Honeywell

DECEMBER 1978

FINAL REPORT

BUILDINGS ENERGY MANAGEMENT PROGRAM WORKSHOP DESIGN

CONDUCTED UNDER

CONTRACT EC-76-C-01-8630

FOR

UNITED STATES DEPARTMENT OF ENERGY

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Printed in U.S.A.

DISCLAIMER

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SECTION I

EXECUTIVE SUMMARY

This document describes activities undertaken by Honeywell's Energy Resources Center under Contract EC-76-C-01-8630 to the United States Department of Energy (formerly the Federal Energy Administration) for design and development of the format, content and materials that were used in conducting 129 one-day energy management workshops for specific commercial business audiences.

The Building Energy Management Workshop Program was part of a National Workshop Program that was intended to increase awareness of energy-related issues and to encourage energy conservation actions on the part of commercial and industrial sectors in the United States. The total effort included executive conferences for chief executive officers and other senior management personnel; industrial energy conservation workshops directed at plant management and engineering personnel; vanpooling workshops designed to inform and encourage business in implementing a vanpooling program for employees; and the building energy management workshops that were specifically developed for managers, owners and operators of office and retail facilities, restaurants and supermarkets.

The total program spanned nearly two years and reached approximately 2,500 participants from all parts of the United States. A detailed followup evaluation is still being conducted to determine the impact of this program in terms of conservation action undertaken by workshop participants.

SECTION II

PROGRAM OBJECTIVES

The overall objective of the Building Energy Management Workshop Program was to provide the guide for commercial building owners, managers and plant personnel to voluntarily undertake the development and implementation of an Energy Management Program. Therefore, the main objective of the subject contract was to design and develop materials and format that would provide that impetus. Honeywell and the FEA shouldered the responsibility of developing a vehicle/tool that could be utilized in promoting energy conservation in the commercial business sector. This emphasis was continually highlighted by the stress on the "bottom line" saving potential of any and all of the conservation activities that were detailed during the workshop. The workshop was developed around the principle that energy conservation is sound business practice.

Our approach was based intrinsically on a number of measurable performance objectives. We attempted to develop a learning experience and environment that would produce measurably significant changes in the behavior, knowledge and experience of those who attended. Some of the performance objectives attendees were expected to achieve were to:

- Effectively assemble an energy management team,
- Initiate a survey of energy uses in their own facility,
- Better understand and use energy measurements,
- Identify potential energy saving areas or activities within their own facilities,
- Effectively evaluate utility company energy charges,
- Understand the fundamentals of a complete energy management plan,
- Report energy usage by unit and dollars,
- Realize the impact of energy availability and costs on their own facility,
- Reflect the impact of future energy activities,
- Tell (sell) the energy story to others.

Less significant but nonetheless relevant, it was our intention to design and develop a format and materials that would be:

- Easily understandable by several levels of management and engineering personnel,

- Flexible enough to accommodate modifications to the content or format,
- Usable as a reference document by attendees,
- Developed around a "hands-on" approach to assimilating information,
- A multimedia approach.

To summarize, the direct impact of the Building Energy Management Workshop Program was to save energy in the commercial building sector through development and implementation of an energy education experience.

SECTION III

BACKGROUND AND SCOPE

The Building Energy Management Workshop Program, which was a part of the Conservation Program, focused on three critical areas of energy use in the commercial and industrial sectors of the nation's economy:

- Energy consumed in industrial and manufacturing processes and operations;
- Energy consumed in the operation and maintenance of commercial and industrial buildings; and
- Energy consumed in transporting employees between worksite and residence.

During the course of this program, the FEA presented an integrated four-part series of conferences, seminars and workshops throughout the United States. The basic program elements were:

- Executive Conferences,
- Industrial Energy Conservation Workshops,
- Building Energy Management Workshop,
- Vanpooling Workshops.

These meetings were conducted by experts in various fields who were employed by the FEA under a series of contracts with private sector organizations. While the principal objective of the Executive Conferences was to present the proposed NEA to top management, the aim of the workshops was to present facts, materials and experiences to functional managers and technical personnel so that they might be motivated and able to organize and implement specific energy conservation measures and programs.

During the course of the program, 94 Executive Conferences and 190 Industrial, 129 Building, and 190 Vanpooling workshops were conducted. These conferences and workshops were held in locations throughout the country during a period of nine months.

The Building Energy Management Workshops Program was directed toward enhancing the conservation efforts of the commercial building sector, specifically office buildings, retail facilities, restaurants and supermarkets. The one-day workshop was intended to familiarize building owners and managers with energy management techniques and approaches and to convince them to tailor and implement a comprehensive conservation program adequate for their needs.

This effort was an extension of the Lighting and Thermal Operations (L&TO) Program, which was initiated in November 1974. The L&TO Program employed FEA regional personnel to contact commercial buildings within their respective regions to explain the program and obtain commitments to implement it. Results of that effort indicated the need for a more comprehensive energy conservation program as well as for a delivery system capable of reaching broader segments of the commercial market in a more cost-effective manner.

SECTION IV

TECHNICAL APPROACH

WORKSHOP AUDIENCE SELECTION

Prior to design and development of the workshop materials, FEA selected four target audiences from the retail sector: (1) office buildings; (2) eating and drinking establishments (restaurants, both food and large table service); (3) food stores; (4) general merchandise stores (medium and large department stores).

CONSERVATION MATERIALS REVIEW

Honeywell accumulated, with considerable FEA assistance, a large number of documents, papers, guidelines, handbooks, etc., on energy conservation in general and, more specifically, materials that addressed the unique conservation opportunities of the four proposed building subsectors (see Appendix A).

We utilized a specifically designed sorting methodology to wade through the mass of printed materials in the most expeditious manner. This methodology is graphically represented in Figure IV-1. It was our objective to use only those materials that would be "significant" in reducing energy consumption in buildings yet "relevant" to the specific audience types, both on a subsector-by-subsector basis (i.e., restaurants versus supermarkets) and on an inter-subsector (manager versus owner versus operating personnel) basis.

FORMAT DEVELOPMENT

To ensure that the conservation actions suggested in the workshop were taken, we determined that a hands-on approach to the presentation format would be more appropriate than a straight didactic approach. This format would stress involvement in the material content and interaction with the leader and other participants.

To facilitate this, the workshop was structured around five miniworkshops or work sessions in which the audience applied a new set of energy information to a predetermined buildings problem (see Appendix B, Sample Workshop Problem Booklet). Building problems were designed around a model facility (specific to audience type) which was detailed in the booklet. These actual facility problems were designed to reinforce the didactic materials in the Five-Step Energy Management Program. This program, which formed the core of the presentation materials, is briefly outlined as follows:

