17

PNL-5702
UC-95d

Consumer Decision and Behavior Research Agenda for the Office of Building and Community Systems

B. L. Mohler
R. M. Scheer
V. Barnes

December 1985

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
by Battelle Memorial Institute

Battelle

PNL-5702

DISCLAIMER

PACIFIC NORTHWEST LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC06-76RLO 1830

Printed in the United States of America
Available from
National Technical Information Service
United States Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161

NTIS Price Codes
Microfiche A01

Printed Copy

Pages	Price Codes
001-025	A02
026-050	A03
051-075	A04
076-100	A05
101-125	A06
126-150	A07
151-175	A08
176-200	A09
201-225	A010
226-250	A011
251-275	A012
276-300	A013

PNL-5702
UC-95d

CONSUMER DECISION AND BEHAVIOR RESEARCH AGENDA FOR THE OFFICE OF BUILDING AND COMMUNITY SYSTEMS

Bryan Mohler
Rich Scheer
Valerie Barnes

December 1985

Prepared for
the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest Laboratory
Richland, Washington 99352

ACKNOWLEDGEMENTS

The authors wish to acknowledge several individuals for their valuable assistance and guidance during this project: Fred Abel and John Millhone, Department of Energy, for arranging the focus group sessions at Building and Community Systems (BCS) and motivating participation; John Franke, Pacific Northwest Laboratory, for his support and guidance; Mark Hattrup, Pacific Northwest Laboratory, for his assistance in conducting the focus group and in depth interviews at BCS; and to the BCS staff who participated in the focus groups for their time and valuable input.

SUMMARY

This report presents a research agenda of Consumer Decision and Behavior Projects related to improving, facilitating and planning Building and Community Systems, (BCS) research and development activities. Information for developing this agenda was gathered through focus group and depth interviews with BCS staff, directors and program managers. The Pacific Northwest Laboratory (PNL) project team also contributed research topics as did Ms. Terry Dinan at Oak Ridge National Laboratory (ORNL) through her literature review of previously conducted consumer decision research. As a result, 75 topics were generated and then categorized and combined to form the research agenda of 20 potential consumer behavior research projects. Each project is fully described in terms of objective, research topics examined, scope, methodology, time frame, level of effort, and dependencies (i.e., what work, if any, would need to be conducted previously or concurrently) in Section 7.0.

In the support of the development of these specific research projects, it was useful to define the role of consumer research in BCS's program. Three areas of research were identified as applicable:

- Consumer Behavior - consumer actions as directed toward energy use
- Consumer Decision Making - consumer purchase decision process as related to conservation expenditures and/or investments
- Intermediate Consumer Technology Adoption - How intermediate consumers, those between the DOE and end consumers, (e.g., manufacturers, architects, engineers) decide to adopt and/or utilize new energy saving technologies and/or processes.

Each of these areas of consumer research are more fully explained in Section 2.0. The consumer decision process and conservation activities are also diagrammed in Figures 2.1 and 2.2 respectively.

A third objective of this project was to determine who each division of BCS; Building Services, Building Systems, Building Equipment, Federal Energy Management, and Analysis and Technology Transfer, perceived their consumers to be. It is clear from the material presented in Section 3.0 that BCS serves a

end consumers, such as homeowners, to intermediate consumers and governmental agencies. This diversity of consumers clearly points out the need to segment and characterize consumers appropriately for a given R&D activity.

The focus group facilitators were also asked to develop a listing of current consumer decision and/or behavior research being conducted within each division. Although there did not seem to be much of this type of work being conducted in either Analysis and Technology Transfer or in the Federal Energy Management Program groups, the other groups were able to list current work involving (their) consumers. These projects are described in Section 4.0.

The research topic ideas generated through the focus group and depth interviews are presented in matrix form in Section 5.0. The source of the idea is identified and an importance and current knowledge rating for each idea is also presented as generated by the group (source). Additional research topics added by the PNL project team are presented in Section 6.0.

The 20 research projects which comprise the research agenda are presented in Section 7.0. The methodology used to generate these projects is also described. A time line is presented in Figure 7.1 which depicts the proposed duration of each of the 20 projects as well as indicate any dependency relationships between projects. This time line, as well as the dependencies section in each project description will help plan the consumer decision research effort. For example, there are a number of projects which could be initiated at time "0" (i.e., no dependencies). However, a large number of them require the results of other projects, especially those of project Number 1, Market Research and Characterization. The information presented in Figure 7.1 will help in planning a logically developed and sequenced consumer decision research program.

CONTENTS

FIGURES

TABLES

1.0 INTRODUCTION AND BACKGROUND

The object of the Consumer Decision Research work being conducted for BCS[a] was to develop an agenda of consumer-related topics that should be researched to improve the usefulness of BCS research for those BCS serves. The research agenda presented in Section 7.0 of this report is the product of several activities designed to ensure that the agenda is complete and that it will improve the market penetration and utilization of BCS research. The initial step toward the development of the agenda was to conduct focus group interviews with representatives of each division of BCS to develop potential research topics of interest. In addition, research topics were suggested by members of the PNL project team. The topics then were combined into groups of related topics and 20 research projects were developed to form the proposed research agenda.

The report that follows describes the project activities and their results in greater detail. Section 2.0 describes the role of various consumer groups in the BCS program. Section 3.0 presents the perceptions of who each division believes its consumers to be. Section 4.0 discusses current work being concluded at BCS that involves consumers and consumer research. Section 5.0 contains research suggestions in matrix format which were the results of focus group interviews with BCS personnel. Section 6.0 contains a list of additional research topics generated by the PNL project team. The actual proposed consumer and market related research projects are presented and described in terms of scope, methodology, level of effort, time and dependencies on other research results in Section 7.0.

(a) BCS = Building and Community Systems; formally BERD, Building Energy Research and Development.

2.0 THE ROLE OF CONSUMER RESEARCH IN BCS'S PROGRAM

Conducting consumer research enables BCS to focus its technology and research on the most promising markets and applications. While the primary emphasis of technology transfer and research utilization activities is on the supply or technology side of the exchange process, consumer research is focused on the demand side. Incorporating demand side information into research design, technology transfer, research utilization and technology commercialization activities increases the chances that the results of such work will be adopted by the appropriate market. By evaluating market potential and identifying adoption barriers prior to conducting research, a prioritized research agenda can be developed that contains projects that have the highest probability of market success and, thus, a greater potential impact on energy conservation and efficient energy use.

Consumer research can be divided into three categories:

1. Consumer Behavior: Topics under this category pertain to how building occupants (tenants, owners, renters, etc.) interact with the existing structure, equipment and appliances in terms of energy use. This category also includes issues pertaining to curtailments and lifestyle patterns that affect energy use within buildings.

2. Consumer Decision Making: Topics under this category concern the decision process that various groups of consumers use to make purchases and/or investments in energy conservation. Research in this category would consider evaluation criteria; information source, form, content and credibility; barriers to investment and market segmentation issues. The model of the consumer decision processes used to develop research projects is presented in Figure 2.1.

3. Intermediate Consumer Technology Adoption: Topics under this category involve issues pertaining to the intermediate consumers of technology and energy saving research. Architects, engineers and manufacturers who utilize the results of research and technology in their work are considered "intermediate" consumers as their products

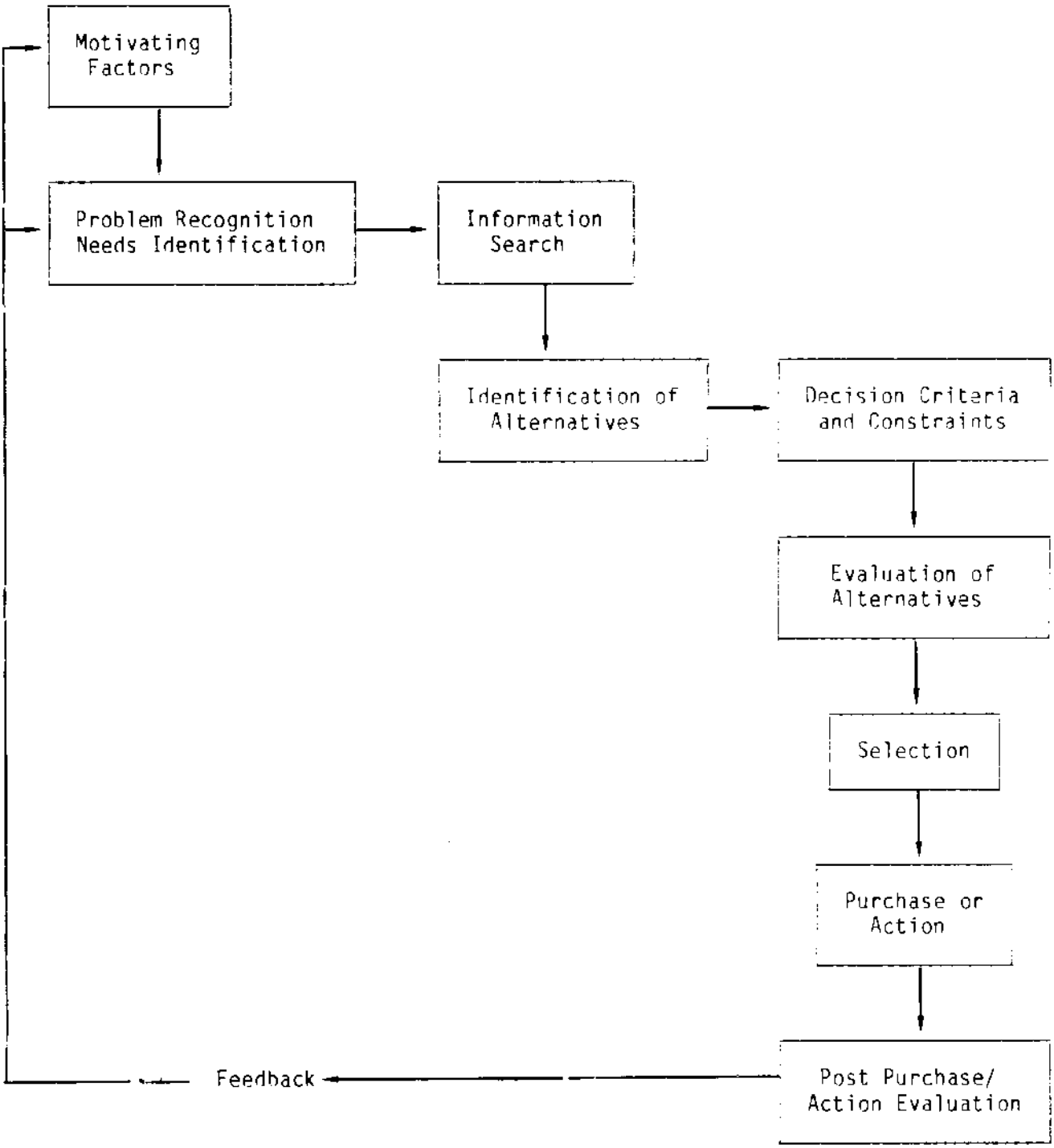

FIGURE 2.1. The Consumer Decision Process

are ultimately resold to end consumers. However, intermediate consumers are also consumers of energy and, as such, can also fall into either or both categories 1 and/or 2 above.

