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IMPLEMENTATION PLANNING FOR INDUSTRIAL ENERGY
CONSERVATION: APPROACH AND METHODOLOGY

by

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1 INTRODUCTION AND SUMMARY

1.1 PURPOSE OF REPORT

The Conservation Technology Implementation Branch (CTIB) of the Office of Industrial Programs (OIP) has conducted implementation planning in three industries -- steel, pulp/paper and agriculture/food processing. Each of these industry-specific studies was conducted by a different contractor:

- Battelle Columbus, "Implementation of Energy Conservation Technology in the Steel Industry," 1980.¹
- RPA, Inc., "Action Programs for Commercializing Energy-Saving Technologies in the Pulp and Paper Industry," 1980.²
- Centec Corp., "Technology Implementation Strategy for the Agriculture and Food Processing Industries," 1980.³

While the three reports are individually useful, each contractor has a different interpretation of what constitutes an "implementation plan." Furthermore, the wide variations in approach and assumptions make it difficult for CTIB to compare the relative costs and benefits of implementing recommended projects in the three different industries.

In FY 1981, CTIB intends to conduct implementation planning for six additional industries -- chemicals, petroleum refining, aluminum, glass, cement and textiles. The purpose of this present report is to guide the contractor for each industry toward a common methodology in terms of approach, areas of analysis, assumptions and reporting. The results and recommendations of each implementation study can then be more useful to CTIB, with industry-specific changes in approach and assumptions defined within the framework of the suggested methodology.

1.2 SUMMARY

An industry-specific CTIB implementation plan is made up of two major parts:

1. An implementation study consisting of technology selection, market demand analysis and policy analysis.
2. A plan consisting of a detailed description and schedule of future CTIB actions, followed by a recommended system for monitoring market results when the plan is implemented.

The first major task, technology selection, involves four principal steps (Fig. 1):

Technology Selection

1. Assembly of a list of technologies from industry, DOE/OIP, consultants, etc.

Figure 1

TECHNOLOGY IMPLEMENTATION PLANNING

2. Screening, using two criteria --
 - (i). has the technology been adequately demonstrated?
 - (ii). can CTIB assistance clearly accelerate market penetration?
3. Ranking, using criteria that fall into six categories --
 - (i). short run energy savings potential
 - (ii). long run energy savings potential
 - (iii). type of fuel saved
 - (iv). financial attractiveness to end-users
 - (v). financial attractiveness to vendors
 - (vi). degree of uncertainty (risk)
4. Selection of technologies from the ranked list for market demand and policy analysis.

The second major task, market demand analysis (for each selected technology) involves six principal steps (Fig. 1):

Market Demand Analysis

1. Evaluation of market in terms of potential current and projected applications and energy savings, end-use segments, geographic concentration, user concentration, similarity of end-use, etc.
2. Evaluation of competing technologies in terms of commercial availability, quality of marketing, user need, etc.
3. Economic analysis in terms of capital requirements and ROI to users and vendors.
4. Industry survey research to verify previous market conclusions, analyze the buying decision process, assess buying intentions, identify early adopters and early suppliers, etc.
5. Market penetration analysis based on technology performance, risk, assessment of market needs, competing technologies, buying intentions, private-sector marketing programs/plans, etc.
6. A base-line market penetration forecast, assuming no CTIB assistance.

The third major task, federal policy analysis (for each selected technology), involves four principal steps (Fig. 1):

Federal Policy Analysis

1. Identification of barriers -- technical, financial, supply, marketing, institutional -- to market penetration.

2. Identification of federal policy options -- primarily those available to CTIB -- for overcoming market barriers.
3. Specification of alternative CTIB policies -- with and without other government actions -- for increasing market penetration.
4. Analysis of the cost/benefit ratios of increasing market penetration by alternative CTIB policies.

The fourth major task, formulation of an implementation plan (for each selected technology), involves two principal steps (Fig. 1):

Implementation Plan

1. Detailed description and costing of future CTIB implementation actions, including a commercialization schedule which identifies suppliers and targets specific market segments, early adopters, etc.
2. Formulation of a system for monitoring market results when the plan is implemented.

While the format and contents of each final report will vary according to industry characteristics and the technologies selected for implementation, the following should be included:

- Industry Characterization
- Technology Identification/Selection
- Market Demand Analysis
 - market potential
 - market segments
 - early adopters
 - early suppliers
 - market penetration
- Policy Analysis
- Implementation Plan
 - CTIB actions
 - commercialization schedule
 - monitoring
 - budget/manpower requirements
- Industry Interview
 - lists of contacts, by task
 - survey methods
 - criteria for selection of contacts
 - percent of industry contacted (by output)
 - potential early users
 - technology suppliers

2 INDUSTRY INTERVIEW

Successful implementation planning is heavily dependent upon industry expertise and opinion, particularly in the areas of market demand analysis and federal policy analysis. Suggested types of industry contact for each implementation planning task are shown in Table 1. While this table should be used as a guide, the number of interviews carried out will depend on the specific technology and the extent of industry concentration.

Industry contact is important for technology selection, both in the choice and application of screening/ranking criteria, and in the identification of technologies. Implementation assistance from CTIB is not limited to technologies developed by DOE/OIP. Many energy-saving technologies developed and demonstrated by the private sector may not be successfully marketed for a variety of reasons, e.g., user inertia, lack of resources for a strong marketing program, etc. In assembling and ranking lists of technologies, interviews should be conducted primarily with personnel in R&D, energy management and production. For ranking, additional interviews may be necessary with marketing (to establish the growth rate of an industry or process), financial/economic (to establish financial criteria), plant management (to assess operator attitudes), and engineering and environmental control (to identify possible environmental problems).

Industry interview is essential in all phases of market demand analysis, especially for the construction of a realistic market penetration forecast. While penetration models are useful tools, industry contact is necessary to assess buyer inertia, industry tradition, strengths/weaknesses of marketing and communications programs, industry image of potential suppliers of the new technology, etc. While the number and type of interviews conducted for market demand analysis are both industry- and technology-specific, it is important that all major potential users are interviewed. It is also vital to identify the potential early users and early suppliers of the technology, both for technical/market analysis and for formulation of CTIB communications programs and commercialization schedules.

Industry input is also necessary for policy analysis, particularly to establish industry attitudes on the likely effectiveness of recommended CTIB policies and actions. The final implementation plan should be linked to targeted buyers, with specific decision dates and installation schedules.

The final report should contain a section on industry interview, detailing lists of contacts (by task), survey methods used, criteria for selection of contacts, and percent of industry contacted (by output). Potential early users should be identified, together with the criteria used for their selection.

