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REPORT BY THE U.S.

General Accounting Office

~~Title~~

More Use Should Be Made Of Energy-Saving Products In Federal Buildings

Many products are available from commercial sources which, when installed in buildings and facilities, can save significant amounts of energy. While Federal agencies are presently using some of these energy-saving devices, they could expand that use and profit accordingly.

This report identifies factors impeding the use of energy-saving products by Federal agencies and discusses several ways in which the Department of Energy could improve its management of the Federal energy conservation effort.

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EMD-79-11
JANUARY 23, 1979

Report

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

NERGY AND MINERALS
DIVISION

B-178205

The Honorable James T. McIntyre, Jr.
Director, Office of Management
and Budget

Dear Mr. McIntyre:

During the past year, we have issued several reports on the Federal Energy Management Program. These reports covered various aspects of the program including DOD's Energy Conservation Investment Program, energy conservation programs at Government contractors' plants, and an evaluation of the plan that was being developed by the Department of Energy to conserve energy in Federal buildings through retrofit programs. While these reports showed that the Federal Energy Management Program has resulted in considerable energy savings, they also identified many areas in which the program could be improved.

This report continues our evaluation of the many facets of the Federal Energy Management Program. We decided to survey the use of available energy-saving technology because some of our previous work had indicated that these products were not being consistently used throughout the Government. The results of this survey have reinforced our earlier beliefs--namely, that more top management emphasis and central management is needed for the program. This report discusses several areas where we believe the program could be improved through more effective management.

We wish to call to your attention our recommendations on pages 11 and 12. As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Operations not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

This report is also being sent to the Secretary of Energy. We are sending copies to the Secretary of Defense; the Administrators, General Services and Veterans Affairs; the four committees mentioned above; and to the chairmen of energy-related congressional committees.

We shall appreciate being advised of the actions taken on the matters discussed in this report.

Sincerely yours,

J. Dexter Peach
Director

GENERAL ACCOUNTING OFFICE
REPORT TO THE
DIRECTOR, OFFICE OF
MANAGEMENT AND BUDGET

MORE USE SHOULD BE MADE OF ENERGY-SAVING PRODUCTS IN FEDERAL BUILDINGS

D I G E S T

The Federal Government must reduce energy use in its buildings and facilities. If Federal agencies achieve the President's 20-percent energy reduction goal for existing buildings, the Government will annually save the equivalent of over 26 million barrels of oil. Much of the easy energy savings have already been obtained by altering temperatures and removing lights. Additional energy savings will require capital investments and the careful analysis and use of energy-saving products and devices.

GAO identified 10 such devices and analyzed their potential use as retrofit projects in various Federal buildings and facilities. In all cases, the projects had a positive benefit-cost ratio and offered the potential to annually save the equivalent of over 10,000 barrels of oil. While Federal agencies are now using some of these energy-saving devices, they could expand that use and profit accordingly. GAO found several factors which impede the Federal Government's use of energy-saving technology:

--The evaluation, collection, and distribution of information on energy-saving devices is not being coordinated.

--Lack of information delays procurement of available energy-saving products.

--Procurement policies do not ensure that adequate consideration is given to energy conservation in the procurement process.

RECOMMENDATIONS

GAO recommends that the Director, Office of Management and Budget (OMB), have the Administrator of the Office of Federal Procurement Policy issue a new policy statement requiring consideration of energy conservation and efficiency in the procurement process.

GAO also recommends that the Secretary of Energy direct officials responsible for the Federal Energy Management Program to develop policies and procedures that will assist agencies to more effectively use currently available energy-saving products. These policies and procedures should provide for the Department of Energy to:

--Coordinate the evaluation of energy-saving devices among Federal agencies to prevent duplication of effort.

--Collect and distribute information on energy-saving devices to those who are responsible for operating and maintaining Federal buildings; and to Federal procurement officials.

--Establish and coordinate a program of demonstration projects utilizing energy-saving devices in Federal buildings.

AGENCY COMMENTS

The Office of Federal Procurement Policy commented that it is not practical to state energy conservation requirements more precisely in general procurement regulations required to satisfy the diverse needs of defense and civil agencies. The Office's comments implied that more specific regulations should be implemented at the agency level and not in overall policy statements. We believe

that the current policy statement is too vague to ensure that agencies will consider all aspects of energy conservation and efficiency when purchasing equipment. Without specific guidance, agencies will continue to purchase equipment without considering its energy use.

