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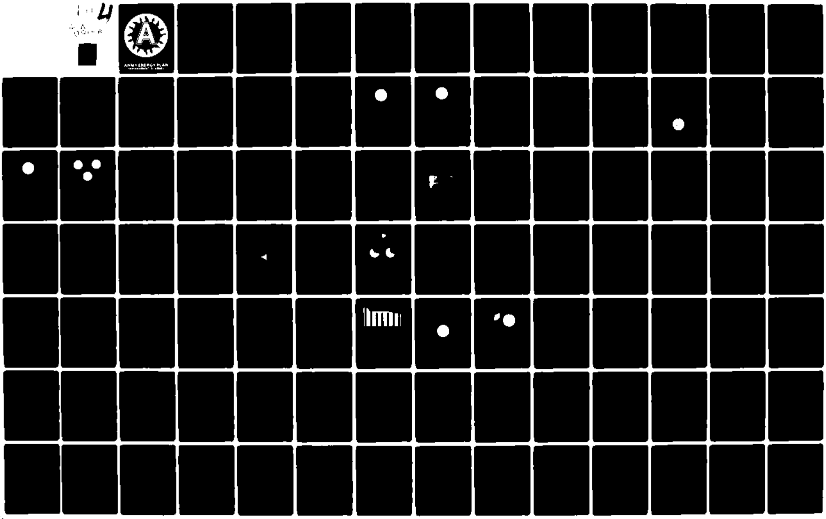

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ARMY ENERGY PLAN

DEPARTMENT OF ARMY

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Vol I

UNITED STATES ARMY

THE CHIEF OF STAFF

8 AUG 1980

The national energy posture has continued to deteriorate since the 1973 oil embargo. Our Nation and the Army continue to be highly dependent on high cost petroleum from foreign sources. The high energy costs that the Army must pay and the uncertainty of a secure energy supply are factors that have an impact on our ability to perform our mission. Although the Army has reduced its energy consumption more than 29 percent since 1973 and nine and one-half percent since 1975, it is important that we continue to manage our energy resources efficiently. A current, aggressive energy program is essential as we move into the decade of the 80's.

This Army Energy Plan provides you with the necessary guidance to ensure that the Army uses energy wisely and sparingly. Its purpose is to ensure that the Army maintains a high state of readiness in an uncertain energy environment. The plan anticipates the energy future, builds on current programs, and provides the opportunity to incorporate new technologies. Implementation of the Army Energy Plan at each level of command should include specific goals that work toward the total Army objectives. Once they are established, achievement will be measured against these goals. Total Army commitment to sound energy policies will reduce our vulnerability to limited external resources and enhance our ability to meet our national security obligations.

I challenge all commanders to reassess existing programs and to ensure that everything is being done, consistent with maintaining operational readiness, to reduce Army energy consumption.

E C Meyer

E. C. MEYER
General, United States Army
Chief of Staff

FOREWORD

This Army Energy Plan has been prepared by the Army Energy Office. Assistance and guidance were provided by the Advisory Group on Energy, the Army staff, and the US Army Logistics Evaluation Agency. It portrays the world, national, and Department of Defense energy environment within which the Army must operate. The plan identifies current and long-term objectives and goals for the Army. It summarizes those existing and new Army programs which will be necessary to accomplish those goals and objectives. To the extent possible, costs have been identified. Energy consumption and costs have been projected to the year 2000. It is implicit in the publication of this plan that the major commands and the Army staff will develop the detailed implementation plans that collectively will result in the achievement of the energy goals established herein. Further reproduction and distribution of this document is authorized and encouraged. Comments and/or recommendations concerning this plan should be forwarded to the Army Energy Office, Headquarters, Department of the Army, Office of the Deputy Chief of Staff for Logistics, Attention: DALO-TSE, Washington, DC 20310.

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CHAPTER Page

SUMMARY

The Army Energy Plan describes the current and projected (to the year 2000) energy situation in which the Department of the Army (DA) must operate and summarizes those actions and programs which have been developed and/or are needed to cope with those conditions. It addresses the Army goals, objectives, policies, and programs for all Army activities.

BACKGROUND.

World situation. World industrial growth during the past century has been characterized and hastened by the widespread availability of inexpensive energy, primarily petroleum. The Arab oil embargo of 1973 served to drive home a number of points, key among them being that the world's principal oil consumers are not the major oil producers. The Middle East and Africa have an estimated 67 percent of the petroleum reserves while Western Europe and the Western Hemisphere have only 16 percent. By most estimates, these reserves are expected to be exhausted within the next 70 years. In the year following the 1973 oil embargo, prices for petroleum rose threefold, signaling the end of cheap oil. In the decade of the seventies, the price of imported crude oil has risen from $1.80 per barrel to an exhorbitant $30.00 per barrel. The combined threats of exhaustion and high cost mandate the use of alternate sources of energy. The distribution of alternate sources of recoverable oil, such as tar sands and oil shale, favor the Western Hemisphere, but economical recovery techniques have not been developed.

The United States situation. The United States (US), with only 6 percent of the world's population, consumes more than 30 percent of the world's energy. It uses more energy per dollar of gross national product (GNP) than any other industrialized nation. Petroleum is used primarily for transportation; coal is used principally for electric utilities and industry; and natural gas is preferred for residential heating and some industrial uses.

Petroleum production in the United States reached its peak in 1970 and is declining. As a result, in 1979 the United States imported approximately 50 percent of its requirements. Many analysts predict that US petroleum reserves will be exhausted before the year 2000, thereby creating a significant potential problem for the Department of Defense (DOD). Coal constitutes 81 percent of the US energy reserves but supplies only 18 percent of the energy consumed.

ENERGY OBJECTIVES, STRATEGIES, GOALS, AND ORGANIZATION.

Objectives and goals. The national energy strategy is reflected in the following objectives established by the President on 29 April 1977 in the National Energy Plan (NEP I) and reinforced in May 1979 in NEP II.

a. In the near term, to reduce dependence on foreign oil and to limit vulnerability to supply disruptions.

b. In the midterm, to keep US oil imports sufficiently low to weather the eventual decline in the availability of world oil supplies caused by capacity limitations.

c. In the long term, to develop renewable and essentially inexhaustible sources of energy for sustained economic growth.

Some of the key specific national goals cited by the President, to be accomplished by 1985, are as follows:

a. Reduce energy usage growth to 2 percent per year.

b. Reduce gasoline consumption by 10 percent.

c. Increase coal production by two-thirds.

d. Use solar energy in 2-1/2 million homes.

e. Reduce energy consumption in Federal buildings by 20 percent per square foot in existing buildings and 45 percent per square foot in new buildings based on an FY 75 consumption.

Organization. The Department of Energy Organization Act, approved 4 August 1977, established the Department of Energy (DOE) to become effective 1 October 1977. This act provided for the consolidation and coordination of energy and energy-related functions of the Federal Energy Administration (FEA), the Energy Research and Development Administration (ERDA), and other Federal agencies under the new department. The organization for energy within DOD consists of a Directorate for Energy Policy under the Deputy Assistant Secretary for Energy, Environment, and Safety (DASD (EES)).

THE ARMY ENERGY SITUATION.

Department of Defense. The DOD consumes 1.85 percent of the nation's energy but consumes approximately 2.5 percent of the total petroleum used by the United States. DOD established the following energy conservation goals.

FY 74 - 7 percent savings over FY 73

FY 75 - 15 percent savings over FY 73

FY 76-79 - 0 percent growth over FY 75

All of these goals were achieved.

Army goals and objectives. Initially the Army was operating under the following energy management objectives which were in effect through FY 77:

a. Conserve energy while maintaining readiness.

b. Maintain zero growth based on FY 75 total energy consumption.

c. Maintain a supportive and cooperative role with designated national energy authorities in the development of new energy sources.

After reviewing the entire energy situation looking to the year 2000 and in consideration of the Presidential goals, the Army Advisory Group on Energy (AGE) adopted some Army goals and objectives that were ambitious and far reaching. These goals and objectives were revised in October 1979 as shown below:

a. Reduce energy consumption by 35 percent by the year 2000.

o Reduce energy consumption in mobility operations 10 percent by FY 85 from the FY 75 consumption level and maintain zero growth from the FY 85 level of consumption to the year 2000.

o Reduce energy consumption in facilities operations 20 percent by FY 85 from the FY 75 consumption level and an additional 20 percent for a total of 40 percent by the year 2000.

o Emphasize energy conservation education/information and incentive programs for all civilian personnel and military personnel and their dependents.

b. Reduce dependence on nonrenewable and scarce fuels by the year 2000.

o Develop the capability to use synthetic gases to reduce the dependence on natural gases; reduce the use of natural petroleum fuels in facilities operations 75 percent by the year 2000.

o Develop the capability to use synthetic or alternate fuels for mobility operations petroleum requirements by the year 2000.

o Increase efficiency of nonrenewable energy dependent mobility systems 15 percent.

c. Attain a position of leadership in the pursuit of national energy objectives.

d. Achieve the above goals without degrading the readiness of the force.

<u>Organization for energy</u>. The organizational elements within the Army for energy are a Special Assistant for Energy within the Office of the Assistant

Secretary of the Army (Installations, Logistics, and Financial Management) (ASA (IL&FM)), the Deputy Chief of Staff for Logistics (DCSLOG), the Army Advisory Group on Energy composed of general officers or civilian equivalent representatives from Army Staff agencies, and the Army Energy Office. The Army Energy Office is located within the Directorate for Transportation, Energy, and Troop Support of the Office of the Deputy Chief of Staff for Logistics (ODCSLOG) and is charged with overall responsibility for supervising and coordinating the Army Energy Program. The Chief of Engineers is responsible for the facilities energy programs at Army installations and the Deputy Chief of Staff for Research, Development and Acquisition is responsible for energy research and development.

Requirements and costs. The Army's share of DOD energy consumption is 18 percent. Of that amount, 83 percent is consumed in installation or facility operations and 17 percent in mobility operations. Between FY 73 and 75 the Army reduced its consumption by 23.6 percent or a total of 83.7 trillion British thermal units (Btu), exceeding the DOD goal by 8.6 percent. In FY 75 the Army consumed 270.9 trillion Btu of energy at a cost of $545 million. In FY 76 and 77, despite yearly reductions of approximately 5 percent in consumption compared with FY 75, the costs exceeded $600 million. The FY 79 cost was over $900 million despite an overall 9.5 percent reduction. If the Army were to maintain the FY 79 level of energy consumption to the year 2000, the cost of energy for that year would be expected to exceed $11.5 billion. On the other hand, if the Army meets its newly adopted goals of reducing overall energy consumption 35 percent, the costs would be expected to be $7.6 billion in FY 2000 resulting in a cost avoidance of $3.9 billion. The estimate for total cost avoidance for the period between FY 79 and 2000 would be in excess of $24 billion. It is proposed that the Army use this cost avoidance in support of the funds needed to develop the Army programs to meet its goals and objectives.

THE ARMY'S ENERGY PROGRAMS.

The Army has operated an extensive energy conservation program with the overall objectives of conserving energy while maintaining force readiness. The program is concentrated in the areas of installation operations, mobility operations, training, and research and development. The Army's activities in each of the above areas, including changes required to meet the long-range goals, are summarized below and are discussed in greater detail in the main body of this plan.

Installation operations. The Army is currently conserving energy in installation operations by such means as reducing heating temperatures to 65^{o} F and cooling temperatures no lower than 78^{o} F in working and living areas, increasing insulation, keeping windows and doors closed, reducing lighting levels, consolidating activities, reducing water temperature levels, and fine tuning equipment for better efficiency. In the near term (FY 80-85) the Army will concentrate on its goal of reducing energy consumption 20 percent by 1985. This goal goes beyond the Presidential, National, and DOD energy reduction goals. Energy Conservation Investment Program (ECIP) and Energy Conservation and Management (ECAM) projects are expected to accomplish at least 12 of the 20 percent reduction goal while the remaining 8 percent is to be achieved through improved energy management. In order to meet its long-term goal of a 40 percent reduction in energy consumption in facility operations, the Army will be conducting comprehensive Energy Engineering Analysis Programs, and testing alternate sources of energy such as solar, biomass, and refuse-derived fuel. By the year 2000, it is expected that about 17 percent of the Army's real property will be replaced with new buildings employing more energy efficient design. Programs for the period will be concerned with innovative construction methods, improved utility systems, energy efficient retrofit of existing buildings, and better management of energy.

Mobility operations. In mobility operations, conservation of energy is achieved through adherence to the 55 mph speed limit and improved petroleum, traffic, and transportation management. Actions such as converting the sedan fleet to compact vehicles and moving heavy equipment on higher mile per gallon transports are expected to significantly reduce fuel consumption in order to meet the 10 percent reduction goal. In the mid- and long-range periods, the greatest challenge faced by Army mobility programs is to maximize fuel economy with no degradation in the state of readiness. Future programs will ensure that vehicle and other fuel consuming equipment under development have fuel economy as an evaluation factor included among established source selection criteria. In the long range the Army will move toward the utilization of electric powered vehicles to the maximum extent for administrative purposes and explore the use of synthetic fuels in order to achieve the Army goal to develop the capability to use alternate or synthetic fuels.

Training. Measures which are being used by the Army to conserve energy in training include consolidating field and firing range training, incorporating conservation into individual and unit training, utilizing dismounted troop movement when feasible, and leaving equipment on site while troops return to garrison by bus or truck. Another key program is the increased use of simulators, simulations, and other training devices. These programs will continue to be pursued vigorously in the near term and at this time appear to offer the best opportunity for savings in training energy consumption in the long-range period with no degradation in the state of readiness.

Research and development. Research and development (R&D) efforts by the Army include cooperative programs with the DOE, the Navy, and the Air Force and the monitoring of commercial developments and demonstration projects in addition to Army initiated research and development.

In the mobility operations area, efforts are directed toward new or improved aircraft and ground propulsion systems and alternate energy fuel sources. New initiatives involve research into fuel savings through improvements in engines and transmissions as well as in fuels and lubricating oils. In order to meet the Army's long-range goals of reduction in energy consumption and dependence on petroleum fuels, Army research and development will concentrate on new engines of improved efficiency capable of using synthetic and alternate fuels.

In the facility or installation operations area, R&D efforts are directed toward providing technology on energy conservation, alternate energy sources, and management of energy resources so as to minimize the impacts of the rising cost of energy and scarce fuels on the Army's readiness and training mission. On-going research includes computer aided evaluation of building energy loads and energy carrier, storage, and distribution system concepts. A data system is being developed to predict, report, and analyze energy consumption. Procurement specifications for solar energy systems for heating, cooling, and hot water are being developed. Other R&D efforts in alternate sources include biomass, waste derived fuel, and coal conversion. Control systems will provide tools for basewide energy management. New conservation techniques as well as improved energy and utility systems are needed to accomplish the President's goals for a 20 percent per square foot reduction in energy consumption in existing buildings and a 45 percent per square foot reduction in energy consumption in new construction. To meet the Army's long-term objective of a 40 percent reduction in energy consumption in installation operations will require an extension into all aspects of energy systems research. Conversion technology will have to be closely examined to develop the capability to use synthetic gas and reduce the use of petroleum heating fuels 75 percent by the year 2000.

Public Affairs. The Office of the Chief of Public Affairs (OCPA) has included "Energy Awareness" as part of its Annual Command Information Plan each year since 1977. The objectives of this plan are to make the Army audience aware of the importance of energy conservation and of the individual's responsibilities in this regard. This audience includes Active and Reserve Army, National Guard, civilian employees, retirees, and dependents which comprise a total audience potentially as large as 35,000,000. In addition, a Public Affairs Plan has been prepared to support the Army Energy Plan and the implementation of Army energy programs and policies designed to meet the Army's near-term and long-range energy goals. This plan provides for the dissemination and circulation of informational materials and outlines the responsibilities of OCPA, DA Staff agencies, and the major commands.

THE SECRETARY OF THE ARMY ENERGY CONSERVATION AWARD.

The Secretary of the Army will annually present awards to recognize the energy conservation achievements at an installation in each of the following categories: Active Army, Army National Guard, and Army Reserves.

FEDERAL ENERGY LEGISLATION.

A summary of the energy legislation, both proposed and enacted by the US Congress, of the greatest interest to the Army is provided in chapter 5. These have been selected from over 100 pieces of energy legislation which have been enacted by Congress since the 1973 oil embargo. The major thrust of this legislation has been to encourage conservation and to reduce dependence on foreign sources.

CHAPTER 1

BACKGROUND: WORLD AND UNITED STATES ENERGY SITUATIONS

1.1 WORLD ENERGY SITUATION.

1.1.1 Historical Perspective. Global industrial and economical growth has been primarily driven by the unrestricted and expanding availability of energy. From a historical perspective, the harnessing of waterpower was the harbinger of the Industrial Revolution, but it has been energy in the form of fossil fuels used in steam and combustion engines that truly revolutionized our industrial capabilities. With seemingly endless supplies of wood, surface coal, yet untapped subsurface coal, and the discovery, starting in 1859, of underground "oceans" of crude oil, the global energy situation early in the 20th century could only be termed ideal.

Crude oil in the form of petroleum and its byproducts eventually proved to be the most efficient and cost-effective energy resource worldwide. Since 1918, the annual increase in world petroleum production has averaged 6.7 percent. It is important to note, however, that it was the industrialized world, represented primarily by Western Europe and the US, that provided the impetus for increased petroleum production for nearly half of this century. Petroleum consumption increased as industrial and economic activity increased throughout the world. In fact, recent worldwide changes in the GNP and petroleum consumption have a close correlation (figure 1-1).

1.1.2 The Global Energy Crisis. In October 1973, the world was subjected to a selective political denial of petroleum by an oil embargo by some of the major producing nations. This embargo on crude oil exports to Western Europe and the US from the Organization of Arab Petroleum Exporting Countries (OAPEC), following the Mideast conflict of late 1973, led to mandatory

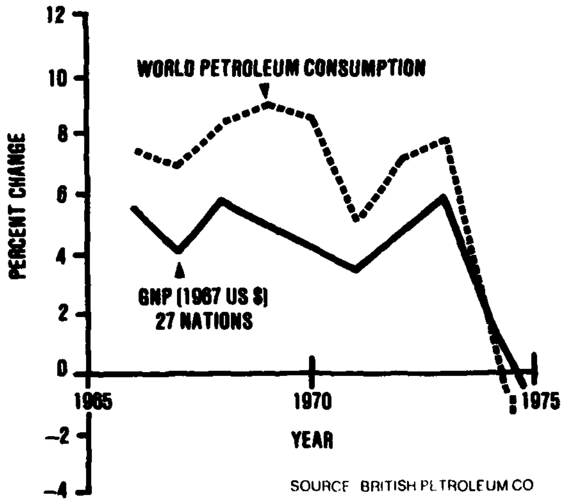


Figure 1-1. CHANGES IN PETROLEUM CONSUMPTION AND GNP APPROXIMATED FOR THE WORLD

curtailment of activities and in turn to lower petroleum consumption throughout the Western World.

An immediate effect of the embargo was a threefold increase in the price of imported petroleum from 1973 to 1974. Oil constitutes about 46 percent of the world's primary energy consumption (figure 1-2). Therefore, the energy problems for the world's industrialized nations are most severe when oil supplies are cut off. Due to this reliance on oil, the world's economic balance soon faltered. This manifested itself in a general slowdown in the tempo of international business and industrial production and unprecedented increases in the rates of unemployment and monetary inflation.

The economic crisis was somewhat abated by the lifting of the embargo in March 1974, but the world suddenly became aware of the harsh realities of a new era of energy supply and demand. In the decade of the seventies the Organization of Petroleum Exporting Countries (OPEC) benchmark price for crude oil rose from

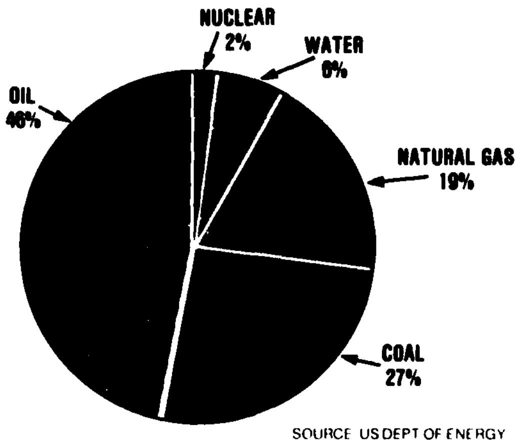


Figure 1-2. WORLD ENERGY CONSUMPTION

$1.80 per barrel on January 1, 1970, to $30.00 per barrel on December 31, 1979. This constitutes an exhorbitant 1500 percent rise in price. The problems of energy supply interruptions have not abated in the US since then. Domestic coal production came to a standstill during the 1976 coal miners' strike. In the winter of 1978-79 the Iranian revolution halted that nation's oil exports, creating yet another shortfall in the world oil supply. Supply interruptions, inadequate allocation of crude oil and shortages of products based on crude oil have begun to be the rule, rather than the exception.

1.1.3 <u>The Global Energy Predicament</u>. While the crisis of 1973 was politically motivated, the real issue with respect to the world's energy situation lies in the fact that the principal oil consumers are not the major oil producers. Geographical distribution of proved and probable crude oil reserves, estimated by the US Department of Energy, places 67 percent of the world's oil in the Middle East and Africa. The combined reserves of the entire Western Hemisphere, along with Western Europe, make up only 16 percent of the world's

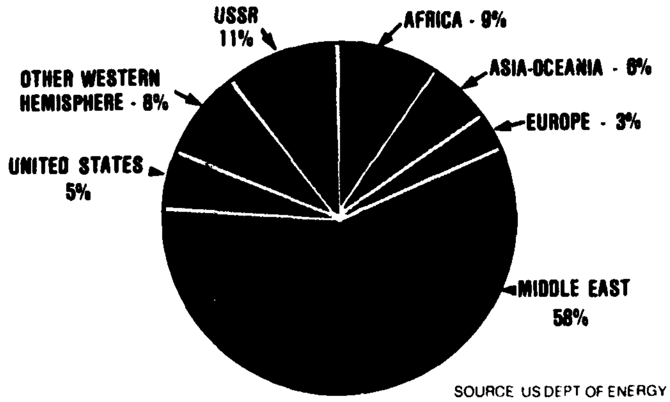


Figure 1-3. DISTRIBUTION OF ESTIMATED, PROVED, AND PROBABLE WORLD PETROLEUM RESERVES

total reserves. The US has a mere 5 percent of the total (figure 1-3). The long term energy predicament is that oil reserves are nonrenewable. Crude oil-based fuels will cease to be economically available in the future. Thus, alternative forms of energy will soon become a necessity. This fact of impending exhaustion is also true for natural gas and in the longer term, coal.

1.1.4 World Oil Depletion. The oil depletion date is the time when the available resources are below the amount necessary to maintain existing world consumption patterns. This constitutes a shortfall in supply. The exhaustion date is when the world has consumed the total of present and ultimately discovered, recoverable oil reserves. As oil reserves are depleted, production can be expected to decline. Theoretical exhaustion dates have been projected based on the length of time that varying levels of production and consumption rates could continue until oil supplies have been totally exhausted. The various estimates of future consumption and the remaining reserves available are no more than informed opinions. New extraction techniques, changing oil prices, conservation measures, and national growth and consumption rates are among the many parameters which, when varied, provide differing theoretical exhaustion dates. Estimates of proven reserves vary for similar reasons. Consequently, a broad range of estimates of both proven and theoretical reserves have been examined.

Four alternative oil consumption growth rates have been used to determine possible exhaustion dates (figure 1-4). The shaded area represents the Energy Research and Development Agency's (ERDA)[1] 1976 estimated spread of total oil resources available. The ERDA upper limit represents the greatest amount of oil resources that are estimated to exist. The ERDA lower limit represents the least

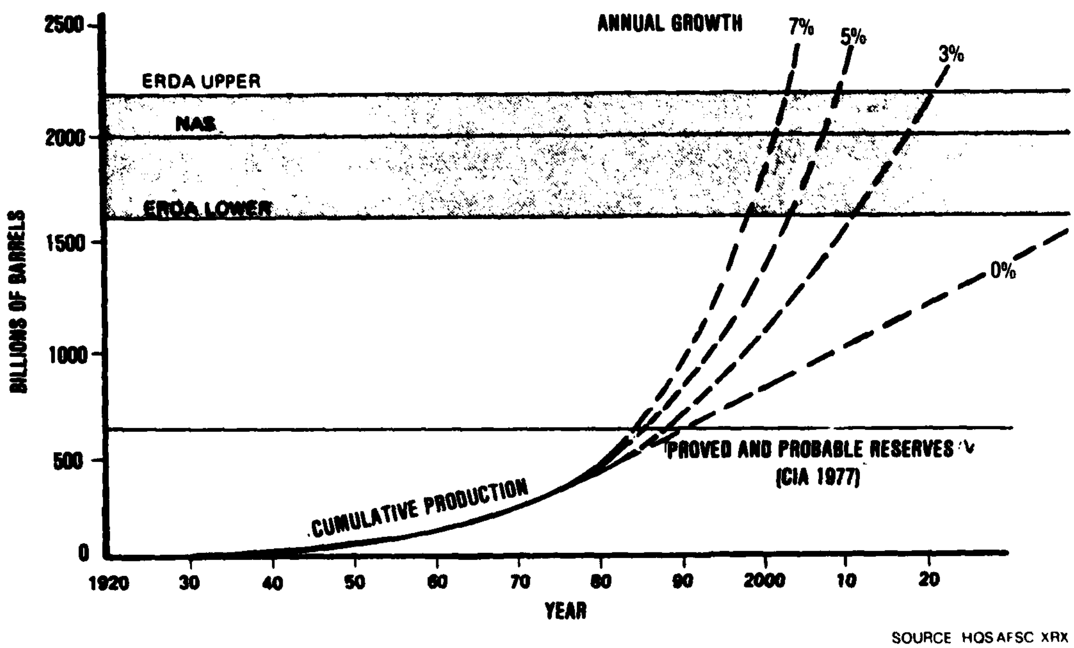


Figure 1-4. USE OF WORLD PETROLEUM RESOURCES

[1]ERDA became part of the Department of Energy (DOE) in 1977.

amount of petroleum reserves considered to exist. The dark line within the shaded band represents the 1975 estimate of the National Academy of Sciences.

It is significant to note that the exhaustion dates are relatively insensitive to reduced growth rates. The difference between exhausting the shaded upper and lower bounds of the ERDA predicted exhaustion rate vary by about 5 to 10 years, depending upon the growth rate assumed. Reducing the historical growth (6.7 percent) to 5 percent would delay exhaustion by about 5 to 6 years, with exhaustion occurring between the years 2000 and 2010. Using a 3 percent growth rate, exhaustion would occur no later than 2020. By these extrapolations even if zero growth in consumption could be achieved, worldwide supplies would be totally exhausted by the middle of the next century.

Both the ERDA and the CIA estimates of proven reserves indicate that about half of the total resources have already been found. If, however, no new oil were discovered, these reserves could be exhausted from as early as the mid-1980s to the early 1990s. The unlikelihood of this occurring, however, is demonstrated by the available projections of world production (figure 1-5). Current world production is approximately 22 billion barrels per year, and it is expected to peak at about 40 billion barrels per year (paragraph 1.2.3) in the 1990s. Thereafter, as total predicted reserves are depleted, production is expected to decrease.

