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Report to the Congress; by Robert F. Keller, Acting Comptroller General.

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It has been estimated that from 4% to 7% of energy consumed in the United States is in support of Government's purchases of goods and services. Energy conservation programs were reviewed at 20 Government contractors' plants to evaluate their effectiveness and to assess efforts of Federal agencies in helping to establish viable programs. Findings/Conclusions: All contractors reviewed were taking some conservation measures, but few had viable energy management programs. Most companies were reluctant to invest in adequate staff or equipment that did not recover costs in a short time. Federal agencies did not supply adequate leadership as evidenced by the following: (1) energy conservation information was not effectively disseminated to contractors; (2) lighting level guidelines were not generally used or interpreted consistently; and (3) improvements were needed in the Department of Defense's energy management program. Although there was agreement on the need for further conservation, several contractors disagreed on amounts of energy that could be conserved. The National Energy Plan proposal to give tax credit to industry for investing in conservation measures is desirable. The new Department of Energy should help bring together fragmented programs. Recommendations: The Director, Office of Management and Budget, and the Secretary of Energy should jointly develop a procurement policy that requires contractors to establish viable energy management programs. Other measures for improving programs should include: establishing reasonable goals, monitoring contractors' efforts, and reporting to Congress; use of Government contracting personnel to disseminate information; developing easily understood lighting guidelines; planning for coordinated efforts by Department of Defense elements; expanding the scope of Defense Contract Audit Agency energy audits; and advising

contractors of funding under the Energy Conservation Investment Program. (HTW)

REPORT TO THE CONGRESS

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

Federal Agencies Can Do More To Promote Energy Conservation By Government Contractors

Although the Federal Government has been promoting energy conservation since late 1973 and several agencies have programs that deal with industrial energy conservation, these programs and actions have had little effect at Government contractors' plants.

All contractors had taken some conservation actions at the facilities reviewed. Very few, however, had viable energy management programs.

Contractors can do more to save energy. The potential for achieving additional reductions in energy use is more than 20 percent in some plants.

Because of possibly high energy savings, the Government must work effectively as a unit to foster and promote energy conservation.

EMD-77-62

SEPTEMBER 30, 1977

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-178205

To the President of the Senate and the
Speaker of the House of Representatives

In view of the importance of conservation as an element of a national energy policy, and as a followup to earlier work we performed, we reviewed the energy conservation programs at 20 Government contractors' plants. Our review evaluated the effectiveness of the contractors' programs and assessed the efforts of Federal agencies in assisting contractors to establish viable conservation programs.

Although the Federal Government has been promoting energy conservation since late 1973 and several agencies have programs that deal with industrial energy conservation, these programs and actions have had little effect at contractors' plants. Through its procurement policies, the Government has an opportunity to promote energy conservation actions by contractors. In view of the large energy savings that could be realized, we believe the Government must assume a more effective and coordinated leadership role to foster and promote energy conservation.

We made our review pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67). Contractors' records were examined by our authority as set forth in 10 U.S.C. 2313(b).

Copies of this report are being sent to the Director, Office of Management and Budget; the Secretaries of Energy, Defense, and Commerce; the Administrators of the Federal Energy Administration, the Office of Federal Procurement Policy, and the General Services Administration; and the chairmen of energy-related congressional committees.

R. F. Keller

Acting Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

FEDERAL AGENCIES CAN DO MORE TO PROMOTE ENERGY CONSERVATION BY GOVERNMENT CONTRACTORS

D I G E S T

This report provides Federal agencies and the Congress with information on the effectiveness of agency efforts to promote voluntary energy conservation by Government contractors. These efforts have not been very effective. While contractors have taken specific energy conservation actions, further energy savings are possible if all contractors set up viable energy management programs in their plants.

At 20 Government contractors' plants:

--All contractors were taking some conservation measures. However, reductions in energy consumption only partly resulted from conservation; much of the decreases stemmed from economic factors. By operating more efficiently and using more efficient equipment and technologies, contractors can reduce their energy consumption--perhaps by over 20 percent in some plants. (See ch. 2.)

--Few contractors have viable energy management programs. While most contractors have issued energy policy statements and formed conservation committees, few have followed up with adequate program staffing and funding. (See ch. 3.)

--Several factors have impeded the development of energy management programs. Internally, program costs seem to be the major inhibiting factor. For example, many companies did not assign full-time staff to their programs and were reluctant to invest in energy-saving equipment that did not recover its cost in a relatively short time. The most important external impediment appears to be a lack of strong Federal leadership. (See chs. 3 and 4.)

What are Federal agencies doing to help contractors establish viable energy management programs? Not enough.

--Energy conservation publications and material were not effectively sent to contractors. (See p. 23.)

--Lighting level guidelines and standards, established by several Federal agencies and technical societies, are not generally accepted and used by contractors. The guidelines are interpreted and applied differently. (See p. 24.)

--Improvements are needed in the Department of Defense's energy management program. (See p. 27.)

The contractors reviewed and the Federal Energy Administration, Office of Management and Budget, Department of Commerce, Department of Defense, and General Services Administration agreed that further conservation is necessary. Several contractors disagree on how much more energy could be conserved. Some feel that financial incentives such as accelerated depreciation and investment tax credits are needed to help them do more to conserve energy.

The Office of Management and Budget, Department of Commerce, and Department of Defense agreed with GAO's recommendations, except for developing a procurement policy that would require Government contractors to establish viable energy management programs. The Federal Energy Administration and General Services Administration are willing to work with the other three agencies to develop a procurement policy.

Recently, the administration and the Congress acted to more effectively deal with the Nation's energy problem. On April 29, 1977, the President's proposed National Energy Plan was issued and legislation creating the Department of Energy was signed August 4, 1977.

The National Energy Plan proposes tax credits for industry and business when they invest in energy-saving equipment and conservation measures. GAO supports these proposals.

The new Department of Energy was given the authority and programs necessary to foster, encourage, and require energy conservation. This should help bring together the Government's fragmented energy policies and programs.

These actions are a positive response to the issues raised by the contractors and agencies in their comments and could alleviate or remove barriers that have prevented contractors from developing viable energy management programs. However, these actions, by themselves, may not be enough. The Government should develop a procurement policy that requires contractors to establish energy management programs that adequately incorporate the following five elements.

--Commitment by top management.

--Development of comprehensive energy-use surveys.

--Goal setting based on survey evaluations.

--Employee motivation campaigns.

--Monitoring programs and their results.

A means should be established for the Government to monitor and evaluate the overall effectiveness of the contractors' energy management programs, including the actions that are taken in response to any new tax incentives.

RECOMMENDATIONS

GAO recommends that:

--The Director, Office of Management and Budget, and the Secretary of Energy jointly develop an energy conservation-related

procurement policy that requires Government contractors to establish viable energy management programs that include the five program elements listed above.

--The Secretary of Energy establish reasonable energy conservation targets and goals for major Government contractors, monitor the contractors' efforts toward achieving these goals, and report to the Congress within 24 months on the progress being made and with recommendations as to whether any new financial incentives that are provided by the Congress for energy conservation are sufficient, or whether mandatory standards are necessary.

--The Secretary of Energy and the Secretary of Commerce use Government contracting personnel in the Department of Defense, the General Services Administration, and other agencies to disseminate energy conservation publications and materials to contractors.

--The Secretary of Energy review the various lighting guidelines and standards that are currently in existence and develop national lighting guidelines and standards that can be easily understood and consistently applied in commercial, public, and industrial buildings.

--The Secretary of Defense:

Develop a formal plan for a coordinated and uniform effort to be exerted by all Department of Defense elements to promote energy conservation by its contractors.

Expand the scope of the Defense Contract Audit Agency energy audits and use technical assistance in these audits for evaluating contractors' energy management programs.

Use the Agency's energy audits to monitor contractors' efforts to establish and maintain viable energy management programs.

Advise all contractors operating Government-owned plants, and the military services responsible for administering such plants, that projects can be submitted for funding under the Energy Conservation Investment Program.

MATTERS FOR CONSIDERATION BY THE CONGRESS

A National Energy Plan containing financial incentives for industry to conserve energy is expected to be enacted. GAO supports investment tax credits as one incentive. The Federal agencies and contractors responding to this report believe that these incentives will be an inducement for contractors, and all industry, to conserve more energy.

Because the Congress must ultimately decide whether voluntary or mandatory energy conservation programs are needed in industry, GAO believes the Congress should maintain close oversight of this area. The Congress could include, in any new legislation, a requirement that the Secretary of Energy monitor and report on industry's efforts in response to any new financial incentives that are provided for energy conservation.

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ABBREVIATIONS

ANSI	American National Standards Institute
DCAA	Defense Contract Audit Agency
DOD	Department of Defense
ECIP	Energy Conservation Investment Program
ERDA	Energy Research and Development Administration
FEA	Federal Energy Administration
FMC	Federal Management Circular
GAO	General Accounting Office
GSA	General Services Administration
GOCO	Government-owned, contractor-operated
HVAC	heating, ventilating and air-conditioning
IES	Illuminating Engineering Society
OFPP	Office of Federal Procurement Policy
OMB	Office of Management and Budget
PBS	Public Building Service

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CHAPTER 1

INTRODUCTION

In 1958, for the first time, the United States consumed more energy than it produced. Since then the gap between domestic energy supply and demand has widened. Demand peaked in 1973 and actually declined somewhat in 1974 and 1975 apparently because of reduced economic activity, higher fuel prices, and conservation measures. In 1976, however, energy demand resumed its upward trend while domestic production continued to fall.

The gap between supply and demand has been largely filled by oil imports. In 1975 petroleum products provided about 46 percent of the Nation's total energy, and 37 percent of these petroleum products were imported. The dependence on foreign oil rose to about 42 percent in 1976 and is expected to climb to about 46 percent in 1977. The cost of oil imports has grown from $3 billion in 1970 to about $27 billion in 1975 and is projected to reach $32 billion in 1977.

THE NEED FOR ENERGY CONSERVATION

The Nation's increasing reliance on imported oil leaves it vulnerable to supply disruptions which could adversely affect the national economy. But this reliance could be lessened by reducing energy demand. Depending on policy actions taken to change consumption patterns, demand can substantially vary. In April 1977 the President issued the National Energy Plan, which combines legislative, administrative, and budgetary proposals aimed at solving the Nation's energy problem. The plan calls for measures ranging from both mandatory and voluntary conservation actions to expanded research on nonconventional energy sources. The administration estimates that if the plan is fully implemented, energy demand growth during the next 10 years can be reduced from the historical rate of 3.5 percent to 2.2 percent annually. The plan also proposes a goal of reducing the growth rate to below 2 percent a year by 1985 through additional voluntary conservation measures.

In simple terms, energy conservation means using less energy and using it more efficiently. Several Federal agencies, including the Energy Research and Development Administration (ERDA) and the Federal Energy Administration (FEA),[1]

[1]Although FEA is discussed throughout this report, our recommendations in chapters 4 and 5 are addressed to the newly established Department of Energy to which the functions of FEA have been assigned. See p. 40 for information on the responsibilities of the Department of Energy.

have found that conservation provides a potentially cheaper alternative for developing additional sources of supply. They have shown that it often costs less to save a barrel of oil than to develop a new one.

ENERGY USE BY THE FEDERAL GOVERNMENT

The Federal Government is the Nation's largest single purchaser of energy, directly consuming almost 3 percent of the energy used in the United States. Although this percentage seems small, it represents the equivalent of about 300 million barrels of oil, costing about $3 billion a year. In addition, the Government uses much energy indirectly through its purchasing and other activities. It relies heavily on private industry to provide goods and services needed to support and carry out its missions.

The total amount of energy used by the thousands of private contractors that do business with the Government is not known. However, available information indicates that from 4 to 7 percent of the energy consumed in the United States is in support of the Government's purchases of goods and services. Thus, the total amount of energy used by the Government comprises 7 to 10 percent of national consumption. It is clear that the Government has a large potential for saving energy and providing leadership in the development and implementation of an aggressive national energy conservation effort.

GAO REVIEWS OF CONTRACTORS' ENERGY CONSERVATION PROGRAMS

In October 1974 we issued a report on the results of a survey of five Government contractors' energy conservation programs.[1] In the report we pointed out that although some actions had been taken to conserve energy, further commitment by both the contractors and Federal agencies was needed to assure viable conservation programs. In view of the importance of conservation as an element of a national energy policy, and as a followup to our earlier work, we reviewed the energy conservation programs of an additional 20 contractors. Our review evaluated the effectiveness of the contractors' programs and assessed the efforts of Federal agencies in assisting contractors to establish viable conservation programs.

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[1]Letter report to the Secretary of Defense and the Administrators of the Federal Energy Administration and General Services Administration. B-178205, October 29, 1974.

The contractors included in our review were selected for broad geographical coverage and importance in terms of business volume and energy use. Their total sales in 1975 exceeded $3.68 billion. Their energy costs totaled more than $45 million, ranging from about $319,000 to over $11 million per year. The energy used by these contractors represented the equivalent of 4.6 million barrels of oil. A list of the contractors and their associated energy use, by type, is shown in appendix I.

ENERGY USE IN CONTRACTORS' PLANTS

Industrial companies use energy for manufacturing operations, transportation, heating, cooling, and lighting. Electricity was the major type of energy used by most of the contractors we visited. In 15 of the 20 locations, electricity acccunted for over 50 percent of total energy consumption. Heating fuel was also a large energy source in many of the locations. It is often converted to steam or hot water, which is piped throughout the facility for space heating and for various manufacturing functions.

Energy use varies with facility design and operational characteristics (such as single and multiple shifts), energy intensity of production activities, and climatic conditions. At many locations it was not possible to trace the patterns of energy use because consumption was generally not submetered to major pieces of equipment or functional operations within a plant. For five locations where we were able to develop approximate energy-use profiles, the dominant energy users were more often lighting and heating, ventilating, and air-conditioning (HVAC) rather than manufacturing operations. The estimated distribution of energy consumption for five companies is shown in the following table.

