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ENERGY CONSERVATION

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ENERGY CONSERVATION IN EXISTING OFFICE BUILDINGS

Phase III

August 1978

Work Performed Under Contract No. EY-76-C-02-2799

Syska and Hennessy 950 9641
New York, New York

and

Tishman Research Corporation 951 0061
New York, New York

U. S. DEPARTMENT OF ENERGY

DISCLAIMER

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NOTICE

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I. INTRODUCTION

A significant goal of the study on Energy Conservation in Existing Office Buildings was to determine the constraints and/or the adverse consequences of possible conservation measures and how to overcome any barriers.

Other goals were to develop realistic energy consumption budgets, if it was determined that this was the proper approach; and if not, to propose an alternative approach; and to indicate applicability of recommendations and methodologies for application to other building types and geographical regions of the U.S.

This report, the third in a series, concerns itself with the findings and recommendations with respect to the above.

Also, this report contains a revision of Questionnaire No. 2 (see Phase I report) in the Appendix.

II. BARRIERS AND THEIR REMOVAL OR AMELIORATION

Upon completion of Phases I and II of the study, the findings and recommendations were presented to a broad cross section of real estate executives and managing agents,* and in addition, to a representative cross section of owners (principals) who participated in this study -- not their employees or agents.

This latter group, representing ownership of about 50 million gross sq. ft. of building space in New York City, agreed to provide candid responses to interviews if their identities were kept anonymous.

Owners are the ultimate decision makers -- the executives who hold the purse strings and who have authority to reject or delay acceptance of the recommendations of those who advise them. It is their attitudes, perceptions, and ultimate actions that dictate the pace and nature of energy conservation in existing office buildings. In the final analysis, they hold the key to unlocking any barriers.

The interviews were conducted by Joseph H. Newman of the Tishman Research Corporation, Charles E. Schaffner of Syska & Hennessy, and Ed Potter of the Real Estate Board of New York. In the representative group were investment owner builders and institutional owners, as well as owners of large and small amounts of office space. Most were at the helm of the businesses that owned office buildings for at least two generations, and this was reflected in the wide range of vintage buildings represented by the group. All owners interviewed managed, or closely supervised the management (by others), of their office buildings.

The findings and recommendations that follow spring from these interviews, are a consensus, and include the insights of the Tishman Research organization with 80-year-old roots in office building ownership, management, and construction.

Most owners:

- were not surprised that previously reported findings showed that owners, as a class, had little appreciation or understanding of energy consumption patterns or their significance. In the first phase of the study, it was reported that only 10% of the building owners monitored and compared their energy consumption with that of others.

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* Presentations were made to more than one thousand building owners, managers, tenants, suppliers, financial people, and professionals at meetings with the Board of Governors of the Real Estate Board of New York, the Building Owners' Association of Greater New York, the Building Products Executive Conference, and individuals.

- welcomed the information on energy consumption and the opportunity to compare consumption of their buildings with that of others. Since some owners who previously had not tracked consumption patterns, indicated they planned to start or had just started, it is anticipated that ownership comprehension of energy utilization will increase over the prior low level. One owner, on becoming faimilar with the results of the study, questioned his designer, who was preparing plans for a new office building outside New York City, about the anticipated energy consumption of his new building. When the owner learned that it was higher than the average for existing buildings in New York City, he sent his designer back to the drawing board. This is an example of instant payback and illustrates how much an owner can influence the decision if he understands the importance of saving energy and energy consumption patterns.

- have little faith in advertising claims for energy cutting devices or systems and believe that claims are exaggerated or may not be applicable to their specific building.

- are evaluating recommendations with skepticism resulting in prolonged assessment before satisfying themselves as to their merits....with advice from consultants and others as well as by developing their own in-house expertise.

- are waiting for feedback from those who have already installed retrofit products or systems. Few owners want to be the first. Some owners believe that costs of retrofitting will decrease when production of newer or improved energy saving systems increase. Others are waiting to see the reliability or credibility of energy-saving equipment installations. When some owners learn of a new development or a new generation of an existing product or system, they tend to wait until it is available if they believe that the new or revised item is in the latter phases of development and may be an improvement over the prior generation.

Compensating, in part, for these conservative approaches that slow the pace of introduction of energy conservation measures in buildings (which, in aggregate may be termed the "learning process") is a new owner attitude that is emerging.

Many office building owners have come to realize that it is in their self interest to cut energy use to protect their investment in the future. This longer-term view helps accelerate the learning process and gives rise to a more positive attitude -- even in situations where tenants pay all or part of their energy bills in rent.