Table 1

INDUSTRY INTERVIEW

Task	Industry Contact					
	R&D	Energy	Production	Plant	Environmental	Marketing
TECHNOLOGY SELECTION						
Technology List	x	x	x			
Screening	x	x	x	x		
Ranking	x	x	x	x	x	x
Technology Selection						
MARKET DEMAND ANALYSIS						
Market Potential			x			
Competing Technologies	x		x	x	x	
Economic Analysis				x		
Survey Research			x	x	x	x
Market Penetration Analysis		x	x	x	x	
Market Penetration Forecast			x	x		
FEDERAL POLICY						
Barriers to Penetration		x			x	
Identification of Options						
CTIB Policies		x			x	
Cost/Benefit Analysis						
IMPLEMENTATION PLAN						
CTIB Actions		x			x	
Monitoring		x				

3 TECHNOLOGY SELECTION

The objective of the selection process is to identify, from a list of technologies, those that have a reasonably good chance of successful utilization in the private sector. These few will be subject to an intensive marketing and policy analysis for full-scale implementation.

To effectively evaluate the market potential of each technology, a thorough market and policy analysis should be a part of the selection process. However, such an intensive study of each technology could be time consuming and expensive. Instead, the selection process attempts to rank those technologies which are most deserving of CTIB support. The top contenders are then chosen for further market and policy analysis.

3.1 LIST OF TECHNOLOGIES

The first step in selecting technologies eligible for CTIB support is to identify technologies relevant to the particular industry and develop a "laundry list" of these technologies. There are several sources for this list:

1. DOE/OIP Technologies

OIP has identified many technologies for possible RD&D and implementation support in a variety of industries.

2. Consulting Firm Reports

Other technologies may be gathered from lists that are available to consulting firms familiar with the particular industry.

3. Companies

The best source of technologies are individual companies within the industry of interest. Two types of companies should be contacted -- vendors (suppliers) and producers. These companies are often willing to divulge non-proprietary information for the benefit of possible OIP support in commercialization.

4. Other

Additional technologies may be found in the literature, or from other sources such as universities, etc.

Once an adequate list of technologies has been gathered, screening criteria can be applied.

3.2 SCREENING OF TECHNOLOGIES

3.2.1 Screening Criteria

CTIB is primarily interested in funding those technologies that (1) have already been demonstrated and (2) need federal assistance for commercialization. Therefore, all the technologies which have not been adequately demonstrated or already have a funded marketing plan are screened out. These two screening criteria should be applied to each technology contained in the initial "laundry list." A more detailed discussion of the two criteria follows:

1. Adequate Demonstration

The first criterion tries to provide an answer to the question -- Has the technology been adequately demonstrated? "Adequate demonstration" means that the technology has been in operation in a representative plant under typical operating procedures for an appropriate length of time. In addition, operating data must be readily available from the time of installation. If the answer is "yes," the technology passes through this screening criterion.

2. Need for Federal Assistance

If a private vendor has already developed a marketing plan and has the resources to market a given technology, then no OIP assistance can be justified. Similarly, if the technology is "commercially available" to the industry, then the technology should not pass this criterion. However, if it appears that the private sector is not planning to market the particular technology, then a need for OIP assistance could be established.

When a demonstrated technology is likely to be implemented by industry alone, then CTIB has no role. Only when technology implementation will not take place within the immediate future without federal assistance should OIP consider the technology as a potential candidate for support.

3.2.2 Difficulties with Screening Criteria

The purpose of the initial screening of technologies is to reduce an initial "laundry list" to a short list of technologies to which ranking criteria will be applied.

Principally because of our definition of "adequate demonstration," it is likely that the screening criteria will leave too few technologies on the new list. The "adequate demonstration" criterion may be theoretically ideal but in reality it may be too strict. The difficulties stem from the definition's requirements:

- a) Use of the technology for an "appropriate" length of time.
- b) Use of the technology in a "representative" plant.
- c) The plant is to use typical operating procedures which are undefined.
- d) The company using it would be willing to share detailed operating data.
- e) The company using it would be ready to collect and provide the detailed operating data.
- f) The company using it has measured and documented the needed operating data.

Requirements (a), (b) and (c) may cause difficulties unless interpreted flexibly. Similarly (d), (e) and (f) may cause considerable difficulty unless a demonstration project has been publicly funded. Our suggestion is that if the demonstration criterion eliminates too many technologies then some of its stricter elements should be revised.

The main problem in applying the other criterion (need for federal assistance) is to obtain information about the internal plans of private companies. Outside evaluators may encounter severe obstacles in obtaining the type of information required by this criterion. Nevertheless, it is important to verify that an OIP implementation program will significantly accelerate private sector utilization of the technology.

3.2.3 Completing the Screening Process

All the technologies which meet the two screening criteria should be included on a second list of technologies which are candidates for OIP implementation support. The contractor, using its own staff and/or a panel of industry experts selected by the contractor and OIP, should perform the screening. Planned effort should be agreed upon by both the contractor and CTIB. Assumptions should be listed, and be consistent across different technologies and different screeners. Any substantial change in screening criteria should be discussed with CTIB and fully documented.

3.3 RANKING OF TECHNOLOGIES

When the screening process is completed, the remaining technologies can then be ranked in order of those most deserving of indepth study. Since this ranking considers only technologies that already have been demonstrated, much of the information needed to evaluate the technologies can be taken from the demonstration data. It is expected that the evaluation and ranking of new technologies based on demonstration data will be considerably more objective and accurate than the evaluation during the initial screening process.

Nevertheless, some criteria may still require judgment. Therefore, it is suggested that each of the technologies be evaluated on each of

the following 6 criteria by a number of experts. We recommend a modification of the Delphi Technique, in which a panel of 5 or 6 experts will judge each technology on each of the 6 criteria individually based on personal expertise and the demonstration data. A mean of the points for each criterion will determine that criterion's score.

3.3.1 Proposed Ranking Criteria

The proposed criteria provide an outline of the main criteria we feel should be included in the evaluation and ranking of new energy-efficient technologies, which are potential candidates for support by CTIB. We have tried to reduce the number of criteria for two main reasons:

1. Simplification of the ranking process.
2. Relation of criteria to the main goals of CTIB.

The main goal of CTIB is to promote those new technologies that have the biggest potential for energy savings, both in the short and long run, and which are likely to be financially attractive, without permanent federal incentives, to both end-users and to vendors.

The six criteria we are proposing are:

1. Amount of energy savings in the short run (up to 3 years).
2. Amount of energy savings in the long run.
3. Type of energy saved by new technology.
4. Financial attractiveness of new technology to end-users.
5. Financial attractiveness of new technology to vendors.
6. Degree of uncertainty associated with new technology.

Each of these six criteria will be covered by one or several operational criteria:

1. Amount of energy savings in the short run

In this measure each expert should make a judgment about the expected amount of energy savings per year in the third year of the implementation process (first year, second year or fifth year could be alternative or additional measures).