1.1.5 <u>Alternative Sources of Oil</u>. Oil shale and bituminous tar sands both contain considerable amounts of recoverable oil. In 1979, the world total oil recoverable from oil shale was estimated by the Institute of Gas Technology (IGT) to be 1.9 trillion barrels. Of this total, it is estimated that 54 percent can be found in the US, 81 percent in the Western Hemisphere, with Western Europe having much of the remainder at 9 percent. Estimated oil deposits in oil shale

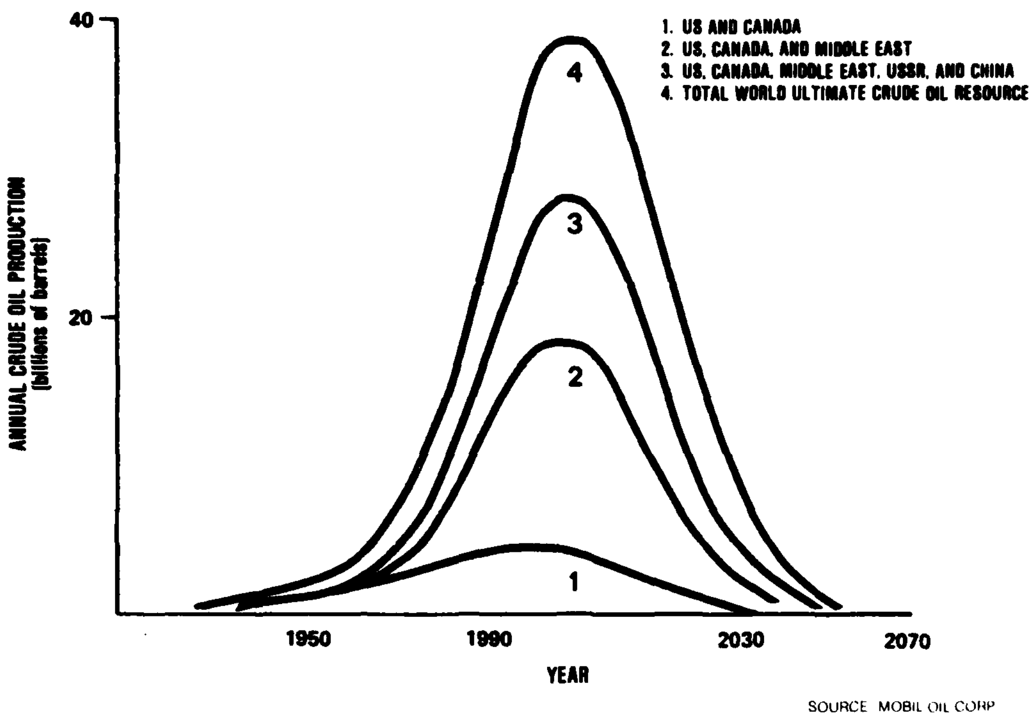


Figure 1-5. PRODUCTION OF PETROLEUM

exceed DOE's conservative estimate of total recoverable world crude oil from conventional wells. Currently, extraction costs of oil from shale are not competitive with the extraction costs of crude oil from oil wells. Environmental objections to the excavation of oil bearing shale arise in three areas:

a. To produce 1 barrel of oil 1.22 tons of shale must be excavated.

b. Oil extraction increases the bulk of the shale 20 to 30 percent creating a disposal problem.

c. The left-over rock could release alkaline salts into water systems thus threatening local agriculture.

The insitu process of crude extraction avoids most of the environmental objections and once developed may be the most desirable of the extraction methods. However, as conventional oil supplies are depleted and costs rise markedly, the oil shale alternative will become increasingly attractive and economically viable. Recovery of oil from tar sands has similar restrictions and problems attendant to oil shale recovery. The Western Hemisphere has the bulk (more than 90 percent) of the total estimated available oil from tar sands (500-1,000 billion barrels of oil).

1.1.6 Natural Gas Resources. Natural gas is usually found in the geographic vicinity of oil bearing formations. Its geographical distribution is therefore similar to that of crude oil. The CIA estimates that total-proved, and probable, world natural gas reserves currently stand at 74.4 trillion cubic meters (figure 1-6). This is the equivalent of 470 billion barrels of oil. Estimates of ultimately recoverable natural gas vary as widely as those for petroleum reserves. Expected exhaustion dates for natural gas follow a pattern similar to

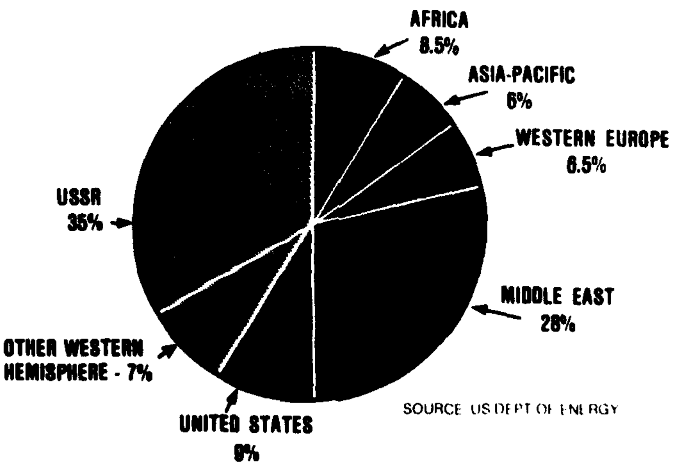


Figure 1-6. DISTRIBUTION OF ESTIMATED, PROVED, AND PROBABLE WORLD NATURAL GAS RESERVES

those for petroleum, with practical exhaustion expected, even under ideal circumstances, no later than the year 2070.

It is noteworthy that while geographical distribution is generally similar to that for crude oil, the Soviet Union has a much larger percentage of estimated, world-proven, and probable, gas reserves (35 percent), than was shown for its share of oil reserves (11 percent). The US has only 9 percent of proved world gas reserves. Although the free world (non-communist) has 63 percent of total gas reserves, it is significant that natural gas is transported in bulk most efficiently by pipeline. Thus, the US can rely less on inexpensive natural gas to supplement its future energy needs than can the Soviet Union which has large domestic gas reserves and can make extensive use of inland gas pipelines. The US on the other hand must look to alternative sources of gas which require more expensive and complicated processes. Such alternative sources include coal gasification, biomass conversion, tight sands and Devonian shale.

1.1.7 Coal Resources. Over one-half of the world's recoverable fossil energy is in the form of coal. Coal consumption, however, accounted for less than one-third of world energy consumption in 1978. The majority of the world's coal deposits are in the industrialized Western nations. Currently, only the communist countries use coal as their predominant energy source. Conversion from oil to coal use in Western nations is expected to increase in the near future. Resolution of problems concerning environmental impacts of coal mining are currently being acted upon. One major environmental issue involved is the costly reclamation of landscape which has been strip- or surface-mined. Also, coal with high sulfur content poses considerable threat to air quality. Sulfur can be substantially eliminated from coal, but the process is costly. In addition, eliminating particulate matter released into the air by burning coal requires a special scrubbing process which is also expensive.

1.2 UNITED STATES ENERGY SITUATION.

1.2.1 Roots of the US Energy Problem. The energy problem in the US stems from the Nation's dependence upon one of its least abundant energy resources to provide for most of its energy needs. Since 1900, for its energy needs the US has switched from over 75 percent coal usage to over 75 percent dependence on oil and gas (figure 1-7). However, crude oil and natural gas account for only 6.6 percent of the US proven recoverable reserves (figure 1-8).

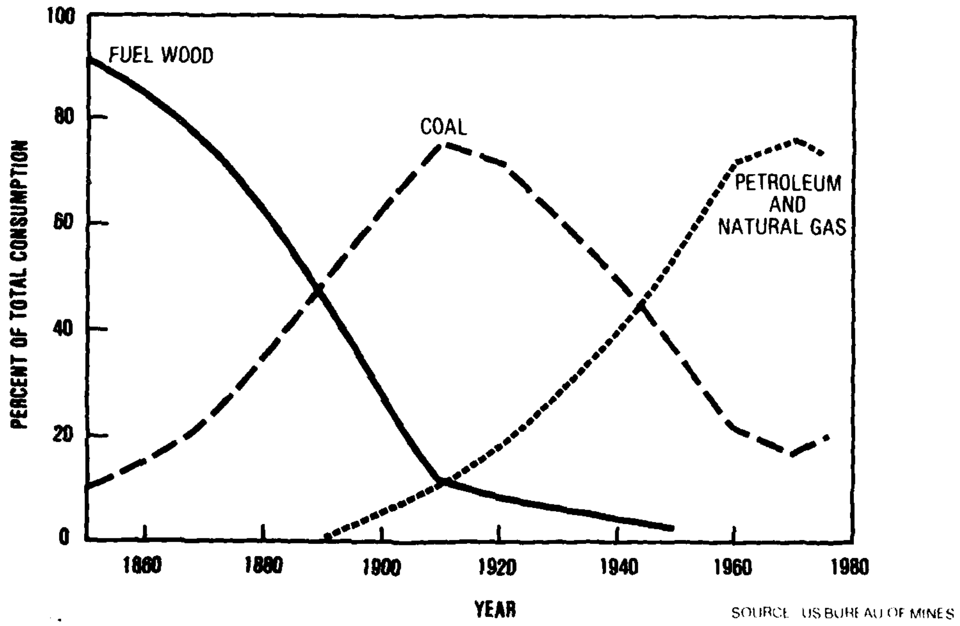


Figure 1-7. UNITED STATES SHIFT IN FUEL USE PATTERNS

From 1950 to 1970, energy costs decreased 28 percent. Inexpensive oil imports grew from 900,000 barrels per day in 1950 to 3.4 million barrels per day

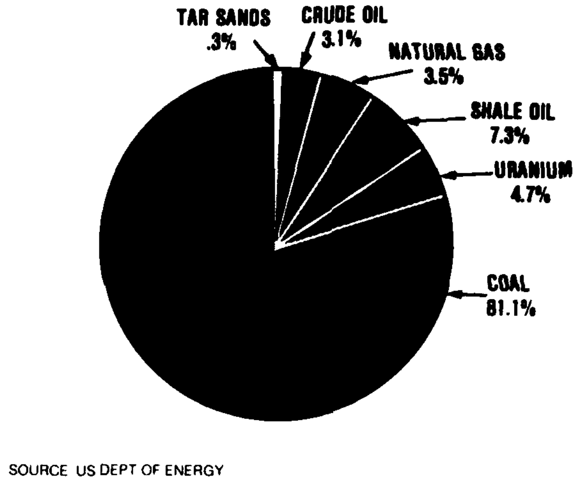


Figure 1-8. DISTRIBUTION OF RECOVERABLE NONRENEWABLE RESOURCES BY TYPE

in 1970. During this period, America's gross national product rose 102 percent and energy consumption virtually doubled. Because oil and gas were cheap and abundant, little concern was given to energy conservation. In fact, higher energy consumption was, in many cases, stimulated by Government regulations. Our current American way of life has been shaped in large part by our increased energy consumption.

With less than 6 percent of the world's population, the US consumes more than 30 percent of the world's energy. The US uses more energy per dollar of the gross national product than any other industrialized nation, more than doubling the consumption per capita of most western European nations.

1.2.2 CY 78 Energy Consumption Patterns and Trends. In 1978 US energy consumption by end-use sector (industry, residential, and transportation) (figure 1-9) indicated that oil was used heavily by all three sectors, but almost

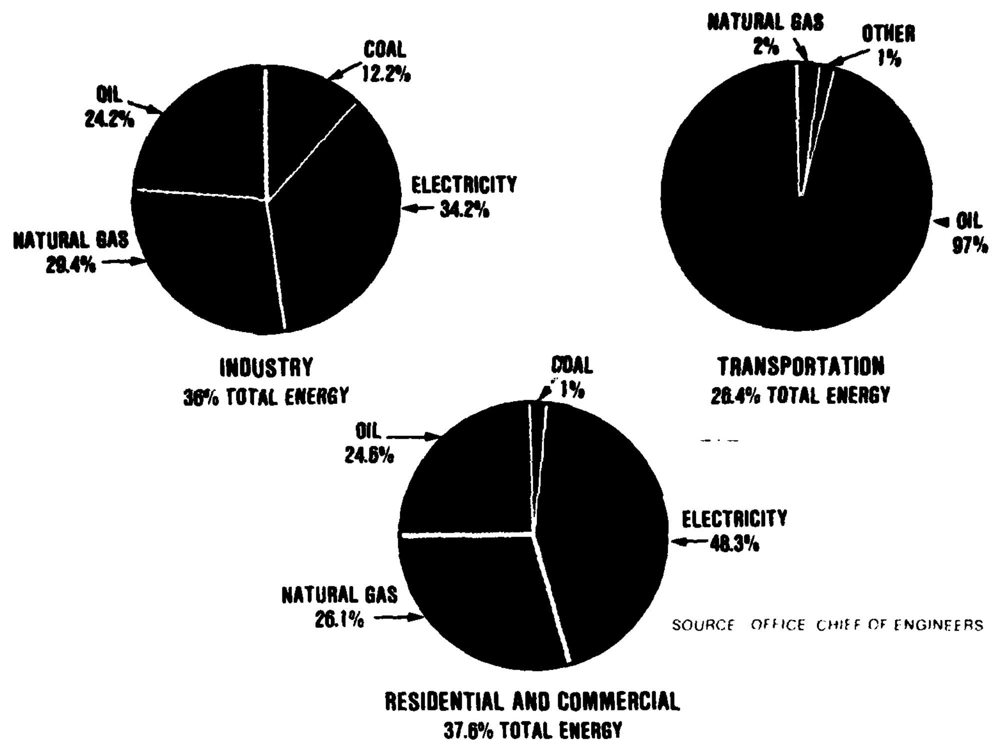


Figure 1-9. US ENERGY CONSUMPTION BY SECTOR, CY 1978

half of the total liquid petroleum was used in transportation. This is true because no economically feasible substitute fuel was available for the internal combustion engine. Coal is used principally by electric utilities and industry. Natural gas is a preferred fuel for residential and commercial use because it is a clean and efficient fuel for heating. Nuclear energy is used in generating electricity.

The consumption of electricity accounted for 30.4 percent of total domestic energy consumed in 1978. Oil and natural gas accounted for 16.5 percent and 13.8 percent, respectively, of total energy used in generating electricity. Coal used for electricity decreased 2.0 percent from 1976 to the 1978 consumption level of 44.2 percent. The remainder of the generating sources were nuclear energy, 12.5 percent; hydroelectric power 12.7 percent; and other sources about 0.3 percent.

It is important to note that conversion of energy from any fuel to generate electrical energy is a relatively inefficient process. Energy is lost each time a conversion takes place. Edison Electric Institute estimates that about 70 percent of the energy contained in fossil fuel used to generate electricity is lost in a chain of conversion and transmission processes before the end use of the electrical energy occurs. As the electricity is converted by the end user to heating a resistor or powering a motor, energy provided by the original source is further reduced. Thus significant energy efficiency improvement opportunities exist in the generation, transmission, and utilization of electricity regardless of the source energy.

Oil consumption grew at an average annual rate of 4.4 percent from 1947 to 1973. The Arab oil embargo forced the price of oil to triple in 1 year and also precipitated an immediate drop in consumption. Domestic demand for refined petroleum products dropped by 1 million barrels per day between 1973 and 1975. In 1976, however, the trend turned upward and oil consumption grew by 6.7 percent. Natural gas consumption, decreased from its peak in 1971 through 1978 although the rate of decrease has slowed.

Coal consumption has decreased steadily from 1950, when coal constituted 38 percent of total energy consumed, until 1973, when the trend reversed because of its comparative price, despite increased restrictions on extraction methods and processes, and more stringent environmental standards. In 1978, coal consumption constituted 18 percent of total energy consumed, as shown in table 1-1.

Table 1-1. DOMESTIC ENERGY CONSUMPTION BY TYPE OF FUEL

YEAR	TOTAL (QUADS)	PERCENT OF TOTAL					
		PETROLEUM[1]	COAL	NATURAL GAS[2]	HYDRO-ELECTRIC POWER	NUCLEAR POWER	OTHER[3]
1950	34.0	39.7	38.0	18.1	4.2	—	—
1955	39.7	44.1	29.1	23.2	3.5	—	—
1960	44.6	45.0	22.8	28.5	3.7	—	—
1961	45.3	45.2	21.9	29.2	3.7	—	—
1962	47.4	44.8	21.5	29.8	3.9	—	—
1963	49.3	44.5	21.7	30.1	3.6	0.1	—
1964	51.2	43.7	22.0	30.5	3.7	0.1	—
1965	53.3	43.6	22.3	30.2	3.8	0.1	—
1966	56.4	43.2	22.2	30.8	3.7	0.1	—
1967	58.3	43.5	21.1	31.3	4.0	0.1	—
1968	61.8	43.8	20.5	31.7	3.8	0.2	—
1969	65.0	43.7	19.6	32.4	4.1	0.2	—
1970	67.1	44.0	18.9	32.8	4.0	0.3	—
1971	68.7	44.5	17.5	33.2	4.2	0.6	—
1972	71.9	45.8	17.3	32.0	4.1	0.8	—
1973	74.7	46.6	17.8	30.4	4.0	1.2	—
1974	73.0	45.8	17.9	30.2	4.5	1.6	—
1975	70.6	46.4	18.2	28.2	4.6	2.6	—
1976	74.2	47.3	18.4	27.4	4.1	2.8	—
1977	76.5	48.6	18.4	26.1	3.3	3.5	0.1
1978	78.6	48.6	18.0	25.3	4.0	3.8	0.3

[1]INCLUDES NATURAL GAS LIQUIDS
[2]DRY NATURAL GAS
[3]INCLUDES COKE IMPORTS, GEOTHERMAL, ETC.

SOURCES: BUREAU OF MINES 1950-1975
FEDERAL ENERGY ADMINISTRATION 1976
US DEPT OF ENERGY, 1977-1978

NOTE: THOSE NOT LISTED CONSTITUTE LESS THAN ONE-TENTH OF ONE PERCENT.

1.2.3 Oil Resources, Reserves, and Depletion. Increased consumption and lower domestic production of oil has led the US to increased dependence on the world oil market. This increases the vulnerability of the US to an interruption of import supplies critical to our energy requirements. In 1978, total imports averaged 8.1 million barrels of oil per day. This was 45 percent of US's consumption. By December 1979, oil imports had increased to 8.3 million barrels per day. Of this, 66.6 percent of all crude oil imports came from the OPEC nations. Arab member nations supplied 54.6 percent of that total. This represented a 30 percent jump in import levels from 1973, just prior to the Arab oil embargo.

As the US depletes its crude oil reserves, importation continues. Estimation of total US crude oil reserves by the United States Geological Survey (USGS) has consistently been going down since 1963 when Duncan and McKelvey of the USGS predicted 658 billion barrels of total crude could be produced. It turns out that some very hopeful projections for new oil discoveries onshore and offshore have thus far been disappointing. A 1974 report to the US Senate stated that in 1945 it required 51 new-field wildcat wells to make one profitable discovery of oil. By 1965, it required 137 wildcat wells. Despite new technology, it was becoming harder and more expensive to find oil. In 1956, Dr. M. King Hubbert, who was chief geology consultant to the Shell Oil Company and is an internationally renowned research geologist, predicted that domestic crude oil production would peak between 1965 and 1970. He based this prediction on the thesis that total available domestic reserves were reaching a point of significant depletion, thereby sowing the seeds for a drop in production. Domestic production did indeed peak in 1970 and declined through 1976. (See table 1-2.) Production has risen since then. Dr. Hubbert's estimate of ultimate total crude oil production was 213 billion barrels. In June 1975, the USGS, after reexamining its earlier predictions and estimates, estimated that the ultimate total production of crude oil for the entire US would be between 218.12 billion barrels (with a 95-percent probability) and 295.12 billion barrels (with a 5-percent probability). These lowered estimates closely correlated with Hubbert's original figures.

Estimates and projections of expected oil depletion dates depend upon assumed oil production and consumption rates. Annual growth rates in consumption are subject to change as conservation and other measures take hold.

1.2.4 Natural Gas Resources, Reserves, and Depletion. Americans have been encouraged by Government and industry to consume natural gas because it is a clean, high efficiency fuel, and up to the present has been inexpensive.

Table 1-2. DOMESTIC CRUDE OIL PRODUCTION

Year	Production (millions of barrels per day)[1]
1950	5.4
1955	6.8
1960	7.0
1961	7.2
1962	7.3
1963	7.5
1964	7.6
1965	7.8
1966	8.3
1967	8.8
1968	9.0
1969	9.2
1970	9.6
1971	9.5
1972	9.4
1973	9.2
1974	8.8
1975	8.4
1976	8.1
1977	8.2
1978	8.7

1 Does not include natural gas liquids, does include lease condensate.

SOURCES: CIA; US Department of Energy

Marketed production and domestic consumption of natural gas both increased steadily from 1950 to the 1973 peak of approximately 22 trillion cubic feet annually. Figure 1-10 depicts data on natural gas production and consumption taken from 1960 to 1977. It also depicts projections of natural gas marketed production and domestic consumption (including imports) from 1977 to the year 1995. These projections suggest that the supply of natural gas will remain close to current levels for some time into the future. The price of natural gas, however, is expected to rise substantially during this period, primarily from two production factors: (1) deregulation of natural gas prices which encourages greater production of gas through conventional techniques, and (2) production of snythetic natural gas which is more costly but expands availablity of natural gas supplies. Coal gasification and biomass conversion appear to be the most likely candidates to provide these supplemental natural gas resources. As energy prices continue to rise, these alternative sources will gradually become economically competitive with other fuels.

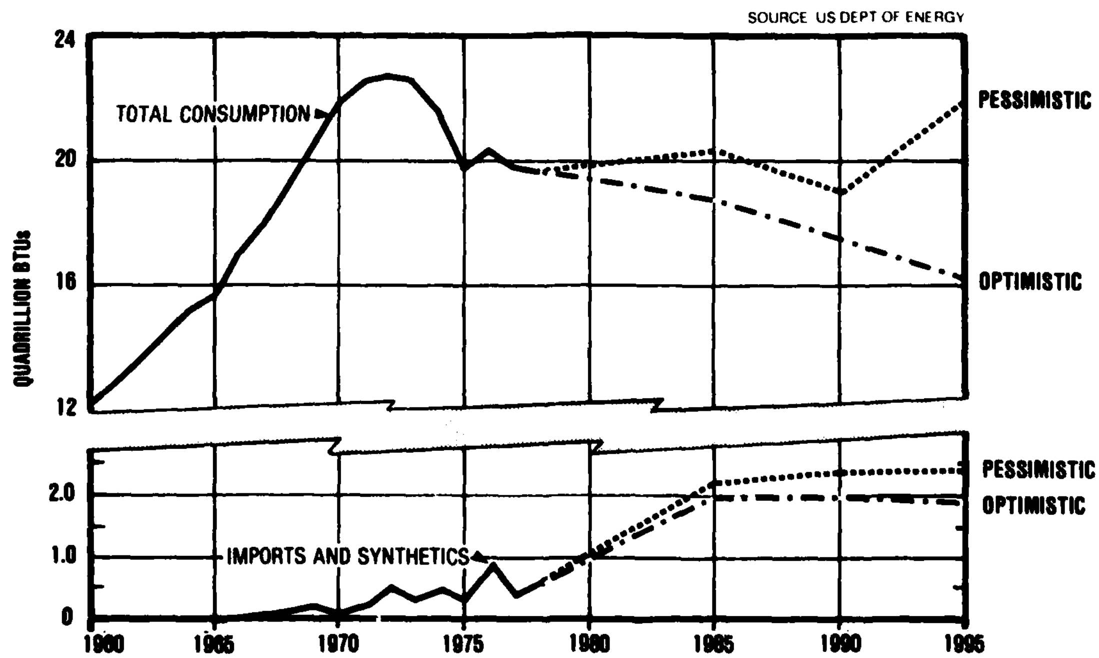
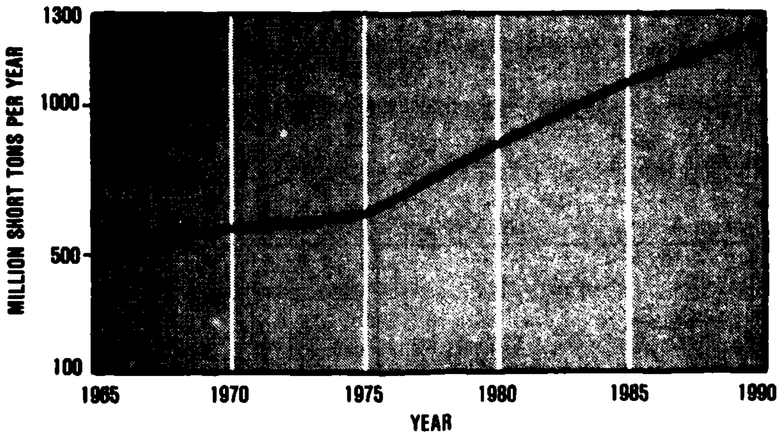


Figure 1-10. PAST AND PROJECTED US NATURAL GAS CONSUMPTION AND IMPORT LEVELS

1.2.5 Coal Resources and Reserves. Coal constitutes 81 percent of US nonrenewable energy reserves, but represented only 18 percent of energy use in 1978. While the coal industry will have only a small amount of excess capacity through the 80s, it is hoped that production can be significantly expanded during this period (figure 1-11). However, expansion of mining capacity will be both labor and capital intensive. It has become increasingly difficult to maintain an adequate mining labor force. To further amplify this obstacle it should be noted that since enactment of the Federal Coal Mine Health and Safety Act in 1969, coal



SOURCE: US BUREAU OF MINES

Figure 1-11. PAST AND PROJECTED US COAL PRODUCTION

mining productivity has declined. The average underground productivity of US coal mines was 10.64 tons per man-day in 1960. It rose to 15.61 tons in 1969, and dropped to 8.5 tons per man-day by 1976. The impact of the Mine Safety Act coupled with mining labor unrest in part caused a 40-percent reduction of deep mine capacity during the period 1970 to 1976. This equated to an elimination of over 200 million tons per year of productive capacity. To compensate, 200 new mines with a capacity of 1 million tons per year might have to be opened at a cost of $30 to $50 million per mine. While doubling coal production can be a partial energy solution, it also apparently provides serious new problems and challenges as well.

The US has enough environmentally acceptable low sulfur coal reserves, located mainly in the Northern Rocky Mountain States, to last for the next few centuries at current rates. However, expansion of US coal production also requires an associated expansion of the coal transportation system and coal handling and burning facilities. The 273-mile slurry pipeline operating in Arizona from the Black Mesa Coal Mines to the Mohave Generating Station handles about 5 million tons of coal per year. Pipelines currently being considered or proposed could increase capacity to 100 million tons per year. In order to accommodate the doubling of our coal production, a major overhaul of the nation's rail network would be required, in addition to providing new rolling stock. The National Academy of Engineers (NAE) estimates that an additional 8,000 railroad locomotives and 150,000 gondola and hopper cars would be required to effect a significant increase in usage of domestic coal reserves. NAE also indicates that at least 130 new rail-barge systems covering over 90,000 miles will need to be constructed to provide the US with 1,300 million short tons per year. This increase in coal production could provide up to 40 percent of US energy needs in 1990 based on current energy consumption levels.

