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DOE/CS/20024--

MANAGEMENT PLAN
F-1469
8-1
ADDITIONAL DEVELOPMENT OF A
THRESHOLD EVALUATION SYSTEM

MASTER

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Prepared For
U.S. DEPARTMENT OF ENERGY
BUILDINGS AND COMMUNITY SYSTEMS
DIVISION

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4 November 1977

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SECTION 1

INTRODUCTION

1.1 BACKGROUND

The DOE Division of Buildings and Community Systems is charged with assuming "...the National Technical Leadership for research, development, and demonstration activities related to energy conservation in buildings and community systems." To meet this charge, BCS engages in the following efforts:

- Accelerate/complement private sector efforts;
- Foster acceptance of energy saving technology;
- Maximize the effectiveness of energy use; and
- Minimize adverse socio-economic and/or environmental impacts.

Each of the aforementioned efforts must be accomplished with a finite level of resources. Therefore, each request for Federal assistance must be carefully evaluated giving consideration to a number of factors which affect the successful commercialization of RD&D projects. A project threshold screening and scoring system has been developed and utilized to aid BCS management in meeting the goals of their charter.

DYNATREND INCORPORATED has been selected to provide BCS with technical support in evaluating potential RD&D investments using the Threshold Screening and Scoring model developed for DOE. Additionally, enhancements to the model are to be implemented which reflect the changing information needs of BCS. This plan presents the management procedures and technical approach to be employed to successfully complete tasks defined in the statement of work. (REF: Enclosure III, RFP EC-77-R-03-1469)

1.2 MANAGEMENT PLAN ORGANIZATION

The following elements are presented in the plan:

- Contract objectives;
- Management structure;
- Detailed technical approach to each task;
- Work Breakdown Structure; and
- Management Control procedures

Contract objectives, presented in Section 2, include the technical goals and schedule and cost objectives of the contract. The organization structures of DOE/BCS and DYNATREND are displayed in Section 3. Moreover, the interface between the organizations is presented in the Management Structure section, as well as key DYNATREND personnel assigned to the project. Section 4 presents the detailed technical approach adopted to accomplish the five tasks in the statement of work. A summary of the overall technical approach precedes a discussion of the detailed approach to each task. The work breakdown structure to be employed in the execution of the contract is presented in Section 5. The management plan concludes with a detailed definition of the management control procedures to monitor schedules, costs, and technical performance of this contract.

SECTION 2

PROJECT OBJECTIVES

2.1 PROJECT DESCRIPTION

The objective of this contract is to enhance the existing threshold screening and scoring model used by DOE's Division of Buildings and Community Systems, and operate the model to evaluate projects competing for government funding for a period of one year 10 AUG 1977 - 10 SEPT 1977. The details and sequence of this effort are as follows:

TASK I - Analysis of the Current Threshold Screening and Scoring System

This task is comprised of three sub-elements. First, an analysis of the current system, identifying modifications that will strengthen the model as a decision-making tool will be conducted. The second sub-element involves the identification of the areas where two sub-system models, performing risk and market penetration analysis, can be entered into the existing system. The third sub-element involves the preparation and submission of a report to DOE identifying the results of the analysis and a schedule for implementing the proposed modifications.

TASK II - System Modification and Subsystem Integration

This task involves the integration of the changes recommended in Task I as well as the two sub-system models. Only those recommendations approved by DOE/BCS will be integrated. Upon receipt of the sub-system models from BCS they will be integrated into the existing program.

TASK III - System Testing and Verification

Subsequent to the integration of the approved recommendations and sub-system models, the threshold system will be tested utilizing

actual BCS project data. In order to insure that all project data is accurate and compatible, a suitable project data input format will be prepared to assist the Program Manager in preparing data for entry into the system. An additional sub-element implicit in this Task is the routine processing of project evaluation requests.

TASK IV - Sensitivity Analysis

Task IV involves the execution of sensitivity analyses. The analyses, performed on an as required basis within the limits of available resources, will investigate such factors as the effect of fuel price changes, timing/amount of federal investment, tax incentives and other topics. The results of all analyses will be submitted to DOE for review and approval.

TASK V - Further Development and Strengthening of the Scoring Model

This task will consist of two sub-elements. First, modifications to the existing scoring model will be developed. This sub-element is related to a similar effort performed in Task I. The second sub-element involves the testing of the modifications to the scoring model.

Each of these tasks is thoroughly discussed in Section 4, Technical Approach.

2.2 TECHNICAL GOALS

The primary technical goal of this contract is to provide DOE/BCS with technical support to evaluate potential RD&D investments in a timely and cost-effective manner. Implicit in this goal are a number of sub-goals including:

- Improve the threshold evaluation system to provide BCS with the appropriate economic and management information to support BCS decision-making needs.

- Evaluate all new projects in a timely manner, providing assistance to program managers in collecting, inputting, and evaluating project data.
- Integrate two new sub-system models (risk and market penetration) into the Threshold system.
- Develop and integrate into the system a scoring model which will assess such factors as environmental impacts, geographic significance, etc.
- Perform sensitivity analyses using the Threshold system.
- Maintain the model and associated data files, employing FORTRAN IV.

The attainment of these goals will be accomplished within the schedule and cost constraints defined in ensuing sections. A detailed description of the technical approach to meet these goals is presented in Section 4.