The following operational measures are recommended:

- 1a. Base use

In the absence of CTIB support, what percentage of the industry (in terms of % of output) do you expect to adopt and use the particular technology in the third year of its implementation?

	<u>Points</u>
- 0-5%	1
- between 5 and 10%	2
- more than 10%	3

1b. Acceleration factor

What degree of acceleration of the implementation process would be achieved by providing assistance to the particular technology? Given CTIB support, what percentage of the industry (in terms of the % of output) do you expect to have adopted the particular technology in the third year of its implementation?

	<u>Points</u>
- less than 10%	1
- between 10 and 20%	2
- more than 20%	3

1c. Total energy savings

Based on the technical description of the technology, the demonstration data and your judgment on the first two operational measures, how much energy will be saved by end-users in the third year of implementation by providing OIP support and assistance to the particular technology?

	<u>Points</u>
- low*	1
- average*	2
- high*	3

2. Amount of energy savings in the long run

The purpose of this criterion is to go beyond the immediate uses of a proposed energy-efficient technology and estimate its energy saving potential in the long run. This would take into account both increased use of the technology in the currently proposed processes as well as in other uses which may require some small modification and adaptation.

2a. Potential future applications

Given CTIB support and assistance to the particular technology, how many potential new applications are there (in a 5-7 year period) which require only minor modifications?

	<u>Points</u>
- very few*	1
- several*	2
- many*	3

* Industry-specific ranges to be set by agreement between contractors and CTIB.

2b. Industry growth

This question tries to obtain information on the long run potential energy savings by focusing on the growth of the industry segment in which the technology would be utilized. For a period of 6 years, what rate of change in industry output do you expect?

	<u>Points</u>
- decline or steady	1
- an average annual increase of 5% or less	2
- an average annual increase above 5%	3

2c. Total energy savings

Based on your judgments on the first two measures, how much energy will be saved by end-users in the fifth year of implementation by providing CTIB support and assistance to the particular technology?

	<u>Points</u>
- low*	1
- average*	2
- high*	3

3. Type of energy saved

3a. Scarcity of energy saved

What type of energy is saved by the new technology?

	<u>Points</u>
- electricity, coal	1
- natural gas or natural gas liquids	2
- petroleum	3

This criterion may receive special weight or it could be included in the screening criteria.

4. Financial attractiveness of new technology to end-user

Three operational measures have been proposed for this criteria.

4a. ROI for end-user (purchaser)

The Discounted Internal Rate of Return on Investment is one of the best measures of profitability.

	<u>Points</u>
- 15-30%	1
- 30-50%	2
- > 50%	3

* Industry-specific ranges to be set by agreement between contractors and CTIB.

4b. The initial capital and installation cost to end-user

Capital cost can be a significant deterrent to utilization of a technology.

	<u>Points</u>
- high*	1
- medium*	2
- low*	3

4c. Indirect Cost

The introduction of a new technology brings with it several types of indirect costs. Several categories of these types of costs listed below but others should also be considered.

Estimate the cost of disruption of the plant and/or production caused by the installation and use of the technology; the cost of downtime in existing processes; the cost associated with changes in plant and/or production procedures required for operation (e.g., hiring new personnel, training programs, etc.)

Do you anticipate that these indirect costs could be:

	<u>Points</u>
- major	1
- moderate	2
- minor	3

Comments:

Additional financial measures could be added. Net Present Value (NPV) and Payback Period are the most obvious. These duplicate 4a, each having its own advantages and shortcomings. In order to avoid redundancy, we have chosen to use only one measure (Discounted Internal Rate of Return).

5. Financial attractiveness to vendors

5a. ROI for vendors

The Discounted Internal Rate of Return on Investment for the vendor (including all direct and indirect costs and all revenue generated by the new technology).

	<u>Points</u>
- 15-30%	1
- 30-50%	2
- > 50%	3

* Industry-specific ranges to be set by agreement between contractors and CTIB.

5b. Capital investment for vendor

Given wide uncertainty in future sales, potential production of a new energy-efficient technology will be influenced by the capital cost of additional manufacturing facilities.

	<u>Points</u>
- high*	1
- medium*	2
- low*	3

6. Degree of uncertainty

There are several sources for uncertainty in the evaluation of the energy saving potential and the financial attractiveness of a new energy-efficient technology.

Some will be listed as separate items; others could be added. All should be incorporated in the overall measure of uncertainty (6e).

6a. Quality of data

The evaluation of all new energy-efficient technologies will be based on some demonstration data, since the screening process requires "adequate demonstration." However, there could be variation in the completeness and quality of the data.

Is the quality and completeness of the demonstration data:

	<u>Points</u>
- poor	1
- good	2
- excellent	3

6b. Vendors' interest

Are there vendors who are seriously interested in the production, marketing, sale and service of the new technology?

	<u>Points</u>
- none have keen interest/a few may consider it	1
- a few have interest/one shows keen interest	2
- several have keen interest	3

* Industry-specific ranges to be set by agreement between contractors and CTIB.

6c. External restrictions

Does the new technology conflict with any existing law or regulation? What kind of environmental or safety problems could be caused by the new technology? Are these potential problem areas?

	<u>Points</u>
- major	1
- moderate	2
- minor	3

6d. Industry attitude

What is the industry attitude toward innovation in general? What is the industry attitude toward energy-saving technologies in particular?

	<u>Points</u>
- negative	1
- neutral	2
- positive	3

6e. Overall measure of uncertainty

Incorporating all the measures above and any other you feel are pertinent, what is your overall judgment of the degree of uncertainty associated with the particular technology?

	<u>Points</u>
- high	1
- medium	2
- low	3

Comments:

One could use only measure 6e or give it a higher weight than to the other measures.

Summary of Proposed Criteria:

We have considered six criteria, each containing between one and five operational measures. The total number of operational measures is 17. These could be reduced since there is redundancy in several of the measures.

3.3.2 Criteria Weighting

Since not every criterion and every measure is of equal importance, weights should be assigned to each criterion and each measure. The criteria would probably best be divided into several groups or ranked according to importance. For example, each criterion in the most important group could

have a weight of 3 while the next group could have a weight of 2. Again, a panel of experts could be used to determine these weightings using the Delphi technique. It is important to emphasize that any weighting of ranking criteria must be industry-specific.

3.3.3 Problems with Ranking Criteria

Six criteria have been proposed, a number probably large enough to cover the complexity of the problem they are intended to assess. The number of operational measures is 17, a number which should probably be reduced. It should be emphasized that each of the six criteria is more important than any one specific operational measure. The six criteria have been chosen to provide a clear framework for assessing new energy-efficient technologies. The specific measures could be modified or changed. As noted earlier, there is considerable overlap among some of the operational measures.

What is important is that all new energy-efficient technologies for a specific industry should be evaluated using the same criteria, the same operational measures, and the same set of experts. The ranges given in several of the operational measures should be the same for all technologies and for all evaluators in a given industry.