Thus, within the three categories of consumer research there are two consumer groups: end consumers and intermediate consumers. Both consumer groups are important because, as will be discussed in Section 3.0, each BCS division primarily serves either end or intermediate users.

The two consumer groups and the three areas of study described above provide a framework for identifying research needs related to the consumers of BCS work. Figure 2.2 presents the conservation and energy use decisions and behaviors available to each group of consumers. Both end and intermediate consumers can affect energy use through behavior. Energy use can also be affected through the purchase of or investment in energy conservation measures for end consumers and through technology adoption for intermediate consumers. By understanding the characteristics of BCS consumers and by targeting research to the specific needs of those groups, BCS research programs can substantially increase their impact on coosumers and consequently increase their impact on energy use efficiency.

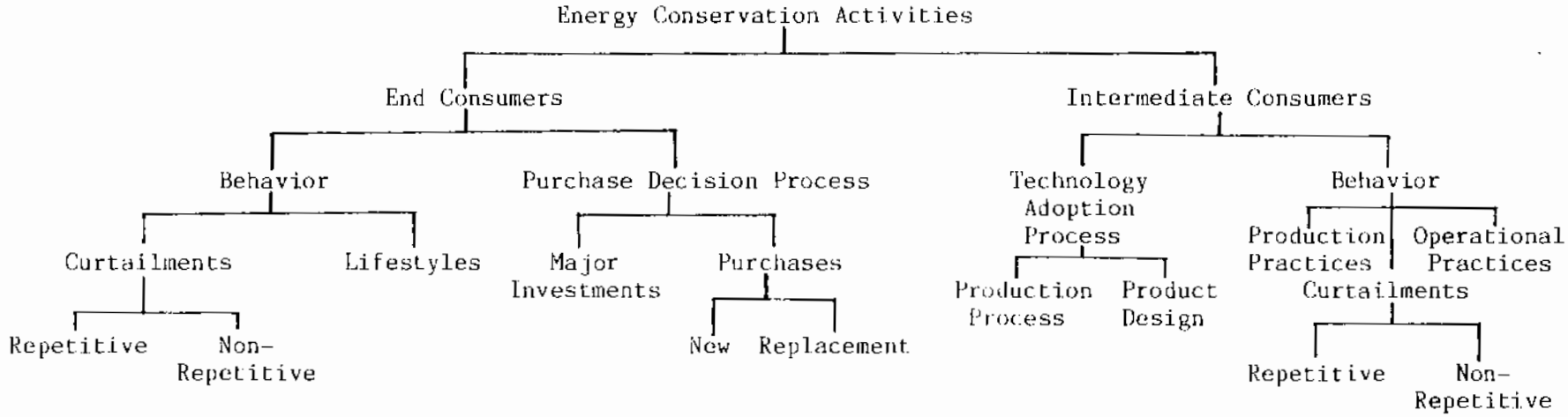

FIGURE 2.2. Diagram of Conservation Activities and Research Categories by Consumer Group

3.0 PERCEIVED CONSUMERS BY DIVISION

To identify the consumers and the research interests of each BCS division, focus groups and depth interviews were conducted with representatives of each BCS division. The individuals who participated included:

1. Building Services Division
   - Mary Fowler
   - Mark Friedrichs
   - Andre Van Rest
   - Floyd Collins
2. Building Systems Division
   - Jim Smith
   - Bob Oliver
   - Marv Gorelick
3. Building Equipment Division
   - Ted Kapus
   - Ron Fiskum
   - Mike McCabe
4. Federal Energy Management Division
   - Bill Bethea
5. Analysis and Technology Transfer
   - Fred Abel

The report which follows present the results of the focus group and depth interviews. The focus group and depth interview participants were asked to develop a list of who they believed the consumers of their work to be. This exercise indicated that BCS serves a large number of different types of consumers. While there is some overlap, each division had a clear and distinct perception of who they believed their consumers to be. The reader may want to refer to this section when reviewing the matrix of potential research topics presented in Section 5.0 and the additioaal topics listed in Section 6.0.

3.1 BUILDING SYSTEM DIVISION (BSD) PERCEIVED CONSUMERS

Generally, the consumers for this division are perceived to exist within the building industry. They are, specifically:

a) Building Planners and Developers
b) Architects
c) Engineers
d) Builders
e) Owners of Commercial and Large Multi-Family Buildings
f) Manufacturers/Fabricators
g) Building Inspectors and Other Officials
h) Long-Lease Tenants
i) Educators (College-Level Architecture Professors)
j) Financial Institutions
k) Home/Building Owners (for Retrofit Activity).

3.2 BUILDING SERVICES DIVISION (BSrD) PERCEIVED CONSUMERS

The perceived consumers of this division cover end and intermediate consumers. This groups also includes consumer "influencers" as a consuming group of their work. Influencers have the ability to impact both end and intermediate consumer decisions. Specific consumer groups include:

a) End Consumers of Energy
    i) Individuals Who Make Investment Decisions
        1. Commercial Building Owners
        2. Home Owners
        3. Building Occupants (Tenants and Renters)
    ii) Operational (Energy Use) Decisions Makers
    (i.e., individuals who are actually consuming energy on the premises)
        1. Home Owners
        2. Building Occupants (Commercial and Industrial)
        3. Renters and Tenants (Residential)

b) Major Categories of Consumers

i) Single Family

ii) Multi Family

1. Large
2. Small (4 or less units)

iii) Commercial

1. Large
2. Small

iv) District and Community System Users

v) Influencers

1. Those who influence end-user decisions concerning energy use and conservation
   - Manufacturers
   - Retailers
   - Utilities
   - Architects
   - State and Local Government
   - Commercializers
2. Influencers can also be either type of consumer (i.e., they are intermediate consumers of BSD work; for example, a manufacturer using an energy saving technology as an input to production.)

This Division's interview participants also indicated which consumer categories have been the target of their work and in what proportion in the past. These breakdowns are presented below by BSrD Branch (Functional Group).

1 Applications Research and Development

a)	Single Family		50%
b)	Multi Family		25%
c)	Commercial		
	i) Large	2.5%	25%
	ii) Small	12.5%	
			100%

It is expected that the breakdown for 1985 will be 1/3 each for single family, multi-family and commercial as multi-family and both small and large commercial are expected to receive more attention next year with single family receiving less.

2. Community Research and Development

a)	Non-Profit and Government	90%
b)	Multi Family (most of these are HUD multi-family units)	10%
		100%

3. Technical Services and Programs

a)	Single Family		30%
b)	Multi Family		
	i) Small	20%	45%
	ii) Large	25%	
c)	Small Commercial		25%
			100%

Large Commercial and Industrial consumer categories are expected to be added in 1985; thus, the percentage breakdowns for this branch will all decrease to reflect these additions.

3.3 BUILDING EQUIPMENT DIVISION (BED) PERCEIVED CONSUMERS

For this division, the primary consumers are perceived to be intermediate consumers and influencers on the end consumer. Other groups, such as end consumers, have been included in the past but are now considered secondary to current research needs and, as such, are not explicitly considered in research efforts.

Major consumer categories for BED include:

a) The (Energy) Consuming Public
b) Homeowners
c) Commercial Building Owners and Occupants
d) Multiplier Groups

i) Utilities

ii) Manufacturers (residential appliances, new and replacement)

iii) Architects and Engineering Firms.

Although the first three groups are end consumers, they are considered as secondary and are not explicitly considered in the work currently being conducted by BED. Most current attention is given to the "multiplier" groups. These are intermediate consumers who commercialize new products, facilitate markets through promotion or other programs (rebates, etc.) and generally influence the purchase decision of the end consumer. These groups are called "multipliers" because their function is to increase or multiply the effects of new energy saving technologies on overall demand by facilitating market acceptance and penetration of these technologies.

3.4 FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP) PERCEIVED CONSUMERS

This division's consumers have traditionally been government related. There are, however, private-sector counterparts which either have been or could be consumers of this division's work. Specifically, the relevant consumers are:

a) The President

b) Congress

c) The Office of Management and Budget

d) Congressional Committees

e) Federal Engineers and Architects

f) Private Engineers and Architects

g) Facilities Engineers (DOD, Labs, etc.)

h) Army Corps of Engineers

i) State and Local Government Engineers

j) Private-Sector Building Engineers.

3.5 ANALYSIS AND TECHNOLOGY TRANSFER (A&TT) PERCEIVED CONSUMERS

The perceived consumers of the work from this area are:

a) Government and Business Planners

b) Congressmen and Congressional Committees

c) Other Researchers and Modelers.

However, it was pointed out that these consumers are not the appropriate targets for the consumer research efforts. The consumers that would most likely be under study as "consumers" are believed to be:

a) Building Owners

b) Building Occupants.

These are basically end consumers of energy and energy-related technologies.

4.0 CURRENT BCS ACTIVITIES THAT INVOLVE CONSUMERS AND CONSUMER RESEARCH

Each group was asked to indicate their perceptions regarding consumer research currently being conducted within their respective divisions. Although there did not appear to be much consumer research being conducted in either the Analysis and Technology Transfer or the Federal Energy Management Program groups, the Building Sciences, Building Equipment, and Building Services Groups were able to list current work involving consumers. These projects are listed below for each of these three divisions by either project title or topic area.

4.1 BUILDING SERVICES DIVISION (BSrD)

This group is currently conducting a number of projects or tasks that are perceived to be consumer related. They are presented by Branch (or Functional Group).