2.3 SCHEDULE OBJECTIVES

The period of performance for this contract, Additional Development of a Threshold Evaluation System, extends 12 months from the date of contract award, 10 August 1977. A fundamental objective of the contract schedule is to maintain the basic operating capability of the Threshold system while performing other tasks contained in the statement of work. The milestone schedule, Figure 2-1, displays the five major tasks and significant sub-elements of each task.

Significant emphasis is placed on integrating a majority of TASK I recommendations, upon approval of BCS personnel, prior to the completion of the TASK I report. Several recommendations presented in

LEGEND

- △ Expected Schedule Due Date
- ▲ Completed Activity
- ◆ Revised Expected Due Date

FIGURE 2-1
THRESHOLD CONTRACT
MASTER MILESTONE SCHEDULE

DYNATREND's proposal and those produced as a result of prior work for BCS, were presented to DOE for early approval. These recommendations focus on the following aspects of the Threshold system:

- Selection of alternate screening criteria
- Orient project data to FY78
- Issue a revised input data survey
- Selection of a fuel price scenario
- Preparation of revised Threshold system reports
- Verification of data file contents

Each of these tasks have been accomplished, thereby minimizing the time to implement tasks after formal submission of the TASK I report.

Two sub-system models and a scoring model to be integrated into the Threshold system will be available approximately 1 March 1978* and 1 April 1978, respectively. These subsystems will be merged into a copy of the Threshold model to eliminate potential delays in evaluating new projects. Once the enhanced system has undergone extensive testing, it will be brought on-line for application to all projects. Similarly, sensitivity analyses involving modifications to the Threshold model will be performed on a copy of the model to avoid any delays or conflicts.

Several procedures have been adopted to insure that all new projects are evaluated in a timely manner. A DYNATREND project team member will be on-site at DOE two days a week to collect completed input data forms, assist program managers in completing the forms and distribute evaluation reports. Moreover, special requests for project evaluations will be honored. All projects will be evaluated and returned to DOE within 24 hours.

DYNATREND's project team approach facilitates the allocation of resources to meet BCS requirements. A detailed schedule of activities

* The risk subsystem model is being developed by DYNATREND under contract EC-77-C-03-1470.

for the upcoming three months and summary thereafter is contained in Section 6.

2.4 COST OBJECTIVES

Time phased project costs are displayed in Table 2-1. DYNATREND's accounting calendar is comprised of 13 four-week periods against which costs are reported to DOE by task and total project. The costs displayed in Table 2-1 are in consonance with the project schedule. The contract objectives presented in the statement of work are attainable within the contract budget.

TABLE 2-1

ADDITIONAL DEVELOPMENT OF A THRESHOLD EVALUATION SYSTEM

TIME PHASED COSTS

TASK	COST TYPE	9/4	10/2	10/30	11/27	12/25	1/22	2/19	3/19	4/16	5/14	6/11	7/9	8/6	TOTAL
ANALYSIS OF CURRENT MODEL	INCR CUM	1788 1788	790 2578	2578	2578	2578	2578	2578	2578	2578	2578	2578	2578	2578	2578
SUBSYSTEM MODIF/ INTEGRATION	INCR CUM	863 863	3520 4383	3070 7453	3055 10508	1000 11508	1000 12508	2500 15008	2500 17508	2000 19508	1576 21084	1720 22804	160 22964	22964	22964
SYSTEM TESTING/ VERIFICATION	INCR CUM		4627 4627	2000 6627	1220 7847	1200 9047	1220 10267	1200 11467	2020 13487	2000 15487	2020 17507	2000 19507	1520 21027	1172 22199	22199
SENSITIVITY ANALYSIS	INCR CUM				3000 3000	2620 5620	5620	3000 8620	3000 11620		3000 14620	3000 17620	17620	3813 21433	21433
SCORING MODEL	INCR CUM								2080 2080	1280 3360	4014 7374	7374	7374	7374	7374
TOTALS	INC CUM	2651 2651	8937 11588	5070 16658	7275 23933	4820 28753	2220 30973	6700 37673	9600 47273	5280 52553	10610 63163	6720 69883	1680 71563	4985 76548	76548

SECTION 3

MANAGEMENT STRUCTURE

3.1 DOE/BCS ORGANIZATION

The DOE Division of Buildings and Community Systems has responsibility for research, development, and demonstration activities related to energy conservation in buildings, community systems and consumer products. A component of the Division, Planning Analysis and Evaluation has responsibility for evaluating potential RD&D investments under consideration by each BCS organizational element identified in Figure 3-1.

DYNATREND will provide the Planning Analysis and Evaluation element of BCS with technical support in the maintenance and enhancement of the Threshold Evaluation System. Moreover, program managers in each organizational element will be provided with assistance in the collection of input data for the system and dissemination of evaluation reports.

3.2 DYNATREND ORGANIZATION

DYNATREND's management approach to projects such as the Additional Development of a Threshold Evaluation system places no tiers of intermediate management between the operating project manager and the corporate officers who have the authority and responsibility to commit company resources as needed to fully support the Project Manager. Management organization, methods, and procedures are simple and direct.

