR(15) THRO1340
DO 601 I=1,8                   THRO1350
DO 8867 JP=1,12                THRO1360
N123(JP)=1                     THRO1370
8867 CONTINUE                   THRO1380
IF (COLVAL(1),EQ,H(1)) N123(1)=2 THRO1390
IF (COLVAL(2),EQ,H(1)) N123(2)=2 THRO1400
IF (COLVAL(2),EQ,H(1)) TEMP(2)=H(1) THRO1410
IF (COLVAL(5),EQ,H(1)) N123(5)=2 THRO1420
IF (COLVAL(5),EQ,H(1)) TEMP(5)=H(1) THRO1430
DO 603 K=3,4                   THRO1440
IF (COLVAL(K),EQ,H(1)) N123(K)=2. THRO1450
603 CONTINUE                   THRO1460
DO 604 L=6,8                   THRO1470
IF (COLVAL(L),GE,HT(1),AND,1,EQ,1) N123(L)=2 THRO1480
IF (COLVAL(L),EQ,HT(1)) N123(L)=2 THRO1490
IF (COLVAL(L),LE,HT(1),AND,1,EQ,8) N123(L)=2 THRO1500
IF (N123(L),EQ,2) TEMP(L)=H(1) THRO1510
604 CONTINUE                   THRO1520
DO 605 N=9,12                  THRO1530
IF (COLVAL(N),EQ,H(1)) N123(N)=2 THRO1540
605 CONTINUE                   THRO1550
WRITE(6,610) SCORE(1),XR(N123(1)),XR(N123(2)),XR(N123(3)),XR(N THRO1560
&123(4)),                      THRO1570
&XR(N123(5)),XR(N123(6)),XR(N123(7)),XR(N123(8)),XR(N123(9)), THRO1580
&XR(N123(10)),                  THRO1590
&XR(N123(11)),XR(N123(12))      THRO1600
610 FORMAT(A4,12(2X,A4))        THRO1610
601 CONTINUE                   THRO1620
WRITE(6,708)                    THRO1630
WRITE(6,631)(WEIGHT(KSCTR,I),I=1,12) THRO1640
                                  THRO1650
```

631	FORMAT(1X,'WTS',3X,12(F4,2,2X))	THR01660
	WRITE(6,708)	THR01670
	WRITE(6,633)	THR01680
633	FORMAT(' PRO=')	THR01690
	COLVAL(2)=TEMP(2)	THR01700
	COLVAL(5)=TEMP(5)	THR01710
	DO 6676 JG=6,8	THR01720
	COLVAL(JG)=TEMP(JG)	THR01730
6676	CONTINUE	THR01740
	DO 635 I=1,12	THR01750
635	PRDUC(I)=COLVAL(I)*WEIGHT(KSCTR,I)	THR01760
	WRITE(6,637)(PRDUC(I),I=1,12)	THR01770
637	FORMAT(' DUC',1X,12F6,2)	THR01780
	WRITE(6,708)	THR01790
	WRITE(6,639)	THR01800
639	FORMAT(' F V.')	THR01810
	WRITE(6,641)	THR01820
641	FORMAT(' A A.')	THR01830
	S1=0	THR01840
	DO 643 I=1,5	THR01850
643	S1=S1+PRDUC(I)	THR01860
	S2=0	THR01870
	DO 645 I=6,8	THR01880
645	S2=S2+PRDUC(I)	THR01890
	S3=0	THR01900
	DO 647 I=9,12	THR01910
647	S3=S3+PRDUC(I)	THR01920
	WRITE(6,649)S1,S2,S3	THR01930
649	FORMAT(' C L ',T16,F6,2,T42,F6,2,T62,F6,2)	THR01940
	WRITE(6,651)	THR01950
651	FORMAT(' T U.')	THR01960
	WRITE(6,653)	THR01970
653	FORMAT(' D E.')	THR01980
	WRITE(6,655)	THR01990
655	FORMAT(' R.')	THR02000
	WRITE(6,657)	THR02010
657	FORMAT(1X,10('-----'),/)	THR02020
	PRNSCU=S1+S2+S3	THR02030
	WRITE(6,680)PRNSCU	THR02040
680	FORMAT(24X,'EXPECTED VALUE(U) =',F10,2,/,1X,T36,5(' '))	THR02050
690	CONTINUE	THR02060
	RETURN	THR02070
	END	THR02080


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6304 FORMAT(40X,'RAW',6X,'WEIGHTED',/,3X,'KEY WORD',17X,'WEIGHT',  
83X,'BASE POST',2X,'BASE POST',/,  
DO 6303 N=1,5  
WRITE(6,6302) N,(DEYND(JJ,N),JJ=1,6),WT(N),(RAW(K,N),K=1,2),  
R(WID(K,N),K=1,2)  
6302 FORMAT(1X,11,1H,,1X,6A4,F4,2,3X,F5,2,1X,F5,2,2X,F4,2,1X,F4  
8,2)  
6303 CONTINUE  
WRITE(6,6305) (OF(K),K=1,2)  
6305 FORMAT(/37X,'PC TOTALS',1X,F5,2,1X,F4,2)  
WRITE(6,6306)  
6306 FORMAT(/'INSTITUTIONAL FEASIBILITY',/,1X,25(1H=),14X,'SCORE')  
WRITE(6,6304)  
DO 6307 N=6,9  
NN=N-5  
WRITE(6,6302) NN,(DEYND(JJ,N),JJ=1,6),WT(N),(RAW(K,N),K=1,2),  
R(WID(K,N),K=1,2)  
6307 CONTINUE  
WRITE(6,6308) (EF(K),K=1,2)  
6308 FORMAT(/37X,'PT TOTALS',1X,F5,2,1X,F4,2)  
WRITE(6,6309)  
6309 FORMAT(/'TECHNICAL FEASIBILITY',/,1X,21(1H=),18X,'SCORE')  
WRITE(6,6304)  
DO 6310 N=10,14  
NN=N-9  
WRITE(6,6302) NN,(DEYND(JJ,N),JJ=1,6),WT(N),(RAW(K,N),K=1,2),  
R(WID(K,N),K=1,2)  
6310 CONTINUE  
WRITE(6,6311) (TF(K),K=1,2)  
6311 FORMAT(/37X,'PT TOTALS',1X,F5,2,1X,F4,2)  
WRITE(6,6320)  
6320 FORMAT(/10X,'PROBABILITY FACTORS',/,16X,'(SUCCESS)',/,7X,  
8'BASE CASE',9X,'POST RESEARCH',/,5X,  
8'PC PT PT PC PC PT PT PP')  
WRITE(6,6321) (PC(I),PI(I),PT(I),PB(I),I=1,2)  
6321 FORMAT(/1X,2(1X,3(1X,F3,2),1X,1H=,1X,F3,2))  
WRITE(6,6322)  
6322 FORMAT(/9X,'RETURN ON INVESTMENT (X)',/,22X,  
8'EXPECTED',/,8X,'NOMINAL',5X,'BASE POST')  
WRITE(6,6323) RURN,(RORB(I),I=1,2)  
6323 FORMAT(/8X,F5,1,5X,F5,1,3X,F5,1//)  
6976 CONTINUE  
RETURN  
END
```

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THR00560  
THR00570  
THR00580  
THR00590  
THR00600  
THR00610  
THR00620  
THR00630  
THR00640  
THR00650  
THR00660  
THR00670  
THR00680  
THR00690  
THR00700  
THR00710  
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THR00880  
THR00890  
THR00900  
THR00910  
THR00920  
THR00930  
THR00940  
THR00950  
THR00960  
THR00970  
THR00980  
THR00990
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C *****
C
C THIS SUBROUTINE WRITES DATA TO SPREAD SHEET DATA FILE
