DoE/CS/20622-1

BUILDING-OWNER ENERGY-EDUCATION PROGRAM

DOE/CS/20622--1

DE82 006916

Final Report

December, 1981

TISHMAN RESEARCH CORPORATION 666 FIFTH AVENUE, NEW YORK, N.Y. 10019

Prepared for the U.S. Department of Energy under Contract Number DE–AC02–80CS20622

BUILDING-OWNERS ENERGY-EDUCATION PROGRAM

Final Report

December 1981

Prepared by:

Tishman Research Corporation
666 Fifth Avenue
New York, New York 10103

Under Contract to
United States Department of Energy
Contract #DE-AC02-80CS20622

ACKNOWLEDGEMENTS

Tishman Research Corporation acknowledges the very special assistance received from The Building Owners and Managers Association International (BOMA), and in particular, Mr. Gardner McBride, Executive Vice President of BOMA. BOMA helped in the design and implementation of this program and, based upon its success, has taken steps to implement a similar program for its membership.

Also, special thanks are given to the officers, members, and staff of the local BOMA chapters which assisted in local coordination and otherwise participated in this program:

Building Managers Association of Chicago

in conjunction with

BOMA/San Francisco

—

BOMA/Suburban Chicago

—

BOMA/Atlanta

Also, deep appreciation is expressed to the individuals who acted as convenors in each city. They played a key role in making these programs possible:

Mr. Peter Cahill, Cahill Construction Co, Inc. . . San Francisco

Mr. Marshall Bennett, Bennett & Kahnweiler . . . . . . Chicago

Mr. Frank Carter, Carter Associates . . . . Atlanta

TABLE OF CONTENTS

Appendices

SUMMARY

This owner education program is an outgrowth from the "Energy Conservation in Existing Office Buildings" study conducted in the mid-seventies under DOE Contract No. EY-76-C-02-2799.000. This earlier study, and subsequent feedback from the response of the public exposed to its findings, identified the building owner as a major force in the process of stimulating energy conservation in private sector commercial office buildings. The findings indicated that very few owners were actually aware of how much energy their buildings consumed or how they compared with other similar facilities. The findings also indicated that it took a relatively lengthy time for an owner, whether institutional, corporate, or private, to move up on the learning curve to a point where he feels confident enough to be a decisive manager.

The owner is the ultimate decision maker. He holds the purse strings and can motivate his managers and professionals to take action. To do this, he must perceive that a serious problem exists and that cost-effective remedies can be achieved. He must be shown in terms he can understand -- but his education can be accelerated. It was hypothesized that in order to stimulate owners, it would be necessary to provide them with tools and insights which would enable them to exercise greater leadership and to more readily understand and accept recommendations from their managers and consultants. Also, it was theorized that the owner could be stimulated to make his staff and outside professionals pay attention.

It was also believed that past efforts by the Department of Energy (DOE) to stimulate energy conservation in commercial buildings had not achieved their full potential because the Government's programs had not been directed to owners, but primarily to architects, engineers, consultants, and building managers. Owners were skeptical. They were simply not on the same wave length as the managers and professionals upon whom they depended. Most of these managers and professionals who do understand energy conservation had been unable to communicate effectively with the decision and policy makers.

This owner education program was designed to test the above hypotheses in a limited "test market" — with the assistance of a leading industry association of owners, Building Owners and Managers Association International (BOMA).

In the building community, as in other business communities, peer groups tend to coalesce around position in the corporate hierarchy. The interaction of the peer group is the mechanism which was exploited in this program to help educate, motivate, and challenge the owner to action. The goal was to persuade the owner to invest an hour or two with his peer group in a carefully planned session. The interaction and influence of the peer group was intended to sustain the motivation required to follow through with an action program. Meetings were held in San Francisco, Chicago, and Atlanta, each attended by between twelve

and twenty-four owners.

Given the short attention span of busy executives and present day saturation of energy talk, this program was designed to be concise and to the point. The session was designed to equip him with some key tools, to teach him some cogent questions to ask, and to excite him to act.

The program was designed to stimulate the owner to challenge or direct his managers and consultants to undertake well conceived programs of energy conservation and to monitor their effectiveness. It was deemed essential to teach the participants how to identify their potential for energy conservation; how to filter out what is most important and what is less relevant; where and how to find alternatives; and how to set objectives, manage programs, and make mid-course corrections. A key premise was that there would be only one opportunity to get the owner's attention for a special education program.

The major conclusions drawn from the participants' feedback include:

- The premise that a well-targeted education program for building owners would motivate them to take action was confirmed. (This report describes one such model program.)

- While many owners have already taken steps to reduce energy use, there remains substantial room for improvement.

- Owners desire peer reinforcement to assure them that a reduction in energy usage can be attained practically and economically.

- Management tools and information provided by trade or industry associations to their members are deemed most credible.

Finally, a model plan was developed to reach buildings owners on a nation-wide basis through BOMA. This has been approved by BOMA International's executive committee and is expected to reach a total of over 200 owners. BOMA intends to implement this plan entirely with their own funding — it will not require any public monies.

PROGRAM OBJECTIVES

- Develop and test market a cogent education program aimed specifically at building owners to help them be more decisive and knowledgeable, and to motivate them to direct their managers and professionals to implement a rational plan for achieving energy conservation in their commercial office buildings.

- Establish a plan, sponsored by the Building Owners and Managers Assocation International (BOMA) to implement this educational program on a nation-wide basis.

CONCLUSIONS

- The premise that a well-targeted education program for building owners would motivate them to take action was confirmed. (This report describes one such model program.)
- While many owners have already taken steps to reduce energy use, there remains substantial room for improvement.
- Owners desire peer reinforcement to assure them that a reduction in energy usage can be attained practically and economically.
- Management tools and information provided by trade or industry associations to their members are deemed most credible.

IMPLEMENTATION

Three cities were selected for test marketing a model program. The criteria for selection of the cities were that they:

- have large concentrations of office space with a large portion in post-war buildings (where there was the greatest potential for savings);
- be in different geographical areas; and
- have a cooperative BOMA chapter.

San Francisco, Chicago, and Atlanta were chosen as test locations which met these criteria.

In each of the three cities, a key person was identified as a highly visible and motivated peer of the building owner community. Each of the three owners were visited personally and invited to be a convenor of a summit meeting at which the education program was to be presented. In every case, after explaining the goals and nature of the program, each agreed to sponsor the program — with the cooperation of the local chapter of BOMA.

To convene these meetings, the sponsors (with the help of members and staff of the local BOMA Chapter, BOMA International, and Tishman Research Corporation) contacted other major owners, inviting them to attend a luncheon meeting during which the program would be presented. DOE was identified as a sponsor of the meeting. Each participant received an outline of the program and its rationale.

Between one and two dozen owners or representatives of property-owning firms in each city were invited to attend each meeting. The invitees included real estate entrepreneurs, senior executives of property management firms who performed the owner functions for investment groups, and senior executives of large corporations who exercised the owner role for corporate-owned real estate.

Prior to the meeting, an energy-use survey was made for one representative building from the portfolio of each participant. This enabled each owner to receive a coded list showing the energy consumption ranking of all the buildings surveyed in his city, as well as a sealed envelope containing the identification of his building. This survey was an effective approach to engender competitive interaction, making the program relevant and interesting, and to obtain insights into the owners' current skills at managing energy consumption.