The Department of Energy advised GAO that representatives of OMB and certain Department of Energy management officials have taken the position that the Department of Energy should have no role in "coordinating" or "managing" agency energy conservation efforts. The Department said this position is inconsistent with GAO's perception of the Department's role as strong central managers of Federal energy conservation activities and that until this issue is settled, it could not positively respond to the GAO recommendations. GAO finds this position to be inconsistent with the requirements of law as the Department of Energy Organization Act requires the Department to assume the type of responsibilities envisioned in GAO's recommendations.

Contents

ABBREVIATIONS

DAR	Defense Acquisition Regulation
DOD	Department of Defense
DOE	Department of Energy
EPCA	Energy Policy and Conservation Act
F	Fahrenheit
FEMP	Federal Energy Management Program
FPR	Federal Procurement Regulation
GAO	General Accounting Office
GSA	General Services Administration
kWh	Kilowatt-hour
mBtu	million British thermal units
OFPP	Office of Federal Procurement Policy
OMB	Office of Management and Budget
VA	Veterans Administration

CHAPTER 1

INTRODUCTION

The Federal Government is the Nation's largest energy user, accounting for about 3 percent of U.S. energy consumption. In its 400,000 owned or controlled buildings and facilities, the Government consumed about 745 million mBtus of energy in fiscal year 1977, or the equivalent of 128 million barrels of oil. The Federal Energy Management Program (FEMP) is the Government's response to its own need to manage and control energy use. Twenty major departments and agencies participating in FEMP account for 99.9 percent of all Federal energy use. They have reported energy reductions in buildings and facilities of 2.1 percent since fiscal year 1975.

The Department of Energy (DOE), which is responsible for FEMP, was established through the Department of Energy Organization Act (Public Law 95-91). The act made DOE responsible for the coordinated and effective administration of Federal energy policy and programs. Within DOE, the Assistant Secretary for Conservation and Solar Applications is responsible for seeing that necessary energy conservation programs are carried out, including:

--Developing and implementing conservation programs.

--Conducting technology application programs.

--Conducting energy conservation commercialization activities.

The Federal Programs Office, under the Buildings and Community Systems Division within the Assistant Secretary's Office, is responsible for policy development, overall coordination, promotion, monitoring, and reporting of Federal energy management activities.

In April 1977, the President issued the National Energy Plan containing proposed legislative, administrative, and budgetary initiatives aimed at solving the Nation's energy problem. Conservation was presented as the cornerstone of the plan. Parts of the plan, aimed at reducing Federal energy use, were implemented on July 20, 1977, with the issuance of Executive Order 12003. This order requires DOE to establish procedures for reducing energy use per square foot by 20 percent by 1985 from 1975 energy consumption levels for existing buildings, and by 45 percent for new buildings.

SCOPE OF REVIEW

This report is a continuation of our effort to review and evaluate the various aspects of FEMP. The purpose of our work was to identify commercially available energy-saving products, to determine whether Federal agencies now use them, and to determine how to increase the use of such products. The work was performed at DOE, the Department of Defense (DOD), the General Services Administration (GSA), and the Veterans Administration (VA).

CHAPTER 2

CURRENTLY AVAILABLE TECHNOLOGY CAN SAVE ENERGY IN BUILDINGS AND FACILITIES

The Federal Government must reduce energy use in its buildings and facilities. If all Federal agencies achieve the President's 20-percent energy reduction goal, the Government will save nearly 153 million mBtus of energy annually, which is equivalent to over 26 million barrels of oil. Much of the easy energy savings have already been obtained by altering temperatures and removing lights. Additional savings will require capital investments, and careful analysis and use of energy-saving technology.