C
C SUBROUTINE PISPRD (BPROJ,OE85,OE2000,BNU,BEYR,BAC,RI,
C BEI,EI1,EIM,IFI,PIV,TPI,TI,OE90,DECUM,ICYC,IAC,BENCST)
C COMMON /AA/BRANCH(5,12),PNAME(5)
C COMMON /A1/CC(2),POESC(25),CHA(2),COP(65,2),SCP(2),YST(2)
C COMMON /A2/CE(2,6),X(2),IYRL(2),CF(25),RNFOH(2),FED(10),UHAR(25)
C COMMON /A3/PRIN(15),TEVDM(6),EPR(5)
C COMMON /HH/CHKT(25),IFED(11),HMS(400),BUX(4,3),DELP(4)
C COMMON /B1/K8CRN,K8RM,K8COR,I8PRD
C COMMON /DD/PROJ,MH,MD,MY,MEYR,NFED(25)
C COMMON /D1/UNIT(25),THKT(6),CFED(25)
C COMMON /D2/PRIV(25),TCE(6),TEV(6),TEVD(6),EER,EMP(25,5)
C COMMON /EI/RAW(2,14),SCORE(8)
C COMMON /FF/XR(2),WEIGHT(2,12),PRODUC(12),WT(14),WTD(2,14),QF(2)
C COMMON /F1/FF(2),TF(2),RORB(2)
C COMMON /GG/COLVAL(12),SKUR(20),N123(12),TEMP(12),H(8),HT(8)
C COMMON /HH/HS(8),PC(2),PI(2),PT(2),PB(2)
C REAL*8 PNAME
C REAL*4 POESC
C REAL*8 BRANCH
C REAL*4 SCORE
C REAL*4 XR
C KPTH=22*(I PROJ=1)
C BAC=IAC
C BEYR=MEYR
C BPROJ=I PROJ
C IF(RI,GE,99,9) RI=99,9
C IF(RORH(1),GE,9999,9) RORH(1)=9999,9
C IF(RORH(2),GE,9999,9) RORH(2)=9999,9
C DO 6666 KGB=1,6
C 6666 CONTINUE
C IF(ISPRD,EQ,1) WRITE(1,2323) BPROJ,OE85,OE2000,
C BNU,BEYR,BAC,RI,RORB(1),
C &RORB(2),EI,EI1,EIM,IFI,PIV,TPI,TI,(TCE(K),K=1,6),
C &TEV(6),TEVD(6),OE90,DECUM,BENCST
C 2323 FORMAT(3F8,1,F8,2,2F8,1,F7,4,2F7,1,3F8,0,4E12,5,6F8,1,2E12
C &5,2F8,1,F8,0)
C IF(ICYC,EQ,1) IPASS=1
C RETURN
C END
C *****
C THIS SUBROUTINE CALCULATES THE PRESENT VALUE
C
C SUBROUTINE RICALC (KK,IY,TCOT, YST,SYD,SYNS,PV,IS,RI,K2)
C COMMON /AA/BRANCH(5,12),PNAME(5)
C COMMON /A1/CC(2),POESC(25),CHA(2),COP(65,2),SCP(2),YST(2)
C COMMON /A2/CE(2,6),X(2),IYRL(2),CF(25),RNFOH(2),FED(10),UHAR(25)
C COMMON /A3/PRIN(15),TEVDM(6),EPR(5)
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THR00010
THR00020
THR00030
THR00040
THR00050
THR00060
THR00070
THR00080
THR00090
THR00100
THR00110
THR00120
THR00130
THR00140
THR00150
THR00160
THR00170
THR00180
THR00190
THR00200
THR00210
THR00220
THR00230
THR00240
THR00250
THR00260
THR00270
THR00280
THR00290
THR00300
THR00310
THR00320
THR00330
THR00340
THR00350
THR00360
THR00370
THR00380
THR00390
THR00400
THR00410
THR00420
THR00430
THR00440
THR00450
THR00460
THR00470
THR00480
THR00490
THR00500
THR00510
THR00520
THR00530
THR00540
THR00550
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COMMON /BH/CHKT(25),IFED(11),MHS(400),BUX(4,3),DELP(4)      THR00560
COMMON /H1/KSCRN,KRSH,KSCUR,ISPRD                             THR00570
COMMON /DD/(PROJ,MH,MD,MY,MEYR,NFED(25))                     THR00580
COMMON /D1/UNIT(25),TMKI(6),CFED(25)                          THR00590
COMMON /D2/PRIV(25),TCF(6),IEV(6),IEVD(6),EER,EMP(25,5)      THR00600
COMMON /EE/RAW(2,14),BCORE(8)                                  THR00610
COMMON /FF/XR(2),WEIGHT(2,12),PRODDUC(12),WT(14),WTD(2,14),QF(2) THR00620
COMMON /F1/EF(2),TF(2),RORB(2)                                THR00630
COMMON /GG/COLVAL(12),SKUR(20),N123(12),TEMP(12),H(8),HT(8)  THR00640
COMMON /HH/HS(8),PC(2),PI(2),PT(2),PB(2)                     THR00650
REAL*8 PNAME                                                  THR00660
REAL*4 PDESC                                                  THR00670
REAL*8 BRANCH                                                  THR00680
REAL*4 SCORE                                                  THR00690
REAL*4 XR                                                      THR00700
YRL=IYRL(KK)                                                  THR00710
PV=0.0                                                         THR00720
DO 9 I=1,IY
  M=MEYR-1975+I-1=IYST(KK)                                     THR00730
  IF(18,NE,1) GO TO 89                                         THR00740
  IF(K2,EQ,1)CSHFL=CCP(M,KK)                                   THR00750
  IF(K2,EQ,2)CSHFL=CCP(M,KK)                                   THR00760
  IF(1,IE,IYST(KK)) CSHFL=(CC(KK)+CHA(KK))/YST               THR00770
  GO TO 79                                                      THR00780
CONTINUE                                                       THR00790
HI=1                                                           THR00800
SYD=YRL -B(+I,+YST)                                           THR00810
IF(K2,EQ,1) ACOP=CCP(M,KK)                                     THR00820
IF(K2,EQ,2) ACOP=CCP(M,KK)                                     THR00830
CSHFL=.5*(ACOP-(CC(KK)+CHA(KK))*SYD/SYRS)+                   THR00840
8*(CC(KK)+CHA(KK))*SYD/SYRS                                    THR00850
IF(1,EQ,IYST(KK)+1) CSHFL=CSHFL+TCDT*(CC(KK)+CHA(KK))      THR00860
IF(1,IE,IYST(KK)) CSHFL=(CC(KK)+CHA(KK))/YST                 THR00870
CONTINUE                                                       THR00880