(For example, one owner with the most energy-efficient building on the list for his city was so proud of his achievement that he offered to share his experiences with the other participants. Another owner with only a fair ranking was motivated to ask his staff some penetrating questions that led to improvements. Still another sought to conduct an audit.)

The procedure used in making the energy survey was as follows. A questionnaire was sent out requesting information on the building shape, size, HVAC systems, lighting, skin, operations schedules, and actual utility energy consumption. The information for each building was provided (in most cases) by the building manager or building engineer assigned by the owner. In order to verify the correctness of the survey data, a site visit was made to each building in the survey by an engineer. This visit provided an opportunity to observe unusual building characteristics, ascertain that correct data was provided, and fill in any data that had not been supplied. Following the site visits, the energy consumption of each building was calculated and normalized on the basis of Btu's per square foot per year for typical building operations. Unusual energy loads such as computers, restaurants, parking garages, and commercial space, were deleted during this normalization. Unusual building operations schedules were accounted for in the normalization.

The owners agreed to provide the information about their buildings provided it was to be kept in confidence. Likewise, the identification of the buildings on the ranked list was to be kept confidential.

(The ranked list for each city, the normalization procedure, and a blank survey questionnaire are included in Appendix I.)

The owner summit meetings were held as follows:

San Francisco . . . . April 30, 1981

Chicago . . . . May 14, 1981

Atlanta . . . . May 20, 1981

The program was presented by Joseph H. Newman, President of Tishman Research Corporation. A copy of Mr. Newman's presentation is included in Appendix II. It may be used as a model for future presentations. Highlights of the presentation included:

- A review of the "Energy Conservation is Existing Office Buildings" study, conducted under a prior DOE contract.
- A rationale for this "Building Owners Energy Education Program"
- The importance of tracking energy use and making comparisons — and a procedure for doing so
- The results, purpose, and procedure for the energy-use survey performed for participants' buildings
- A list of popular energy conservation measures taken to date

- A projection of certain new energy conservation opportunities
- A discussion of tenant/owner relationships with respect to energy
- A discussion of the BOMA-recommended lease statement on cost sharing for retrofit energy conservation measures

Five months following the meetings, the participants were surveyed by BOMA to obtain feedback on:

- What steps had been taken as a result of the program?
- If no steps had been taken, why not?
- Would a continuing program be useful?

In this survey, approximately fifty percent of the respondents indicated that they had taken some positive steps as a result of the program:

- Initiation of an energy conservation reward system in branch offices
- Initiation of systems for monitoring energy use
- Authorized building surveys by staff and/or outside professionals
- Hired engineers for specific feasibility studies
- Responded to existing staff proposals that had been "on the shelf"
- Instructed their staff to investigate items recommended in the presentation (see Appendix II)

The large majority of owners were appreciative and enthusiastic about the program. Some indicated that DOE should have initiated a program targeted to owners earlier. They also voiced the opinion that the conduit for conducting future programs should be their own industry associations. They are most comfortable with management and analytical tools, product data, and other information provided by their own organizations. All but one owner responded that the program was helpful.

During the course of the face-to-face interaction with the participants, both at the meeting and in following encounters, the following observations were made:

- Over half of the buildings surveyed were operating reasonably effectively; however, room for improvement still exists. (Of 34 buildings surveyed, 16 were operating below 90,000 Btu's per square foot per year.)

- Some owners did not fully appreciate positive steps already taken by their staffs — in fact; many had done homework prior to attending the meeting to get a better understanding of what was happening in their buildings.

- Most owners need reinforcement from those in whom they have confidence (usually their peers) to assure them of the extent of the problem and to convince them that it is economically and technically correctable.

- Owners welcome simplified and easily understandable management tools such as standardized reporting procedures, and easy ways to assess potential energy savings on a "what if" basis.

- Capital expenditures for energy retrofit could be accelerated if costs were shared with tenants.

- Peer interaction among owners can have a beneficial affect in motivating them to take action.

Finally, based on the success of the program, Building Owners and Managers Association International has taken steps to initiate a BOMA-sponsored program to be held at its national meetings in 1982. The BOMA program, as planned, will be based on the project described above and is described in detail in Appendix III.

APPENDIX I

Energy Survey of Representative Buildings

- Results
  - San Francisco
  - Chicago
  - Atlanta
- Procedure for Normalization
- Sample Questionnaire

SAN FRANCISCO BUILDING SURVEY RESULTS

Energy Consumption Analysis

BUILDING #	GROSS BTU/SF	ADJUSTED BTU/SF/YR
# 1	51,900	47,573
# 2	73,791	57,389
# 3	54,187	58,065
# 4	64,665	61,720
# 5	65,734	67,700
# 6	126,786	82,500
# 7	85,323	85,323
# 8	136,466	90,215
# 9	159,295	170,945
	Mean Value	80,158
	Mean Value (less high)	68,810

CHICAGO BUILDING SURVEY RESULTS

ENERGY CONSUMPTION ANALYSIS

BUILDING #	GROSS BTU/SF	ADJUSTED BTU/SF/YR
# 1	63,139*	84,181
# 2	58,658*	89,610
# 3	88,601*	92,595
# 4	97,316	97,316
# 5	104,683*	99,204
# 6	99,455	99,455
# 7	102,000	102,000
# 8	71,837*	106,270
# 9	72,778	114,912
#10	102,257*	133,404
#11	121,100*	140,392

* PORTION OF THE LOAD IS SUBMETERED AND NOT INCLUDED IN THIS NUMBER.

MEAN = 105,394.45

ATLANTA BUILDING SURVEY RESULTS

ENERGY CONSUMPTION ANALYSIS

BUILDING #	GROSS BTU/SF	ADJUSTED BTU/SF/YR
# 1	93,954	83,438
# 2	87,042	81,827
# 3	58,041	64,076
# 4	186,135	175,150
# 5	74,463	74,463
# 6	89,084	89,084
# 7	65,410	63,346
# 8	63,061	63,061
# 9	65,306	65,306
#10	88,766	92,021
#11	101,454	94,304
#12	170,421	126,776
#13	144,602	148,545
#14	81,462	81,462
	MEAN VALUE	93,061

PROCEDURE FOR NORMALIZATION

Energy Consumption Analysis

1. Sum total site energy in BTU/Year:

   Electrical Energy (KWH x 3414 = BTU's) +

   Gas Energy (Therms x 100,000 = BTU's) +

   Oil Energy (Gallons x BTU Content/Gallon = BTU's) =

   Gross Energy Consumption (BTU/Year)

2. Estimate all major non-typical loads in BTU/Year and subtract from Gross Energy Consumption above. This is accomplished by multiplying estimated connected load by estimated hours of operation:

   Computers (plus) Associated Cooling +

   Garage Lighting (plus) Ventilation +

   Restaurant Equipment (plus) Cooling (plus) Ventilation +

   Retail Lighting (plus) Ventilation =

   Net Energy Consumption

3. Adjust gross floor area of building to delete any areas (such as parking) for which the entire load has been accounted in Step 2 above.