4.1.1 Applications Research and Development

1. Single Family Sector

   a) Home Energy Rating System includes work done by the Consumer Energy Council of America (CECA) concerning existing research findings on consumer needs and attitudes toward home rating systems. This work also includes analyses of existing rating systems as case studies. The determination of criteria for rating systems is also being examined using inputs from realtors and builders.

   b) Building Energy Retrofit Research (BERR) involves the assessment of energy use patterns before and after retrofits have occurred. It also investigates potential problems with engineering estimates of energy savings and quality of retrofit installations to explain energy use patterns.

2. Multi Family Sector

   There has been no consumer research conducted in the multi-family sector. It was mentioned that BCS is likely to support Bonneville

Power Administration's development of a multi-family rating system which would involve consumer decision-making issues as related to residence selection.

3. Commercial Sector

   a) Technology Adoption Research involves a literature search which is currently being conducted to determine what is known about decision making and the technology adoption process in the commercial sector.

   b) Retrofit Research involves internal BSD planning functions and some background research concerning initial segmentation of the commercial sector to determine:

      i) what is currently known about decision making in each segment

      ii) what government and/or private retrofit activity is taking place in each segment.

   c) Technology Adoption in the Commercial Sector was recently initiated at Oak Ridge National Laboratory (ORNL) to examine the technology adoption process in the commercial sector.

4.1.2 Community Research and Development

District Heating and Cooling Technology Transfer is basically a promotion vehicle for district systems. It involves a film presentation to target audiences on the benefits of district heating and cooling. A questionnaire is administered to the film viewers which includes some attitudinal and reaction questions about the presentation. The film and presentation are the result of a district system developed and utilized in a large university setting.

4.1.3 Technical Services and Programs

There is no consumer research conducted by this Branch (Functional Group). Work conducted by Applications Research and Development is, however, utilized extensively by this group in designing and implementing their programs.

4.2 BUILDING SYSTEMS DIVISION (BSD)

This group's experience in consumer research has been somewhat limited. There is, however, a great deal of interest in expanding the role of consumer research currently conducted by BSD. The work described below is underway and invnlves consumer research to some extent.

1. Proof of Concept Studies involve conducting long-term, high-risk research projects concerning (new) energy savings building technologies that would not otherwise be conducted by the private sector. As part of these studies, there has been some exploratory work concerning marketability, possible cost, and market potential of the subject technology.

2. Post Occupancy Evaluations are currently being conducted for commercial lighting systems. Evaluation data for lighting systems are collected from a variety of sources, including occupants of the structure under study. The purpose of the evaluation is to monitor the equipment performance and the occupants' reactions and attitudes toward the lighting system in terms of comfort, quality and energy use. The data will be used to develop lighting standards and programs.

4.3 BUILDING EQUIPMENT DIVISION (BED)

This group has conducted consumer research to better understand market acceptance of their research. The research is discussed by Branch (Functional Group).

4.3.1 Energy Conversion Equipment

1. End User Tests (Field Work) are no longer being explicitly conducted, however, they are implicitly included in the prioritization and development of research activities. Field work involves product testing and use of prototype appliances to determine consumer reactions, preferences, likes, dislikes, etc., prior to full-scale market introduction. Field work has been conducted on refrigerators, freezers, heat-pump water heaters and freezer compressors.

2. Cost and Manufacturer Analysis is conducted to determine if the dollar investment on research is spent on projects that are most likely to have their results utilized and adopted in the market place. While this work is not currently conducted in depth, the topics which are, or should be, addressed include:
   a) final cost to the consumer
   b) consumer price elasticities
   c) consumer/market acceptance potential
   d) identification of harriers to acceptance
   e) development of strategies to overcome barriers.

   This type of research should also identify and evaluate potential manufacturers who would/could utilize newly developed technologies.

4.3.2 Test and Evaluation

1. Appliance Label Format Evaluation work utilizes focus groups to evaluate consumer and dealer reactions to varying label formats and designs. There are 4 studies (1 in each of 4 U.S. regions), 3 of which concern refrigerators and 1 which concerns gas furnaces. There will be 4 consumer group studies and 4 dealer studies. The studies are also varied across geographic regions where utilities serving the area may or may not have a program to encourage the purchase of energy-efficient appliances. This geographic variation serves as a limited test of the effectiveness of such programs.

2. Model of Market Behavior research conducted at Oak Ridge National Laboratory (ORNL) constructed a model to explain and predict market behavior. This model is currently being revised by Lawrence Berkeley Laboratory (LBL) to include the effects and influences of builders, end consumers, manufacturers, utilities and other (e.g., government), effects on market behavior and acceptance of energy saving technology.

5.0 MATRIX OF POTENTIAL RESEARCH TOPICS DERIVED FROM FOCUS GROUPS AND DEPTH INTERVIEWS

The primary purpose of the focus-group and depth interviews was to begin the development of an agenda of consumer research concerning consumer decision making, consumer behavior and intermediate consumer utilization decisions. To this end, each focus group and depth interview participant was asked to develop a three-column matrix including research topic, importance rating of the topic, and the current level of knowledge within BCS about the topic. The importance and knowledge ratings are scaled 0 to 10; 0 meaning of little importance or little current knowledge within BCS, to 10 meaning very important or substantial knowledge about this topic within BCS. It should be noted that the topics were suggested by the group members, who are, for the most part, research planners. It was suggested in the course of the interviews that there may be a difference in the importance of a particular topic between research planners and those who actually implement research results.

The matrix presented here is a composite of the individual group matrices. The source(s) of each topic, importance, and knowledge ratings are presented. Multiple importance and/or knowledge reflect a difference in opinion between group members. Some ratings, as denoted by an asterisk, were not explicitly given by the group members but were inferred from the group discussion of the issue by the interviewer.

The categories of topics are consistent with the definitions presented in Section 2.0. They are:

1) Consumer Decision Making
2) Consumer Behavior
3) Other Related Issues.

Intermediate and end-consumer activity are both included in these categories as "consumers." The reader should refer to Section 3.0 to determine which specific consumer groups are involved for each potential research topic by source of the topic.

Subject Categories and Potential Research Topics		BSD[a]	BSrD	BED	FEMP	A&TT
Category: Consumer Decision Making						
Topic: Consumer interest in: 1. - Paybacks - Changes in Energy Prices - ROIs - Life Cycle Costs - Conservation	Source	X	X			
	Importance[b]	10	9			
	Knowledge[c]	4	5			
Topic: How much time, effort and money are consumers willing to expend to acquire the information needed to make various types of decisions 2.	Source		X			
	Importance		7			
	Knowledge		3			
Topic: What information is needed by consumer segments in terms of form, content and delivery mechanism to be able to make cost-effective energy-use decisions 3.	Source	X	X			
	Importance	10	7			
	Knowledge	3	2			
Topic: Market Segmentation and Analysis: a) Identification and analysis of the types of decision makers (segments); b) Analysis of the types of decisions made by each segment 4. (s=single family; m=multi family; c=commercial; d=district)	Source	X	X	X		
	Importance	10	10	9 | 8		
	Knowledge	4	S)5 C)3 M)4 D)6	5 | 5		
Topic: What does each type of decision maker need, at a minimum, to make each type of purchase/investment/design decisions made 5. (s=single family; m=multi family; c=commercial; d=district)	Source	X	X			
	Importance	10	9			
	Knowledge	3	S)5 C)3 M)3 D)7			

[a] BSD = Building System Division; BSrD = Building Services Division; BED = Building Equipment Division, FEMP = Federal Energy Management Program (or FCPD); A&TT = Analysis and Technology Transfer

[b] Importance is rated 0 – 10; 0 being unimportant to 10 being very important. Multiple ratings reflect disagreement between group participants

[c] Knowledge is rated 0 – 10; 0 meaning no knowledge on this topic within BERD to 10 meaning a lot is known within BERD on this topic. Multiple ratings reflect disagreement between group participants

Subject Categories and Potential Research Topics		BSD[a]	BSrD	BED	FEMP	A&TT
Category: Consumer Decision Making						
Topic: 6. What is the upper limit (i.e., potential) of actions or investments consumers are willing to make in conservation given: a) all the information they need; b) available financing (s=single family; m=multi family; c=commercial; d=district)	Source		X			
	Importance[b]		10			
	Knowledge[c]		S)6 C)3 M)3 D)3			
Topic: 7. What are energy conservation investment dollars competing with (i.e., what other types of investments or purchases) (s=single family; m=multi family; c=commercial; d=district)	Source		X			
	Importance		10			
	Knowledge		S)6 C)3 M)3 D)3			
Topic: 8. What are the most effective ways of influencing the thinking and decision makers in each consumer group	Source		X			
	Importance		10			
	Knowledge		2			
Topic: 9. What are the options which could be used to motivate (voluntary) investment in energy conservation	Source	X				
	Importance	8				
	Knowledge	3				
Topic: 10. What are the criteria used by each consumer group to make energy-related decisions	Source	X				
	Importance	10				
	Knowledge	5				

[a] BSD = Building System Division; BSrD = Building Services Division; BED = Building Equipment Division, FEMP = Federal Energy Management Program (or FCPD); A&TT = Analysis and Technology Transfer

[b] Importance is rated 0 → 10; 0 being unimportant to 10 being very important. Multiple ratings reflect disagreement between group participants

[c] Knowledge is rated 0 → 10; 0 meaning no knowledge on this topic within BERD to 10 meaning a lot is known within BERD on this topic. Multiple ratings reflect disagreement between group participants

Subject Categories and Potential Research Topics		BSD[a]	BSrD	BED	FEMP	A&TT
Category: Consumer Decision Making						
Topic: 11. What are the barriers and factors contributing to resistance to new technology adoption by either: a) manufacturers b) end consumers	Source	X		X		
	Importance[b]	9		10 | 9		
	Knowledge[c]	3		6 | 6		
Topic: 12. What are the most effective mechanisms for educating consumers on energy-related technologies	Source			X		
	Importance			10 | 9		
	Knowledge			5 | 7		
Topic: 13. How do consumers in each segment make decisions (i.e., what are the consumer decision processes)	Source			X		
	Importance			5 | 9		
	Knowledge			7 | 6		
Topic: 14. What are the effects of utility-sponsored activities (programs, advertising, etc.) on consumer decision making	Source			X		
	Importance			10 | 9		
	Knowledge			5 | 3		
Topic: 15. What are the effects of home tenure decisions on energy conservation investments	Source			X		
	Importance			8 | 4		
	Knowledge			5 | 0		

[a] BSD = Building System Division; BSrD = Building Services Division; BED = Building Equipment Division, FEMP = Federal Energy Management Program (or FCPD); A&TT = Analysis and Technology Transfer

[b] Importance is rated 0 – 10; 0 being unimportant to 10 being very important. Multiple ratings reflect disagreement between group participants

[c] Knowledge is rated 0 – 10; 0 meaning no knowledge on this topic within BERD to 10 meaning a lot is known within BERD on this topic. Multiple ratings reflect disagreement between group participants

Subject Categories and Potential Research Topics		BSD[a]	BSrD	BED	FEMP	A&TT
Category: Consumer Decision Making						
Topic: 16. What non-economic factors motivate investments in energy conservation (i.e., comfort, etc.)	Source					X
	Importance[b]					10*
	Knowledge[c]					1*
Topic: 17. Are home energy bills a determining factor in the purchase decision of a home or just a relevant factor	Source					X
	Importance					9*
	Knowledge					2*
Topic: 18. Who are the prospective adopters of district heating/cooling systems and what are the barriers to adoption	Source		X			
	Importance		10*			
	Knowledge		3*			
Topic: 19. How can energy efficiency become a competitive advantage to manufacturers who utilize energy-efficient technologies	Source			X		
	Importance			9*		
	Knowledge			3*		
Topic: 20. How can builders and mobile home manufacturers be educated on how, and motivated to build energy-efficient homes	Source	X				
	Importance	10*				
	Knowledge	1*				

* Estimated from discussion.