1.2.6 Alternate Sources of Energy. Following are some of the more prominent and promising sources of fuels derived from either plentiful or renewable resources.

1.2.6.1 Coal Gasification. Gas manufactured from coal was first produced in the late 18th century. The first US company was chartered in Baltimore in 1816. The advent of electricity and the availability of abundant natural gas negated the need for synthetic gas; therefore, coal gasification technology research was practically abandoned. Three coal gasification processes are currently under development.

Production of synthetic gas from coal is currently uneconomical in comparison with the regulated price of natural gas. As the supply of natural gas becomes critical, substitute fuels will be required.

1.2.6.2 Coal Liquefaction. The conversion technology required to use coal as a source of liquid fuels has existed for many years. During World War II, Germany built several synthetic fuel plants with a combined output of approximately 100,000 barrels per day. Availability of low priced crude oil in the US has made this conversion technology uneconomical. However, for the past 20 years, the U.S. Office of Coal Research, Bureau of Mines, along with commercial interests has expended considerable research and development effort to improve the efficiency of conversion processes, lower the costs of facilities required, and generally make this alternative fuel source more competitive.

1.2.6.3 Biomass. Biomass suitable for conversion into energy is available from three general sources: trees and plants, plant and animal residue, and urban and industrial wastes. Wood-fired boilers have a long history of successful operation; particularly, in forest industry areas such as the Pacific-Northwest and parts of the South. Considerable wood resources are available from slash material (tops, branches and stumps) alone in addition to wood supplied from increased harvesting. The air pollution emissions from wood are less than coal, particularly since wood emits practically no sulfur pollutants.

Studies have shown that substantial quantities of increasngly costly fossil fuels can be conserved by implementing waste fuel systems. Furthermore, considerable gains in other areas can be achieved by reducing trash and garbage to a less bulky essentially inert ash and residue, which can be landfilled in an environmentally compatible manner.

1.2.6.4 Nuclear. The growth rate for nuclear power from fission is a function of the economic conditions of the utilities along with problems which stem from growing environmental objections, safety considerations, complex licensing procedures, and construction and supply limitations. Moreover, the current most common reactor (lightwater) generates electricity from uranium-238, a non-renewable, finite resource. The ability to greatly expand nuclear generating capacity depends largely on the development of breeder reactors. These reactors, which could be in operation late in this century, produce more fuel than they consume. The US has enough purified uranium-238 in storage which, if used in a breeder program, potentially could produce the electrical equivalent of more than five times that which could be produced by all of the oil possessed by all the oil exporting nations combined.

Nuclear fusion, the process of combining the nuclei of light elements, has been successfully demonstrated in the laboratory for very short periods of time. However, the solution to the problem of containing the tremendous heat necessary to sustain the fusion reaction is not near at hand. An important feature of the fusion process is that its fuel can be derived from seawater.

1.2.6.5 Solar Energy. Harnessing radiant energy through various solar energy applications is an appealing concept because the technology emits almost no pollutants and does not compromise the environment or our health to the same extent as do other energy technologies. Some of the areas the DOE is pursuing in this field are: heating and cooling; solar thermal conversion; photovoltaic conversion; and ocean thermal energy conversion.

The technical barriers to using solar energy are associated with the facts that the sun's rays are spread diffusely over the surface of the earth and are intermittent. To harness large amounts of radiant energy, solar collectors must cover large areas, and the larger the facility, the higher the cost. Thus, the economic barriers to the use of solar energy stem from the fact that high initial costs are required for solar energy facilities, even though the operating costs may be low.

1.2.6.6 Wind Energy. Man has long recognized and utilized the energy in the wind. Windmills were known in China and Japan as early as 2000 B.C. and have been in common use for at least 700 years in parts of Europe. Wind energy systems were in wide use in the Western US until about 1950. Some are still to be found in remote regions, pumping water into stock tanks or generating electricity for individual farm houses. Wind is actually a universally distributed manifestation of the earth's solar energy. It requires a technology quite different from solar energy and therefore is mentioned separately here. DOE's general objective regarding wind power is to advance the technology and accelerate the development and utilization of reliable and economically viable wind energy systems to meet future energy requirements in the appropriate applications and regions.

1.2.6.7 Geothermal Energy. The heat inside the earth is a vast potential source of energy. The Geysers plant in California, for example, is currently producing electricity from geothermal energy. In Idaho, one site uses geothermal energy for space heating. A probable course of development for geothermal energy in the near future will be construction of powerplants using hot water, brine, or steam separated from hot water or brine deposits, which occur in a few areas in the United States. Geothermal power is not expected to displace either fossil or nuclear fuels as a major source of electricity generation but will probably be exploited to whatever extent is practicable. The Army's most practical use of geothermal energy would be for space heating.

1.2.6.8 Hydrogen, Ammonia, Alcohol, and Methane. These fuels have the common properties of being synthesized from abundant materials and of having products of combustion that are not noxious and that can be assimilated into the environment at the point of use. Hydrogen is the simplest and cleanest and has the highest heating value per pound of the fuels mentioned. Moreover, it is a basic ingredient for the other alternative fuels.

Today, hydrogen is most commonly produced by the steam reforming of volatile hydrocarbons. Some hydrogen is currently produced by the electrolytic decomposition of water. In the future, other possibilities for hydrogen production include bioconversion, use of ultraviolet light from a fusion torch, and use of municipal rubbish and plants as feedstock for chemical reforming using existing technology.

Ammonia is used extensively in the fertilizer industry, but it can also serve as a fuel. It can either be burned directly or be used as an input to a fuel cell.

Alcohol is produced from synthetic gas obtained from coke, coal, or natural hydrocarbons as well as the fermentation/distillation of biomass. Methanol can be produced by the destructive distillation of wood or municipal solid waste which also produces methane gas. In mainland China and India small farms and villages have been using manure-fired methane generators for the past 20 years. Since manure is a relatively small resource in the US, other waste use such as crop residue, forestry leavings, and seaweed are being considered. Four to eight billion tons a year of trees, sugarcane, and other crops could be grown on marginal land, not used for agriculture production, and be made into ethanol, methanol, or methane on a large scale. These fuels are clean burning, efficient, and offer little or no environmental problems. A mixture of 10 percent alcohol and 90 percent gasoline or "gasohol" is already considered a viable means of stretching our use of petroleum distillates. The Army is participating in several gasohol tests including R&D into gasohol use in tactical vehicles.

CHAPTER 2

NATIONAL ENERGY OBJECTIVES, STRATEGIES, GOALS, AND ORGANIZATION

2.1 INTRODUCTION. The following reflects the nation's energy objectives, strategies, and goals as excerpted from the background information on the National Energy Act (NEA) and the National Energy Plan (NEP). The NEA was passed by Congress on 15 October 1978 after nearly a year and a half of deliberation. The NEA is composed of five separate acts:

a. The National Energy Conservation Policy Act of 1978.

b. The Power Plant Industrial Fuel Use Act of 1978.

c. The Public Utilities Regulating Policy Act of 1978.

d. The Natural Gas Policy Act of 1978.

e. The Energy Tax Act of 1978.

2.2 NATIONAL ENERGY PLANNING PRINCIPLES. The NEP was promulgated in two phases: NEP (NEP I) published in April 1977 prior to the passage of the NEA, and the NEP II published in May of 1979 after the passage of the NEA. NEP II complements and expands upon NEP I. NEP I contains 10 energy planning principles. They establish the context in which energy policy will be formulated, and provide the foundation for the NEA. Following are excerpts of those principles:

a. The energy problem can be effectively addressed if the Government accepts responsibility for dealing with it comprehensively, and if the public understands its seriousness and is ready to make necessary sacrifices.

b. Healthy economic growth must continue.

c. Environmental protection policies must be maintained.

d. The US must reduce its vulnerability to potentially devastating supply interruptions.

e. The US must solve its energy problems in a manner that is equitable to all regions, sectors, and income groups.

f. Growth of energy demand must be restrained through conservation and improved energy efficiency.

g. Energy prices should generally reflect the true replacement cost of energy.

h. Both energy producers and consumers are entitled to reasonable certainty as to Government policy.

i. Resources in plentiful supply must be used more widely, and the nation must moderate its use of those in short supply.

j. Use of nonconventional sources of energy must be vigorously expanded.

2.3 NATIONAL ENERGY GOALS/OBJECTIVES.

2.3.1 Goals. NEP I established the following goals to be achieved by 1985:

a. Reduce the rate of growth of energy consumption to below 2 percent per year.

b. Reduce gasoline consumption by 10 percent below the 1975 level.

c. Reduce oil imports to less than 6 million barrels per day, about one-eighth of total energy consumption.

d. Establish a strategic petroleum reserve of 1 billion barrels.

e. Increase coal production by about two-thirds, to more than 1 billion tons annually.

f. Insulate 90 percent of existing American homes and all new buildings.

g. Use solar energy in more than 2-1/2 million homes.

2.3.2 Objectives. Three primary energy objectives are included in NEP II:

a. As an immediate objective, which will become more important in the future, the Nation must reduce its dependence on foreign oil and its vulnerability to supply interruptions.

b. In the mid-term, the Nation must seek to (1) keep imports sufficiently low to protect US security and to extend the period before world oil demand reaches the limits of production capacity, and (2) develop the capability to use new higher-priced ("backstop") technologies as world oil prices rise.

c. The Nation's long-term objective is to have renewable/and essentially inexhaustive sources of energy to sustain a healthy economy.

The oil reduction goals listed above have been further amplified in the Presidential speeches of July 1979 at which time he said that the United States will never again import more oil than it did in 1977.

In addition to the NEP, on 20 July 1977, the President issued Executive Order No. 12003 which has as its goal a 20 percent reduction in energy use per square foot in existing Federal buildings and 45 percent reduction in energy consumption for new Federal buildings by 1985 as compared to the energy per square foot consumed in 1975.

2.4 NATIONAL ENERGY STRATEGIES. The strategy outlined in NEP II is built upon the accomplishments of the NEA. The plan--

a. Encourages greater conservation and domestic production of oil through decontrol of oil prices.

b. Ensures that the costs and benefits of decontrol are borne fairly and equitably through a windfall profits tax on excess producer revenues.

c. Accelerates the development of new energy sources through tax credits and other incentives for shale oil and solar energy.

d. Strengthens the Nation's capacity to address a host of different decisions through proposals to streamline the management of energy decisions and approvals for new energy projects.

e. Ensures that new technologies can be deployed when they are needed and at least cost through a broad program of research and incentives.

2.5 ENERGY ORGANIZATION IN THE FEDERAL GOVERNMENT. The Department of Energy Organization Act, approved 4 August 1977, established a Department of Energy (DOE) in the Executive Branch of the Federal Government, effective 1 October 1977. The Act provided for transfers to the Secretary of Energy all of those energy functions heretofore vested in the Administrator of the Federal Energy Administration (FEA), and the Administrator of the Energy Research and Development Agency. In addition, energy related functions vested in numerous other Federal agencies were also transferred to the Secretary of Energy. The general organization for the DOE as reorganized, effective 1 October 1979, is depicted in figure 2-1.

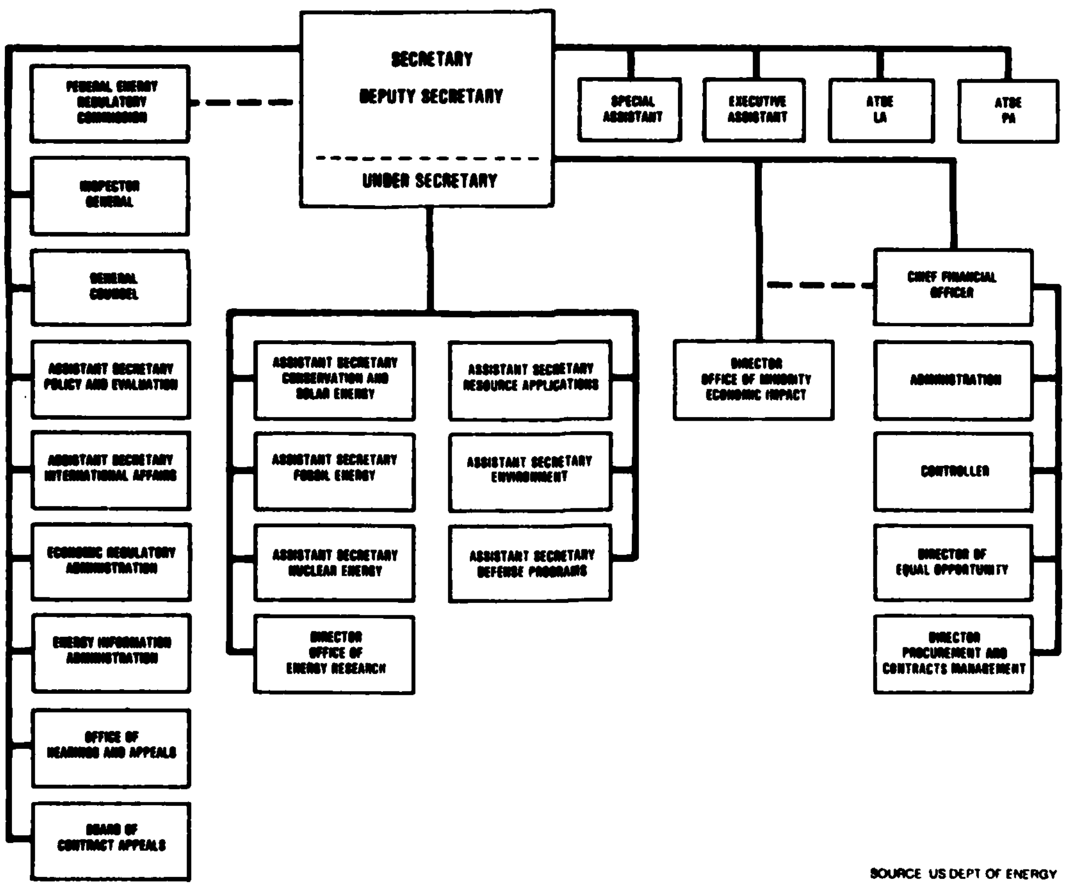


Figure 2-1. DEPARTMENT OF ENERGY ORGANIZATION

CHAPTER 3

THE ARMY ENERGY SITUATION

3.1 BACKGROUND. In order to address the Army energy situation, it is necessary to place it in perspective with the DOD energy environment as well as that of the Nation. DOD accounts for approximately 1.85 percent of the total national energy consumption (figure 3-1) and 82 percent of the total Federal Government energy consumption.

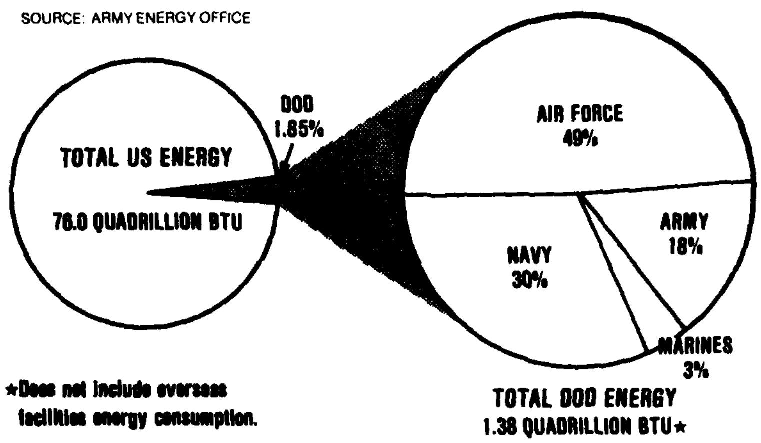


Figure 3-1. DISTRIBUTION OF DEFENSE ENERGY, FY 79

While the overall DOD energy consumption is approximately 1.85 percent of the total US consumption, the percentage for petroleum consumption is approximately 2.5 percent. In terms of daily consumption, DOD consumes the equivalent of approximately 660,000 barrels of oil equivalent (BOE). Liquid petroleum requirements comprise 68 percent of that amount or nearly one-half million barrels of oil per day, thereby underscoring the importance of petroleum to DOD operations. War, or the imminent threat of war, could cause these requirements to be doubled or tripled. The crucial importance of petroleum to DOD operations, coupled with the fact that at present approximately one-half of the US consumption is imported, make a reliable supply of petroleum of prime concern to DOD. Of the 1.38 quadrillion Btu's of energy consumed by DOD in FY 79, the Army consumed about 18 percent, the Marine Corps 3 percent, the Navy 30 percent, and the Air Force 49 percent, as shown in figure 3-1.

Of the Army's annual usage of energy, 83 percent is consumed in facilities operations and 17 percent in mobility operations (figure 3-2). Facilities operations consumption is that energy utilized to heat, cool, ventilate, and light buildings and provides for building process loads as well as that energy consumed in industrial operations. Mobility operations include the energy used to move the Army and to conduct its operations and training in the field. Relative to the Army, the Navy and Air Force consume a proportionally greater share of their total consumption in their mobility operations, 60 and 72 percent respectively, as shown in figure 3-2.

3.1.1 DOD goals, objectives, and strategies. In support of national objectives, DOD established a goal in FY 74 to reduce energy consumption by 7 percent over FY 73. In FY 75, the goal was set at 15 percent savings using the FY 73 consumption level as the base figure. The goals for FY 76 through FY 79 were established at zero growth as compared with FY 75. The DOD goals have been exceeded by a comfortable margin in each instance as shown below:

FY	Savings Goal	Savings Achieved
74	7% (base FY 73)	25%
75	15% (base FY 73)	26%
76	0 (base FY 75)	7%
77	0 (base FY 75)	3%
78	0 (base FY 75)	9%
79	0 (base FY 75)	10%

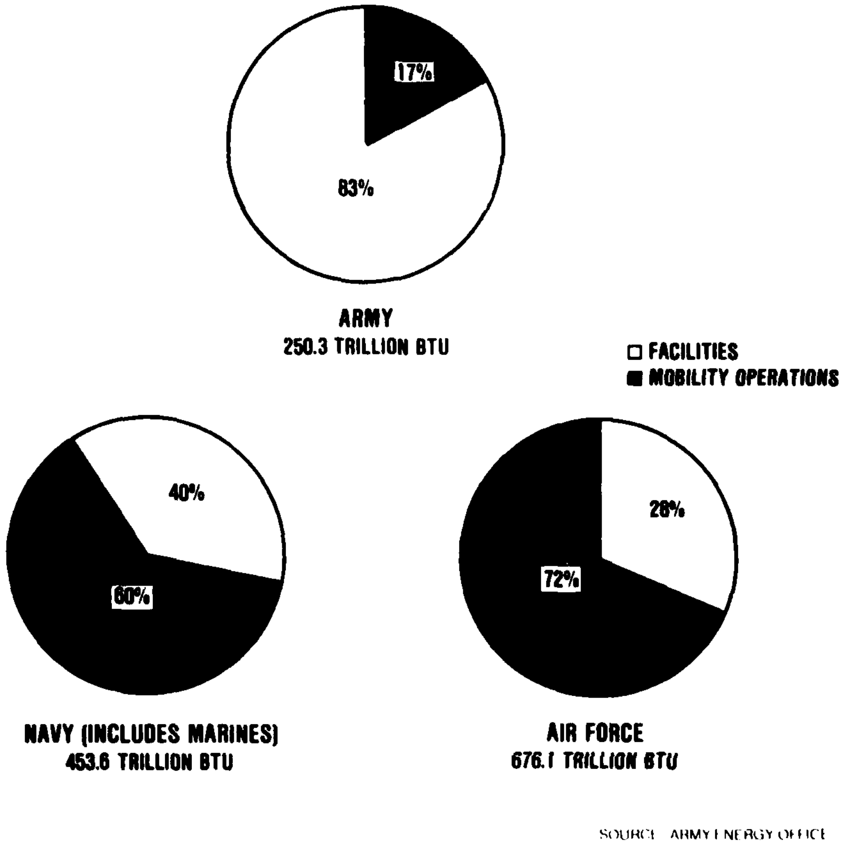


Figure 3-2. DISTRIBUTION OF ENERGY WITHIN SERVICES, FY 79

The Department of Defense Energy Management Plan (DEMP), dated 30 June 1979, presents an overview of the DOD energy management program. The DEMP is designed to: (1) achieve national energy goals and objectives, which the Congress and The President have mandated, as well as greater self-sufficiency; (2) reduce energy costs; and (3) ensure the operational readiness of the strategic and tactical forces. The program covers three distinct, but interrelated areas:

a. Supply of energy required to support mobility operations and installations.

b. Energy conservation to reduce energy consumption in mobility fuels and utility energy sources that support installations.

c. Energy technology applications to better utilize more plentiful energy resources and to demonstrate the feasibility of new energy technologies.

3.1.2 DOD energy organization. After the 1973 Arab oil embargo, a Directorate for Energy was established in DOD under the Assistant Secretary of Defense for Installations and Logistics. On 15 August 1977, the energy management function and the Directorate for Energy were placed under the Office of the Deputy Assistant Secretary of Defense for Environment and Safety. At the same time that office was redesignated the Office of Deputy Assistant Secretary of Defense for Energy, Environment, and Safety (ODASD(EE&S)) and the Directorate for Energy became the Directorate for Energy Policy (figure 3-3).

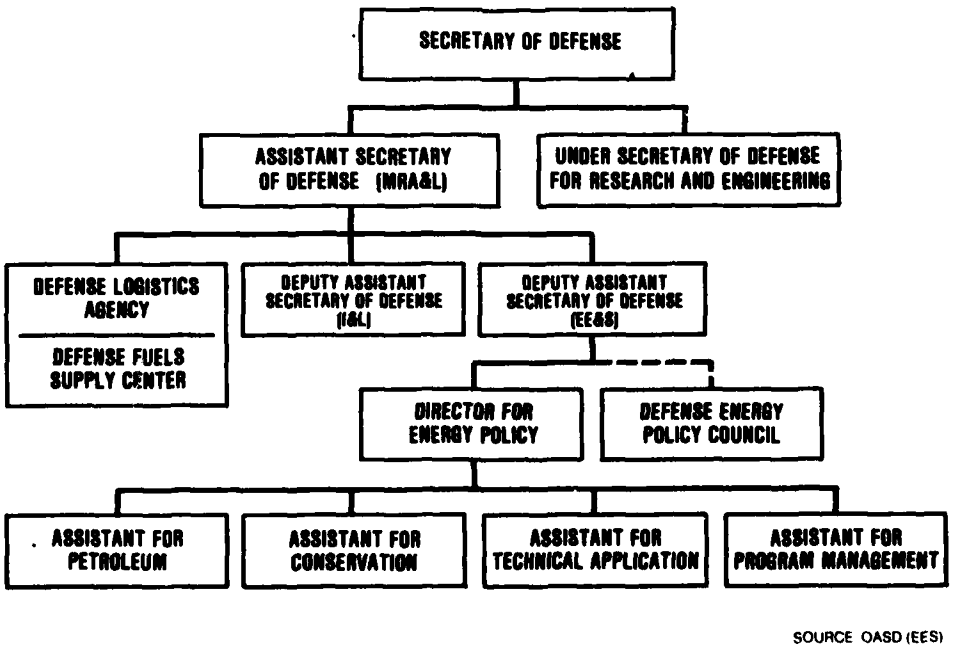


Figure 3-3. DEPARTMENT OF DEFENSE ORGANIZATION FOR ENERGY MANAGEMENT

The OASD(EE&S) serves as chairman of the Defense Energy Policy Council (DEPC) which was established to serve as a forum for the development of broad energy policy. It is composed of representatives from the following agencies: OASD (MRA&L), Organization of the Joint Chiefs of Staff (OJCS), Defense Logistics Agency (DLA), Army, Navy, and Air Force.

3.2 ARMY GOALS, OBJECTIVES, AND POLICIES.

3.2.1 Current goals. From 1975 through 1978 the following goals in support of national and DOD objectives were enunciated by the Army Energy Office (AEO):

a. Conserve energy while maintaining readiness.

b. Maintain zero growth based upon FY 75 total energy consumption.

c. Maintain a supportive and cooperative role with designated national energy authorities in the development of new energy sources.

These goals applied in this form through FY 78 until February 1978 when the Army Energy Plan was published. This plan established more comprehensive goals and objectives for both the short term (FY 85) and the long term (year 2000). Rather than maintain zero growth, the new goals call for reduced energy consumption to the year 2000 as well as reducing the Army's dependence on scarce and non-renewable fuels. These goals are discussed in detail below. Prior to setting new goals for the near- and long-term, the Army did very well against the various prevailing goals.

With FY 75 as the base year, the Army achieved a reduction in energy consumption of 7.3 percent in FY 76, 6.5 percent in FY 77, and 7.1 percent in FY 78, thereby exceeding the DOD zero growth goals for each of those years. In FY 75 the Army exceeded the DOD savings goal of 15 percent over FY 73 consumption by a comfortable 6.8 percent.

3.2.2 Long-range goals. The national energy goals were established in the NEP I and conservation goals within the Executive Branch were included in Executive Order 12003. (See paragraph 2.3.) NEP II established further plans to meet the energy problems but set no further goals (paragraph 2.2). On 21 September 1977, the Secretary of the Army and the Chief of Staff in a joint document entitled "Total Army Goals" stated, "We will focus our efforts on: Energy systems (structure, power sources, and equipment) which make more efficient use of fuels, reduce dependence on nondomestic fossil fuels, and use less expensive and more plentiful resources."

In considering how to address the various mandates it is clear that the Army Energy Program must address the long term as well as the near term. Looking forward to the year 2000, it is essential that the Army establish goals which are ambitious in terms of requiring the Army to extend its reach, yet are realistic and attainable. Current trends in world and US energy supplies were outlined in chapter 1. After giving due consideration to the potential sources of energy and their availability between now and the year 2000, the forecasted state of technology with respect to equipment and the Army's anticipated requirements, a new set of Army goals have been developed by the Army Staff through the medium of the Advisory Group on Energy (AGE). The following goals and objectives for the Army were approved by the AGE in October 1979 with the stipulation that there would be no degradation in the readiness of the force:

REDUCE ENERGY CONSUMPTION BY 35 PERCENT BY THE YEAR 2000.

- Reduce energy consumption in mobility operations 10 percent by FY 85 from the FY 75 consumption level and maintain zero growth from the FY 85 level of consumption to the year 2000.

- Reduce energy consumption in facilities operations 20 percent by FY 85 from the FY 75 consumption level and an additional 20 percent for a total of 40 percent by the year 2000.
- Emphasize energy conservation education/information and incentive programs for all civilian personnel and military personnel and their dependents.

REDUCE DEPENDENCE ON NONRENEWABLE AND SCARCE FUELS BY THE YEAR 2000.

- Develop the capability to use synthetic gases to reduce the dependence on natural gases; reduce the use of natural petroleum fuels in facilities operations 75 percent by the year 2000.
- Develop the capability to use synthetic or alternate fuels for mobility operations petroleum requirements by the year 2000.
- Increase efficiency of nonrenewable energy dependent mobility systems 15 percent.

ATTAIN A POSITION OF LEADERSHIP IN THE PURSUIT OF NATIONAL ENERGY OBJECTIVES.

ACHIEVE THE ABOVE GOALS WITHOUT DEGRADING THE READINESS OF THE FORCE.