The fact that electric energy costs continue to rise and are in the vicinity of 10¢/KWH has had a significant effect on owner attitude. The higher costs make more energy conservation measures attractive on a cost benefit basis and are beginning to influence some tenants and users in their decision making process regarding where to locate.

In querying owners on which incentives appeal most to them, it became apparent that government incentives were not needed to motivate owners whose costs for energy are approaching the 10¢/KWH level to start doing something about conservation, but it was clear that it could have a benefit in helping further hasten the learing process, accelerate their timing in making commitments, or get them to do more than they now have contemplated. Owners consider tax credits, accelerated depreciation, and elimination of tax assessment of retrofitted energy-saving equipment as the most attractive among possible incentives. It is believed that these incentives, if effected, will signal a greater "sense of urgency."

Most owners are not planning to borrow money for energy conservation retrofitting, but instead are budgeting for future energy conservation improvements using existing income. Therefore, loan guarantees or favorable loans are not considered important potential incentives for retrofitting. However, for new construction, most owners would like the lender, they will do business with, to grant them more favorable terms for that portion of the loan relating to energy conservation expenditures. This is an important finding in light of a previously held view that lenders could influence energy conservation favorably when potential borrowers were shopping for financing, by setting energy conservation related requirements prior to, or as a condition of a loan.

There are two possible actions that would irritate most office building owners and diminish the improving climate, if they came to pass; in some cases a cooperative attitude would change to an adverse one. The first is proposed time-of-day rates wherein the local utility seeks to charge a higher rate during peak hours....usually in the heart of the work day. Because office building activities are relatively inelastic, owners indicate that this will not help reduce energy. However, some owners appear interested in low rates at night, if thermal storage was determined to be feasible for existing office buildings. In any event, demand load levels may decrease when base load is reduced by energy conservation measures yet to be implemented. If this happens, time-of-day rates may not be deemed as attractive to its proponents.

The second is possible mandatory requirements for existing office buildings. Most owners feel that their voluntary responses, due to self motivation, should be recognized and that undue government interference or regulation would place an unfair onus on owners who have been instituting conservation measures voluntarily. Owners who have taken positive action don't want to be penalized to a greater degree than those who have not been doing their part. This suggests a strong need to monitor trends in achievement of energy savings in existing office buildings to determine to what extent practical goals are being met, before establishing public policy. This was recommended in the Phase I report.

A leading barrier to achievement of conservation is the owners' lack of understanding of potential benefits. An educated owner is most likely to be a responsive owner. An uncertain owner procrastinates in making decisions.

There are two levels of understanding required. One is being able to measure consumption absolutely and relatively and being able to appreciate the significance thereof; and the other is being able to assess alternative conservation measures the value of each, and the performance of each. When an owner moves up on the learning curve he is in a position to make decisions or to influence them. A basic constraint that this study has identified is the relatively lengthy time it takes an owner to get up to speed so that he feels confident enough to be decisive. It is a relatively easy one to ameliorate -- by a continuing DOE educational and demonstration effort; and by tracking consumption patterns using representative sampling to permit owners to make comparisions as was recommended in the Phase I report and is being recommended in this report in the section entitled "Energy Budget."

Another leading barrier is lack of economic motivation. It appears that the price of energy in New York City has recently approached the level where economic justification or rationale comes more easily to an owner than in the past and this barrier has practically disappeared. In other sections of the country where costs have not yet reached or are not yet getting close to the 10¢/KWH, it may not yet "hurt" the owner. Many New York City owners were not motivated to spend money for conservation when energy costs were at 5 or 6¢/KWH. The resistance to retrofitting in other geographical regions where energy costs are relatively "low" may be similar to that experienced in New York City when energy costs were "low".

Some owners believe that the relatively high vacancy rate for office buildings during the early and mid 70s resulted in many owners not having enough cash flow to justify retrofitting expenditures during this period...or even to think about conservation, and that this delayed the educational process and the achievement of the more positive attitude that has emerged recently.

Postponement of expenditures during low or no-profit years is not uncommon in the real estate community and many owners will not make capital expenditures during bad times even when energy costs are high. Confidence in the future level of business activity is obviously a factor that influences timing of positive actions, too. Thus low levels of economic vitality may be considered a barrier. Achievement of a healthy national economy is clearly not a DOE task, but DOE must recognize its significance.