4. Divide Net Energy Consumption (Item 2) by Adjusted Gross Floor Area (Item 3) to determine BTU/GSF/Year. Please note that this number is not normalized to operation schedules or for seasonal weather.

5. To normalize for operation schedules, estimate the annual number of hours that the building systems and lighting actually operate to meet the tenants' occupancy schedules. For overtime operations, multiply the percentage of floor area times the number of overtime hours to determine effective hours of overtime. Add this to the normal daytime building schedule. Also, determine a standard hours of operation (no overtime) for comparison purposes.

   Perform an annual energy consumption analysis (using computerized or hand calculation method) for the building, or a similar building, at both total hours of actual operation and standard hours of operation. Determine consumption normalized for operation (BTU/GSF/Year) as follows:

$$\frac{\text{Calculated Consumption BTU/GSF/YR} \atop \text{Standard Operation}}{\text{Calculated Consumption BTU/GSF/YR} \atop \text{Actual Operation}} = \frac{\text{CONSUMPTION NORMALIZED FOR OPERATION} \atop \text{BTU/GSF/YR}}{\text{Net Energy Consumption (Step 3)} \atop \text{BTU/GSF/YR}}$$

6. To normalize for weather variations, perform an annual energy consumption analysis for the building or a similar building using climate data for a base year and actual weather data for the year in consideration. Determine consumption normalized for weather (BTU/GSF/YR) as follows:

$$\frac{\text{Calculated Consumption BTU/GSF/YR} \atop \text{Base Year}}{\text{Calculated Consumption BTU/GSF/YR} \atop \text{Actual Year}} = \frac{\text{NORMAL ENERGY CONSUMPTION} \atop \text{BTU/GSF/YR}}{\text{Energy Consumption Normalized for} \atop \text{Operation (Step 5)}}$$

SAMPLE QUESTIONNAIRE

Part 1 . . . . Energy Data

Part 2 . . . Building Data

This questionnaire was used to obtain and normalize the energy consumption of one building from each of the participants' portfolios. The results enables each owner to receive a coded list showing the energy consumption ranking of all the buildings surveyed in his city, as well as a sealed envelope containing the identification of his building. The owners agreed to provide the information about their buildings provided it was to be kept in confidence.

Building Owner ______________________________

Building Name ______________________________

Address ______________________________

____

Name of Person Responding ______________________________

Position ______________________________

Telephone (   ) ______________________________

ENERGY DATA

1. Electrical Consumption in 1980

- Who is electrical energy provided from:

  ____

- Is this building centrally metered? /_/yes /_/no
- If building is submetered, provide description of loads that are submetered:
  - Tenant lighting & utility power /_/yes /_/no
  - Tenant air conditioning /_/yes /_/no
  - Computer /_/yes /_/no
  - Kitchen /_/yes /_/no

- Provide electrical consumption from utility bills:

1980	KWH/Meter #1		KWH/Meter #2		KWH/Meter #3 *		Total KWH
JAN		+		+		=	
FEB		+		+		=	
MAR		+		+		=	
APR		+		+		=	
MAY		+		+		=	
JUN		+		+		=	
JUL		+		+		=	
AUG		+		+		=	
SEP		+		+		=	
OCT		+		+		=	
NOV		+		+		=	
DEC		+		+		=	
						1980 Total	

*Add more columns for additional meters.

2. Steam Consumption in 1980

- Who is steam purchased from: ______________________________
- Average supplied pressure: ______________________________
- Provide steam consumption from utility bills:

1980	Thousand #/Mo.	1980	Thousand #/Mo.
JAN	________	JUL	________
FEB	________	AUG	________
MAR	________	SEP	________
APR	________	OCT	________
MAY	________	NOV	________
JUN	________	DEC	________
		1980 Total	________

3. Gas Consumption in 1980

- Who is gas purchased from:

______________________________ ______________________________

- Heating value per cubic foot: ______________________________
- Provide gas consumption from utility bills:

1980	Thousand Cubic Ft/Mo.	1980	Thousand Cubic Ft/Mo.
JAN	________	JUL	________
FEB	________	AUG	________
MAR	________	SEP	________
APR	________	OCT	________
MAY	________	NOV	________
JUN	________	DEC	________
		1980 Total	________

4. <u>Oil Consumption in 1980</u>

- Who is oil purchased from: ______________________________

- Heating value per gallon or grade of oil: ____________
- Provide oil consumption from utility bills:

1980	Gallons/Mo.	1980	Gallons/Mo.
JAN	________	JUL	________
FEB	________	AUG	________
MAR	________	SEP	________
APR	________	OCT	________
MAY	________	NOV	________
JUN	________	DEC	________
		1980 Total	________

5. Does the Owner or Management presently monitor consumption (peak demand and total energy) to help evaluate consumption savings due to conservation efforts or to make comparisons with certain goals?

/_7yes /_7no

If "YES" describe: ______________________________

____

6. Does Owner or Management know how building consumption compares with other buildings of about the same age and similar physical characteristics?

/_7yes /_7no

7. How do tenants pay utility bills:

Rent Inclusion	/_7yes	/_7no
Submetering paid to owner	/_7yes	/_7no
Submetering paid to utility	/_7yes	/_7no

3. Unoccupied Spaces

- List any major spaces which were not occupied during portions of 1980.

Gross Sq. Ft.		Months
______	x	______
______	x	______
______	x	______

4. Numbers of Floors

- Above Grade ______
- Below Grade ______

5. Areas

- Gross Floor Area ______
- Net Rentable Floor Area ______
- Office Floor Area Above Grade ______
- Commerical Floor Area Above Grade ______
- Area Below Grade ______
- Garage Area ______
- Typical Gross Floor Area/Floor Above Grade

Floors		Gross Sq. Ft.
______	@	______
______	@	______
______	@	______
______	@	______

- Roof ______

6. Floor to Floor Height (Typical) ______

7. Windows

- % Window Area of Wall Area ____________
  - Insulated Glass /_7yes /_7no
  - Tinted Glass /_7yes /_7no
  - Reflective Glass /_7yes /_7no
  - Operable Windows /_7yes /_7no

    IF "YES" WHAT TYPE ________________________________

8. Exterior Wall Construction

- Masonry /_7yes /_7no
- Glass /_7yes /_7no
- Metal Panel /_7yes /_7no
- Insulated /_7yes /_7no
- % Exterior Wall sharing party wall with adjacent building ________________________________

9. Roof

- Insulated /_7yes /_7no

10. HVAC

- Normal hours of operation

Day of the Week	Start	Stop
Monday through Friday	______ a.m.	______ p.m.
Saturday	______ a.m.	______ p.m.
Sunday	______ a.m.	______ p.m.

- Are there any areas which regularly receive heating or cooling after hours?