In arriving at these goals many considerations were involved. A brief rationale of the basis upon which the goals were established and the general direction in which the Army must proceed for their accomplishment is stated below. A more detailed explanation of programs and alternatives for accomplishing the Army's goals is included in chapter 4. In order to reduce dependence on foreign energy sources, particularly petroleum fuels, two general approaches are considered necessary: first, reduce overall consumption of energy, and second, substitute a more readily available energy source for the nonrenewable and scarce fossil fuels. The basic assumptions are:

a. The Army will remain at essentially the same strength and be located in the same major locations. (Consideration has been given to planned force mechanization and the impact of potential force relocations.)

b. The Army's mission will be substantially unchanged.

The Army FY 85 mobility goal extends the Presidential goal of reducing gasoline consumption by 10 percent by including diesel and aviation fuels in its 10 percent reduction. While the Army increases its mechanization and deploys new sophisticated equipment, it must reduce its overall consumption through better energy management, the fielding of more efficient systems, and by developing the capability to use a wide range of synthetic and alternate fuels.

One of the 1977 Presidential goals requires the reduction in the annual growth rate of energy consumption to less than 2 percent, roughly half the current national rate. By 1985, this rate could result in an increase greater than 20 percent in the nations' energy consumption. In that same time frame, the Army is committing itself to reduce its consumption 10 percent in the mobility operations area and 20 percent in the facilities operations area, approximately an 18.4 percent reduction overall.

Improving energy efficiency of existing buildings, the use of selective and total energy systems, more efficient equipment, and better energy management are some of the methods to be combined to achieve the goal of 40 percent reduction in energy consumption in facilities operations by the year 2000. Developing the capability to use synthetic gas derived from abundant or renewable sources in place of natural gas will assure a secure energy source in instances where a gaseous fuel is either preferable or required.

Continuing in the facilities operations area, aggressive action will be required to reduce the use of natural petroleum fuels as heating oil in order to promote petroleum availability for mobility operations. Coal, either in direct fired, gaseous, or other processed states, solar and biomass energy are prime alternate energy sources to accomplish these objectives.

Concurrently, actions in the mobility operations area to develop the capability to replace natural petroleum requirements with synthetic fuels or electricity are required. These actions must be coupled with efforts designed to obtain more efficient use of the scarce natural petroleum fuels where required.

In the pursuit and accomplishment of the aforementioned ambitious goals, the Army will be attaining a position of leadership in the pursuit of national energy objectives while maintaining the inviolate objective of not degrading the readiness of the force.

3.2.3 Objectives. The overall objectives of the Army Energy Program are stated in AR 11-27 as follows:

a. Assure the availability and supply of energy to Army forces in accordance with mission and readiness priorities.

b. Participate in the national effort to conserve energy resources.

c. Attain, as a minimum, conservation goals established by the DOD.

d. Participate in national research and development efforts toward new and improved energy sources.

e. Implement DOD energy-reporting requirements.

f. Promote Army-wide awareness of the essential need to conserve energy resources and to foster a willingness to participate in conservation of these resources.

g. Recognize accomplishments of Army personnel in energy conservation.

3.2.4 Policies. In order to accomplish the Army's energy objectives, the following policies were established in AR 11-27 and will facilitate the accomplishment of the Army's long range energy goals:

a. Army energy resources will be intensively managed to assure their efficient and effective utilization in support of mission requirements.

b. Conservation of energy will be maximized consistent with mission, readiness, and health and safety requirements.

c. Energy conservation will be stressed in the design, development, production, procurement, and operation of equipment, weapons systems, and facilities. Energy consumption will be considered as a factor in the decision process during design, development, and construction of new equipment and facilities.

d. Energy requirements will be a mandatory agenda item at all in-process reviews (IPR).

e. Army-fixed facilities and mobile and transportable equipment will be operated and maintained to assure optimum performance and minimize energy consumption.

f. Close coordination will be maintained with other military services, the DOD Director for Energy Policy, Defense Logistics Agency (DLA), the DOE, the Environmental Protection Agency (EPA), other Federal agencies, educational and scientific institutions, and industry to assure a continuing exchange of information and ideas.

g. Department of the Army (DA) Staff elements and the major commands and their subordinate commands/agencies down to battalion level will establish a single point of contact (POC) to coordinate and expedite actions on energy matters and to disseminate essential information. For DA Staff agencies and major commands and agencies, the name, rank, agency, address (room for HQDA Staff), and telephone number of the agency POC will be provided to HQDA (DALO-TSE). These items will be kept up to date.

h. Specific policy on petroleum fuels and coal is contained in AR 703-1.

i. Specific policy on utilities services is contained in the AR 420 series.

j. AGE (sec I, chap 7, AR 11-27) and other existing DA boards, committees, and councils (e.g., the Select Committee, General Staff Council, and Army Policy Council) will serve as forums to discuss and resolve significant energy matters such as priorities, allocations, and budget restraints.

k. DA policy, plans, and activities will be assessed for their potential, adverse, or beneficial impact on energy.

l. Energy conservation will be incorporated into troop training and information programs.

m. Performance will be continually monitored against established energy conservation goals using the Defense Energy Information System (DEIS).

3.3 ORGANIZATION.

3.3.1 Key elements. The DA organization for energy consists of the following elements: a Special Assistant for Energy, located in the Office of the Assistant Secretary of the Army (Installations, Logistics, and Financial Management) (OASA(IL&FM)), the Deputy Chief of Staff for Logistics (DCSLOG), the AGE and the AEO. These elements are backed up by the Army Staff and staff agency representatives. An abbreviated organization chart is shown in figure 3-4.

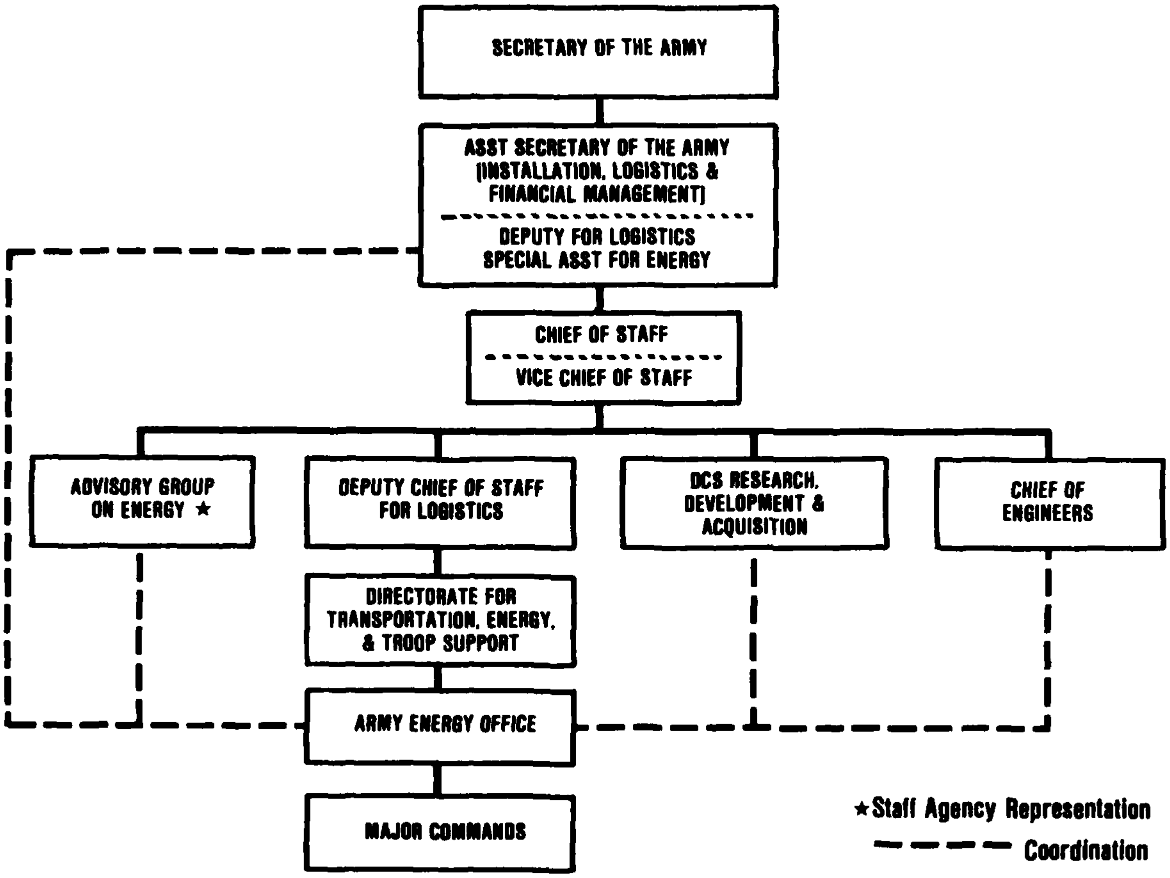


Figure 3-4. ARMY ENERGY ORGANIZATION

The Deputy Chief of Staff for Research, Development, and Acquisition (DCSRDA) and the Chief of Engineers (COE) are shown separately by virtue of their major separate responsibilities in the energy area. These responsibilities are summarized in paragraph 3.3.2.

3.3.1.1 Special Assistant for Energy. The Special Assistant for Energy is a designated position on the staff of the Secretary of the Army. This responsibility has been delegated to the Deputy for Logistics in OASA(IL&FM). The responsibilities of the Special Assistant are to represent the Army on the Defense Energy Policy Council (DEPC), to implement those tasks and initiatives emanating from the DEPC, and to monitor the Army Energy Program. The AEO has a direct coordination relationship with the Special Assistant.

3.3.1.2 Advisory Group on Energy (AGE). The AGE was organized in April 1975 under the authority of AR 11-27 with a minimum required membership level of lieutenant colonel or civilian equivalent. As a result of the approval of the recommendations of an energy management study, the AGE was elevated to a general officer level body by Headquarters, Department of the Army (HQDA) letter, file DALO-TSE (M), dated 5 July 1977, subject, "Army Energy Plan." The Director of Transportation, Energy, and Troop Support of the Office of the Deputy Chief of Staff for Logistics (ODCSLOG) chairs the AGE. The Secretary is the Chief, AEO. It is composed of a general officer or civilian equivalent designated from each of the following Army Staff elements:

Office of the Deputy Chief of Staff for Logistics (ODCSLOG), Chairman

Office of the Deputy Chief of Staff for Operations and Plans (ODCSOPS)

Office of the Deputy Chief of Staff for Research, Development, and Acquisition (ODCSRDA)

Office of the Deputy Chief of Staff for Personnel (ODCSPER)

Office of the Assistant Chief of Staff for Intelligence (OACSI)

Office of the Chief of Engineers (OCE)

Office of the Surgeon General (OTSG)

Office of the Comptroller (OCA)

Office of the Chief Army Reserve (OCAR)

Office of the Chief National Guard Bureau (OCNGB)

Office of the Director Program Analysis and Evaluation (PAED), Office of the Chief of Staff, Army

Office of the Chief of Public Affairs (OCPA)

The AGE has the following functions:

a. Continually review Army policies, programs, and procedures for their impact on energy and recommend corrective action when necessary.

b. Provide a forum for the exchange of information and ideas and determine actions required to attain Presidential, National, or DOD-established goals for energy conservation and energy self-sufficiency.

c. Develop and provide recommendations on urgent energy matters.

The AGE is supported by a working group chaired by the Chief, AEO, with action officer representation from the same staff elements as the AGE.

3.3.1.3 Army Energy Office. The AEO was established in ODCSLOG by Chief of Staff Memorandum 73-10-133, dated 23 November 1973. The AEO is located in the Directorate for Transportation, Energy, and Troop Support. AR 11-27 assigned to the DCSLOG the Army General Staff responsibility for the following energy related functions:

a. Supervising and coordinating the Army Energy Program.

b. Formulating and recommending coordinated DA policy for the allocation, supply, and use of energy resources within the Army.

c. Developing and executing a comprehensive energy conservation program.

d. Providing principal Army staff advisers and contacts on energy related matters to the Office of the Secretary of Defense (OSD), Office of Management and Budget, the Congress, other military and government departments and the civilian sector.

e. Participating in the budgetary process for the Army Energy Program within overall guidance and policies developed by the Director of the Army Staff and the Comptroller of the Army.

3.3.2 Army Staff responsibilities. Summaries of specific responsibilities assigned to other Army Staff agencies are as follows:

DCSOPS - Establish priorities, ensure energy considerations are introduced into unit training and exercises, and materiel requirements. Ensure energy conservation is incorporated in the curriculum of schools and individual training programs.

DCSRDA - Initiate research and development actions to conserve energy, and ensure that energy conservation is incorporated in the development, acquisition, manufacture, operation, and use of Army materiel.

DCSPER - Emphasize energy conservation in the incentive awards program and other personnel related programs.

COA - Assist Army Staff in development of energy related budgeting actions.

COE - Develop and manage the installations and utilities element of the Army Energy Program, including construction, serve as principal Army Staff adviser on the Army Facilities Energy Plan (AFEP) and has power procurement responsibilities for DA.

TSG - Ensure health and preventive medicine aspects of the Army energy program and plan are adequate.

CPA - Develop and execute command and public information support for the Army Energy Program and Plan.

All staff agencies - Ensure energy considerations are included in agency functional responsibilities, coordinate energy matters with the Army Energy Office, and establish a single point of contact for energy matters.

3.3.3 Command responsibilities. Commanders at all levels down to and including installation commanders are encouraged to establish and use command energy councils or committees. Commanders are responsible for:

a. Developing and maintaining an active command energy program to include a comprehensive energy plan. Commanders of major commands will establish MACOM goals and will provide copies of their plans to the AEO and will provide annual updates of those plans.

b. Designating an activity with the responsibility of coordinating all energy matters. The use of full-time personnel is encouraged whenever feasible.

c. Maintaining liaison and cooperation with appropriate Federal, state, and local energy offices.

3.3.4 Long-range organizational considerations. It is anticipated that the reduced availability of fossil energy sources and the higher cost of energy will demand increased attention from the Army's management as the year 2000 approaches. Accordingly, as the need for intensive management increases, there will be a requirement for more full-time personnel who are dedicated to energy matters. It is also anticipated that a more extensive management information system in support of this intensive management effort will be required. However, no major changes in the organizational structure for the management of energy at the DA level are considered necessary or required.

3.4 REQUIREMENTS AND COSTS.

3.4.1 Requirements.

3.4.1.1 Current Requirements. The Army's energy consumption in FY 79 was 43.2 million barrels of oil equivalent (MBOE). This represents a reduction of 9.5 percent from the FY 75 level of consumption and a 29.4 percent reduction from the pre-embargo FY 73 level of consumption. (See figure 3-5.)

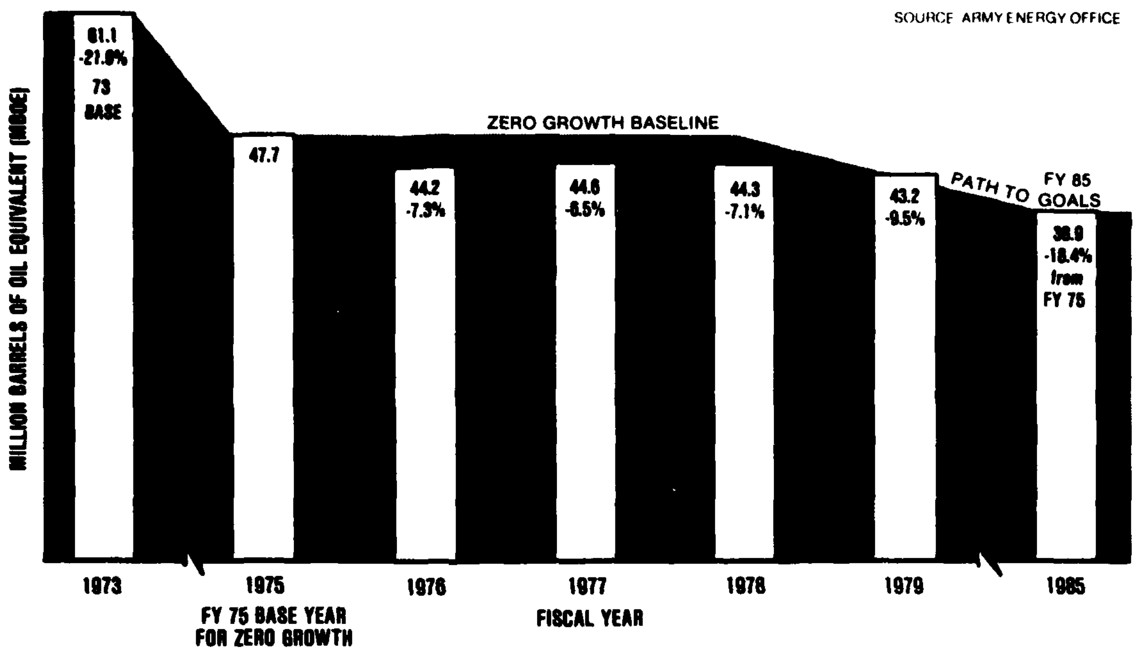


Figure 3-5. ENERGY CONSUMPTION

The Army met the DOD and Army zero growth objective in FY 76 and 77, and again in FY 78 by reductions of 7.3, 6.5, and 7.1 percent, respectively, compared to FY 75 despite record setting low temperatures during that period. Energy consumption in FY 79 was further reduced to 9.5 percent below FY 75 which is below the straight line glide path to FY 85 goals. Consumption of energy by major command is shown in figure 3-6.

In FY 79, 10 CONUS installations consumed almost 19 percent of the total energy consumed by the Army worldwide. The largest consumer consumes 2.4 percent of the total. Four of the top 10 consumers are FORSCOM installations. TRADOC accounts for another 3, and DARCOM the remaining 3.

Ranking FY 79	CONUS Installation	Energy Consumption (MBtu) (FY 79)
1	Fort Bragg, NC	5,983,575
2	Fort Hood, TX	5,735,396
3	Redstone Arsenal, AL	5,019,617
4	Fort Campbell, KY	4,937,300
5	Fort Lewis, WA	4,913,208
6	Fort Benning, GA	4,848,544
7	Fort Knox, KY	4,763,352
8	Fort Rucker, AL	4,473,505
9	Radford AAP, VA	3,929,002
10	Holston AAP, TN	3,915,921

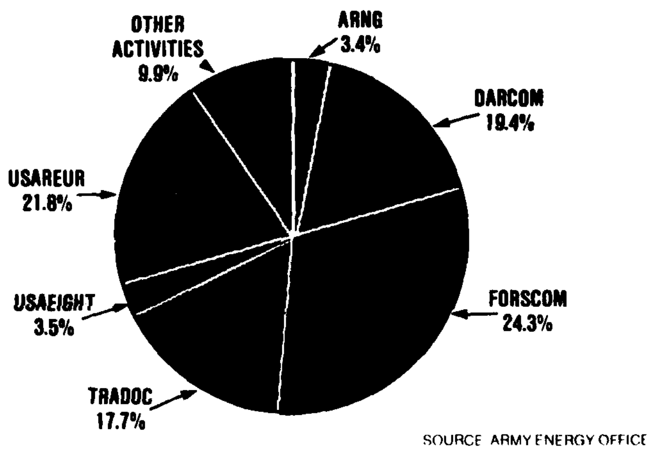


Figure 3-6. ENERGY CONSUMPTION BY MAJOR ACTIVITY, FY 79

Energy consumption by energy resource is shown in figure 3-7. Petroleum fuels represent the largest single energy source and are the principal energy resources used in mobility operations. The breakout of petroleum fuels shows that nearly 57 percent are consumed as heating fuels. Petroleum heating fuels when coupled with natural gas, purchased electricity, coal, liquid petroleum gas (LPG), and purchased steam represent total energy consumed in facility operations and account for 83 percent of total Army energy.

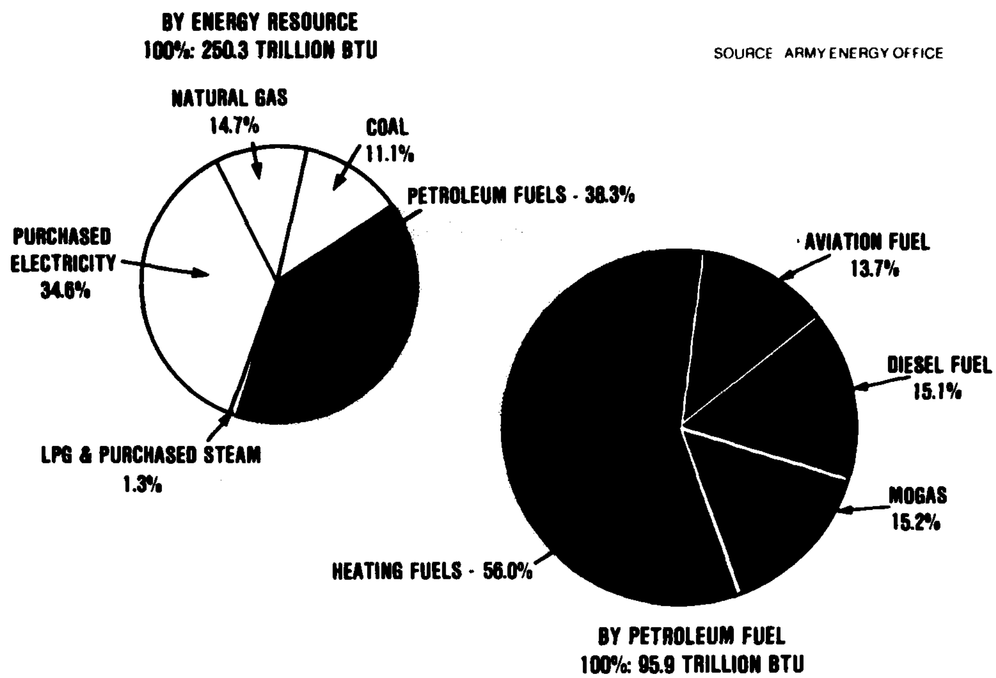


Figure 3-7. ENERGY CONSUMPTION BY RESOURCE, FY 79

A reduction of 10 percent in energy consumption in the facilities area would have about the same impact on the Army's total energy consumption as a reduction of 50 percent in energy consumption in mobility operations. This fact, when coupled with the number of available alternative energy sources, makes the facilities operations area the more desirable target for conservation, investment, and research and development efforts to reduce total Army energy consumption.

3.4.1.2 Long-range considerations. In order to meet the Army goals for the year 2000, several changes are required in the energy consumption by resource. As petroleum fuels are replaced with shale oil derivatives or synthetic liquid fuels such as alcohol, existing distribution systems and engines with or without modification may continue to be utilized. The percentage of total energy consumed as coal (11.1 percent) and electricity (34.6 percent) are expected to increase while the combination of LPG and purchased steam decline.

Army energy consumption (figure 3-7) is compiled based upon the original form in which the Army purchases it. Accordingly, in the long term, the use of electricity could be understated to the extent that the Army could generate its own electricity through hydropower, coal or biomass fired powerplants. Likewise, the use of gas could be distorted to the extent that the Army generated its own synthetic gas from coal or other sources.

3.4.2 Costs.

3.4.2.1 Long range prospects. Using the best available information, energy unit costs have been projected by the Cost of Energy Resources Forecasting System (CERFS) to the year 2000 in yearly increments. Cost projections have been prepared based upon meeting the Army's long-range energy consumption goals. Two sets of forecasts generated by CERFS are discussed here. A more detailed discussion is included in appendix E.

The first set of forecasts represents anticipated energy costs over the next 20 years, while the second set of forecasts incorporates the price escalations projected by the Office of the Secretary of Defense (OSD). Under the anticipated conditions, costs would increase over 800 percent to $7.6 billion by FY 2000 despite a decrease approaching 35 percent in total energy consumption. If the Army did not make this effort to conserve fuels, the cost in FY 2000 would be expected to exceed $11 billion. The cost per MBtu in 1973 averaged $0.89. In 1975 it had risen to $2.01, and it is expected to increase to $8.20 by 1985 and to $40 by the year 2000. Budgeted amounts similarly rise significantly, but fall short of the expected energy costs. Using the prevailing acceptable fuel inflation figures projected by OSD, the FY 85 budget will total $1.3 billion. This amount will then rise to $2.1 billion by FY 2000. This will result in a budget-cost gap of $400 million in FY 85 rising to a differential of $5.5 billion in FY 2000. The discrepancy between anticipated costs and projected budgeting must be addressed and resolved to preclude severe impact on the Army budget, generally, and local command budgets specifically.

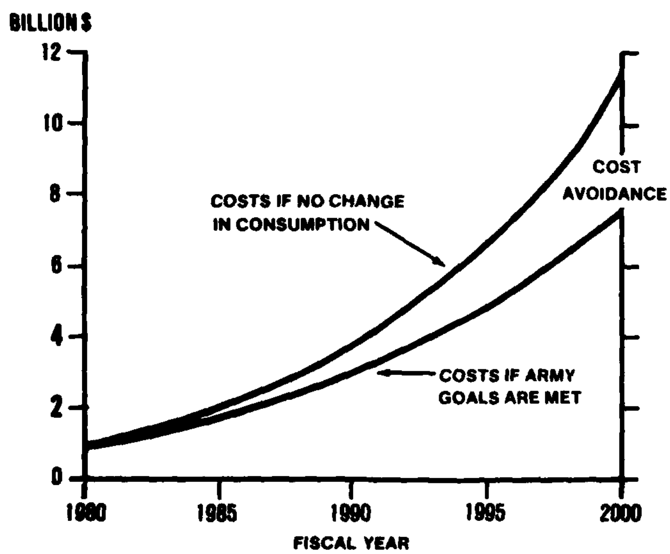
A comparison of costs under the two consumption scenarios is shown in figure 3-8. Case I assumes constant energy consumption from the FY 79 base year. Case II assumes that the Army's energy reduction goals of a 10 percent reduction in mobility energy use are met by 1985, with zero growth through the year 2000, while a 40 percent reduction in facility energy use is achieved by FY 2000, thus yielding a 35 percent overall reduction in energy consumption by FY 2000.

CASE		FY 79	FY 85	FY 2000
I	BASE CASE			
	Facilities	$658.06	$1611.23	$9921.10
	Mobility	257.94	384.75	1647.11
	Total	$916.00	$1995.98	$11568.21
II	ARMY GOALS ACHIEVED			
	Facilities		$1410.82	$6062.61
	Mobility		366.60	1565.44
	Total		$1777.42	$7628.05
Cost avcidance under CASE II			$218.56	$3940.15

Figure 3-8. ENERGY COST COMPARISON ($M)

From a cost avoidance standpoint, $219 million would be freed up in FY 85 and $3.9 billion during FY 2000. This cost avoidance is based upon estimated unit prices for energy, and the expected impact of the Army's energy goals upon consumption. Consumption levels from FY 79 were used for the base case calculations, while outyear consumption levels assumed that Army consumption goals are met.

This information is graphically summarized in figure 3-9. The upper curve illustrates the annual costs of energy to the Army if consumption was maintained at the FY 79 level. The lower curve represents anticipated costs if Army conservation goals are met. The area between these two curves represents the cost avoidance to be realized as the Army achieves its goals. These figures, as determined by CERFS, point to a cumulative cost avoidance through the year 2000 of over $24 billion. The Army should strive to obtain credit for this cost avoidance which will be used to assist in justifying funds for other related energy costs; e.g., construction to include ECIP and to develop and procure more energy efficient equipment.