The DYNATREND company organization is shown in Figure 3-2. Note that the Principal in charge reports directly to the President of the Corporation. Technical team members report administratively to the Vice-President of Operations. These two corporate officers have complete knowledge at all times of the status of all work

FIGURE 3-1

BCS ORGANIZATIONAL STRUCTURE

DYNATREND INCORPORATED ORGANIZATION

RJM91277

EFFECTIVE: 18 OCTOBER 1977

APPROVED:
Ronald J. Massa

FIGURE 3-2
COMPANY ORGANIZATION

going on within the company, of all planned work, and of the workload and availability of members of the professional staff and of supporting elements such as contracts, accounting, publications, etc. The direct lines of communication and the centralized knowledge of and control over company resources create an extremely flexible and responsive organization which can act swiftly and effectively to meet the needs of DOE/BCS.

3.3 PROJECT ORGANIZATION/KEY PERSONNEL

Successful completion of this effort requires the timely application of highly competent technical personnel with background and experience in economic analyses associated with RD&D investment management problems in general, and detailed knowledge of the existing model and its use within DOE in particular.

DYNATREND has selected a project team, depicted in Figure 3-3, with the requisite technical and management background to perform the contract tasks. Mr. Albert J. Gravalles, Vice-President of DYNATREND will have overall responsibility for the successful execution of all contractual matters, both technical and fiscal. As Principal in Charge, Mr. Gravalles is empowered to commit resources and act for the company in all matters related to the contract.

Mr. Robert Roblin will act as the Project Manager for the contract. He will report directly to Mr. Gravalles and have responsibility for all technical matters associated with the contract. Moreover, Mr. Roblin will be responsible for insuring that all tasks are completed in a timely and cost-effective manner.

TASK I, analysis of the current threshold screening and scoring system will be conducted by Mr. Roblin. He will be responsible for the analysis of the existing model and identification of areas in the model which require strengthening. Mr. Khalatbari will assist Mr. Roblin in the accomplishment of TASK I.

FIGURE 3-3

PROJECT ORGANIZATION

ADDITIONAL DEVELOPMENT OF A THRESHOLD EVALUATION SYSTEM

The second task, system modification and subsystem integration, will also be conducted by Mr. Roblin. This task will consist of integrating recommended changes to the model as well as integrating new sub-system models. Ms. Purcell will perform the requisite computer programming and de-bugging of the modifications.

TASK III, system testing and verification will be assigned to Mr. Roblin, a member of the DYNATREND professional staff. This task involves the testing and verification of the modifications implemented in TASK II and the ongoing operation of the threshold system.

TASK IV, sensitivity analysis will be assigned to Mr. Khalatbari. This task consists of the performing sensitivity analyses on the threshold model.

Last, TASK V, further development and strengthening of the scoring model will be the responsibility of Mr. Roblin. The efforts associated with this task involve the identification of methods to strengthen the existing scoring model.

3.4 ORGANIZATIONAL INTERFACES

Two primary interfaces will be established between DOE/BCS and DYNATREND. The Principal-in-Charge will interface with the contracting office and technical monitor on overall contract management and technical performance. The Project Manager will interface with the technical monitor and BCS Program Managers to accept technical direction and collect and disseminate project evaluation data/reports. As necessary, the Project Manager will be assisted by project team members in interfacing with BCS program managers in the collection and dissemination of Threshold Evaluation data.

SECTION 4

TECHNICAL APPROACH

4.1 INTRODUCTION

Five tasks presented in the statement of work are to be performed under this contract. The technical approach to be employed to successfully complete each task is presented in this section. The detailed technical approach to each task is presented individually, however, several groundrules have been adopted which affect the overall execution of this effort.

First, it is recognized that modifications to the Threshold system should be implemented in phases, and only after careful consideration of DOE/BCS information needs, data requirements, and effects on the overall theoretical approach. Secondly, changes to the system should be transparent to the user, and the third, the requirement for soliciting new data from Program Managers should be kept to a minimum. Finally, the basic evaluation capability of the system should not be disrupted due to the performance of special studies or incorporation of enhancements.

4.2 TASK I - ANALYSIS OF THE CURRENT THRESHOLD SCREENING AND SCORING SYSTEM

The Threshold Evaluation System was developed to provide BCS with the capability to evaluate potential RD&D investments on the basis of economic and fuel conservation benefits and costs. During the past two years, this tool has evolved to meet the changing information needs of BCS as well as reflect changes in the market place (e.g., projected price of fuel). In keeping with this evolutionary concept, TASK I focuses on an analysis of the current model resulting in recommendations as to how the model can be strengthened as a BCS decision-making tool. Furthermore, the placement of a risk and market penetration subsystem in the current model is to be analyzed.

4.2.1 Evaluation of the Threshold Concept

The conceptual foundation of the Threshold system was evaluated in detail with the preliminary results presented in Section 2.4 of DYNATREND's response to the RFP. Subsequent to contract award, several additional studies have been performed and the results presented to BCS for review. These additional studies focused on two topics, strengthening the quantitative evaluation criteria and modifying the data base and reports to provide more comprehensive information on each individual project.

Six additional screening criteria were proposed to either replace or supplement the existing EI, ETI, and MEI. These criteria measure the efficiency of the Federal investment, the total investment, and marginal efficiency of accelerated user return in the investment. A comparison of the existing criteria to the proposed criteria is displayed in Table 4-1. The primary difference between the existing and proposed criteria is the inclusion of user capital costs. Selection of the appropriate criteria was performed according to the methodology discussed in the following paragraph.