Gross Sq.Ft.	Start	Stop	Days/Week
______	______ a.m.	______ p.m.	______
______	______ a.m.	______ p.m.	______
______	______ a.m.	______ p.m.	______

10. HVAC (Continued)

- % Gross Space Air Conditioned ______
- Central Refrigeration /_7yes /_7no
  - Electric Driven /_7yes /_7no
  - Steam Turbine /_7yes /_7no
  - Steam Absorption /_7yes /_7no
  - Total Tonnage: ______
- Central Heat /_7yes /_7no
  - Electric Boiler /_7yes /_7no
  - Steam Converter /_7yes /_7no
  - Oil Boiler /_7yes /_7no
  - Gas Boiler /_7yes /_7no
- Window Units /_7yes /_7no
  - Provide both heating and cooling /_7yes /_7no
  - Type: ______
- Self-Contained Package Units /_7yes /_7no
  - Total Tonnage: ______
- Does Building Engineer cut off outside air during extreme outside temperatures? /_7yes /_7no

11. Systems

- Interior (Typical)
  - VAV /_7yes /_7no
  - Dual Duct /_7yes /_7no
  - Reheat /_7yes /_7no
  - Reheat with reset /_7yes /_7no
  - Constant Volume /_7yes /_7no
  - Other /_7yes /_7no

    IF "YES" describe: ______

    ______

11. Systems (Continued)

- Perimeter
  - Area Served by typical zone ________ gsf
  - Normal Schedule for heating or cooling Start ________ a.m.
    Stop ________ p.m.
  - Average number of hours/week overtime

Zones		Hrs/Wk
________	@	________
________	@	________
________	@	________

  - 4-Pipe /_7yes /_7no
  - 2-Pipe /_7yes /_7no
  - 3-Pipe /_7yes /_7no
  - Electric Resistance /_7yes /_7no
  - Electric Heat Pump /_7yes /_7no
  - Induction Units /_7yes /_7no
  - Other /_7yes /_7no
    IF "YES" describe: ____

    ____

12. Lighting

- Watts per square foot ________
- Typical Fixture
  - 2-Tube /_7yes /_7no
  - 4-Tube /_7yes /_7no
- Typical Area/Fixture ________
- Wall Switches /_7yes /_7no

12. Lighting (Continued)

- Lighting Schedules
  - Typical Weekday Schedule

Square Feet	Start	Stop
________	________ a.m.	________ p.m.
________	________ a.m.	________ p.m.

  - Typical Saturday Schedule

________	________ a.m.	________ p.m.
________	________ a.m.	________ p.m.

  - Typical Sunday Schedule

________	________ a.m.	________ p.m.
________	________ a.m.	________ p.m.

  - Areas with Frequent Overtime Lighting

________	________ a.m.	________ p.m.
________	________ a.m.	________ p.m.

13. Large Electrical Loads

- Computer
  - KWH/Month: ________________

    OR
  - Square Feet Computer Center: ________________
- Kitchen
  - Square Feet: ________________
- Other (Describe): ________________

  ____

14. List Major Energy Conservation Measures taken is past five year, including the following:

- Is enthalphy control of outdoor air in use? /_7yes /_7no
- Is condenser water used for heating? /_7yes /_7no
- Is cooling tower water used for heat removal (cooling) in lieu of refrigeration? /_7yes /_7no
- Are chillers equipped with thermocycle sequence (compressor inoperative) i.e., free cooling? /_7yes /_7no
- Are there demand limiters and load shedding devices in use? /_7yes /_7no
- Is steam condensate returned to boiler? /_7yes /_7no
  - If "NO" is heat of condensate used before being wasted? /_7yes /_7no
- Other (describe): ____

____

____

____

____

____

____

____

____

15. Enclose copy of rental plans for the building.

APPENDIX II

Presentation by

Joseph H. Newman
President
Tishman Research Corporation

This presentation may serve as a model for similar future owner eduction programs.

U.S. DEPARTMENT OF ENERGY

BUILDING OWNER ENERGY EDUCATION PROGRAM

SAN FRANCISCO - APRIL 30, 1981

CHICAGO - MAY 14, 1981

ATLANTA - MAY 20, 1981

Joseph H. Newman
Tishman Research Corporation
666 Fifth Avenue, New York, N.Y., 10103

Let me start by telling you how I came to be here today.

It all started in the mid seventies --- a short 5 years ago, when we conducted a study, under DOE contract, on energy conservation potential and energy utilization characteristics in over 1,000 existing office buildings in New York City. The study covered the 5-year period 1971 through 1975. We gathered more than 50,000 bits of physical and operating information on these office buildings, the aggregate area of which was over 250 million gross square feet and the age of which ranged from 8 to 82 years old; and we discussed our findings with owners of these buildings. The study was the first time representative sampling was used with extensive normalization for occupancy, space utilization, and weather. This permitted rational comparative analysis not otherwise possible.

What did we learn?

We learned that there was about a 12% savings in normalized energy consumption when comparing 1971/1972, the 2 years before the 1973 oil embargo, with 1974/1975 — largely due to simple adjustments in building operating temperatures and lighting practices; for example, delamping and use of lower wattages. The savings based upon raw energy consumption data were an apparent 19% --- about 50% greater than the normalized amount of 12%. This lent credence to justification for normalization, i.e., adjustment for key variables, such as weather, occupancy, and utilization, which affect energy consumption but are beyond the control of an owner.

We learned that the 12% savings occurred despite the fact that owners and managers were found to have little quantitative perception relating to energy consumption patterns in their buildings.

Only 10% of the building owners monitored and compared their building's energy consumption to that of others. In general, except in terms of dollars, owners did not know how much they saved, or what the potential benefits of further energy consumption measures could be, absolutely or relatively. We concluded that without the widespread practice of continuous and accurate tracking of consumption, it would be difficult for owners to achieve the next level of energy savings and easy to retrogress, as has been observed in individual cases. We concluded that lacking adequate information on energy utilization it would be very difficult to establish and maintain rational energy conservation policies and to guide decision makers in both the public and private sectors. How can one take corrective action if one doesn't know whether its needed; or when taken, if it does the intended job. We concluded that this fundamental information deficiency must be overcome. Also we were sensitive to the fact that numbers, indicators, and other quantitative yardstick held enormous fascination for owners, consumers, and policy makers and that authoritative information simply expressed motivates people to examine likenesses and differences which inspire beneficial results in a competitive society such as ours.

This general lack of awareness, in my judgment, was the most significant and surprising finding. Also, we found a high degree of non-uniformity in quality and quantity of owner known information relating to building characteristics and operation. This deficiency of uniformity compounded the problem springing from lack of owner knowledge of energy consumption patterns, as all these are interrelated.

We found a substantial spread of physical characteristics, operating practices, and energy consumption patterns in existing office buildings, indicating that a variety of retrofit measures and strategies are necessary to achieve different levels of conservation, and economic benefit.

A few examples illustrating this wide spread are as follows:

	RANGE	MEAN	MEDIAN
1975 consumption, normalized (MBTU/sq.ft)	65-223	112	108
Age (years)	8-82	44	48
Total Building Area	17,000-1,850,000	401,000	318,000
Total Wall Area (SF)	7,400-503,000	130,000	106,000
Per Cent Glass on Wall	13-67	29	26
Temperature, winter day - F	68-75	71	71
Watts/sq.ft. - lighting	1.5-5.3	2.8	2.5

What else did we find?

Post-World War 11 buildings showed a potential savings of 13 to 28% with an average of 21%, based upon a statistical sample studied, in detail, for a 3 year payback.

Pre-World War 11 buildings showed a potential savings of 8 to 11% with an average of 10% based upon a statistical sample studied, in detail, for a 3 year payback.