NOTE: Cumulative cost avoidance $24 billion (FY 79-2000)

Figure 3-9. ENERGY COST PROJECTIONS - MODERATE ECONOMIC INFLATION

3.4.2.2 Related energy costs. The price paid for energy is the principal but not the only cost involved in a comprehensive energy program. The cost to retrofit existing buildings to make them more energy efficient, the additional cost of energy efficient new construction, the cost of energy audits and studies, the cost of research and development into new energy sources and systems, and the additional expense for labor intensive systems and energy training will all add to the annual energy cost.

It is anticipated that by the year 2000 many of these energy related costs will be absorbed into new standards and specifications for construction of new facilities and such programs as the Energy Conservation Investment Program will no longer be required.

CHAPTER 4

ARMY ENERGY PROGRAMS

4.1 SUMMARY.

4.1.1 Introduction. In compliance with Executive Order 12003, dated 20 July 1977, which directed the Federal Government to set the example for the nation in energy conservation, the Army Energy Program was reviewed to determine what revisions were necessary to comply with Presidential guidance and what the revised program would cost. Outlined below are brief summaries of the Army's programs, which are covered in greater detail in later sections of this chapter. The funding required for these programs in the near term, FY 82 to FY 86, totals $1.015 billion (table 4-1).

Table 4-1. SUMMARY OF ARMY ENERGY PROGRAM REQUIREMENTS ($ BILLION)

APPN/PROJ	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 82-86
MILCON	107.5	136.9	164.9	171.8	179.8	188.8	842.2
ECIP	(101.9)	(132.3)	(134.9)	(136.8)	(139.8)	(143.8)	(687.6)
CONV	(5.6)	(4.6)	(30.0)	(35.0)	(40.0)	(45.0)	(154.6)
OMA	15.5	15.5	9.7	5.9	3.9	3.9	38.9
EEAP	(14.6)	(15.0)	(9.2)	(5.4)	(3.4)	(3.4)	(36.4)
MGMT	(.7)	(.3)	(.3)	(.3)	(.3)	(.3)	(1.5)
ENERGY INFO	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(1.0)
PROC							
ECAM	0.0	8.3	7.1	10.1	12.7	12.7	50.9
RDT&E	14.3	21.4	21.3	13.7	13.2	13.4	83.0
FACILITY	(2.9)	(3.2)	(3.1)	(1.0)	(.6)	(.3)	(8.2)
MOBILITY	(10.1)	(15.3)	(16.2)	(12.2)	(12.1)	(13.1)	(68.9)
DOD/DOE	(1.3)	(2.9)	(2.0)	(.5)	(.5)	(.0)	(5.9)
TOTAL PROGRAM REQUIREMENTS	137.3	182.1	203.0	201.5	209.6	218.8	1,015.0

4.1.2 Ongoing programs.

4.1.2.1 Energy conservation programs. The Army's energy conservation goal for FY 76, 77, and 78 was to maintain zero growth in energy consumption over that consumed in FY 75. The FY 79 goal was to reduce the energy consumed by 8 percent from the FY 75 base. The Army achieved this goal with a total energy consumption in FY 79 of 9.5 percent less than in FY 75 and 29.4 percent below FY 73. Executive Order 12003 established a goal to reduce energy consumption in existing facilities by 20 percent (Btu/ft^2) by FY 85 using FY 75 as the base year. The Army achieved through FY 79 a 15.7 percent reduction in Btu/ft^2 in existing facilities. The AGE established a 20 percent absolute (Btu) energy reduction goal for fixed facilities to be achieved by FY 85 using FY 75 as the base year. The Army has achieved a 9.99 percent reduction in energy consumption at fixed facilities through FY 79. Energy savings have been achieved through a combination of energy savings techniques in the facility and mobility operations areas such as installation of storm windows, insulation, temperature controls, energy monitoring and control systems, heat recovery equipment, adherence to 55 mph speed limit, improved motor vehicle management, combining operational and administrative flying requirements, and use of flight simulators.

In comparing energy conservation with reduced operations in the Army for FY 73-76, the following items were considered: total Army strength, total Army budget, total energy consumption, and major installation closures (CONUS). All areas considered showed a downward trend from FY 73 to FY 76 with energy consumption showing the largest percent reduction. An analysis of this trend is shown below:

PERCENT REDUCTION BY CATEGORY - FY 76 vs FY 73

Energy Consumption	27.9%
Army Strength	1.8%
Army Budget	16.5%
Major Army Installations (CONUS)	8.1%

An analysis of figures shows that although there has been a reduction in each category presented, the reduction in energy consumption exceeds the total percent reduction in every other case. Although many things have an influence on energy consumption, it is felt that these indicators are representative of the level of operation of the Army and that a substantial part of the reduction in energy consumption can be attributed to energy conservation measures taken since 1973. While total energy consumption has been decreasing at fixed facilities, the use of electrical energy has generally been increasing. Electrical energy consumption increased 3 percent through 1978 compared to that consumed in FY 75 but showed a decline in FY 79 of 1.04 percent. Even though a decline was achieved in FY 79, electrical energy use and the means to reduce consumption has become a high priority in meeting Army energy goals.

Army contractors are being motivated to develop and submit value engineering changes which will reduce overall energy costs to the Army. Value engineering clauses outlined in the Defense Acquisition Regulations provide incentives for contractors to reduce operating costs, including energy savings on equipment and newly constructed facilities. The Army's effort to make contractors and procurement and technical personnel more aware of this potential should greatly increase these cost and energy savings benefits.

4.1.2.2 Training and operations. The Army's policy is to conserve the maximum amount of energy consistent with allocating and utilizing those resources necessary to maintain the required state of readiness. The post-Vietnam phase-down, with its accompanying reduction in force and reduced industrial, operational, and training activities, has helped reduce the Army's consumption of energy. Another assist in achieving energy savings while attaining the Army's readiness objective has been and continues to be increasing the use of training simulators and simulations. Advance planning to leave equipment on site, the use of small wheeled vehicles to represent large, tracked, tactical vehicles, and improved petroleum (POL) handling techniques are some of the additional means being used to accomplish energy savings in the training environment. Training simulators reduce consumption of mobility fuels and help reduce total Army energy consumption; however, simulators increase electrical consumption at fixed facilities.

4.1.2.3 Administrative automobiles. The Army's goal to have 97 percent of the sedan fleet comprised of compact and subcompact vehicles by the end of 1980 has been set back because of lack of funding for replacement vehicles. The goal remains, but the target date--a function of funding--is uncertain. Concurrent action is intended to adjust procurement of administrative vehicles in conformance with Presidential guidance on gasoline consumption goals for the nation's automobiles.

4.1.2.4 Energy Engineering Analysis Program (EEAP). These studies are the key to meeting National, Presidential, DOD and Army energy goals. These studies will provide the impetus for integration of energy conservation, energy use, and energy control systems and will result in the optimum use of the energy resources available. The objectives of these studies are to--

a. Develop a systematic plan of projects that will result in the reduction of energy consumption in compliance with the objectives set forth in the Army Facilities Energy Plan (AFEP) without decreasing the present standard of living.

b. Use and incorporate applicable data and results of related studies, past and current, as feasible.

c. Develop coordinated Basewide Energy Systems Plans for each military installation.

d. Prepare Program Development Brochures (PDBs), DD Forms 1391, and supporting documentation for feasible energy conservation projects at each installation.

e. List and prioritize all recommended energy conservation projects.

f. Develop an energy systems overlay to the installation master plan, if required.

4.1.2.5 The Quick Return on Investment Program (QRIP). Another Army program designed to conserve energy and reduce costs is the Quick Return on Investment Program (QRIP). The program provides a centralized source of funds for timely financing of "Quick Return" investments. The proposal for a project under the program must--

a. Be for at least $3,000 but cannot exceed $100,000.

b. Be self-amortizing within 2 years.

c. Be off-the-shelf equipment requiring minimum modification.

d. Produce hard-dollar savings which can be reflected by reductions in the benefiting appropriations.

e. Be concurred in by the MACOM energy office.

4.1.2.6 The Energy Conservation Investment Program (ECIP). The objective of ECIP is energy reduction through retrofit of existing facilities. The early phases of ECIP, which started in FY 76, included the most easily accomplished energy saving installation operations projects. The follow-on programs are more sophisticated. They include such projects as energy monitoring and control systems, boiler controls, and heat recovery equipment. Effective with FY 79, criteria for justifying and prioritizing ECIP projects is the energy saved per dollar invested ratio or E/C ratio.

4.1.2.7 Energy Conservation and Management Program (ECAM). ECAM is a procurement funded energy conservation program which applies to Government-owned, contractor-operated (GOCO) plants only and is analogous to ECIP. ECAM will fund for energy conservation measures at active and inactive GOCO plants. ECIP will continue to fund for Government-owned, Government-operated (GOGO) plants.

4.1.2.8 Facility Solid Fuel Conversion Program. Based on the President's policy to reduce dependence on critical fuels and his desire that Executive agencies set the example, all large boiler plants on Army installations are being considered for conversion to solid fuel. AR 420-49, 18 November 1976, "Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems," was rewritten to emphasize the Army's need to increase the use of solid fuels.

4.1.2.9 Dual Fuel Program. All natural gas only heating units and plants with over 5 MBtu/hr output are being modified to have the capability to use oil in addition to natural gas. In view of potential curtailment of fuel oil like that experienced during the Iranian crisis of 1979, oil fired only heating units and plants are being modified to have the capability to use natural gas in addition to oil.

4.1.2.10 Alternate sources of energy. The Army has an active program to increase its use of coal, wood, solar, and refuse derived fuels (RDF) to furnish its energy needs. Wood/coal plants are programed for Red River Army Depot, Texas and Fort Stewart, Georgia. Studies are being conducted to investigate the feasibility of the Army entering into cooperative agreements with industry and utilities where the Army would furnish wood fuels from its timberlands, provide real estate for plant siting, etc., in return for favorable utility rates and/or thermal energy. Heat recovery incinerators are also being included in the MCA program to reduce dependence on critical fuels. Although high cost estimates have restricted progress on solar energy projects, the Army has urged the Office of the Secretary of Defense to seek expanded DOE support for demonstration projects. The Army is moving ahead on those projects that can be reasonably justified.

4.1.2.11 Army energy showcase. Under the overall umbrella of the DOD-DOE Memorandum of Agreement, 19 October 1978, and the Defense Energy Program Policy Memorandum (DEPPM) 78-8, the Army designated the Red River Army Depot-Lone Star Army Ammunition Plant complex in Texas as the principal installation for demonstrating advanced energy conservation/alternate fuel concepts. This jointly funded program by DOE and the Army is demonstrating the effectiveness and commercial potential of selected energy initiatives to reduce the dependence on critical fuels. In addition to adapting solar energy systems to industrial requirements, the major technology thrusts include biomass (the use of wood waste for solid, liquid, and gaseous fuels), alternate transportation concepts (gasohol and electric powered vehicles), photovoltaic battery charging stations, terratecture, lignite, boiler fuels, and specific energy conservation measures.

4.1.3 Long-range programs (FY 86-2000).

4.1.3.1 Installation operations. By the year 2000 only 17 percent of the Army's real property will have been replaced with new, more energy efficient buildings. As a result the Army's ability to meet energy goals will depend on retrofitting existing facilities to make them more energy efficient. Reducing dependence on critical fuels through energy conservation and increased reliance on solid fuels will require a dedicated MCA program to convert or replace existing heating plants. Command emphasis must be placed on energy conservation.

4.1.3.2 Mobility operations. Readiness is the big factor in determining what sacrifices, if any, can be made in mobility operations to offset the decreasing availability and the increasing costs of current sources of energy. The Army is headed for increased mechanization of its force structure with a commensurate impact on fuel consumption. In order to compensate for this, the Army long-range mobility operations programs are considering lighter weight vehicles, improved engine performance and the utilization of synthetic and alternate fuels. The bottom line is that an adequate state of readiness will be maintained.

4.1.3.3 Training. Readiness is of equal concern in determining the extent of training programs as it is in mobility operations. Training concerns the readiness of the individual or unit to do the job. Training is a major consumer of energy whose consumption can be reduced through two programs which prevail now and will continue to prevail in the future. They are: (1) the constant search for ways and means of reducing unnecessary movement of troops and equipment, and increasing efficiency in use of existing equipment and facilities through training; and (2) the greater use of simulators and simulations as training devices. The Army will continue vigorous pursuit of both programs in the long-range period.

4.1.3.4 Research and development. Long-range Army energy R&D programs will seek effective energy conservation measures, alternative energy sources, and improved energy management techniques for military facilities. In mobility operations, the Army R&D projects will concentrate on areas that will contribute toward meeting the Army's goals to reduce energy consumption and dependence on petroleum based fuels.

4.2 INSTALLATION OPERATIONS.

4.2.1 General. The Army is vigorously pursuing a multifaceted energy reduction program. Thus far, all of the broad program objectives have been met. Figure 3-2 indicates that installation operations or facilities consume

83 percent of the Army's total energy, with mobility operations consuming the balance of 17 percent. It is quite apparent from these figures that the Army's greatest potential for energy reduction exists in installation operations. The Army Facilities Energy Plan is summarized at appendix A.

In installation operations, the Army has reduced its total energy consumption, but at the same time significant increases in cost have occurred due to higher prices. If the Army had continued to use energy at the same rate as in 1973, it would have cost almost $1.3 billion more than the actual cost through 1979. This indicates the major impact that installation operations energy reduction has had from a budgetary standpoint.

The Army is continuing to exploit most of the low cost opportunities for energy reduction, such as: reducing heating temperatures (65° F during working hours and 55° F during nonworking hours in offices, and lower temperatures in warehouses and other facilities where occupancy and activity permit); raising cooling temperatures (thermostats set no lower than 78° F); and reducing lighting levels to the minimum of 50 footcandles. The Army is also operating equipment during off-peak hours, consolidating activities into the minimum number of buildings, weatherstripping, caulking leaks, reducing hot water temperature levels, and fine tuning mechanical equipment to achieve better efficiency. Other energy related actions that have been taken or that are under way are: the processing of exigent MCA projects for energy reduction, updating AR 420-49 to provide policy guidance on fuel selection for new facilities and conversion of existing equipment, establishing a moratorium on electrical resistance heating, publishing guidelines on the use of waste oil as a fuel, and promoting the use of solid fuels. Future energy reductions will depend increasingly on additional funding.

Concurrent with energy reduction, the Army must also ensure that energy supplies are available to meet minimum essential needs and ensure against total interruption of utilities services. Consequently, the Army has a program for stockpiling fuel at major heating plants. Although not directed toward energy conservation, this program is an essential part of the overall program to ensure continuity of essential supplies and operations.

4.2.1.1 Short-range facility goals. The Army's FY 85 facility energy goals are to reduce energy consumption and to reduce dependence on critical fuels. These goals are:

a. Reduce absolute facility energy consumption (Btu) 20 percent. This will be achieved by:

(1) Twenty percent reduction in energy consumption (Btu/ft^2) in existing facilities.

(2) Forty-five percent reduction in energy consumption (Btu/ft^2) in new buildings.

(3) Design to meet energy targets (Btu/ft^2) for building envelopes in new construction.

(4) Energy reduction through improved energy management.

(5) Renewable energy source substitution.

b. Reduce dependence on critical fuels by:

(1) Thirty percent reduction in use of petroleum based fuels.

(2) Fifteen percent of facility energy derived from solar, coal, RDF, and biomass fuels.

(3) Improvement in efficiency of building and industrial plant process systems.

4.2.1.2 Long-range facility goals. The Army's energy goals for the year 2000 are:

a. Reduce installation absolute facility energy consumption (Btu) 40 percent.

b. Reduce dependence on critical fuels by--

(1) Reducing use of natural petroleum fuel by 75 percent through a combination of--

(a) Absolute reduction in energy consumption,

(b) Conversion to solid fuel (coal, biomass, and RDF),

(c) Conversion to renewable energy sources (solar, geothermal, wind), and

(d) Conversion to synthetic liquid fuels.

(2) Developing the capability to use coal gas, wood gas, and other synthetic gases to reduce dependence on natural gas.

4.2.2 Funding. Executive Order 12003 requires that energy consumption in existing facilities be reduced by 20 percent on a Btu per square foot basis by 1985, with FY 75 as the base year. The Army's funding to meet this requirement is being achieved largely through a separately identified MCA program entitled the Energy Conservation Investment Program (ECIP). It is currently planned to achieve about 12 percent of the EO 12003 goal by ECIP. The remaining 8 percent reduction is to be achieved through improved energy management and energy conservation projects at installation levels.

In order to identify, in a systematic manner, what energy conservation measures must be utilized to achieve this 20-percent reduction, the Army initiated a program in FY 77 to conduct energy engineering analyses at all CONUS active installations. Studies have been funded for 72 Army installations to develop an integrated basewide energy use and control system. From these studies and others that follow, a program will be developed and prioritized based upon meeting energy reduction goals at minimum costs.

ECIP funding priorities for FY 76-78 were largely determined on the basis of amortization. Individual projects with early dollar amortization were given the highest priority, resulting in deferral of many worthy projects which had a potential for high energy savings rather than quick payback. For programs starting with FY 79, funding criteria have been changed and projects are required to amortize within the life of the facility or the retrofit action, rather than within a specified number of years. Projects are then prioritized on the basis of MBtu's of energy saved per year per thousand dollars invested--an E/C ratio.

Executive Order 12003 further stipulates that a 45-percent reduction in the use of energy by new facilities will be achieved by 1985, again measured against energy use per square foot by existing facilities in 1975. This will be achieved by installing additional insulation, using solar screening, introducing heat recovery systems and enthalpy control, and improving energy management systems.

4.2.3 Alternate sources of energy.

4.2.3.1 Solar energy demonstration and construction. The Military Construction Authorization Act 1979, Public Law 95-356, Section 804 requires that 25 percent (based on the estimated dollar value of the construction cost) of all new facilities except family housing (family housing requirement is 100 percent) that are placed under design shall include solar energy systems to the extent that engineering analyses demonstrate it is cost effective. The law made this requirement effective 90 days after enactment of the act. The law was enacted 8 September 1978; therefore, all design-starts on or after 7 December 1978 are subject to these requirements. DOD requires a summary of the engineering analysis be furnished prior to initiating final design. Essentially the Act requires that an engineering/economic analysis must be made as part of the design process for all military projects. Those projects for which solar energy applications are determined to be cost effective are to be designed as solar energy projects. For the purpose of the engineering/ economic analysis, a solar energy system shall be considered cost effective if the original investment cost differential can be recovered over the "expected" life of the facility. Further the Act stated that only the initial cost of the systems is to be considered in determining cost effectiveness; hence, if the 25-year energy (operating costs) savings, exclusive of any maintenance and replacement costs, exceed the original investment cost differential, the original cost differential is to be considered recovered and the solar energy application becomes cost effective. The Army is actively involved in demonstrating the feasibility of solar energy to heat domestic hot water, to heat and cool buildings, and to generate electric power. The funding for these projects has been provided by the Congress directly under military construction appropriation, and by DOE as a part of the national solar energy program.

Current program planning, covering FY 76 through FY 80, will result in approximately 50 Army projects being evaluated for solar energy systems. As of 1 April 1980, five projects were completed, and 11 were under construction. The solar energy projects which are under design include reserve centers, dental clinics, family housing, barracks, administrative buildings, range operation centers, hospitals, field houses, maintenance shops, and solar ponds. New initiatives as a part of a $100 million, 3-year solar energy demonstration program implementing the President's National Energy Plan are forthcoming.

The cost experience to date with use of solar energy systems follows:

a. A solar energy system of stated capacity can be installed in a new building for about one-half of the cost of retrofitting the system to an existing building.

b. The payback period under present amortization rules is up to 25 years. However, under current rules, the authorized fuel cost escalation rates beyond 5 years are suspect and penalize the use of solar energy systems.

c. Successful solar energy installations require unusual attention to design details, equipment selection, and careful construction installation.

4.2.3.2 Refuse derived fuel (RDF). The Resources Conservation and Recovery Act of 1976 requires that Federal agencies use RDF as a primary or supplemental fuel to the maximum extent practicable. Additionally, AR 420-49 (18 November 1976) requires that RDF be considered in the future for all large boilers which burn solid fuel. Also, large boilers which are constructed to burn oil will be designed to permit conversion to coal/RDF combination, if required at some future date. Generally, this will apply to boilers over 50 MBtu/hr in output capacity. There are relatively few boilers this large being installed in Army facilities. The FY 79 Army construction program included a modular refuse-fired heat recovery incinerator at Fort Eustis, VA. This consists of two 20-ton per day refuse burners in an incinerator connected to one steam generating, water tube type package boiler which will provide steam to the existing steam supply system at a post boiler plant. Solid waste which is processed through a shredder is to be burned. Future MCA programs include the following projects:

FY 80 MCA Program

Fort Knox, Ky - Heat recovery incinerator.

Fort Leonard Wood, MO - Solid waste incinerator with heat recovery.

FY 81 MCA Program

Redstone Arsenal, AL - Solid waste incinerator with heat recovery.

FY82 MCA Program

Fort Dix, NJ - Solid waste incinerator with heat recovery.

Fort Rucker, AL - Solid waste incinerator with heat recovery.

Fort Gordon, GA - Solid waste incinerator with heat recovery.

4.2.4 Other installation actions.

4.2.4.1 Medical facilities. As a result of guidance from the US Army Health Facility Planning Agency (SGFP), the Office of Chief of Engineers (OCE) has written medical facilities interior design criteria to minimize energy use without compromising patient care. Additionally, the SGFP has recommended to OCE that solar energy be used in medical and dental facilities when feasible.

Because of the wide variety of energy sources and the ages of health care facilities, medical activities have been directed to work with their installation facility engineer to maximize energy conservation on an installation-by-installation basis. As improved methods of energy conservation are surfaced, these methods will be incorporated in pertinent regulations for utilization at medical facilities. A study, Fixed Facilities Energy Consumption Investigation, conducted by the Corps of Engineers, is currently under way at Forts Belvoir, Carson, and Hood to determine the energy consumption patterns at typical medical facilities on an installation. The Surgeon General (TSG) desires to establish a true baseline of energy consumption for existing buildings at medical facilities utilizing the results of the study. Evaluation of the data obtained from metering will identify specific areas that require automatic control monitors which will permit highly reliable energy conservation control.

4.2.4.2 Improved troop support. A principal energy conservation objective is to insure that the latest energy conservation technology is being considered and applied during the design and construction phases of new commissary stores. Also, an energy conservation program has been developed for recently constructed commissaries and for commissaries in buildings neither designed nor constructed as commissaries. Refrigeration equipment is the major consumer of energy in commissary stores, and has the highest potential for energy savings through the application of effective conservation measures. The commissary at Fort Riley, KS, has been designated as a test facility for energy conservation procedures to be used in the modernization of existing commissary stores. The invitation for bid for construction of new commissaries includes the requirement for maximum use of energy conservation subsystems.

A second, equally important energy conservation objective is the development of a program by the Troop Support Agency to advise and assist commands and installations in conserving energy in dining facilities, laundry/dry-cleaning facilities, clothing sales stores, and troop issue support activities.

In the laundry/dry-cleaning facility area, an energy checklist has been developed which is being used during technical assistance visits to identify conditions where energy is being wasted. Where waste is observed, corrective actions are recommended, and in many instances on the spot corrections are achieved. Heat reclamation equipment is now specified for modernization/new construction of laundry/dry-cleaning facilities, and such equipment has been installed in the new facilities at Schofield Barracks, Fort Dix, and Walter Reed Hospital. In addition, existing facilities are phasing in the use of low temperature detergents that require 140° F water instead of 160° F water. One [illegible] saving device under consideration is a tunnel washer which utilizes

3/4 gallon of 140^{o} F water for a pound of wash, compared to the conventional washer which requires 3-1/2 gallons of 160^{o} F water for the same job.

4.2.4.3 Improved uniforms. The Army has adopted, or has under consideration, several items of clothing that will allow personnel greater comfort in the normal temperature range and greater flexibility in coping with temperature variations, permitting fuel savings for both heating and cooling offices and buildings. Already adopted are durable press uniforms which will eliminate energy expended for pressing and reduce energy consumption for laundry. In addition, there are fabrics and uniform items under development that will have greater versatility and thus permit a reduction in the number of clothing items supplied to soldiers. Since many uniforms contain a high amount of polyester fiber, which is derived from petroleum, a reduction in the number of uniforms supplied will assist in reducing the nation's petroleum consumption.

4.2.5 Near-term new initiatives (FY 80-85).

4.2.5.1 Meeting Presidential goals. In order to achieve the Presidential goal of a 20-percent reduction in energy consumption (Btu/ft^2) over FY 75 by 1985 in existing buildings, as stated previously, it is anticipated that ECIP projects will lead to reduction of about 12 percent of this goal, with the remaining 8 percent reduction to be achieved largely through improved energy management at installation levels and locally conducted repair and maintenance projects. The Energy Conservation and Management Program (ECAM) will do at procurement funded installations what ECIP does at others and will also contribute to the 20 percent. The second Presidential goal is to reduce energy consumption on a Btu/ft^2 basis by 45 percent in new buildings by 1985, based on 1975 energy consumption figures. This will be achieved through more energy efficient architectural and mechanical design which will include installing additional insulation over and above that customary in previous years. Heat recovery systems as well as modern energy management systems will be introduced. Total and selective energy systems will be considered and successful construction procedures demonstrated by the General Services Administration (GSA) will be included in new buildings. The additional costs associated with meeting this goal will not be readily separable from the construction costs. The costs will be wrapped up in the estimated project cost. It is estimated, however, that the energy reduction requirement will require additional funds of up to 10 percent of the total project cost for complex, large energy-use facilities.

An additional goal is to reduce dependence on imported petroleum fuels through the increased use of coal, refuse derived fuels, and biomass fuels. The Army policy for fuel selection is stated in AR 420-49, Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems.

4.2.5.2 Energy engineering analysis (EEA) and solid fuel conversion studies. The EEA and the solid fuel conversion studies are the key to meeting the Army facility energy goals. These studies will provide comprehensive energy analyses on a basewide scale necessary to support the development of basewide energy systems. They will provide the impetus for integration of energy conservation, energy use, and energy control systems and will result in the optimum use of the energy resources available. Analyses are under way at 72 Army installations with preliminary results showing possible savings of 17 to 34 percent of total installation energy consumption. Actions are well under way to award additional contracts using programed FY 80 OMA funds to study approximately 40 more Army installations.

In addition to these relatively large scale studies there is a necessity to analyze and evaluate new and innovative conservation devices and concepts that are continuously emerging as a result of the national emphasis on energy reduction. Collectively, Army installations spend hundreds of millions of dollars per year on such items without the benefit of an analysis that assesses the true energy savings benefits and cost effectiveness. Accordingly, an Energy Conservation Technical Information and Analysis Center (ECTIAC) has been established at USA Facilities Engineering Support Agency (FESA), Fort Belvoir, VA, to serve as a clearing house for the Army. This will ensure that the best energy conservation devices and concepts are identified and maximum effectiveness in their application is achieved. EEA funding is shown in table 4-2:

Table 4-2. ENERGY ENGINEERING ANALYSIS FUNDING ($M) OMA FUNDS

DESCRIPTION	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 82-86
Program Management	.3	.3	.3	.3	.3	.3	.3	1.5
Basewide Energy	11.6	14.6	14.6	8.8	5.0	3.0	3.0	34.4
Fuel Conversion	3.0	-	-	-	-	-	-	-
ECTIAC	.4	.4	.4	.4	.4	.4	.4	2.0
Required Resources	15.3	15.3	15.3	9.5	5.7	3.7	3.7	37.9

4.2.5.3 Facility Fuel Flexibility Program. The Army has identified projects to implement OSD guidance to add oil-firing (dual-fuel) capability to single fuel natural gas plants over 5 MBtu/hr capacity by FY 82. Conversion of these plants to coal burners has been considered and it has been determined that it would not be technically or economically feasible in the near term. Almost all of these plants are in the relatively low capacity range and many contain packaged boilers which cannot be converted directly to coal.