Distribution of Total Annual Energy Use

Contractor	Lighting	HVAC	Manufacturing and other
	(percent)		
A	15	44	41
B	19	54	27
C	17	32	51
D	50	35	15
E	29	44	27

Voluntary reductions in annual energy consumption, as well as potential conservation actions advocated by FEA, the General Services Administration (GSA), and the Department of Commerce, heavily emphasize curtailments in and more efficient use of lighting and HVAC operations. As shown above, these activities account for a major portion of annual energy use, and waste in these areas is often easily identified.

CHAPTER 2

ACTIONS HAVE BEEN TAKEN TO CONSERVE ENERGY BUT THE POTENTIAL FOR FURTHER CONSERVATION IS HIGH

All contractors had taken some conservation measures at the facilities included in our review. However, the reductions in energy use experienced by many contractors only partially stemmed from these efforts. A substantial portion was attributable to economic factors. Our statistical analysis indicated that while some conservation actions may have been stimulated by increases in the cost of energy, changes in consumption are more closely linked to changes in employment levels and plant areas. Thus, much of the decrease in energy use experienced by the contractors could be temporary and may disappear as the national economic climate improves.

The potential for additional energy reductions in individual plants is high. In our opinion, 1975 consumption levels could be cut more than 20 percent. Few of the contractors had implemented all the easily identified and generally recommended energy conservation measures which require no expenditure of capital funds. Much more could be done in this area. In addition, relatively few energy conservation projects requiring capital spending had been implemented. By replacing existing equipment with new technologically advanced energy-efficient equipment, energy use could be further reduced by a significant amount.

MUCH OF THE REDUCTIONS IN ENERGY CONSUMPTION CAN BE ATTRIBUTED TO ECONOMIC FACTORS

We obtained data from the 20 contractors on employment levels, plant areas, manufacturing activities, and types and cost of energy used. The basic data indicated to us that changing levels of business activity, as reflected in changes in employment and plant utilization, may have influenced the energy consumption patterns of the contractors.

Using statistical analysis, we assessed the impact that employment, plant area, energy unit prices, heating degree days, and the contractors' voluntary energy conservation efforts had on their energy use. The analysis included 18 of the 20 contractors for the years 1972 through 1975. Two contractors were excluded from the analysis; one because it operated in an energy intensive field and the other due to insufficient data.

Employment, plant area, and energy unit prices were statistically significant factors in the overall use of energy by these companies. Our analysis showed that employment was the most important element in electricity consumption, accounting for almost 67 percent of the variation in electrical energy use. Plant area was the most important factor in explaining heating fuel consumption. It accounted for roughly 74 percent of the variation in the fuel used for heating. The summary results of the statistical analysis are included in appendix II.

While it was difficult to separate the effects of voluntary efforts from those of increasing energy costs, we believe that higher prices may have had more of an impact in conserving energy. From 1972 through 1975, energy costs increased significantly. For example, average electricity prices for 12 contractors rose 88 percent, and average heating fuel prices went up 130 percent.

The results of our analysis were in general agreement with data released by the Department of the Interior on April 5, 1976, which showed that total energy use in the United States declined by 2.5 percent in 1975. Interior reported that several factors, including higher fuel prices, energy conservation efforts, and reduced economic activity contributed to this drop. Reduced economic activity was indicated as the strongest force in restraining energy use.

A THREE-PHASE APPROACH FOR CONSERVING ENERGY

Energy conservation activities can be grouped into three phases. Phase I includes what are generally known as common sense type measures, such as turning off lights and equipment when not needed, reducing light levels, and utilizing more efficient light sources. Such efforts require relatively little capital investment and prior analysis. Phase II involves those projects requiring more extensive engineering studies and capital outlays with the potential of early cost recovery. Examples include air-conditioning economizing systems and automated facility central control systems. Phase III projects refer to major renovations which may require extensive economic feasibility studies, major capital outlays, and cost recovery periods of over 10 years. Such projects might involve installation of heat recovery systems, double glazing of windows, and insulation of building walls and roofs to reduce HVAC loads.

The identified potential for further reductions in energy use for six contractors is shown in the following table.

Estimated Potential for Further Reductions in Energy Use for Selected Contractors

Contractor	Identified potential by phase (therms)			Potential reductions relative to 1975 (percent)
	I	II	III	
A	1,219,425	3,041,232	720,000	19
B	1,596,910	891,867	-	15
C	1,118,277	167,420	-	17
D	877,270	365,530	-	17
E	322,804	190,400	251,204	20
F	2,031,711	612,360	3,127,680	23

These estimates of potential energy-use reductions were identified through partial energy-use surveys either by the contractors or by our staff members in the plants, or a combination of both, and were agreed to by the contractors. These potential reductions relate to specific identified actions that could be taken and do not represent the total potential for energy conservation that might be identified through comprehensive energy-use surveys. Although we recognize that the potential in individual plants depends on many factors, including the past efforts that have been made to reduce energy use, we believe that this potential exceeds 20 percent in many plants.

The fact that a contractor listed in the table has a large potential for future conservation does not necessarily imply that little effort has been made to save energy. In some cases, the fact that the potential can be stated indicates that the contractor has tried to identify new cost-effective conservation projects.

MORE EMPHASIS NEEDS TO BE GIVEN TO ELIMINATING WASTE IN EASILY RECOGNIZED AREAS

All of the contractors had implemented conservation measures involving such obvious Phase I type actions as turning lights and ventilation fans off in unoccupied building areas at night, on weekends, and holidays and changing thermostat levels to around 78° F in the summer and 68° F in the winter. Nevertheless, we found that much more can be done in many of these areas.

Several of the suggested Phase I conservation measures are listed below together with the number of contractor locations at which the measures were implemented and the number of locations where more could be done. To provide some idea of the relative energy savings resulting from each of the measures, the estimated savings of one of the largest contractors are shown.

Frequently Implemented Phase I Type Conservation Measures

Conservation measures	Number of locations		Estimated annual energy savings for one contractor
	Measures implemented	Could do more	(millions)
Turn off lights when not needed	19	17	20.2 kwh
Change from uniform to task lighting and lower light levels	15	15	24.9 kwh
Utilize economizer light bulbs	12	11	6.1 kwh
Change thermostat settings to 78° F in summer; 68° F in winter	15	5	9.2 kwh and 0.4 therms
Turn off ventilation fans when buildings are largely unoccupied	12	9	35.0 kwh and 1.8 therms
Turn off boilers used for comfort heating when not needed	6	5	2.4 therms

A reduction of 1 million kwh is equivalent to saving 1,724 barrels of oil. Thus, the total energy saved by the contractor, for which the estimated annual energy savings are shown above, comes to approximately 248,000 barrels of oil. Obviously, the potential for reducing energy consumption through such easily implemented, low-cost Phase I conservation measures is great. The following are some specific examples of what can be accomplished.

Reducing lighting associated energy use

Lighting is a major consumer of electrical energy in buildings. Much of the energy used to light buildings is wasted through poor design practices and maintaining excessively high light levels. There are various actions that can be taken to reduce substantially the energy consumed by the lighting system, while still providing building occupants with the quality and quantity of illumination required to perform their various tasks and functions.

At one location, we found that the contractor had cut his energy use by about 19 percent. Despite the contractor's apparently successful efforts, we identified additional potential energy savings in lighting of about 19 percent, or 12.3 million kwh, as shown below.

Opportunity	Annual energy savings	Estimated Cost to implement	Estimated Annual savings
	(million kwh)		
Use of economizer fluorescent lights	2.6	$10,422	$ 64,100
Reduce light levels	6.8	-	170,700
Install switches to turn off office lights when not in use	2.9	70,000	72,500
Total	12.3	$80,422	$307,300

Many areas at this particular location were designed with high uniform light levels averaging 110 footcandles in office areas and 150 footcandles in assembly areas. The light levels had been lowered in some areas (primarily hallways) but generally, the levels in work areas had not been reduced. Based on selected light level readings, the plant manager agreed that the lighting in office, assembly, and warehouse areas could be cut anywhere from 35 to 45 percent with a savings of 6.8 million kwh a year or about $170,000.

We also suggested the use of more economical fluorescent lights as a way to conserve energy. The plant manager determined that the first year savings were greater than the additional cost of the new lights and, therefore, decided to use them.

Turing off ventilation fans

Ventilation and climate control operations can significantly affect a building's total energy consumption. It is common practice to ventilate areas such as offices and conference rooms 24 hours a day, rather than just when they are in use. Conservation guidelines issued by several governmental agencies and industry associations point out that energy use could be reduced considerably if such areas were only ventilated when they are occupied.

Twelve of the facilities we visited were trying to conserve energy by turning off ventilation fans. However, we found many opportunities for greater savings. For example, at one location, 125 fans were in operation. At the time of our review, 12 operated constantly to control the humidity for certain production needs while the remaining 113 were for employee comfort and, therefore, could be turned off after working hours. But only 1 of the 113 fans was shut down during nonworking hours.

A central plant security monitoring system is planned within the next 2 years which will be designed to cycle the ventilation fans. We observed that until the central control system is installed, the 112 fans could be switched off manually during nonduty hours. The plant manager agreed that the fans could be turned off at night and on in the morning. The estimated annual savings would be more than 2.7 million kwh or the equivalent of about 4,700 barrels of oil. The annual dollar savings would amount to about $82,000.

CAPITAL INVESTMENTS WILL BE NEEDED TO ACHIEVE FURTHER REDUCTIONS IN ENERGY USE

While substantial energy savings can be realized for little or no cost, many measures require capital investment. At several locations, we noted significant potential for further reductions in energy use from Phase II and III projects. However, without appropriate incentives, the capital needed for such projects may not be forthcoming because the payback periods may be considered unduly long or projects with higher priority may preempt available funds.

Examples of Phase II and III type projects include the installation of central automatic facility and equipment controls, localized light switches, ventilation economizer systems, and wall and roof insulation. Energy savings from these kinds of projects can exceed 15 percent. Cost recovery periods based on energy savings alone vary from about a year for some economizer systems to about 4 years for such things as localized light switches.

Installation of central, automated facility control systems

Energy can be conserved in many plant operations through increased use of automated control systems. We noted that 10 of the 20 contractors were considering or had recently purchased such systems. Installation cost, estimated cost recovery periods, and estimated percentage reductions in total facility energy use are shown in the following table for five contractors.

Contractor	Cost to install	Estimated cost recovery period	Reduction in energy use relative to 1975
		(years)	(percent)
A	$ 70,000	0.8	5
B	225,000	.6	11
C	220,000	1.7	2
D	89,000	1.3	2
E	250,000	2.2	2

The estimated cost recovery periods vary from less than a year to about 2 years, depending on plant size and system complexity, and on the basis used for estimating cost savings. Relatively low percentage savings in energy may be deceiving. For instance, the 2 percent reduction in annual electricity use for contractor E corresponds to 5.5 million kwh or the equivalent of 9,483 barrels of oil.

Installing localized light switches can be helpful in reducing electricity use

We found only three facilities with effective lights-off programs. At a number of the facilities, it appeared to us that the installation of localized switches to turn off unneeded lights would result in significant energy savings.

At one location, facility engineers estimated that the installation of about 4,000 local switches would produce annual electricity savings in excess of 7 million kwh, about 3 percent of the facility's power use. The annual cost savings would amount to about $140,000. Installation costs for the switches were estimated to be about $500,000, thereby making the cost recovery period somewhat less than 4 years. But this project was not considered economically attractive by the contractor.

At another location, however, a contractor had modified the centrally switched facility to semilocalized switching by rewiring and installing 77 individual switches. The cost to install the switches was about $8,000. The estimated savings amounted to 810,000 kwh per year or about $13,800, corresponding to a cost recovery period of less than a year.

Improving the efficiency of the climate control system can result in significant energy savings

While many contractors were improving the efficiency of their HVAC operations, there is much more that can be done in this area. We noted that only 7 of 17 facilities which could use automatic fresh air economizers had done so. The remaining 10 companies were either not equipped with economizers or existing economizers were inoperative due to lack of proper maintenance. The following table, which is based on information from a consultant's study of one facility, illustrates some of the potential for energy conservation associated with HVAC systems operation.

HVAC Energy Conservation Study Results

Energy conservation opportunity	Estimated Implementation cost	Annual energy cost reduction	Cost recovery period	Reductions in energy use: Electricity	Reductions in energy use: Heating fuel
			(years)	(kwh)	(therms)
Turn off air-conditioning systems on weekends and at night	$ -	$240,000	-	11,300,000	150,000
Repair and install air economizer systems	44,000	32,000	1.4	1,800,000	-60,000
Incorporate variable air volume temperature controls	141,000	66,970	2.2	2,300,000	150,000
Total	$185,000	$338,970		15,400,000	240,000

The potential energy savings shown above correspond to about 10 percent of the total energy used at the facility in 1975. The contractor had partially implemented the air-conditioning turnoff program suggested by the study and was negotiating a contract for about $35,000 to repair existing fresh air intake economizers and install new ones where appropriate. The installation of variable air volume temperature controls was postponed pending verification of savings realized from the other two measures.

IMPROVEMENTS IN TECHNOLOGY CAN SIGNIFICANTLY IMPROVE ENERGY-USE EFFICIENCY

Advancements in technology can improve the energy efficiency of facility operations and industrial processes. Many these, such as waste heat recuperators, promise efficiencies of more than 30 percent. Our review indicated, however, that potential users may be reluctant to invest in advanced technologies because of a lack of confidence in new equipment performance and reliability. Examples of some new energy efficient technological products which we noted during our review are discussed below.

Chiller condenser cleaning brushes

In industrial companies, chiller operations alone can account for more than 25 percent of electrical energy consumption. Automated brush cleaning of the internal parts of the chiller condenser tubes can reduce energy use from between 10 to 30 percent in most instances. Systems installation cost is about $15 for each 12,000 Btu's of capacity and cost recovery periods range from about 1 to 2 years.

Exhaust air heat recovery systems

The use of exhaust air heat recovery systems is recommended by several Federal agencies as a cost-effective way to conserve energy. Such systems can recover up to 80 percent of the waste energy in the exhaust air for useful tasks, such as space heating or preheating combustion air.