An additional savings of only 2% was achievable by utilizing measures with a payback in excess of 3 years. These longer payback measures were not practical or cost effective. A 3 year or less payback was considered reasonable by most owners. The indicated savings are those possible beyond the 12% savings already saved in 1974/1975 --- that I mentioned earlier.

We found that the strongest correlation noted between energy consumption and energy related attributes were: age, hours of lighting, hours of perimeter heating and cooling, and type of perimeter system (central or local).

We found that, in general, post-World War 11 buildings tended to have more ventilation than necessary; have excess heating, cooling, and lighting capacities; and have centralized control systems that hamper selective cuts in energy used in vacant or under-utilized space. The savings that could be effected by reducing this excess capacity and controlling waste energy in under-utilized or unoccupied space is significant.

Investments in appropriate devices or systems which: reduce the quantity of outside air; better control heating, cooling, and ventilating; dim or provide energy-efficient lighting are specific retrofit strategies that can be feasibly implemented to provide a reduction in usage.

We found that building owners, in large part, dictate the pace of energy conservation in existing office buildings through their attitudes, perceptions, and ultimate actions --- notwithstanding advice they receive from their staff, consultants, or designers.

It was found that most owners:

- were not surprised that data in the first phase of this study showed that only 10% of the building owners monitored and compared their energy consumption to that of others;
- indicated they were considering or had just started tracking consumption because they were beginning to appreciate its value. One owner, on becoming familiar with the results of the study, sent his designer back to the drawing board because he now understood enough to become dissatisfied with the anticipated energy consumption of a new office structure he was building. This is an example of instant payback and illustrates how much an owner can influence the decision if he understands energy consumption patterns and their significance;
- had little faith in advertising claims for energy cutting devices or systems. Believing the claims were exaggerated or inapplicable to their needs, they were evaluating information on potential benefits with skepticism, resulting in prolonged assessment before satisfying themselves as to their merits;
- were waiting for feedback from those who had already implemented retrofit measures and were seeking advice from many quarters before reaching decisions.

We found that most owners felt uncomfortable in loosening the purse strings to fund energy conservation measures in their buildings. It was determined that the most significant basic barrier to achieving greater energy conservation in existing office buildings is the relative lengthy time for an owner, whether institutional, corporate, or private, to move up on the learning curve to the point where he feels confident enough to be decisive. It was clear that the building owner is a force in the process of stimulating energy conservation in private sector commercial buildings. He is the ultimate decision maker. He, or the person to whom he delegates the holding of the purse strings, calls the final shots and can motivate his managers and professionals to take action if he is shown how in terms he understands.

In off-the-record discussions with owners I found that most were reluctant to support those on their staff, or consultants, or others to whom they looked to for advice. Much of the recommendations owners were receiving were sound, but they reacted by doling out required funding slowly. Many a manager complained, off-the-record too, about being unable to fulfill his mission, or being frustrated by his boss or company policy.

Many an owner hid behind the argument that his tenant pays the bill. Most, however, just lacked the proper decision making tools and were not psychologically or otherwise prepared to delegate. Fortunately, there were enough instances where owners equipped with adequate information and who had educated themselves, made forceful beneficial decisions to lend credence to my contention about owner confidence fostering action.

The so-called New York energy conservation office building study received wide publicity in 1977 and 1978 among building managers, designers and consultants ---- but the message reached very few owners outside the New York area.

As the seventies drew to a close more owners moved up on the learning curve and became decisive; the marketplace began flooding with new energy saving products, experts sprang up like weeds, media saturation took place, more literature on energy conservation "how to" than I have ever seen on any single building technical subject was printed. If one wanted, one could attend different energy related seminars, shows, or courses almost every week of the year. While this caused some confusion, the body of knowledge helped broaden the base of understanding among most managers, engineers, architects, and consultants. This had a beneficial effect resulting in a significant decrease in consumption in both existing and new office buildings --- in the aggregate --- nationwide. But no one knew with any degree of accuracy how much energy fat was removed, how much was left, how much more could be removed cost beneficially.

Some owners bragged about their conservation achievements when in fact their buildings were among the worst in their community. Others spent money with no results, because they were at the point of diminishing returns but without realizing it. Others complained about fuel prices escalating not understanding that BTU utilization is not directly related to price. Some others complained that the measures taken did not result in anticipated savings. Others were unable to identify the effectiveness of each measure taken. Some measures cancelled out the benefit of sound measures previously taken.

There were promises of 30, 40, and 50% savings, yet these were made on buildings that had only 25% or less energy fat remaining that could be removed cost beneficially or practically.

As some owners built new buildings they were exposed to wide array of measures that they thought would be economically applicable to existing buildings, many of which were not. Retrofit costs generally exceed new construction costs by a wide margin.

By the time the 1980's rolled around, energy conservation regulations for new buildings and in some cases for existing buildings proliferated. In many cases, this had a counter-productive effect. Some owners found that their good intentions were not sufficient ---- or that they were asked to do things that affected occupant comfort and productivity. By now some of the horror stories re non-working energy conservation equipment and poor service emerged. Conflicting requirements between State and the Federal government requirements were frequent occurrences.

Most importantly energy prices in America had doubled or tripled, or quadrupled --- depending upon locality and fuel mix.

Now we are here today, and energy remains the fastest escalating component of building ownership in existing buildings; utility costs continue to rise no small part of which is due to conservation itself; and throughout all of this most owners with whom I speak feel neglected or frustrated. No one has paid much attention to the man with the purse strings. There were no programs tailored to his special needs --- to provide him with insights to enable him to exercise greater leadership to more readily understand and accept recommendations from his managers and advisors --- to discuss and share problems and solutions with his peers. There were no programs known to us catering to executives with limited time available and with interest in the general rather than specific picture.

It was suggested that a brief executive program of an hour or two duration be developed to educate owners to support well-concerned programs of energy conservation, to monitor their effectiveness, and to understand what is generally practical and what is not too effective. If nothing else, to give owners an insight into the proper questions to ask --- to give them a chance to share their successes and frustrations with their peers. Further, it was suggested that this approach be test evaluated in three cities: San Francisco, Chicago, and Atlanta, in cooperation with the local BOMA Chapter.

That's why I am here today. If the reasons I have expounded are not enough, let me give you a few more of current origin. The policies of the new administration in Washington, D.C., call for less regulation, less money for DOE, and less Federal government interference. While considered worthwhile and applauded by most owners and the building community at large, these policies will result in a sharp reduction in energy related information, research, and financial incentives. My visits to 3 cities for this owner educational program will probably be the last of the DOE "educational" activities. Executives, managers and professionals will have to turn with increasing frequency to their own trade and professional organizations and rely on their own ingenuity. Philosophically, this will be good, in the long run, but it will be more difficult and costly in the short run to get information. The need to share experiences and information will grow. The need to cooperate among yourselves will grow. The discipline of regulations will disappear. The only thing that will not likely change is the increasing costs for energy.

I will now return to the agenda.

I will not tell you, specifically, what's wrong or right with your buildings or what specific remedies or measures suit your situation. This would be presumptious as I know little about your buildings. The thrust of my remarks relates to what you as an owner ---- a policy maker ---- should know as a minimum and how an owner may be more effective as a decision maker. I look at your role differently than I look at the role of a building manager. You must, likewise.