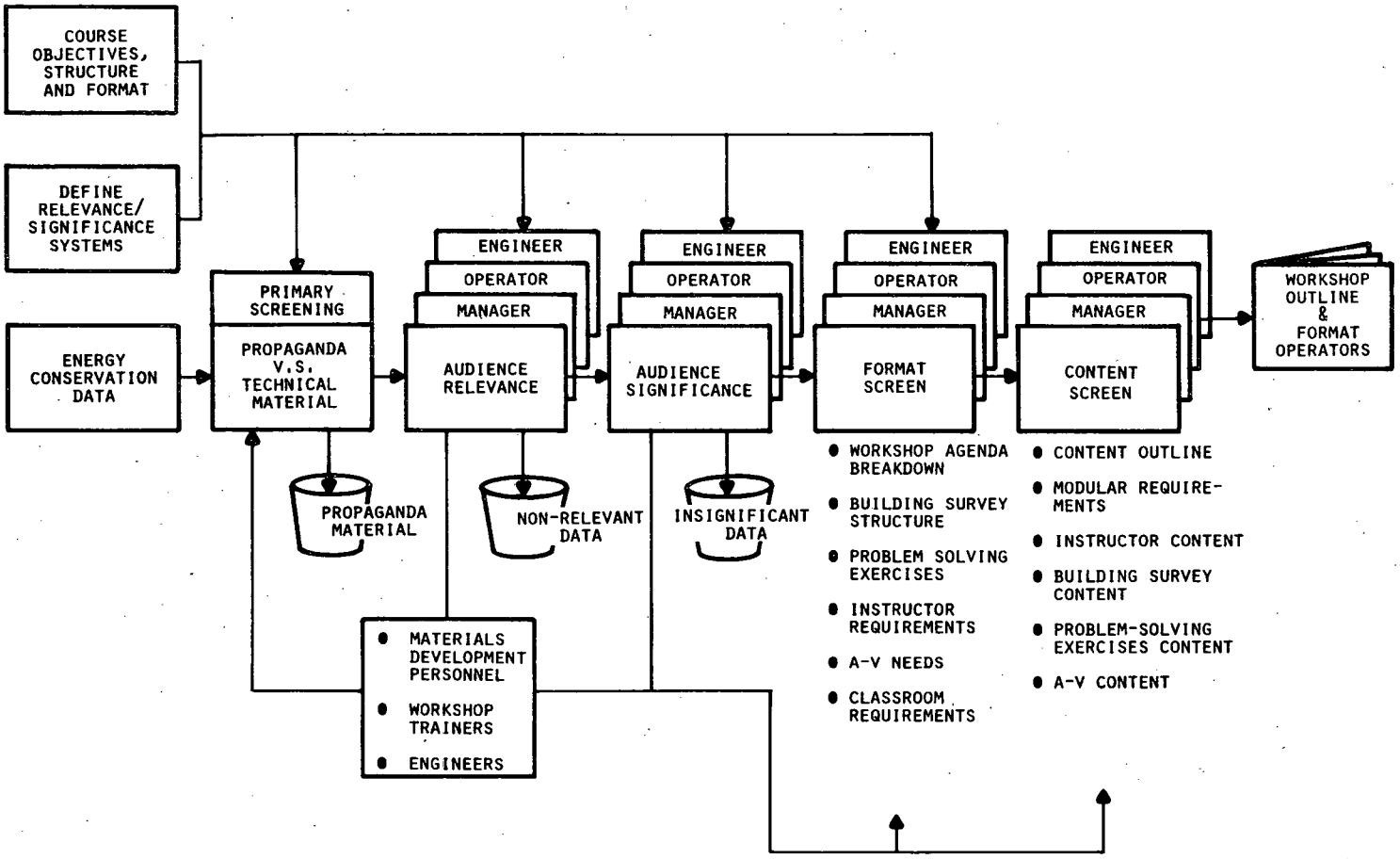

Figure 4-1. Energy Conservation Data Utilization Plan

- Step 1: Select an energy management team;
- Step 2: Survey (audit) the facility;
- Step 3: Find energy conservation opportunities (ECO's) and determine potential savings;
- Step 4: Set up a comprehensive energy management action program plan;
- Step 5: Plan implementation and followup.

This approach was utilized because it had proven successful when implemented in many companies and throughout Federal Government facilities. In addition to the wide acceptance of this approach, it was clearly based on sound business/engineering common sense practices.

Additionally, in the format development phase a decision was made to minimize the engineering or complex details, both to maintain a balance between the economic-engineering information in the presentation and to avoid an "information overkill" situation. Therefore the energy conversion tables, standards information, mechanical systems descriptions and glossary were placed in the back of the workbook and only used as reference material during the presentations.

CONTENT DEVELOPMENT

Our intention in developing the actual content of the workbook was to:

- Minimize the technical detail. This was done because the anticipated audience would be a mixture of management and engineering professionals, but predominantly management.
- Minimize the didactic (lecture style of presentation) interaction and maximize the inter-participant, experiential exchanges.
- Present all materials/information in viewgraph from to enhance direct interaction and sharing between leaders and participants (slide presentations need a darkened room and therefore inhibit this desired interaction).
- Develop several learning/experience blocks within the workshop day that would lead to immediate application of the didactic information to the sample/model facility problems.
- Design the workshop book to give the participant a well grounded, albeit brief, familiarization with the tools (e.g., audits and followup forms, energy conversion tables, etc.) used to implement a comprehensive energy management program.

AGENDA DEVELOPMENT

A detailed agenda was prepared to reflect the basic interactive and other format variables mentioned above. This agenda formed the basis for content development and structuring of the instructional methodology.

A very simplified version of the workshop agenda is presented below to better illustrate the application of the aforementioned content strategies. We have chosen to present an expanded version of the agenda with a running commentary on the basic instructional methodology, leader instructions and the specific materials involved. Additionally, an initial summary statement has been provided to give the reader the proper orientation on the learning/experience block that was mentioned in the preceding section.

Simplified Agenda

8:00 AM	Registration and Orientation
8:30 AM	Energy Overview
9:30 AM	Workshop I (Learning Block No. 1)
9:40 AM	What Uses Energy in Your Restaurant?
10:00 AM	Break
10:15 AM	What Can You Do About Your Energy Dilemma?
10:25 AM	Five-Step Energy Management Action Plan Overview
10:30 AM	Step 1: Select an Energy Management Team
10:45 AM	Step 2: Survey Your Restaurant
11:00 AM	Workshop II (Learning Block No. 2)
12:00 PM	Lunch
1:30 PM	Step 3: Find Energy Conservation Opportunities and Determine Potential Savings
3:00 PM	Break
3:15 PM	Workshop III (Learning Block No. 3)
4:15 PM	Steps 4 and 5: Set Up and Implement a Complete Energy Management Action Plan
4:30 PM	Workshop IV (Learning Block No. 4)

Expanded Agenda

During this section of the program the participants were introduced to the criticality of the energy situation confronting business, industry and the nation. The Energy Overview also attempted to impress upon the participant that, although a crisis exists today and will more so in the future, there is something that can be done to solve or at least minimize the economic impact on current business practices.

Instructional Methodology and Materials	Agenda
	8:00 AM
Instructor handles Section I with:	I. Introduction A. Welcome B. Enrollment
Enrollment forms to be filled out and handed in.	C. Logistics 1. Facilities 2. Agenda
Go over class agenda and have attendees insert in book.	3. Workshop Materials a. Names on books b. List complete
Instructor/attendees introductions and filling in name cards. Instructor uses flip chart or blackboard to write down key words that directly relate to overall workshop objective (to be used later).	D. Introductions 1. Instructors 2. Attendees a. Who you are? b. Where you are from? c. Why you are here?
	8:30 AM
Instructor develops objective with student participation and key words from introductions to arrive at objectives of workshop.	II. Objectives of Workshop Overview
Objectives will be on overheads.	A. What is the Energy Problem? B. How you and your facility fit into the problem C. How you can develop and implement an Energy Conservation Plan for your Facility
	8:40 AM
Instructor poses question. Attendees will answer five subjective questions pertaining to energy problems. Overhead of questions. Post-film discussion - overheads. Answer quiz questions and develop belief that energy problem exists.	III. What is the Energy Problem? A. Pre-film quiz B. Dept. of Commerce film C. Post-film discussion 1. Questions answered 2. Update of film a. Current oil imports b. Nuclear plants construction c. Consumption of Energy
Summary of Section	

Instructional Methodology and Materials	Agenda
III. There is an energy problem; main hope of survival is conservation.	
	9:15 AM
Instructor poses questions; directed discussion. What is a Barrel of Oil Equivalent? National picture on slides compared to other markets. Charts on overheads with comparisons for their facility using various types of fuels. Do you know comparison to average data available?	IV. How do you and your facility fit into our Energy Problem? A. BOEs your facilities consume B. Typical uses of energy in your type of facilities 1. Electricity 2. Natural gas 3. Fuel oil 4. Propane C. How does your facility stack up?
	9:30 AM
Attendees will receive directions to take information they have of energy usage in their facility and convert that usage to BOEs. (Objective - students begin to see how they fit into energy problem.)	V. Workshop I A. Total kWh used in your facility B. BOEs C. 10 percent savings

The next learning block was based on presenting the fundamental information to enable the participants to implement Steps 1 and 2 of the Energy Management Plan, Selecting a Professional Team and Surveying a Building. The hands-on approach was accomplished here by having the participants form "teams," assign temporary responsibilities and set some energy management goals and objectives, e.g., saving 20 percent of the total energy costs in two years. Once the teams were formed, the exercise of surveying a model building (provided in the workshop manual) had to be attempted. The overall objectives of these two excercises were that the attendees:

1) Understand the personnel needed to form an effective energy management team;

2) Realize that the task of surveying a facility was not a simple one and would require some segmentation of work and a clear understanding of what should be surveyed. (The latter information was presented prior to the workshop exercise.)