[a] BSD = Building System Division; BSrD = Building Services Division; BED = Building Equipment Division, FEMP = Federal Energy Management Program (or FCPD); A&TT = Analysis and Technology Transfer

[b] Importance is rated 0 – 10; 0 being unimportant to 10 being very important. Multiple ratings reflect disagreement between group participants

[c] Knowledge is rated 0 – 10; 0 meaning no knowledge on this topic within BERD to 10 meaning a lot is known within BERD on this topic. Multiple ratings reflect disagreement between group participants

Subject Categories and Potential Research Topics		BSD[a]	BSrD	BED	FEMP	A&TT
Category: Consumer Decision Making						
Topic: Who makes the purchase decisions for appliances and equipment, and how is the decision made, for: 21. a) new appliances b) replacement of purchases	Source			X		
	Importance[b]			9*		
	Knowledge[c]			3*		
Topic:	Source					
	Importance					
	Knowledge					
Topic:	Source					
	Importance					
	Knowledge					
Topic:	Source					
	Importance					
	Knowledge					
Topic:	Source					
	Importance					
	Knowledge					

* Estimated from discussion.

[a] BSD = Building System Division; BSrD = Building Services Division; BED = Building Equipment Division, FEMP = Federal Energy Management Program (or FCPD); A&TT = Analysis and Technology Transfer

[b] Importance is rated 0 → 10; 0 being unimportant to 10 being very important. Multiple ratings reflect disagreement between group participants

[c] Knowledge is rated 0 → 10; 0 meaning no knowledge on this topic within BERD to 10 meaning a lot is known within BERD on this topic. Multiple ratings reflect disagreement between group participants

Subject Categories and Potential Research Topics		BSD[a]	BSrD	BED	FEMP	A&TT
Category: Consumer Behavior						
Topic: 22. What factors motivate or influence energy use decisions, by segment	Source	X				
	Importance[b]	8				
	Knowledge[c]	3				
Topic: 23. What energy-related technologies are currently being utilized within each consumer segment	Source	X				
	Importance	10				
	Knowledge	0				
Topic: 24. What types of influences, incentives or information do consumers need to make energy-use/lifestyle decisions	Source		X			
	Importance		9			
	Knowledge		S)5 C)3 U)3 D)7			
Topic: 25. What are the usage elasticities with respect to efficiency and energy cost trade-offs (i.e., how do consumers use various products as a response to changing costs and varying efficiency levels)	Source			X		
	Importance			5 ¦ 8		
	Knowledge			0 ¦ 6		
Topic: 26. What are the effects of utility actions (i.e., programs, advertising, etc.) on consumer behavior related to energy use and conservation	Source			X		
	Importance			10 ¦ 9		
	Knowledge			5 ¦ 3		

[a] BSD = Building System Division; BSrD = Building Services Division; BED = Building Equipment Division, FEMP = Federal Energy Management Program (or FCPD); A&TT = Analysis and Technology Transfer

[b] Importance is rated 0 – 10; 0 being unimportant to 10 being very important. Multiple ratings reflect disagreement between group participants

[c] Knowledge is rated 0 – 10; 0 meaning no knowledge on this topic within BERD to 10 meaning a lot is known within BERD on this topic. Multiple ratings reflect disagreement between group participants

Subject Categories and Potential Research Topics		BSD[a]	BSrD	BED	FEMP	A&TT
Category: Consumer Behavior						
Topic: 27. What are the options available to affect behavioral changes which reduce energy use in private and public applications	Source				X	
	Importance[b]				9*	
	Knowledge[c]				2*	
Topic: 28. How can voluntary compliance to energy guidelines be motivated	Source				X	
	Importance				10*	
	Knowledge				2*	
Topic: 29. What are the most effective means available to inform private firms about Energy Consideration in Design workshops, and how can they be motivated to participate	Source				X	
	Importance				9*	
	Knowledge				2*	
Topic: 30. How can the knowledge gained from the Energy Consideration in Design workshops be transferred to commercial, industrial and residential sectors for retrofit activities	Source				X	
	Importance				10*	
	Knowledge				1*	
Topic: 31. Are there ways of providing consumers with immediate feedback on energy use decisions, in a cost-effective way, to improve their use decisions	Source			X		
	Importance			9*		
	Knowledge			3*		

* Estimated from discussion.

[a] BSD = Building System Division; BSrD = Building Services Division; BED = Building Equipment Division, FEMP = Federal Energy Management Program (or FCPD); A&TT = Analysis and Technology Transfer

[b] Importance is rated 0 → 10; 0 being unimportant to 10 being very important. Multiple ratings reflect disagreement between group participants

[c] Knowledge is rated 0 → 10; 0 meaning no knowledge on this topic within BERD to 10 meaning a lot is known within BERD on this topic. Multiple ratings reflect disagreement between group participants

Subject Categories and Potential Research Topics		BSD[a]	BSrD	BED	FEMP	A&TT
Category: Consumer Behavior						
Topic: 32. How can consumers and sales persons be educated about interaction effects of behavior and structural/appliance characteristics on energy use	Source	X				
	Importance[b]	9*				
	Knowledge[c]	1*				
Topic:	Source					
	Importance					
	Knowledge					
Topic:	Source					
	Importance					
	Knowledge					
Topic:	Source					
	Importance					
	Knowledge					
Topic:	Source					
	Importance					
	Knowledge					

* Estimated from discussion.

[a] BSD = Building System Division; BSrD = Building Services Division; BED = Building Equipment Division, FEMP = Federal Energy Management Program (or FCPD); A&TT = Analysis and Technology Transfer

[b] Importance is rated 0 – 10; 0 being unimportant to 10 being very important. Multiple ratings reflect disagreement between group participants

[c] Knowledge is rated 0 – 10; 0 meaning no knowledge on this topic within BERD to 10 meaning a lot is known within BERD on this topic. Multiple ratings reflect disagreement between group participants

Subject Categories and Potential Research Topics		BSD[a]	BSrD	BED	FEMP	A&TT
Category: Other Related Issues						
Topic: 33. What determines which technologies and strategies will succeed in the market and how can success be measured	Source	X				
	Importance[b]	8				
	Knowledge[c]	3				
Topic: 34. Evaluate and quantify estimates for energy savings for each technology and strategy (i.e., what impact will BERD research have on energy savings)	Source	X				
	Importance	10				
	Knowledge	2				
Topic: 35. What are the best mechanism and criteria to use in prioritizing research efforts	Source	X				
	Importance	10				
	Knowledge	4				
Topic: 36. What are the most effective ways of soliciting private research partners to work with the Federal government's research efforts	Source			X		
	Importance			9 | 0		
	Knowledge			3 | 0		
Topic: 37. Determination of who potential non-federal users of FEMP work are	Source				X	
	Importance				8*	
	Knowledge				1*	

* Estimated from discussion.

[a] BSD = Building System Division; BSrD = Building Services Division; BED = Building Equipment Division, FEMP = Federal Energy Management Program (or FCPD); A&TT = Analysis and Technology Transfer

[b] Importance is rated 0 → 10; 0 being unimportant to 10 being very important. Multiple ratings reflect disagreement between group participants

[c] Knowledge is rated 0 → 10; 0 meaning no knowledge on this topic within BERD to 10 meaning a lot is known within BERD on this topic. Multiple ratings reflect disagreement between group participants

Subject Categories and Potential Research Topics		BSD[a]	BSrD	BED	FEMP	A&TT
Category: Other Related Issues						
Topic: 38. Establish a base-line data base by which to measure the effect of retrofit and research activities	Source	X			X	
	Importance[b]	10			10*	
	Knowledge[c]	4			2*	
Topic: 39. Is energy scarcity or supply perceived to be a 1) current or 2) long-term problem or issue of concern	Source					X
	Importance					8*
	Knowledge					2*
Topic: 40. Do energy conservation investments increase the (resale) value of the home (rather than consumers simply perceiving that they do)	Source					X
	Importance					9*
	Knowledge					1*
Topic: 41. Which market strategy will be most effective in improving market penetration of energy-efficient buildings and appliances: a) technology push; b) demand pull; or c) a combination of both	Source					X
	Importance					10*
	Knowledge					1*
Topic: 42. What are manufacturers intentions in terms of new product offerings; how can this activity be tracked to help plan BCS research efforts	Source			X		
	Importance			10*		
	Knowledge			1*		

* Estimated from discussion.