PV=PV+CSHFL/(1,+RI)**(I-IYST(KK))                             THR00890
9 CONTINUE                                                     THR00900
IF(1,EQ,IY +1,AND:18,NE,1)-PV=PV+CC(KK)*SCP(KK)/(1,+RI)**(I- THR00910
IYST(KK))                                                       THR00920
RETURN                                                         THR00930
END                                                            THR00940
*****                                                         THR00950
*****                                                         THR00960
*****                                                         THR00970
*****                                                         THR00980
*****                                                         THR00990
THIS SUBROUTINE CALCULATES THE PRESENT VALUE ADJUSTMENT      THR01000
FOR PROJECTS HAVING DIFFERENT PHYSICAL LIFETIMES            THR01010
*****                                                         THR01020
*****                                                         THR01030
SUBROUTINE ADJUST(YRL1,YRL2,PV,PV1,PV2,RI,IY1,IY2)           THR01040
COMMON /AA/BRANCH(5,12),PNAME(5)                             THR01050
COMMON /A1/CC(2),PDESC(25),CHA(2),CCP(65,2),SCP(2),IYST(2)  THR01060
COMMON /A2/CF(2,6),X(2),IYRL(2),CF(25),HNFOH(2),FED(10),UMAH(25) THR01070
COMMON /A3/PRIN(15),TEVDH(6),EPR(5)                          THR01080
COMMON /BH/CHKT(25),IFED(11),MHS(400),BUX(4,3),DELP(4)      THR01090
COMMON /H1/KSCRN,KRSH,KSCUR,ISPRD                             THR01100

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	COMMON /DD/PROJ,MM,MD,MY,MEYR,NFED(25)	THRO1110
	COMMON /D1/UNIT(25),TNKT(6),CFED(25)	THRO1120
	COMMON /D2/PRIV(25),TCE(6),TEV(6),TEVD(6),EER,EMP(25,5)	THRO1130
	COMMON /EE/RAW(2,14),SCORE(8)	THRO1140
	COMMON /FF/XR(2),WEIGHT(2,12),PRODUC(12),WT(14),WTD(2,14),GP(2)	THRO1150
	COMMON /F1/EF(2),TF(2),RORB(2)	THRO1160
	COMMON /GG/COLVAL(12),SKOR(20),N123(12),TEMP(12),H(8),HT(8)	THRO1170
	COMMON /HH/HS(8),PC(2),PI(2),PT(2),PB(2)	THRO1180
	REAL*8 PNAME	THRO1190
	REAL*4 POESC	THRO1200
	REAL*8 BRANCH	THRO1210
	REAL*4 SCORE	THRO1220
	REAL*4 XR	THRO1230
	IF (IYRL(1).EQ,IYRL(2)) GO TO 9901	THRO1240
	PVADJ=0.0	THRO1250
	IF (IYRL(1).GT,IYRL(2)) GO TO 8980	THRO1260
	YRF=YRL2/YRL1	THRO1270
	IYRF=YRF	THRO1280
	MORE=YRL2-YRL1	THRO1290
	IF (RI.EQ.0.0) GO TO 100	THRO1300
	CRF=RI/(1.-1./(RI+1.))*IYRL(1)	THRO1310
	GO TO 200	THRO1320
100	CRF=1./IYRL(1)	THRO1330
200	ADDJ=CRF*PV1	THRO1340
	DO 4772 MD=1,MORE	THRO1350
	PVADJ=PVADJ+ADDJ/(1.+RI)**(IY1+MD)	THRO1360
4772	CONTINUE	THRO1370
7134	CONTINUE	THRO1380
	PV1=PV1+PVADJ	THRO1390
	GO TO 9901	THRO1400
8980	CONTINUE	THRO1410
	YRF=YRL1/YRL2	THRO1420
	IYRF=YRF	THRO1430
	MORE=YRL1-YRL2	THRO1440
	IF (RI.EQ.0.0) GO TO 300	THRO1450
	CRF=RI/(1.-1./(RI+1.))*IYRL(2)	THRO1460
	GO TO 400	THRO1470
300	CRF=1./IYRL(2)	THRO1480
400	ADDJ=CRF*PV1	THRO1490
	DO 4472 MD=1,MORE	THRO1500
	PVADJ=PVADJ+ADDJ/(1.+RI)**(IY2+MD)	THRO1510
4472	CONTINUE	THRO1520
6134	CONTINUE	THRO1530
	PV2=PV2+PVADJ	THRO1540
9901	CONTINUE	THRO1550
	PV=PV2-PV1	THRO1560
	RETURN	THRO1570
	END	THRO1580

332	FORMAT(1X, 'ENTER TODAY'S DATE (MM/DD/YY)')	HSU00560
	READ(5,*) MM,MD,MY	HSU00570
13	WRITE(6,22)	HSU00580
22	FORMAT(1X, 'ENTER DESIRED BRANCH')	HSU00590
	READ(5,*) JSBR	HSU00600
	PAUSE	HSU00610
C		HSU00620
C	READ DATA FROM SPREAD AND ASSIGN VALUES	HSU00630
C	TO ARRAYS, MAKING APPROPRIATE ADJUSTMENTS	HSU00640
C		HSU00650
A9	CONTINUE	HSU00660
30	CONTINUE	HSU00670
	NP=NP+1	HSU00680
	READ (1,9339,END=45) (DATA(L),L=1,2),DATA(26), (DATA(L),L=3,25),	HSU00690
	DATA(27)	HSU00700
9339	FORMAT(3F8,1,F8,2,2F8,1,F7,4,2F7,1,3F8,0,4E12,5,6F8,1,	HSU00710
	4E12,5,2F8,1,F8,0)	HSU00720
	IPROJ=DATA(1)	HSU00730
	READ(2,IPROJ,132) (PRJNAM(L,IPROJ),L=1,5)	HSU00740
	READ(3,IPROJ,68) XNBRCM	HSU00750
68	FORMAT(F3,0)	HSU00760
132	FORMAT(5A8)	HSU00770
	NBRCM(NP)=XNBRCM	HSU00780
	IBRCH=XNBRCM	HSU00790
	IF(1IBRCH,NE,JSBR) GO TO 30	HSU00800
	NB=NBRCH(NP)	HSU00810
	NPRJ(NB)=NPRJ(NB)+1	HSU00820
	NUM(NP)=DATA(1)	HSU00830
	DEBS(NP)=DATA(2)	HSU00840
	IF 2000(NP)=DATA(26)	HSU00850
	BNQ(NP)=DATA(3)	HSU00860
	MEYR(NP)=DATA(4)	HSU00870
	IAC(NP)=DATA(5)	HSU00880
	RI(NP)=DATA(6)	HSU00890
	HRI(NP)=DATA(7)	HSU00900
	PRI(NP)=DATA(8)	HSU00910
	E1(NP)=DATA(9)	HSU00920
	E11(NP)=DATA(10)	HSU00930
	HEI(NP)=DATA(11)	HSU00940
	BENCST(NP)=DATA(27)	HSU00950
	TFIR=DATA(12)	HSU00960
	PIVR=DATA(13)	HSU00970
	TPTR=DATA(14)	HSU00980
	TIR=DATA(15)	HSU00990
	TFI(NP)=TFIR*1.0E-3	HSU01000
	PIV(NP)=PIVR*1.0E-3	HSU01010
	TP1(NP)=TPTR*1.0E-3	HSU01020
	T1(NP)=TIR*1.0E-3	HSU01030
	DO 776 JH=1,6	HSU01040
	NG=JH+15	HSU01050
	TCE(NP,JH)=DATA(NG)	HSU01060
776	CONTINUE	HSU01070