As a result of stated policies (para 4.2.5.1), the Army has surveyed large boiler plants for conversion to solid fuel. A March 1974 field survey of all boilers over 20 MBtu/hr in CONUS indicated a total cost of approximately $90 million for either austere conversion of selected boilers or construction of replacement boiler plants to burn coal/solid fuel. Subsequent reviews have indicated that conversions would probably be limited to plants above 100 MBtu/hr in lieu of boilers over 20 MBtu/hr. The impacts of inflation and major changes in environmental standards since that estimate was made have vastly escalated the estimated cost, putting it in the range of $500+ million and extended the programed period beyond FY 85. The environmental considerations associated with such conversions add both delays and costs. MCA funding to begin major plant conversions at a limited number of installations has been requested in FY 80. This will be a long-term program extending beyond FY 85. Resources required to begin this program for the programed years are shown in table 4-3.

Table 4-3. SOLID FUEL CONVERSION FUNDING ($M) MCA FUNDS

	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 82-86
Required Resources	6.7	5.6	4.6	30.0	35.0	40.0	45.0	154.6

The program to provide 30-day oil storage capacity at heating plants over 5 MBtu/hr is almost completed. In addition, installations are keeping oil storage tanks filled to high levels to protect against unforeseen interruptions in supplies. CONUS installations which burn coal have been advised to increase storage to approximately 90-day supply levels based on winter consumption.

4.2.5.4 Energy reduction in new buildings. The additional costs associated with meeting the President's goal to reduce energy consumption in new Federal buildings by 45 percent based on an FY 75 consumption base will not be readily separable from the construction costs. The costs will be wrapped up in estimated project cost. It is estimated, however, that the energy reduction requirement will require additional funds of up to 10 percent of the total project cost for typical new structures. An integrated approach to facility design is being used to achieve the 45 percent reduction goal. This approach considers such factors as siting and orientation of the building; location within the building of energy using and energy rejection areas; passive and active solar energy; reduction of air infiltration; energy recovery devices; zoned heating and cooling systems; proper use of insulation and insulated windows; and the use of automatic energy monitoring and control systems.

A building simulation program called "Building Load Analysis Systems Thermodynamics (BLAST)" program which was developed through the Corps of Engineers' energy research and development program is used to validate designs. This program is operational on the Boeing Commercial Computer Service and the Control Data Corporation Cybernet. BLAST is a computer assisted building simulation program that can be used to examine numerous design alternatives. BLAST is based on user oriented input language and includes a library of common building materials and components used in military construction. Using actual weather tapes it computes the building loads based on the facility architectural design. It simulates air handling system design and the mechanical systems required to meet the loads. It includes solar energy and total energy systems in addition to conventional HVAC systems. The BLAST program is being used to establish FY 75 baseline data for energy consumption for various building types. Using this baseline data, BLAST will determine if new building designs will meet the 45 percent reduction goal established by Executive Order 12003 and the building energy targets established by DOE.

4.2.5.5 Energy Conservation Investment Program (ECIP). Executive order 12003 requires that energy consumption in existing Army facilities, including family housing, be reduced by 20 percent on a Btu/ft^2 basis by 1985, with FY 75 as the base year. The Army's funding to meet this requirement is being achieved through a separately identified military construction funded program titled the Energy Conservation Investment Program (ECIP). It is currently planned to achieve about a 12 percent reduction in energy consumption by expansion of ECIP. The remaining 8 percent reduction is to be achieved largely through improved energy management at installation levels and locally approved operation and maintenance projects.

In the FY 76-79 time frame, ECIP has achieved the following results under the funding programs indicated:

MCA	FHMA
144 Projects	34 Projects
$158 Million	$13.4 Million
1.6 MBOE Annual Savings	89,000 BOE Annual Savings
$28.0 Million Annual Savings	$2.0 Million Annual Savings

The funding requirements necessary for the Army to meet its goals of reducing dependence on nonrenewable and scarce fuels (FY 81-86) are shown in table 4-4.

Table 4-4. ENERGY CONSERVATION INVESTMENT PROGRAM FUNDING ($M)
MILCON FUNDS

APPN	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 82-86
MCA	72.0	100.0	100.0	100.0	100.0	100.0	500.0
FHMA	27.2	30.0	33.0	35.0	38.0	42.0	178.0
MCAR/MCARNG	2.7	2.3	1.9	1.8	1.8	1.8	9.6
Required Resources	101.9	132.3	134.9	136.8	139.8	143.8	687.6

4.2.5.6 Family housing. The Army's family housing inventory is a readily available source for conservation projects which can provide significant reductions of total Army natural gas consumption. These projects total $136.0 million for CONUS family housing only and include improving insulation, weatherstripping, installation of storm doors and windows as well as the installation of water flow reducers, set-back thermostats, time clocks for water heaters and flue pipe dampers. Total family housing energy program requirements are shown in table 4-5 and in para 4.2.5.5, above.

Table 4-5. FAMILY HOUSING ENERGY CONSERVATION FUNDING ($M) FHMA FUNDS

	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 82-86
Required Resources	27.2	30.0	33.0	35.0	38.0	42.0	178.0

4.2.5.7 Metering. Utility meters have been installed in family housing units at Fort Eustis, Fort Gordon, and Yuma Proving Ground. A total of 4,008 electrical and fuel meters were installed in 2,494 family housing units. This was a test program to establish energy consumption base data in family housing. Problems associated with meter reading, maintenance and billing were analyzed. Data collection of family housing energy consumption was initiated 1 January 1979. Report on family housing metering program was submitted to Congress in March 1980. The Naval Facilities Engineering Command had tri-service responsibility for preparing the report. Actual energy consumption will be compared to norms derived from computer simulation techniques.

4.2.5.8 Energy Conservation and Management Program (ECAM). ECAM is a procurement funded energy conservation program which applies to Government-owned, contractor-operated (GOCO) plants only and is analogous to ECIP. ECAM will fund for energy conservation measures at active and inactive GOCO plants. ECIP will continue to fund for Government-owned, Government-operated (GOGO) plants. All

ECAM effort will be developed in accordance with ECIP guidance in that minimum Energy-to-Cost (E/C) ratios and cost effectiveness criteria must be met. Energy conservation at GOCOs has been funded in the ECIP program in FY 81 and prior years. Due to the need for an orderly transition and the more rigid Congressional requirements for the completion of design for procurement funded projects than for MCA projects, the earliest that procurement funded ECAM effort can commence is FY 82. In the interim, ECIP effort to correct energy problems at GOCOs will continue through FY 81. Funding for ECAM is shown in table 4-6.

Table 4-6. ENERGY CONSERVATION AND MANAGEMENT PROGRAM FUNDING ($M)

APPN	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 82-86
Proc							
Aircraft	-	.10	.13	.18	.25	.25	.91
Missiles	-	.06	.10	.10	.10	.10	.46
W&TCV	-	.10	.13	.18	.25	.25	.91
Ammo	-	8.00	6.70	9.60	12.10	12.10	48.50
MCA*	9.07	-.--	-.--	--.--	--.--	--.--	--.--
Required Resources	9.07	8.26	7.06	10.06	12.70	12.70	50.78

*Reflected in ECIP (para 4.2.5.5).

4.2.6 Long-range programs (FY 86-2000)

4.2.6.1 General. Since 83 percent of the total energy used by the Army is consumed by installation operations, it is essential that maximum energy reductions be achieved in that area in order to insure that sufficient petroleum will be available for mobility operations requirements. The determination of what long-range facilities programs to pursue to meet the Army's long-range energy goals and objectives and to carry the major portion of the Army's energy reduction must be prefaced by the following broad assumptions and guidelines:

a. Assumptions:

(1) Force structure/stationing will remain basically the same. (The potential relocation of forces from Korea has been considered.)

(2) Real property inventory will grow slowly, and by the year 2000 only about 17 percent of the Army's existing inventory will be from new construction.

(3) Retrofit of existing facilities will be extensive in the near term and continuing.

(4) Cooperation will be essential in environmental areas, particularly on an interim basis, where direct coal combustion is utilized.

b. Guidelines:

(1) Natural gas, liquid petroleum gas, and oil derived from natural crude oil will gradually be replaced by alternate energy sources.

(2) Use of coal, biomass, and refuse-derived fuel will be increased.

(3) All feasible alternate sources of energy will be exploited.

(4) On-post gasification of coal and biomass will increase.

(5) A broad range of innovative techniques will be applied to new construction.

(6) New construction will include multiple use facilities.

(7) New facilities will eliminate occupant control of internal temperatures.

(8) Total energy/selective energy systems, based largely on solid fuels, will be constructed at major installations.

4.2.6.2 Long-range outlook. The Army's facility operations programs for the long-range period will be limited to a great extent by the state-of-the-art. The Army has under consideration many programs in its efforts to minimize the effect of energy shortages and high costs on military facilities and the Army mission. The Army remains current on the progress being made by private industry, continuously testing developments for possible inclusion in the Army' acility operations energy programs. Listed below are key areas of development which have potential as long-range programs for the achievement of the Army's facilities operations goals of reducing energy consumption 40 percent, and reducing the use of petroleum fuels 75 percent by the year 2000:

a. Construction.

(1) Increased underground construction.

(2) More multiple use facilities.

(3) Decreased facility energy loss.

(4) Total energy and selective energy systems.

b. Utilities.

(1) Filtering and recirculation of air.

(2) Reclamation of waste energy.

(3) Use of solar energy for heating and cooling buildings.

(4) Use of biomass and waste-derived fuels as a fuel supplement or as a primary fuel.

(5) Use of nuclear energy for military facilities.

(6) Use of coal as the primary energy source for military facilities while meeting environmental standards.

(7) Increased utilization of heat pumps.

(8) Metering of all facilities to include family housing.

(9) Implementation of a 4-day, 10-hours per day, work week.

(10) Use of geothermal energy for heating and cooling.

(11) Use of wind-driven energy for heating and cooling.

(12) Increased utilization of coal and biomass gasification.

c. Management.

(1) Prediction, reporting, and analysis of energy consumption for a military installation.

(2) Control facility energy use with reliable automated energy control systems.

4.3 MOBILITY OPERATIONS.

4.3.1 General. The Army has several management programs designed to reduce energy consumption in mobility operations. They are:

a. POL management.

b. Traffic management.

c. Transportation management.

The above programs are all dedicated to the Army's energy management objective of conserving energy while maintaining readiness.

4.3.2 POL management.

4.3.2.1 Mobility fuel consumption. Army mobility fuel consumption dropped dramatically in FY 74 as a result of conservation measures imposed during the 1973 oil embargo and the ensuing petroleum shortage. Except for a slight increase in consumption in FY 77, overall Army mobility fuel consumption has been reduced each year since 1973. However, diesel fuel and aviation fuel use is beginning to show a slight upward trend due to tactical training and operational readiness requirements. Since 1975, overall mobility fuel consumption has consistently been below the goal as shown in figure 4-1. In FY 78, with initial publication of this plan, a 10 percent reduction goal for FY 85 was established compared to the FY 75 baseline year. The Army is ahead of the straight-line projection to the FY 85 goal. However, based upon input from major commands, further reduction of mobility fuels may begin to cut into operational readiness which cannot be allowed. Based on this input, a concerted effort is being made at DA to recognize the absolute requirement for fuel efficiency even before it gets to the user. Regulatory changes have been recommended which will require that energy conservation/efficiency be made a requirement in the initiation of potential materiel systems. This would affect the preparation of documents such as Mission Element Need Statements (MENS), Letters of Agreement (LOA), Required Operational Capabilities (ROC), and Letter Requirements (LRs). In addition, the ability to make fuel efficient improvements on equipment already in the field is

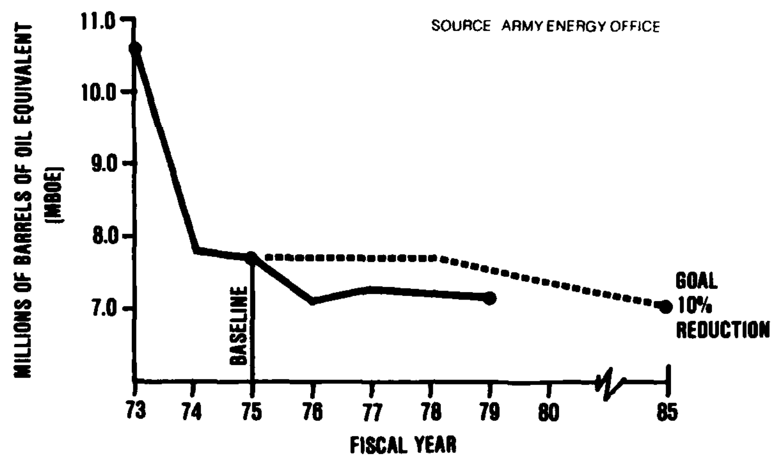


Figure 4-1. ARMY MOBILITY FUEL CONSUMPTION
(MILLIONS OF BARREL EQUIVALENT)

being developed through the use of a fast pay-back program specifically designed for initiatives in the energy area.

4.3.2.2 Reduction initiatives.

The Army has initiated action in many areas in an attempt to reduce overall mobility fuels consumption. US Army DARCOM Materiel Readiness Support Activity (MRSA) states that, to date, the Army Oil Analysis Program has provided no data that would permit extending oil change intervals. Some on-condition extensions have occurred. Physical property testing shows promise, and oil change intervals could possibly be extended to more than twice the present period, but as of this date, the only extension granted has been for one generator.

Transportation motor pools and tactical units have been directed to comply with the Clean Air Act provisions for inspection and maintenance. Compliance involves periodic testing of exhaust emissions to insure that emission contaminants are within Environmental Protection Agency certification parameters. These standards require that vehicle engines be properly tuned which will also provide the added benefit of reduced fuel consumption.

In the Army's evaluation of logistic acceptability and supportability of materiel systems under development or deployed, fuel economy is included as an important factor. Among ongoing actions stressing this factor is curtailment in the production of the 10-kilowatt (kW) turbine generator, due to a determination that the turbine uses three times as much fuel and costs three times as much as the diesel version of this generator. Since the turbine weighs less than half the weight of the diesel, it will still be used where transportation weight is a factor.

Another fuel saving development is a recent user/developer action to design a 1.5 kW tactical generator to run on methanol (alcohol) instead of gasoline or diesel fuel. Future developments will include larger generators using this fuel, resulting in further reduction in use of gasoline and diesel fuel.

The Army's Carpooling and Parking Controls Regulation, AR 210-4, expands the use of carpools and mass transit modes over one car, one person travel to and from work. Although this does not conserve Army energy, it does make a significant contribution to energy conservation and environmental quality on a national basis.

4.3.2.3 Army National Guard and US Army Reserve actions. The Army National Guard has initiated two programs designed to curtail POL consumption. The first program is energy allocation, based on FY 75 consumption, with some increase for

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aviation fuel necessitated by an increased flying hour program. An allocation is made to each state without regard for any specific type of fuel. To exceed this allocation, a state must present justification to and receive approval from the Chief, National Guard Bureau. The second program estimates fuel requirements in barrels. The allocation for aviation fuel has increased due to an authorized increase of 13 percent in flying hours in FY 80 over FY 75. Although the density of track and wheeled vehicles has increased considerably since 1975, the petroleum limits for FY 75 hold. Each state is held strictly responsible for energy conservation while meeting training readiness requirements.

The United States Army Reserve (USAR) actively participates in energy conservation measures that are operationally oriented and command influenced (e.g., POL, electricity, and other forms of energy conservation for installation/facility activities, training activities, etc.) as directed and managed by United States Army Forces Command (FORSCOM).

4.3.3 Traffic management. In some instances the Army receives credit for energy savings only in terms of reduced cost for the service provided. In all cases, the energy savings assist in meeting the national goals. A number of traffic management actions have been taken with energy conservation spinoff benefits.

a. Stress adherence to the 55 mph maximum speed limit for motor vehicles.

b. Consolidate Army group passenger movements to make maximum use of carrier capability.

c. Increase use of surface transportation (bus/rail) for short-haul movement (450 miles or less) of Army passenger traffic.

d. Use scheduled commercial airlift in lieu of military aircraft, when it is available and meets requirements, and restrict use of special aircraft missions whenever possible.

e. Encourage consolidation of hold baggage with household goods (HHG) for surface transportation in international movements.

f. Establish an approval authority for air shipment of HHG, limiting air shipment to only those cases when hardship to service members would result.

g. Encourage service members to utilize the do-it-yourself method of moving personal property.

h. Maximize surface shipments of cargo whenever responsive.

i. Encourage consolidation of cargo shipments and maximum use of cube of vehicles, vessels, planes, and containers.

j. Carefully scrutinize requests for expedited modes and exclusive equipment use. Requests should be challenged where it does not appear warranted by logistical or security considerations.

k. Curtail TDY travel and utilize scheduled commercial surface carriers, wherever feasible, in lieu of commercial air, Government air or surface, or privately owned vehicles for passenger transportation.

4.3.4 Transportation management.

4.3.4.1 Vehicle management. During the FY 74 oil embargo and ensuing gasoline shortage, the Army initiated action to reduce the total number and size of the vehicles in its sedan fleet. On-hand, large, high fuel consumption vehicles will be replaced with smaller sizes through the normal replacement process as the large vehicles meet replacement eligibility criteria and the funding situation permits. Smaller sedans will assist in meeting the Army's gasoline consumption objective along with the improved gasoline mileage expected of newer models. Because of funding constraints, the Army did not buy the proposed quantity of replacement vehicles in FY 78, 79, and 80. Consequently, the original goal to have 97 percent of the sedan fleet composed of compact and subcompact vehicles by

FY 80 was not achieved. The goal has not changed but the target date remains in question. Table 4-7, using FY 77 as a base year, shows progress as of FY 80 compared to the ultimate goal. Additionally, electric vehicles, scooters, and bicycles are being widely used for on-post courier, patrol and maintenance operations.

Table 4-7. ARMY SEDAN FLEET

	FY 77	FY 80	Goal
Subcompact	364	503	364
Compact	4,483	6,508	10,837
Midsize	2,364	1,088	298
Large	4,913	3,425	25
TOTAL	12,124	11,524	11,524

Source: Army Energy Office

4.3.4.2 Aircraft management. The following actions limiting aircraft utilization have had a definite impact on energy conservation:

a. Elimination of Combat Readiness Flying (CRF) requirements for aviators with less than 1,500 hours total time who are not in operational flying positions.

b. Introduction of Synthetic Flight Training System (SFTS) for Army aircraft. This greatly reduces actual flying time by substitution of synthetic flight time for CRF annual minimums and basic entry flight training. The Army has saved an estimated 18 million gallons of jet fuel in just the last 25 months. Additional savings are expected as more systems are introduced.

c. Consolidation of aircraft within company, brigade, and divisional-sized organizations--also consolidation in specific geographical areas. Amalgamation of aircraft will reduce aircraft usage through consolidation of missions without degradation of mission support.

d. Elimination of the minimum annual flying hour requirement to retain aircraft for administrative flying support purposes.

4.3.5 Near-term new initiatives (FY 80-85). One of the greatest challenges facing the Army in the near term is the selection and procurement of mobility equipment that insures no degradation in the state of readiness but maximizes fuel economy. The task is far from simple, particularly if the Army decides to restructure its 16 divisions, a decision which could be made as the result of tests at Fort Hood, Texas. The restructuring under consideration calls for greatly increased mechanization of the fighting force with highly mobile logistics support oriented well forward in the battle area. Studies conclude that a large percentage of the combat vehicles of the maneuver battalions will have to be replaced or extensively repaired during the first days of combat. The vast logistics fleet needed to support the fighting force will be subject to similar risk of early destruction.

Lack of sufficient data on wheeled vehicle energy consumption in an Army use environment caused the ASA(IL&FM) to issue a memorandum to the Director of the Army Staff in June 1977, suggesting that future wheeled-vehicle procurement give particular attention to the attainment of maximum fuel economies. To this end, and in furtherance of the President's energy conservation program, the memorandum further suggests that efforts be directed towards--

a. Purchase and test of commercially available vehicles in the military environment where adequate test data is not available.

b. Use of incentives which will encourage innovative design features and materiel usage to maximize fuel economy, with fuel consumption incorporated as a significant evaluation factor among established source selection criteria. It is further suggested that contracts include incentives that reward contractors for the achievement of fuel performance goals.

c. Conducting a comprehensive study directed at methods of attaining fuel economies in our wheeled-vehicle fleet.

Consistent with the above guidance, Army policy is being revised to require that energy requirements be (1) a documented evaluation factor in source selection, competitive test and evaluation, and other actions involving the selection of equipment development contractors, and (2) an agenda item, when appropriate, at decision reviews for equipment under development.

An important Army near-term energy motivated program which meets the criterion of fuel economy is the M113A1 Armored Personnel Carrier modernization. The improved powerplant efficiency is expected to realize a 20 to 30 percent fuel savings which will have an even greater significance from a fuel economy standpoint, if the heavy division currently being tested is adopted by the Army.

The requirement imposed on the Armed Forces by DOD that they meet the substantive portions of state and local air quality regulations has caused the Army to develop an exhaust gas analyzer for use in inspection and maintenance (I&M) procedures for tactical and administrative wheeled vehicles. Early in FY 78, 500 of these systems were distributed to the field. This program for monitoring and analyzing each vehicle's exhaust at intervals not to exceed the state requirement is expected to provide a fuel saving spinoff, by keeping vehicle engines properly tuned to meet primary standards for carbon monoxide and hydrocarbon emissions.

4.3.6 Long-range programs (FY 86-2000).

4.3.6.1 General. Readiness is the key word that motivates mobility operations programs. The capability of Army equipment, in well-trained hands, to best the enemy on the field of battle is the minimum acceptable standard. Energy consumption by this equipment is of major concern from the standpoint of the logistics effort necessary to keep it operational. A determination of what long range mobility programs to pursue to meet the Army's energy goals and objectives while maintaining a high state of readiness must be prefaced by the following broad assumptions:

a. Force structure (total strength)/stationing will remain the same. (The potential relocation of forces from Korea has been considered.)

b. Army divisions will be restructured with emphasis on mechanization.

c. Current world East-West power balance will remain stable.

d. Synthetic fuels will replace petroleum based fuels whenever possible.

4.3.6.2 Long-range outlook. Long-range planning has begun to be more closely scrutinized to incorporate the energy factor. The "Army Environment 1985-95" study by the Strategic Studies Institute, Army War College, contains numerous references to energy needs and resources as an item of major interest to the Army of the future. The Science and Technology Objectives Guide (STOG) will place greater emphasis and higher priority ratings on energy factors in the revision of STOG currently under way. As the principal users' document, identifying force needs and requirements, the STOG plays an important role in establishing the parameters on which future equipment and weapons systems will be structured. These requirements are carefully analyzed in formulating specific weapon systems or equipment items to be incorporated into the Extended Planning Annex of the Program Objective Memorandum (POM). Thus, energy factors will enter directly into the long-range development cycle.

The incorporation of energy factors into the specifications for design and engineering of future Army combat mobility and operational requirements will require additional resources as well as tradeoffs of other requirements considerations. For this reason the specific nature of the Army's program in force structuring (equipment) will require very careful analysis and critical judgments. Many of the current high mobility, high maneuverability equipment have increased rather than decreased fuel requirements. A major example is the XM1 tank which is powered by a turbine engine. To achieve the higher speeds required by the user and to power the additional tank-borne equipment, items will require much higher fuel consumption rates. This, in turn, will increase the logistic requirements factor in terms of the additional tankers, pipelines, pumps, etc., required to meet the increased needs. A similar statement may be made for most mobility equipment, whether land or air. Listed below are key energy projects under development. All will contribute to meeting the Army's mobility operations goals of reducing energy consumption to zero growth from FY 85 to the year 2000, and developing the capability to replace most, if not all, natural petroleum requirements with synthetic or alternate fuels by the year 2000, while increasing the efficiency of energy dependent mobility systems by 15 percent with no degradation to readiness.

a. Tire style versus fuel consumption.

b. Storage and delivery means for synthetic and alternative fuels.

c. Lighter weight vehicles.

d. Utilization of synthetic fuels.

e. Utilization of alternative fuels (gasohol, methanol).

f. Utilization of synthetic lubricants.

g. Energy efficient diesel engines.

h. Battery powered vehicles.

i. More energy efficient engines and engine components.

4.4 TRAINING.

4.4.1 General. The Army, in conjunction with energy conservation goals, continues to allocate energy resources to training activities to the extent required to maintain readiness. The Army objective in meeting required readiness standards within the framework of energy conservation goals is to accomplish necessary training more efficiently and effectively.

4.4.2 Simulators. A range of simulators and simulation training devices are being developed by the Army to enhance training effectiveness, reduce training time and costs, and reduce energy usage.

4.4.2.1 Truck driver trainer. The truck driver training devices in addition to providing improved training in a shorter period of time will impact the effort to reduce the use of mobility operations energy. This device allows a student driver to practice many driving functions without the fuel and maintenance costs associated with using operational equipment. Not only will this reduce the energy consumed during training but fuel efficient operation techniques will carry over into the every day driving of both Army and personal vehicles.

4.4.2.2 Synthetic Flight Training System. Synthetic Flight Training System (SFTS) is an advanced state-of-the-art aviation training device. It has been demonstrated that it can reduce the cost to accomplish certain requisite training activities heretofore prohibited during actual flight. The newer generation of trainers (AH-1, AH-64) permit gunnery and missile firing training. This capability will afford a flight time offset in the training base and at the operational unit level.

4.4.2.3 Tank systems and fighting vehicle trainers. The training devices which impact on reduced mobility operations energy include the driver trainer and the conduct-of-fire trainer. The driver trainer duplicates the interior of a single vehicle driver's compartment and permits the student (five students per training device) to initially learn the controls and operator techniques without actually driving the vehicle and without expending the fuel associated with actual operation. The conduct-of-fire trainer permits realistic and effective training of gunners and commanders while supplementing or reducing live fire exercises currently required to achieve adequate levels of training. Accordingly, use of these trainers minimizes expenditure of ammunition, fuel, and operating costs associated with using actual vehicles.

The Army National Guard has also adopted the policy of maximum use of the mechanical simulators listed below in order to reduce energy consumption while maintaining unit readiness:

M55 laser device

M31 field artillery trainer

Sabot 81mm subcaliber device

Tank turret trainers

LAW 35mm subcaliber device

Sand tables

Terrain boards

Pneumatic devices for mortars

6-wheel ATV combat vehicle simulators/train tracked vehicle operators

Flight simulators

4.4.3 Other training actions. Other actions in progress that are associated with troop training and exercises are:

a. Improving POL handling techniques to reduce waste and theft.

b. Consolidating garrison stay-behind detachments, thus reducing billet and support facility operating requirements.

c. Leaving equipment on site when training will continue and troops must be returned to garrison.

d. Consolidating field training and range firing.

e. Moving heavy equipment on the most fuel efficient vehicles.

f. Substituting nontactical vehicles for tactical vehicles wherever practical.

g. Developing 1/4-ton vehicle and/or dismounted training exercises in lieu of those using vehicles with greater energy consumption.

h. Utilizing dismounted troop movement when feasible.