[a] BSD = Building System Division; BSrD = Building Services Division; BED = Building Equipment Division, FEMP = Federal Energy Management Program (or FCPD); A&TT = Analysis and Technology Transfer

[b] Importance is rated 0 → 10; 0 being unimportant to 10 being very important. Multiple ratings reflect disagreement between group participants

[c] Knowledge is rated 0 → 10; 0 meaning no knowledge on this topic within BERD to 10 meaning a lot is known within BERD on this topic. Multiple ratings reflect disagreement between group participants

Subject Categories and Potential Research Topics		BSD[a]	BSrD	BED	FEMP	A&TT
Category: Other Related Issues						
Topic: 43. How can energy conservation be repositioned in the market, and with consumers, to energy efficiency (conservation implies deprevation)	Source			X		
	Importance[b]			7*		
	Knowledge[c]			2*		
Topic:	Source					
	Importance					
	Knowledge					
Topic:	Source					
	Importance					
	Knowledge					
Topic:	Source					
	Importance					
	Knowledge					
Topic:	Source					
	Importance					
	Knowledge					

* Estimated from discussion.

[a] BSD = Building System Division; BSrD = Building Services Division; BED = Building Equipment Division, FEMP = Federal Energy Management Program (or FCPD); A&TT = Analysis and Technology Transfer

[b] Importance is rated 0 → 10; 0 being unimportant to 10 being very important. Multiple ratings reflect disagreement between group participants

[c] Knowledge is rated 0 → 10; 0 meaning no knowledge on this topic within BERD to 10 meaning a lot is known within BERD on this topic. Multiple ratings reflect disagreement between group participants

6.0 ADDITIONAL RESEARCH TOPICS GENERATED BY THE PNL PROJECT TEAM

This section contains additional consumer decision making and behavior research topics generated by the PNL project team. These topics were not included in the matrix structure used in Section 5.0 because they were generated outside of BCS and, thus, the source is consistent and the knowledge and importance ratings used in Section 5.0 do not apply. These topics were integrated with the BCS-generated topics for research design efforts which are presented in Section 7.0 of this report.

ADDITIONAL CONSUMER BEHAVIOR AND DECISION MAKING RESEARCH TOPICS

44. What are the likely characteristics of future consumers? Will the composition of the population change over the next 20 years in ways that may affect energy decision making, both investment and use?

45. Where in the U.S., or the world, have consumers purchased above average levels of energy conservation goods and services? What local factors contributed to this?

46. Can corporate "good will" or "public image" be used to motivate companies to adopt energy conservation techniques and/or practices? If so, to what extent and how?

47. Are there discrepancies between people's perceptions of how they use energy (i.e., spend energy dollars) and how they actually use it? Can these be reconciled in such a way so as to motivate energy conserving behavior?

48. What is the feasibility of establishing a publicly-accessible database decision aid/expert system to assist architects, engineers, and designers in designing energy-efficient buildings?

49. What information currently is possessed by each consumer segment about the energy-related technologies available to them?

50. To what degree do consumer attitudes predict their energy conservation behaviors?

51. What is the relative importance of economic and non-economic considerations in the decisions of different types of consumers when they are considering, for example: (a) choosing among new appliances; (b) retrofits in existing buildings; or (c) new construction?

52. What non-economic factors discourage investment in energy conservation (e.g., health risks associated with formaldehyde in blown insulation, the inconvenience of remodeling, the availability of building materials or technologies) by intermediate and end uses?

53. What risks are perceived by energy consumers (intermediate and end consumers) in using new energy-conserving technologies? Do these perceived risks affect behavior? If so, how?

54. What are the specific types of energy-related decisions that can be made by each consumer group (i.e., their "spheres of influence")?

55. Do state and local government energy-related activities and regulations significantly impact consumer behavior (especially engineers)? If so, are these entities also consumers of BCS services and research?

56. What consumer behaviors comprise the universe of "energy conservation" (e.g., turning off lights, insulating buildings, bicycling/taking the bus rather than driving) and which behaviors conserve the greatest amounts of energy? How can this type of information be used by consumers?

57. What are public (mis)conceptions about energy conservation and alternative energy technologies (elderly vs. school age, income levels, etc.)?

58. What groups of the public use the greatest amounts of each type of energy?

59. What energy-related choices are likely to be influenced by conservation motives?

60. What role does "product familiarity" play in the type of information best utilized by the consumer groups? (Familiarity may be a segmentation technique) Communication should match the technical complexity of its intended audience (i.e. intermediate users would use a different kind of information than would end consumers when making decisions).

61. What information delivery mechanism do end and intermediate consumers find most reliable in terms of giving credible, useful information (i.e., appliance labels, public and private product advertising, consumer reports etc...)?

62. How important is "immediate feedback" in getting end consumers to curtail or alter energy use?

63. How does the current environment affect the actual market penetration of new technology (i.e. to what degree does rising fuel cost enhance market penetration)? How can a long term perspective or perceptions be used and motivators?

64. What type of new technology will the end or intermediate consumer be inclined to use if they perceive energy scarcity to be a long-term problem?

65. What type of new technology will the end or intermediate consumer be inclined to use if they perceive energy scarcity to be only a current issue of concern?

66. Are environmental factors, or personal attitudes of end or intermediate consumers, more important to the actual market success of new efficient equipment or appliances?

67. What are the best methods for establishing a base-line data base so that the effects of various BCS developed technologies can be measured? (Earlier research concludes that actual consumption data must be used to get true usage figures. True usage can be obtained with "data-logging" equipment or in the form of utility billing data.)

68. What degree of awareness and credibility does BCS have among its perceived customers and does it affect adoption of their technology and/or research?

69. How much knowledge about current equipment, appliances, etc...do the end or intermediate consumers presently have?

70. Are Americans willing to invest in energy efficient technology on an individual level for the good of the entire society? If so, how can this be motivated?

71. Why do end consumers buy appliances that are promoted as being energy "efficient" (this may give insight as to how conservation should be positioned in the market)?

72. What is the awareness level among end consumers regarding appliance efficiency labels and are they perceived as useful?

73. What are the incremental effects of financial incentives on conservation behavior, purchases and investments?

    (a) Do consumers offered incentives take more and/or different actions than consumers not offered incentives?

    (b) Do consumers offered incentives take more of the action recommended by auditors than those who are not offered incentives?

    (c) Do consumers offered incentives choose more cost effective conservation actions than those not offered incentives.

74. How are household energy use decisions made and what are the roles of individual family members in energy use decisions?

75. Does a threshold exist for energy prices above which consumers become concerned enough to take conservation actions? Does this threshold vary by consumer segment?

7.0 DEVELOPMENT AND CONTENT OF SPECIFIC RESEARCH PROJECTS

In this section, we describe twenty research projects derived from the 75 topics listed in Sections 5.0 and 6.0 that comprise the proposed research agenda for BCS. In addition, the method used by the PNL project team to develop this research agenda from the topics is described.

7.1 METHODOLOGY

The first step in developing a research agenda was to clarify and combine the 75 topics listed in Sections 5.0 and 6.0 into categories containing related topics. The results of this clarification are presented in Table 7.1. The "Topic Number" column in the table refers to the topic numbers used in Sections 5.0 and 6.0. The six categories of related research topics are:

- market segmentation and identification
- communication
- decision process and variables
- option identification and evaluation
- product/technology characterization and assessment
- market assessment.

The "Xs" in Table 7.1 indicate the categories into which a particular topic was classified. Where a topic was cross-cutting and involved issues from more than one category, the dominant category classification is indicated by a "| X |" symbol in that category.

The second step in preparing an agenda was to develop specific research projects for each category of topics. Projects were developed around topics that were grouped together consistently within each category. Twenty research projects were identified in this manner.

7.2 PROPOSED PROJECT DESCRIPTIONS

The twenty project descriptions presented below provide a brief outline of the type of work proposed for the BCS research agenda. Each project description includes the following information:

TABLE 7.1. Topic Categorization

Topic Number	Topic	Segmentation Identification	Communication	Decision Process and Variables	Option Identification and Evaluation	Product Characterization	Market Assessment
1	Consumer decision variables			X			
2	Information aquisition			X			
3	Information form source & content	X	X	[X]			
4	Segmentation and analysis	[X]	X	X			
5	Minimum information needs		X	[X]			
6	Upper limit of action						X
7	Investment competition			X			
8	Consumer influences	X	[X]				
9	Motivation alternatives				X		
10	Decision criteria			X			
11	Barrier to technology adoption			[X]			
12	Consumer education		X				
13	Decisions within segments	X		[X]			
14	Utility program impacts				X		
15	Tenure decision influences			X			
16	Non-economic factors			X			
17	Energy bill influences			X			
18	District system adoption						X
19	Conservation as competitive advantage					X	[X]
20	Building industry education		[X]		X		
21	Decision maker identification			X			
22	Motivating factors	X		[X]			
23	Energy technologies	X				[X]	
24	Influences/information/incentives		X	[X]	X		
25	Usage elasticities			[X]		X	
26	Utility actions/influences				X		
27	Behavioral changes	X			[X]		

TABLE 7.1. (contd)

Topic Number	Topic	Segmentation Identification	Communication	Decision Process and Variables	Option Identification and Evaluation	Product Characterization	Market Assessment
28	Voluntary compliance		X		[X]		
29	Workshops		X		[X]		
30	Knowledge transfer		X				
31	Usage feedback		X				
32	Consumer education		X				
33	Market success						X
34	Technology savings					[X]	X
35	R&D options				X		
36	Research partners				X		
37	FEMP market potential	X					
38	Baseline data base for evaluation				X		
39	Scarcity as long or short term	[X]		X			
40	Home value					X	
41	Marketing options			X			
42	Manufacturers intention tracking					[X]	X
43	Reposition of conservation		X				
44	Future consumer characterization	X					
45	Past purchase behavior	X		X		X	[X]
46	Public image				X		
47	Discrepancies in use		X				
48	Expert system				X		
49	Segment information	X					
50	Attitudes to behavior			X			
51	Economic vs noneconomic incentives	X		[X]			
52	Conservation discouragement			[X]		X	X
53	Risk			X			

TABLE 7.1. (contd)

Topic Number	Topic	Segmentation Identification	Communication	Decision Process and Variables	Option Identification and Evaluation	Product Characterization	Market Assessment
54	Decision maker situation	X		[X]			
55	State and local				X		
56	"Universe" of alternatives			X			
57	(mis) conceptions	[X]	X				
58	Energy use	X					
59	Conservation motives			X			
60	Product familiarity			X			
61	Information delivery mechanisms		X				
62	Immediate feedback		[X]	X			
63	Environmental factors						X
64	Long term perceptions			[X]		X	
65	Short term perceptions			[X]		X	
66	Environment vs attitudes			X			
67	Methods of establishing database				X		
68	BCS credibility		X				
69	Knowledge levels	X					
70	Social problem			[X]	X		
71	Efficient appliance purchase			[X]	X		
72	Appliance labeling awareness	X			[X]		
73	Financial options				X		
74	Family member roles			X			
75	Action threshold	X		[X]			

1.	Title	Project Title
2.	Objective	What is the primary purpose of conducting this project
3.	Research Topics	What research topics identified by BCS and PNL staff are addressed by the project
4.	Scope	What tasks are to be conducted in this project
5.	Methodology	How will each task be carried out
6.	Time	What length of time will the project take
7.	Level of Effort	An estimate of cost and person/years
8.	Dependencies	What other projects must be concluded prior to or concurrently with the project being described.