Instructional Methodology and Materials	Agenda
	9:45 AM
Instructor asks: Slide show of equipment that uses energy in facility. Continuation of slide show/lecture.	VI. What Uses Energy in your Facility? A. Electrical 1. Lighting 2. HVAC 3. Refrigeration 4. Elevators
Continuation of slide show lecture, breaking down energy consumption into areas of use and types of fuels. Data from Government, publications, Honeywell, etc.	B. Fuels 1. Heating 2. Cooling 3. Humidification 4. Hot Water 5. Steam
	10:00 AM - Break
	10:15 AM
Instructor asks questions and develops, with class participation, the belief that a plan is necessary to solve problem.	VII. What can you do about <u>your</u> energy problem? A. Energy Management Plan Action overview 1. Why Plan? a. To know where you are b. To know where you are going c. To know what your responsibilities are
Lecture/discussion; overview of Plan. Overheads. Objective of planning overview is to illustrate the need for a team effort in planning an energy management program and to lead into the next section, Five-Step Energy Management Action Program.	2. What is a "Plan?" 3. What is included in a Plan a. Objective b. Resources c. Possible paths to objective d. Potential problems e. Best path f. Total plan g. Implementation and followup
	10:25 AM
Instructor lecture - Five-Step Energy Management Action Plan on overheads. This section is merely an overview	B. Five-Step Energy Management 1. Select a professional team 2. Survey your buildings

Instructional Methodology and Materials	Agenda
of steps. Instructor includes short explanation of each step when overviewing.	3. Find energy conservation opportunities and determine potential savings 4. Set up a complete Energy Management Action Plan 5. Implement Plan
	10:30 AM
Instructor lecture plus class participation. Visuals. Objective - Attendees understand what a professional team is and how to select in their facility. Instructor will go through areas on outline filling in with class comments. This will be done on flip chart or blackboard.	VIII. Step 1: Selection of a Professional Team A. What is a professional team? B. Why a professional team? 1. Completion of Steps 2, 3, 4, and 5 C. What needs to be done? 1. Skills required 2. Authority required 3. Resources available
	10:45 AM
Instructor lecture plus class input.	IX. Step 2: Survey Your Building(s) A. What is a survey? 1. Collection of necessary data 2. Finding out where you have been going B. Why do a survey? 1. Completion of Steps 3, 4, and 5 2. Find out where you are today so you can get where you want to be tomorrow
Visuals. Instructor fills in examples in these areas with class input.	C. What do you survey? 1. Energy usage 2. Energy users 3. Building construction 4. Building size 5. Building operating schedule
Visuals. Instructor/class go through each area discussing and listing importance and type of information to be obtained from each area.	D. How do you survey? 1. Resources a. Utility bills b. Building blueprints c. Building occupancy d. Building functions e. Physical survey f. Energy conservation team

Instructor Methodology and Material	Agenda
How to fill out a survey form using information you have gathered. Handouts - Survey Form. Class/instructor go over survey form.	2. Use of Resources a. Survey forms b. Team involvement
	11:00 AM
Participants break into groups to: 1. Select a team. 2. Survey sample building. Followup class presentations by teams.	I. Workshop II A. Selecting a professional Energy Management Team B. Sample building survey
	12:00 PM - Lunch

When each team had finished the exercise, presentations of the results were made to the whole group. The instructors attempted to draw out the salient principles expressed by the participants, i.e., ease/difficulty of the exercise, exploration of ways to improve the expediency of the task, etc.

Following the lunch break, which was always attended by the entire group to promote further discussion of the morning's activities, the participants, still working together in teams, applied some newly learned skills and knowledge to Workshop III - Step 3: Finding Energy Conservation Opportunities and Determining Potential Savings.

To accomplish this task, the participants had to absorb a large amount of information on typical heating, ventilating and air conditioning systems, energy conversion methodology, return-on-investment calculations and understanding utility bills. Again when the didactic material had been presented the teams were asked to work out a number of energy conservation problems (provided in the workshop manual). The intent here was to give the participant a feeling for where to look for energy conservation opportunities and how to calculate and then prioritize the actions to accrue savings. Each team was asked to present their results to the entire group. Additionally, they were asked to present alternative energy conservation opportunities.

Instructor Methodology and Material	Agenda
	1:30 PM
	XI. Step 3: Find Energy Conservation Opportunities and Determine Potential Savings

Instructor Methodology and Material	Agenda
Instructor asks questions; class input. Instructor reviews examples of ECOs.	A. What is an ECO? 1. Building modification 2. People modification
Definition. Examples of energy savings versus money savings (or cost avoidance). Instructor lecture plus class discussion.	B. What is a potential savings? 1. Energy 2. Money C. Why find ECOs and potential savings? 1. Completion of Steps 4 and 5 2. Determine the greatest potential savings opportunities
	2:00 PM
Instructor refers to information found on survey and calculates potential savings in various areas using available formulas.	D. How to find ECOs and potential savings 1. Analyze building survey information for energy users a. Utility bills b. Energy calculations c. Building operation schedule d. HVAC systems e. Lighting f. Refrigeration
Instructor utilizes examples in using available formulas.	
Discussion on choosing the best ECOs in regard to the four items listed.	2. Determine applicable a. Potential ECOs 1. No cost ECOs 2. Low cost ECOs 3. Capital expense ECOs b. Practicality c. ROI d. Action
Handouts - formulas for computing potential savings.	
Attendees break into groups to do workshop.	3:00 PM - Break

Instructor Methodology and Material	Agenda
	3:15 PM
III. At end of time groups present answers. Objective of workshop - class members get experience in finding ECOs and determining potential savings.	III. Workshop III A. Finding ECOs for a sample building B. Determining potential savings for a sample building

The final workshop learning experience entailed imparting an understanding of Steps 4 and 5: Set Up and Implement a Complete Energy Management Action Plan. The objective here was to stimulate the participants to think about their own facilities and to project activities that might be undertaken following the workshop. Most importantly, the followup and reporting activities were stressed to ensure the results of any energy conservation actions. Each participant was asked to formulate a very rudimentary action plan and to write it up on the forms provided by the instructor. These forms served a dual purpose in that they would be used by the followup evaluation contractor, D.A.Stewart and Associates, as well as by each of the participants to begin taking actions upon return to his facility.