The energy situation, the need for energy conservation, and training in energy conservation techniques are incorporated in the curriculum and training programs of all schools and training centers. Also, energy conservation is being stressed, on a continuing basis, in the Army Suggestion, Incentive Awards, and Command Information Programs. Promotional information for the Army-Wide Suggestion Campaign has emphasized the need for ideas to reduce costs and increase efficiency and economy of operations. Energy conservation has been among the major areas of concern.

4.4.4 Near-term new initiatives (FY 80-85).

4.4.4.1 Simulators. Utilizing simulators in lieu of a major item of equipment will play an ever increasing role in training for the Active Army, National Guard, and USAR during this period and will make substantial contribution to energy and dollar savings in Army training. The Army will continue to develop and seek improvement in its current simulator inventory and to search for new areas of training in which simulators can be utilized. Listed in table 4-8 are the Army's estimated cost avoidance for the near-term period through the increased use of flight simulators. Simulators currently under development with expected availability during the near-term period are:

Simulator	FY Availability
Observed Fire Trainer	1981
Tank Weapons Gunnery Simulator System	1985
Marksmanship/Gunnery Laser Device	1983
Command Group Simulator	1983
Flight Simulators	
AH-1FS	1979 - (Prototype fielded)
UH-60FS	1980 - 3d Qtr
AH-64FS	1982

Table 4-8. ESTIMATED COST AVOIDANCE - USE OF FLIGHT SIMULATORS (FY 80-83) ($M)

		FY 80		FY 81		FY 82		FY 83	
		Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars
	Flying	812481		812481		812481		812481	
UH-1	Simulator	262600		259829		234518		215481	
Savings	Total		68.0		67.3		60.7		55.8
	Flying	58684		58684		58684		58684	
CH-47	Simulator	3750		11250		18750		26250	
Savings	Total		5.2		15.6		26.1	36488	36.5
	Flying	138557		138557		138577		138577	
AH-1	Simulator	3750		11250		18750		18750	
Savings	Total		3.4		10.2		17.1		17.1
	Flying	27600		60912		95764		130504	
UH-60	Simulator	6000		6000		10000		42000	
Savings	Total		1.5		1.5		2.4		10.2
	Flying	--		--		--		--	
AH-64	Simulator	--		--		--		2500	
Savings	Total	--		--		--			2.4
	Flying	1037322		1070634		1105486		1140226	
Grand	Simulator	276100		288329		282018		304981	
Total	Total Savings		78.1		94.6		106.3		122.0

4.4.4.2 Other training actions. The in-process revision of AR 350-1 (Army Training) will emphasize resource conservation in consonance with Army energy goals.

Several state National Guard training actions have been conducted and planned for the period FY 78-83 to assist in meeting energy conservation goals while still maintaining a condition of readiness. Among these are:

a. Idaho's completion in FY 79 of miniranges for subcaliber firing which will reduce gasoline and diesel consumption for travel to regulation size ranges.

b. Illinois' construction of a weekend training site near Marseilles, Illinois, scheduled for completion in FY 80, where equipment can be consolidated, thereby eliminating movement of many vehicles to and from the training site.

c. Arizona's planned construction of a bulk fuel dispensing system at decentralized facilities in order to reduce fuel consumption in refueling vehicles and equipment.

d. Washington's study to determine the economic advantage of installing air spoilers on cabs of trucks used to deliver equipment to units throughout the state.

e. Michigan's experimental program for an "Audio-Visual Conferencing System" which would reduce travel to conferences or meetings but permit conferees to go to a central conference facility in their respective city and be able to communicate with each other from each location.

The USAR plans expansion of existing equipment concentration sites (ECS) at annual training sites (ATS) and construction of new ECSs where necessary to minimize the requirement for convoying vehicles to ATS for training. Currently designs are under way for providing new ECSs at Fort Carson, CO; Knox Field, AL; Fort Polk, LA; Fort Chaffee, AR; Los Alamitos, CA; and Seagoville, TX. Completion of these projects will help concentrate equipment near its area of usage/training and reduce movement of vehicles to and from the training sites.

4.4.5 Long-range programs (FY 86-2000). It is axiomatic that the keynote for success on the battlefield is a quality training program. However, a viable training program in the past has meant energy consumption on a large scale. The Army has two programs which are aimed at reducing energy consumption in training. These programs will continue to be pursued vigorously in the near-term and at this time they appear to offer the best opportunity for the savings in training energy consumption needed to meet the Army's long-range mobility operations goals. These programs are training energy conservation actions as outlined in paragraph 4.4.3, and the use of simulators, which are in use by the Active Army, National Guard, and Army Reserve. As new items of equipment are added to the Army's inventory during the long-range period, the Army will continue to actively pursue development and use of a full spectrum of simulations, simulators, and other training devices.

4.5 RESEARCH AND DEVELOPMENT.

4.5.1 General. Energy research and development in the Army is increasing in magnitude in direct proportion to the opportunities provided by developments in the private sector. The Army follows up on breakthroughs in the civilian sector in its search for new ways to reduce energy consumption. The Army Energy Research and Development Program (AERDP) consists of an Army Facilities Energy (R&D) Plan and an Army Mobility Energy (R&D) Plan. These plans are summarized at appendix B and C, respectively. The AERDP addresses two types of projects: energy-motivated projects and energy-related projects. Generally, facilities projects such as energy resources conservation and improved energy utilization for military installations and total energy/utility systems are energy motivated. Mobility projects such as vehicle energy conservation and transmission and power systems are usually energy related.

4.5.2 Army Energy R&D programs (AERDP). The AERDP categories are four in number: Basic Research, Exploratory Development, Advanced Development, and Engineering Development. Several projects are part of an extensive cooperative effort between the Army and DOE. In addition to the joint Army-DOE effort, the Army, Navy, and Air Force are engaged in an energy R&D information exchange program designed to avoid duplication and to conserve energy.

4.5.2.1 Basic Research Program. The Basic Research Program provides fundamental knowledge for the solution of identified military problems and is part of the base for subsequent exploratory and advanced developments. In energy basic research, the technology of small engines for aircraft propulsion is being studied, with the payoff being reduced fuel consumption and cost. Power generation is being studied in terms of energy transformation, storage, and conversion systems for use in providing energy required for Army communication surveillance, fuzing, propulsion, and other critical applications.

Basic research on aircraft propulsion continues on aerodynamics, heat transfer materials sciences, and lubrication. Research also includes walls on primary lithium cells with new inorganic electrolyte solvent, direct oxidation hydrocarbon/air fuel cells, magnetic field calculations in near-saturated media, computer-aided design for mobile electric powerplants, and superconductors to produce high temperature material in forms suitable for applications to superconducting generators and motors.

4.5.2.2 Exploratory Development Program. The dominant characteristic of the exploratory development effort is that it is pointed toward specific military problem areas with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters. Energy exploratory development--

a. Includes the provision of propulsion technology for gas turbine engines.

b. Provides technological advances for the improvement of Army engine durability, fuel economy, fuel tolerance, simplicity, low emission, and compactness.

c. Improves on technology in liquid hydrogen and gaseous fuels and their utility as alternate fuels in Army surface and air powerplants.

d. Develops more efficient fuel cell systems.

e. Improves efficiency in energy use at Army facilities.

f. Identifies cost effective alternate energy sources for use at Army installations.

g. Provides innovative facility oriented energy management techniques.

During FY 79 exploratory development, the Army explored technologies that offered significant improvements in the small gas turbine engines. Research investigated the sensitivity of new engine/systems components to alternate and emergency fuels, and continued research to develop cheaper and more efficient fuel cell systems. Also considered were the application of atomic, nuclear, and coal technologies to Army power needs and the efficient operation of energy systems with presently available resources.

4.5.2.3 Advanced Development Program. The Advanced Development Program includes all projects which have reached the stage of developing hardware and nonmateriel technological prototypes or techniques for experimental or operational test. The program includes advanced technological propulsion systems to insure satisfaction of mission requirements. Vehicle transmission/steering unit development provides for design development and testing of these systems and their associated subcomponents for both wheeled and track vehicles. Under energy conservation, the program evaluates and validates criteria for solar energy systems used for heating and cooling of buildings at military installations.

Aircraft engine efforts, begun in FY 76 in the 800-horsepower (hp) class advanced technology demonstrator program, will continue in FY 80. The vehicle transmission/steering unit development emphasizes development of the 600 hp hydromechanical transmission system for the 20-ton combat vehicle family. The vehicle engine program is concerned with developmental turbine diesel and rotary engines.

4.5.2.4 Engineering Development Program. This program includes those development projects which are being engineered for military service use but have not yet been approved for procurement or operation. It is characterized by major line item projects.

4.5.2.5 Near-term new initiatives (FY 80-85). In facilities R&D, short-term exploratory development in facilities energy technology will be pursued to support the President's goals for 20 percent reduction (Btu/ft^2) in energy consumption in existing buildings and a 45 percent reduction (Btu/ft^2) in energy consumption in new construction. This program will focus on: (1) techniques for managing the use of energy; (2) installation energy consumption prediction to establish conservation goals; (3) evaluation of energy consumption for alternative design and operating conditions to provide a basis for energy system optimization; and (4) providing designers and facilities engineers with techniques for conservation investment maximization.

Additional facilities R&D new initiatives include the examination, field testing, validation or rejection of products, systems and techniques developed to improve efficiency, effectiveness, and economy of energy in military energy systems. Included for consideration in the examination are peak electrical demand, the efficiency of large boiler plants, detection of thermal loss, boiler convertibility, geothermal sources, low energy heat recovery, and nontactical generators.

The development of Army equipment requires a long leadtime, and as a result the current and upcoming generation (FY 80-85) of equipment was not designed with energy consumption as a principal consideration. However, the Army is developing an expanded mobility R&D plan with emphasis placed on direct energy conservation, to include tactical wheeled vehicles. New initiatives in the mobility area involve fuel savings research into engine performance as well as fuel and lubricating oil improvement.

4.5.2.6 Long-range programs (FY 86-2000). The Army's long-range R&D facilities operations program is a continuing extension of the current and near-term orientation toward military energy technology which entails energy systems research designed to contribute to the achievement of the Army's long-range facility operations goals. The objectives of this research address the requirement to minimize the adverse impacts of increasing fuel cost and the decreasing availability of petroleum supplies for strategic, tactical, training, and routine Army operations. These objectives are the development of--

a. Effective energy conservation techniques to reduce energy consumption at military faciities.

b. Alternative energy sources for military facilities.

c. Techniques, procedures, and systems for effective management of energy resources used by the Army.

In the mobility operations area the Army's R&D will be a continuing effort to meet long-range mobility operations goals in reduction of both energy consumption and dependence on petroleum fuels. General areas planned for reduction of energy consumption in field operations are:

a. Development of novel engine cycles and geometry for improved efficiency, especially at part load.

b. Improvement of operational efficiency of internal combustion engines through development of diagnostic procedures and equipment.

c. Improvement of process control monitoring devices; e.g., "fluid pump," fluidic temperature, and fuel control sensors to optimize system efficiencies.

d. Improvement of operational efficiencies of internal combustion engines through incorporation of synthetic lubricants.

e. Extension of oil change intervals for aviation and automobile equipment.

f. Reduction of energy consumption in food processing by:

(1) Systems approach to energy management of food service operations.

(2) Reconstituting frozen foods.

(3) Flexible packaging.

(4) Radiation preservation.

g. Development of improved laundry systems for conservation of energy and water.

h. Development of high efficiency area lighting equipment.

i. Elimination of unnecessary losses in electric power generation and utilization for military equipment.

Reduced dependence on petroleum fuels is to be pursued by:

a. Evaluation of synthetic fuels for aviation, automotive, and power generation.

b. Utilization of low grade heat for alternate fuel production (by biological means).

c. Development of methods for production, storage, and utilization of coal petroleum slurry fuel.

d. Production of methanol from municipal trash.

e. Application of solar energy for electric power (solar cells).

f. Investigation of new technology for high efficiency hand-cranked generators.

g. Development of a high power, fast charge, lead acid battery for peak load operation.

For a list of mobility operations projects being considered for implementation and funding in the long-range period, see appendix B. These projects have not been officially screened for relevance or priority.

4.5.3 Research and development - mobility equipment. This category includes those research and development items initiated primarily to satisfy a validated need of the Army force in terms of accomplishing a specific combat or combat support mission. Except for the Army's portion of DOE/DOD joint initiatives, such as photovoltaics and the development of specifications and testing methods for the use of synthetic fuels in military engines, these programs are justified on the basis of accomplishing this mission rather than their contribution to the achievement of the Army's energy goals. For this reason and because the portions of these programs that can be identified with reduced energy usage or reduced reliance on fossil fuels are at the task/subtask level, it is not possible to relate the programs' research and development funding directly to their contribution toward reduced energy usage. The Army's strategy for meeting its energy goals with respect to mobility equipment is to continue to manage these programs as an integral development while identifying and emphasizing the energy-relevant tasks and subtasks to ensure appropriate funding is provided for them.

4.5.3.1 Energy efficient equipment. Army programs that contribute to energy efficiency or the use of more abundant energy resources include the following;

a. Fuel efficient engines. The Army has several on-going actions for fuel efficient engines in combat vehicles. These programs include the AGT 1500 fuel economy improvements and an Adiabatic diesel engine. The AGT 1500 fuel economy improvements development will be completed in FY 80 and will move into application on production vehicles in FY 81. The Adiabatic diesel engine (500-700 hp) promises to reduce fuel consumption by 30 percent while achieving a smaller, lighter propulsion system that is more powerful.

Also under development is a 10kW small gas turbine generator. Extensive progress has been made with this generator by: utilizing ceramics in improved components, increasing power density, improving the heat recovery system, and by engine operation at higher temperatures, which results in dramatic improvement in fuel economy.

An ongoing energy-related project worthy of special note is the previously mentioned improvement in power plant efficiency for M113A1 armored personnel carriers. A new transmission, the Allison X-200, is to replace the Allison TX-100 transmission on the M113. The X-200 is far more efficient, providing an estimated 22 percent improvement in operating characteristics.

b. Suspension systems. The Army has a new suspension system under development called the Loopwheel. This new experimental suspension will cause a signficant decrease in vehicle rolling friction if it is successful.

c. Electric power production. The Army is pursuing three major energy related mobile electric power production RDT&E programs. The Army's fuel cell to be used as a power source to replace small gasoline-powered generators will reduce energy requirements by 75 percent. It will use a locally producible nonpetroleum synthetic fuel. The electric power production gas turbine ceramic component and gas turbine regenerative programs are aimed at improving performance as well as reducing fuel consumption.

4.5.3.2 Photovoltaics. A Defense Photovoltaic Program Office was established under Army direction in FY 79 to use terrestrial solar photovoltaic power systems in DOD. This initiative is responsive to legislation which promotes federal agencies' use of solar cell equipment. Previous related efforts include a DOD and DOE demonstration program for solar cell applications and an analysis of the potential DOD market for such equipment.

An energy-motivated program of major significance to the Army is directed toward demonstrating the feasibility of solar cell (photovoltaic) energy conversion for a wide variety of military electrical power consuming equipment. To date, several items of military equipment have been converted to solar cell power and transported to various military installations to be operated under more realistic military conditions. These include a small battery charger, radio relay systems, telephone communications station, and a 10 kW water purification plant. An 8 kW solar cell power system for a radar station has become operational, as has a 60 kW power augmentation to a remote radar site which constitutes the world's largest solar cell array.

4.5.3.3 Synthetic fuels. The decreasing availability of fuel from conventional crude oil dictates investigation into other sources of mobility fuels to meet Army requirements for the foreseeable future. Conventional motor gasoline blended with alcohol (90 percent/10 percent mix) has been successfully used by both private individuals and state governments and offers many advantages. It is being used in Army administrative vehicles and a thorough investigation into its physical properties and its effects on tactical equipment is being made to qualify it as an acceptable fuel across the board. Synthetic fuels derived from oil shales and possibly tar sands, as well as blends of such synthetics with conventional crude oil based fuels, also are being evaluated to assess their ability to be used as alternate fuels as they become available.

4.5.4 DOE/DOD joint initiatives. The results of an investigation by the DOE/DOD joint initiatives working group identifies nine initiatives which could be undertaken jointly by DOE and DOD. In addition to the initiatives, one installation in each service has been recommended to be a showcase installation. The initiatives that are wholly or partially within the Army's purview are:

(1) Photovoltaic development and utilization.

(2) A share of solar heating and cooling for buildings.

(3) Biomass-fired central heating plant.

(4) Pyrolysis plant for conversion of wood to liquid fuels.

(5) A share of synthetic mobility fuels.

(6) Energy "showcase" installation.

The division of funds between DOD and DOE for these initiatives is based on the use of DOE funds to cover research, development, design, testing, and high technical risk costs, and use of DOD funds to cover the capital costs of those projects that prove out, up to an amount equivalent to the estimated 10-year cost savings to DOD based on escalated future energy costs and straight line present worth. Any additional capital costs would be allocated based on benefits which will accrue to DOD and DOE.

4.6 PUBLIC AFFAIRS.

4.6.1 General. The public affairs aspect of the Army Energy Program has been given increased emphasis. The objectives and accomplishments of the program must be widely publicized in order to gain the awareness and support of the Army's internal and external audiences. A Public Affairs Plan (Appendix D) which covers both the near-term and long-range periods has been developed to support the Army's energy plan as it evolves and is implemented. This plan provides for the dissemination and circulation of informational materials and outlines the responsibilities of the Office, Chief of Public Affairs, Department of the Army Staff agencies, and the major commands.

As described in paragraph 4.6.4, the Secretary of the Army approved the establishment of the Army energy conservation award. It recognizes annually the Active Army, Army Reserve, and Army National Guard installations that show the greatest achievement in energy conservation. The intent is to develop a competitive spirit in the field.

Articles on Army energy initiatives have been published in several widely distributed civilian publications, as well as in Army Command Information media. The Army, in conjunction with the other services and DOD, also has taken action to produce a movie designed to get the message to the individual soldier.

An Army energy exhibit was designed and produced. It was first displayed at the annual AUSA meeting in Washington in October 1978. It was shown at the 6th Energy Technology Conference in February 1979, the 7th Energy Technology Conference in March 1980, and has been at DARCOM Headquarters, the DARCOM Facility Engineer Conference, the FORSCOM Facility Engineer Conference, the

Worldwide RPMA Conference in New Orleans, and the Pentagon. The exhibit maintains a full schedule for showings across the country.

4.6.2 Energy Information Program. In support of the public affairs aspect of the Army Energy Program, one of the goals of this plan is to "expand energy conservation education/information and incentive programs for all civilian personnel and military personnel and their dependents." Two-hundred thousand dollars per year will provide the resources necessary to further energy awareness in all employees and their dependents. This will be accomplished by: increasing the distribution of information packets, brochures, pamphlets; traveling exhibits; films; advertisements; and the establishment of an energy information exhange center. An informed energy consumer is the key to an effective Army Enerny Program.

4.6.3 Energy Awareness. The Office, Chief of Public Affairs, has established "Energy Awareness" as part of its Annual Command Information Plan each year since 1977. This plan was used by all public affairs officers, and was supported by materials produced by DA, DOD, and DOE. The objectives of the plan are to make all members of the Army audience aware of the importance of energy conservation and of their responsibilities in that regard. In pursuit of the above-cited objectives, a wide variety of materials have been prepared and distributed. Joint OCPA/ODCSLOG publicity effort during CY 79 includes:

- 45 news stories.
- 24 radio spot announcements.
- 26 ARNEWS features/messages.
- 5 Commanders Call articles/features.
- 3 one-minute TV spot announcements.
- 15 pieces of artwork for Army editors.
- November 1979 SOLDIERS magazine article.

The information disseminated topics on energy shortages, conservation, consumption, synthetic fuels, and strategic fuel reserves for use by some 400 Army National Guard, Reserve, and Active Army use. It is estimated that 75 percent of these 400 publications used at least one article on energy in each 3-month period. A 1976 DOD study established that there is a potential readership audience for these materials of 35 million persons which includes Active and Reserve Army, National Guard, civilian employees, retirees, and dependents.

4.6.4 The Secretary of the Army Energy Conservation Award. An annual Army-wide Secretary of the Army Energy Conservation Award has been established. The objectives of the award are to provide added incentive to reduce energy consumption and to recognize the achievements of installations in exceeding energy reduction goals. Three awards will be presented annually to the Active Army, Army National Guard, and Army Reserve installation which conducts the most outstanding energy reduction program during the preceding fiscal year. Fort Richardson, Fort McCoy and the Tennessee State NG were the recipients of FY 79 awards.

Criteria used to evaluate the installation's nomination is based on the following representive examples:

a. Methods and extent of implementing conservation measures: by command emphasis, training programs, publicity, energy suggestion, and car pooling programs, etc.

b. Short-term facilities retrofit: those accomplished, those budgeted, and those planned. Retrofit program should indicate cost and energy savings, either estimated or actual as applicable.

c. Long-term facilities retrofit: those budgeted, and those planned. Estimated cost and energy savings should be included.

d. Mobility operations fuel saving schemes; e.g., use of simulations, consolidating unit movement activities: Each scheme should indicate actual or estimated fuel savings.

e. Results of energy conservation program: Results will be a comparison of the preceding fiscal year's consumption against the designated base year's consumption, as reported in the Defense Energy Information System (DEIS). The results may be adjusted for those installations which experience significant changes over which they cannot exercise control, such as mission changes, expansion of the installation, changes in tempo of operations, extensive new construction, or weather. The American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) guide will be used as a basis for computing adjustments.

4.7 REPORTING.

4.7.1 General. Presently, the Army relies primarily on The Defense Energy Information System (DEIS I and II) reports, which are concerned solely with energy consumption data for energy management information. The DEIS is designed to facilitate energy management by providing timely, up-to-date, reliable, and accurate information on all forms of energy except nuclear. For each energy resource, the system provides information on:

Quantity consumed.

Quantities on hand.

Prior FY/baseline period consumption.

Source of receipts.

Quantity sold to other services.

Usage by category.

Variance from the standard.

The DEIS further provides a means for evaluating energy consumption against established goals.

The DEIS procedure for reporting energy status applies to all Army activities including COE activities and the Army National Guard. Energy status of USAR activities is reported by host activities. The policies, procedures, and responsibilities concerning Army input to DEIS are outlined in chapter 5 of AR 11-27 and DOD Manual 5726.46. The reports are used by DOD and DA for management purposes and are furnished to non-DOD Federal departments and agencies and to Congress upon request. Therefore, it is mandatory that input data to DEIS be accurate.

In an effort to reduce computational errors and to meet Federal reporting requirements ASD(MRA&L) Defense Energy Office has contracted to reprogram and restructure DEIS so that reports can be accepted in normal energy units of measure and the computations to convert them to Btu can be made by the Defense Logistics Agency computer to reflect Btu's per square foot for each reporting installation. Alternative and renewable energy sources will be added to the report also.

In addition to the DEIS I and II reports, the OCE receives annual reports, which summarize costs (including manpower, supplies, and energy) and quantity data. The Technical Data Reports cover fixed installation usage with the exception of Army National Guard and Army Civil Works activities. While these reports suffer from a time lag factor, they are extremely useful to facilities engineers in managing their energy programs. An Annual Summary of Operations containing data compiled by Army installations is published and distributed to all installation engineers and other interested personnel.

4.7.2 DEIS I. DEIS I is a monthly report which reflects bulk petroleum fuels inventory, receipts, sales to DOD and non-DOD activities, and Army consumption and usage. The report is prepared as of 0800 hours local mean time on the last Friday of each month and reflects data to that time and date from the cutoff of the previous month.

4.7.3 DEIS II. DEIS II is a quarterly report which provides information on utility-type energy resources. The report reflects inventories of coal and liquified petroleum gas (LPG), plus baseline and current consumption information on purchased electricity, natural gas, LPG, coal, and purchased steam, and includes data for tenants supported by the reporting agency.

4.7.4 New reporting initiatives. A recent Army Energy Management Study performed for the AEO, DCSLOG, DA, reflected a breakdown in the crossfeeding of information at the major command level. The study indicated the need for development of a command management information program in lieu of the present requirement of merely assuring the validity and timeliness of energy data for higher authority. The study recommended that appropriate information be forwarded periodically to the AEO as part of an overall energy management information program with the specific requirement that an annual narrative report outlining significant accomplishments and shortfalls be submitted by 31 December of each year from each major subordinate command.

The Construction Engineering Research Laboratory (CERL) is currently developing the Energy Consumption Reporting and Analysis System (ECRAS). The ECRAS is intended to be a single system for facility engineering energy consumption management and planning. It will employ energy utilization indexes to predict building energy consumption based on weather data and descriptive data on the facility. The final systems data base is being designed to automatically provide the input data for a number of existing standard reports to include DEIS II. The intended benefits of the ECRAS include:

a. One-time entry of consumption data.

b. Budgeting by requirements.

c. Analysis of energy conservation program progress.

d. Automated reporting to higher headquarters.

e. Analysis of energy impact due to changes (actual or proposed) in real property inventory.

CHAPTER 5

FEDERAL ENERGY LEGISLATIVE SUMMARY

5.1 INTRODUCTION. The US Congress has passed into law over 100 pieces of legislation directly related to energy matters since the oil embargo in 1973. This chapter highlights and summarizes enacted laws and proposed legislation most pertinent to the Army's energy situation and its energy plan. A complete listing of these laws is provided in appendix F.

5.2 THE NATIONAL ENERGY ACT. The most significant piece of energy legislation passed since the Arab oil embargo is a group of bills called the National Energy Act. This act was signed into law by the President on 9 November 1978. The Act allows moderate, planned energy price increases that will have minimal adverse effect on the nation's economy and will motivate the users of energy to reduce their energy consumption and use energy more efficiently. The provisions of the Act are expected to reduce oil import needs by 1985 through gradual conversion of oil and natural gas usage to renewable energy sources such as coal, solar, and biomass. The NEA consists of five separate Acts:

a. The National Energy Conservation Policy Act of 1978 (Public Law 95-619) emphasizes energy conservation and encourages the practical use of solar energy where oil and gas are now used. It recognizes that a major component of the nation's effort to sustain economic growth and productivity over the long run depends upon initiatives for reducing the growth in energy demand as well as developing the use of renewable energy sources.

b. The Power Plant and Industrial Fuel Use Act of 1978 (Public Law 95-620) emphasizes conversion of large oil and natural gas boilers to coal. It prohibits the use of oil and gas in new electric utility generating facilities or in new industrial boilers with a fuel heat input rate of at least 100 million Btu/hour.

c. The Public Utilities Regulatory Policy Act of 1978 (Public Law 95-617) encourages state regulatory authorities to consider time-of-day pricing, seasonal rates, cost of service pricing, interruptible rates, and lifeline rates, and prohibits declining block rates which favor larger users by pricing successive blocks at lower per-unit prices. In the past, the costs of utilities have risen substantially because of marked increases in the cost of construction, capital, and fuels. The purpose of the bill is to restructure electric and natural gas rates to encourage conservation of energy, efficient use of facilities and resources, and equitable rates to electricity and natural gas consumers.

d. The Natural Gas Policy Act of 1978 (Public Law 95-621) sets a series of maximum price increases for various categories of natural gas. Price controls on new gas and certain intrastate gas will be lifted as of 1 January 1985. The President may declare an emergency if a gas shortage exists or is imminent and endangers supplies for "high priority" uses, such as in residences/small commercial establishments, or any use where the curtailment would endanger life, health, or maintenance of physical property.

e. National Energy Tax Act of 1978 (Public Law 95-618) provides for various taxes or tax credits to motivate energy users to use less energy or to substitute renewable energy for nonrenewable oil and natural gas.