Prioritization of research projects is indicated by the "dependencies" listed for each project. The project is dependent upon the results of the projects listed in the "dependencies" category. These projects may either be conducted prior to the project of interest or concurrently in some cases. A timeline for the proposed research agenda is shown in Figure 7.1. The estimates of cost and level of effort are only preliminary and are subject to change given the actual work scope agreed upon.

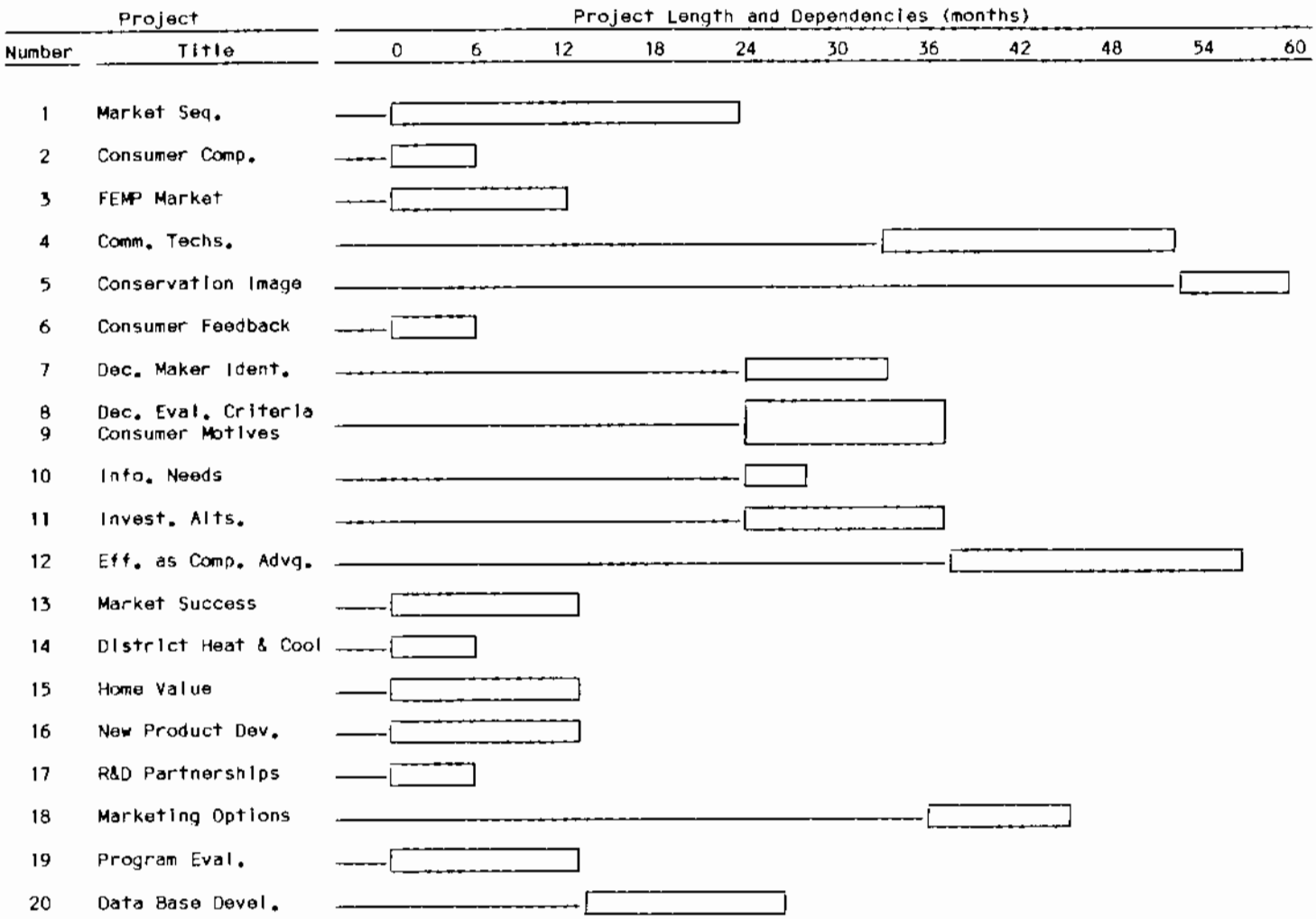
Project
Number
Title
Project Length and Dependencies (months)
0
6
12
18
24
30
36
42
48
54
60
1 Market Seq.
2 Consumer Comp.
3 FEMP Market
4 Comm. Techs.
5 Conservation Image
6 Consumer Feedback
7 Dec. Maker Ident.
8 Dec. Eval. Criteria
9 Consumer Motives
10 Info. Needs
11 Invest. Alts.
12 Eff. as Comp. Advg.
13 Market Success
14 District Heat & Cool
15 Home Value
16 New Product Dev.
17 R&D Partnerships
18 Marketing Options
19 Program Eval.
20 Data Base Devel.

FIGURE 7.1.

SEGMENTATION: PROJECT 1

1. Title: Market Segmentation and Characterization

2. Objective: Identify and characterize market segments for both residential and commercial consumers (end & intermediate). Assess each in terms of:
   - Knowledge and attitudes toward energy use and conservation
   - Energy technologies employed
   - Psychographics (lifestyle and opinion)
   - Geographics
   - Expectations and perceived risk
   - Energy use
   - Relevant energy-use decision
   - Appropriate decision makers.

3. Research Topics:
   #4 Segmentation and Analysis
   #49 Segmentation Information
   #57 (Mis) Conceptions
   #58 Energy Use
   #69 Knowledge Levels

4. Scope:
   1. Collect survey data on residential and commercial consumers
   2. Evaluate and analyze each

5. Methodology:
   1. Make use of existing survey data such as ELCAP, RECS, NBECS, NAHB and BOMA to identify important consumer characteristics.
   2. Collect primary data to supplement existing data where needed.
   3. Analyze (all) data utilizing techniques such as Factor, Cluster, Discrimination and Regression Analyses to segment the market.
   4. Determine implications of market segments in terms of energy use and conservation for BCS R&D planning.

SEGMENTATION: PROJECT 1 (contd)

6. Time: 2 years

7. Level of effort: $350-$500K (2+ person years)

8. Dependency: None

SEGMENTATION: PROJECT 2

1. Title: Trends in Consumer Composition
2. Objective: Assess the effects of population changes and trends on future energy efficiency and consumption
3. Research Topics: #44 Future Consumer Characterization
4. Scope:
   1. Develop baseline from existing demographic data.
   2. Develop alternative scenarios of consumer characteristics and descriptions.
   3. Assess impacts of alternative scenarios on energy efficiency and use.
   4. Determine implication of impacts for BCS planning and R&D efforts.
5. Methodology:
   1. Evaluate census data and link to usage/conservation patterns
   2. Employ scenario development models
   3. Analyze impacts and implications
6. Time: 6 months
7. Level of effort: $75-100K (1/2-3/4 person-year)
8. Dependencies: None.

SEGMENTATION: PROJECT 3

1. Title: FEMP Market Assessment

2. Objective: Evaluate the market for FEMP generated materials, information, and products.

3. Research Topics: #37 FEMP Market Potential

4. Scope:
   1. Identify and describe current FEMP materials, information and products.
   2. Identify and characterize current FEMP consumers
      i) Develop criteria for inclusion in consumer group
      ii) Characteristics for identification of potential consumers
   3. Identify new consumers and assess adoption potential
   4. Oevelop a strategy to approach the market.

5. Methodology:
   1. Survey or interview current consumers
   2. Analyze existing data and identify new consumers
   3. Develop strategy once we know who, and where new consumers are.

6. Time: 1 year

7. Level of Effort: $150K (1 person year)

8. Dependencies: None.

COMMUNICATION: PROJECT 4

1. Title: Effective Communication Techniques

2. Objective: Determine the most effective techniques for communicating energy use and conservation information to the relevant market segment(s).

3. Research Topics:
   - #8 Consumer Influences
   - #12 Consumer Education
   - #20 Building Industry Education
   - #29 Work Shops
   - #30 Knowledge Transfer
   - #32 Consumer Education
   - #61 Information Delivery Mechanisms

4. Scope:
   1. Identify appropriate market segments by levels of knowledge, technologies employed and information needs
   2. Identify (minimum) information needs not currently available to decision makers within each segment
      i) determine appropriate information form
      ii) determine appropriate information content
   3. Identify and evaluate alternative communication channels and vehicles in terms of:
      - credibility
      - believability
      - effectiveness
      - cost
      - reach
      - access to appropriate targets
   4. Develop communication strategies appropriate for each segment.

5. Methodology:
   1. Segmentation (see methodology under Market Segmentation and Characterization Project)

COMMUNICATION: PROJECT 4 (contd)

2. Collect primary data via surveys, interviews or focus groups from decision makers within segments
   i) assess desired form of information
   ii) assess desired content
   iii) identify minimum information needs
   iv) evaluate of current communication channels
3. Analyze data to develop channels.

6. Time: 1-1/2 years.

7. Level of Effort: $250-$350K (2 person years).

8. Dependencies: Decision maker identification project.
   Market segmentation and characterization project.
   Information needs project.

COMMUNICATION: PROJECT 5

1. Title: Changing Conservation's Image with Consumers

2. Objective: Identify techniques to change the image (meaning) of energy conservation.

3. Research Topics: #43 Reposition of Conservation
   #68 BCS Credibility

4. Scope:
   1. Identify appropriate market segments
   2. Assess current image of conservation with consumers who conserve within each segment
   3. Identify potential benefits of conservation to consumers within appropriate segments
   4. Identify most effective means of communicating these benefits to consumers
   5. Develop strategies which convey these benefits to target consumers through best channels.