Instructor Methodology and Material	Agenda
	4:15 PM
Instructor lecture plus class discussion (visuals). Objectives - (1) Attendees know what to put in a plan; (2) How to give a plan credibility by proper auditing and reporting; (3) Attendees understand implementation.	XIII. Step 4 and 5 - Set Up and Implement a complete Energy Management Action Plan A. What to build into your plan B. Critique and followup of your plan 1. Auditing 2. Reporting C. Implementation
	4:30 PM
Attendees break into groups and outline an energy management action plan with implementation procedures. Attendees present plans and turn in a copy to instructor.	XIV. Workshop IV A. Develop an Energy Management Action Plan for your facility B. Develop a plan for implementation of your ECOs

Instructor Methodology and Material	Agenda
	5:30 PM
Instructor lecture 1. Have goals of workshop been accomplished? Review goals. 2. You have a place to start solving your energy problems -- your energy management action plan -- it's up to you to make it work. Instructor hands out FEA evaluation form to be filled out by attendees.	IV. Closing A. Summation B. Evaluation of Workshop
	6:00 PM
	C. Adjourn

EDITORIAL REVIEW BOARD (ERB)

The preliminary draft materials were submitted to FEA/Honeywell-selected experts representating specific building constituencies. We endeavored to assemble a well balanced ERB for the purpose of reviewing and recommending changes in or additions to both the preliminary and final draft course materials. In choosing this team, we selected the best individuals from the energy conservation community to provide a broad theoretical and technically based consensus. The rationale for this teaming effort was based on several criteria:

- Technical expertise and experience in the field of energy conservation management directly related to buildings;
- Knowledge of governmental concerns and emphasis in energy conservation management for buildings;
- Building systems expertise (mechanical and architectural design considerations);
- Broad understanding of the problems of implementing a conservation program within their constituent building communities;
- Knowledge of the demeanor of the facility personnel that would be involved in implementing a conservation program.

Editorial Review Board Members

Office Buildings

Bob Michaud	Building Owners & Managers Association
Art Olafson	Building Owners & Managers Association
Bernie Haimes	Building Owners & Managers Association

Restaurants

Dean Colin	Jack Miller & Associates
Andrew Poledar	National Restaurant Association

Supermarkets

Walter White	Kroger Company

Retail Stores

Gordon Williams	National Retail Merchants Association
Larry Green	Sears
Edward H. McGuire	Macy's
John Peterson	Minnesota Energy Agency
Robert S. Curl	FEA Region Five Representative

The ERB reviewed the materials in terms of:

1) Agenda/Material Content --

- Relevancy of topics,
- Time structuring and emphasis,
- Order of topics addressed,
- Degree of idea exchange permitted by the information,
- Format of materials;

2) Specificity --

- Appropriateness for the specific markets,
- Usefulness of the cost/benefit energy conservation actions for the audience,
- Technical accuracy,
- Advisibility of implementing an energy management plan,
- Degree of flexibility given the variety of facility sizes and levels of energy management sophistication/experience for various audience compositions;

3) Audience Acceptability --
The ERB members met in Minneapolis to discuss with Honeywell and FEA, in open forum, the results of their individual reviews of the preliminary draft workshop materials. Likewise they each submitted written comments (marked-up copy) for further and more detailed study. Written comments were solicited by mail from these same members for the final coming-ready copy.

INVITATIONS, BROCHURES AND TRADE LETTER OF ENDORSEMENT

As part of an overall, FEA-designed invitation process, Honeywell subcontracted with Marketec Inc., a Minnesota-based advertising/public relations firm, to develop an invitation package that would ensure maximum attendance at the workshops. Marketec determined that a multipiece, personally addressed mailing would enhance the level of attendance. The invitation package consisted of four pieces:

- Brochure,
- Invitation,
- Response card,
- Endorsement letter from specific trade associations.

The following trade associations were personally contacted by FEA and Honeywell to solicit their support in promoting the workshop program to their respective memberships:

Office Buildings	- Building Owners and Managers Association;
Retail Stores	- American Retail Federation, - National Retail Merchants Association;
Supermarkets	- Food Marketing Institute (Supermarket Institute), - National Association of Retail Grocers of the United States Inc.;
Restaurants	- National Restaurant Association.

The National Association of Chain Drug Stores and the American Hotel/Motel Association also provided endorsement letters partway through the implementation phase of the workshop program.

Material Printing

All approved workshop materials were submitted to FEA for final printing and dissemination to the specific workshop sites. All materials were prepared in keeping with Government Printing Office style guidelines.

SECTION V

DISCUSSION OF RESULTS

Direct results of the work outlined in Section IV, Technical Approach, are evidenced by the production and ultimate use of workshop materials for the four distinct workshop types: Office Buildings, Retail Facilities, Restaurants and Supermarkets. Honeywell was responsive to the terms of this contract in that all task and deliverable responsibilities were accomplished in a cost-effective and timely manner. This section details the following:

- Workshop format,
- Instructional methodology,
- Invitation materials,
- Deliverables.

WORKSHOP FORMAT

At the very earliest stages of the working relationship formed between Honeywell and FEA, the basic format and workshop orientation were designed and developed. Honeywell's prior experience in conservation training and education dictated that audience involvement should be the underlying tenet of the workshop format. Therefore this precept was significant in formation of the skeletal structure of the workshop and was translated into designing actual energy management experiences into the agenda and overall workshop day.

The workshop format was built around utilization of a generic building case study combined with a five-step approach to developing and implementing a comprehensive energy management plan uniquely tailored to the needs and problems of each workshop participant. Each step of this approach was outlined thoroughly and then a problem-solving, miniworkshop experience was developed to provide the actual participant involvement. The five steps of the Energy Management Action Program were as follows.

- Select an energy management team,
- Survey the facility,
- Find energy conservation opportunities (ECOs) and determine potential savings,
- Set up a complete energy management action plan,
- Implement the plan.

Throughout the program emphasis was placed on developing a plan of action that could be implemented readily following the workshop experience.

In addition to providing actual experiences (discussed in greater detail in the next subsection), developing an energy management team, surveying a model facility and determining potential savings, the participants were given a number of tools to assist in their background understanding of energy mechanical systems, conservation terminology, energy standard and utility billing procedures, to name just a few.

The individual case study model buildings were developed from actual buildings in the Minneapolis area. To every extent possible we endeavored to make the case study realistic and manageable. Some minor modifications were made during the course of the program, however the overall building data remained intact.

In an effort to encourage and enhance the personal involvement of each participant, we requested that actual utility data be brought to the workshop. Whenever possible throughout the workshop day, references to this actual data were made in the hope that the participants could transfer information from the case study problems to their own real-world energy dilemmas.

INSTRUCTIONAL METHODOLOGY

The basic premise of the instructional methodology was one of promoting didactic interaction between instructors and participants and among participants. The interaction between instructors and participants was designed to convey information and planning skills specifically regarding the development and implementation of an energy management action plan. The interaction among participants was exhibited by the discussions carried on during the miniworkshop experiences, where participants shared anecdotes about their own energy problems and their attempts to solve them.

This interaction was encouraged through use of a number of well established instructional techniques. The first, and probably the most basic tenet, was the use of simulated hands-on learning experiences. These consisted in part of a paper and pencil exercise whereby the participants were asked to apply the didactic materials to "typical" problems. We attempted to provide in each workshop type problems and exercises that were specific to, in terms of language and building parameters, and normally encountered in that building sector.

Another technique employed throughout the workshop day was that of group presentation. Following completion of each of the workshop exercises, each group made a presentation of results to the other groups for comment and sharing of information. Many times the information and results that were presented differed markedly from one group to another, and this sharing experience prompted greater understanding of the specific errors or wrong assumptions employed by other teams.

Although more subtle than the above techniques, we attempted to impart an urgency to the work being undertaken to accomplish two objectives:

- To ensure the participants attention to the criticality of the energy dilemma that was facing them, and
- To give them the understanding, through actual experience, that the implementation of a conservation solution was complex, could not be attempted without a well thought-out plan and involving the skills and actions of a number of people in each participant's organization.