A fundamental concern of BCS management is the ranking of projects according to the screening criteria. Therefore, a prerequisite to selecting revised screening criteria is an analysis of changes in project ranking. A three-step process was employed. First, all projects were ranked by each screening criteria followed by grouping projects according to branch designators. The number of projects passing the screening criteria at each cut-off-level was then examined. Finally, Spearman Rank-order correlation was used to evaluate the change in ranking between the original criteria and the proposed replacements. The conclusions of this investigation were presented at a briefing held at DOE on 9 September 1977. Each of the revised criteria has been incorporated into the model under TASK II of the contract.

All information on projects is presently oriented to Fiscal year 1976. New projects to be evaluated in the upcoming year would be required to de-escalate costs to conform with this orientation. It was proposed and accepted by BCS to orient the Threshold system

CRITERION	COMPUTATION	MEASURE OF
EI*	$\text{NPV}^* (\text{ENERGY SAVINGS}) / \text{NPV} (\text{FED. INVEST.})$	$\left\{ \begin{array}{l} \text{Gross user return to} \\ \text{federal investment} \end{array} \right.$ Net user return to federal investment Net private sector return to federal investment
EI	$\text{NPV} (\text{ENERGY SAVINGS}) / \text{NPV} (\text{FED. INVEST.})$	
EI1	$\text{EI} - [\text{NPV} (\text{CAP}) / \text{NPV} (\text{FED. INVEST.})]$	
EI2	$\text{EI1} - [\text{NPV} (\text{PRIV. RDD}) / \text{NPV} (\text{FED. INVEST.})]$	
ETI*	$\text{NPV}^* (\text{ENERGY SAVINGS}) / \text{NPV} (\text{FED.} + \text{PRIV. RDD})$	$\left\{ \begin{array}{l} \text{Gross user return to} \\ \text{total RDD investment} \end{array} \right.$ Net user return to total RDD investment Net operating cost (energy savings) return to total investment
ETI	$\text{NPV} (\text{ENERGY SAVINGS}) / \text{NPV} (\text{FED.} + \text{PRIV. RDD})$	
ETI1	$\text{ETI} - [\text{NPV} (\text{CAP}) / \text{NPV} (\text{FED.} + \text{PRIV. RDD})]$	
ETI2	$\text{NPV} (\text{ENERGY SAVINGS}) / \text{NPV} (\text{FED.} + \text{PRIV. RDD} + \text{CAP})$	
4-3 MEI*	$\text{NPV}^* (\text{ACCEL. ENERGY SAVINGS}) / \text{NPV} (\text{FED. INVEST.})$	$\left\{ \begin{array}{l} \text{Gross accelerated user return} \\ \text{to federal investment} \end{array} \right.$ Net accelerated user return to federal investment
MEI	$\text{NPV} (\text{ACCEL. ENERGY SAVINGS}) / \text{NPV} (\text{FED. INVEST.})$	
MEI1	$\text{MEI} - [\text{NPV} (\text{ACCEL. CAP}) / \text{NPV} (\text{FED. INVEST.})]$	

Note: *denotes criterion uses 7% discount rate for NPV (Energy Savings).
All other NPV's use 10% discount rate.

TABLE 4-1
COMPARISON OF SCREENING CRITERIA

to FY78. The existing data file has been updated to incorporate this change. Furthermore, to insure that all project data is accurate, evaluation reports were produced with the FY78 orientation and new screening values and forwarded to Program Managers for verification. A revised input form presently in use will reflect these changes.

The TASK I study also produced a variety of recommended changes to the threshold evaluation report. More comprehensive investment and management data has been added to the reports. This supplemental data will assist the BCS decision-maker in evaluating the economic costs and benefits of projects under consideration for funding.

The final study in TASK I is a review of the current spread sheet reports. The analysis and management information needs of BCS will be evaluated to define reporting needs.

TASK I culminates in a final report presenting the results of the analysis of the current model and recommended changes. In order to facilitate the accomplishment of several recommendations, approval of BCS was solicited prior to the submission of the report. (See conference record contained in October Technical Status Report.)

4.3 TASK II SYSTEM MODIFICATION AND SUBSYSTEM INTEGRATION

This task involves the programming of TASK I modifications approved by BCS into the current Threshold system and integration of risk and market penetration subsystems into the model. All modifications will be performed using standard FORTRAN IV.

4.3.1 Phased Implementation

Since the inception of the threshold screening and scoring model, a number of changes have been implemented, at the request of BCS, to strengthen the model as well as to reflect modifications in the information requirements of BCS management. Additional solicitations

for enhanced risk and market penetration subsystems are evidence that the character of the model will continue to change in the future. A defined implementation strategy for future enhancements is necessary to avoid several problems. For example, the system must be operational during the modification process, thereby not hindering routine project evaluations. DYNATREND will meet this goal by integrating enhancements on a copy of the existing model. The enhanced version will only be available for use after the system has been fully tested and de-bugged. Furthermore, the changes will be transparent to the user, with the exception of the two subsystem models, which will require users to be cognizant of the theoretical changes as well as the added data requirements. The user will be informed of changes to concepts and formulae in the model.