3.3.4 Final Ranking and Selection of Technologies

The aim of the ranking procedure is to assign to each technology a single number by which all the technologies can be compared and ranked. Each member of the panel assigns a point score (1, 2 or 3) to each criterion. The mean point score for each criterion is then multiplied by the criterion's weight. The sum of the products serves as the single number for that technology. The technologies are then ranked in order, three being selected for detailed market and policy analysis. The selected technologies would be the top three from the ranked list, unless discussions between the contractor and CTIB indicate otherwise.

4 MARKET DEMAND ANALYSIS OF SELECTED TECHNOLOGIES

The purpose of a market analysis for an industrial product, whether it be an energy-efficient technology or not, is to reduce uncertainty as to user needs and the market for the product. The market analysis is also a decision tool in choosing an implementation strategy for a technology. An industrial market analysis can be broken down into four major components: (i) a study of the past market and the potential future market from secondary information sources, (ii) an economic analysis of the technology in terms of the costs and benefits to the end-user and the vendor, (iii) primary research on the market for the technology, and (iv) a market penetration analysis of the technology.

The following points are important in any market analysis:

1. The market for an industrial product is not usually restricted to one industry segment. Thus, the reasons for success or failure of a technology in one industry segment can be instructive as to what actions need to be taken to increase implementation of the technology in the industry segment under study.
2. The industrial buying process is complex and reflects several factors: the influence of the buyers formal organization, the large number of persons involved, and the complex technical and economic factors involved. Any analysis of the market must take the buying process into account.
3. The technology under analysis does not exist in a vacuum. Rather, it must compete against new and existing technologies and the prejudices of the end-user.
4. An essential attribute of the technology is that it be perceived as serving a present or future need of industry. If it cannot be shown as serving a need, the probability of successful implementation will be very low.

4.1 INDUSTRIAL MARKET STUDIES

The study of the market for a technology requires reliance on numerous secondary information sources such as the Department of Commerce, Department of Agriculture, trade associations, trade journals, etc. A listing of a number of these sources and directories for locating these sources is provided in Appendix I. The objective of the market study is to gauge the size of the market, the current trends, and the various market segments. Specific areas which would be covered in a typical market study would include the following:

1. Current and projected market in terms of number of applications and associated energy savings (5 year historical and 5 year projected, typically).

2. Breakdown of the total market into end-use segments.
3. Analysis of the competitive situation in the market.
4. Identification of competing technologies and regulatory situations which might diminish the technology's life-cycle.
5. Analysis of the buying decision process within companies that constitute the market.
6. Other major market or technology factors which will affect the implementation potential.

These areas are discussed in greater detail below.

4.1.1 Current and Projected Size of Market

The analysis of the size of the market for a particular technology cannot usually be done with a high degree of precision unless one has unit shipment figures from all vendors of a particular type of equipment. An estimate usually must be derived through the use of sources such as the U.S. Industrial Outlook, the Census of Manufacturers, the Annual Survey of Manufacturers and the Current Industry Reports published by the Bureau of Census. The analysis of future trends in the market can be accomplished by a regression analysis, but should be supplemented by an informal survey of knowledgeable persons which might include the industry officer at the Bureau of Industrial Economics in the Department of Commerce, trade association representatives, industrial marketing managers, and industry experts. Based on this analysis of market size, a determination can be made as to whether the market trend is growth, no-growth or decline. If the technology is newly introduced and there is little or no historical data on the technology, the analysis should be supplemented by examining equipment which the technology can potentially replace or eliminate.

4.1.2 End-Use Industries Characterization and Segmentation

A characterization of the end-use industry segments is required in determining the potential for technology implementation. The characterization and segmentation of the industry should also provide information as to where the implementation strategy should focus. Markets may be technically segmented by operating parameters (capacity, temperature ranges, etc.) and design parameters (end-product, raw materials, etc.). The following factors should also be included in the characterization and segmentation:

- geographic distribution of the industry segment
- concentration of production
- influence of large processing concerns in the industry
- regulation of the industry
- labor relations

- financial profiles of companies which make up the industry
- major plant locations
- energy innovation adopters in the industry.

Any other information about the industry which will assist in determining either the potential for technology adoption, industry needs, or the focus of an implementation strategy should be included in the characterization.

4.1.3 Vendor Competition

This section of the market study should focus on the vendors of the technology and other substitute equipment. Each vendor should be briefly profiled as to:

- its technology offering
- other product lines which the vendor sells to the industry
- sales of the technology to other industries
- market share

The profile should also provide information on the relationship between the industry and the vendor. An overview of the competitive situation between the vendors should be included, particularly with regard to innovation and introduction of energy-conserving technologies.

4.1.4 Competing Technologies

Technologies which would compete directly or indirectly with the technology under study should, where possible, be identified. This would include equipment which is currently available or in development. Those technologies which would indirectly compete against the one under study might include, for example, process improvements which would make waste energy recovery less economically attractive.

4.1.5 The Buying Process

An analysis of a "typical" decision process for the purchase of capital equipment within the industry should be conducted. This analysis should identify the types of individuals involved in the decision, the evaluations which must be conducted of both the technology and the vendor, and the phases of the decision process for obtaining capital equipment.

4.1.6 Other Important Market Factors

Any other market factors which are important to the implementation of the technology by the industry should be described.

4.2 ECONOMIC ANALYSIS OF TECHNOLOGY IMPLEMENTATION

This section will present methods, problems and issues relating to the financial analysis of the adoption and implementation decision by end-users and vendors of new, energy-efficient technologies. The basic premise of this section is that in order to successfully commercialize technology in the private sector, it is essential to show profitability for the potential energy-efficient technology.

4.2.1 Interdependence of End-Users and Vendors

Any serious attempt to convince industrial firms to adopt a new technology must be based on strong economic grounds. In the long run, profit oriented companies have to be persuaded that an investment in an energy-efficient or energy-conserving technology yields benefits to them, either in the form of direct financial return, or as protection against supply cut-offs (fuel switching technologies).

Two types of firms have to be shown that it would be profitable for them to be involved with a new process or a new technology. These two are the suppliers of such equipment/technology, i.e., those who manufacture it and sell it, and the users of such equipment/technology who would be the potential users of the new energy-efficient technology. Of the two groups, the latter is more important. If potential end-users of a newly developed technology are not interested in buying the new technology, no vendor will be interested in producing it. Only when there is a need translated into a demand for a new technology will potential suppliers find the technology profitable to produce. However, the relationship is more complex. End-users would generally not show much interest in any equipment/technology which is not commercially available, e.g., fluidized-bed combustion equipment.

The interest shown by end-users, i.e., the number of units end-users are willing to buy, depends on the price of the new equipment. The vendor's price depends to a considerable extent on the potential sales volume. Thus, decisions by potential end-users and vendors are interdependent. Only when both groups have found it profitable to adopt the new technology will implementation succeed.