It should be noted that many owners believe that if energy costs had remained relatively low, say, about 5¢/KWH, when the business climate improved recently, there would not have been as strong an interest, as is now developing, in achieving additional energy savings beyond the 12% achieved during the two years after the 1973 oil embargo. This emphasizes the strong motivational role energy price plays.

III. ENERGY CONSUMPTION BUDGETS

Unlike a new building, where there is considerable flexibility during the design process, each existing office building has many fixed physical and operating characteristic limitations. This makes the potential for reducing energy consumption in each case unique. Also, as conservation programs are implemented, the remaining potential savings may decrease to a point of diminishing returns -- an energy consumption baseline below which it is neither economical or practical to go.

For example, Building 996 (see Phase II Report) showed a consumption, in 1975, of 69,000 BTU/gross sq ft/year. If the indicated retrofit and operational strategies were implemented, there would be a potential savings of 5,200 BTU/gross sq ft/year, i.e., 8% based upon a three year payback. In this case, a reasonable energy budget or goal for an owner would be 63,800 BTU/gross sq ft/year (69,000 minus 5,200).

In another example, Building 650 showed a consumption, in 1975, of 164,000 BTU/gross sq ft/year with a projected energy savings of 36,900 BTU/gross sq ft/year, i.e., 23% based upon a three year payback. In this case, a reasonable energy budget or goal for an owner would be 127,100 BTU/gross sq ft/year (164,000 minus 36,900).

In the first example, both the actual 1975 and the future target consumptions are relatively low -- at levels that might be used to design a new energy prudent building. In the second example, both the 1975 actual and the future target consumption levels are higher than the levels for which a new energy prudent building may be designed. If a level of, say, 85,000 BTU/gross sq ft/year had been set as an office building retrofit target in New York City, Building 650, as a practical matter, could not comply. It could fall short by 42,000 BTU/gross sq ft/year (127,000 minus 85,000). Building 996, in the first example would already be in compliance. Consumption budgets for existing buildings based on a single generalized number for all buildings does not make sense.

What does make sense, is an energy budget or goal unique to each building. There are two elements to consider when establishing such an energy savings budget or goal for existing buildings.

- the potential annual savings peculiar to the specific building;

- the payback for the potential savings for the specific building.

The first item can only be determined by an energy audit survey and use of an analytical method to estimate energy savings for a variety of energy conservation opportunities. In this study, the AXCESS computer program was utilized to estimate savings. The detailed procedure is described in the Phase II report.

There are many methodologies for determining potential savings for a specific building and while it may make sense to eventually standardize an assessment approach, or standardize criteria for assessment, it appears more important now to motivate owners to make an assessment of potential savings by any reasonable methodology. It is not now clear how long it will take to refine methodologies to provide a high level of confidence, determine whether uniformity is desirable, and to obtain adequate data on correlation between computer programs and actual consumption.

Also, owners must be persuaded to track their energy patterns continuously, month-by-month. However, the methodology for tracking energy consumption should be standardized as quickly as possible, as recommended in the Phase I report, because it is relatively simple and not likely to be controversial.

To establish the payback period, in years, it is only necessary to divide the Implementation Cost, as determined by the owner, by the Annual Cost Savings.

Each owner will have different criteria for a reasonable payback period and these may change with time or nature of retrofitted item(s), but owners generally accept, as reasonable, payback periods of three or less years. Also, it is clear from the findings in the Phase II study that payback periods beyond three years are on the asymptote of the savings vs. years of payback curve, i.e, three years is about the point of diminishing returns.

Therefore, it is recommended that DOE urge all owners of office buildings to set their own energy budgets based upon establishing: the potential savings for each building owned; the cost of implementation of such potential savings; and the annual cost savings possible with a payback of three years or less (unless the owner will tolerate a longer payback). Since, in most cases, there will be a variety of retrofit options with payback periods ranging from immediate to more than ten years, the BTU/sq ft/year to be saved should be the sum of all measures that evidence a three year or less payback or a combination of selected measures that will achieve the same results.

Once a goal is set, an owner should not limit himself to use of energy conserving measures upon which the goal was predicated.

New and improved energy conservation measures are being brought to market every month and the owner should be encouraged to use the best possible devices and procedures in any appropriate combination. However, owners should be urged to reassess their goals regularly, with a maximum interval of three years, because more conservation may be achievable as good technological advances are commercialized.