AGENCIES ARE NOT MAKING OPTIMUM USE OF ENERGY-SAVING TECHNOLOGY

Many products and devices are available from commercial sources which, when installed in buildings and facilities, can save significant amounts of energy. For example, by installing a heat run-around 1/ at VA's Martinez Hospital, which was using 100 percent outside make-up air, the hospital could save over 23,000 mBtus per year, representing an energy reduction of about 32 percent compared to 1975 energy use. In another case, studies performed by GSA showed that by using condenser tube cleaning brushes and a stack gas economizer at the Virginia Heating Plant, about 9 million kWhs and over 115,000 gallons of fuel oil could be saved annually. This amounts to over 8 percent of the plant's total 1977 energy use for these two fuels. Devices such as these can help ensure that Federal facilities meet the President's energy reduction goals.

To determine their economic feasibility, we selected 10 currently available energy-saving devices and analyzed their potential use at selected Federal facilities in California, Ohio, Washington, and Washington, D.C. While we recognize that these 10 devices do not comprise an all-inclusive list, we believe they are representative of the

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1/The heat run-around is an air-to-air heat exchanger, which removes energy from exhaust air and transfers it to incoming air without danger of contamination.

types of energy-saving technology that are available on the market today. Each device was analyzed as a retrofit project for a building or facility to which it had application. In all cases, the projects had a positive benefit-cost ratio, meaning they would return benefits greater than their cost over the project's expected life. The following schedule shows our analysis of each project.

Analysis of Energy Conservation Demonstration Projects for Selected Federal Buildings and Facilities

Device (note a)	Estimated project cost	Potential annual savings		Benefit/ cost ratio
		Energy mBtus	Dollars	
Heat run-around	$386,554	23,054	$ 81,378	3.49:1
Temperature control valves	3,500	528	1,847	8.75:1
Stack gas economizers	167,600	16,123	40,308	4.78:1
Electric ignitors	90,160	11,520	19,125	3.52:1
Chiller brushes	30,225	610	7,556	3.13:1
Time clocks	420	48	547	16.93:1
High-pressure sodium vapor lights	170,400	4,648	17,162	2.01:1
Chiller water temperature controls	18,000	1,242	4,841	3.49:1
Energy-saving ballasts	33,792	673	6,702	3.29:1
Null thermostat	15,000	1,143	6,000	6.63:1

a/See appendix I for description of devices.

These projects would annually save almost 60,000 mBtus of energy, or the equivalent of over 10,000 barrels of oil, if they were installed at these facilities. There are other benefits that may be realized by the Government from using some of these energy-saving devices. For example, chiller brushes save energy by preventing sediment buildup on the inside of a condenser tube, thus allowing maximum heat transfer on the surface of the tubes. Chiller condenser tubes not equipped with the brushes develop mineral deposits which must be manually removed usually once a year. GSA has estimated that it costs at least $5,000 per unit to manually

clean its newest 5,000-ton chillers at the Virginia Heating Plant using GSA personnel and a specialized contractor to dismantle and reassemble the equipment. Over the 5-year expected life of the brushes, GSA could therefore avoid at least $25,000 in regular maintenance for one large chiller.

While Federal agencies are now using some of these energy-saving devices, they could expand that use and profit accordingly. Our survey disclosed several factors which impede the Federal Government's use of energy-saving products and devices. They include the following:

--The evaluation, collection, and distribution of information on energy-saving products is not being coordinated.

--Lack of information delays procurement of available energy-saving products.

--Procurement policies do not ensure that adequate consideration is given to energy conservation in the procurement process.

The evaluation, collection, and distribution of information on energy-saving products is not being coordinated

Federal personnel responsible for operating and maintaining buildings are often either unaware of commercially available energy-saving products, or are hesitant to use them without reliable information about their energy-saving potential. While some agencies do evaluate energy-saving devices, they usually do not share the results of their tests with other agencies. The information obtained from the evaluations is generally distributed only within the agency performing the evaluation. As a result, devices that have been tested and proven to be effective energy savers are not being installed in many Federal facilities.

Evaluating energy-conserving devices is an important step in getting the Federal Government to use the products. DOD, VA, and GSA officials said manufacturers' claims of energy efficiency are sometimes misleading, and without verification by the Federal Government, cannot always be relied upon. For example, one device advertised by the manufacturer to improve boiler efficiency by 10 to 15 percent was tested by GSA's Region IX. The tests showed

that the device failed to improve boiler efficiency not only by the amount advertised, but to any measurable extent.