4.2.2 Capital Investment

Companies use a variety of financial techniques to evaluate the economic benefits of investments. All the techniques involve a comparison of the size of the capital investment and operating cost associated with the investment, as compared to the increased revenues and profits. The cost of any new technology includes both direct and indirect costs. The direct costs include the cost of the new equipment, the installation cost, the cost associated with the removal of old equipment less the revenue from its sale, and the cost of training of operators for the new equipment. The indirect costs include any loss of production (downtime), any loss of sales, the cost associated with any changes that have to be made in other equipment, in fuel storage facilities,

and in moving material to or from the new equipment. The costs must include all the additional (incremental) expenses incurred by adoption of the new technology.

On the revenue side, the analysis incorporates the incremental revenue generated by the new investment, any cost savings due to the new investment and any other savings in operating cost in related units or processes. The financial analysis is based on estimates of both costs and revenues. The estimates will generally be based on a set of assumptions, some of which will be industry-specific.

For most companies, a shortage of available capital forces decision makers to choose between several potential projects. All projects that do not meet the company's minimum financial criteria are eliminated. For projects demonstrating similar financial benefits, those which increase the company's market share, broaden the product line, etc., will usually be chosen over those which reduce costs through adoption of energy-efficient equipment.

There are several techniques to evaluate the financial benefits of an investment project. Since these methods are well known this report will discuss the various methods very briefly.

The most common simple methods for evaluating investments are:

- a. The payback method.
- b. The simple rate of return.
- c. Accounting rate of return.

The main advantage of these methods is simplicity, and the limited need for complex projections and assumptions. Their main shortcomings are neglect of time value of money concepts, the common assumption of an even flow of incremental revenue, and neglect of the increased revenue from investments with a long economic life.

To correct these shortcomings, more sophisticated methods are widely used:

- a. Discounted payback period.
- b. Savings investment ratio.
- c. Discounted internal rate of return.
- d. Net present value.

The two most preferred techniques, c and d, emphasize cash flow and the time value of money. Projects of different life-times and size may be compared to each other on an equivalent basis.

4.2.3 ROI Analysis

The return on investment (ROI) for end-users can depend on several factors, including:

- Whether a new technology produces the same quantity and quality as the older technology at lower overall cost.
- Whether a new technology produces a larger quantity at a given quality, or a higher quality for a given quantity, at the same overall cost.
- Whether the company expects increased, decreased or unchanged unit sales.
- The age, condition and resale value of the current equipment intended to be replaced by the new equipment.

In the case of a new energy-efficient technology, the first factor would normally be the most significant. The decision to adopt a new energy-efficient technology will be largely determined by the size of the capital investment, direct and indirect costs, and the cost savings due to lowered energy requirements.

The return on investment for vendors of the proposed new energy-efficient technology is based on the incremental cost and revenues for the vendors.

The expected revenue will depend on the following factors:

1. The level of cost savings of the new technology to end-users. The higher the net present value, the easier it will be to convince end-users to purchase the new equipment.
2. Fuel cost as a percentage of the end-user's total cost. The higher this proportion, the more likely it is that the manufacturing companies will show interest in the new technology.
3. The amount of operational information available to potential customers.
4. Federal incentives for adoption of energy-efficient technologies.
5. The quality of marketing and sales.
6. The attitude of the industry toward energy-efficient technology.

We recommend that:

1. Net present value and payback methods be used for financial analysis.
2. The profitability analysis be done for both vendors and end-users. The two analyses should be consistent.
3. Assumptions about fuel prices, costs and revenue be clearly stated. ANL recommends the following values be used by all contractors for financial analyses:
 - discount rate - 15%
 - energy prices - EIA high oil price scenarios
 - economic growth - Mid-term Energy Forecast System (MEFS)
 - depreciation method - sum-of-the-years digit method

If a specific technology should require specialized treatment, the assumptions can be modified accordingly.

4.3 PRIMARY RESEARCH IN THE INDUSTRIAL MARKETPLACE

The objective of industrial survey research is to identify as precisely as possible the awareness, attitudes, intentions, motivations, and barriers in the marketplace affecting the adoption of a technology. Survey research generally involves five major steps: (i) selecting an interview method, (ii) selecting a sample, (iii) development of interview guides, (iv) conducting the survey, and (v) interpreting the results.

4.3.1 Selection of the Interview Method

There are four basic options for conducting survey research: mail surveys, phone surveys, personal interviews, and focus group interviews. Within the four basic options, there are a number of variations and combinations of methods which can be effectively applied.

Mail surveys are the least effective industrial survey technique of the four options. Generally the mail survey is only used when the sample is large and the informational needs are simple. Industrial marketing research surveys usually require a response which goes into great depth and deals with a sample which may be considered statistically small (less than 30 respondents).

Phone surveys are a favored technique because they are most economical in obtaining the information needed. When the phone survey involves a new product probe, it is advisable to mail to the respondent a brief description of the technology prior to the interview. A rule of thumb in using phone surveys is that you will have the attention of the respondent for no more than twenty minutes. Thus, the interview guide should be developed accordingly.

Personal interviews are generally used when the information to be collected is complex and there is a large amount of data which has to be collected in each interview. This technique is also used when dealing with a highly concentrated market such as the auto or steel industries. A key factor in personal interviewing is the interviewer's skill in drawing out information from the respondent, and in gauging personal reaction to questions and comments.

An alternative to the personal interview is the focus group interview. A focus group usually consists of 6-12 selected individuals who are brought together to discuss the technology. The group is led by a moderator who introduces areas of importance regarding the technology. The technique can be effective, but there are several pitfalls. These include: domination of the discussion by a few individuals, discussions being diverted to unproductive areas (e.g., the latest problems the group has had with DOE) and fears of potential anti-trust problems if the discussion gets into certain areas.

4.3.2 Selection of the Sample

There are two basic methods of sampling used in industrial survey research: probability samples and non-probability samples. Again, like the selection of an interview technique, variations and combinations of methods can be used to develop the sample.

Non-probability samples involve judgment, convenience, and quota type considerations. Judgment is frequently used in determining the types of persons to be sampled, e.g., corporate engineers, plant managers, purchasing agents, etc. These individuals are chosen on the basis of certain characteristics or information which they generally possess. Convenience samples are, as implied in the name, drawn on the basis of accessibility. They are usually used for testing an interview guide or obtaining background information. A quota sample is a variation of the convenience sample in which controls are placed as to the selection of sampling units (e.g., size).