Prior to bringing any enhanced version of the model on-line, several rigorous tests will be performed. DYNATREND will calibrate the model using a sample of BCS projects to verify the accuracy of all computations. The sample will not be restricted to typical projects but will include "outliers" to verify system performance under a wide range of data values. The results of these runs will be verified by manual calculation of the formulae. This process will eliminate the need to re-evaluate projects due to programming errors.

4.3.2 Additional Efforts

Several sub-tasks will be performed under this task. Briefly, they are:

- RESTRUCTURE PROGRAM - In order to increase the operating efficiency of the model, the program will be restructured.
- USER MANUAL - A comprehensive User's Guide will be prepared which will explain how the system is operated.

This manual will be structured to enable personnel unfamiliar with data processing concepts to understand, access, and utilize the model.

- SYSTEM DOCUMENTATION - Detailed flow charts, variable name definitions and the requisite job control language to operate the model will be prepared.

4.4 TASK III SYSTEM TESTING AND VERIFICATION

TASK III is comprised of three basic sub-tasks which can be summarized as:

- Test and verify the modifications and sub-system models integrated in the Task II effort.
- Develop an appropriate input format to assist project managers in entering new project data into the system.
- Maintain the system and process project evaluations at the request of DOE/BCS.

DYNATREND recognizes that the successful completion of this task, without disruption, is of fundamental importance to BCS management. An accurate and responsive threshold evaluation system must be available, at all times, to respond to BCS needs.

4.4.1 Testing and Verification

The enhanced version of the model will be tested and verified utilizing actual BCS projects. A sample of projects that display a variety of characteristics will be subjected to an analysis with the new system. DYNATREND will thereby be able to verify the system's performance under a wide variety of situations. All new mathematical equations will be verified by manual computation according to the procedures defined in the program.

It should be noted that until the system has been tested, the modifications will not be available to the user. This will eliminate the possibility of evaluating a project on the basis of erroneous calculations. As stated previously, all modifications will be developed and tested on a separate copy of the program; when debugged and ready for operation, it will be switched with the then current program, which will become the copy used for subsequent modification.

4.4.2 Re-evaluation of Existing Projects

The modified system will significantly enhance the information base available to BCS management for project evaluation and funding decisions. After the integration and testing of significant changes to the model, at the request of BCS, DYNATREND will process all projects in the existing data file using the enhanced system. This process will be both cost and time effective due to the availability of the batch processing version of the Threshold model. Projects will be reviewed for significant changes in the values of the critical variables. Any project exhibiting such a change will be reviewed with the technical managers to determine the project's disposition.

4.4.3 Ongoing Operation of the Threshold System

DYNATREND has the requisite experience and staffing to be fully responsive to BCS in the day to day operation of the Threshold Evaluation System. We are committed to providing technical and management services in a timely manner to meet the particular needs of DOE/BCS.

BCS frequently requires project evaluations to be performed in a relatively short period of time. DYNATREND will respond to all project evaluation requests within 24 hours. We will assure that

DOE requests are met on the basis of the following procedures.

- A project team member will routinely be on-site at DOE two days per week to collect new input data and distribute evaluation reports.
- A project team member will be available to honor special evaluation requests at all other times.

4.4.4 Systematic Project Review

To insure that ERDA/BCS is meeting its goals and objectives, it is necessary to perform a periodic review of projects. This review will focus on the following questions:

- Are the type of projects being considered for funding consistent with goals and objectives of BCS?
- What is the range of energy savings realized?
- What are the characteristics of the federal and private investments?
- What are the variations in the critical values of EI, MEI, ETI?

To further assist DOE/BCS in accomplishing its goals, the spread sheet will be modified. To be an effective management tool, the spread sheet should provide:

- Summary data across all projects should be provided, such as:
 - Federal investment by year
 - Private investment by year
 - Energy savings by year, by type

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4.5.1 Operating Approach

DYNATREND will conduct sensitivity analyses at the direction of the technical manager. At this time, the exact number and type of analyses to be performed has not been defined by BCS. DYNATREND proposed to perform three separate, but related, sensitivity analyses. The rationale for the selection of the three proposed studies is based on our findings in an earlier study for BCS and represents a logical progression of enhancements to the model. Time and funding permitting, DYNATREND will be available to perform additional analyses.

4.5.2 Proposed Sensitivity Analyses

Although the content of each sensitivity analysis is subject to the discretion of the technical monitor, the following suggested analyses are typical of those to be performed:

- Effect of Energy Prices on IRR and Market Penetration - Fuel prices have significant impact on the consumer's decision to purchase energy conserving products. Typically, the consumer will make a decision to purchase a unit on the basis of the perceived rate of return on his investment based on an estimate of future changes in the price of energy. This sensitivity analysis will examine changes in the perceived IRR given the user's perception of price forecasts and its concurrent effect on market penetration.
- Useful Life Variations - The determination of a hardware units useful life at the RD&D stage involves a measure of uncertainty. Due to the major impact useful life has on the rate of return and market penetration, BCS must be capable of defining what changes in project selection will occur due to variations in the predicted useful life. The present IRR does not account for useful life differences

between new and substitute technology. This sensitivity analysis will explore alternative methodologies for hardware units with different useful lives.

- Use of Existing Market Penetration Models - Market penetration models have been developed for DOE under existing contracts and by the National Laboratories. This sensitivity analysis will investigate the feasibility of employing one of the available models, with modifications, in the Threshold system.