5. Methodology:
   1. Segmentation (see methodology under Market Segmentation and Characterization Project)
   2. Collect primary data through survey, interviews, or focus groups to assess current image of conservation and of persons who conserve
   3. Identify most effective communication methods (see methodology under Effective Communication Techniques Project) for changing a potentially negative image
   4. Analyze data to develop effective strategy.

6. Time: 6 months.

7. Level of Effort: $75K (1/2 person year)

8. Dependencies: Market segmentation and characterization project
   Effective communication project.

COMMUNICATION: PROJECT 6

1. Title: Consumer Feedback

2. Objective:
   1. Determine the relative importance of energy use feedback on consumers' energy use decisions
   2. Determine the most effective ways of providing feedback if it's found to be important.

3. Research Topics:
   #31 Usage Feedback
   #47 Discrepancies in Use

4. Scope:
   1. Investigate the role feedback plays in energy consumption decisions
   2. Evaluate alternative techniques for providing energy consumption feedback.
   3. Develop a matrix of type of use by feedback techniques
   4. Determine implications of feedback issues for BCS.

5. Methodology:
   1. Review existing literature on the role of feedback.
   2. Examine past case studies and research conducted by electric utilities, particularly in the area of real time pricing
   3. Identify and evaluate existing and proposed techniques for providing energy use feedback to consumers
   4. Analyze investigation results in terms of implications for BCS R&D planning.

6. Time: 6 months.

7. Level of Effort: $75-100K (1/2 person year)

8. Dependencies: None.

DECISION PROCESS: PROJECT 7

1. Title: Decision Maker Identification

2. Objective: To determine, by market segment, who the relevant decision makers are in each situation concerning energy use and conservation.

3. Research Topics: #21 Decision Maker Identification
   #54 Decision Maker Situation
   #74 Family Member Roles

4. Scope:
   1. Conduct market segmentation
   2. Determine the types of energy related decisions that are made within each segment (i.e., consumption, equipment, investment...)
   3. Identify the individuals or entities involved with each type of decision
   4. Determine who the key decision makers (vs influencers) are for each decision type with social network data
   5. Evaluate data and determine the implications for BCS planning and R&D activities.

5. Methodology:
   1. Segmentation (see methodology for segmentation and characterization project)
   2. Review appropriate literature concerning decision makers
   3. Collect primary data as required through surveys, interviews and focus groups
   4. Analyze data and develop strategy to influence appropriate decision makers in terms of energy related decisions.

6. Time: 9 months.

7. Level of Effort: $100K (3/4 person years)

8. Dependencies: Market segmentation and characterization project.

DECISION PROCESS: PROJECT 8

1. Title: *Consumer Decision Evaluation Criteria

2. Objective: To determine the evaluation criteria used by consumers when selecting from among alternatives available to meet energy needs.

3. Research Topics:
   - #1 Consumer Decision Variables
   - #10 Decision Criteria
   - #11 Barriers to Technology Adoption
   - #25 Usage Elasticities
   - #52 Conservation Discouragement
   - #53 Risk
   - #60 Product Familiarity
   - #65 Long Term Perspectives
   - #66 Short Term Perspectives
   - #71 Efficient Appliance Purchase

4. Scope:
   1. Market segmentation
   2. Identify major important evaluation criteria by segment
   3. Determine the relative importance of each criterion
   4. Determine the implications for BCS planning and R&D efforts.

5. Methodology:
   1. Market segmentation (see methodology for market segmentation and characterization project)
   2. Review energy decision making literature
   3. Collect primary data to supplement existing data through surveys, focus groups or interviews
   4. Analyze data and determine its implication for BCS planning and R&D
   5. Develop a strategy for BCS to influence evaluation criteria which motivate desired behavior in terms of energy conservation.

6. Time: 1 year.

DECISION PROCESS: PROJECT 8 (contd)

7. Level of Effort: $150-$200K (1+ person year)

8. Dependencies: Market segmentation and characterization project.
Consumer Motivation Issues project.

*NOTE: Should be conducted in conjunction with the Consumer Motivation Issues project (Number 9) to develop a more comprehensive strategy to motivate desired consumer behavior.

DECISION PROCESS: PROJECT 9

1. Title: Consumer Motivation Issues

2. Objective: Determine what motivates consumer behavior in terms of energy use including the examination of, but not limited to:
   - Tenure decisions
   - Utility bills
   - Noneconomic and economic motives
   - Financial motives
   - Altrusism
   - Price thresholds
   - Attitudes
   - Expectations.

3. Research Topics:
   - #15 Tenure Decision Influences
   - #16 Non-Economic Factors
   - #17 Energy Bill Influence
   - #22 Motivating Factors
   - #24 Influences/Information/Incentives
   - #50 Attitudes to Behavior
   - #51 Economic versus Non-Economic Incentives
   - #59 Conservation Motives
   - #66 Environment versus Attitudes
   - #70 Social Problems
   - #75 Action Threshold

4. Scope:
   1. Market segmentation
   2. Identify important motivators of conservation behavior
   3. Evaluate relative importance of motivators using multi-attribute utility techniques
   4. Analyze the impact of important motivators on energy conservation behavior
   5. Determine implications of motivation study results for BCS planning and R&D activities.

DECISION PROCESS: PROJECT 9 (contd)

5. Methodology:
   1. Market segmentation (see methodology under Market Segmentation and Characterization Project)
   2. Review the literature pertaining to energy conservation behavior
   3. Collect primary data, where needed, through surveys, focus groups, or behavioral interventions to supplement the literature
   4. Analyze data and determine implications for BCS
   5. Develop BCS strategy to motivate desired conservation behavior in terms of energy conservation.
6. Time: 1 year.
7. Level of Effort: $150-200K (1+ person year)
8. Dependencies: Market segmentation and characterization project. Consumer decision and evaluation criteria project.

DECISION PROCESS: PROJECT 10

1. Title: Information Needs

2. Objective: Determine the appropriate form, content, and source of energy use and conservation information needed by consumer segments to facilitate energy consumption decision making.

3. Research Topics:
   - #2 Information Aquisition
   - #3 Information Form, Source & Content
   - #5 Minimum Information Needs
   - #56 "Universe" of Alternatives

4. Scope:
   1. Segment the market
   2. Determine information needs by segment
   3. Determine implications for BCS R&D and programmatic (tech transfer) planning.

5. Methodology:
   1. Segmentation (see methodology under Market Segmentation and Characterization Project)
   2. Collect primary data regarding segment levels and types of energy use and levels of knowledge about technologies currently used and available.
   3. Analyze data for implications for BCS R&D planning.

6. Time: 3 months (assuming dependency projects are complete).

7. Level of Effort: $75K (1/2 person year).

8. Dependencies: Market segmentation and characterization project.

DECISION PROCESS: PROJECT 11

1. Title: Competitive Investment Alternatives

2. Objective: Determine the alternative investments available to consumers that compete for potential conservation expenditure.

3. Research Topics: #7 Investment Competition

4. Scope:
   1. Market segmentation and characterization
   2. Determine current or expected levels of conservation expenditure
   3. Identify non-conservation alternatives within that expenditure range
   4. Conduct decision analysis to determine consumer preferences for investment choices
   5. Evaluate analysis results in terms of implications for BCS planning and R&D activities.

5. Methodology:
   1. Conduct market segmentation (see methodology in Market Segmentation and Characterization Project)
   2. Analyze existing survey data on consumer investment choices and preferences
   3. Collect primary data as needed through surveys, interviews and focus groups
   4. Conduct analyses which could include:
      - conjoint analysis
      - multi-dimensional scaling
      - perceptual mapping
   5. Interpret results for BCS activities

6. Time: 1 year

7. Level of Effort: $250K (1 1/2 person years)

8. Dependencies: Market segmentation and characterization project.

MARKET ANALYSIS: PROJECT 12

1. Title: Energy Efficiency as a Competitive Advantage

2. Objective: Determine how to increase the importance of energy efficiency to consumers as a product, or residence characteristic.

3. Research Topics: #19 Conservation as a Competitive Advantage

4. Scope:
   1. Segment the market
   2. Determine existing importance level of conservation relative to other product or residence features
   3. Develop market strategies to increase importance of energy efficiency as a product feature.

5. Methodology:
   1. Conduct segmentation (see methodology under Segmentation and Characterization Project)
   2. Review findings of consumer motivation and cecision evaluation projects for relevant motives/evaluation criteria for energy efficiency decisions
   3. Collect primary data from consumers by segment and product category
   4. Assess importance of product features and integrate with findings of prior projects
   5. Develop and evaluate strategies and incentives designed to increase the importance of energy efficiency
   6. Field test (test market) each strategy or incentive
   7. Recommend appropriate strategies to BCS.

6. Time: 1-1/2 year.

7. Level of Effort: $250-300K (1 1/2 person year).

8. Dependencies: Market segmentation and characterization project.
   Consumer motivation issues project.
   Consumer decision and evaluation criteria.

MARKET ANALYSIS: PROJECT 13

1. Title: Market Success and Potential

2. Objective: To determine factors leading to the success of conservation strategies in the market place including upper limits on willingness to invest.

3. Research Topics:
   - #6 Upper Limit of Action
   - #33 Market Success
   - #45 Past Purchase Behavior
   - #63 Environmental Factors

4. Scope:
   1. Identify instances of successful market penetration of conservation technologies
   2. Evaluate these instances in terms of the factors which lead to successful market success
   3. Report findings as related to BCS planning and R&D activities.

5. Methodology:
   1. Review literature concerning marketing strategies and adoption of conservation technologies and programs
   2. Conduct case study analysis on those instances exhibiting successful market penetration
   3. Evaluate and assess the factors contributing to success of the technology or strategy
   4. Utilize this information to develop recommendations for BCS marketing, planning and R&D activities.

6. Time: 1 year.

7. Level of Effort: $100-150K (1 person year).

8. Dependencies: *Could be done in conjunction with the Program Evaluation Project.

MARKET ANALYSIS: PROJECT 14

1. Title: Market Potential for District Heating and Cooling

2. Objective: Identify prospective adopters of district heating and cooling systems and potential barriers to its adoption.

3. Research Topics: #18 District Systems Adoption

4. Scope:
   1. Identify and assess existing district heating and cooling system users
   2. What factors contribute to the use of district systems?
   3. Identify where else these necessary conditions exist
   4. Identify barriers to adoption of district systems
   5. Recommend potential target markets.