Probability sampling include random, cluster and stratified sampling techniques. Random samples are generally not used in industrial marketing research because many industry sectors are configured on the 80-20 rule (80% of the sales are made by 20% of the firms). The cluster sampling method emphasizes the formulation of clusters by either size, geographic location, or job title and choosing a wide spectrum of individuals to be sampled within the cluster. Stratified samples, the dominant sampling method in industrial survey research, are generally chosen on the basis of industrial concentration. The industry sector is divided by size of the establishment. From each grouping, sampling units are chosen from the large, medium-sized, and small establishments. The target for the sample is usually 50% of the buying power within the industry segment.

4.3.3 Development of Interview Guides

Two basic techniques are used in the interview process: the structured technique and the non-structured technique. The non-structured technique is most often used in industrial survey research. Focus groups and personal interviews use the non-structured technique as do phone surveys to some extent. These interviews seek to encourage the respondent's ideas or thoughts about a subject. The interviewer's skills in encouraging the respondent to freely express views and move through the main discussion points are critical in the non-structured technique. The non-structured interview guide is merely an outline of questions which the interviewer will cover.

The structured survey is commonly used in mail surveys and as an adjunct to phone surveys. These types of surveys are generally used when the population to be surveyed is large and market demand is relatively unconcentrated. The questionnaire used in this type of survey might cover the following areas:

1. Identification of individual and responsibilities.
2. General information about the plant, company, and energy use.
3. General information on capital projects.
4. Awareness and knowledge of the technology.

5. Attitudes and opinions on the technology.
6. Evaluations and intentions to implement or not implement the technology.
7. Barriers to implementation.

4.4 MARKET PENETRATION ANALYSIS

The analysis of the potential market penetration of an industrial innovation involves three basic steps. First, the salient characteristics of the market and the innovation must be identified to determine where the innovation matches industry needs and where it conflicts with industry needs. Second, a base-line forecast is made for the adoption of the technology, without any CTIB support, using both qualitative and quantitative tools. Finally, effects of alternative CTIB implementation strategies are evaluated.

4.4.1 Identification of Factors which Accelerate or Delay Implementation

Research on the innovation diffusion process has shown that it takes approximately 5 to 10 years, on the average, before one half of the major firms in an industry begin using an important innovation (e.g., railroads converting to diesel). The rate at which the innovation is adopted is a function of the following characteristics:

- Relative advantage of the innovation as compared to the idea, practice or product it replaces or competes against.
- The degree to which the innovation is consistent with existing values and practices.
- The degree to which the innovation is easily understood and used.
- The extent to which the innovation can be tested on a limited basis.
- The extent to which the results of using an innovation can be observed by, or described, to others.

Within the marketplace, barriers which an innovation must pass can be broken down into general marketplace characteristics and specific firm-related characteristics. Marketplace characteristics include:

- Economic structure, stability and flexibility.
- Attitudes and views toward risk-taking, technological change, and the potential suppliers of the new technology.
- Political, legal, regulatory constraints and encouragement.
- Institutional factors which include: industry concentration, intra-industry cooperation, and labor relations.

Those characteristics specific to the firm include:

- Financial structure, standing and commitments.

- Organizational structure, flexibility, communication, networks, chain of command, etc.
- State of capital equipment and special requirements.
- Managerial objectives, policies, control, etc.

Information on these market and innovation characteristics should be available from the secondary research conducted on the market, and the survey research conducted on the technology. Based on this information, a general determination of the fit of technology into the marketplace can be derived. The technologies can be classified by market potential and results to date. Below is one example of evaluation which is derived from the Boston Consulting Group's product portfolio analysis:

<u>Market Results</u>	<u>Market Potential</u>	
	<u>High</u>	<u>Low</u>
Encouraging:	"Star"	"Cash Cow"
Disappointing:	"Problem Children"	"Dogs"

Those which will need attention in implementation strategy development are the "problem children" and the "cash cows." Those which are categorized as "dogs" would most likely require a heavy commitment to carry out an implementation strategy with little probable benefit. Those in the "star" category would not need any federal assistance in market penetration.

4.4.2 Market Penetration Forecast

There are three basic types of technological forecasting techniques:

- Exploratory techniques -- extrapolations of historical industry trends in rates of technology adoption.
- Normative techniques -- needs-oriented techniques based on assessments of the future, and technology requirements for the future.
- Dynamic techniques -- techniques which combine exploratory and normative elements into a feedback cycle.

It is not the purpose of this report to provide a total overview of these forecasting techniques. Rather, two of the more common techniques will be explained.

The most appropriate normative technique is the Delphi Method. This uses the dynamics of group interaction and expert opinion to forecast the need and adoption of a technology. The technique is a forecast tool which is appropriate for long-term forecasts. In the Delphi Method a panel of experts is invited to discuss the potential of technologies in a specific industry sector. A questionnaire is filled out by each individual on the technology in question and the collective results are discussed. Based on those discussions the questionnaire is revised and redistributed. Again the results are presented for further discussion. From these discussions a forecast for the adoption of a technology can be developed.

The most appropriate of the exploratory techniques is the substitution method. This method seeks to measure the rate at which new technologies are substituted for old. The Mansfield Model⁴ is the most well known of all the techniques. This model is based on the assumption that the implementation of a technology in an industry is dependent on the relative profitability of the technology as compared to other alternative investments, and the investment to adopt the innovation as a percentage of the total assets of the firm.

5 POLICY ANALYSIS IN TECHNOLOGY IMPLEMENTATION

Policy analysis is a term commonly applied to a broad set of approaches to problem solving in engineering and social sciences. In its application to technology implementation, policy analysis refers to the assessment of federal actions to accelerate the adoption of energy conserving technology by the private sector. The process through which energy conserving technology is adopted by industry in the absence of federal involvement has been discussed previously. In this section of the report, barriers to technology adoption, and options available to the federal government for removal of these barriers, are discussed. Implementation strategies for those options relevant to the Office of Industrial Programs are emphasized.

5.1 BARRIERS TO TECHNOLOGY IMPLEMENTATION

Market penetration by new technologies has been shown to be dependent on a number of factors of which the most important is profitability. If specific new technologies do not promise minimally acceptable return on investment their chances for adoption by industry are low. Characteristics of a new technology which reduce its profitability act as a barrier to market penetration. Market penetration barriers can be divided into three broad categories:

- Technological
- Financial
- Institutional

Barriers for any specific technology may result from any combinations of the factors listed above and classification based upon these categories may not be obvious. However, ANL feels that an understanding of the decision processes used by firms will show that a barrier to technology adoption can be reduced to one of these categories. Table 5.1 lists the barriers to technology implementation discussed here.

Table 5.1 Barriers to Technology Implementation

Category	Examples
Technological	Reliability, Maintenance, Space and Personnel Requirements
Financial	Capital Availability and Business Investment Strategies
Institutional	Information Needs and Environmental, Energy, Health and Safety Impacts and Regulations

Reliability, personnel, maintenance and space requirements are examples of technological factors which could affect the market acceptance of a technology through their impact on the profitability of the investment. Exceptional personnel and maintenance requirements increase operating costs, thereby reducing the present value of an investment. Space requirements sometimes present a physical barrier which can result in additional engineering expenses. Reliability is an important factor in maintaining production levels and product quality. Technological barriers indicate that further research and development work may be required before market acceptance will occur.