No single agency is specifically responsible for overseeing the testing of commercially available products for their energy savings effectiveness. Those agencies such as DOD, DOE, National Bureau of Standards, and GSA which do evaluate energy-saving devices, do so independently of each other and thus, in some cases, duplicate each other's work. For example, in August 1976, GSA evaluated the performance of chiller brushes installed at the Virginia Heating Plant. The test results indicated the brushes performed effectively. Nevertheless, the Air Force in November 1977 tested the same device at Wright Patterson Air Force Base, and similar tests have also been conducted by the Navy. This test duplication is unnecessary and has deterred the widespread purchase and use of energy-saving devices because each agency believes it must evaluate the product before using it.

To avoid duplication of tests, the results of these evaluations should be widely distributed. However, we found little communication of test results between Federal agencies. What communication does exist is usually informal and sporadic. DOE could greatly improve this situation if it cooperated with GSA, DOD, VA, the National Bureau of Standards, and other appropriate agencies, to establish a program of demonstration projects. By selecting several Federal buildings throughout the country, installing energy-saving devices, and carefully documenting and publicizing the energy savings, the Government could demonstrate the effectiveness of these energy conservation measures. This demonstration program could be coordinated by DOE as part of its FEMP activities. Such a demonstration program would not only promote the use of energy-saving devices within the Federal Government but would also encourage the use of such devices in the private sector.

Lack of information delays procurement of available energy-saving products

Federal procurement statutes and regulations encourage the maximum number of potential suppliers of goods and services, and discourage any purchase which restricts competitio or limits the Government to a single source of supply. Unde Goverment procurement regulations, a contract may be awarded on a sole-source basis when it can be documented that the property or services needed can be obtained from only one

person or firm. Although some of the newer energy-saving devices are manufactured by only one company, contracting officers in DOD and GSA have hesitated to purchase these items because of a lack of information to justify the purchase.

Sole-source procurement is generally considered the least desirable purchase method. Before approving such a purchase, the contracting officer must sign a determination and findings document, which justifies the reason for the sole-source procurement, and clearly and convincingly establishes that the contract could not have been awarded by formal advertising.

Determination and findings documents are normally made for each purchase of a sole-source item. According to DOD and GSA officials, this requirement causes delays and sometimes discourages the contracting officer from purchasing the item. We found three instances in GSA's Region IX where, even though an energy conservation project had been approved and funds were available to purchase the energy-saving device for the project, 5 months later a contract still had not been awarded for the item. According to the contracting officer, this delay resulted from gathering data to justify the sole-source purchase of the item. GSA energy conservation officials said the delay was caused by the contracting officer's hesitancy to make the sole-source purchase. DOD officials told us they had experienced similar delays with sole-source procurements.

In commenting on this matter, the Office of Federal Procurement Policy (OFPP) stated that formal advertising and competitive negotiations are the preferred methods of procurement under Federal procurement statutes and that they are continually striving to increase competition. OFPP pointed out that functional specifications which incorporate energy efficiency requirements can be used in conjunction with competitive procurement, and this is preferable to sole-source solicitations. By using functional specifications, the Government would describe the problem to be solved rather than predetermining what specific products will best solve it. A valid functional specification would accurately reflect the needs of the Government while avoiding unduly restrictive requirements which tend to limit competition without satisfying a real need. By using such a specification, the Government would tend to encourage improvements in design, concept, and performance, especially with the rapidly changing technology in the energy area.

We agree that competitive procurement using functional specifications may be preferable to sole-source solicitations. However, in cases where sole-source procurement is still needed and used, DOE could assist agency contracting officers with making the purchase. If, through FEMP, DOE would coordinate the evaluation of energy-saving devices and collect information for the Government as a whole, it would also be in a position to know whether proposed sole-source contracts for particular energy-saving devices are justified. DOE could publish, and update as needed, its findings of the devices' energy-saving potential and whether any identical or similar devices are available in the marketplace. Contracting officers throughout the Government could rely on DOE's information in preparing their determination and findings documents for proposed sole-source contracts. We believe that this type of management effort, though not as good as using functional specifications, could significantly reduce the time it takes agencies to award contracts for energy conservation devices.