The systems are most effectively used in industrial processes where exhaust air temperatures exceed 150° F or substantial amounts of processed air are exhausted. In such cases, system cost recovery periods are often less than 3 years.

For example, at one private company, a heat recovery unit was installed over a paint shop. Exhaust air from paint baking and drying ovens was about 225° F. In the recovery unit, heat from the exhaust air was transferred to the cold, incoming air which was used in turn to space heat the paint shop. Purchase and installation costs amounted to about $22,000. Annual cost savings from reduced heating requirements were estimated to be about $13,000, and the cost recovery period is less than 2 years.

We observed many contractor operations such as paint booths, welding shops, and chemical treatment areas in which large quantities of air were exhausted. Most of these operations exhausted processed air without attempting to recover

the energy it contained. We believe that much improvement can be made in this area and that contractors should evaluate their operations to assess the possibilities for cost-effective application of exhaust air heat recovery systems.

CHAPTER 3

NEED FOR VIABLE ENERGY MANAGEMENT PROGRAMS

Energy management involves the same basic techniques that apply to production, purchasing, finance, and administration. Little attention was given to energy management in the past because energy was plentiful and cheap. But with energy costs climbing, energy management programs are becoming more important.

Contractors have taken many specific energy conservation measures. However, few have established viable energy management programs. At many facilities, we observed inactive or lagging conservation programs. While most contractors had issued conservation policy statements and formed energy conservation committees, few had adequate program staffing and funding. None had developed comprehensive energy-use profiles, and goals for reducing energy use were generally set more or less arbitrarily.

A number of factors have impeded the development of energy management programs. Program costs seem to be the strongest internal factor while a lack of strong Federal leadership appears to be the most important external factor.

PROGRAMS LACK EMPHASIS AND CONTINUITY

Although several contractors appeared to be slowly developing energy management programs, none had established programs which adequately incorporated the five program elements advocated by FEA and the Department of Commerce. The five elements are

--top management commitment,

--development of comprehensive energy-use surveys,

--goal setting based on survey evaluations,

--employee motivation campaigns, and

--monitoring program implementation and results.

The relative lack of emphasis and continuity of the contractors' energy conservation programs is indicated by the fact that average percentage energy-use reductions were much larger in 1974 than in either 1973 or 1975. In general, the contractors were more aggressively implementing conservation measures in 1974 than in either of the other 2 years.

Need for top management to provide emphasis and resources

Company conservation programs are as strong as the commitment of top management and the resources allocated to support them. In the plants we visited, most corporate headquarters had issued policy statements supporting conservation efforts. Most of the companies had also established energy conservation committees and assigned part-time energy coordinators. However, prior to our review only one company had a full-time staff member assigned to its program and only six companies supported their programs with capital funds exceeding 3 percent of their annual energy costs.

In a budget-balancing move, one company simply laid off all four technicians who had been assigned to energy conservation projects. We noted that the technicians could have more than offset their annual salaries if the company had taken such easily implemented conservation measures as lowering light levels and turning off lights and ventilation fans at night.

At another company, top management seemed generally unaware of the status of its conservation program. In a letter to FEA, the company's president designated the manager of facility engineering as the energy coordinator. However, in discussions with the energy coordinator, we learned that he had not been told what his responsibilities were, except to act as a focal point to receive information from FEA. In addition, many companies had not allocated adequate funds to the energy conservation programs. At several companies, proposed projects with less than 3-year cost recovery periods had not been funded.

While there were numerous instances of inadequate management support for energy conservation programs, there were also some indications of increasing management interest in developing such programs. In this connection, during our review a corporate official for one company advised us that while the company had not completed the Phase I energy conservation measures, they have been energy conscious for years and had a very active program during 1974. He stated that it was the company's intention to return to an active program. He also advised us that a formal policy and procedure for energy conservation had been prepared. On the important point of funding, the official advised us that, as the company's financial position improves, consideration will be given to the more sophisticated conservation measures requiring greater capital expenditures. He stated that, due to the rapid fluctuations in the company's financial position, a definite payback period had not been established for evaluating energy

conservation proposals, but he believed a 2- to 3-year write-off period would be acceptable in the near future.

Comprehensive energy-use surveys are needed

Detailed knowledge of plant and equipment energy use is necessary to (1) identify areas of energy waste in facility and equipment operations, (2) justify the cost effectiveness of proposed energy conservation projects, and (3) verify the success of implemented conservation actions. Yet, at the time of our review, none of the contractors had completed such comprehensive energy-use surveys. As a result, energy conservation coordinators at many companies were unable to quantify energy savings from specific, implemented conservation measures. They could not separate the impact of business conditions on energy use from the effects of genuine, long-term conservation actions. Further, the efforts of many energy conservation coordinators may be frustrated by the lack of credible data when they try to justify capital outlays for proposed conservation projects.

In carrying out Phase I type conservation actions, detailed surveys may not always be necessary since such measures as turning off lights and fans, reducing light levels, and resetting thermostats are clearly effective energy savers. However, once the more obvious actions have been taken, continued energy-use reductions depend on identifying more difficult areas and following up with action. Representatives of three companies indicated, though, that they believed detailed surveys were too costly and required too much manpower. Several other executives felt that company staffs are sufficiently acquainted with plant and equipment operations to identify energy waste without lengthy studies.

We believe, however, that after the obvious energy waste has been eliminated, further major conservation measures are rarely identified and implemented without a detailed survey of plantwide energy use. At two facilities, for instance, professional consultants' studies of plantwide HVAC systems turned up major energy waste areas. In addition, a consultant's study of the chemical process and heating operations at a Government-owned, contractor-operated (GOCO) plant found that energy costs could be cut by 25 percent if all identified conservation opportunities were implemented.

Need to establish realistic goals

FEA and Commerce energy management guidelines point out that goals for reducing energy use should be realistic and based on evaluation through energy-use surveys. We observed that only two companies had based their energy conservation goals on engineering estimates corresponding to potential, identified energy conservation actions. Four companies had no quantifiable goals, whereas the goals in the remaining 14 companies were based on arbitrary considerations or were imposed on the companies by external sources, such as the local Public Utilities Commission.

More effective employee motivation needed

Even though most of the companies surveyed had made numerous appeals to employees to help conserve energy, we believe that these efforts need to be expanded and improved. Company publicity efforts typically included newspaper articles, top management memoranda to employees, posters, and notices on light switches. Yet the lights-off programs in 17 companies we visited were only partially effective. In one company, more than 26,000 violations were reported during an 11-month period. We also noted during our night inspections that numerous violations were still occurring.

Need for conservation actions and programs to be monitored

It is important for management to review the progress and effectiveness of implemented energy conservation projects. This review process often requires onsite inspections because reductions in energy use resulting from specific conservation projects are usually not traceable when monitoring on a plantwide basis. Monitoring is particularly necessary to insure implementation of those Phase I type actions which require employee participation to be successful.

We noted during our plant visits that few companies adequately monitored conservation efforts. Most of the companies either had no monitoring program, or their existing programs were ineffective. An official of one company first told us that the company had an effective conservation program and had put into effect all conservation actions which did not require capital funding. He was somewhat surprised, however, when we demonstrated to him (backed up by his own facility engineering staff) that plantwide electricity use could be further reduced another 10 percent by simply enforcing the lights-off program, by reducing light levels to company recommended standards, and by using watt-economizer

fluorescent light bulbs. As a result of our discussions the company took action to put a periodic monitoring program into effect.

INCREASING ENERGY COSTS HAVE NOT STIMULATED IMPROVED ENERGY MANAGEMENT PROGRAMS

In spite of rapidly rising energy costs, the conservation efforts at many of the plants we visited appeared to have slowed down or even halted after initial low-cost Phase I type conservation actions had been implemented. This is contrary to the claims of several contractors that rising energy costs stimulate their conservation efforts. Further, we noted numerous instances where energy conservation investment opportunities with payback periods of 1 year or less had not been acted on.

In 1975 total energy costs for the 20 plants we visited were more than $45 million--an increase of 61.5 percent over 1973. Total energy cost increases during this period ranged from about 15 percent to 100 percent. Unit energy prices increased even more, ranging from about 137 percent for electricity to over 180 percent for heating fuel. As shown below, 14 companies experienced their highest annual energy cost increases in 1974 while the remaining 6 companies' energy costs increased most rapidly in 1975.

Schedule of Energy Cost Increases for 1973-1975

Year	Average energy cost per company (millions)	Number of companies showing highest year to year percentage increase	Average percentage change in energy unit prices over preceding year	
			Electricity	Heating fuel
1975	$2.27	6	20.8	33.5
1974	1.79	14	45.4	70.7
1973[a]	1.41	-	11.0	17.8

[a]/1972 as a base year applied only to 12 companies.

Considering that increases in the cost of energy are forecast for the future, it appears that energy is becoming a more significant cost of doing business. Nevertheless, increasing

energy costs have not acted as a stimulus for contractors to establish viable energy management programs or allocate adequate financial resources to the program.

IMPEDIMENTS TO DEVELOPING ENERGY MANAGEMENT PROGRAMS

Our review indicated that from a contractor's viewpoint, a number of factors, both internal and external, impede the development of viable energy management programs. As previously noted, program costs appear to be the strongest internal impediment. Many companies did not assign full-time staffing to their programs. Also, many companies were reluctant to invest in energy-saving equipment unless the investment could pay back its costs in a relatively short time period--1 to 2 years in some cases. In addition, conservation projects must compete for funding with business expansion, equipment replacement, and required occupational safety and environmental investments.

Externally inhibiting is the fact that, until recently, the Federal Government has not effectively emphasized the need for energy conservation. The voluntary nature of the Government's program and continuing doubts about the necessity of conservation may have contributed to contractors' reluctance to initiate actions that might cause their employees some inconvenience.

The credibility gap concerning the reality of the energy problem and the need for conservation still lingers. According to one contractor executive, the Government still has not convinced people that conservation is necessary. Another official pointed out that energy conservation was given high priority during the 1973 Arab oil embargo, but now that oil is available, conservation has dropped in priority and become just another area of potential cost reduction. We believe that the lack of resources provided by contractors to develop energy management programs and to fully implement known conservation measures are to some extent attributable to doubts people have regarding the need for conservation.

CHAPTER 4

OTHER AREAS WHERE IMPROVEMENTS ARE NEEDED TO PROMOTE ENERGY CONSERVATION

The Federal Government has been promoting energy conservation since late 1973. Although several Federal agencies have programs dealing with industrial energy conservation, these programs have had little effect at Government contractors' plants. As we have noted, this lack of impact stems from the fact that the need for energy conservation has not been effectively emphasized; also, agencies have relied on a voluntary energy conservation philosophy in their relationships with contractors.

In view of the significant energy savings that could be realized, the Government must assume a more effective and coordinated leadership role to promote energy conservation. There are several issues which we believe need to be considered. They include the development of an energy conservation-related procurement policy, more effective dissemination of energy conservation information and techniques, the development of national lighting guidelines and selected improvements which we feel are needed in the Department of Defense (DOD) energy management program. These issues are discussed in the following sections of this chapter.

FEDERAL PROCUREMENT POLICY SHOULD INCLUDE ENERGY CONSERVATION DIRECTION FOR CONTRACTORS

In October 1974 we issued a report to the Secretary of Defense and the Administrators of FEA and GSA on the results of an initial survey of five contractors' energy conservation programs. We concluded that although the contractors had taken some actions to save energy, there was a need for the agencies to become more directly involved and provide guidance and direction to contractors for establishing effective energy conservation programs. We suggested the development of a formal Government-wide contractor energy conservation policy and a unified Federal approach to require contractors to adopt, through the contracting process, viable energy conservation programs.

In responding to our report, the three agencies (DOD, FEA, and GSA) indicated they preferred to rely on voluntary rather than mandatory actions for achieving energy conservation at contractors' plants. DOD stated that the use of an energy conservation clause in contracts had been studied extensively in coordination with GSA, and it was determined to be administratively unworkable. Both FEA and GSA advised us,

however, that they supported our suggestion on the need for a formal Government-wide contractor energy conservation policy and that efforts were being made to develop such a policy.

Such efforts by FEA and GSA were curtailed when the Office of Federal Procurement Policy (OFPP) rejected a GSA proposed contract clause. In this respect, in February 1975 GSA advised OFPP of several alternatives and actions that had been considered to encourage or require contractors to conserve energy. GSA stated that the time was right for establishing a Federal procurement policy which requests that, in contracts over $10,000, contractors voluntarily agree to use their best efforts to conserve energy. GSA, therefore, recommended that the Federal procurement community, through OFPP, take the initiative and institute a voluntary contractor energy conservation clause.

On April 28, 1975, OFPP advised GSA of its opposition to the inclusion of an energy conservation compliance clause in Government contracts. OFPP questioned whether the benefits to be gained by the proposal would outweigh the additional burdens that would be imposed on the procurement process and on the contractors. OFPP concluded that the Federal Government should not open the procurement process to the implementation of socioeconomic programs by administrative direction unless a determination was made that such action was compelling in the national interest.

We believe the reasons advanced by OFPP for rejecting GSA's proposal are questionable. Energy conservation is a vital part of the national effort to halt our growing dependence on imported oil. The Federal Government, perhaps more than any other sector of the economy, must develop and implement an aggressive conservation effort to limit its growth of energy demand. The Government is a large energy user. It has influence in many sectors of the economy. And it has an obligation to responsibly establish and implement policies it advocates for adoption by others. Given the range of activities existing in the Federal Government, it has a unique opportunity to show what can be done.

We believe this report clearly demonstrates that there are numerous opportunities for contractors to use energy more efficiently. Many of the actions that could be taken by the contractors to conserve energy are cost effective. Some actions can be accomplished at no cost while others may require minimal capital expenditures. For example, one contractor had the opportunity to achieve energy savings of 12 million kwh annually and realize cost savings of over $225,000 by reducing light levels and installing switches to turn off lights when not in use.