Examples of financial barriers to energy conservation technology are capital availability and business investment strategies. Shortages of capital affect the selection of investment projects by, in effect, requiring higher rates of return for discretionary investments. This affects not only the number of conservation projects that will be implemented, but also the extent of private sector energy conservation research and development. Businesses with investment strategies requiring short-term profits present a barrier to large conservation projects.

Lack of information on available technologies is an example of an institutional barrier to energy conservation. Other institutional barriers can include exceptional environmental, energy, health and safety impacts which may violate regulations. Compliance with existing regulations may increase both capital and operating expenses associated with a project, thus decreasing the economic attractiveness of a project. Projects may be terminated in some special cases.

The discussion of barriers to market penetration presented here has been general in nature with the purpose of presenting a basic classification scheme for factors affecting a project's profitability. Specific barriers to conservation options will depend on the nature of the technology and industry under consideration. Primary sources of information concerning market penetration barriers can be obtained by industrial interview and marketing research, as discussed elsewhere in this report.

5.2 POLICY ANALYSIS

When a barrier to market penetration of a technology has been identified, the federal government is faced with a decision as to what policy, if any, is appropriate to overcome the barrier. Ideally the decision should be based upon the costs and benefits of the policies considered. Potential federal policy options are identified and a discussion of their impacts is presented in this section. A general discussion of cost/benefit analysis is also included.

5.2.1 Policy Identification

Federal involvement in public policy may take the form of scientific, economic or regulatory policy designed to accelerate the adoption of new technology. The purpose of the policy is to affect the investment decision of the buyer (or supplier) by changing the economic value of a project. Policy options available to the government are summarized in Table 5.2.

Table 5.2 Some Possible Policies to Promote
Industrial Energy Conservation

Category	Examples
Scientific	Basic Research Technology Development Technology Demonstration Technology Transfer
Economic	Accelerated Depreciation Taxes and Tax Credits Loans and Loan Guarantees Grants Acquisition Subsidies
Regulatory	Energy Pricing Efficiency Standards Fuel Switching Data Reporting Patenting and Licensing

Scientific policy options include sponsorship of basic research, technology development, technology demonstration and technology transfer activities related to energy conservation. Research, development and demonstration (RD&D) policies are intended to remove technical uncertainty surrounding conservation technology or provide basic knowledge for new innovations. Uncertainty regarding cash flows associated with a specific project will sometimes result in the setting of a higher minimum acceptable rate of return by industrial firms. This higher minimum acceptable rate of return will result in a failure to invest in marginally economic conservation projects. Technology transfer programs are intended to publicize and reduce uncertainty associated with technologies which have progressed through the RD&D stage and are available commercially. Although these policies have been pursued in the past by DOE and its precursor agencies, no clear relationship between these policy options and increased market penetration by industrial energy conservation technology has been demonstrated in the literature.

Examples of economic policy options are accelerated depreciation schedules, energy taxes and tax credits, government loans and loan guarantees, grants, and acquisition subsidies. The effect of these policies is to provide a subsidy to producers or consumers, which improves returns on investment or reduces the impact of an economic barrier to market penetration. Some possible economic policies are discussed below.

Accelerated depreciation schedules allow firms to write off depreciation allowances in shorter time periods, thus increasing the present value of an investment. Depreciation allowances increase an investment's present value by reducing the taxable income in the early years of the project. Investment tax credits act in a manner similar to accelerated depreciation schedules. A project's present value is increased through a reduction in taxes proportional to the firms' capital investment. Both of these policies assume, however, that

adequate private resources of capital exist for the initial investment. Also, once enacted, they are not easily subject to budgetary control by policy makers.

Loan guarantees have been used to enable private firms to obtain capital at lower interest rates. This reduces the amount of interest payments required over the project life and thus increases the net present value of the project. Loan guarantees also reduce the economic risks of a project to some extent by reducing the liability of the individual firm. Direct federal loans function similarly, with more of a direct intervention of the government into private credit markets. Although these options have been used in the past there is some evidence that the probability of default by the firm is increased when loans are guaranteed by the government, which could result in a loss of government funds.

Grants are direct cash payments which can be used to subsidize consumers or producers of energy conservation technology. These payments can be used to offset RD&D and production costs in the case of suppliers or to offset capital and operating costs in the case of end-users. Used in any of these ways, grants are an extremely flexible means of affecting investment decisions. Specific target groups eligible for grants can be targeted and the grant expenditures are subject to budgetary control. Although grants appear to be an economically efficient method of stimulating energy conservation, the concept is untried in the industrial sector.

There are two basic types of government acquisitions available to policy makers. In one form of acquisition policy, the government guarantees a price for a product and in the second form, the government guarantees a demand level. These acquisition policies most directly affect technology suppliers by reducing uncertainty associated with new product demand levels. However, some benefit may accrue to end-users also if federal installations of new technology act as demonstration projects. The effectiveness of acquisition policies in the acceleration of industrial energy conservation technology, like most of the policies discussed in this section, has not been clearly documented in the literature.

The final policy option available is the regulatory approach. Examples include energy pricing rules, energy-efficiency standards for appliances, and fuel conversion regulations. Regulatory approaches differ from the other policy options discussed in this section in that they are not designed to increase the economic attractiveness of an investment. They instead move the investment from the discretionary capital project category to the mandatory compliance category. In this way, energy conservation is assured (although methods of circumventing regulations always seem to exist). Administration and enforcement costs can be significant and the impact of regulatory actions on economic efficiency cannot always be quantified and distortions of market signals may occur.

The discussion of policy identification presented here is of necessity somewhat vague. This is because of the technology- and industry-specific nature of the CTIB implementation analyses. As discussed earlier, variations in individual manufacturing facilities may be important factors in determining market penetration and innovative policy options which address these variations may be available. The most valuable source of information concerning plant

operations and requirements is the industry itself. The importance of extensive industrial contact in the process of technology implementation is discussed in earlier sections.

5.2.2 Cost/Benefit Analysis

The primary output of the market penetration analysis is an estimate of energy savings resulting from the commercialization of a new conservation technology. This estimate represents the base case of no federal involvement and forms a starting point for the policy analysis. The policies that have been identified and selected for analysis are examined to determine their incremental effect on the market penetration estimate. This incremental market penetration can be expected because of the relationship between the federal policy and the present value of the investment which the policy was designed to accelerate. The dollar value of the energy savings in present value terms represents a measure of the direct benefits associated with the policy under consideration. Other indirect benefits may accrue from decreased dependence on foreign oil or environmental benefits, but these impacts are generally difficult to quantify.