4.6 TASK V - FURTHER DEVELOPMENT AND STRENGTHENING OF THE SCORING MODEL

The scoring model is established to assist BCS management in the selection of a portfolio of projects (for DOE funding) that have passed the screening criteria. The emphasis in this task will be placed on strengthening the scoring model to better serve the BCS decision-maker in the project portfolio decision.

4.6.1 Strengthening the Scoring Model

The present scoring model is based on the assumption that one can quantify subjective judgements and rank order the projects according to these judgements. The model tries to incorporate all possible parameters that affect a potential project. Many of the sub-elements which make up the parameters are hard to measure in quantifiable terms. However, some of the elements, if approached differently, could be measured. For instance, the sub-element environmental impact could be directly reflected in the price of fuel as a shadow price. The reduction in fuel consumption or the use of a cleaner fuel type such as natural gas would be reflected in the shadow prices of the fuel type.

DYNATREND believes that a major problem is that the scoring model does not employ any economic criteria developed earlier in the threshold model. The only evaluation of quantitative economic

values for a project occurs during the screening model. This can result in a situation where a project meeting the minimum threshold levels in the screening model could be scored equally with projects having much larger economic benefits. Clearly, this will not result in the selection of the optimum portfolio.

A far more rational approach in determining how the optional portfolio will be selected would be to rank order the projects using objective economic criteria computed as a result of the screening analysis.

An approach using such criteria would be to use EI2 as the basis for the ranking. This and other similar methodologies will be explored.

SECTION 5

WORK BREAKDOWN STRUCTURE

The internal work breakdown structure (WBS) is provided in Figure 5-1. It is consistent with both the project organization structure presented previously and the task definition presented in Sections 3 and 4. Costs will be accumulated at the task level indicated in the WBS, and summarized through the WBS to provide management with the cost status compared with the scheduled accomplishment. The WBS is part of the DYNATREND job order cost planning and control system, and forms the basis for routine cost and performance reporting to the client, which is normally provided at level 2 of the WBS.

Each WBS element identifies the project team member accountable for the task (per Section 3).

WORK BREAKDOWN STRUCTURE

FIGURE 5-1

SECTION 6

MANAGEMENT CONTROL PROCEDURES

6.1 MANAGEMENT CONTROL

Successful management of all projects requires that the project have an organizational structure which enhances management control, that the management staff duties be comprehensively and clearly defined, and that adequate control procedures be established and enforced. These needs are discussed in the following sections.

6.1.1 Organization

The project organization is presented in Section 3. Note that all control and reporting responsibilities are clearly defined.

6.1.2 Project Management Staff Duties

Successful achievement of the threshold contract objectives is dependent on the skills and experience of the Principal in Charge and the Project Manager. The Principal in Charge has authority to act for the company in all matters related to the contract (technical, contractual, fiscal), and will be fully responsible to DOE for the execution of all phases of the project including:

- Analysis, interpretation, and execution of the project technical, management, and administrative requirements.
- Establishment and assignment of functional task responsibilities.
- Business Services - maintenance of job cost accounting system, preparation of billing vouchers, processing of payrolls and other employee claims, etc.

- Publications - typing, art work, drafting, photography, editing, and related activities required to produce reports, charts, drawings, slides, viewgraphs, and similar material necessary for communication and dissemination of information.

The Project Manager, reporting to the Principal in Charge will have responsibility for timely and cost-effective completion of all technical activities associated with the contract.

6.2 MAJOR PROJECT MILESTONES

Major project milestones are shown in Figure 2-1. These milestones are presented by task with the exception of contractual reporting requirements which are presented at the bottom of the schedule. Two schedule deviations should be noted. The submission of the contract management plan and TASK I report were postponed to facilitate the incorporation of several modifications into the Threshold system.

6.3 DETAILED CONTRACT SCHEDULE

A detailed contract schedule is presented in Figure 6-1 with all significant subtasks identified. TASK I, analysis of the current model, will be completed by 18 November. Each of the approved enhancements to the Threshold system will have been implemented under TASK II at that time with the exception of a revised spread sheet report. The three remaining work items in TASK II, restructuring of the Threshold computer program and integration of the two subsystem models will occur as scheduled. TASK III includes routine operation of the system, an ongoing task. An updated users guide will also be prepared under TASK III. Four sensitivity analyses will be performed in TASK IV, each spanning approximately 1.5 months. The scheduling of each analysis is flexible allowing special studies to be performed in response to DOE requests.

FIGURE 6-1

THRESHOLD CONTRACT SCHEDULE

Development and integration of an enhanced scoring model will begin in March, 1978 with the scoring model being available for use in May. All contractual reporting requirements are displayed in accordance with the Reporting Requirements Checklist.

6.4 MANAGEMENT CONTROL PROCEDURES

DYNATREND utilizes several internal project control procedures to monitor cost and schedule progress of all contracts. Project man-hours and costs are reported internally in single report. Weekly computerized Project Cost Reports are distributed to each Program Manager, and responsible Task Manager. Figure 6-3 displays a sample set of Project Cost Reports. Cost Report (1) is the summary for the D1014 Contract, and encompasses the entire Contract Work Breakdown Structure. Cost Report (2), D1014-10, is for level 2 of the WBS, reflecting one of three major work subdivisions. Cost Reports (3), for example, D1014-1010 through D1014-1020 are level 3 of the WBS. Note there are two discrete subdivisions of work at level 3 in Task D1014-10.