A secondary premise behind the approach was to do everything short of twisting arms to encourage immediate and responsible conservation actions on the part of the organizations represented. In conjunction with Stewart and Associates (the FEA evaluation contractor), an Energy Management Action Planning form was filled out at the end of the workshop and given to both the FEA evaluation staff and the workshop participant. Our hope was that each participant would utilize this documentation as an initial vehicle prior to developing full-scale energy management plans and programs.

Lastly, the instructional methodology was structured to facilitate an exchange of energy management ideas from the participant to the training staff in the hope of enhancing and impacting the total program on a real-time basis. This objective was also met through an evaluation process whereby the staff could modify the workshop to fit the needs of the particular audience, i.e., the engineering/manager mix in the audience.

SECTION VI

CONCLUSIONS

The ultimate objective of the work undertaken by Honeywell in the interest of the Federal Energy Administration was to increase energy consumption efficiency in the United States. More specifically, Honeywell designed and developed the format, content and materials for energy management workshops that were offered to the commercial building sector. This section is an explication of those conclusions and/or recommendations that were corollary to the overall intent and purpose of the contract.

FORMAT/CONTENT DEVELOPMENT

To achieve continuity among the four workshop types, Honeywell developed a format and agenda that was basic to each in terms of workshop flow or timing, didactic versus interactive presentation, content development, teachability, audio-visual presentation and overall purpose. To these ends we were successful. With the exception of the specific content items, i.e., case studies, each workshop could be totally interchanged, therefore substantially reducing the learning curve of the instructors.

The specific content of the workshops could have been better coordinated with the individual supporting organizations. Although the energy conservation opportunities detailed in the workshop manual were fairly congruent regardless of building type, the unique presentation manner (the "language that retailers speak") and the level of presentation (who was the "real" energy decision-maker for a chain restaurant, for instance) needed greater refinements, and that could have been accomplished through establishing an early and impactful relationship with the specific supporting organizations.

INVITATIONAL PROCESS

The invitational process was a modification of the existing statement of work because it was determined that the original mechanics of this process, i.e., that the invitees would be preselected by executives in attendance at the Executive Conference, would not be realizable.

Some of the mechanisms for contacting potential attendees were unacceptable, such as the Dun and Bradstreet files. The files were outdated, inadequate and, for the most part, a waste of effort on the part of the FEA and Honeywell. It would have been much more expedient to have used actual supporting associations' membership files. We did request these files from many state associations following a selling job, and in those cases where association-

identified members were invited we had a higher degree of attendance. This was highly evidenced by BOMA membership. Each state association contacted members regarding their interest before invitations were sent. The office building workshops were well attended and continuously had a better invitation-to-attendance ratio.

ADVERTISING

At the start of the program, all the FEA contractors and FEA program staff determined a requirement for workshop advertising support. Honeywell, in participation, offered the support of our advertising staff in the development of a comprehensive publicity campaign for the workshops. However, FEA did not utilize this offer of support during the program. Due to delayed and somewhat confounded efforts of the FEA regional Public Information Staff, the needed publicity was not supplied. We believe that attendance would have been higher in some areas if publicity support would have been coincident with the invitation process and the workshop itself.

APPENDIX A
BIBLIOGRAPHY OF MATERIALS USED IN PREPARING WORKSHOP MANUAL

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APPENDIX B

SAMPLE WORKSHOP PROBLEM BOOKLET

FEDERAL ENERGY ADMINISTRATION
ENERGY CONSERVATION WORKSHOP

RETAIL STORES

DATE: _____

LOCATION (CITY): _____

NAME: _____

COMPANY: _____

ADDRESS: _____
STREET

_____
CITY STATE ZIP

COMPANY PHONE: _____
AREA CODE

POSITION WITH COMPANY: _____

ENERGY CONSERVATION WORSHOP
WORKSHOP I
ELECTRICAL ENERGY USAGE

Assignments:

1. Fill in the blanks below for each team member and totals for the team.

Team	A	B	C	D	E	F
Team Member	KWH/Yr.	$/Year	SQ. FT.	KWH/Sq. Ft.	$/SQ. FT.	$/KWH*
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
Totals						

*Note - $/KWH Arrived at by Dividing Total for Column B by Total for Column A.

II. Answer the following questions.

A. If you saved 10% on your electrical usage what would the annual savings in dollars be for your team?

_____

B. As a team what would you spend for electricity if it went up 1¢ per KWH?_____

C. What is the range in $/sq. ft. cost for your team members?

_____

If there is a difference why?

_____

_____

_____

_____

_____

_____

ENERGY CONSERVATION WORKSHOP
WORKSHOP II

SELECTING AN ENERGY MANAGEMENT TEAM
SURVEYING YOUR BUILDINGS

ASSIGNMENT:

1. As a team establish your organizational chart for a professional energy management team. Be prepared to present your organization in terms of:

   A. Objectives

   B. Representation to accomplish your objectives

   C. Representation which will give you the required support from management and workers

2. Using the sample facility information which follows complete the survey form

ENERGY MANAGEMENT SURVEY FORM

INSTRUCTIONS :

1. PRINT AN ANSWER FOR EVERY QUESTION (IF IT IS NON-APPLICABLE PRINT "NA")

2. IF YOU HAVE SEVERAL BUILDINGS, EACH WITH ITS OWN ELECTRIC, FUEL OR PURCHASED ENERGY RECORDS, USE A SEPARATE SURVEY FORM FOR EACH BUILDING.

3. IF YOU HAVE A MULTIPLE-BUILDING COMPLEX, WITH A SINGLE ENERGY COST TOTAL, USE THIS TOTAL IN FILLING OUT THE SURVEY FORM.

BUILDING NAME : _____

ADDRESS : _____

CITY : _____ **STATE :** _____ **ZIP:** _____

SURVEY TEAM	DUE DATE	DATE COMPLETE
IN CHARGE : _____	_____	_____
HVAC, CHILLERS, BOILERS _____	_____	_____
LIGHTING AND MISCELLANEOUS _____	_____	_____
PROCESS _____	_____	_____
UTILITY AUDIT _____	_____	_____

BUILDING DATA – GENERAL INFORMATION

GROSS SQ. FT. _____

HEATED OR COOLED SQ. FT. _____

NUMBER OF FLOORS _____

TYPES OF USEAGE IN % OR SQ. FT. :

OFFICES _____

RETAIL _____

STORAGE _____

MECHANICAL EQUIPMENT _____

LOBBIES OR MALLS (ENCLOSED) _____

OTHER _____

_____

_____

OCCUPANCY

BUILDING USE AND OCCUPANCY :

WEEKDAYS:	OCCUPIED BY:	_____	PEOPLE FROM	_____ TO	_____ (HOURS)
		_____		_____	_____
		_____		_____	_____
		_____		_____	_____
		_____		_____	_____
SATURDAYS		_____		_____	_____
SUNDAYS, HOLIDAYS		_____		_____	_____

* (ACCOUNT FOR 24 HOURS A DAY, IF UNOCCUPIED, PUT IN ZERO)

ENERGY HISTORY

YEAR OF ENERGY HISTORY: 19____

NUMBER OF MONTHS COVERED: _____ (MAX. 12 MONTHS)

ELECTRICITY

TOTAL AMOUNT USED: _____KWH

TOTAL COST: $ _____

WHAT % OF ABOVE ELECTRICAL COST IS DEMAND CHARGES: _____ %

NATURAL GAS

TOTAL AMOUNT USED: _____

(CHECK ONE) : CCF _____ THERMS _____

MCF _____

TOTAL COST: $ _____

OIL

TOTAL AMOUNT USED: _____GALS.