To realize these savings, however, the factors which have impeded the development of energy management programs must be removed. A wide range of Government procurement policy options are available to encourage contractors to conserve energy. These range from voluntary programs and reporting to mandatory development, implementation, and submission of energy conservation plans. A procurement policy requiring the development of energy management programs and a provision allowing contractors to share in the cost savings may be the motivation and incentive needed to assure realization of substantial energy savings. Accordingly, we believe that the Office of Management and Budget (OMB) should have OFPP, in line with its statutory responsibility to provide overall direction of procurement and procurement-related policies:

--Work with the Department of Energy, GSA, DOD, and other appropriate executive branch agencies to develop an energy conservation-related procurement policy and contract clause that would require Government contractors to establish viable energy management programs.

--In developing this policy, give consideration to allowing contractors to share in the cost savings which accrue from the implementation of energy conservation opportunities.

PUBLICATIONS AND INFORMATION MUST BE MORE EFFECTIVELY DISSEMINATED

Federal agencies have developed or contracted out for numerous publications and studies to assist industry in conserving energy. For example, FEA, Commerce, and the National Bureau of Standards have jointly developed a handbook entitled "Energy Conservation Program Guide for Industry and Commerce (EPIC)" which focuses on two aspects of energy conservation. First, it presents the key steps necessary to implement an energy conservation program. Second, it presents information on specific energy conservation opportunities which have been identified by industry as ways to reduce energy use. In spite of all of the agencies' efforts in funding studies and publishing handbooks and brochures, we found that very few of the contractors' plant personnel had received any of this information.

The District Director of one of Commerce's field offices told us that representatives from his office were spending 2 days a week visiting business concerns throughout the area encouraging them to conserve energy and providing them with information on how this can be accomplished. The Director

stated, however, that large firms, such as the contractors we were reviewing, were not being visited by representatives from his office. He said the Department's efforts were directed primarily at medium and small size firms, and he felt that large firms have the means to produce a conservation program without the help of Commerce.

We believe some of the material developed by these agencies would be very useful in assisting contractors to establish and implement energy management programs. We feel that FEA and Commerce should coordinate their efforts to disseminate this material through DOD and GSA in order to take advantage of their network of contract administration representatives who are in day-to-day contact with firms doing business with the Government. In this way, FEA and Commerce will be able to reach thousands of business firms, both large and small, who could greatly benefit from receiving this information.

RECOMMENDATION

We recommend that the Secretaries of Energy and Commerce:

--Use Government contracting personnel in DOD, GSA, and other agencies to disseminate energy conservation publications and materials to contractors.

NATIONAL LIGHTING GUIDELINES AND STANDARDS SHOULD BE DEVELOPED

During the past few years, FEA has stressed reducing lighting levels in buildings as a major means of conserving energy. Lighting level guidelines and standards have been promulgated by several Federal agencies and technical societies. But these guidelines and standards are not generally accepted and used by the contractors, and the lighting levels in many facilities exceed the applicable standards. We found that there are problems in interpreting and applying the guidelines and, in some instances, the various standards conflict with each other.

On November 18, 1974, FEA called for a voluntary 25 percent reduction in energy used for lighting, heating, cooling, and operating commercial, public, and industrial buildings. As part of this effort, FEA published a booklet entitled "Lighting and Thermal Operations, Energy Management Action Program for Commercial • Public • Industrial Buildings."

These guidelines recommended lighting levels ranging from 50 to 100 footcandles for office work centers, 30 footcandles for office space where there were no immediate tasks,

and 10 footcandles for hallways and corridors. For tasks performed in manufacturing areas, the guidelines suggested that the levels at the work stations should be no greater than those established by the American National Standards Institute (ANSI). The ANSI standards were based on standards that had been developed by the Illuminating Engineering Society (IES).

We observed that most of the contractors were still using uniform, overall lighting systems and that the lighting levels at many plants exceeded the FEA recommended standards. For example, at one location we took 77 different light level readings and found that 66 exceeded the applicable standard. At another location, our tests showed that the light levels generally exceeded the standards as follows:

Location	FEA standards	Footcandles measured
Secretary's desk	50±10	90
Reading desk, computer room	50±10	125
Day superintendent's desk	50±10	100
Supervisor's desk	50±10	130
Manager's desk	50±10	120

At this same plant, we took light level readings in various manufacturing areas and found that they exceeded the standards published by ANSI and IES as shown below:

Location	ANSI-IES standard	Footcandles measured
Machine shop tool crib	50	200
Machine shop final inspection	100	200
Machine shop grinders	50	90
Weld shop	50	95

There are several reasons why the guidelines and standards were not being used. Several contractors indicated that they do not agree with the FEA guidelines. They believe that lowering light levels to the recommended levels would adversely affect employee morale and productivity.

Furthermore, the FEA guidelines stress that the lighting levels recommended by them are for nonuniform task lighting. That is, only the task itself is fully illuminated at the recommended light level and the surrounding areas drop off in illumination. We found that there is a problem using the guidelines and standards because the tasks themselves are often poorly defined and the definitions can be confusing. For example, the guidelines define some office

tasks as "Normal office work, such as reading and writing * * *," others as "Prolonged office work which is somewhat difficult visually * * *," and still others as "Prolonged office work which is visually difficult and critical in nature * * *." The guidelines state that visual difficulty is not only a function of the type of task and the lighting system, but also of the length of time the task must be performed. In our discussions with contractor personnel, they pointed out that these types of definitions can mean different things to different people.

An official of IES told us that many people take their recommended light levels out of context and use them to uniformly light areas surrounding tasks to recommended task levels. He said the IES had not been very successful in obtaining widespread acceptance that its recommended levels are for task lighting only and not for uniform lighting.

GSA has also issued two sets of office lighting guidelines and standards. One set was intended primarily for internal use by the Public Building Service (PBS) of GSA in the maintenance and operation of buildings in its inventory. The second set was issued under a Federal Management Circular (FMC) to the heads of executive departments and agencies and was applicable to all buildings owned or leased by executive departments and agencies, including GOCO facilities.

A comparison of the various standards showed that in addition to the problems of interpretation and application, the lighting levels recommended by FEA and GSA are different from each other. And both are different from the levels recommended by IES for office tasks which are similar in nature. To illustrate the variations, the following is a comparison of several tasks and the recommended lighting levels.

Task description	Recommended lighting level			
	FEA	GSA FMC	GSA PBS	IES
	(footcandles)			
Drafting	100±20	50	100±20	150 to 200
Reading poor reproductions	75±15	50	75±15	150
Reading handwriting in hard pencil or on poor paper; reading fair reproductions	75±15	50	75±15	100
Reading handwriting in ink or medium pencil on good quality paper	50±10	50	50±10	70
Reading high contrast or well printed materials	50±10	50	50±10	30

The Energy Policy and Conservation Act (Public Law 94-163) requires the development and implementation of an energy conservation plan for buildings owned or leased by agencies of the United States. This plan is to include mandatory lighting efficiency standards. The act also requires States to establish mandatory lighting efficiency standards for public buildings if they want to qualify for Federal assistance for their State energy conservation programs. In view of these requirements, we believe that the various lighting level guidelines and standards currently in existence should be reviewed, and national lighting guidelines and standards that can be easily understood and consistently applied should be developed.

RECOMMENDATION

We recommend that the Secretary of Energy:

--Review the various lighting guidelines and standards that are currently in existence and develop national lighting guidelines and standards that can be easily understood and consistently applied in commercial, public, and industrial buildings.

IMPROVEMENTS NEEDED IN DEPARTMENT OF DEFENSE ENERGY MANAGEMENT PROGRAM

DOD was responsible for the greatest part of the Government business at each of the 20 plants we visited. Over the past few years, DOD has taken a number of actions to more effectively manage its energy resources and promote energy conservation. In January 1974, a Director for Energy was

appointed to be primarily responsible for energy matters within DOD. His duties include managing the Department's overall energy conservation program and coordinating the efforts of the various DOD elements involved in performing energy-related functions.

We were told by the Director that DOD has tried to motivate and encourage contractors to voluntarily conserve energy. For instance, DOD issued a procurement circular which requested defense contractors to implement energy conservation measures.

We recognize that DOD has taken actions to promote energy conservation, but we believe that there are several areas in which more can be done to strengthen and improve the Department's energy management program.

Formal plan needed for promoting energy conservation by contractors

In October 1974 we reported to DOD that there were inconsistencies in the manner in which it was promoting energy conservation at contractors' plants. We suggested that a formal plan should be developed for providing energy conservation guidance and direction to contractors.

In our current review, we found that the efforts being made by DOD are still not being carried out in a coordinated and consistent manner. For example, contractors operating Army-owned plants were requested to use the lighting standards established by GSA, while contractors operating Air Force- and Navy-owned plants were not asked to do so.

DOD is in a unique position, through its network of plant representatives, to give energy conservation guidance, encouragement, and direction to contractors. We noted, however, that the plant representatives generally have little to do with contractors' conservation programs. One plant representative told us he does not believe he is in a position to take action to encourage the contractor to conserve energy because there are no energy conservation provisions in the contract. At another location, the Government plant representative's staff member, who was designated as the energy conservation coordinator, said he was not familiar with the contractor's energy conservation program and did not know who on the contractor's staff was involved in it.

In view of the many opportunities for contractors to conserve energy, we believe DOD should develop a formal plan for a coordinated and uniform effort to promote maximum energy conservation by contractors.

Defense Contract Audit Agency's energy audits should be expanded

In February 1974 the Defense Contract Audit Agency (DCAA) initiated audits of defense contractors' energy consumption. The DCAA regional offices were to determine if contractors had program plans to adequately monitor the use and cost of energy and if they intended to institute additional procedures to further reduce energy use.

The DCAA audit reports and additional information were made available to the DOD Director for Energy when he testified in April 1975 before the Senate Committee on Government Operations. He stated that only 4 of 127 contractors where DCAA audits had been completed were considered to have energy-use programs that were lacking in some respect.

As part of our review, we looked at the DCAA audits and held discussions with DCAA officials. We found that the work done by DCAA was generally restricted to a review of energy use documents and published contractor programs. Further, DCAA informed us that if the contractor had reduced energy consumption by 5 percent, which was the nationwide goal at the time of their audits, the program was deemed adequate. In our opinion, DCAA's efforts were too limited to assess the overall adequacy of a contractor's program. We believe that if DCAA had expanded the scope of their work, significant additional potential for energy reductions would have been readily identified. As noted throughout this report, we found many opportunities for contractors to conserve energy through such easily recognized Phase I type measures as turning off lights and ventilation fans and using more efficient lighting.

We believe that the Director for Energy could get useful information for the Defense energy management program from the DCAA energy audits. They could serve as a means of monitoring contractors' efforts to establish and implement viable energy management programs. The audits should be expanded, however, to determine whether contractors' conservation programs adequately incorporate the five elements recommended by FEA and Commerce: (1) top management commitment, (2) development of comprehensive energy-use surveys, (3) goals based on survey evaluations, (4) employee motivation campaigns, and (5) internal monitoring of the program. In addition, we believe that DCAA should use technical assistance where necessary to insure that the audits are comprehensive enough to properly assess contractors' programs.

Action should be taken on proposals for Energy Conservation Investment Program funding

Seven of the 20 plants reviewed were GOCO facilities. Capital investments for plant and equipment additions and modifications at these facilities are normally funded from the procurement budgets of the DOD organization owning the plant. Items which are considered normal maintenance and upkeep are paid for by the contractor.

We noted that generally, those energy conservation projects requiring capital investment from procurement funds had to compete with other capital investment projects for limited funds. Projects which were production-related or those which were needed in order to comply with environmental and safety regulations took precedence over energy conservation investments regardless of cost recovery periods. For example, one GOCO contractor submitted nine energy conservation projects in its fiscal year 1977 procurement budget request. These projects were subsequently deleted in spite of the fact that three of the projects had cost recovery periods of from 2 to 8 months. When we discussed the reasons for dropping these projects with DOD officials at the plant, we were told they were deleted because of the unavailability of funds. One official said that unless the projects have a beneficial effect on production, there was little chance of them being approved.

In March 1975 DOD established an Energy Conservation Investment Program (ECIP) which started in fiscal year 1976. The purpose of this program was to reduce energy consumption through self-amortizing, retrofit projects to existing facilities. The program was intended to operate for 6 years and funding levels of over $100 million per year were established.

Proposed projects and cost estimates for ECIP funding were requested by DOD from a number of GOCO plants, including the one discussed above. This contractor submitted the same nine projects that were previously deleted from his fiscal year 1977 capital budget request plus one additional project. Five of the 10 projects appeared to meet the funding criteria that had been established for the ECIP program, but none were approved.

In discussions with DOD program officials, we learned that very few GOCO projects were being submitted by the military services for ECIP funding. We were advised that GOCO projects could be funded if they meet the criteria. We also discussed this matter with officials in the office of

the Director for Energy. They indicated they were unaware of the high deletion rate of energy conservation projects at GOCO plants and the lack of participation in ECIP.

It appears that there has been a lack of communication and coordination within DOD on the funding of energy conservation projects at GOCO plants. We believe that action should be taken to insure that all DOD elements and GOCO contractors are aware that ECIP funding is available and that requests for such funding will be considered if a project meets established criteria.

RECOMMENDATIONS

We recommend that the Secretary of Defense take action to improve DOD's energy management program by:

--Developing a formal plan for a coordinated and uniform effort to be exerted by all DOD elements to promote energy conservation by its contractors.

--Expanding the scope of the DCAA energy audits and using technical assistance in these audits for evaluating contractors' energy conservation programs.

--Using the DCAA energy audits to monitor contractors' efforts to establish and maintain viable energy management programs.

--Advising all contractors operating Government-owned plants and the military services responsible for administering such plants that projects can be submitted for funding under the ECIP.

CHAPTER 5

AGENCY AND CONTRACTOR COMMENTS AND OUR EVALUATION

We furnished a draft of this report for review and comment to the 20 contractors whose plants we visited and to the five Federal agencies (FEA, OMB, GSA, DOD, and Commerce) responsible for the matters discussed throughout this report. The contractors and the Federal agencies agreed that further conservation of energy resources was necessary; however, there were differences of opinion expressed by a number of the contractors as to how much more energy could be conserved. Some of the contractors also expressed the view that what is needed to assist industrial firms to improve and expand their efforts to conserve energy are financial incentives such as accelerated depreciation and investment tax credits.