	TEVR=DATA(22)	HSU01080
	TEVPR=DATA(23)	HSU01090
	TEV(NP)=TEVR*1.0E-6	HSU01100

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TEVD(NP)=TEVDRA1,OE=6
DO 99 L=1,5
PNAME(L,NP)=PRJNAM(L,IPROJ)
99 CONTINUE
GO TO 30
45 CONTINUE
DO 196 M=1,NP
IF(NHRCH(M),NE,J8BR) GO TO 196
IF(OE85(M),LT,0,0) OE85(M)=OE85(M)
IF(OE2000(M),LT,0,0) OE2000(M)=OE2000(M)
RND(M)=RND(M)*100,
RI(M)=RI(M)*100,
196 CONTINUE
C
C WRITE OUT SPREAD SHEETS,SUMMING COLUMNS
C
WRITE(6,400) MM,MD,MY
400 FORMAT(/,1X,'DATE',1,12,1H/,12,1H/,12,42X,'INPUT DATA',16X
8,'EVALUATION CRITERIA',/,
846X,34(1H-),2X,30(1H-),
1,46X,110-12 BTU',6X,'MBDOE',7X,'YR',8X,'ROI',21X,'B=C',/,
814X,'PROJECT NAME',21X,'TO 2000',4X,'1985 2000 INTR',
81ACC (X)',4X,'ETI',
85X,'MEI',4X,'(10165)',/,14X,12(1H-),20X,9(1H-),2X,6(1H-),1X,
86(1H-),2X,
84(1H-),1X,2(1H-),2X,5(1H-),2(2X,6(1H-)),2X,8(1H-))
WRITE(6,300) (BRANCH(L,J8BR),L=1,5)
300 FORMAT(/10X,5A8/)
DO 195 M=1,NP
IF(NHRCH(M),NE,J8BR) GO TO 195
TCET=TCET(M,6)
WRITE(6,305) NUM(M),(PNAME(L,M),L=1,5),TCET,OE85(M),OE2000(M),
8MEYR(M),IAC(M),RI(M),ETI(M),MEI(M),BENCST(M)
305 FORMAT(1X,13,1X,5A8,1X,F9,1,2X,F6,1,1X,F6,1,2X,14,2X,12,2X,F5,
81,3(1X,F7,0))
TOT1=TOT1+TCET
TOT2=TOT2+OE85(M)
TOT3=TOT3+OE2000(M)
TOT15=TOT15+BENCST(M)
195 CONTINUE
WRITE(6,1) TOT1,TOT2,TOT3,TOT15
1 FORMAT(/6X,'BRANCH TOTAL',20X,F9,1,2X,F6,1,1X,F6,1,33X,F9,1)
190 CONTINUE
C
291 CONTINUE
C
WRITE(6,410) MM,MD,MY
410 FORMAT(/,1X,'DATE',1,12,1H/,12,1H/,12,35X,'INVEST TO 2000',
81('1000'),/,46X,29(1H-),30X,'TOTAL ENERGY',/,
850X,'ROED',5X,'PRIVATE',3X,'TOTAL',3X,'ENERGY SAVING TO 2',
81000 (THU) 1,1X,'SAVING (10-65)',/,
814X,'PROJECT NAME',21X,'FEDL PRIV CAPITAL INVEST',3X,
81GAS',3X,'OIL',3X,'COAL',
82X,'ELIC',1X,'OTHER TOTAL ACTUAL DISCD',/,14X,12(1H-),19X,
82(1X,5H-----),2(1X,8H-----),6(1X,5H-----),2(1X,6(1H-))

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HSU01110
HSU01120
HSU01130
HSU01140
HSU01150
HSU01160
HSU01170
HSU01180
HSU01190
HSU01200
HSU01210
HSU01220
HSU01230
HSU01240
HSU01250
HSU01260
HSU01270
HSU01280
HSU01290
HSU01300
HSU01310
HSU01320
HSU01330
HSU01340
HSU01350
HSU01360
HSU01370
HSU01380
HSU01390
HSU01400
HSU01410
HSU01420
HSU01430
HSU01440
HSU01450
HSU01460
HSU01470
HSU01480
HSU01490
HSU01500
HSU01510
HSU01520
HSU01530
HSU01540
HSU01550
HSU01560
HSU01570
HSU01580
HSU01590
HSU01600
HSU01610
HSU01620
HSU01630
HSU01640
HSU01650

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46	WRITE(6,300) (BRANCH(L,J8BR),L=1,5)	HSU01660
	DO 295 N=1,NP	HSU01670
	IF(NBRCH(N),NE,J8BR) GO TO 295	HSU01680
	WRITE(6,345) NUM(M), (PNAME(L,M),L=1,5),TFI(M),PIV(M),TPI(M),TI(M),	HSU01690
	R(TCE(M,KL),KL=1,6),TEV(M),TEVD(M)	HSU01700
345	FORMAT(1X,11,1X,5A8,2(16),2(19),6(16),2(17))	HSU01710
	TOT4=TOT4+TFI(M)	HSU01720
	TOT5=TOT5+PIV(M)	HSU01730
	TOT6=TOT6+TPI(M)	HSU01740
	TOT7=TOT7+TI(M)	HSU01750
	TOT8=TOT8+TEV(M)	HSU01760
	TOT9=TOT9+TEVD(M)	HSU01770
295	CONTINUE	HSU01780
	WRITE(6,2) TOT4,TOT5,TOT6,TOT7,TOT8,TOT9	HSU01790
2	FORMAT(/6X,'BRANCH TOTAL',27X,2(06,1),2(1X,08,1),36X,2(1X,06,1),	HSU01800
	R////////)	HSU01810
888	CONTINUE	HSU01820
999	CONTINUE	HSU01830
	STOP	HSU01840
	END	HSU01850


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C      OPENFILE 4,"BIGFILE","NUMERIC"      DAT00560
C      OPENFILE 7,"PRICES","NUMERIC"      DAT00570
C      ENTER INFORMATION FOR RUN OF PROGRAM      DAT00580
C      ENTER INFORMATION FOR RUN OF PROGRAM      DAT00590
C      ENTER INFORMATION FOR RUN OF PROGRAM      DAT00600
      WRITE(6,110)      DAT00610
110    FORMAT(///IX,' SELECT DELIVERED ENERGY PRICES;',/,
      81X,' 1=CURRENT EEA, 2=APAE-F2, 3=APAF-F4, 4=REVISED EEA;',/
      81X,' 5=USA-MODERATE, 6=BESOM-MODERATE, 7=EIA0178F, 8=EIA0178C') DAT00620
      READ(5,*)IENX      DAT00630
      WRITE(6,3377)      DAT00640
3377   FORMAT(/3X,'WANT TO MAKE A SERIES OF RUNS') DAT00650
      WRITE(6,5544)      DAT00660
5544   FORMAT(3X,'ANS 1=YES, 0=NO')      DAT00670
      READ(5,*) ISEK      DAT00680
      IF(ISEK,10.0) GO TO 3451      DAT00690
      WRITE(6,3378)      DAT00700
3378   FORMAT(3X,'1=SEQUENTIAL, 2=NON-SEQUENTIAL') DAT00710
      READ(5,*) ISEQ      DAT00720
      IF(ISEQ,10.1) GO TO 1770      DAT00730
      WRITE(6,4146)      DAT00740
4146   FORMAT(3X,'ENTER NO OF PROJECTS TO BE RUN, 1,
      8'FOLLOWED BY THEIR NUMBERS')      DAT00750
      READ(5,*) MPROJ,(MMS(M),M=1,MPROJ)      DAT00760
      GO TO 3459      DAT00770
3459   CONTINUE      DAT00780
1770   CONTINUE      DAT00790
      WRITE(6,9913)      DAT00800
9913   FORMAT(/3X,'ENTER THE STARTING AND ENDING PROJECT NUMBERS;',/
      8,
      83X,'SEPARATED BY COMMAS')      DAT00810
      READ(5,*) NSTART,NPROJ      DAT00820