As good managers and executives you should not have to be bothered with details unless you are a one-man show.

You should turn to experts and professionals in whom you have confidence. However, you have an obligation to be able to see the big picture and have sufficient insights and information to ask the right questions.

You must motivate those on whom you depend. You have to be in a position to support them when they make their recommendations. The most resourceful owners are those who lead. Those who are fearful because of the unknown stifle the initiative of their staff and advisers. If I had to select one priority -- a bare minimum action -- to be taken by an owner, I would recommend that he make adequate arrangements for someone he trusts to put on his desk at the same time each month, two numbers, for each building he owns. These numbers should tell him, in an instant, how much energy each building in his portfolio has consumed during the prior month — in BTU's/sq ft/year; and how much energy each building consumed during the same month last year. The bottom-line energy utilization numbers should be adjusted or normalized for weather, occupancy, and hours of building utilization (and other independent variables).

When an owner does this on a regular basis, he will be able to track and make comparative analyses of energy consumption patterns and trends month-to-month and year-to-year --- and among the different buildings in his portfolio.

Why is this important? The first management rule of control is to understand what you have. I can't imagine anyone not making business decisions without knowing one's profit ---- or loss ---- the bottom-line adjusted for special circumstances. As I indicated in my earlier remarks, most owners in New York City, in 1975, did not know about their patterns of consumption. Today more do, but I have evidence that the relative number is still small.

I told you about the minimum information required. However, if you want to have effective comparisons not only from year to year but from region to region, with other similar buildings, that you do not own, in the same or different regions of the country, it will be necessary to have access to consumption information from a representative cross section of buildings all of which, for at least occupancy, utilization, and weather conditions, are in the same terms and adjusted. Why is adjustment important? A building that is, say, half empty, will likely use less energy than one fully occupied; one operating say, 1 shift instead of 2 shifts --- likewise. Of course, a colder year compared with a warmer year will show a different consumption unless normalized to take into account this variable. Normalizing for the variables beyond your control is like adjusting financial figures for inflation or unusual conditions so you can establish true economic benefits.

How can you make this happen? How can you compare your findings with that of others on a regular timely basis? You will have to find someone who can gather representative consumption information from a wide cross-section of owners of office buildings --- normalize it --- and disseminate it in aggregated form. Who may this be? Enter BOMA. They can do this if they wish. Government agencies can do this, but I doubt if they have the money or that you would want them to do it. Private organizations or companies could do it, for a fee, if enough owners would be willing to subscribe.

With adequate comparative consumption information in front of you, one can spot trends, note whether conservation measures taken were effective, and can see how one stands among his peers.

To repeat what I said earlier, there is a tremendous American fascination with single numbers. Most of you understand how businessmen react to cost-of-living indicators; the Dow Jones average; inflation rates; housing starts; balance of trade statistics; and the like. Such indicators tell you succinctly what the score is. I am certain most of you have a feel for energy costs but not for usage.

I remind you that normally there is little relationship between energy costs and energy utilization. Fuel adjustments costs that cause increased energy costs occur no matter how much you conserve. Imagine what the cost of energy utilization would be if you took no steps to conserve. But how do you assess intelligently your energy conservation results unless you track consumption properly?

Once you know the score and analyze your "energy statement" regularly, you will be in a position to judge the extent of your problem or opportunity, if any.

If you have instituted energy saving measures over the years, you can assess the benefits achieved by comparing current consumption data with historic data. If you have done little in the way of conservation initiatives, you can seek out potential strategies that will fit your needs more knowledgeably.

From our visits to your managers and the building in your portfolio that you selected, we know that a goodly number of you have taken substantial steps to conserve energy during the last 5 or so years.

At this time, I would like to discuss the results of the energy survey which we made of one typical building in each of the portfolios of those who participated in our study. The purpose of making this survey was to demonstrate both the need for "energy accounting" as I have previously discussed -- and to demonstrate a technique for doing so.

The objective of the accounting technique is to normalize the major variables that occur between buildings to establish a baseline performance. This will allow you to compare the performance of buildings within your portfolio and compare the performance from year to year and season to season. The variables to which we addressed ourselves were the following:

- Weather - In this survey, all data was for the calendar year of 1980 — therefore, we did not have to make adjustments for weather. However, for your information, for comparative purposes we did test the effects of climate variations between San Francisco, Chicago, New York, and Atlanta on a prototype state-of-the-art office building using a computer model which I will describe in a few minutes. The results were as follows:
  - San Francisco .... 51,000 BTU/SF/YR
  - Chicago 59,000
  - New York 56,000
  - Atlanta 50,000

- Unusual Loads - Computers, television stations, large retail areas, and parking were adjusted for. When possible, estimates of energy consumed by these users were subtracted from the gross consumption. Our estimates were made from data provided by you on the questionnaire, or by our own engineering guestimates. I caution you to make these estimates very carefully when you undertake your own audits. We suspect errors.

- Occupancy - Adjustments were made for two occupancy-related factors:
  - large areas of unrented space for large parts of the year;
  - large areas of the building working unusually long hours.

  In the case of unrented space, we added to the total energy consumed an assumed lighting and utility power load that would have been consumed if the space were occupied, based on the building standard reported on the questionnaire multiplied by the building's standard tenant patterns. In the case of long schedules, such as may occur with computer centers, accountants, law offices, etc., we made an adjustment using our computer model. We used the computer because of the complex relationships which exist between lighting, utility and plant loads. What we did was to estimate an equivalent full-load lighting hours. If the normal building operation schedule was, say, 3100 hours per year and 25% of the building operated a second shift of 10 hours, we multiplied 10 hours times 5 days per week times 52 weeks per year times 25% and added the resulting 650 hours to the 3100. We then tested the energy performance of a standard building operating at 3750 hours and compared it to one operating at 3100 hours. We applied this ratio to the adjusted energy consumed by your building -- reducing the consumption number.

Now, to look at what you have in front of you. As we promised, each of you has an envelope with the energy performance of your building.

You, of course, are free to share this information with your associates — especially those of you with the best performance may wish to do so. On the sheet, we have listed all buildings surveyed in your city and ranked them by their relative performance based on their adjusted energy performance. You will note that we also have listed a gross consumption — the number you get when you simply divide the square footage into the gross consumption. As you will note, this number is quite deceptive and, therefore, does not provide you with a useful management tool.

NOTE: AT THIS POINT THERE IS A DISCUSSION OF THE SPECIFIC FINDINGS IN THE CITY WHERE THE MEETING IS TAKING PLACE.

Let's now return to conservation measures being utilized. Most owners have taken certain steps to date. Let me list, briefly, some of the more popular conservation measures instituted in the last several years. Not all will apply to every building. Chances are most of you have taken advantage of them. If any do not sound familiar or you have a question about them, we can discuss them later, if you let me know:

(1) REDUCE SUPPLY AIR QUANTITY - This is effective when lighting loads are decreased. For a constant volume reheat system, electrical energy savings are possible all year round and there is a cooling energy savings in summer. For a variable air volume system there will also be similar savings.