OMB, DOD, and Commerce agreed with all of our recommendations except for developing a procurement policy that would require Government contractors to establish viable energy management programs. The primary reason cited by these agencies was the lack of a coordinated national policy for energy conservation. FEA and GSA indicated a willingness to work with the other three agencies in the development of an appropriate procurement policy that would adequately address this subject.

Discussed below are the major comments on our report, along with our evaluation where differences exist.

CONTRACTOR COMMENTS

With respect to the actions that have been taken by contractors to conserve energy and the potential for further conservation, eight of the contractors advised us of various conservation actions that had been taken since the time we visited their plants. These actions included improvements made in their energy management programs, such as assigning a full-time coordinator to manage the program, and actions to reduce their energy consumption by means of relamping and insulation programs.

Concerning the potential for further conservation, five contractors informed us that they believe the 20 percent reduction figure we cite may be too optimistic for those contractors who have already embarked on and implemented conservation programs. Conversely, one contractor stated that they are reasonably sure the 20 percent reduction can be achieved. Another contractor informed us that, subsequent to our review,

they significantly expanded their conservation program, and in 1976 consumption of electricity decreased 27 percent and natural gas decreased 16 percent compared to 1975 consumption. It was evident from the comments made by the contractors that there are differing views on the amount of energy savings that can reasonably be expected to be realized in industrial plants. Our review clearly indicated that the potential for energy reductions in individual plants is high. We recognize, of course, that the reductions achieved will vary widely depending on many factors, including the past efforts that have been made to reduce energy use and the commitment that management makes to establish and carry out a viable energy management program.

In their comments, a number of the contractors expressed the view that they have good energy management programs and that what is needed to assist industrial firms to improve and expand their efforts to conserve energy are financial incentives such as accelerated depreciation and investment tax credits. As stated earlier, financial constraints are a major impediment to companies' development of viable energy management programs. For example, many companies require very short cost recovery periods for investments in energy-saving projects and equipment. We believe that conservation should have top priority for Government financial assistance because it has the greatest potential payoff and is most attractive on an incremental cost basis. Areas offering the greatest opportunity include insulation and other measures to conserve energy in new and existing buildings and the use of more efficient equipment and processes in industrial plants. Still, there is a need, as discussed in this report, for contractors to establish viable energy management programs and to allocate more financial and staff resources to their programs.

We support the concept of investment tax credits as an incentive for achieving energy conservation in the industrial sector. In our March 17, 1975, Alternative Energy Proposals[1] we proposed a 10-year industrial investment tax credit of 10 percent for the installation of equipment which would result in improved energy efficiency. We also proposed that model performance standards be developed for industrial processes in key energy-using industries based on the most efficient technology available. The standards were to include increased

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[1]Alternative Energy Proposals Developed by the General Accounting Office in Response to Congressional Inquiries: Statement of Comptroller General before House Ways and Means Committee on March 17, 1975.

energy efficiency in steam generation, heat recuperation, and materials recycling.

More recently, in our report on the President's National Energy Plan,[1] we agreed with the administration's proposals to provide a 5-year, 10-percent investment tax credit for industry for investments in approved energy-saving industrial equipment and a 10-percent tax credit for business investments in approved energy conservation measures. We believe that these financial incentives may result in additional efforts by industry to conserve energy by making energy-saving investments more economically attractive.

FEDERAL ENERGY ADMINISTRATION COMMENTS

FEA stated that it agreed with our general conclusions that while Government contractors have taken specific energy conservation actions, there are many opportunities for achieving further significant energy savings if viable conservation programs were established by all contractors in their plants. FEA agreed that the Government, through its procurement policies, can promote positive energy conservation actions by contractors and advised us that it partially concurs with our recommendation for the development of a procurement policy and contract clause that would require Government contractors to establish viable energy management programs. FEA said it is their feeling that all segments of industry should have viable programs and that requiring only Government contractors to have such programs limits the potential benefits as compared to an appeal to the entire industrial community. FEA said it has worked with OFPP in the past on this subject and will continue to in the future if such a requirement is decided upon.

We agree with the view expressed by FEA that all segments of industry should have viable energy conservation programs. We believe, however, that FEA should not propose inaction on the part of the Federal Government developing and implementing an energy conservation procurement policy for contractors simply on the basis of limited potential benefits which it believes can be realized when compared to the entire industrial community. Benefits are benefits from whatever source they come. We believe there are significant benefits to be gained from the action we proposed. The Federal Government is a large energy user, and we believe it has an obligation to responsibly establish and implement policies it advocates for adoption by others.

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[1]An Evaluation of the National Energy Plan. EMD-77-48, July 25, 1977.

With respect to our two recommendations for FEA to use Government contracting personnel to disseminate publications and materials to contractors and to pursue the development of national lighting guidelines and standards, FEA advised us that it concurred with the intent of our recommendations and that actions were being taken on these matters.

OFFICE OF MANAGEMENT AND BUDGET COMMENTS

OMB stated that it does not support our recommendation for OFPP to develop an energy conservation-related procurement policy and contract clause that would require contractors to establish viable energy management programs. OMB's reasons were the lack of a coordinated national policy for energy conservation and the lack of a quantification of the cost and benefits for such socioeconomic programs.

On April 29, 1977, a very important first step was taken toward the development of a national energy policy when the administration presented its National Energy Plan. The plan is based on a number of principles, strategies, and goals which the administration believes must be pursued if the Nation is to solve its energy crisis. The first principle set forth in the plan states, in part, that the energy problem can be effectively addressed only by a Government that accepts responsibility for dealing with it comprehensively. The sixth principle--the cornerstone of a National Energy Policy--is that the growth of energy demand must be restrained through conservation and improved efficiency. In our view, a further step in the direction of developing and implementing such a policy would be for OMB to demonstrate its commitment to supporting the cornerstone of the administration's energy plan through the development of a Government-wide procurement policy that calls for all contractors to establish viable energy management programs. We believe this report clearly points out the need for such a policy. It shows the energy waste that is now occurring and the potential for savings in this area.

Regarding the need for quantification of the cost and benefits of an energy conservation program, we again believe that this report adequately demonstrates the savings, both in terms of dollars and energy, that can be achieved through energy conservation programs. The report also recognizes that some energy conservation projects may require extensive economic feasibility studies, capital outlays, and cost recovery periods exceeding 10 years. In fact, a few of the contractors we visited had conducted selected studies that showed, for individual conservation projects, what the costs, benefits, and payback periods would be. Thus, the quantification of costs and benefits has been done to some extent,

but more is needed. Since a good energy conservation program would include these studies as an integral part, OMB's statement that more cost/benefit studies are needed before further action can be taken seems to us to be contradictory and not well founded. Further, as this report shows, significant savings can be achieved through common sense type actions, such as turning off lights and equipment when not needed, reducing light levels, and using more efficient light sources. Actions of this type require little investment for the substantial benefits or savings that can be achieved, and have long been recognized as being cost effective.

DEPARTMENT OF COMMERCE COMMENTS

Commerce stated that the report certainly shows a need for improvement in Government energy conservation efforts aimed at the type of companies reviewed. It also stated that the report suggests a specific and reasonable way to improve the dissemination of information to contractors about energy conservation, and it intends to implement our recommendation on this matter.

Commerce does not believe, however, that the report fully identified the reasons for the inadequate energy conservation programs found in the companies reviewed, and for this reason, suggested that we eliminate our recommendation for the development of an energy conservation procurement policy that would require contractors to establish viable energy management programs. The agency's comments seem to indicate several concerns. On the one hand, they believe that some of our findings show that a voluntary program should be continued because of the achievements that have been made; on the other hand, they are concerned that some of our findings may result in the premature abandonment of the voluntary approach to energy conservation. They pointed out, however, that the agency does not suggest that mandatory measures are never appropriate, but only that they are a last resort, to be used where normal incentives such as the cost of energy, as well as the desire of individuals and industries to promote the public interest cannot be relied upon to accomplish the needed result.

We believe that the voluntary approach to energy conservation has not been fully effective. It has not been effective because many of the companies visited were simply not aware of how to go about establishing and implementing an effective conservation program. They were also not aware of the potential savings involved. Perhaps this would not have been the case if agencies like Commerce had been more effective in disseminating information to these companies on

energy conservation. For example, in commenting on our report one contractor stated that:

> "Dissemination of useful information should be improved. Our experience here is that we have received essentially no information from Federal agencies except the FEA guidelines on lighting which were received during the GAO review of this plant."

Despite the lack of awareness by contractors of the potential savings involved from a good energy conservation program, Commerce stated that their programs have stressed the distribution of information and use of seminars to promote understanding of these savings. We believe, however, that Commerce's efforts to disseminate information were very limited. Further, the Director of one of the agency's field offices told us that large firms, such as the contractors we reviewed, were not being visited by their representatives because he believed that these firms had the means to develop a conservation program without help from Commerce. While large firms may be capable of developing a good conservation program, our review showed that most had not, and they could have used some help.

Commerce questioned whether our findings have widespread applicability since (1) they are based on a sample of only 20 contractors, (2) some of the firms may have little incentive to reduce costs because of the types of contracts they held, and (3) a number of the plants reviewed were GOCO facilities. The 20 firms we selected for review were based on a judgment sample and, therefore, cannot be statistically projected to all Government contractors. The contractors were chosen to provide broad geographical coverage and were significant in terms of business volume and energy use. These were large firms, with total annual energy costs ranging from $319,000 to over $11 million. Since significant savings can be realized from adoption of better conservation measures by them, we believe our assessment of their energy use provides a useful input for energy conservation policy decisions. The widespread presence of conservation opportunities among these contractors also leads us to believe that similar opportunities may be present, to some extent, in other Government contractors' facilities.

We agree with Commerce that, to the extent that costs are a factor in energy conservation, procedures need to be worked out by the agencies to increase the cost incentives for certain types of contracts and contractors. Our analysis shows that price does not have a great effect on some

contractors' energy use because of their type of contract. This was shown by the low-price elasticities of both electric energy and heating fuel energy use.

Commerce stated that, in assessing the effectiveness of conservation programs, economic factors cannot be differentiated from the impact that voluntary conservation efforts had on the program. Commerce said that GAO tries to make such a distinction through the use of statistical techniques to determine which of these factors has contributed most to the degree of energy conservation actually achieved. In explaining their position, Commerce pointed out that its program and FEA's program both have relied upon understanding of the cost effectiveness of energy conservation as a primary motivating factor and thus, to separate economic considerations from the impact of voluntary conservation programs is fallacious.

We believe it is possible through statistical techniques to assess the relationship that economic factors (such as employment, plant area and energy unit prices) and voluntary conservation efforts have on reducing the use of energy. As shown in appendix II, we tested this belief by including the voluntary program as an explanatory variable in our statistical analysis. The analysis showed that the economic factors were statistically significant in explaining overall energy use by the contractors. It was difficult to separate the effects of voluntary conservation efforts from those of increasing energy costs; however, we believe that increased prices may have had more of an impact in conserving energy than the voluntary efforts. In addition, and more importantly, we did not rely solely on our statistical analysis to measure the voluntary program's full impact on energy used. As shown in our report, we relied extensively on the findings from our reviews at the contractors' plants to assess the voluntary efforts that were being made to conserve energy.

DEPARTMENT OF DEFENSE COMMENTS

DOD advised us that the report would be helpful as it continues to develop measures to insure that contractors use their energy more efficiently. DOD concurred with the recommendations we made for improving its internal energy management program and advised us of the actions that had been taken on these matters.

While DOD concurred that it can improve its energy conservation efforts at contractors' plants, it was also totally against developing a contract clause requiring contractors to establish viable energy management programs. The reasons

were much the same as those given by OMB and Commerce. DOD said it was their view that an effective industrial energy conservation program should emanate from the highest level of Government concerned with overall energy policy and management. DOD said that pending some movement of the Government in this direction, it feels the best approach for DOD in complying with existing guidance is to continue current promotional efforts with its contractors.

During our review, we did not find that DOD's promotional efforts were very effective. From our experience, Government contractors are usually reluctant to actively pursue accomplishing socioeconomic objectives. Therefore, we believe it is necessary for DOD and other agencies to take more positive action to assure that contractors comply. In this case, an appropriate contractual clause in all major contracts appeared to be a logical course of action.

DOD also commented that it feels, given the dramatically rising energy prices during the period 1972-1975, decreases in employment could not adequately explain the significant decline in energy use experienced by the contractors during this period. As discussed in chapter 2 and appendix II, our statistical analysis showed that plant area, employment, heating degree days, and price are important variables in explaining energy use. We have added estimates of average energy use by the contractors in 1972 and 1975 in table 2 of appendix II to more fully respond to the question raised by DOD. This table implies that not only is the coefficient of the particular variable important in explaining changes in energy use, but how much that variable itself changes is also a factor. Thus, for example, during the period, large price changes with a low coefficient account for more of the electrical energy decline than employment. Also, for heating fuel energy use, we agree with DOD that some of the reduced plant areas may have been because of conservation efforts by the contractors. On the other hand, we believe that economic factors are also important in explaining this change.

GENERAL SERVICES ADMINISTRATION COMMENTS

GSA stated that it completely supports the efforts to save energy in every way possible. GSA stated that it would be willing to assist OFPP in developing appropriate parts of the energy conservation procurement policy and contract clause which we recommended for Government contracts. GSA also informed us that it agreed with our recommendation for improving the distribution of energy conservation publications and advised us of several actions it was taking in this regard.

OVERALL CONCLUSIONS

Our basic purpose in this report has been to provide the responsible Federal agencies and the Congress with information on the effectiveness of the agencies' efforts to promote voluntary energy conservation by Government contractors. We believe these efforts have not been very effective. While contractors have taken many specific energy conservation actions, there are numerous opportunities for achieving further significant energy savings if viable energy management programs were established by all contractors in their plants.