Procurement policies do not ensure that adequate consideration is given to energy conservation during the procurement process

The Energy Policy and Conservation Act (EPCA) (Public Law 94-163) requires that mandatory standards be developed with respect to energy conservation and energy efficiency to govern the procurement policies and decisions of the Federal Government. Executive Order 11912 delegated to OFPP the responsibility to provide policy guidance to agencies in accordance with the act. In August 1976, OFPP issued Policy Letter 76-1, which

> "* * * requested agencies to ensure that the principles of energy conservation and efficiency are applied in the procurement of property and services whenever the application of such principles would be meaningful and practicable and consistent with agency programs and operational needs."

The policy letter further states that these principles may be appropriate, along with price and other relevant factors, in the formulation of purchase requests and solicitations and during the evaluation and selection of bids and proposals. After review by OFPP, specific procedural

implementation of this policy was published in DOD's Defense Acquisition Regulation (DAR) 1/ and in GSA's Federal Procurement Regulation (FPR).

While the OFPP policy letter establishes broad guidelines, it does not prescribe the use nor call for the development by procurement agencies of mandatory energy conservation standards, as was intended by the Congress in enacting the EPCA. The statement only requests--but does not require--agencies to consider energy conservation in the procurement of property and services.

DOD's and GSA's implementation of the OFPP policy statement is also vague with respect to how procurement officials are to consider energy conservation in their purchases. The wording used in the two regulations is almost identical to the wording of the OFPP policy statement and does not specifically require consideration of energy conservation in the procurement process.

Since the OFPP policy and the implementing regulations issued by DOD and GSA are vague, a product's energy efficiency has not been consistently considered when making purchases. For example, agencies are purchasing new and replacement equipment without including energy-saving devices in the invitation for bids. Invitations for bids issued by GSA's Region IX over the past 2 years to replace large chiller units, failed to consider energy-saving devices, such as chiller brushes and water temperature controls. Moreover, GSA officials said that consultants designing new buildings do not include such devices in their specifications. To make the equipment more energy efficient after it is installed, the agency would have to program a retrofit project to install these devices.

OFPP advised us that it believes its Policy Letter 76-1 is simple, clear, and understandable and that:

> "It is not practical to state the policy more precisely in general procurement regulations which govern the broad universe of purchased supplies and services required to satisfy the diverse needs of defense and civil agencies."

1/Defense Acquisition Regulation formerly Armed Service Procurement Regulation; change effective Mar. 8, 1978.

OFPP further stated that the efforts required to upgrade the energy efficiency of Federal buildings are generally available through GSA's Public Building Service and other agencies responsible for the design, operation, and maintenance of Federal buildings. OFPP's comments implied that GAO should direct its suggestions on this matter to the agencies responsible for managing buildings and not to OFPP.

In our opinion, the current OFPP policy statement and its implementation in the DAR and the FPR is too vague to ensure that agencies will consider all aspects of energy conservation and efficiency when purchasing equipment. Even though OFPP reviewed the procurement regulations, OFPP did not require DOD and GSA to develop more specific regulations. It seems clear that without specific guidance, agencies will continue to purchase equipment without considering its energy use. DOD officials stated that they would like to have more energy conservation requirements for procurement regulations however, they are limited by the policy guidance issued by OFPP.

Under the mandate of the Office of Federal Procurement Policy Act (41 U.S.C. 401 et seq.), OFPP has the responsibility to "provide overall direction of procurement policy." It also has the authority to "prescribe policies, regulations, procedures, and forms, which shall be in accordance with applicable law and shall be followed by executive agencies" in the procurement of property, services, and in construction contracts. OFPP has itself stated that it has "a clear role as the final arbiter of procurement matters for the Federal agencies."

We believe that OFPP should exercise its authority to require executive agencies to develop mandatory standards for energy conservation and energy efficiency in Federal procurements. Therefore, OFPP should issue a new policy statement requiring agencies to consider energy conservation and efficiency in the procurement process, and it should ensure that DOD and GSA implement this policy. At a minimum, the implementing instructions should require procurement officials to use life-cycle costing procedures to evaluate the feasibility of including energy-saving devices along with original system purchase or replacement.