TOTAL COST: $ _____

TYPE OF OIL: # _____

PURCHASED STEAM

TOTAL AMOUNT USED: _____

TOTAL COST: $ _____

PURCHASED CHILLED WATER

TOTAL AMOUNT USED: _____

(CHECK ONE) : MILLION BTU _____

TON/HRS _____

TOTAL COST: $ _____

TOTAL COST OF FUEL OR PURCHASED ENERGY FOR HEATING ONLY:

$ _____

INTERIOR LIGHTING

TOTAL AMOUNT OF INSTALLED LIGHTING:

FLUORESCENT _____ KW

INCANDESCENT _____ KW

HOURS/WEEK LIGHTED SPACE IS FULLY OCCUPIED *

FLUORESCENT _____ HRS

INCANDESCENT _____ HRS

HOURS/WEEK LIGHTS ARE "ON":

FLUORESCENT _____ HRS

INCANDESCENT _____ HRS

LIGHTS ARE ON DURING UNOCCUPIED HOURS BECAUSE OF:

_____ JANITORS

_____ OVERTIME

_____ BOTH

_____ OTHER

CHILLED WATER PLANT

ELECTRIC DRIVE CENTRIFUGAL CAPACITY: _____ TONS

STEAM TURBINE CENTRIFUGAL CAPACITY: _____ TONS

ABSORPTION MACHINE CAPACITY: _____ TONS

RECIPROCATING MACHINE CAPACITY: _____ TONS

* DO NOT INCLUDE HOURS FOR JANITORIAL SERVICE OR CASUAL OVERTIME.

SPACE CONDITIONING EQUIPMENT AND SCHEDULES

TOTAL HP ALL AIR HANDLING FANS: _____ HP

TOTAL CFM HANDLED: _____ CFM

PERCENT OF OUTSIDE AIR: _____

TOTAL HOURS HVAC UNITS RUN EACH WEEK: _____ HRS

TOTAL HOURS PER WEEK SPACES SERVED ARE FULLY OCCUPIED: _____ HRS

TOTAL COOLING CAPACITY FOR HVAC UNITS HAVING INTERNAL REFRIGERATION COMPRESSORS: _____

CHECK ONE: _____ KW _____ BTU

_____ TONS

SPACE TEMPERATURE NORMALLY MAINTAINED DURING COOLING SEASON: _____ ^{0}F

HEATING SEASON DAYTIME TEMPERATURE (NORMAL SETTING) : _____ ^{0}F

IS THE TEMPERATURE SET BACK AT NIGHT DURING THE HEARING SEASON?

_____ YES _____ NO

BUILDING "D" DATA

Size: 75,000 square feet gross area, 65,000 square feet net usable area without stockroom and equipment rooms.

Dimensions: 125 feet x 200 feet, 2 floors above ground plus basement.

Mechanical System: Central plant providing hot and chilled water. Heating and cooling accomplished by a variable volume reheat system. Humidification provided for entire building.

Electrical System: Fluorescent lighting throughout with 4-40W tubes per fixture, 277V system, 4 watts per square foot including ballast "as built". Approximately 150-180 foot-candles at floor level. Additional electrical load consists of a store sign drawing 5 kW, display lighting 15 kW when fully utilized, stockroom lights 10 kW and an electric domestic hot water heater of 4 kW rating.

OCCUPANCY AND OPERATING SCHEDULE

Normal store hours:

Monday	9:30 - 9:00
Tuesday	9:30 - 6:00
Wednesday	9:30 - 6:00
Thrusday	9:30 - 9:00
Friday	9:30 - 6:00
Saturday	9:30 - 6:00
Sunday	12:00 noon - 5:00

Due to stocking, arranging and cleaning after normal store hours the air conditioning system is operated on a continual, 24-hour, 7-day-a-week basis. Lights are left on until the last employee or cleaning personnel leave at approximately midnight on Mondays and Thursdays, 9:00 p. m. on Tuesday, Wednesday, Friday, Saturday and Sunday.

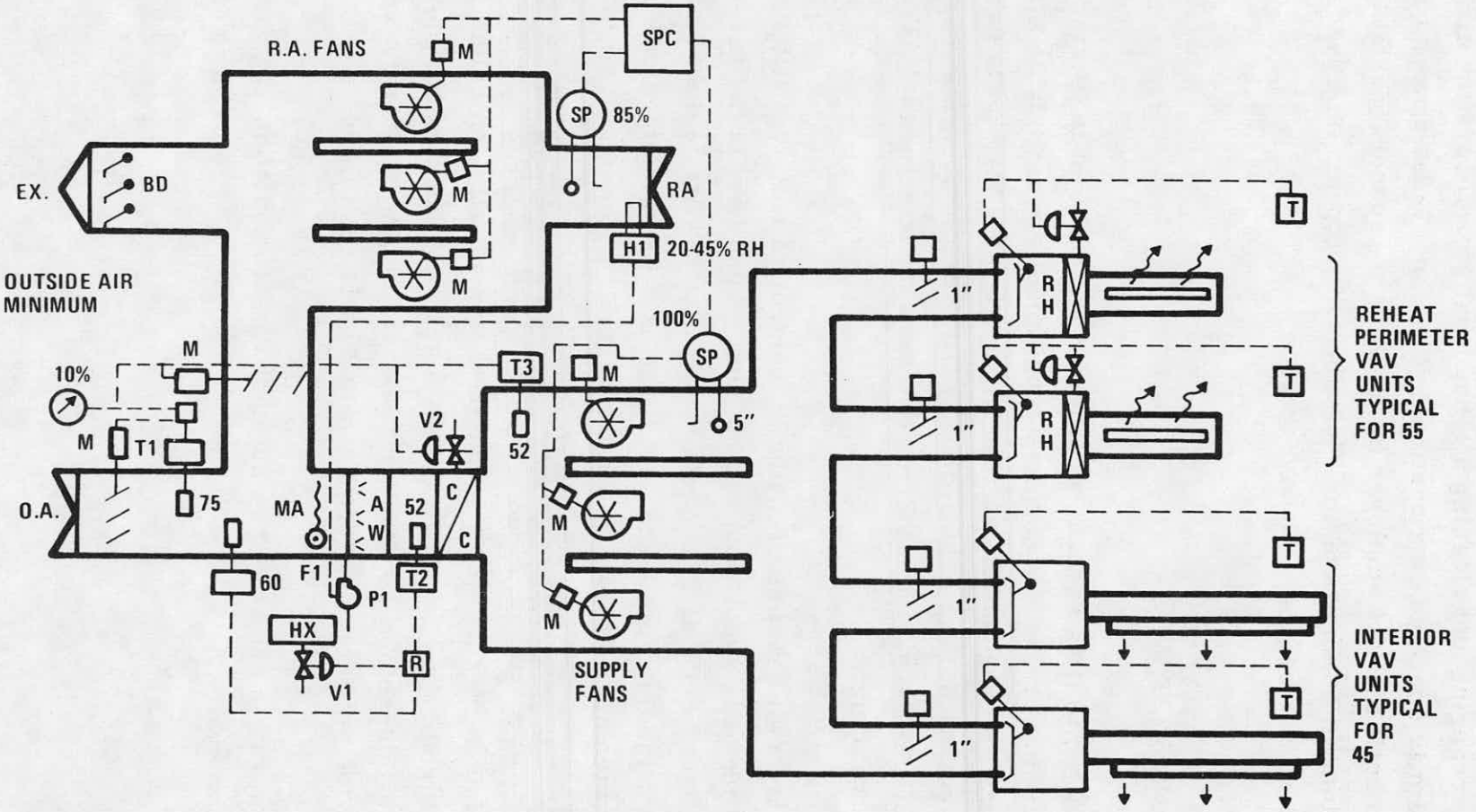
AIR CONDITIONING SYSTEM

A central heating, ventilating and air conditioning (HVAC) unit is located in the basement equipment room. It supplies conditioned air to variable air volume units located throughout the store. The perimeter VAV units have hot water reheat coils which are controlled by their respective area thermostats in sequence with the variable volume dampers. The interior VAV units have damper control only.