The factors which our review indicated have impeded the development of energy management programs are twofold: (1) the overall financial constraints that are associated with establishing and implementing the program; these include the cost of staffing and funding for proposed conservation projects, the relatively short payback periods that are required for capital investments, and the fact that energy conservation projects must compete for funding with other capital investment projects and required occupational safety and environmental investments and (2) a lack of strong Federal leadership emphasizing the need for energy conservation. We believe our identification of these factors as primary impediments has been confirmed to a large extent by the comments made by some of the contractors and agencies that a coordinated national energy policy and financial incentives, such as investment tax credits, are needed to motivate and assist contractors to improve and expand their efforts to conserve energy.

Within recent months, two important actions have been taken by the administration and the Congress to more effectively deal with the Nation's energy crisis. These two actions were the issuance by the President on April 29, 1977, of a proposed National Energy Plan and the legislation that was signed on August 4, 1977, (Public Law 95-91, 42 U.S.C. 7101) creating the new Department of Energy. As discussed on page 34, the National Energy Plan contains proposals to provide tax credits for industry and business for investments in energy-saving equipment and conservation measures. We support these proposals.

The new Department of Energy was established by reorganization of energy functions within the Federal Government in order to secure effective management to assure a coordinated national energy policy. Under the legislatic , the Department was given the authority and programs necessary to foster, encourage, and--where appropriate--require energy conservation. In addition to the consolidation of conservation programs from the primary energy agencies (FEA and ERDA), the

Department acquired authority from Commerce for the Government's program to promote voluntary industrial energy conservation. This reorganization should help bring the Government's heretofore fragmented energy policies and programs into a structure capable of both developing and implementing an overall national energy plan.

We believe the two actions discussed above are a positive response to the issues raised by the contractors and agencies in their comments, and could have a direct and significant impact on alleviating or removing the barriers which our work indicates have impeded the development of viable energy management programs by Government contractors. We are concerned, however, whether these actions standing alone are sufficient and believe that the Government should develop an energy conservation-related procurement policy requiring contractors to establish energy management programs that adequately incorporate the following five program elements: (1) top management commitment, (2) development of comprehensive energy-use surveys, (3) goal setting based on survey evaluations, (4) employee motivation campaigns, and (5) monitoring program implementation and results. We believe a means should also be established for monitoring and evaluating the overall effectiveness of the contractors' energy management programs, including the actions that are taken in response to any new tax incentives that are provided for energy conservation purposes. We believe this could be accomplished by adopting a suggestion made by FEA that contractors be required to submit their energy conservation plans as a part of their proposals when bidding on Government contracts, and these plans could then be evaluated as a part of the source selection process. After contract award, the effectiveness of a contractor's energy management program could be evaluated against prescribed standards by the contract administrative services and the contract audit agency.

RECOMMENDATIONS TO THE DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET AND THE SECRETARY OF ENERGY

We recommend that the Director, Office of Management and Budget and the Secretary of Energy jointly develop an energy conservation-related procurement policy that requires Government contractors to establish viable energy management programs which include the five program elements previously listed. This policy should provide for contractors to submit their program plans as part of their contract proposals and for subsequent evaluation of the effectiveness of the program by contract administrative and audit agency personnel.

We also recommend that the Secretary of Energy establish reasonable energy conservation targets and goals for major Government contractors. Using information obtained by officials of the agencies responsible for awarding and administering the contracts, the Secretary should monitor the progress of the contractors' efforts toward achieving these goals. The Secretary should then report back to the Congress within 24 months on the progress being made and with recommendations as to whether any new financial incentives that are provided by the Congress for energy conservation are sufficient, or whether mandatory standards are necessary.

MATTERS FOR CONSIDERATION BY THE CONGRESS

Within the near future, a National Energy Plan is expected to be enacted which will contain financial incentives for industry to pursue with more vigor the conservation of our energy resources. We support the concept of investment tax credits as an incentive for achieving energy conservation in the industrial sector. The Federal agencies and contractors responding to our report believe that these incentives will be an inducement for contractors, and all of industry, to conserve more energy.

Because the Congress must ultimately decide whether voluntary or mandatory energy conservation programs are needed in industry, we believe that the Congress should maintain close oversight of any new programs and incentives it provides for industry in this area. We believe this could be accomplished by means of the report which we have recommended that the Secretary of Energy provide to the Congress. The Congress could include a specific requirement for this report in any legislation that is enacted to provide financial incentives for industrial energy conservation.

SCHEDULE SHOWING CONTRACTOR ENERGY USE AND COST INFORMATION FOR 1975 (note a)

APPENDIX I

Contractor	Energy type: Electricity (000 kwhs)	Energy type: Heating fuel (note c) (000 therms)	Total facility energy equivalent (note b): Therms (000)	Total facility energy equivalent (note b): Barrels of oil (000)	Total facility energy equivalent (note b): Energy cost (000)
1. Aerojet Solid Propulsion Company (note d) Sacramento, California	35,394	3,320	6,859	118	$ 1,325
2. Bell Telephone Laboratories Whippany, New Jersey	23,357	1,094	3,429	59	835
3. Control Data Corporation Aerospace Division Minneapolis, Minnesota	14,666	260	1,726	30	319
4. General Dynamics Fort Worth Division Fort Worth, Texas	113,780	14,102	25,480	439	2,520
5. General Electric Company Ordnance Systems Pittsfield, Massachusetts	31,664	1,573	4,739	82	1,110
6. General Electric Company Space Division Valley Forge, Pennsylvania	56,714	1,210	6,881	119	1,911
7. Goodyear Aerospace Corporation Akron, Ohio	32,971	3,668	6,965	120	1,363
8. Holston Defense Corporation (note e) Holston Army Ammunition Plant Kingsport, Tennessee	86,712	70,482	79,153	1,365	11,062
9. Honeywell Inc. Twin Cities Army Ammunition Plant New Brighton, Minnesota	23,721	1,448	3,820	66	902
10. Hughes Aircraft Company Ground Systems Group Fullerton, California	63,500	1,015	7,365	127	1,642
11. ICI United States, Inc. (note e) Indiana Army Ammunition Plant Charlestown, Indiana	18,760	2,962	4,838	83	843
12. Lockheed Missiles and Space Company Sunnyvale, California	210 488	4,614	25,663	442	4,306
13. Martin Marietta Aerospace Orlando Division Orlando, Florida	65,651	705	7,270	125	1,878
14. Rockwell International (note f) Columbus Aircraft Division Columbus, Ohio	78,447	8,608	16,453	284	2,855
15. Sperry Rand Corporation Sperry Division Great Neck, New York	33,084	1,833	5,141	89	1,522
16. TRW Inc. TRW Equipment Group Euclid, Ohio	98,713	4,357	14,229	245	2,584
17. TRW Inc. TRW Systems and Energy Group Redondo Beach, California	138,918	3,319	17,211	297	3,714
18. United Technologies Corporation Norden Division Norwalk, Connecticut	15,564	741	2,306	40	668
19. Vought Corporation Systems Division Dallas, Texas	150,101	10,622	25,632	442	3,311
20. Westinghouse Electric Corporation Electro-Mechanical Division Cheswick, Pennsylvania	31,872	564	3,752	65	747
Total	1,324,077	136,505	268,912	g/4,636	$45,497

a/The data shown is for calendar year 1975 except where otherwise noted. For these exceptions the data corresponds to a fiscal year basis as used by these contractors.

b/By total facility energy in equivalent therms, we refer to the combined consumption of electricity and heating fuel (converted to equivalent therms). In converting electricity usage to equivalent therms, we used the conversion factor of 10,000 Btu's equals 1 kwh, reflecting resource energy inputs at the powerplants. In converting to equivalent barrels of oil, we used the conversion factor for crude oil used by the Department of the Interior--5,800,000 Btu's per barrel.

c/Heating fuel is the sum, in equivalent therms (1 therm = 100,000 Btu's), of the fuels used in the facilities and includes, where applicable, fuel oil, natural gas, coal, purchased steam, and propane.

d/Data shown is on a fiscal year basis: December 1, 1974 - November 30, 1975.

e/Data shown is on a fiscal year basis: July 1, 1974 - June 30, 1975.

f/Data shown is on a fiscal year basis: October 1, 1974 - September 30, 1975.

g/Column does not add to total due to rounding.

STATISTICAL ANALYSIS

EXPLAINING VARIATIONS IN ENERGY USE

SUMMARY OF RESULTS

We performed a number of regression analyses[1] to estimate the relationships between total energy use and the area of the plant, the number of employees of the company, heating degree days, the relative price of energy (total cost of that energy divided by the total energy used), and a variable to measure the effect of the "voluntary energy conservation program."

Several of these variables were highly correlated, making it difficult to separate the effects of one from the other. This was true of plant area and employment and also of the price variable and the variable representing the "voluntary energy conservation program" in 1974 and 1975. Table 1 on page 47 shows that while the price variable was significant, the variable used to measure the conservation program was not when both were included in the same equation. On the other hand, the conservation program variable was significant when the price variable was not included in the estimating relationship. We analyzed electrical energy used and energy used for heating separately to eliminate the problem of correlation between employment and plant area. The results of these two analyses are summarized in the following table which lists the coefficients of the most significant estimated regression equations.

Variable	Electrical energy used	Energy used in heating
Employment	0.77	(a)
Energy price	-.53	-0.35
Area	(a)	1.21
Degree days heating	(a)	.50

[a]Not included in equation.

[1]A statistical technique that attempts to measure the relationship between a given variable (in our case energy use) and other variables of interest (area, employment, relative price, etc.).

APPENDIX II

These values can be explained in the following manner. The coefficient of 0.77 for employment in the electrical energy-use equation means that a 1-percent increase in employment, other things being equal, will result in a 0.77 [1]-percent increase in electrical energy use. A 1-percent increase in the price of electricity means a 0.53 [2]-percent decrease in energy used.

The sign of the price coefficient confirms economic theory that price increases reduce quantity consumed while price decreases would increase quantity consumed. These two examples should aid in interpreting relationships that are directly related (shown by a positive value) and those that are inversely related (shown by a negative value).[3] Other values in the chart have similar explanations.

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[1]The value of 0.77 is the best single estimate; however, a more precise statistical statement would be that we may be 95 percent confident that the value lies between 0.63 and 0.91.

[2]Similarly, for 95 percent confidence, the value lies between 0.23 and 0.83.

[3]Direct or positive relationship means that an increase in the independent variable results in an increase in the dependent variable, while a decrease in the independent variable results in a decrease in the dependent variable. An inverse relationship means an increase in the independent variable results in a decrease in the dependent variable, and a decrease in the independent variable results in an increase in the dependent variable.

TECHNICAL DETAILS

Initially, we used regression analyses to determine the relationship between overall energy consumption and employment, plant area, heating degree days, unit price of energy, and a variable to control for the effect of the voluntary program. Graphs of energy consumption plotted against the other variables (factors) indicated that some of the variables may vary nonlinearly with energy use. For this reason and the fact that the use of logarithms allows elasticities to be obtained directly from the coefficients of the regression equations, we primarily used natural logarithms of the data in our analysis.

Our analysis on a year-to-year basis indicated that some variables thought to be significant were not. We increased the sample size to 66 observations by pooling the data for the 18 companies for the 3 or 4 years where data was available. Whereas some of the variables were not statistically significant when estimated on a year-by-year basis, they become significant when estimated using the pooled data.

We found that some of our explanatory variables were highly correlated to each other as well as to energy use. For example, employment and area, two of the more important explanatory variables, are closely correlated. Also, unit price and the control variable for the volunteer program are closely related. This phenomenon makes it difficult to separate the impact of the different explanatory variables on energy use.

Separating the regression analysis into two equations, one representing electrical energy used and the other representing energy used for heating helped alleviate this problem. Further, it was logical to make this division since some of the explanatory variables relate only to either heating energy or electrical energy.[1]

To determine which variables contributed the most explanatory power to our equations, we ran a number of regressions in log form using different combinations of explanatory variables. The results are summarized in the following table.

[1]For example, heating degree days clearly correlates only with energy used for heating.

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TABLE 1

REGRESSION ANALYSIS RESULTS ON LOGARITHMIC VALUES USING THE LEAST SQUARES METHOD

Dependent Variable--Overall Energy Use

Equation No.	Constant	Area	Employment	Degree days heat	Price of energy	Program (note a)	R^2 (note b)
1	2.207	0.927	d/	d/	d/	d/	
	c/(4.76)	(14.85)					0.7751
2	2.673	d/	0.779	d/	d/	d/	
	(4.12)		(9.89)				.6045
3	1.569	.616	.246	d/	-0.465	d/	
	(3.63)	(7.03)	(3.10)		(-4.17)		.8430
4	1.866	.732	.231	d/	d/	-0.201	
	(3.91)	(8.08)	(2.67)			(-2.23)	.8140
5	2.274	.575	.213	-0.075	-.657	.178	
	(2.56)	(6.15)	(2.43)	(-1.18)	(-3.74)	(1.37)	.8504

Dependent Variable--Electric Energy Use

Equation No.	Constant	Employment	Price of electricity	Program (note a)	R^2 (note b)
1	1.885	0.821	d/	d/	
	(3.15)	(11.32)			0.6671
2	2.061	.811	d/	-0.177	
	(3.42)	(11.26)		(-1.50)	.6787
3	1.311	.769	-0.528	d/	
	(2.27)	(11.19)	(-3.43)		.7194
4	.982	.763	-.684	.161	
	(1.50)	(11.06)	(-3.21)	(1.06)	.7244

Dependent variable--Heating Fuel Use

Equation No.	Constant	Plant area	Heating fuel price	Degree days heat	Program (note a)	R^2 (note b)
1	-0.575	1.139	d/	d/	d/	
	(-.907)	(13.37)				0.7363
2	-5.931	1.208	-0.352	0.497	d/	
	(-6.38)	(15.77)	(-3.12)	(6.78)		.8509
3	-5.191	1.296	d/	.442	-0.246	
	(-5.54)	(17.87)		(6.09)	(-2.35)	.8416
4	-5.850	1.216	-.318	.492	-.435	
	(-6.01)	(14.89)	(-1.98)	(6.53)	(-.301)	.8511

a/Program-Dummy variable for "voluntary" program to start in 1974. 1972 and 1973 coded zero, and 1974 and 1975 coded 1. The program variable is not expressed as a logarithm.

b/R^2-A measure of the amount of variance in the dependent variable that is explained by variations of the independent variables.

c/Numbers in parentheses are T values--a value of 1.96 or larger indicates a statistically significant variable at the 95-percent level of confidence.

d/Variable not included in the equation.