CHAPTER 3

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Although the Federal Government has reduced energy consumption over the past 3 years, considerably more will have to be done if the President's energy conservation goals are to be achieved. Agencies are using energy-saving technology; however, its use at any specific facility appears to be dependent largely on the knowledge and commitment of those individuals responsible for the facility. No system exists to ensure that available energy-saving devices will be consistently evaluated and used when shown to be effective. It seems clear that there are a number of cost-effective technologies now available that could be used for retrofit projects in Government buildings. We earlier identified a number of them and tested their effectiveness in various Federal facilities. In all cases, they were cost-effective investments. We feel that an expanded version of this type of analytical effort should be a priority undertaking of DOE.

DOE officials responsible for FEMP acknowledged that the problems our survey revealed are impeding the use of energy-saving devices in the Federal Government. They indicated that, in the absence of a clear delineation of their responsibilities in this area, they are unable to address many of these problems. They plan no future actions to correct the problems we identified.

If the Federal Government intends to act as a leader in the energy conservation area, it must eliminate roadblocks to reducing energy consumption in general, and to using energy-saving technology, specifically. It is DOE's responsibility, through FEMP, not only to remove these roadblocks, but also to establish a program which will ensure a coordinated, well-managed Federal energy conservation effort.

RECOMMENDATIONS

We recommend that the Secretary of Energy direct officials responsible for FEMP to develop policies and procedures that will assist agencies to more effectively use currently available energy-saving products. The policies and procedures that are issued should provide for DOE to:

--Coordinate the evaluation of energy-saving devices, such as those discussed in this report, among Federal agencies in order to prevent duplication of effort.

--Collect and distribute information on energy-saving products to those who are responsible for operating and maintaining Federal buildings and to Federal procurement officials. The information distributed should include: (1) data on product evaluation and energy-saving potential, (2) instructions for performing benefit/cost analysis, (3) instructions and examples for using functional specifications and (4) information on sole-source limitations to expedite the preparation of determination and findings documents.

--Establish and coordinate a program of demonstration projects utilizing energy-saving devices in Federal buildings.

We recommend that the Director, Office of Management and Budget (OMB), have the Administrator, Office of Federal Procurement Policy, issue a new policy statement requiring consideration of energy conservation and efficiency in the procurement process. We also recommend that the Administrator, Office of Federal Procurement Policy, and the Secretary of Energy work together to assist DOD and GSA to develop specific policies and procedures, including the use of life-cycle costing procedures, to be incorporated into the DAR and the FPR, which will require procurement officials to consider energy conservation and efficiency when initiating, evaluating, and selecting bids and proposals for goods and services for the Federal Government.

DEPARTMENT OF ENERGY COMMENTS

In commenting on this report, DOE stated that:

"Our responsibility for issuing guidelines for agencies to follow in preparing 10-year plans and annual reports is the current subject of extensive discussions within DOE, with OMB and with other agencies. Representatives of OMB and certain DOE management officials have taken the position that the Federal Programs Office and DOE should have no role in 'coordinating' or 'managing' agency energy conservation efforts. Obviously, this position is inconsistent with

GAO's perception of our role as strong central managers of Federal energy conservation activities. Until this issue is settled, we cannot positively respond to the GAO recommendations."

We are concerned with the comments made by DOE on our suggestions for improving the Federal Government's energy conservation program. Presidential Memoranda, Executive Orders, and Public Laws dealing with energy envision and authorize a strong, structured energy conservation program within the Federal sector. As stated in Section 102 (2) of the Department of Energy Organization Act (Public Law 95-91), DOE was established, in part:

"* * * to achieve, through the Department, effective management of energy functions of the Federal Government, including consultation with the heads of other Federal departments and agencies in order to encourage them to establish and observe policies consistent with a coordinated energy policy, and to promote maximum possible energy conservation measures in connection with the activities within their respective jurisdictions; * * *"

Dispersed energy conservation efforts present the potential for duplication and, in some cases, conflict. To minimize these problems, we believe that DOE should effectively serve as the lead agency for energy conservation throughout the Federal Government, and should make this point known to other agencies and departments.