The project cost reports reflect and relate directly to the Budgetary allocations and the CWBS. Our project cost reporting system is currently incorporating the budgetary baseline allocations into display format. In the interim, DYNATREND uses the Program Status Report (see Figure 6-4), to display project cost performance against budgeted elements of cost over time. This report is updated in accordance with the cost activity and the dynamic nature of the particular program, but never less than once a month.

We currently format our cost reports by Work Breakdown Structure element, and collect actual direct and indirect costs by the same element of cost nomenclature used by DOE. We also currently budget and collect actual labor costs by both man-hours, location, and labor category. Thus the DYNATREND cost and manpower information is highly compatible with DOE standard cost reporting procedures. The ERDA Form 536 Contract Management Summary Report is similar

FIGURE 6-3
SAMPLE PROJECT COST REPORT

D1014-TOTAL ① 05/01/77									
FUNDED TO DATE	0.00							CONTRACT EST COST	0.00
DL HRS/ /\$	THIS WEEK		MONTH-TO-DATE		FISCAL YEAR-TO-DATE		CONTRACT-TO-DATE		
OVMD									
BURLINGTON	293.0	3680.12	293.0	3680.12	6861.5	147070.09	6861.5	147070.09	
	3312.11		3312.11		132363.08		132363.08		
ARLINGTON	116.0	1274.00	116.0	1274.00	2118.0	41605.40	2118.0	41605.40	
	1146.60		1146.60		37444.86		37444.86		
WASHINGTON-FRA	392.0	4132.40	392.0	4132.40	6556.0	115438.90	6556.0	115438.90	
	1652.96		1652.96		46175.56		46175.56		
PHILADELPHIA	200.0	1874.00	200.0	1874.00	3480.0	59421.80	3480.0	59421.80	
	1686.60		1686.60		53479.62		53479.62		
WASH-SOUTHWEST	00.0	0.00	00.0	0.00	628.0	12709.60	628.0	12709.60	
	0.00		0.00		11438.64		11438.64		
TOTAL	1001.0	10960.52	1001.0	10960.52	19643.5	376245.79	19643.5	376245.79	
	7798.27		7798.27		280901.76		280901.76		
MATERIAL	0.00		0.00		0.00		0.00		
SUB & CONSLT	0.00		0.00		63764.91		63764.91		
OTHER DIRECT	0.00		0.00		12942.88		12942.88		
TRAVEL	0.00		0.00		30999.29		30999.29		
COMPUTER TIME	0.00		0.00		546.00		546.00		
GEN & ADMIN	2813.82		2813.82		114810.09		114810.09		
INTER-DIV	0.00		0.00		16809.85		16809.85		
TOTAL	21572.61		21572.61		897020.57		897020.57		

D1014-10XX ② 05/01/77									
FUNDED TO DATE	0.00							CONTRACT EST COST	0.00
DL HRS/ /\$	THIS WEEK		MONTH-TO-DATE		FISCAL YEAR-TO-DATE		CONTRACT-TO-DATE		
OVMD									
BURLINGTON	197.0	1776.43	197.0	1776.43	808.0	7162.26	808.0	7162.26	
	1598.81		1598.81		6446.03		6446.03		
ARLINGTON	44.0	647.60	44.0	647.60	152.0	2160.80	152.0	2160.80	
	582.84		582.84		1944.72		1944.72		
WASHINGTON-FRA	270.0	3424.20	270.0	3424.20	1122.0	13767.80	1122.0	13767.80	
	1369.68		1369.68		5507.12		5507.12		
PHILADELPHIA	160.0	1674.00	160.0	1674.00	672.0	6995.60	672.0	6995.60	
	1506.60		1506.60		6296.04		6296.04		
WASH-SOUTHWEST	00.0	0.00	00.0	0.00	00.0	0.00	00.0	0.00	
	0.00		0.00		0.00		0.00		
TOTAL	671.0	7522.23	671.0	7522.23	2754.0	30086.46	2754.0	30086.46	
	5057.93		5057.93		20193.91		20193.91		
MATERIAL	0.00		0.00		0.00		0.00		
SUB & CONSLT	0.00		0.00		0.00		0.00		
OTHER DIRECT	0.00		0.00		0.00		0.00		
TRAVEL	0.00		0.00		0.00		0.00		
COMPUTER TIME	0.00		0.00		0.00		0.00		
GEN & ADMIN	1887.03		1887.03		7542.06		7542.06		
INTER-DIV	0.00		0.00		0.00		0.00		
TOTAL	14467.21		14467.21		57822.43		57822.43		

FIGURE 6-3 (Continued)