The air handling system consists of manually controlled roll-type filters, air washer, cooling coil, supply and return fans. Supply air is delivered through high-pressure ducts in duct shafts to all floors. Air is distributed on each floor via a medium-pressure duct loop. Air from the medium-pressure loop is then distributed through the variable volume units to individual zones.

Each supply fan has vortex dampers which are automatically controlled to maintain the required static pressure in the supply duct work. Static pressure controls position-return air dampers on each floor to maintain a relationship between the supply and return air volumes to each floor.

Building humidity is controlled by automatic operation of an air washer in each central fan system.



Air Conditioning System

AIR CONDITIONING UNIT

SUPPLY FANS

Location	Fan Room
Model No.	490
CFM (each)	30,350
S. P.	5.0 in.
RPM	726
Type	Cent.

MOTOR

HP	50
RPM	1775
Voltage	230/460/3/60
Amps	229/115

RETURN AIR FANS

Location	Fan Room
Model No.	490
CFM (each)	27,775
SP	1.5 in.
RPM	514
Type	Cent.

MOTOR

HP	15
RPM	1760
Voltage	230/460/3/60
Amps	73/36.5

CHILLED AND HOT-WATER SUPPLY

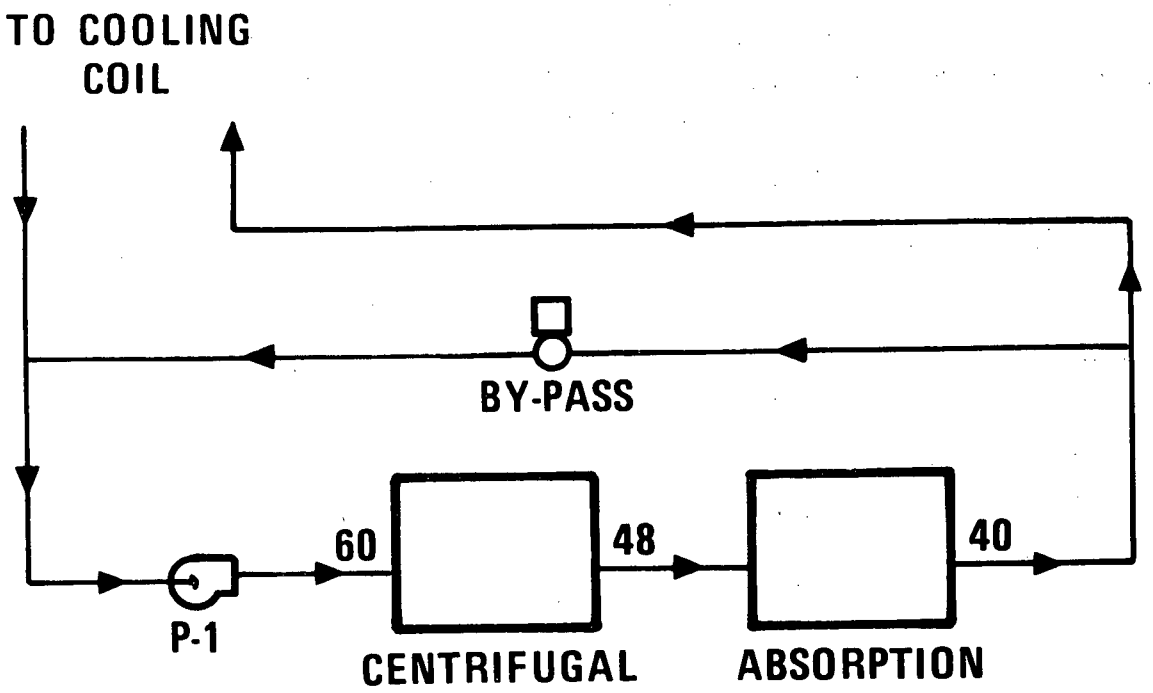
Primary equipment for supplying chilled water and hot water is located in the basement boiler room.

CHILLED WATER SYSTEM

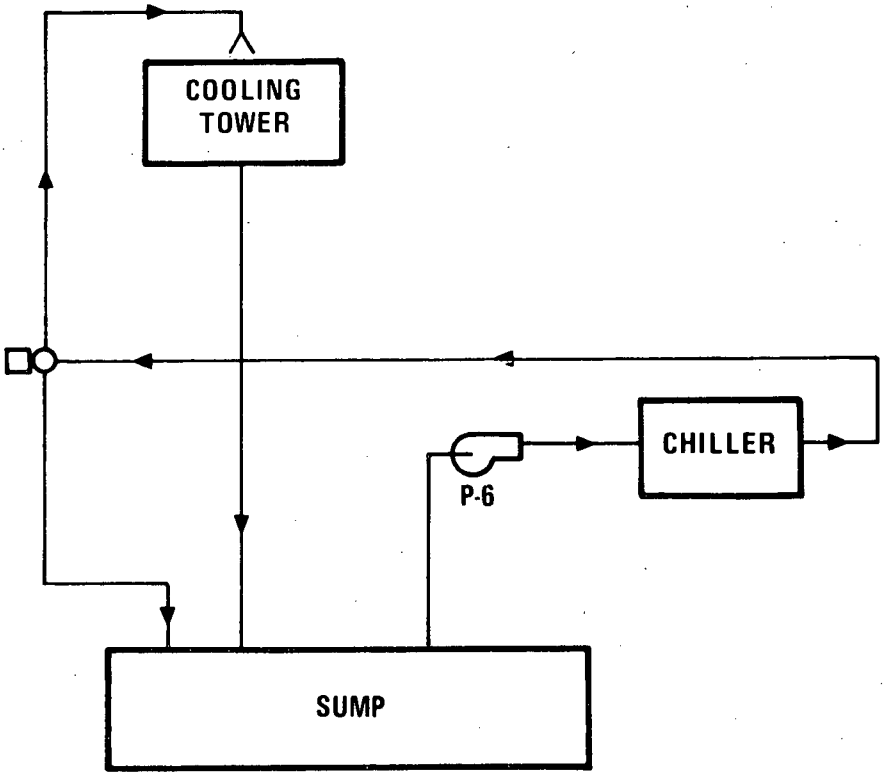
The chilled water is provided by two water chillers consisting of one centrifugal and one absorption unit. The absorption unit operates on hot water. The chillers are piped in series such that the chilled water passes through the centrifugal and then the absorption unit. A primary chilled water pump circulates chilled water to the three-way control valve on the cooling coil.

Condenser water for the chillers is provided by a cooling tower. A condenser water pump circulates condenser water through the condensers and to the cooling tower. The tower supply line is equipped with a control valve and by-pass line to maintain the condenser water at proper temperature.

The following diagrams illustrate the basic chilled water and condenser water systems.