      MPROJ=NPROJ-NSTART+1      DAT00830
      DO 7717 IB=1,MPROJ      DAT00840
      MMS(IB)=NSTART+IB-1      DAT00850
7717   CONTINUE      DAT00860
3559   CONTINUE      DAT00870
30     CONTINUE      DAT00880
      WRITE(6,199)      DAT00890
199    FORMAT(/3X,'ENTER TODAY'S DATE = MM/DD/YY') DAT00900
      READ(5,*) IIM,IID,IYY      DAT00910
      PAUSE      DAT00920
      DO 1600 I RANGE=1,MPROJ      DAT00930
      N=MMS(I RANGE)      DAT00940
      DAT00950
      DAT00960
      DAT00970
      DAT00980
      DAT00990
      DAT01000
      DAT01010
      DAT01020
      DAT01030
      DAT01040
      DAT01050
      DAT01060
      DAT01070
      DAT01080
      DAT01090
      DAT01100
C      READ INFORMATION FOR PROGRAM FROM FILES
C      READ INFORMATION FOR PROGRAM FROM FILES
C      READ INFORMATION FOR PROGRAM FROM FILES
      READ(2,N,2)( PRJNAM(L),L=1,5)
2      FORMAT(5A8)
      READ(1,N,900) BRCH
900    FORMAT(F3.0)
      KBRCH=BRCH
      READ(7,IENX,2996) ((DELP(KYR,KFUEL),KYR=1,25),KFUEL=1,4)
2996   FORMAT(100F5.2)
      REWIND 3
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WRITE(6,36) ENAME(I)
READ(5,4) EPR(I)
40 CONTINUE
WRITE(6,54)
54 FORMAT (/, ' FIRST YEAR OF FEDERAL INVESTMENT')
READ(5,4) IFYR
WRITE(6,50)
50 FORMAT (/, ' FEDERAL INVESTMENT PER YEAR, IN ACTUAL UNITS',/)
DO 53 J=1,10
IYR=IFYR+J-1
WRITE(6,70) IYR
READ(5,4) CFED(J)
CFED(J)=CFED(J)/1.E6
53 CONTINUE
WRITE(6,61)
61 FORMAT (/, ' FIRST YEAR OF PRIVATE INVESTMENT')
READ(5,4) IPYR
IF (IPYR.EQ.0) GO TO 64
WRITE(6,62)
62 FORMAT (/, ' PRIVATE R&D INVESTMENT')
DO 64 J=1,10
IYR=IPYR+J-1
WRITE(6,70) IYR
READ(5,4) PRIV(J)
64 CONTINUE
IF (IPYR.EQ.0) IPYR=1976
WRITE(6,72)
72 FORMAT (/, ' MARKET ENTRY YEAR')
READ(5,4) MEYR
IYR=MEYR
60 CONTINUE
C
IP=1
C
RIP=IP
WRITE(6,68)
68 FORMAT (/, ' YEAR = NO. OF UNITS')
IQQ=MEYR-1975
IK=IQQ-1
DO 5432 IG=1,IK
CMKT(IG)=0.0
5432 CONTINUE
DO 78 J=IQQ,15
IYR=J+1975
WRITE(6,70) IYR
70 FORMAT (/, ' ')
READ(5,4) CMKT(J)
78 CONTINUE
IYR=1995
WRITE(6,70) IYR
READ(5,4) CMKT(16)
IYR=2000
WRITE(6,70) IYR
READ(5,4) CMKT(17)
WRITE(6,86)
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WR101110
WR101120
WR101130
WR101140
WR101150
WR101160
WR101170
WR101180
WR101190
WR101200
WR101210
WR101220
WR101230
WR101240
WR101250
WR101260
WR101270
WR101280
WR101290
WR101300
WR101310
WR101320
WR101330
WR101340
WR101350
WR101360
WR101370
WR101380
WR101390
WR101400
WR101410
WR101420
WR101430
WR101440
WR101450
WR101460
WR101470
WR101480
WR101490
WR101500
WR101510
WR101520
WR101530
WR101540
WR101550
WR101560
WR101570
WR101580
WR101590
WR101600
WR101610
WR101620
WR101630
WR101640
WR101650
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80	FORMAT (Z, ' TOTAL MARKET (UNITS)')	WR101660
	DO 81 I=1,5	WR101670
	IYR=1975+5*I	WR101680
	WRITE(6,70) IYR	WR101690
	READ(5,4) TMKT(I)	WR101700
81	CONTINUE	WR101710
	RIFYR=IFYR	WR101720
	RIPYR=IPYR	WR101730
	WRITE(2,777)RIB,RIS,AC,CC(1),CHA(1),YST(1),(CE(1,J),J=1,5),RNFD	WR101740
	8N(	WR101750
	81),RPROJ,	WR101760
	8 YRI(1),SCP(1),CC(2),CHA(2),YST(2),(CE(2,J),J=1,5),RNFDH(2),	WR101770
	8 YRI(2),SCP(2),RIP,EYR,CH,CD,CY,RIFYR,	WR101780
	8 (CFED(J),J=1,10)	WR101790
	8 ,RIPYR,(PRIV(L),L=1,10),(CHKT(L),L=1,17),(TMKT(I),I=1,5),(E	WR101800
	8PR(K),K=1,5)	WR101810
777	FORMAT(80 F10,4)	WR101820
	DO 1901 I=1,5	WR101830
	CE(1,I)=0.	WR101840
	CE(2,I)=0.	WR101850
1901	CONTINUE	WR101860
	WRITE(6,111)	WR101870
111	FORMAT(IX, 'ANOTHER PROJECT, (I=YES,0=NO)')	WR101880
	READ(5,4) IJK	WR101890
	IF(IJK,EQ,1)GO TO 190	WR101900
	STOP	WR101910
	END	WR101920

C	THE PURPOSE OF THIS PROGRAM IS TO CHANGE THE	WR100010
C	DESCRIPTION OF THRESHOLD PROJECT,	WR100020
C	FILE - DESCRIBE DATA A1, WE USE IT AS A SEQUENTIAL	WR100030
C	FILE IN OTHER PROGRAMS, BUT HERE WE USE IT AS	WR100040
C	A DIRECT ACCESS FILE.	WR100050
C	LAST MODIFIED BY JILL CHEN ON 01/31/79	WR100060
C		WR100070
C		WR100080
	DEFINE FILE 1(160,120,F,1DUM)	WR100090
	REAL*4 DESC(25),A(5,5)	WR100100
5	CONTINUE	WR100110
	WRITE(6,10)	WR100120
10	FORMAT(1X,'PLEASE ENTER PROJECT NUMBER ',/)	WR100130
	READ(5,*)	WR100140
20	CONTINUE	WR100150
	READ(1,1,30)L,(DESC(LL),LL=1,25)	WR100160
30	FORMAT(14,1X,25A4)	WR100170
	WRITE(6,60)L,(DESC(LL),LL=1,25)	WR100180
60	FORMAT(1X,'THE DESCRIPTION OF PROJECT ',14,1X,'IS ',1X,25A4)	WR100190
	WRITE(6,80)	WR100200
80	FORMAT(1X,'PLEASE ENTER DESCRIPTION OF PROJECT ',14,/ 81X,' ENTER 20 CHARACTERS PER LINE, MAXIMUM 5 LINES,1,/ 82X,'XXXXXXXXXXXXXXXXXXXXXXX',/)	WR100210
	DO 100 K=1,5	WR100220
	READ(5,90)(A(LL,K),LL=1,5)	WR100230
90	FORMAT(5A4)	WR100240
100	CONTINUE	WR100250
	WRITE(1,1,30)L,((A(LL,K),LL=1,5),K=1,5)	WR100260
	WRITE(6,110)	WR100270
110	FORMAT(1X,'CONTINUE ? (YES, 2=NO)')	WR100280