FUNDED TO DATE		0.00		01014-1010 05/01/77		3		CONTRACT EST COST		0.00	
DL HRS/	/S	THIS WEEK		MONTH-TO-DATE		FISCAL YEAR-TO-DATE		CONTRACT-TO-DATE			
OVHD											
BURLINGTON		00.0	0.00	0.00	0.00	24.0	158.30	24.0	158.30		
ARLINGTON		00.0	0.00	0.00	0.00	00.0	142.47	00.0	142.47		
WASHINGTON-FRA		03.0	41.40	03.0	41.40	75.5	865.10	75.5	865.10		
PHILADELPHIA		20.0	16.56	20.0	16.56	40.0	346.04	40.0	346.04		
WASH-SOUTHWEST		00.0	177.84	00.0	177.84	00.0	409.60	00.0	409.60		
TOTAL		23.0	0.00	23.0	0.00	139.5	0.00	139.5	0.00		
MATERIAL			194.40		194.40		857.15		857.15		
SUB & CONSLT			0.00		0.00		0.00		0.00		
OTHER DIRECT			0.00		0.00		0.00		0.00		
TRAVEL			0.00		0.00		0.00		0.00		
COMPUTER TIME			0.00		0.00		0.00		0.00		
GEN & ADMIN			65.01		65.01		343.52		343.52		
INTER-DIV			0.00		0.00		0.00		0.00		
TOTAL			498.41		498.41		2633.67		2633.67		

FUNDED TO DATE		0.00		01014-1020 05/01/77		3		CONTRACT EST COST		0.00	
DL HRS/	/S	THIS WEEK		MONTH-TO-DATE		FISCAL YEAR-TO-DATE		CONTRACT-TO-DATE			
OVHD											
BURLINGTON		56.0	357.84	56.0	357.84	201.0	1786.10	201.0	1786.10		
ARLINGTON		00.0	0.00	00.0	0.00	16.0	1607.49	16.0	1607.49		
WASHINGTON-FRA		61.0	812.20	61.0	812.20	232.0	177.60	232.0	177.60		
PHILADELPHIA		110.0	159.84	110.0	159.84	312.0	2966.70	312.0	2966.70		
WASH-SOUTHWEST		00.0	324.88	00.0	324.88	00.0	1186.68	00.0	1186.68		
TOTAL		227.0	1157.60	227.0	1157.60	761.0	3258.00	761.0	3258.00		
MATERIAL			1041.84		1041.84		2932.20		2932.20		
SUB & CONSLT			0.00		0.00		0.00		0.00		
OTHER DIRECT			0.00		0.00		0.00		0.00		
TRAVEL			0.00		0.00		0.00		0.00		
COMPUTER TIME			0.00		0.00		0.00		0.00		
GEN & ADMIN			613.79		613.79		5886.21		5886.21		
INTER-DIV			0.00		0.00		0.00		0.00		
TOTAL			4705.75		4705.75		16185.80		16185.80

TITLE _____

WORK ORDER _____ CONTRACT TYPE _____ ISSUE _____

PROGRAM MANAGER _____ CURRENT FUNDING LEVEL _____

REPORTS REQUIRED _____ CRDL ITEMS _____ 75% CLAUSE _____ OTHER _____

	NEGOTIATED COST ELEMENTS	ACTUALS* TO DATE	COSTS AVAILABLE TO COMPLETE
DIRECT LABOR	_____	_____	_____
ENGINEERING OHD	_____	_____	_____
TRAVEL	_____	_____	_____
SUBCONTRACTS	_____	_____	_____
OTHER DIRECT	_____	_____	_____
COST S/T	_____	_____	_____
G&A	_____	_____	_____
TOTAL COST	_____	_____	_____
FEE	_____	_____	_____
TOTAL COST & FEE	_____	_____	_____

FIGURE 6-4. PROGRAM STATUS REPORT

to our DYNATREND Program Status Report (reference Figure 6-4). The DYNATREND form provides additional visibility into each element of cost, budget, actual costs, and variance. Where required, the DYNATREND Project Manager has the plot completed for direct labor, hours, and subtotal program costs to provide biweekly, monthly, or quarterly variance visibility and analysis.

6.5 REPORTING REQUIREMENTS

Detailed schedule activities are listed in Table 6-1. The Project Manager is responsible for proper and timely submission of all reports. Status reports are required bi-monthly for TASK III. These reports will identify all new BCS projects evaluated during the reporting period, present an analysis of the characteristics of the projects under review and the status of proposed enhancements to the model. All contractual reporting requirements will be submitted to DOE on ERDA forms 533M and 536 accompanied by a Technical Status Report including progress, problems, and conference records. Two additional reports presenting the results of the TASK I investigation and a final report will be required. The final report, in addition to presenting contract accomplishments will include the results of each sensitivity analysis and TASK V, Further Development and Strengthening of the Scoring Model.

6.6 PROJECT STATUS REVIEWS

DYNATREND holds internal Project Status Reviews monthly. At these reviews, the technical, schedule, and cost status of each task will be briefly discussed. These individual status reports will then be aggregated to provide a project status report. This report will be discussed at project status briefings held bi-monthly with BCS.

In keeping with DYNATREND's philosophy of management by exception those tasks proceeding according to plan will be reported in summary form. However, tasks not proceeding according to plan will be reported in detail.

TABLE 6-1

CONTRACT REPORTING REQUIREMENTS

<u>Data Item</u>	<u>Frequency</u>
Management Plan	15 days after contract execution
TASK I Report	60 days after contract execution
TASK III Report	Bi-monthly
TASK III Briefing	Bi-monthly
Technical Status Report	Monthly
Contract Management Summary Report	Monthly
Cost Management Report	Monthly
Final Report - Draft	Contract Completion
Final Report - Final	30 days after receipt of DOE Comments