Chilled Water Supply



Condenser Water

CHILLER AND COOLING TOWER DESCRIPTION

CENTRIFUGAL WATER CHILLER

Machine Model	19C-810
Capacity	423 Tons

CHILLER

Model No.	19016-919
GPM	896
Ent. Water Temp.	60°F
Lvg. Water Temp.	48.6°F
Passes	2

CONDENSER

Model No.	19R16-338
GPM	1270
Ent. Water Temp.	85°F
Lvg. Water Temp.	94°F
Passes	2

COMPRESSOR

KW Input	265
RPM	3550
Full Load Amps	740
Voltage	480/3/60
Refrigerant	F-11

ABSORPTION WATER CHILLER

Model No.	EK-50
Capacity	200 tons

EVAPORATOR

GPM	330
Ent. Water Temp.	55°F
Lvg. Water Temp.	40.1°F
Passes	3

ABSORBER/CONDENSER

GPM	900
Ent. Water Temp.	85°F
Lvg. Water Temp.	98.6°F
Passes	2/1

GENERATOR

GPM	275
Ent. Water Temp.	250°F
Lvg. Water Temp.	222.3°F
Passes	3

POWER REQUIREMENTS

Voltage	440/3/60
HP (total)	15.5
Control Voltage	120/1/60
Amps	20

COOLING TOWER

Location	Roof
Model	452-204

FAN (4)

Type	H-3

MOTOR (4)

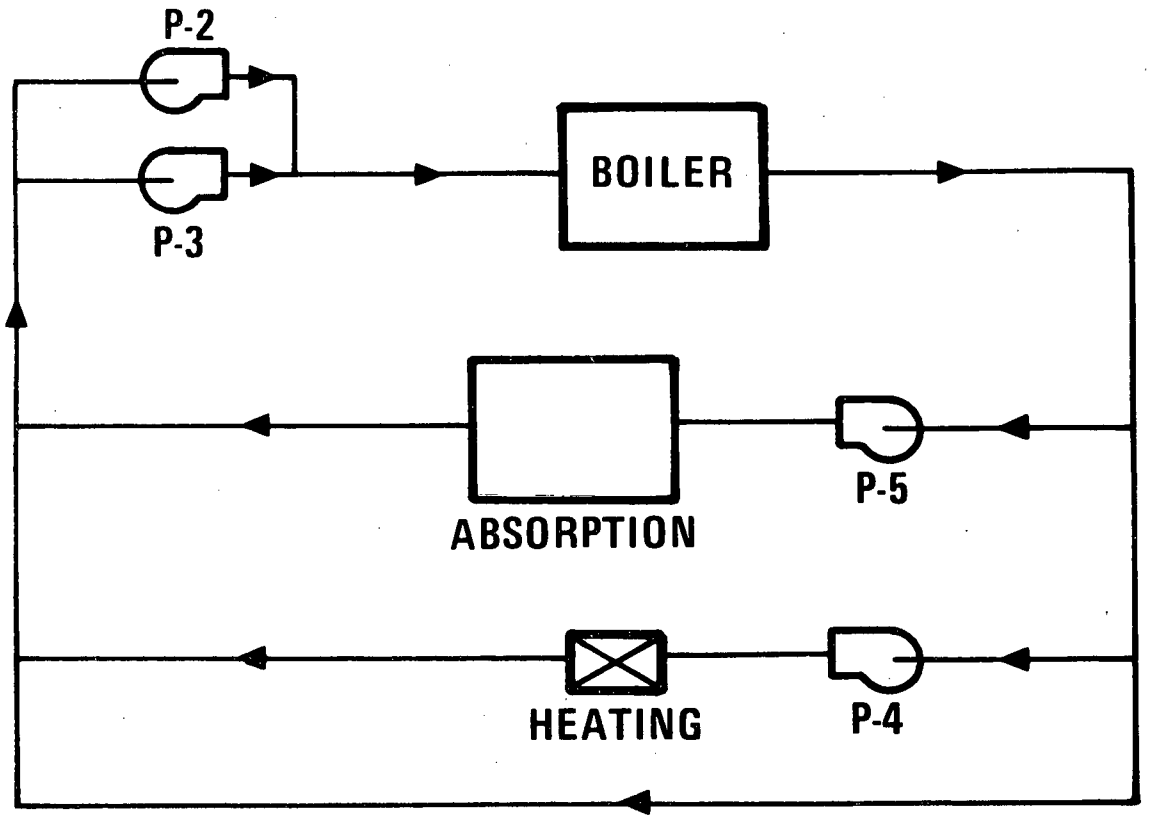
HP	40
RPM	1760
Voltage	230/460/3/60
Amps	93-46.5

HOT WATER SYSTEM

Hot water for heating and operation of the absorption unit is provided from a primary hot water loop. This water is heated by a boiler.

Water is circulated in the primary hot water loop. Secondary hot water pumps supply water to heating equipment and the absorption unit.

The following diagram shows the basic hot water supply system.



Hot Water Supply

HOT WATER BOILER

Model	400 gh
SIZE	
Passes	2
Pressure	150 psi
Heating surface	2000 sq ft
CAPACITY	
MBH	15,930
HP	400
BLOWER MOTOR	
HP	15
Voltage	440/3/60
Amps	18
BURNER	
Fuel	Natural Gas and No. 2 oil
Firing Rate	16,738,000 Btuh Input
Oil	121.3 gph
Gas	16,738 cfh

PUMPS

Pump No.	Model	GPM	HD.	H. P.	Function
P-1	4030-6G	900	40	25	Chilled water
P-2	4040-5E	600	45	15	Primary hot water
P-3	4040-5E	600	45	15	Primary hot water
P-4	4040-6G	850	85	30	Secondary hot water
P-5	5822	550	28	5	Hot water to absorption
P-6	6977	1000	80	25	Condenser water

BASE YEAR ENERGY - BUILDING "D"

1975	KWH	MCF	No. 2 Fuel Oil Gallons
Jan.	390,940	0	16,335
Feb.	471,966	6,998	10,100
Mar.	621,588	2,270	0
Apr.	614,592	2,594	0
May	622,050	3,366	0
June	396,660	2,574	0
July	445,698	2,129	0
Aug.	445,698	3,432	0
Sept.	618,420	3,436	0
Oct.	527,934	1,891	900
Nov.	301,092	1,700	9,075
Dec.	491,108	0	22,870
Average Cost:	2¢/KWH	$1.50/MCF	35¢/Gallon

ENERGY MANAGEMENT
WORKSHOP III

Calculate the potential savings in the following areas using information from the building "D" survey form:

1. ECO - Annual lighting savings by having 2/3 of the fluorescent and all of the display lighting on 3 hours less per day, 7 days per week, 51 weeks per year.

   A. kWh/year = _____kWh.

   B. At 2-1/2¢/kWh $/year = $_____.

2. ECO - Annual lighting savings if one third (1/3) of the fluorescent fixtures are disconnected (including ballast). Assume no reduction in lighting per #1 above has been done.

   A. kWh/year = _____kWh.

   B. At 2-1/2¢/kWh $/year = $_____.

3. ECO - Annual electrical savings by shutting down the A/C fans the average of 8 hours per day, 7 days per week, 52 weeks per year.

   A. kWh/year = _____kWh.

   B. At 2-1/2¢/kWh $/year = $_____.

4. ECO - Annual cooling savings if outdoor air for ventilation is reduced from 10% to 0% for 4 hours per day when the store is occupied by less than 15% of its "normal" occupants, 7 days-per-week during the duration of the 20 week cooling season.

   BTU to cool air sensibly = CFM x T. D. x 1. 08 where:

   CFM = Cubic feet per minute

   T. D. = Dry bulb temperature difference between entering air and leaving air from the cooling coil.

   Assume: 1. Average T. D. = 20°

   2. Chilled water costs 3¢ per ton hour (one ton hour = 12, 000 BTU)

   A. Total BTU saved during cooling season = _____BTU.

   B. Total cooling dollar savings = $_____.

5. Determine the two (2) best additional ECO's your team believes will result in the greatest potential savings for building "D":

   A. We believe an ECO exists in (action):

   _____

   _____

   _____

   B. We believe another ECO exists in (action):

   _____

   _____

   _____

ENERGY MANAGEMENT ACTION WORKSHOP IV

Energy Management Action Plan and Implementation

Assignments:

1. As an individual, develop an energy management action plan for your facility using Form FEA-0531-S-O B-1. Include the no-cost and low-cost items that you plan to implement in your facility and the capital expense items that you will be planning for throughout the next fiscal year.

2. As a team develop the best overall energy management action program drawing from the individual action plans.

3. As a team develop a plan for implementation which encompasses the areas discussed in implementation.

Presentations will be given on your team's energy management action plan and implementation plan.