	READ(5,*)K	WR100290
	IF(K,EQ,1)GO TO 5	WR100300
	STOP	WR100310
	END	WR100320
		WR100330
		WR100340

C	PROGRAM TO FIX THRESHOLD DATA BASE	ERR00010
C		ERR00020
C	LAST MODIFIED BY JILL CHEN ON 01/02/79	ERR00030
C		ERR00040
	DEFINE FILE 2(150,830,E,1DUM)	ERR00050
	DIMENSION DATA(80)	ERR00060
8	WRITE(6,4449)	ERR00070
4449	FORMAT(1/,1X,'ENTER PROJECT NUMBER -')	ERR00080
	READ(5,*) IPRJ	ERR00090
9	WRITE(6,2)	ERR00100
2	FORMAT(1X,'ENTER ITEM NUMBER(1=80)')	ERR00110
	READ(5,*) ITEM	ERR00120
30	READ(2'IPRJ,20)(DATA(L),L=1,80)	ERR00130
	WRITE(6,4) DATA(ITEM)	ERR00140
4	FORMAT(1X,'OLD # ',E12,5)	ERR00150
	WRITE(6,3)	ERR00160
3	FORMAT(1X,'ENTER CORRECT DATA')	ERR00170
	READ(5,*) CORR	ERR00180
	DATA(ITEM)=CORR	ERR00190
	WRITE(2'IPRJ,20)(DATA(L),L=1,80)	ERR00200
20	FORMAT(80E10,4)	ERR00210
	WRITE(6,5)	ERR00220
5	FORMAT(1X,'CONTINUE ? 1=NEW PROJECT 2=SAME PROJECT 3=NO',/)	ERR00230
	&1X,'4=SAME PROJECT NEXT ITEM?')	ERR00240
	READ(5,*) I1	ERR00250
	IF(I1.EQ.1) GO TO 8	ERR00260
	IF(I1.EQ.2) GO TO 9	ERR00270
	IF(I1.EQ.3) GO TO 10	ERR00280
	ITEM=ITEM+1	ERR00290
	GO TO 30	ERR00300
10	STOP	ERR00310
	END	ERR00320

```
C PROGRAM TO READ AND PRINT OUT DATA FROM PROJECT
C THRESHOLD DATA-FILE
C
C LAST MODIFIED BY JILL CHEN ON 12/28/78
C
C DEFINE FILE 2(150,830,E,IDUM),3(150,54,E,IDUM)
C DIMENSION ARRAY(80)
C REAL AB PNAME(5)
C OPENFILE 2,"HIGFILEB","NUMERIC"
C OPENFILE 3,"PROJNAMEB","STRING"
C WRITE(6,1)
1 FORMAT(1X,'ENTER PROJECT NUMBER')
C READ(5,4)
C READ(3:1,2) (PNAME(K),K=1,5)
2 FORMAT(5A8)
C WRITE(6,3) (PNAME(K),K=1,5)
3 FORMAT(1X,5A8)
C READ(2:1,6) (ARRAY(K),K=1,80)
6 FORMAT(80E10,4)
C J1=1
C J2=4
C DO 8 J=1,20
C WRITE(6,4) (ARRAY(J),J=J1,J2)
4 FORMAT(1X,4E12,5)
C J1=J1+4
C J2=J2+4
8 CONTINUE
C STOP
C END
```

```
REA00010
REA00020
REA00030
REA00040
REA00050
REA00060
REA00070
REA00080
REA00090
REA00100
REA00110
REA00120
REA00130
REA00140
REA00150
REA00160
REA00170
REA00180
REA00190
REA00200
REA00210
REA00220
REA00230
REA00240
REA00250
REA00260
REA00270
REA00280
REA00290
```

```
      WRITE(6,5)
5     FORMAT (/, 'PROJECT DATA INPUT', /,
      &1 ENTER CODE FOR EVALUATION', /,
      &1 1=NEW TECHNOLOGY, 2=SUBSTITUTE')
      READ(5,*) IS
      RIS=IS
      WRITE(6,6543)
6543  FORMAT (' SECTOR: 1=RES, 2=COMM, 3=INDU, 4=H/C/I')
      READ(5,*) IS
      RIS=IS
15     WRITE(6,17)
17     FORMAT (' NUMBER OF YEARS ACCELERATED')
      READ(5,*) IAC
      AC=IAC
      GO TO (18,25), IS
18     KK=2
      WRITE(6,19)
19     FORMAT (/, ' NEW SYSTEM UNIT APPLICATION DATA')
      GO TO 29
25     WRITE(6,27)
      KK=1
27     FORMAT (/, ' CONVENTIONAL SYS UNIT APPLICATION DATA')
29     WRITE(6,30)
30     FORMAT (' CAPITAL COST')
      READ(5,*) CC(KK)
      WRITE(6,33)
33     FORMAT (' MANUFACTURING COST')
      READ(5,*) CHA(KK)
      WRITE(6,34)
34     FORMAT (' YEARS TO INSTALL')
      READ(5,*) IYST
      YST(KK)=IYST
      WRITE(6,35)
35     FORMAT (/, ' ENERGY USE (SAVINGS), BTU/YEAR')
      DO 37 I=1,5
      WRITE(6,36) ENAME(I)
      READ(5,*) CE(KK,I)
36     FORMAT (' ', A8)
37     CONTINUE
      WRITE(6,38)
38     FORMAT (/, ' NON-FUEL OPER & MAINT COST/SAVINGS ($/YR)')
      READ(5,*) RNFOM(KK)
      WRITE(6,41)
41     FORMAT (' YEARS OF USEFUL-LIFE')
      READ(5,*) IYRL
      YRI(KK)=IYRL
42     FORMAT (I2)
      WRITE(6,39)
39     FORMAT (' SCRAPPAGE VALUE FRACTION')
      READ(5,*) SCP(KK)
      IF (KK.EQ.1) GO TO 18
      WRITE(6,43)
43     FORMAT (/, ' ENERGY PRICES (COMMERCIALIZATION YEAR, $/MMBTU)')
      DO 40 I=1,5
      IF (CE(1,I).EQ.0., AND, CE(2,I).EQ.0.) GO TO 40
```

```
WR100560
WR100570
WR100580
WR100590
WR100600
WR100610
WR100620
WR100630
WR100640
WR100650
WR100660
WR100670
WR100680
WR100690
WR100700
WR100710
WR100720
WR100730
WR100740
WR100750
WR100760
WR100770
WR100780
WR100790
WR100800
WR100810
WR100820
WR100830
WR100840
WR100850
WR100860
WR100870
WR100880
WR100890
WR100900
WR100910
WR100920
WR100930
WR100940
WR100950
WR100960
WR100970
WR100980
WR100990
WR101000
WR101010
WR101020
WR101030
WR101040
WR101050
WR101060
WR101070
WR101080
WR101090
WR101100
```

```
35  CONTINUE
    READ(3,4844,END=889) JPRJ,(PDESC(L),L=1,25)
4844  FORMAT(14,1X,25A4)
    IF(JPRJ,EN,N) GO TO 879
    GO TO 35
889  CONTINUE
    REWIND 3
    DO 111 LL=1,25
111  PDESC(LL)=BLANK
879  READ(4'N,1199) (DATA(L),L=1,80)
1199  FORMAT(HOE10,4)
C
C  ADJUST DATA & PRINT OUT ON TERMINAL
C
    MEYR=DATA(28)
    KK=MEYR-1975
    DO 8801 J=KK,25
8801  DELP(J,5)=DATA(80)*EXP(.025*(J-1))
7708  CONTINUE
    N1=DATA(13)
    WRITE(6,233) N,11M,11D,11Y
    IF (N1,NE,0) WRITE(6,234) N1
233  FORMAT(///,1 PROJECT NUMBER ,13,36X,'DATE: ',12,1H/,12,1H/,12)
234  FORMAT(1X,1 (ORIGINALLY ',13,1))