To help foster energy conservation budget setting for existing office buildings, it is recommended that DOE publish, annually, for at least a five year period the budgets set by owners during the prior year for a representative cross section of office buildings. DOE should use a standard format, identify the highlights of methodology, potential measures, actual and normalized consumption, anticipated paybacks. DOE may have to provide anonymity and a modest incentive to owners or their representatives to help obtain the information and provide it in the desired format.

The five year data base will provide a framework for follow-up on extent of energy conservation achievement. Tracking and reporting annually what happens after the budget is set, for at least five years, is also recommended. The recommendation to track consumption patterns using representative sampling (see Phase I report). It will help owners move up more quickly on the learning curve.

DOE should also urge appropriate professional and owner groups to standardize criteria and/or methodology for assessing energy conservation potential in existing buildings and continue to help obtain required information and data towards that end.

IV. APPLICABILITY OF RECOMMENDATIONS AND METHODOLOGIES TO BUILDING TYPES AND GEOGRAPHICAL REGIONS

The methodologies and suggestions for representative sampling, normalization, determining potential energy savings, establishing budgets, uniformity of reporting of data, educational efforts and the like, are applicable to office buildings wherever located in the U.S. and with some modifications may be adopted to other building types. The recommendations made in this report are national in scope. Tailoring their utilization to other building types, where necessary, is urged.

One cannot interpolate or extrapolate the New York City office building consumption data to obtain insights for other cities and regions, because of different climates, likely different building mixes and regional operating practices. Also, New York has taller buildings than most of the country and insulation measures will have a substantially greater effect on low rise buildings than on tall buildings...and it is more practical to insulate low rise structures. However, in the opinion of the investigators, similar correlations or relationships are likely to be found, with respect to energy consumption and certain characteristics, in most other geographical areas as was found in New York City. In particular, it is believed older buildings are likely to use less energy.

An old building in any region of the country has certain characteristics in common with all older buildings. It is likely to have local heating and/or cooling systems, local switching, lower lighting levels, and lower electrical and mechanical capacities, and fewer hours of heating/cooling.

As in New York City, it is believed there is a substantial spread in physical characteristics, operating practices and consumption patterns throughout the U.S. -- the older the community the greater the spread.

Many of the design and technological features utilized in office buildings either originated in New York and were copies, or many New York design firms were engaged to design out-of-town office buildings. Also, there was a great deal of cross fertilization when New York building designs incorporated features originating in other areas. The rich variety of office building design and building vintages suggest that New York is not too dissimilar to the rest of the country with similar climate. Likewise, adoption of new technology, practices, or designs do not usually have regional boundaries although rate of utilization may vary in different regions.

Therefore, while information, using representative sampling should be obtained for the entire country, it is not necessary to wait to utilize the broad based findings and recommendations in this study on a national scale.

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APPENDIX

In the Phase I report, it was indicated that there was a need for a uniform building energy information form to be adopted by the private and public sectors -- and that "upon completion of the remaining phases, a proposed form, based upon the results of the completed study, will be prepared". This has been done. See attached pages.

This revised information form (questionnaire) contains less questions than the original one since it was determined that some of the data sought at the beginning was not really necessary or useful.

The purpose of the information form is to help obtain a description of office buildings in terms of physical and operating characteristics of energy consumption in both qualitative and quantitative format, to permit analyses of interrelationships between these characteristics and energy consumption, and to identify quickly significant potential energy conservation measures. Also, it may be used as a prelude to a formal energy audit, as a tool to make comparative analyses among cities or buildings in a given city, and to assess potential impacts of recommendations and policies being considered.

Building No. ______

I

BUILDING IDENTIFICATION, OWNERSHIP, MANAGEMENT, AND OCCUPANCY

Building Identification

Building Address: ________________________________
No. Street

____
City State ZC

Ownership

Building is owned by (check one):

___ Corporation

___ Partnership

___ Individual

___ Other (describe): ________________________

Name of entity: ________________________

Name of chief executive officer or key principal: ________________________

Address of owning entity: ________________________

Phone number: ________________

Management

Building is managed by (check all applicable):

___ Owner

___ Management entity owned by Owner

___ Independent management entity

___ Tenant

Building No. ______

Name of management entity (indicate "SAME" if building is managed by owner): ______________________________

Name of person in charge of management of building: ______________________________

Address: ______________________________

Phone number: ____________________

Name of building operating engineer: ______________________________

Phone number: ____________________

Occupancy

Date of first occupancy after construction: ______________ (Month / Year)

Building No. _____

II

TYPE OF SPACE

Office Space

Computer space (area where major energy consuming equipment is located; include all adjacent areas served by supplemental air conditioning) and all other office space with special unusually high energy consumption (specify use on back of this sheet):

__________ Gross Square Footage

(Indicate "YES" or "NO" in each space) (1)

Air conditioned:

___ served by building cooling system

___ served by own cooling system

Heated:

___ served by building heating system

___ served by own heating system

Ventilated only: ___

---

(1) Make any explanatory comments on back of this sheet.