BRIEF DISCRIPTION OF THE ENERGY-SAVING DEVICES DISCUSSED IN THIS REPORT

NULL THERMOSTAT

Maintaining the highest comfortable building temperatures during the cooling cycle and the lowest comfortable temperatures during the heating cycle will save considerable energy. The Federal Government requires that thermostats be set no higher than 68 degrees Fahrenheit (F) during the heating season and no lower than 78 degrees F during the cooling season. With some existing thermostats, no allowance is made for moment-to-moment changes from heating to cooling modes or cooling to heating modes. Thus, on a warm winter afternoon, the chillers might be operating to cool the building to 68 degrees F, the winter heating level. A null thermostat allows temperatures to float between preset points. This precludes resetting thermostats for each season and ensures that cooling units will not operate when winter conditions are below 78 degrees F. Such a system is available for use in residential and small to moderate size office buildings.

TEMPERATURE CONTROL VALVES FOR RADIATORS

Conventional radiator control valves work manually. They have only two positions, "on" and "off". A control valve is available which allows between 5 and 80 percent of the steam load to flow through the radiator by automatically adjusting steam supply according to heat demand. It can save nearly half the energy used with conventional radiator valves.

PACKAGED STACK GAS ECONOMIZERS

A packaged stack gas economizer is a heat exchanger which transfers heat from the flue gas leaving a boiler to the feedwater entering the boiler. The feedwater flows through tubes located in the exhaust stack, preheating the water before it enters the boiler. The boiler burns less fuel because the amount of heat needed to produce steam will be less. These packaged units are available for boilers ranging in size from 10,000 to 20,000 pounds an hour.

ELECTRIC IGNITORS

Electric ignitors are used in place of gas-burning pilot lights in home furnaces. With these ignitors, the pilot light operates only when the furnace is on, thus saving the

energy required to keep a pilot light lit. Savings of from 7 to 10 percent in home gas consumption can be achieved with the ignitor.

ON LOAD CLEANING SYSTEM FOR CONDENSER TUBES

Deposits of any type on heat transfer surfaces retard heat transfer. Whenever a deposit interferes with heat transfer, there must be a corresponding increase in energy to overcome the thermal resistance. One system for keeping air conditioning condenser tubes free of deposits is the on-load brush cleaning system (chiller brushes). The system consists of small nylon brushes which are flushed through each condenser tube several times a day.

TIME CLOCKS FOR CONVENIENCE EQUIPMENT

Convenience equipment such as cigarette, coffee, and candy machines; food machines; and drinking fountains with chilled water, often use energy even when a building is not occupied. This equipment can be turned on and off automatically by using time clocks, saving energy when not in use.

HEAT RUN-AROUND FOR HOSPITALS

Many hospitals exhaust 100 percent of their conditioned air in order to protect against infection. Each time the facility undergoes a complete air change, ambient air must be either heated or cooled to the desired temperature. Heat exchangers can reduce energy use in this situation by extracting energy from the exhaust air stream and transferring it to incoming air without danger of contamination. As a result, chillers and boilers will not have to use as much energy to heat and cool incoming air.

MORE EFFICIENT EXTERIOR LIGHT SOURCES

In many facilities, exterior lighting uses a significant amount of energy. Some installations still use inefficient incandescent bulbs. Much more efficient light sources are available, such as high-pressure sodium vapor, which gets 10 times as many lumens per watt as incandescent and over twice as many lumens per watt as mercury vapor.

CHILLER WATER TEMPERATURE CONTROL

Current chillers are programed to operate and control air conditioning systems by chilling water at a constant temperature to meet the needs of the hottest day of the year. Chiller water temperature controls automatically reprogram chillers to supply the correct water temperature to meet the building's air conditioning needs on a moment-to-moment basis. For every degree warmer the water is maintained, the chiller uses about 3 percent less energy.

MORE EFFICIENT INTERIOR LIGHTING

During recent years, the Government has undertaken a major effort to reduce lighting levels in Federal buildings by removing fluorescent tubes from fixtures in office space, hallways, and storage areas. Recent developments in interior lighting provide additional energy savings. For example, some fluorescent lighting tubes claim 30 to 50 percent reductions in electrical consumption. Similarly, energy-saving ballasts for fluorescent fixtures can save significant energy in office fixtures.

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