    IF (DATA(1),EQ,0,0) WRITE(6,201)
    IF (DATA(1),EQ,1,0) WRITE(6,201)
    IF (DATA(1),EQ,2,0) WRITE(6,202)
201  FORMAT(/15X,'NEW TECHNOLOGY INPUT DATA FORM')
202  FORMAT(/12X,'SUBSTITUTE TECHNOLOGY INPUT DATA FORM')
    NSEC=DATA(2)
    IF (NSEC,EQ,0,0) NSEC=5
    IF (NSEC,NE,1) GO TO 666
    DO 399 JK=1,4
399  A1(JK)=AAA(JK,1)
    GO TO 777
666  IF (NSEC,NE,2) GO TO 888
    DO 389 JK=1,4
389  A1(JK)=AAA(JK,2)
    GO TO 777
888  IF (NSEC,NE,4) GO TO 811
    DO 812 JK=1,4
812  A1(JK)=AAA(JK,4)
    GO TO 777
811  DO 379 JK=1,4
379  A1(JK)=AAA(JK,3)
777  WRITE(6,203) (PRJNAM(L),L=1,5), (SECTOR(L,NSEC),L=1,3)
    WRITE(6,911) (BRANCH(L,KBRCH),L=1,5), (PDESC(L),L=1,25)
203  FORMAT(/1X,1 PROJECT NAME = ',5A8,/,1X,1 SECTOR = ',3A4)
911  FORMAT(1X,1 BRANCH = ',5A8,/,1X,1 DESCRIPTION = ',12A4,/,15X,13A4)
    WRITE(6,204) DATA(3)
204  FORMAT(/1X,1 ACCELERATION OF MARKET ENTRY: ',F3,0,1 YEARS')
    IF (DATA(18),EQ,0,0) DATA(18)=1.0
    IDATE=DATA(28)-1975
    DO 314 J=1,2
    TEV(J)=0
```

```
DAT01110
DAT01120
DAT01130
DAT01140
DAT01150
DAT01160
DAT01170
DAT01180
DAT01190
DAT01200
DAT01210
DAT01220
DAT01230
DAT01240
DAT01250
DAT01260
DAT01270
DAT01280
DAT01290
DAT01300
DAT01310
DAT01320
DAT01330
DAT01340
DAT01350
DAT01360
DAT01370
DAT01380
DAT01390
DAT01400
DAT01410
DAT01420
DAT01430
DAT01440
DAT01450
DAT01460
DAT01470
DAT01480
DAT01490
DAT01500
DAT01510
DAT01520
DAT01530
DAT01540
DAT01550
DAT01560
DAT01570
DAT01580
DAT01590
DAT01600
DAT01610
DAT01620
DAT01630
DAT01640
DAT01650
```

```
DO 313 I=7,11
KK=1+69
K1=MEYR-1975
K2=1-6
DATA(KK)=DELP(K1,K2)
K3=1+12*(J=1)
K4=1+69
TEV(J)=TEV(J)+DATA(K3)+DATA(K4)*IE=6
313 CONTINUE
K5=12+J
COP(J)=TEV(J)+DATA(K5)
314 CONTINUE
IF (DATA(1).EQ.2,0) GO TO 300
WRITE(6,205)
205 FORMAT(4X,'NEW',/,47X,'SYSTEM',/)
WRITE(6,2206) DATA(16)
2206 FORMAT(1X,'CAPITAL COST ($)',26X,F13,2)
WRITE(6,1206) DATA(17)
1206 FORMAT(1X,'MANUFACTURING COST ($)',20X,F13,2)
WRITE(6,207) DATA(18)
207 FORMAT(1X,'YEARS TO INSTALL',26X,F12,1)
DO 999 II=19,23
999 IF (DATA(II).EQ.0,00) DATA(II+97)=0,0
IF (NSEC.NE.1) GO TO 555
DO 77 JJ=19,23
DATA(JJ)=DATA(JJ)/1000000,
77 CONTINUE
GO TO 551
555 IF (NSEC.NE.2) GO TO 1551
DO 79 JJ=19,23
DATA(JJ)=DATA(JJ)/1000,
79 CONTINUE
1551 IF (NSEC.NE.4) GO TO 551
DO 1777 JJ=19,23
1777 DATA(JJ)=DATA(JJ)/1000000000,
551 CONTINUE
WRITE(6,208) (A1(JK),JK=1,4), (DATA(K+57),DATA(K),K=19,23)
208 FORMAT(1X,'ANNUAL ENERGY-SAVING $',4A4,/,3X,'GAS',7X,'OIL',
8,F5,2,' ($/HHBTU)',4X,F22,2,/,3X,'DIL',
87X,' ',F5,2,15X,F22,2,/,3X,'COAL',6X,' ',F5,2,15X,F22,2,/,3X
8,'FUEL',6X,' ',F5,2,15X,F22,2,
8/,6X,' (>10,500 BTU/KWH)',/,3X,'OTHER',5X,' ',F5,2,15X,F22,2,
8/)
WRITE(6,209) COP(2),TEV(2),DATA(24),DATA(25)
209 FORMAT(1X,'TOTAL OPERATING COST/SAVING ($/YR)',8X,F13,2,/,
81X,'ENERGY COST/SAVINGS',23X,
8F13,2,/,1X,'NON-FUEL O&M',30X,
8F13,2,/,1X,'USEFUL LIFE (YRS)',25X,F12,1)
WRITE(6,210) DATA(26)
210 FORMAT(1X,'SCRAPPAGE VALUE (FRACTION)',17X,F12,2)
GO TO 9999
300 CONTINUE
WRITE(6,305)
305 FORMAT(44X,'CONVENTIONAL',7X,'SUBSTITUTE',/,47X,'SYSTEM',
812X,'SYSTEM'/)
```

```
DAT01660
DAT01670
DAT01680
DAT01690
DAT01700
DAT01710
DAT01720
DAT01730
DAT01740
DAT01750
DAT01760
DAT01770
DAT01780
DAT01790
DAT01800
DAT01810
DAT01820
DAT01830
DAT01840
DAT01850
DAT01860
DAT01870
DAT01880
DAT01890
DAT01900
DAT01910
DAT01920
DAT01930
DAT01940
DAT01950
DAT01960
DAT01970
DAT01980
DAT01990
DAT02000
DAT02010
DAT02020
DAT02030
DAT02040
DAT02050
DAT02060
DAT02070
DAT02080
DAT02090
DAT02100
DAT02110
DAT02120
DAT02130
DAT02140
DAT02150
DAT02160
DAT02170
DAT02180
DAT02190
DAT02200
```

```
WRITE(6,306) DATA(4),DATA(16) DAT02210
306 FORMAT(1X,'CAPITAL COST',10X,F13,2,5X,F13,2) DAT02220
WRITE(6,307) DATA(5),DATA(17) DAT02230
307 FORMAT(1X,'MANUFACTURING COST ($)',20X,F13,2,5X,F13,2) DAT02240
IF (DATA(6).EQ.0.0) DATA(6)=1 DAT02250
WRITE(6,308) DATA(6),DATA(18) DAT02260
308 FORMAT(1X,'YEARS TO INSTALL',26X,F12,1,6X,F12,1) DAT02270
IF (NSEC.NE.1) GO TO 1555 DAT02280
DO 277 JJ=7,11 DAT02290
DATA(JJ)=DATA(JJ)/1000000, DAT02300
DATA(JJ+12)=DATA(JJ+12)/1000000, DAT02310
277 CONTINUE DAT02320
GO TO 1155 DAT02330
1555 IF (NSEC.NE.2) GO TO 1666 DAT02340
DO 1179 JJ=7,11 DAT02350
DATA(JJ)=DATA(JJ)/1000, DAT02360
DATA(JJ+12)=DATA(JJ+12)/1000, DAT02370
1179 CONTINUE DAT02380
1666 IF (NSEC.NE.4) GO TO 1155 DAT02390
DO 1900 JJ=7,11 DAT02400
DATA(JJ)=DATA(JJ)/1000000000, DAT02410
DATA(JJ+12)=DATA(JJ+12)/1000000000, DAT02420
1900 CONTINUE DAT02430
1155 DO 11 K=7,11 DAT02440
11 IF (DATA(K).EQ.0.0.AND.DATA(K+12).EQ.0.0) DATA(K+69)=0.0 DAT02450
WRITE(6,309) (A1(JK),JK=1,4),DATA(K+69),DATA(K),DATA(K+12),K=7,11) DAT02460
309 FORMAT(1X,'ANNUAL ENERGY USE',4A4,'/',3X,'GAS',7X,'OIL',