Building No. _____

All other office space

_________Gross Square Footage

(Indicate "YES" or "NO" in each space) (1)

Air conditioned:

___ served by building cooling system

___ served by own cooling system

Heated:

___ served by building heating system

___ served by own heating system

Ventilated only: ___

Total office space (sum of above two items)

_________Gross Square Footage

Non-Office Space

Garage:

_________Gross Square Footage

(Indicate "YES" or "NO" in each space) (1)

Air conditioned:

___ served by building cooling system

___ served by own cooling system

Heated:

___ served by building heating system

___ served by own heating system

Ventilated only: ___

---

(1) Make any explanatory comments on back of this sheet.

Building No. _____

All Commercial:

(includes public restaurants, shops, banks, theaters, show-rooms, stores, airline offices, etc.)

__________ Gross Square Footage

(Indicate "YES" or "NO" in each space) (1)

Air Conditioned:

___ served by building cooling system

___ served by own cooling system

Heated:

___ served by building heating system

___ served by own heating system

Ventilated only: ___

All other non-office space

(includes arcades, main lobbies, display space, core area, mechanical equipment areas, etc.)

__________ Gross Square Footage

(Indicate "YES" or "NO" in each space) (1)

Air conditioned:

___ served by building cooling system

___ served by own cooling system

Heated:

___ served by building heating system

___ served by own heating system

Ventilated only: ___

Total non-office space (sum of above three items)

__________ Gross Square Footage

Grand Total (Office and non-office; sum of above five items)

__________ Gross Square Footage

(1) Make any explanatory comments on back of this sheet.

Building No. _____

Current Occupancy (as of date of survey)

	Gross Sq. Ft. (office and non-office)
Total vacant space	_______
Total space occupied	_______
Total	_______

Current Office Tenancy (as of date of survey)

	Combined Gross Sq. Ft. Office Space Above and Below Grade	
Office tenancy only (tenants & subtenants):		
Occupied by Owner		_____
Occupied by tenants (excluding Owner)		
Largest tenant	_____	
All other tenants	_____	
Total occupied by all tenants (excluding Owner)		_____
Total vacant office space (whether or not for lease or occupancy and with no significant use of lights or cooling)		_____
Total		_____

Estimate the typical percentage of gross office space utilized in a typical week in survey year.

	Percentage of space utilized during Hrs. indicated		
		Outside Normal Office Hours:	
	Normal Office Hrs. _____ a.m. to _____ p.m.	Early Evening _____ p.m. to _____ p.m.	Balance of Evening to Start of Normal Office Hrs. _____ p.m. to _____ a.m.
% Gross Office Space:			
Monday to Friday	_____	_____	_____
Saturday	_____	_____	_____
Sunday or Holiday	_____	_____	_____

Number of floors comprising building: _____

Above Grade (including street level, mechanical floors, and penthouse floors: _____

Below Grade: _____

Total Height of building: _______ feet

Above grade: _______ feet

Below grade: _______ feet

Building No. _____

III

ENERGY CONSUMPTION & METERING

Building Energy use Record for Survey Year(s)

Indicate all fuels used and from whom purchased:

Electricity	____	Purchased from:	________________
Gas	____	" "	________________
Steam	____	" "	________________
Oil	____	" "	________________
________	____	" "	________________

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

___YES (Describe): ________________________________

____

___NO

Does Owner or management know how building consumption compares with that of other buildings of about the same age and similar general physical characteristics?

___YES

___NO

If Owner or management makes comparison, how does it compare:

___ Better

___ About equal

___ Worse

Building No. _____

Metering and Billing:

	% of Total Gross Space					
	Electricity		Steam		Gas	
	Office Space	All Other	Office Space	All Other	Office Space	All Other
Direct metering of tenants by Utility (1)	___	___	___	___	___	___
Submetering by Owner (2)	___	___	___	___	___	___
Rent inclusion (2)	___	___	___	___	___	___
Total	100%	100%	100%	100%	100%	100%

(1) Tenant buys energy directly from utility.
(2) Owner provides energy which he buys directly from utility.