(2) LOWER SPACE TEMPERATURES DURING WINTER AND RAISE SPACE TEMPERATURES DURING SUMMER - The mandatory temperature regulations opposed by most owners are history. However, their promulgation did give most owners an appreciation of what temperature adjustments can do. A few degrees change give significant savings. I believe the Federal Government went overboard. The extremes were not realistic. This reminds me to tell you that any owner undertaking an energy savings measure that unduly detracts from comfort, jeopardizes health or safety, is not acting in the overall interest. Overreacting is just as bad, in my judgment, as doing nothing.

(3) DELAMPING, USE OF MORE EFFICIENT FIXTURES AND LAMPS - Delamping reduces wattage to about 2 watts/sq ft.

(4) RAISING CHILLED WATER TEMPERATURE - Setting the chilled water thermostat of the chiller machines as high as room load conditions will permit.

(5) LOWER CONDENSER WATER TEMPERATURE - Supplying condenser water to the chiller machines at as low a temperature as wet bulb temperatures at the cooling tower permit.

(6) REDUCING DOMESTIC HOT WATER TEMPERATURE AND FLOW - A decrease in temperature levels and amount of water to be heated is an obvious saving.

(7) REPLACE WINDOW AIR CONDITIONING UNITS WITH HIGH EFFICIENCY UNITS - If window units or any local units are used, replace them with current more efficient models.

(8) CLOSE AIR DAMPERS DURING WARM-UP, COOL-DOWN AND SHUTDOWN CYCLES - These actions prevent hot or cold air from entering the system when there is no need for it.

(9) IMPROVE OR ADD INSULATION - Double Glazing and reflective glass for fenestration is often overlooked when more insulation is needed.

(10) INSTALL WEATHER STRIPPING - Decreased infiltration will result in a very big savings.

(11) TURN OFF KITCHEN EXHAUST FANS AFTER MEAL TIMES

(12) DUTY CYCLE FANS - While this measure of shutting off fans for about 5 minutes every half hour saves energy a more effective measure some owners are using is fan speed reduction. Of course, if the building has a VAV system, it does the same thing, viz, automatically reduces the fan output.

(13) PROVIDE VARIABLE SPEED PUMPS - Convert constant speed pumps in the chilled and space heating water loops to variable speed operation to match the demand.

(14) TURN OFF REHEAT SYSTEM PUMP DURING DAYTIME

(15) REDUCE TOILET EXHAUST IF HIGHER THAN REGULATORY REQUIREMENTS

(16) CONVERT CONSTANT VOLUME REHEAT SYSTEM TO VARIABLE AIR VOLUME SYSTEM, IF FEASIBLE

(17) STRAINER CYCLE OR ECONOMIZER CYCLE - A strainer cycle is only applicable for systems requiring chilled water such as fan coil and induction systems.

Cooling tower cools condenser water which in turn cools the refrigerant which refrigerant cools the water for air conditioning.

When cooler outside air during Spring/Fall is available, and humidity is below 50%, the condenser water can be cooled enough by the evaporation in the cooling tower to be used as chilled water directly (i.e., by-passing use of refrigerants).

To be used directly, water must be clean or it may foul the air conditioning equipment; thus the strainer cycle. However, keep in mind that even with strainer cycle equipment requires some cleaning.

Another option is to use a heat exchanger to cool the chilled water by direct use of condenser water. The disadvantage is that there is a gradient temperature loss.

One can use outside air directly if air is cool enough. However, with hydronic systems, strainer cycle makes more economic sense because water is cooling media. Exception - in very dry climates such as Arizona.

Assume that the kinds of measures I have just cited have been implemented. You have cut wattage for lighting, reduced quantities of air to be heated or cooled, utilized more efficient equipment, and provided adequate insulation. You are saving energy and are close to the point of removing most of the energy fat that can be removed practically and cost beneficially.

Where do you go from here?

There are other strategies that can be utilized that I find are not yet widely implemented and which can lead to significant additional savings. The opportunity to take advantage of them is at hand.

There are three things that you must do or plan to do, starting in 1982:

(1) Control waste energy in underutilized or unoccupied space, i.e., don't use energy when no one is in a space. Only provide heating, cooling, lighting and ventilation when and to the extent necessary.

(2) Use better tools to assess or diagnose the alternative measures (and their interaction) available to you before reaching a decision.

(3) Use more rational and accurate and simpler building management automated systems.

With respect to the first item, do not use lights when no one is present and less lighting if there is adequate daylighting. Do not cool free space after normal hours, only space utilized. Do not set temperatures as high or as low as customary when no one is in the space.

Provide a small capacity separate chilled water system for a single floor or a partial floor tenant who requires chilled water after normal operating hours --- or small size air conditioning equipment to serve special needs during after hours in lieu of operating many large size handling systems and fan motors which must serve unoccupied floors as well as occupied floors.

I have found that it is not uncommon for lights to be left on in offices, 50% of the time, when no one is there.

This may be remedied by several approaches - individually - or in combination.

You can hire people to walk the building shutting off lights in unoccupied spaces. This can be inefficient.

You can automatically shut all lights off in a space by using time clocks, say at the end of the work day or at lunch, leaving it up to those who did not leave the space to override the off lighting. Or you can install an occupancy detector that shuts lights off automatically when no one is present in a space and turns them on again automatically when the person returns.

You can dim lights in perimeter or other spaces having access to daylighting so that the combination of artificial and natural daylighting meets the need at the work place.

Occupancy controls and dimming controls are in early stages of commercialization. Fuller scale availability and market acceptance is anticipated in 1982/1983. It is not too early to be planning for this. Ancillary benefits are a reduction in cooling energy and longer lasting lamps.

If you have a building that does not have the ability to permit local switching, e.g., only switching by floor or large area, you need to take steps to correct this whether or not you contemplate automatic switching.

With respect to better diagnostic tools, they help set goals realistically. Setting goals is important in any business. Before you can set goals regarding energy conservation you need not only to track consumption patterns and compare them as I talked about at the start. You need to get an estimate or a qualitative feel for what is possible and how alternative conservation measures and strategies differ or interact in various combinations. Put simply, what is the impact of a contemplated measure on energy consumption.

There are many computer programs for doing this. Certainly manual calculations can be used. Both these require relatively high degree of sophsitication and expertise.

What is needed, in my judgment, are simple screening methods which would receive widespread approval and become nationally recognized. I will describe, briefly, a simplified technique recently developed, for doing this. The technique exists in two forms --- a graphic technique utilizing an inter-related series of nomographs; and a computer-based technique using the same equations which are manipulated by a micro computer. These techniques are accepted ASHRAE "First Principles" equations in computing loss and gain from thermal and solar sources, lighting and internal loads, ventilation loads, and plant efficiency. The techniques are designed to make it easy to analyze the effects of such changes as lighting schedules, the use of daylight, the use of high efficiency fluorescent tube and ballasts, the use of different shading devices, and different glazing types, the impact of insulation, and other variables.

In the computer form, one can load in a limited number of building descriptors in about 10 minutes and, in a matter of seconds, observe the effect produced by changing one variable. In half an hour, we have been able to test several dozen alternatives. The cost of using this tool is the cost of a micro computer, a small charge for the software, and the very small amount of time required to operate it. This should be compared with the cost of operating the very heavy computer simulations available now which may cost thousands of dollars to make a single comparison.