Table 2

AVERAGE ESTIMATED ENERGY USE 1972, 1975

USING REGRESSION EQUATIONS (note a)

Electrical energy			Employment Coefficient		Amount		Price Coefficient		Amount		Total therms (in logs)	Total therms
1972	= 1.31 +	0.769	x	(8.72)	-	0.528	x	(-2.32)				
	= 1.31 +		6.71		+		1.22			=	9.24	10,301
1975	= 1.31 +	.769	x	(8.43)	-	.528	x	(-1.61)				
	= 1.31 +		6.48		+		0.85			=	8.64	5,653

Heating energy			Plant area Coefficient		Amount		Price Coefficient		Amount		Degree days heat Coefficient		Amount		Total therms (in logs)	Total therms
1972	= -5.93 +	1.21	x	(7.78)	-	0.352	x	(-3.01)	+	0.497	x	(8.08)				
	= -5.93 +		9.41		+		1.06		+		4.02			=	8.56	5,219
1975	= -5.93 +	1.21	x	(7.64)	-	.352	x	(-1.99)	+	.497	x	(8.20)				
	= -5.93 +		9.24		+		0.70		+		4.08			=	8.09	3,262

a/Average based on 12 firms in 1972, 18 firms in 1975.

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FEDERAL ENERGY ADMINISTRATION
WASHINGTON, D.C. 20461

March 29, 1977

OFFICE OF THE ADMINISTRATOR

Mr. Monte Canfield, Jr.
Director
Energy and Minerals Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Canfield:

Thank you for your letter of February 24, 1977, enclosing copies of the draft report to Congress on "Improvements Needed in Federal Agencies' Programs and Efforts to Promote Energy Conservation by Government Contractors."

I appreciate the opportunity to review and comment on the report and I agree with your general conclusions that:

-- Government contractors have taken specific energy conservation action; however, there are many opportunities for achieving further significant energy savings if viable energy conservation programs were established by all contractors in their plants.

-- The Government, through its procurement policies, can promote positive energy conservation actions by contractors.

-- Federal agencies should increase their efforts of disseminating energy conservation materials to Government contractors.

-- There is a need to develop uniform lighting guidelines and standards for use in commercial, public and industrial buildings.

APPENDIX III

In a few instances, I do have some concern about specific details in your recommendations. These are noted in the enclosed comments on the individual recommendations.

Your report will be most helpful to the Federal Energy Administration and other Federal agencies as we strive to develop measures to ensure that Government contractors use their energy more efficiently in the future.

Sincerely,

John F. O'Leary
Administrator

Enclosure

APPENDIX III

COMMENTS ON RECOMMENDATIONS

Recommendations: "We recommend that the Office of Federal Procurement Policy, in line with its statutory responsibility to provide overall direction of procurement and procurement-related policies:

> Work with the Federal Energy Administration, the General Services Administration, the Department of Defense, and other appropriate Executive Branch agencies in the development of an energy conservation related procurement policy and contract clause that would require Government contractors to establish viable energy management programs."
>
> "In developing this policy, give consideration to allowing contractors to share in the cost savings which accrue from the implementation of energy conservation opportunities."

Comments: We partially concur. It is our feeling that all segments of industry should have viable energy conservation programs. Requiring only Government contractors to have such programs severely limits the potential benefits as compared to an appeal to the entire industrial community. However, if such a requirement is decided upon, what constitutes a viable energy conservation program should be clearly defined. Once this has been established, contractors could be required to submit their energy conservation plans as a part of their proposals when bidding on Government contracts and these plans would be evaluated as a part of the source selection process. There are additional considerations, such as whether to exclude certain sizes or types of contracts, which would have to be explored and administrative decisions made in order to implement the recommendations. After contract award, the effectiveness of a contractor's energy conservation program could then be evaluated against a standard by the contract administrative services and the contract audit agency. The Federal Energy Administration (FEA) has worked with the Office of Federal Procurement Policy in the past on this subject and will continue to in the future.

We concur in that portion of the recommendation concerning sharing of energy conservation cost savings with contractors.

Recommendations: "We recommend that the Federal Energy Administration and the Department of Commerce:

Use Government contracting personnel in the Department of Defense, the General Services Administration, and other agencies to disseminate energy conservation publications and materials to contractors."

Comments: We concur in the intent of this recommendation. FEA has used this communication channel a few times in the past. It is a valuable channel, and we intend to make use of it in the future whenever we have publications and materials appropriate to this audience. The Government can also learn from industry. Government personnel who have access to contractor facilities should look for energy conservation techniques that could be used by Federal agencies. A good example of this type of information exchange has been in the vehicular area. Several Government agencies are incorporating in their operations some of the energy conservation techniques developed by Douglas Aircraft Company in their very successful vehicular energy conservation program.

Recommendations: "We recommend that the Federal Energy Administration:

Review the various lighting guidelines and standards that are currently in existence and develop national lighting guidelines and standards that can be easily understood and consistently applied in commercial, public and industrial buildings."

Comments: We concur in the intent of this recommendation. The several existing lighting standards are being reviewed by FEA, in conjunction with the National Bureau of Standards and the Energy Research and Development Administration, for development of a Federal lighting standard in response to the Energy Policy and Conservation Act (EPCA) requirements. Housing and Urban Development has been assigned responsibility under EPCA for development of national building standards. We believe promulgation of a lighting standard for commercial, public, and industrial buildings would be more appropriately done in conjunction with that work. In any case, implementation of the recommendation would require legislative authority if the standard were anything more than a guide for voluntary action.

Recommendations: "We recommend that the Department of Defense take action to improve its energy management program ...."

Comments: FEA has no direct interest affected by this recommendation. However, we have assisted the Department of Defense in its promotion of energy conservation programs in the past and will continue to do so in the future.

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

April 21, 1977

Mr. Monte Canfield, Jr
Director, Energy and Minerals
Division
General Accounting Office
Washington, D. C. 20548

Dear Mr. Canfield:

By letter dated February 24, 1977, Mr. R. W. Gutmann, Director, Procurement and Systems Acquisition Division, General Accounting Office, forwarded to this Office copies of a draft report entitled, "Improvements Needed in Federal Agencies' Programs and Efforts to Promote Energy Conservation by Government Contractors." Mr. Gutmann requested our comments on the draft report and advised that these comments could be referred to your Division.

The draft report has been carefully reviewed and evaluated. The initial recommendations enunciated in the draft report address the Office of Federal Procurement Policy (OFPP), an element of the Office of Management and Budget. The recommendations were (1) that OFPP work with other executive branch agencies to develop an energy conservation related procurement policy and contract clause requiring Government contractors to establish viable energy management programs, and (2) that in developing this policy, OFPP give consideration to allowing contractors to share in cost savings.

As you know, President Carter has moved to form a Department of Energy and to develop a comprehensive national energy conservation policy. It can be presumed that a sizeable portion of this policy, when developed, will address itself to energy conservation matters apropos of industry in general.

An essential benefit of such a national policy, in our judgment, is that it can be uniformly applied. It can be imposed industry-wide, not just on that segment of industry contracting with the Government.

The history of attempting to implement socio-economic objectives through the procurement process has been uneven and in many cases produced unsatisfactory results even

when backed by statutory requirements and concerted implementation efforts. This has been caused principally by (1) disparaties in business conditions created between industry as a whole and that minority which holds Federal contracts, and (2) because cost and benefits have been generally unknown, presenting questions over effectiveness and efficiency of government procurement as well as in pursuing the particular non-procurement objective. The Commission on Government Procurement, of which the Comptroller General was a member, reported that "the cumulative effect of programs already imposed on the procurement process and the addition of those contemplated could overburden it to the point of threatening breakdown." The conclusion is even more valid today.

Pending development of a national policy, we are pleased to advise you that the OFPP has been active and successful in implementing its responsibilities for those national policies that have been promulgated to assist energy conservation. On August 6, 1976 the Administrator for Federal Procurement Policy issued OFPP Policy Letter 76-1 to the Heads of Executive Departments and Establishments. This policy letter, which implements, in part, Executive Order 11912, requires that the principles of energy conservation and efficiency be adhered to where meaningful and practicable; e.g., in developing Government requirements and in source selection decisions. The Department of Defense will implement this policy in a soon to be released Defense Procurement Circular. A copy of the proposed Department of Defense implementation has been provided to the General Services Administration for implementation in its Federal Procurement Regulations.

On February 2, 1977, OFPP issued its Policy Letter 77-1, again to the Heads of Executive Departments and Establishments. This policy letter was issued in compliance with the Solid Waste Disposal Act, as amended by Public Law 94-580, the Resources Conservation and Recovery Act of 1976, enacted on October 21, 1976. The letter directed that Federal procurement be effected in a manner that maximizes the use of recovered or recycled materials.

Pending the development of a coordinated national policy for energy conservation with uniform industry-wide procedures; and pending further quantification of the cost and benefits for such socio-economic provisions, we do not support the recommendations directed to the OFPP but have directed the office to continue to aggressively look for opportunities to promote energy conservation.

The remaining recommendations in the draft report are addressed to other agencies or offices. These recommendations should be useful to those eventually charged with development of national energy conservation standards and programs.

Sincerely,

James T. McIntyre, Jr.
Deputy Director

APPENDIX V

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Administration
Washington, D.C. 20230

April 28, 1977

Mr. Monte Canfield, Jr.
Director, Energy and
Minerals Division
U.S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Canfield:

This is in reply to your letter of February 24, 1977, requesting comments on the draft report entitled "Improvements Needed In Federal Agencies' Programs and Efforts To Promote Energy Conservation by Government Contractors."

We have reviewed the enclosed comments of the Assistant Secretary-designate for Domestic and International Business and believe they are responsive to the matters discussed in the report.

Sincerely,

Elsa A. Porter
Assistant Secretary-designate
for Administration

Enclosure

APPENDIX V

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Domestic
and International Business
Washington, D.C. 20230

April 19, 1977

Mr. Monte Canfield, Jr.
Director, Energy and
Minerals Division
U. S. General Accounting Office
Washington, D.C. 20548

Re: GAO Report "Improvements Needed in Federal Agencies' Programs and Efforts to Promote Energy Conservation by Government Contractors"

Dear Mr. Canfield:

Enclosed is the response of the Domestic and International Business Administration to the above-referenced report.

We believe that the report makes several valuable recommendations but the report also, we feel, gives an unfair picture of the present Voluntary Industrial Energy Conservation Program (VIECP). The enclosed response treats those concerns in some detail.

Sincerely,

Frank A. Weil
Assistant Secretary-designate
Domestic and International Business

Enclosure

APPENDIX V

COMMENTS OF

DOMESTIC AND INTERNATIONAL BUSINESS ADMINISTRATION

DEPARTMENT OF COMMERCE

ON

DRAFT GAO REPORT

ENTITLED

"IMPROVEMENTS NEEDED IN FEDERAL AGENCIES' PROGRAMS AND EFFORTS TO PROMOTE ENERGY CONSERVATION BY GOVERNMENT CONTRACTORS"

Analysis of Draft GAO Report "Improvements Needed in Federal Agencies' Programs and Efforts to Promote Energy Conservation by Government Contractors"

The draft GAO Report "Improvements Needed in Federal Agencies' Programs and Efforts to Promote Energy Conservation by Government Contractors" is valuable and correct in a number of respects. It certainly shows a need for improvement in Government energy conservation efforts aimed at the type of company investigated: i.e., large companies--primarily in the aerospace industry--having defense procurement contracts. The study also suggests a specific and reasonable way to improve the dissemination of information to Government contractors about energy conservation by FEA and the Department of Commerce. This suggestion, which we intend to implement, is that this Department and the FEA should "utilize Government contracting personnel in the Department of Defense, the General Service Administration, and other agencies to disseminate energy conservation publications and materials to contractors." Also, by describing several instances in which Government contractors voluntarily implemented energy conservation measures whose value had been demonstrated by the investigators, the study gives practical and credible examples of the workability of voluntary energy conservation programs based on understanding rather than coercion.

On the other hand, insofar as the study purports to indicate that the inadequate energy conservation practices found were the result of the voluntary approach to energy conservation, it seems invalid, and reliance upon such evidence by the Congress may result in the premature abandonment of the voluntary approach to energy conservation. We do not suggest that mandatory measures are never appropriate, but only that they are a last resort, to be used where normal incentives such as the cost of energy, as well as the desire of

individuals and industries to promote the public interest, cannot be relied upon to accomplish the needed result. We also believe that a study limited to a few defense contractors is an inadequate basis upon which to assess the overall effectiveness of voluntary conservation programs.

[See GAO note 1, p. 63.]

A further skewing factor is the fact that about one-third of the firms in the sample were Government-owned, contractor-operated (GOCO) plants with respect to which there was a Government policy that placed a low priority on energy conservation projects involving capital expenditures As to these plants, the study noted: "Projects which were production related or those which were required to comply with environmental and safety regulations took precedence over energy conservation investments regardless of cost recovery periods." (See p. 48.) With such a sample, the study could be expected to show a need for improvement in energy conservation.

On page 34 it is stated that Government energy conservation programs and actions have had little effect at Government contractors' plants, and that " . . . the primary reason for this lack of impact is that the need for energy conservation has not been effectively emphasized and the agencies have relied on a voluntary energy conservation philosophy." The only evidence in the study that might be relevant to such an assertion is: (a) facts that show that companies in the group studied had not effectively implemented known conservation measures; and (b) a regression analysis purporting to indicate that, for the companies studied, increased energy costs were a more significant factor in promoting energy conservation than was the Government's voluntary conservation program.