Method of Charging	Services Supplied by Owner to Other Buildings: Chilled Water	Steam	Electricity
Submetered (check all applicable)	___	___	___
Other charge method (check all applicable)	___	___	___
(describe): ______________________			
Estimated annual % of total services generated	___%	___%	___%

No services supplied (check if applicable): ___

Estimate percentage of electricity used which is generated on premises, if any, other than for emergency standby: _____%

Building No. _____

Consumption by Fuel Type:

Electrical

Consumption Data

Year______

Month	Date	K W Hr.
January	_____	_______
February	_____	_______
March	_____	_______
April	_____	_______
May	_____	_______
June	_____	_______
July	_____	_______
August	_____	_______
September	_____	_______
October	_____	_______
November	_____	_______
December	_____	_______

Demand Data

Month	Date of Reading	K W Hr.
January	_____	_______
February	_____	_______
March	_____	_______
April	_____	_______
May	_____	_______
June	_____	_______
July	_____	_______
August	_____	_______
September	_____	_______
October	_____	_______
November	_____	_______
December	_____	_______

Building No. _____

Oil

Type of oil: ________________

Year _____	Month	Date	K W Hr.
	January	____	________
	February	____	________
	March	____	________
	April	____	________
	May	____	________
	June	____	________
	July	____	________
	August	____	________
	September	____	________
	October	____	________
	November	____	________
	December	____	________

Steam

Year _____	Month	Date	Pounds
	January	____	________
	February	____	________
	March	____	________
	April	____	________
	May	____	________
	June	____	________
	July	____	________
	August	____	________
	September	____	________
	October	____	________
	November	____	________
	December	____	________

Building No. ____

IV

HEATING, VENTILATION AND AIR CONDITIONING (HVAC) IN OFFICE SPACE

Part I - Perimeter

Units located in perimter space (defined as space 15 feet or less from outside wall). If there are no mechanical, cooling, ventilating or radiation units located in perimeter space, check box: ☐, complete following description and then proceed to Part II - Interior.

If there are no units on outside wall, describe provision made for:

a) Cooling: ____________________

b) Heating: ____________________

c) Taking-in fresh air: ____________________

Perimeter units in building. Estimated percentage of space served by each type unit:

Type of Unit	Heat & Cool	Heat Only
Induction	___	___
Fan coil	___	___
Incremental: air cooled	___	___
water cooled	___	___
Dual duct	___	___
Radiation	___	___
Variable volume	___	___
Variable volume with reheat	___	___
Window	___	___
Through the wall	___	___
Other (specify):____________	___	___
Total	___	___

Note: Sum of combined totals shall equal 100%.

Building No. _____

Perimeter thermal medium at unit (check all applicable):

	Heating	Cooling
Air	___	___
Water	___	___
Steam	___	
Electricity	___	
Refrigerant		___
Other (specify): ____________________	___	___
____________________	___	___
____________________	___	___

Type and basis of controls (check all applicable):

Manual (by valve or switch control): At unit	___
In office space	___
Automatic: In individual room	___
In individual zones	___
In multiple rooms or zones	___
Other (describe): ________________________	___

Number of hours of operation of perimeter units in typical day during heating season:

	Number of Hours			
	Heat*	Heat With Fan Off	None	Total
Monday to Friday	___	___	___	24
Saturday	___	___	___	24
Sunday or Holiday	___	___	___	24

Number of hours of operation of perimeter units in typical day during cooling season:

	Number of Hours			
	Cool	Fan Only	None	Total
Monday to Friday	___	___	___	24
Saturday	___	___	___	24
Sunday or Holiday	___	___	___	24

---

*heating provided by direct radiation or with fan system operating.

Building No. _____

Part II - Interior

Distribution of HVAC located in interior space (more than 15 feet from exterior wall). If no interior distribution, check box [ ], complete following description and then proceed to Part III - Other Information.