The simplified energy extracting technique is designed to increase one's understanding of the problem and to improve management skills. It is not intended to be a tool for final engineering design; rather, it is intended to help an owner better manage his staff or consultants by looking at more alternatives than ordinarily. The techniques are in the final stages of development and are expected to be widely available in early 1982 or before. If there is interest on your part, we will arrange a demonstration near the end of this year.

The operation and dependability of building management automatic systems, according to a recent survey reported in a trade publication, have caused building owners and managers to be unhappy about 50% of the time. In my observation, these systems control energy usage centrally, in most cases, and utilize pneumatic controls. These energy control systems require constant calibration and maintenance. If the sensors read wrong information and send it to a control computer which causes a certain action to be taken, energy conservation can turn into overutilization. I have seen automatic systems shut down and the building operator control manually.

Fortunately, the limitation of the pneumatic systems of the 1970's will be overcome with the advances in microprocessor technology.

It is now possible to control smaller areas, i.e., locally and to create smaller more accurate systems.

The new approach is referred to as Direct Digital Control (DDC). In the soon to be obsolete systems the brains are distributed among remote control units, i.e., locally. Each of these units or controllers can handle a separate or a series of functions, e.g., a separate heating/cooling zone, or a separate fan. Each controller is a closed loop which can control such ordinary functions as temperature setting as well as energy management functions; for example, when to start loads or when to start up.

In the existing systems the remote units communicate with a control unit constantly for analysis and direction of what to do.

Direct Digital Control through electronics is a non-mechanical approach providing a greater degree of reliable precision control than traditional hardware. Electonic controls using pneumatic muscle provide the best combination of reliability, precision, and serviceability.

Keep in mind that as DDC comes on stream, some companies will offer them as add-ons rather than replacements. This likely will not solve the problem. Stand-alone building control - locally, in my judgment - is the way to go. These separate or local units can be tied together if deemed necessary. Stand-alone lets you start slowly.

Perhaps all that is necessary to do the job are a few units (low cost). You can find out as you go, without a major investment. Other features are simplicity of installation, built-in diagnostics to identify and fix problems quickly, and ability of the owner to change the program based upon changing site conditions.

TENANT/OWNER RELATIONSHIP

No discussion on energy conservation would be complete without commenting on the fact that many investment owners say or think - why should I spend money to save energy when the tenant is paying for it? It has been said that passing through energy costs or recapture of increasing energy costs is a major disincentive to energy conservation.

BOMA International has addressed this. I read from a draft of their Office Building Lease Manual that will be distributed in June:

> "Tenant shall pay its pro-rata share of all operating costs of the Building in excess of the operating costs for the calendar year in which the commencement of this Lease occurs. Operating costs include all expenditures which by generally accepted accounting practice are treated as items of expense and not capital items. Landlord may submit statements to Tenant monthly based upon estimates of increases in operating costs for the current calendar year. In such event Tenant shall promptly pay such statements following receipt. Within 90 days after the end of the calendar year Landlord shall submit a statement to Tenant setting forth the actual operating costs for the preceding calendar year and any adjustment for overpayment or underpayment

shall be made between the parties within 30 days thereafter. If for any reason Landlord should elect not to bill Tenant monthly for increases, either actual or estimated, Tenant shall pay all amounts due Landlord when Landlord submits a statement of the amount due. If for any reason, including imposition of governmental requirements, laws or regulations, Landlord shall expend monies directly or indirectly which are intended to reduce the energy consumption of the Building and which, by generally accepted accounting practice are treated as capital expenditures, Tenant shall also pay its pro-rata share of the amortization of such capital expenditures based upon a life acceptable to the appropriate taxing authority. Landlord shall submit a statement to Tenant, not less than annually, itemizing the capital expenditures made, the amortization schedule applied and Tenant's pro-rata share of the annual amortization. Tenant shall promptly pay to Landlord the amount shown on the statement."

Passing on capital expenditure, to save energy, in my judgment, will become more commonplace in time. Obviously there will be variations of this such as sharing of such expenditures. The tenant is becoming increasingly sophisticated and tougher. In a tenant's market, he will be more successful in getting the owner to spend more for energy conservation. Some tenants who pay will start making the investment themselves particularly in the lighting area, and they try to claim the benefit due to reduced demand and cooling loads.

We are now entering a period of regulatory reform, but I predict that if the tenant gets more militant because he thinks he is not getting a fair deal he will fight for regulation, at the landlord's expense, and this will be one of the places where he may get his way.

APPENDIX III

Plan to Implement:

Owner Energy Education Program 1982 - 1983

Building Owners and Managers Association International

The officers of BOMA have authorized the Executive Vice President to present a plan for a BOMA-sponsored program on a nation-wide basis during 1982 - 1983.

The intent is to present the program at BOMA's semi-annual regional meetings in the second half of 1982 and the first half of 1983. The regions are:

Midwest Northern . . . . September, 1982

Pacific Northwest. . . . . September, 1982

Pacific Southwest. . . . . October, 1982

North Central. . . . . October, 1982

Mid Atlantic . . . . February, 1983

Southwest. . . . . March, 1983

Southern . . . . April, 1983

The exact site of each meeting will be established at the annual meeting in the Spring of 1982.

The regional meetings were selected as the appropriate forum because they are:

- well attended;
- organized by region, allowing for desired peer group interaction;
- scaled in size to allow desirable participant interaction;
- budgeted for education program events.

Attendance of regional meetings is estimated to be in the range of 200 at each meeting. Participation at the Owner Energy Education Program will be in response to a program announcement, "Informational opportunity for owners and senior managers." Attendance at each Owner Energy Education Program is anticipated to be in the range of twenty to thirty, providing a workable group size to allow for participant response. The total attendance nationwide is thus expected to be in the range of 150 to 200. Follow-up response is anticipated to continue informally during the remainder of the semi-annual meeting events.

The program content will be developed by BOMA's Operating Methods Committee during the Spring of 1982. It will rely heavily on the program developed by Tishman Research Corporation and BOMA for the DOE-sponsored test program. It will be modified to include updated information. The presentation will be made by an invited guest who is a consulting engineer, energy consultant, or energy manager for a real estate firm. Selection of the speaker will be made in close coordination with the regional organization. The meetings will be staffed in each case by the Executive Vice President of the Association who will begin each meeting with a statement of the continuing importance of energy conservation.

The following steps are planned to implement the programs. The program concept has currently been endorsed by the President of BOMA International:

- The program concept will be presented to the Operating Methods Committee for approval at the Winter business meeting scheduled in Scottsdale, Arizona, for the week of December 5th, 1981.

- The Operating Methods Committee will review and revise the program outline and back-up materials. The program outline will be finalized in June 1982.

- Speakers will be selected in conjunction with the regional conference program managers during the Summer of 1982.

It is not anticipated that the program as outlined above will require any additional budget from BOMA. The budget for travel for the Executive Vice President and for convening the Operating Methods Committee are already included as line items in BOMA's normal budget.

Educational programs are regularly reviewed and measures are taken to repeat successful programs when appropriate. A typical recycle period for education programs is three years.