[See GAO note 2, p. 63.]

As to the first of the above types of evidence, we note that one cannot conclude from data showing inaction on energy conservation--without more--that such inaction results from unwillingness to act where a company is aware of the potential benefits achievable. On the contrary, there are numerous instances recounted in the study (See, e.g., pp. 13, 14, 15, 18, 28 and 30) in which the contractors implemented measures suggested by the investigators as soon as they understood the magnitude of the savings that could be achieved. Also, in some cases involving GOCO plants, agency policies directly blocked management's intended implementation of conservation measures.

[See GAO note 1, p. 63.]

All of these impediments to the operation of natural cost reduction incentives--i.e., lack of understanding, Government agency policies which directly discourage investment in energy conservation investments at GOCO plants [See GAO note 1, p. 63.]

need to be removed before one can conclude that a voluntary approach to energy conservation cannot work.

The regression analysis is the other evidence relied upon to indicate the ineffectiveness of voluntary conservation efforts as compared to "economic factors" such as the rising cost of energy. Before addressing the analysis itself, I would like to point out a fallacy involved in the attempt to differentiate between "economic factors" and the response to voluntary conservation program efforts. The DOC and FEA programs have relied upon understanding of the cost effectiveness of energy conservation as a primary motivating factor, because there are large potential energy conservation possibilities that not only would serve the national interest, but would be demonstrably cost effective. Our programs have stressed the distribution of information and the conduct of seminars to promote understanding of these savings possibilities, which are often a direct function of the cost of energy. Thus, to "separate" economic considerations from the impact of voluntary conservation programs is fallacious.

However, the study purports to make just such a distinction, and to determine, using statistical techniques, which of these factors has contributed most to the degree of energy conservation actually achieved. (See p. 8.) Appendix III of the paper, at p. 6, shows that for the "voluntary program" factor, a dummy variable (set at zero and 1 for different periods) was used, even though it was recognized that the factor of energy price was "highly correlated" with the factor. The use of a dummy variable in such a situation

generally does not yield meaningful results. In the present case, where the variables are not only "highly correlated," but fundamentally the same, as discussed above, the result obtained would seem to be meaningless.

The study thus did not adequately analyse the reasons for the poor energy conservation programs found in the companies studied. Furthermore, while the study (p. 37) notes that a "wide range of Government procurement policy options are available to encourage contractors to conserve energy," these options are not outlined or discussed in any detail. Nor are options outside the procurement process discussed. It is merely stated, without explicit analysis: "We believe that a procurement policy requiring the development of energy management programs and a provision allowing contractors to share in the cost savings may be the motivation and incentive needed to assure timely realization of substantial energy savings."

For the above reasons, the study, while helpful in identifying certain problems, is inadequate in its analysis of both the causes of those problems and the effectiveness of alternative solutions involving changes in basic Government policies, either with respect to standard contract provisions or to fundamentally new approaches to energy conservation by the Government. The study would be greatly improved by the elimination of those sections either explicitly or implicitly recommending such basic changes until the deficiencies of the study and subsequent report have been remedied.

GAO notes:

1. Deleted comments refer to material contained in the draft report which has been revised or which has not been included in the final report.

2. Page references throughout this appendix refer to our draft report and may not correspond to this final report.

APPENDIX VI

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

DE
Manpower, Reserve
Affairs and Logistics

19 May 1977

Mr. Monte Canfield, Jr.
Director, Energy and Minerals Division
United States General Accounting Office
Washington, D. C. 20548

Dear Mr. Canfield:

This is in reply to a letter from Mr. R. W. Gutmann, Director, Procurement Division, GAO, dated 24 February 1977, to the Secretary of Defense regarding a draft report on "Improvements Needed in Federal Agencies' Programs And Efforts To Promote Energy Conservation By Government Contractors," GAC Code 950272, OSD Case #4558.

We appreciate the opportunity to review and comment on the draft report. The report will be most helpful as the Department of Defense and other Government agencies continue to develop measures to ensure that Government contractors use their energy more efficiently.

With regard to the specific recommendations concerning the Department of Defense (DoD):

- We concur that a viable energy program needs to be promoted to encourage private industry to make energy conservation investments in contractor-owned and contractor-operated plants.

- The Defense Contract Audit Agency (DCAA) has prepared an operations audit program for energy conservation that substantially expands our original adequacy test. This program incorporates the five program elements advocated by the Federal Energy Administration as outlined in the draft report and utilizes technical assistance from other DoD sources. It was programmed into our audit schedule in February 1977 for defense contractor locations having an auditable dollar value of $150 million or more. The program will also be accomplished at other locations as resources permit.

- Even though the Energy Conservation Investment (ECI) Program was developed for in-house facilities, we concur with the GAC recommendations that Government-owned Contractor-operated (GOCO) plants be included within the program. The Department of

the Army currently has a small number of ECI projects for GOCO facilities in the 1979 and 1980 programs. Next year's Planning and Programming Guidance Memorandum will provide the opportunity to accomplish more energy conservation projects in these facilities.

With respect to the recommendation that the Office of Federal Procurement Policy work with other agencies to develop a contract clause that would require Government contractors to establish viable energy management programs, we believe it would be impractical to develop a meaningful clause until such time as the cognizant Federal agencies develop the necessary energy standards.

Addressing the overall thrust of the report, it must be recognized that DoD is a promoter of industry energy management programs and is actively engaged in this effort with contractors. A copy of the latest Defense Logistics Agency (DLA) guidance to Defense Contract Administration Services Regions is at Enclosure 1. DLA will also continue to provide technical assistance to DCAA in their expanded energy audits.

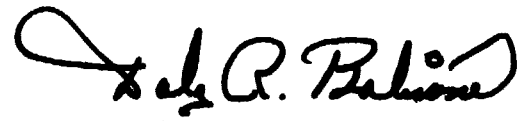
[See GAO note 1, p. 67.]

We concur that DoD can always improve its energy conservation effort with industry. However, the largest industrial users of energy are the basic material producers, i. e., aluminum, steel, castings, forgings, etc. DoD has very minor direct procurement from these elements of industry. Additionally, DoD procurement represents a relatively small portion of the average contractor's total business, so our procurement impact on the corporate energy management policy is of minor importance. Since energy usage is not generally susceptible to control or accountability on a contract by contract basis, meaningful conservation measures must emanate from plant or corporate policy.

It is our view that an effective industrial energy conservation program should emanate from the highest level of Government concerned with overall energy policy and management. This type program could be pursued with the "captains of industry" with the full force of major public policy and would include the total industrial community. Pending some movement of our Government in this direction, we feel the best approach for DoD in complying with existing guidance is to continue current promotional efforts with defense contractors.

Generally speaking, it is recommended that the savings and the voluntary efforts of the contractors visited be presented in a more positive fashion in the report, adding objectivity. Some suggested clarifications and corrections to the text are at Enclosure 2.

Sincerely,



DALE R. BABIONE
Acting Principal Deputy Assistant
Secretary of Defense (Logistics)

Enclosures (2)

APPENDIX VI

SPECIFIC COMMENTS ON THE REPORT

While the report stated defense contractors had made some conservation efforts, it does not fairly present the significant reductions reported on page 30. Energy costs at the 20 locations surveyed increased only 61.5 percent in the test period while unit prices for electricity and heating fuel increased 139 and 180 percent respectively. The observations on pages 7-9 (and Appendix III) relate to increases and decreases in energy consumption which correlate with conditions such as employment, conservation programs, energy cost, degree days and plant area. Although the energy use by these companies is affected by such factors, the information presented does not demonstrate that the significant reductions in energy consumption at the 20 locations were caused by decreases in employment. It is also noted that reduction in occupied plant area is a conservation opportunity exercised by many contractors as part of their conservation programs. The opinion expressed that an "observed decrease in annual energy use could be temporary and may disappear as the national economic climate improves" is related to the conclusions of the Department of the Interior reported on page 9 and not the 20 locations which GAO reports "may" have been influenced by changes in employment levels and plant area. A reader would have a serious misunderstanding that the voluntary programs of the 20 locations had little impact on the significant savings reported on page 30.

[See GAO note 2.]

[See GAO note 3.]

GAO notes:

1. The enclosure referred to in this paragraph has not been included as part of this appendix.

2. Deleted comments refer to material contained in the draft report which has been revised or which has not been included in the final report.

3. Page references throughout this appendix refer to our draft report and may not correspond to this final report.

Encl 2

APPENDIX VII

UNITED STATES OF AMERICA
GENERAL SERVICES ADMINISTRATION
WASHINGTON, DC 20405

April 20, 1977

Honorable Elmer B. Staats
Comptroller General of the United States
General Accounting Office
Washington, DC 20548

Dear Mr. Staats:

We have reviewed your Draft Report "Improvements Needed in Federal Agencies' Programs and Efforts to Promote Energy Conservation By Government Contractors", and have included our comments as an enclosure.

The General Services Administration completely supports the efforts to save energy in every way possible. We have demonstrated strong agency programs to save energy--in the design of new buildings, operation of existing buildings, motor vehicle management, appliance procurement and other areas. We are attempting to do more and are confident that we can save additional energy.

We appreciate the opportunity to submit our comments on this report.

Sincerely,

Robert T. Griffin
Acting Administrator

Enclosure

GSA FACT SHEET
Public Buildings Service
March 22, 1977

SPECIFIC COMMENTS ON RECOMMENDATIONS IN THE REPORT INVOLVING GSA

Recommendation, page 53 - The Office of Federal Procurement Policy (OFPP) should work with the FEA, GSA, DOD, and other appropriate Executive Branch agencies in the development of an energy conservation related procurement policy and contract clause that would require Government contractors to establish viable energy management programs.

Response - GSA will assist OFPP in developing appropriate parts of the policy action cited in this recommendation.

Recommendation, page 53 - Give consideration to allowing contractors to share in the cost savings which accrue from the implementation of energy conservation opportunities.

Response - GSA is operating a Value Management program in both of its largest procuring entities, the Public Buildings Service (PBS) and the Federal Supply Service (FSS). These programs recognize and reward cost savings and performance improvement, including energy savings.

Recommendation, page 53 - The FEA and Department of Commerce should utilize Government contracting personnel in the DOD, GSA, and other agencies to disseminate energy conservation publications and materials to contractors.

Response - GSA will take and/or continue several actions to increase the distribution of its energy conservation publications. We expect to:

- Continue the availability of GSA energy publications at our Regional Business Service Centers which are frequented by contractors and prospective contractors. To date, thousands of our publications, applicable to the building industry, have been provided to interested parties at a nominal fee, and provided to state and local governments at no charge.

- Encourage functional personnel to urge contractors to read and use our energy conservation publications.

- Consider distributing its energy conservation publications through the National Technical Information Service (NTIS), with the result that more organizations would become aware of their availability.

[See GAO note, p. 70 .]

- Continue to stress the importance of energy conservation through our regional energy conservation conferences. Since October 1976, more than 1,200 persons have attended GSA energy conservation seminars which have been held in Boston, New York City, Philadelphia and Washington. Instructions on how to request energy conservation information are presented at each conference.

- Continue incorporating building energy conservation guidelines in each architech/engineer contract.

- Work with trade and professional associations to promote energy conservation with their members.

Recommendation, page 53 - The FEA should review the various lighting guidelines and standards that can be easily understood and consistently applied in commercial, public and industrial buildings.

Response - GSA has made substantial progress in reducing the energy used for lighting in both new and existing buildings and stands ready to assist FEA in this matter, if desired. Existing legislation requires FEA to develop lighting efficiency standards.

GAO note: Page references throughout this appendix refer to our draft report and may not correspond to the final report.

PRINCIPAL OFFICIALS RESPONSIBLE FOR ADMINISTRATION OF ACTIVITIES DISCUSSED IN THIS REPORT

	Tenure of office	
	From	To
OFFICE OF MANAGEMENT AND BUDGET		
DIRECTOR:		
James T. McIntyre, Jr. (acting)	Sept. 1977	Present
Bert Lance	Jan. 1977	Sept. 1977
James T. Lynn	Feb. 1975	Jan. 1977
Roy L. Ash	Feb. 1973	Feb. 1975
DEPARTMENT OF ENERGY		
SECRETARY OF ENERGY:		
James R. Schlesinger	Aug. 1977	Present
OFFICE OF FEDERAL PROCUREMENT POLICY		
ADMINISTRATOR:		
Lester A. Fettig	May 1977	Present
James D. Currie (acting)	Feb. 1977	May 1977
Hugh E. Witt	Dec. 1974	Feb. 1977
FEDERAL ENERGY ADMINISTRATION		
ADMINISTRATOR:		
John F. O'Leary	Feb. 1977	Present
Gorman Smith (acting)	Jan. 1977	Feb. 1977
Frank G. Zarb	Dec. 1974	Jan. 1977
John C. Sawhill	May 1974	Dec. 1974
William E. Simon	Dec. 1973	May 1974
DEPARTMENT OF COMMERCE		
SECRETARY OF COMMERCE:		
Juanita Kreps	Jan. 1977	Present
Elliot L. Richardson	Feb. 1976	Jan. 1977
Rodgers C. B. Morton	May 1975	Feb. 1976
John K. Tabor (acting)	Mar. 1975	Apr. 1975
Frederick B. Dent	Feb. 1973	Feb. 1975

APPENDIX VIII

	Tenure of office	
	From	To
DEPARTMENT OF DEFENSE		
SECRETARY OF DEFENSE:		
Harold Brown	Jan. 1977	Present
Donald Rumsfeld	Nov. 1975	Jan. 1977
James R. Schlesinger	July 1973	Nov. 1975
GENERAL SERVICES ADMINISTRATION		
ADMINISTRATOR:		
Joel W. Solomon	May 1977	Present
Robert T. Griffin (acting)	Feb. 1977	May 1977
Jack Eckerd	Nov. 1975	Feb. 1977
Arthur F. Sampson	June 1972	Oct. 1975

(950272)