If there is no distribution of HVAC in interior space, describe provisions made for:

a) Cooling: ______________________________

b) Heating: ______________________________

c) Taking-in fresh air: ______________________________

Floors with interior air conditioning:

	Number of Floors	
	Cooling Only	Cooling & Heating
a) Central supply air distribution	___	___
b) Self-contained units:		
one unit per floor	___	___
several units per floor	___	___
c) Other (describe): ______________	___	___

Indicate type of air distribution system:

	Estimated % of Interior Area Served
Constant volume	___
Single zone	___
Constant volume with zoned reheat	___
Multizone	___
Dual duct	___
Variable volume	___
Other (Specify): ______________	___
Non-conditioned	___
Total	100%

Building No. _____

Type and basis of controls (check all applicable):

Manual (by valve or switch control): At unit ____

In office space ____

Automatic: In individual room ____

In individual zones ____

In multiple rooms or zones ____

Other (describe): ______________________________

Building No. _____

Part III - Other Information

Return air distribution (check one only):

Duct ___

Ceiling plenum return ___

If there is no cooling tower, check box ☐, complete description below and then proceed to question regarding cooling systems.

Heat dissipation mechanism where there is no cooling tower or air cooled condenser (describe): ______________________________

Type of cooling tower (check one only):

Single central cooling tower ___

Multiple cooling towers ___

Air cooled condenser ___

The number of condenser water pumps operating during the cooling season are (check one only):

Varied as a function of load ___

Not varied as a function of load ___

None ___

Condenser water control:

	YES	NO
Are fans cycled to maintain condenser water temperature?	___	___
Is condenser water temperature reset?	___	___
Is cooling tower provided with winter protection?	___	___
Is condenser water bypass provided at cooling tower?	___	___
Other condenser water temperature control means (describe, if any): ______________________________	___	___

Cooling systems:

	% of Office Gross Sq.Ft.	Installed Tonnage
Central system	___	X X X
Local systems (all)	___	___ tons
No cooling system	___	
Total	100%	

Building No. _____

If no central installation of chilled water, check box ☐ , and then proceed to section regarding Exterior Walls.

Central installation of chilled water:

	No. of Units	Installed Total Tonnage
Type of unit:		
electric reciprocation	_____	_____
electric centrifugal	_____	_____
steam turbine	_____	_____
Other (specify): ____________________	_____	_____
	Total	_____

Water temperature at chiller: ______ °F

Water temperature (check one only):

Constant ___

Rescheduled ___

If tenants have their own condenser water pumps, indicate here: _____

Heating systems: (check all applicable)

Primary heating system:

steam or hot water boiler ___

electric boiler ___

resistance heating ___

direct gas fired ___

district heating ___

Other (specify): ____________________ ___

Design heating load: _________BTU/hr.

EXTERIOR WALLS ABOVE GRADE AND ROOF

Area of vertical and horizontal envelope:

Exposed surface area:	No. of S.F.	% Glass
Walls, exposure A	____	____
" " B	____	____
" " C	____	____
" " D	____	____
" " E (if any)	____	____
" " F (if any)	____	____
Walls - Total surface area	____	
Roof - Total surface area	____	
Total exposed area	____	
Non-exposed surface area (non-visible continuous or demising of vertical envelope)	____	
Total envelope area	____	

Wall orientation and construction:

	Wall Exposure					
	A	B	C	D	E (if	F any)
Orientation, list one of the following: N,NE,E,S,SE,SW,W,NW	____	____	____	____	____	____
Construction (check all applicable):						
double glazing	____	____	____	____	____	____
single glazing	____	____	____	____	____	____
metal curtain wall	____	____	____	____	____	____
masonry	____	____	____	____	____	____
Other (specify):________________	____	____	____	____	____	____
ordinary clear glass	____	____	____	____	____	____
heat absorbing glass	____	____	____	____	____	____
solar reflecting glass	____	____	____	____	____	____

Building No. _____

Shading (check all applicable):

External shading from the sun:

Orientation	No shading	Partial shading	Substantial or complete shading
East	___	___	___
South	___	___	___
West	___	___	___
North	___	___	___

Internal shading:

___ None

___ Venetian blinds

___ Drapes or curtains

___ Shades

___ Other (describe): ____________________

Insulation

Roof: ___ None ___ Present

Exterior walls: ___ None ___ Present

If building exterior envelope is of more than one general type of construction, e.g., lower several floors are masonry and all upper floors are metal curtain wall, describe in sufficient detail to clarify answers in this section.