The cost associated with a policy may also be categorized according to direct and indirect effects. Examples of direct costs are increased capital and operating costs incurred by consumers, decreased tax revenues and program administration costs. Indirect costs are generally more difficult to quantify than direct costs because of their ripple effect through the economy. Decreased industry productivity, local plant closings and unemployment are some indirect costs which may inadvertently result from the implementation of a policy.

Policy-related costs and benefits are summarized in Table 5.3.

Table 5.3 Examples of Policy-Related Costs and Benefits

<u>Costs</u>	<u>Benefits</u>
<u>Direct</u>	<u>Direct</u>
Increased Capital Costs	Energy Savings
Increased Operating Costs	
Administrative Costs	
Subsidy Costs	
<u>Indirect</u>	<u>Indirect</u>
Decreased Productivity	Energy Security
Inflation	Environmental Benefits
Unemployment	
Local Dislocations	

When the costs and benefits of a policy have been identified and characterized as a function of time, the cost/benefit analysis can be performed. The distribution of the costs/benefits are taken into account using the present value analysis which compares cash flows based on the time value of money. The analysis is fairly simple and allows quick selection of the viable policy alternatives. It should be noted that an important alternative is the option to do nothing in the event that no alternative exhibits a positive net present value.

The present value approach to cost/benefit analysis provides a consistent and simple method for use by CTIB contractors. Ground rules concerning the selection of various economic parameters used in the analysis should be agreed upon prior to the initiation of the studies, however. These ground rules concern assumptions made about values for tax rates, discount rates (minimum acceptable rates of return), energy prices, economic growth rates and projection period. ANL recommends the following values be used by all CTIB implementation contractors to assure consistent results:

- discount rate - 15%
- energy prices - EIA high oil price scenarios
- economic growth - Mid-term Energy Forecast System (MEFS)
- projection period - 1985-2000
- depreciation method - sum-of-the-years digit method

These values are commonly encountered assumptions and should be adequate for most technologies. However, if a specific technology should require specialized treatment, the assumptions can be modified accordingly.

5.3 IMPLEMENTATION PLANS

For the purpose of this discussion, ANL has differentiated between an implementation study and an implementation plan. The implementation study consists of background analysis required to develop a rational implementation plan, plus a detailed implementation plan. The study follows the general outline of this report. A proposed outline for an implementation study is presented in Table 5.4. The section describing the implementation plan is an action-oriented section designed to suggest the scope and directions of CTIB activities for the acceleration of conservation technology market penetration in a particular industry. A suggested outline for a CTIB implementation plan is presented in Table 5.5.

The implementation plan should identify target market segments for implementation programs. The identification should include a list of potential early adopters and early suppliers of a particular technology. The communications program, which is basically a plan describing how the target market segments will be reached, should then be detailed. The communications program can consist of technology transfer reports, press releases through trade or professional journals or publications at relevant conferences. The commercialization schedule is then presented for the period of study. This schedule includes forecasts of market penetration rates which are used to monitor progress of CTIB programs. Monitoring of implementation programs is discussed in Section 6.

Table 5.4 Suggested Implementation Study Outline

1.0	Industry Characterization
2.0	Technology Assessment
3.0	Market Assessment
	3.1 market potential
	3.2 market penetration
4.0	Policy Analysis
5.0	Implementation Plan
Appendix:	Industry Liaison
	o industry contacts
	o survey methods

Table 5.5 Suggested Implementation Plan Outline

5.0	Market Segments
	5.0.1 Early Adopters
	5.0.2 Early Suppliers
5.1	Communications Program
5.2	Commercialization Schedule (including possible additional demonstrations and/or legisla- tive initiatives programs)
5.3	Monitoring
5.4	Budget and Manpower Requirements

An important issue which the implementation study should address is additional RD&D requirements of new and existing technologies. Information gathered from industry interviews can provide guidance to other branches of OIP involved in technology RD&D.

Of the policies discussed in Section 5.2.1, certain alternatives are more suited for CTIB involvement than others. This fact results from the political nature of the policy alternatives as well as CTIB's perception of their own role in the acceleration of energy conservation technology. For example, rapid deregulation of energy prices could be shown to be the most effective means of increasing industrial conservation, but implementation of this policy would require approval of the executive and congressional branches. Therefore, the implementation plan should focus on policies which have particular potential for successful implementation by CTIB.

Each contractor should provide a special section on the necessary steps needed to implement a specific technology transfer plan. Specifically:

- a. What steps should be taken by DOE?
- b. When should each step be taken?
- c. Which steps/actions are dependent on the success of previous steps and which are independent of previous steps?
- d. Can specific problems be anticipated in the implementation process?
- e. When should DOE's role end
 - due to failure?
 - due to success?
- f. An explicit list of assumptions made to evaluate and monitor the above.
- g. What variations/alterations should be considered if implementation doesn't follow expected success?
- h. What amount of personnel time and variable cost is needed to follow the implementation plan?

6 MONITORING OF IMPLEMENTATION PROJECTS

6.1 MONITORING OF TECHNOLOGY IMPLEMENTATION

Self-evaluation and monitoring of implementation plans are an important element of modern management. We suggest that each contractor be required to provide CTIB with a self-evaluation/self-monitoring procedure to evaluate the effectiveness and success of the commercialization plan. Specifically:

- a. What type of information does CTIB need to evaluate the success of each step?
- b. When should CTIB collect the needed information?
- c. How should CTIB collect the above information?
- d. What would be the cost of obtaining such information?
- e. What are the levels of success that would indicate
 - minimum (adequate) success
 - reasonable (medium) success
 - highly satisfactory success.
- f. How to revise the study's recommendations if assumptions made by contractors do not hold (e.g., petroleum price assumptions).

6.2 OBJECTIVES OF A MONITORING PROCEDURE

The above outline for self-monitoring information is of major importance. As a public agency under multiple conflicting pressures by a diversity of environments, it is essential that an ongoing self-evaluation process should be part of any implementation project. It would be useful for:

1. Evaluation of projects and methods used in implementation.
2. A decision to terminate budget allocation to a project because of satisfactory transfer.
3. A decision to terminate budget allocations to a project because of failure (no appeal to industry).
4. Providing information to other agencies and Congress.
5. Budget preparation.
6. Evaluation of implementation methods.
7. Evaluation of contractors.

The requirement for a monitoring procedure to be incorporated into an implementation plan will direct the contractors:

- to be realistic and practical
- to realize the difficulties faced by OIP in promoting implementation/commercialization

- to be detailed in providing specific steps, timetables, assumptions, etc.

In summary, a self-monitoring process with clear quantitative goals and timetables will provide essential information to DOE decision makers, without the need to be constantly dependent on the contractors, other outside consultants or on uninformed judgment about the effectiveness of the implementation process.

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Appendix I

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