&F5,2,' ($/MMBTU)',8X,2(F18,2),/,3X,'DIESEL',
&F5,2,' ($/MMBTU)',8X,2(F18,2),/,3X,'COAL',6X,'ELECTRICITY',F5,2,19X,2(
&F18,2),/,3X,'ELECTRICITY',6X,'ELECTRICITY',F5,2,19X,2(F18,2),
&F5,2,19X,2(F18,2),/,3X,'OTHER',5X,'ELECTRICITY',F5,2,19X,2(
&F18,2),/)
WRITE(6,310) COP(1),COP(2),TEV(1),TEV(2),DATA(12),DATA(24),DA
&TA(14),DATA(25) DAT02530
310 FORMAT(1X,'TOTAL OPERATING COST/SAVING ($/YR)',8X,F13,2,5X,
&F13,2,/,
&1X,'ENERGY COST/SAVINGS',23X,F13,2,5X,
&F13,2,/,1X,'NON-FUEL O&M',30X,F13,2,5X,
&F13,2,/,1X,'USEFUL LIFE (YRS)',25X,F12,1,6X,F12,1)
WRITE(6,312) DATA(15),DATA(26) DAT02590
312 FORMAT(1X,'SCRAPPAQE VALUE (FRACTION)',17X,F12,2,6X,F12,2) DAT02600
9999 CONTINUE DAT02610
INAM=DATA(P7) DAT02620
IF (INAM.EQ.0.0) INAM=1 DAT02630
WRITE(6,211) NAME(INAM) DAT02640
211 FORMAT(1X,'MARKET PENETRATION DATA - UNITS',A8) DAT02650
BH=UND(1) DAT02660
IF (NSEC.EQ.2) BH=BHR(2) DAT02670
WRITE(6,212) BH DAT02680
212 FORMAT(1X,'TOTAL',5X,'FEDERAL',8X,'PRIVATE',/,
&27X,'MARKET',5X,'FUNDING',8X,'FUNDING',/,
&1X,'YEAR',8X,A8,7X,'SIZE',6X,'($1000)',8X,'($1000)')
DO 213 NN=1,10 DAT02690
FED(NN)=DATA(32+NN)*1000 DAT02700
PRI(NN)=DATA(43+NN)/1000 DAT02710
DAT02720
DAT02730
DAT02740
DAT02750
```



```
213 CONTINUE
    IFY=DATA(32)-1976
    IPY=DATA(43)-1976
    DO 1903 I=1,25
    CFED(I)=0
    PRIV(I)=0
1903 CONTINUE
    DO 1901 I=1,10
    IF (I.GI.25) GO TO 1902
    CFED(IPY+I)=FED(I)
    PRIV(IPY+I)=PRI(I)
1901 CONTINUE
1902 CONTINUE
    DO 215 M=1,15
    IYEAR=1975+M
    ID=M/5+70
    IF (M.EQ.5.OR.M.EQ.10.OR.M.EQ.15)
&WRITE(6,142) IYEAR,DATA(53+M),DATA(ID),CFED(M),PRIV(M)
142 FORMAT(1X,14,1X,F12,0,2X,F12,0,2X,F10,1,5X,F10,1)
    IF (M.EQ.5.OR.M.EQ.10.OR.M.EQ.15) GO TO 215
    WRITE(6,214) IYEAR,DATA(53+M),CFED(M),PRIV(M)
214 FORMAT(1X,14,1X,F12,0,16X,F10,1,5X,F10,1)
215 CONTINUE
    WRITE(6,401) DATA(69),DATA(74),CFED(20),PRIV(20),
&DATA(70),DATA(75),CFED(25),PRIV(25)
401 FORMAT(/1X,'1995',1X,F12,0,2X,F12,0,2X,F10,1,5X,F10,1,/,/1X,'2000',
&1X,F12,0,2X,F12,0,2X,F10,1,5X,F10,1)
    IF (DATA(72).EQ.0,0)GO TO 119
    BND=DATA(63)/DATA(72)*100
    GO TO 107
119 BND = 9999999999999999,9
107 WRITE(6,216) BND
216 FORMAT(/1X,'PERCENT OF TOTAL MARKET IN 1985: ',F5,1,1X)
    IF (IPRCA.EQ.0) KPTR=3
    WRITE(6,431) (CNAME(L,IENX),L=1,3)
431 FORMAT(/1X,'A ENERGY PRICES BASED ON ',SA4,////)
1600 CONTINUE
    STOP
    END
```

```
DAT02760
DAT02770
DAT02780
DAT02790
DAT02800
DAT02810
DAT02820
DAT02830
DAT02840
DAT02850
DAT02860
DAT02870
DAT02880
DAT02890
DAT02900
DAT02910
DAT02920
DAT02930
DAT02940
DAT02950
DAT02960
DAT02970
DAT02980
DAT02990
DAT03000
DAT03010
DAT03020
DAT03030
DAT03040
DAT03050
DAT03060
DAT03070
DAT03080
DAT03090
DAT03100
DAT03110
DAT03120
DAT03130
DAT03140
```

```
C PROGRAM TO WRITE DATA FOR THRESHOLD SCREENING MODEL
C TO RANDOM ACCESS FILE
C
C LAST MODIFIED BY JILL CHEN ON 12/15/78
C
C DIMENSION CC(2),CHA(2),CE(2,5),RNFDM(2),SCP(2),YRL(2),YST(2)
C DIMENSION DATA(80),CHKT(17),CFED(10),PRIV(10),EPR(5),TMKT(5)
C REAL*4 ALPHA(5,5)
C REAL*8 PNAME(5),ENAME(5)
C DATA YES/'YES'/
C DATA ENAME/'GAS','OIL','COAL','ELECT','OTHER'/
190 CONTINUE
C OPENFILE 1,"BRANCHB","NUMERIC"
C OPENFILE 2,"BIGFILEB","NUMERIC"
C OPENFILE 3,"PROJNAMB","STRING"
C OPENFILE 4,"DESCRIPB","STRING"
C WRITE(6,4450)
4450 FORMAT('ENTER NEW PROJECT NUMBER')
READ(5,*)IPROJ
WRITE(6,9988)
9988 FORMAT(1X,'ENTER BRANCH DESIGNATION:',/,
81X,'6 = CONSUMER PROD',/,
81X,'7 = URBAN WASTE TECH',/,1X,'8 = COMMUNITY SYS',/,
81X,'9 = ARCH/ENGL',/,1X,'10 = CONS MOTIV',/,1X,'11 = NEA PROJECTS',
8/)
READ(5,*)BRCH
WRITE(1,333)BRCH
333 FORMAT(F3,0)
WRITE(6,399)
399 FORMAT(1X,'ENTER PROJECT NAME')
READ(5,299)(PNAME(L),L=1,5)
299 FORMAT(5A8)
WRITE(3,29A)(PNAME(L),L=1,5)
298 FORMAT(1X,5A8)
WRITE(6,295)(PNAME(L),L=1,5)
295 FORMAT(/,1X,'ENTER DESCRIPTION FOR 1,5A8,/,
82X,'XXXXXXXXXXXXXXXXXXXXX 20 CHARACTERS EACH LINE FOR 5 LINES'
8,////)
DO 990 II=1,5
READ(5,987)(ALPHA(KK,II),KK=1,5)
987 FORMAT(5A4)
990 CONTINUE
WRITE(4,200)IPROJ,((ALPHA(KK,LL),KK=1,5),LL=1,5)
200 FORMAT(14,1X,25A4)
WRITE(6,3777)
3777 FORMAT(1X,'ENTER ORIGINAL PROJECT NUMBER')
READ(5,*)RPROJ
RIP=1
DO 477 JJ=1,17
477 CMKT(JJ)=0.0
DO 478 JJ=1,5
478 EPR(JJ)=0.0
CM=0.0
CD=0.0
CY=0.0
WRI00010
WRI00020
WRI00030
WRI00040
WRI00050
WRI00060
WRI00070
WRI00080
WRI00090
WRI00100
WRI00110
WRI00120
WRI00130
WRI00140
WRI00150
WRI00160
WRI00170
WRI00180
WRI00190
WRI00200
WRI00210
WRI00220
WRI00230
WRI00240
WRI00250
WRI00260
WRI00270
WRI00280
WRI00290
WRI00300
WRI00310
WRI00320
WRI00330
WRI00340
WRI00350
WRI00360
WRI00370
WRI00380
WRI00390
WRI00400
WRI00410
WRI00420
WRI00430
WRI00440
WRI00450
WRI00460
WRI00470
WRI00480
WRI00490
WRI00500
WRI00510
WRI00520
WRI00530
WRI00540
WRI00550
```