____

____

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(where necessary, continue comments on back of this sheet)

Building No. _____

VI

LIGHTING IN OFFICE SPACE

Wattage by Type:

Area served by:	Avg.Watts/SF Office Area	All Other	Total
Fluorescent	____	____	____
Incandescent	____	____	____

Area by Type:

Area served by:	% of Total Area Office Area	All Other	Total
Fluorescent	____	____	____
Incandescent	____	____	____

Estimate number of lighting systems (an arrangement of similar lamps and fixtures providing illumination to a significant portion of the office space in the entire building). ____

Lighting switches (check all applicable):

Local area switches:	Manual	Automatic*
Room by room	___	___
Areas up to 1,500 sq. ft.	___	___

*clocks, computer, or sensor control

Avg. gross sq. ft. of office space per local area manual switch (estimate):

____________ sq. ft.

Central switches controlled (check all applicable):

	Manual	Automatic
Via lighting panel on floor	___	___
Via remote switch on floor controlling panel contactor	___	___
Via central building console	___	___

Comments on lighting system describing significant elements of lighting system mix, switching controls, or other characteristics not apparent from foregoing items: ________________________________

____

____

(where necessary, continue comments on back of this sheet)

Building No. _____

Estimate percentage of square footage of office space in which lights are on during typical week for whatever reason and in any amount, excluding safety lighting (estimate to nearest 5%)

Lighting Use:

During Hour Beginning	% of Gross Office Space: Monday to Friday	Saturday	Sunday and/or Holiday
12:00 midnight	___	___	___
1:00 a.m.	___	___	___
2:00 a.m.	___	___	___
3:00 a.m.	___	___	___
4:00 a.m.	___	___	___
5:00 a.m.	___	___	___
6:00 a.m.	___	___	___
7:00 a.m.	___	___	___
8:00 a.m.	___	___	___
9:00 a.m.	___	___	___
10:00 a.m.	___	___	___
11:00 a.m.	___	___	___
12:00 noon	___	___	___
1:00 p.m.	___	___	___
2:00 p.m.	___	___	___
3:00 p.m.	___	___	___
4:00 p.m.	___	___	___
5:00 p.m.	___	___	___
6:00 p.m.	___	___	___
7:00 p.m.	___	___	___
8:00 p.m.	___	___	___
9:00 p.m.	___	___	___
10:00 p.m.	___	___	___
11:00 p.m.	___	___	___

Make an adequate statistical survey to obtain the percentage of the total time lights are left on unnecessarily, i.e., when no one is present. Conduct one survey for rooms and another one for open office area.

Rooms: Percentage of the time lights are on when no one is present ____%

Open Office Area: Percentage of the time lights are on when no one present ____%

Briefly describe survey procedure: ______________________________

____

____

____

____

____

(where necessary, continue comments on back of this sheet)

Building No. _____

VII

TEMPERATURE CONTROL IN OFFICE SPACE

Temperature Control

	% of Total Office Square Footage under Control
Occupant control (perimeter, interior)	____%
Building management control (perimeter, interior)	____
Total	100%

Thermostats controlled by building management are generally set at:

	Degrees Fahrenheit	No. of Hours for which Setting is Maintained
Winter day	___ °F	_____ hrs.
Winter night	___	_____
Summer day	___	_____
Summer night	___	_____

Temperature at which refrigeration or heating plant is typically turned on:

	Degrees Fahrenheit Outdoor*	
	Heating Season	Cooling Season
Perimeter	___ °F	___ °F
Interior	___	___

*Outdoor temperature is measured by (check one):

___ wet bulb

___ dry bulb

Dates of heating and cooling (air conditioning) use for central system serving perimeter only:

	Typical Month and Day	
	Heating	Cooling
System started for continuous use	________	________
System stopped from continuous use	________	________

Mild-weather (i.e., Spring/Fall) means of cooling building interior (check all applicable):

___ outside air

___ cooling equipment

Building No. _____

Enthalpy control of outside air (check one):

___ installed

___ not installed

Air circulated:

_______ Total CFM

_______ Minimum outside air delivered as a percentage of above

---

Outdoor air quantity reductions during temperature extremes (check one):

___ partial

___ complete

Winter humidification:

_____ percentage of space served by humidifiers

_____ no humidification

Building No. _____

VIII

ELEVATORS

	(1) No. of Elevators	(2) Average No. of Floors Travelled by Elevator	(3) (1) times (2)
Elevator statistics:			
Passenger	_____	_____	_____
Freight	_____	_____	_____
Total	_____	avg. _____	_____

Building No. ____

IX

CONSERVATION IN OFFICE SPACE

"Economizer" cycle (defined as automatic utilization of outside air for cooling) (check one):

- ___ none
- ___ not in operation
- ___ in operation when temperature reaches _____ °F

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

Indicate other conservation measures considered significant.

____

____

____

____

____

(where necessary, continue comments of back of this sheet)

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