5. Methodology:
   1. Review existing studies on district systems
   2. Collect primary data where needed through case studies
   3. Develop list of necessary conditions for district systems to be applicable
   4. Identify/develop strategies to overcome barriers to adoption
   5. Identify potential target markets.

6. Time: 6 months.

7. Level of Effort: $100-150K (1 person year).

8. Dependencies: None.

PRODUCT CHARACTERIZATION: PROJECT 15

1. Title: Conservation Investment Relationship to Home Value
2. Objective: Determine if conservation investments do in fact increase the value of the consumer's home.
3. Research Topics: #40 Home Value
4. Scope:
   1. Collect data on conservation improvement options and their costs
   2. Collect data on home values
   3. Develop econometric analysis techniques to analyze the data
   4. Conduct analyses and report results.
5. Methodology:
   1. Utilize existing data such as Annual Housing Survey. Dodge Data, RECS, etc.
   2. Review literature concerning conservation investment and home value
   3. Collect supplemental primary data as needed
   4. Construct econometric model to analyze the data
   5. Analyze data and report findings.
6. Time: 1 year.
7. Level of Effort: $100K (3/4 person year).
8. Dependencies: None.

PRODUCT CHARACTERIZATION: PROJECT 16

1. Title: Tracking Manufacturers' New Product Development

2. Objective: To identify new product and technology trends and their implications to BCS.

3. Research Topics: #42 Manufacturers' Inventory Tracking

4. Scope:
   1. Develop a representative sample of manufacturers
   2. Obtain information concerning manufacturers intentions for new product development
   3. Evaluate manufacturer plans

   Optional:

   4. Develop predictive capabilities

5. Methodology:
   1. Analyze existing data (e.g., SIC codes) to develop a sample of manufacturers to track
   2. Conduct patent analysis
   3. Analyze results of patent analysis in terms of BCS planning, R&D activities and identifying potential research partners

   Optional:

   4. Utilization of Basics, Patent Analysis or BTIP (PNL-BATTELLE Models) or other forecasting tools.

6. Time: 1 year.

7. Level of Effort: $150K (1 person year).

8. Dependencies: Could be conducted jointly with the BCS R&D Partnership study (Number 17).

OPTIONS: PROJECT 17

1. Title: BCS R&D Partnerships*

2. Objective: Determine the most cost effective means of soliciting private research partners to work with the Federal Government to conduct energy conservation R&D.

3. Research Topics: #36 Research Partners

4. Scope:
   1. Review and assess existing partnership arrangements between private firms and the Federal Government
   2. Identify potential new research partners
   3. Recommend strategies to solicit agreements with new partners.

5. Methodology:
   1. Conduct interviews with both private sector and government R&D professionals from a wide variety of areas such as; NIH, DOD, NASA, etc.
   2. Identify factors which contribute to successful partnerships
   3. Identify institutional barriers to partnerships
   4. Develop criteria for identification of new private sector R&D partners
   5. Recommend potential strategy to approach private firms as R&D partners.

6. Time: 6 months.

7. Level of Effort: $75-100K (1/2 person year).

8. Dependencies: None.

NOTE: Conducting tracking manufacturers new product development project (Number 16) could aid in identifying research partners.

OPTIONS: PROJECT 18

1. Title: Alternative Marketing Options

2. Objective: To identify and assess new marketing options designed to motivate conservation behavior.

3. Research Topics:
   - #9 Motivating Alternatives
   - #28 Voluntary Compliance
   - #41 Marketing Options
   - #46 Public Image

4. Scope:
   1. Conduct market segmentation
   2. Conduct program evaluation
   3. Conduct consumer motivation issues and decision evaluation criteria projects
   4. Assess findings from program evaluation, motivation issues and decision criteria projects
   5. Develop and assess potential marketing options for segments
   6. Develop implementation strategies for selected options.

5. Methodology:
   1. Conduct market segmentation (see methodology for Market Segmentation and Characterization Project)
   2. Conduct program evaluation (see methodology for Program Evaluation Project)
   3. Conduct consumer motivation issues project (see methodology for Consumer Motivation Issue Project)
   4. Analyze findings of above projects
   5. Review literature concerning new, alternative marketing options
   6. Develop criteria for assessing alternative options using expert input
   7. Develop recommendations concerning most promising options including strategies for their implementation.

OPTIONS: PROJECT 18 (contd)

6. Time: 6 months.

7. Level of Effort: $75-100K (1/2 person year).

8. Dependencies: Market segmentation and characterization project.
   Program evaluation project.
   Consumer motivation issues project.
   Consumer decision evaluation criteria project.

OPTIONS: PROJECT 19

1. Title: Program Evaluation*

2. Objective: To determine the effectiveness of existing energy conservation programs that have been conducted by utilities, state and local governments and the federal government.

3. Research Topics:
   - #14 Utility Program Impacts
   - #26 Utility Action Influences
   - #34 Technology Savings/Options
   - #55 State and Local Programs
   - #72 Appliance Labeling Awareness
   - #73 Financial Options

4. Scope:
   1. Develop criteria for selecting programs for evaluation
   2. Select sample of programs to evaluate
   3. Evaluate program effectiveness in terms of cost and benefits
   4. Determine the implications of analysis results for BCS planning and R&D programmatic activities.

5. Methodology:
   1. Conduct focus groups interviews with participants from DOE, Utilities, National Laboratories, etc. to determine selection criteria
   2. Collect data and documentation on programs selected for analysis
   3. Conduct case study analysis of these programs utilizing program evaluation methodologies
   4. Provide recommendations on future BCS programmatic activity.

6. Time: 1 year.

7. Level of Effort: $100-150K (3/4 person year).

8. Dependencies: None.

*Could be conducted in conjunction with the Market Success and Potential Project (Number 13).

OPTIONS: PROJECT 20

1. Title: Data Base Development

2. Objective: Develop baseline database to provide a means for consistent evaluation and development of R&D and programmatic activities.

3. Research Topics: #38 Baseline Data Base
   #48 Expert System
   #67 Methods of Establishing Data Base

4. Scope: 1. Collect data on the following variables:
   - Attitudes
   - Knowledge
   - Consumption levels
   - Technologies
   - Demographics
   - Psychographics

   for appropriate market segments
   2. Construct computerized database
   3. Document and make available the database to potential users.

5. Methodology: 1. Conduct segmentation and collect relevant data (see methodology for Market Segmentation and Characterization Project)
   2. Develop software necessary to access the data
   3. Write documentation and user manual
   4. Disseminate.

6. Time: 1 year.

7. Level of Effort: $100K (3/4 person year).

8. Dependencies: Market Segmentation and Characterization Project

DISTRIBUTION

No. of Copies

OFFSITE

25 Dr. Fred Abel
Building and Community Systems
U.S. Department of Energy
1000 Independence Avenue
Forrestal Building
Washington, D.C. 20585

Mr. Ken Kazmer
Manager, Building Systems Research
Gas Research Institute
8600 West Bryn Mawr Avenue
Chicago, IL 63631

Ms. Terry Dinan
Demand Analysis Group
Energy Division
Oak Ridge National Laboratory
Post Office Box X
Oak Ridge, TN 37831

3 Mr. Terry Oliver
MS/KRR
Bonneville Power Administration
Office of Conservation
1002 N.E. Holladay
P.O. Box 3621
Portland, OR 97232

30 Technical Information Center

Paul Stern
Commission on Behavioral and Social Sciences Education
National Academy of Sciences
National Research Council
2101 Constitution Ave., N.W.
Washington, D.C. 20418

Elliot Aronson, Chair
Stevenson College, University of California
Santa Cruz, CA 95064

No. of Copies

John M. Darley
Department of Psychology
Princeton University
Princeton, NJ 08544

Daniel H. Hill
Institute for Social Research
University of Michigan
Ann Arbor, MI 48104

Eric Hirst
Energy Division
Oak Ridge National Laboratory
Post Office Box X
Oak Ridge, TN 37831

Willett Kempron
Institute of Family and Child Study
Michigan State University
East Lansing, MI 48824

Thomas J. Wilbanks
Energy Division
Oak Ridge National Laboratory
P.O. Box X
Oak Ridge, TN 37831

Mark Levine
Lawrence Berkeley Laboratory
Building 90, Room 3125
University of California
Berkeley, CA 94720

Clark W. Giellings
Program Manager of Demand Side Programs
Electric Power Research Institute
3412 Hillview Avenue
P.O. Box 10412
Palo Alto, CA 94303

No. of
Copies

Diane Pirkey
Office of Policy Integration
U.S. Department of Energy
1000 Independence Avenue
Forrestal Building, Room 7H-021
Washington, D.C. 20418

Barry McNutt
Office of Policy Integration
U.S. Department of Energy
1000 Independence Avenue
Washington, D.C. 20418

Linda Carlson
Energy Information
Administration
U.S. Department of Energy
Forrestal Building, Room 2H-027
1000 Independence Avenue
Washington, D.C. 20418

Julie Oliver
Energy Information
Administration
U.S. Department of Energy
Forrestal Building, Room 2H-027
1000 Independence Avenue
Washington, D.C. 20418

Wendell Thompson
Energy Information
Administration
U.S. Department of Energy
Forrestal Building, Room 2H-027
1000 Independence Avenue
Washington, D.C. 20418

John Millhone
Director of Building and
Community Systems
U.S. Department of Energy
Forrestal Building, Room 6F-231
1000 Independence Avenue
Washington, D.C. 20418

No. of
Copies

Alan Streb
Director of Industrial Programs
U.S. Department of Energy
Forrestal Building, Room 5G-067
1000 Independence Avenue
Washington, D.C. 20418

John Brogan
Director of Energy Systems
Research
U.S. Department of Energy
Forrestal Building, Room 5E-052
1000 Independence Avenue
Washington, D.C. 20418

Melvin Chiogloji
Director, Office of State and
Local Assistance Programs
U.S. Department of Energy
Forrestal Building, Room 6A-049
1000 Independence Avenue
Washington, D.C. 20418

No. of
Copies

ONSITE

DOE Richland Operations Office

D. R. Segna

35 Pacific Northwest Laboratory

B. L. Mohler (10)
R. M. Scheer (5)
V. Barnes (5) - HARC
O. B. Beizer
T. J. Secrest
W. B. Ashton
R. G. Rivera
M. P. Hattrup
R. C. Adams
R. J. Moe
J. L. Braitman
Publishing Coordination MH (2)
Technical Information (5)