NOTE: The first two provisions of the NEA apply directly to Army installations and power plants and are discussed in detail herein; the latter three affect overall energy pricing policy and are listed here only to describe all bills in the NEA.

5.2.1 National Energy Conservation Policy Act (NECPA) of 1978. Title V of NEPCA pertains specifically to federal agencies. The purpose of the Act is to reduce the demand for energy and to conserve nonrenewable energy sources produced in the

US and elsewhere, without inhibiting beneficial economic growth. In Title V, the Congress reports that the US is facing an energy shortage, particularly for oil and natural gas, and that the nation has insufficient domestic supplies of oil and natural gas to satisfy demand. According to the Congress, unless effective measures are taken by federal agencies and other users of energy to reduce the energy demand growth rate, the US will become increasingly dependent on the world oil market and increasingly vulnerable to interruption of oil received from foreign sources.

In Part 3 of Title V, the Congress states that there is an urgent need to promote the design, construction, and operation of buildings to conserve energy and make more efficient use of fuels and energy in federal buildings. In the construction or renovation of buildings, the cost of energy consumed over the life of such buildings must be considered as well as the initial cost of such construction or renovation. The Congress also states that the federal government, as the largest energy consumer in the US, should be in the forefront in implementing energy conservation measures.

The purpose of Part 3 is to promote the use of commonly accepted methods to establish and compare the life-cycle costs of operating federal buildings and the life-cycle fuel and energy requirements of such buildings, with or without special features of energy conservation, and to promote the use of solar heating and cooling and other renewable energy sources in federal buildings. (Life-cycle cost is defined as the total costs of owning, operating, and maintaining a building over its useful life, including its fuel and energy cost.)

Authority for establishing life-cycle cost methods is assigned to the DOE in consultation with the Office of Management and Budget, the National Bureau of Standards, and the General Services Administration. DOE is required to establish practical and effective methods for estimating life-cycle costs for federal buildings, and to develop and prescribe the procedures to be followed in implementing these methods. The law requires all new federal buildings to be life-cycle cost-effective and cost evaluations of new buildings are to be made on the basis of life-cycle cost rather than on initial cost.

DOE is also required to establish energy performance targets for federal buildings and to take appropriate actions to promote achievement of such targets.

Federal agencies were required to conduct a preliminary energy audit by 15 August 1979 of all buildings with 30,000 or more square feet of floor area which they occupy or control. No later than 15 August 1980, a preliminary audit is required for all buildings with 1,000 to 30,000 square feet of floor area. The results of the audits must be given to DOE and they must provide the Congress with a full report of all energy audits conducted under this part of the law.

Part 3 of Title V requires federal agencies to use the energy audits to select buildings for retrofit measures to improve their energy efficiency in general and to minimize their life-cycle cost. Retrofit measures will include (but are not limited to) energy conservation, solar technology and other renewable energy resources measures, and any maintenance and operating procedures determined by the energy audits as appropriate energy conservation measures. The law requires federal agencies to give priority to low or no cost changes in maintenance and building operating procedures over measures requiring substantial structural modifications and investments.

At least 1 percent of an agency's total floor area must be retrofitted during the first full fiscal year after enactment of the laws and an additional percentage (at least 1 percent higher) must be retrofitted during the second year, with annual increases thereafter to assure all footage is retrofitted by

1 January 1990. In its annual budget submissions to Congress, each agency is required to specifically set forth and identify in a separate line item the funds requested for retrofit measures to be funded under this law.

Finally, Part 3 of the law requires each federal agency to provide DOE with complete information on its program and activities in regard to this law. DOE in turn is required to provide the Congress with a comprehensive report on all federal government activities funded under this law toward the achievement of Congress' energy objectives.

5.2.2 Power Plant and Industrial Fuel Use Act. This act places a restriction on new fuel-burning installations of 100 million Btu/hour by prohibiting the use of natural gas or petroleum as a primary energy source. The law does provide for specific exemptions which must be approved by DOE. Also, if an existing installation of 100 million Btu/hour has or previously had a technical capability to use coal or another alternate fuel, the Fuel Use Act prohibits, in accordance with stated rules, the use of petroleum or natural gas, or both, as a primary source. This same restriction applies to installations that could have such capability without substantial physical modification of the plant or substantial reduction in the rated capacity of the plant; as well as to existing installations where it is financially feasible to use coal or another alternate fuel.

5.3 PUBLIC LAWS ESTABLISHING NATIONAL ENERGY POLICY.

5.3.1 Federal Nonnuclear Energy Research and Development Act of 1974 (Public Law 93-577). This act established policy guidelines for the Energy Research and Development Administration (now DOE) and provided authority for development of an overall national program to conduct nonnuclear research, development, and demonstration.

The Army has provided support to this program primarily through use of its facilities to provide for the demonstration element of energy projects. Importantly, this law provided the Army with clear indication of the Federal Government's commitment to energy research.

5.3.2 Energy Policy and Conservation Act of 1975 (Public Law 94-163). This act is the authority for the establishment of a Strategic Petroleum Reserve (SPR). This reserve is an additional potential source of crude oil to be used in the event of war. The Defense Production Act of 1950 would have to be evoked, however, in order to provide for refinement of SPR crude oil.

The Energy Policy and Conservation Act contained amendments to the Emergency Petroleum Allocation Act that provided the new oil price policy which initially rolled back the price of crude oil. Provisions for gradual cost increases of domestically produced oil were frozen because of increases in prices due to inflation and other causes. The freeze on this policy was lifted as of 1 September 1977.

5.3.3 Energy Conservation and Production Act of 1976 (Public Law 94-385). This law incorporates provisions to minimize the use of energy in residential housing, commercial and public buildings, and industrial plants through Federally supported State energy conservation implementation programs. Four major areas for energy savings cited are: transportation, residential and commercial buildings, industry, and utilities planning (rate structure reform).

The Army is a bulk consumer of electricity. It pays a commodity as well as a demand charge. The commodity billing is based on a flat rate per kilowatt-hour. A demand charge is an additional charge levied on the basis of the period or time of day that electrical consumption occurs. As such, the Army pays more for electricity during periods of peak demand. While the impact of existing utility rate reform has generally not been determined, any legislation providing for shifting of the cost burden from residential to high volume users will cause Army utility costs to rise significantly. It might well also cause the Army to consider generating its own electricity should it become cost effective to do so.

5.3.4 Department of Energy Organization Act (Public Law 95-91). This act established the DOE and assigned to it the authority for many energy functions heretofore vested in the FEA, ERDA, Department of Housing and Urban Development, Department of the Interior, and other Federal agencies. The consolidation of Federal energy functions was to provide added focus and coordination in national energy matters and to implement an NEP. For the general functions and organization of the DOE, refer to figure 2-1.

5.4 FEDERAL LAWS HAVING DIRECT EFFECT UPON THE ARMY.

5.4.1 Defense Production Act of 1950, As Amended (Public Law 94-152). The Army's fuel requirements are protected by this act in that availability of necessary fuels and equipment are guaranteed in the interest of national security. This is accomplished through provisions for expansion of production capacity and supply. It also establishes a system of priorities and allocation for materials and facilities and provides for their requisition. The provisions of this act can be evoked by the President at his discretion.

5.4.2 Solar Energy Research, Development, and Demonstration Act of 1974 (Public Law 93-473). This law provides for ERDA (now DOE) initiation of a research, development, and demonstration program to resolve major technical problems that inhibit commercial utilization of solar energy in the US. Some of the technologies with which this R&D program deals include:

a. Direct solar heat.

b. Thermal energy conversion.

c. Photovoltaic processes.

d. Windpower conversion.

e. Solar heating and cooling of buildings.

f. Energy storage.

While the Army is involved in some direct research into photovoltaics and power cells, its primary contribution has been in demonstration projects.

5.4.3 Electric Vehicle Research, Development, and Demonstration Act of 1976 (Public Law 94-413). This law specifically calls for the Secretary of Defense to provide for demonstration of electric test vehicles to the greatest extent feasible. The Army Tank-Automotive Command was lauded during events leading to passage of this act in the House Committee Report for its support in development of ground propulsion engines. It is expected that Army participation in research and demonstration projects of this kind will continue.

5.4.4 Emergency Natural Gas Act of 1977 (Public Law 95-2). This act authorized the President to order emergency deliveries and transportation of natural gas to deal with existing or imminent shortages. While this authority expired on 30 April 1977, it is pertinent that, should the need arise again for emergency legislation concerning natural gas, precedence exists for enactment of remedial authority. The Army did indeed receive assistance in obtaining natural gas during the severe winter of 1976-77 as a result of this act.

5.4.5 The National Energy Act. Previously discussed in 5.2.

5.5 NEEDED LEGISLATION. Following are the areas that need to be included in national legislation in order to facilitate implementation of the Army Energy Plan and to help achieve the goals and objectives set forth therein.

5.5.1 Coal. Part of the Army's energy plan calls for conversion of oil and natural gas burning facilities to coal; therefore the future availability and use of coal is important.

5.5.1.1 Coal Supplies. It is anticipated that national legislation will also require widespread conversions by industry and Government from oil and natural gas to coal. Consequently, it is essential that provisions be made to expand the nation's coal supply. However, environmental concerns pertaining to coal mining, labor unrest, leasing agreements, and inadequate mining equipment and rail transportation facilities are problems that can potentially thwart the expansion of coal production. Therefore, broad legislative action is needed in these areas to insure adequate coal supplies in the future.

5.5.1.2 Coal Usage. The Clean Air Act of 1970 has had the effect of prohibiting the burning and thus eventually the mining of much of the underground coal which contains sulfur beyond specified levels. Only a small percentage of eastern coal reserves (estimates as low as 5 percent) are available for use as low sulfur fuel. Legislation is needed that will provide the means for development of the capability of using high sulfur content coal that will be environmentally acceptable in light of the Nation's energy requirements in both the near- and long-term.

5.5.2 Alternative Fuels. If the Army is to meet its goal of substituting synthetic gas for natural gas by the year 2000 and reducing oil consumption by 75 percent, it is essential that legislation continue to provide increasing funds for research, development, and demonstration of alternative fuel production, delivery, and use. Coal gasification and liquification, alcohol production from various sources, shale oil, refuse derived fuels, and solar energy to include photovoltaics are some of the more promising alternatives that require further funding through legislation.

5.5.3 Nuclear Power. A limited number of Army installations consume energy in sufficient quantity to warrant consideration for use of total (centralized) energy systems. Nuclear power plants are theoretically a viable option in such circumstances. However, the environmental and safety aspects of establishing nuclear powered facilities which are provided for in current legislation all but eliminate use of nuclear power as a practical option. Therefore, further clarification and/or adjustment of legislation concerning nuclear power plants is needed to facilitate what is currently an arduous process for nuclear plant licensing and operation.

5.5.4 Refuse-Derived Fuel (RDF). Commercial firms that do business in the area of refuse-derived fuels have offered certain Army installations a no cost retrofit of their heating facilities to burn RDF. In return, these firms require long-term commitments from the retrofitted installations to purchase all of the RDF from that firm. However, because of the Federal Government's legal prohibition against entering into long-term contracts, the Army cannot take advantage of such offers. Therefore, legislation is needed which would authorize the use of operation and maintenance funded contracts over an extended period of time at those installations which could achieve energy savings without adverse personnel or operational effects.

APPENDIX A

FACILITIES ENERGY PLAN

SUMMARY

A.1 INTRODUCTION.

A.1.1 Purpose. The purpose of this summary is to present the status of implementation of the Army Facilities Energy Plan (AFEP), dated 1 October 1978.

A.1.2 Relationship to the Army Energy Plan. The Army Energy Plan (AEP), dated February 1978, provided a detailed background of the energy environment within which the Army must operate. The AEP has been augmented by messages from the Army Energy Office which demonstrate the urgency of the energy situation and the precarious balance of international and national policies pertaining to energy. The AEP directs development of detailed implementation plans which will support programing and budgeting documents. The AFEP further conveys the need for MACOM facilities' energy plans and summaries of operations reports.

A.1.3 Enhancement of the standard of living. The enhancement of the standard of living for military personnel and their dependents is essential to attract and maintain an all volunteer force. Unfortunately, the enhancement is directly related to, as in the civilian sector, the more prevalent ownership and use of convenient, personal appliances, plus energy intensive central air conditioning systems which are used throughout the modern, modular barracks, and new family quarters. These higher living standards, combined with high energy consuming training aids like the modern flight simulators, computers, and computer terminals, have all resulted in increased electrical consumption. Therefore, more energy conservation is required in other areas both to meet goals and to continue to improve the quality of military life.

A.2 FY 79 ARMY-WIDE DATA.

A.2.1 Building data. For purposes of standardization and the maintenance of an adequate audit trail, the size of each MACOM building floor area is that floor square footage that is specified by each of the MACOMs in their facility energy plan. The total size of building floor Army-wide that was maintained for FY 79 is 1,033 million square feet.

A.2.2 Energy consumption. Energy consumption data were also obtained from the MACOM Facilities Plans. The data indicated that 208.5 trillion Btus were consumed by the Army MACOM facilities in FY 79. This represents a 9.99 percent reduction from FY 75. Table A-1 shows Army facility energy consumption by major command, and figure A-1 relates energy consumption by energy source. As can be seen from a review of figure A-1, the individual energy sources totals have all been reduced from the FY 75 totals as compared to FY 79 totals except for a slight increase in the use of electric in FY 78 and for steam in FY 79.

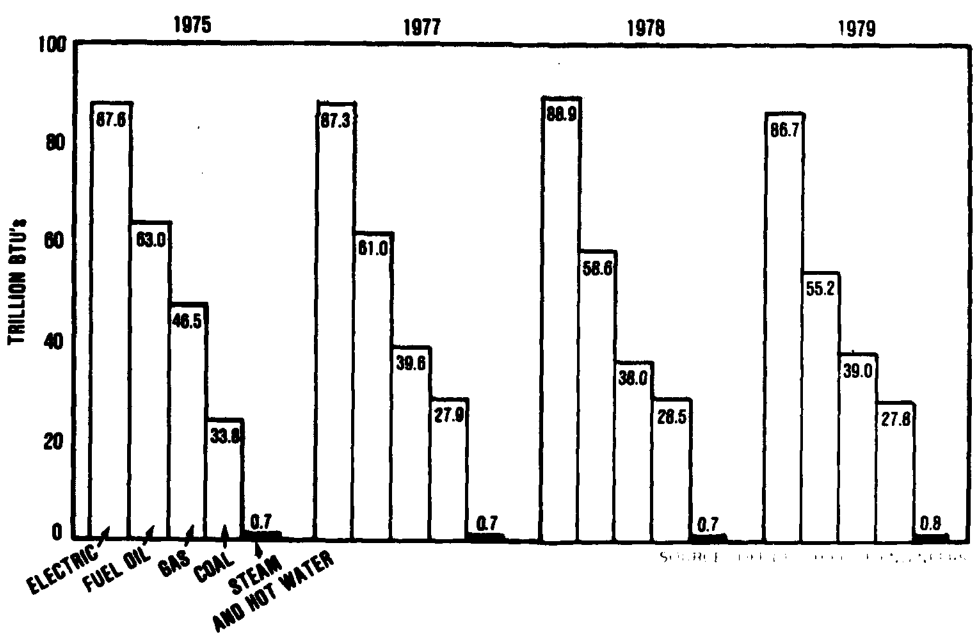


Figure A-1. ARMY FACILITY ENERGY USE BY ENERGY SOURCE

TABLE A-1
FACILITY ENERGY CONSERVATION PROGRESS

6 May 1980

	FY 75 BASE YEAR			FY 78			FY 79			FY 85 TARGET YEAR	FY 79 vs FY 75
Command	MSF[1]	TBTU[2]	KBTU/SF	MSF	TBTU	KBTU/SF	MSF	TBTU[2]	KBTU/SF	KBTU/SF	%KBTU/SF
DARCOM	198.4	56.9	286.9	232.4	47.0	202.2	212.7	45.7	214.7	191.8	25.2
MTMC	9.3	1.5	160.1	9.0	1.2	135.4	9.2	1.1	126.2	111.1	21.2
USAINSCOM	2.0	0.5	263.0	2.0	0.4	232.0	2.4	0.5	211.0	212.0	19.8
USAHSC	6.4	3.1	491.9	9.3	4.0	435.4	10.1	4.2	419.0	371.2	14.8
FORSCOM	236.3	53.0	224.3	252.2	49.4	195.9	257.0	49.3	191.7	173.1	14.5
USARJ	24.0	4.1	168.6	15.1	2.0	137.8	10.0	1.5	146.8	134.2	12.9
COE[3]											
Facilities	4.7	1.2	251.1	4.7	1.1	247.0	4.1	.9	219.5	200.0	12.6
Process	-	6.7	NA	-	7.2	NA	-	6.0	NA	NA	NA
MDW	5.0	1.3	252.8	4.5	1.1	245.8	4.6	1.0	224.4	200.0	11.2
EUSA	23.3	7.5	322.0	22.8	7.4	325.9	22.2	6.4	289.7	257.5	10.0
USMA	10.0	2.0	205.2	10.4	2.0	193.0	9.9	1.9	188.4	158.4	8.2
USAREUR	261.1	43.9	168.3	269.7	44.9	166.7	278.2	43.8	157.4	134.9	6.5
TRADOC	180.6	39.5	218.5	178.0	40.1	225.3	179.2	38.6	215.3	174.3	1.5
USACC	9.1	1.9	207.7	8.9	1.8	205.9	9.2	1.9	211.7	166.9	(1.9)
WESTCOM	17.5	2.0	114.3	20.1	2.5	123.9	20.4	2.8	136.2	105.0	(19.1)
Subtotal	988.6	225.1	227.7	1039.1	212.1	197.2	1029.2	205.6	199.7	182.2	12.3
ARNG	-	2.6	-	-	2.7	-	-	2.9	-	-	-
BMDSCOM	-	2.7	-	-	1.6[4]	-	-	1.0[4]	-	-	-
S.E. ASIA	-	1.2	-	-	0	-	-		-	-	-
Total Energy	-	231.6	-	-	216.4	-	-	209.5	-	-	-

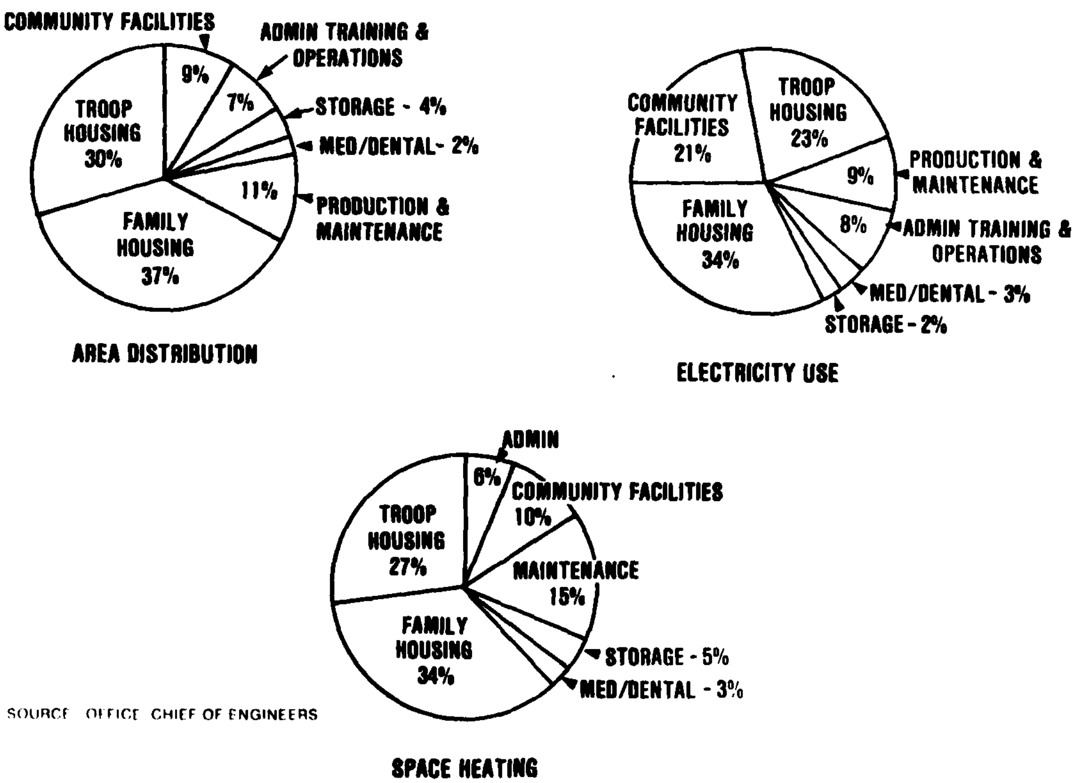
1 Square foot data extracted from Tech Data Reports.
2 BTU data furnished by DALO on 23 Nov 79 from DEIS data.
3 The breakout of COE's consumption (TBTU) is estimated.
4 Derived by taking 60 percent of BMDSCOM total consumption as reported on DEIS I.

A.3 ARMY PROGRESS TOWARD GOALS. In the facility operations, the Army has reduced overall energy consumption in FY 79 by 9.99 percent from FY 75, as stated above. The Army has reduced its Btu/sq ft by 13.5 percent in FY 79, compared to the FY 75 baseline figure. It is noted that DARCOM contributed a large part of the total savings. The DARCOM reductions result from an active conservation program and, to a presently undefined extent, from changes in mission and production. FORSCOM, in spite of the extreme weather conditions that were experienced during the summers and winters of FY 77 and 78 (the East experienced as much as a 12 percent increase in heating degree days), significantly reduced energy consumption.

A.4 MACOM PERSPECTIVES.

A.4.1 <u>Energy Engineering Analysis Program (EEAP)</u>. The EEAP (formerly the Integrated Basewide Energy Studies (IBES)) is under way, in whole or in part, at 37 installations. Except for the early gains achieved through energy conservation actions, the implementation of the EEAP is proving to be the single most effective action taken to date to achieve our energy goals. Funding of the remaining EEAP will further help to replace the installation's undermanned and piecemeal efforts with a highly qualified and fully dedicated professional effort. This will provide precise definition of the installation's overall energy system and will result in early preparation of comprehensive, integrated, installation-wide energy conservation projects. The result should be maximum energy savings for minimum investments and meet ECIP criteria. The ability to meet assigned FY 85 energy goals is strongly dependent on funding of the remainder of the EEAP.

A.4.2 Energy Conservation Investment Program (ECIP). The MCA includes funds that can be utilized by existing facilities to upgrade or retrofit current energy intensive systems to convert them to a more energy efficient operation. The Family Housing Management Account (FHMA) also has an ECIP account which provides for the retrofit of existing family quarters to reduce energy consumption. The FHMA ECIP is very important as the ongoing EEAP reveals that at a troop installation the family housing energy consumption accounts for 34 percent of the total electrical and heating energy consumed. See figure A-2 for typical energy distribution at Ft Hood, Texas. It also provides approximately 50 percent of the



SOURCE OFFICE CHIEF OF ENGINEERS

Figure A-2. DISTRIBUTION OF INSTALLATION ENERGY CONSUMPTION potential opportunity to reduce energy consumption on the installation. The reduction in funding of the MCA ECIP and the FHMA ECIP below critical required levels will seriously jeopardize the attainment of the assigned energy conservation goals. This is particularly true in overseas MACOMs which have been excluded from ECIP funding in the program years prior to FY 81 (except where they consumed US source energy). They will have only 4 program years to achieve energy conservation goals through retrofit of existing facilities.

A.4.3 Personnel. An effective energy management program to reduce energy consumption in facilities requires a combination of administrative measures, increased supervision, improved management, public awareness programs, efficient operation, and maintenance of utilities systems, scheduling of activities to minimize the use of energy, improved maintenance and calibration of equipment and controls, in addition to retrofit projects identified by the EEAP or installation personnel. The most fundamental obstacle to execution of the energy management program is the absence of a properly staffed and effective organizational structure to plan, implement, coordinate, and monitor total energy management programs. The MACOMs have partially identified their deficiencies in staffing which exceed 344 personnel shortfall. Without additional personnel, installations are prevented from realistically identifying energy deficiencies and properly programing for their correction.

A.4.4 Space utilization. Responsibility for the proper utilization of facilities is a command function. Commanders are responsible for the proper, most efficient utilization of all facilities within their command through continuous planning and study, combined with an annual survey of occupied space. The building condition and degree of utilization are vital ingredients in the efficient management and implementation of an effective energy conservation program. The MACOMs and several installation commanders are paying renewed attention to these surveys and have found them profitable in reducing inefficient space and overall energy consumption.

A.4.5 General. *Continuing* energy shortages, combined with drastic increases in the costs of fuel, electrical power, and other utility services, require that conservation programs be given the highest priority and full commitment of all concerned. The very large expenditures required for ECIP, family housing ECIP, new energy conservative construction, and energy management programs are absolutely essential if the Army is to achieve its energy goals by FY 85 and beyond. Managing an energy conservation program is difficult but executing the program without adequate resources is impossible.

APPENDIX B

ARMY FACILITIES ENERGY RESEARCH AND DEVELOPMENT PLAN

SUMMARY

(TO BE PUBLISHED)

APPENDIX C

ARMY MOBILITY ENERGY RESEARCH AND DEVELOPMENT PLAN

SUMMARY

C.1 INTRODUCTION. Energy is necessary to the Army in maintaining readiness to assure national security in peacetime, crisis, or war. The Army energy program, which is in concert with and in support of national energy goals, establishes the basis for reducing energy consumption, reducing dependency on conventional hydrocarbon fuels, and tasks the Army to obtain a position of energy leadership.

C.1.1 Purpose.

The overall objective of the Army Mobility Energy R&D Plan is to ensure a cohesive, coordinated program leading toward stronger mobility energy R&D that can respond to existing and future Army requirements to cope with the coordinated R&D energy programs and provide documentation for R&D resource allocation.

National security objectives can be achieved only if we are prepared to meet essential military energy requirements. The ability of the United States to deter armed conflict, to respond to military aggression, to field modern and effective weapons, to meet our worldwide commitments, even to exist as a nation depends upon the availability of an adequate supply of energy of the type and quality to meet the needs of our armed forces. At the same time, the military must also be aware and account for the needs of the economy.

C.1.2 Goals. The Army Mobility Energy R&D Plan, when implemented, should greatly assist the Army in supplying energy of the type, quality, and quantity for both short- and long-range time frames. The plan concentrates on energy systems (structure, power sources, equipment) which will make more efficient use of fuels, reduce dependence on nondomestic fuels, and use less expensive and/or more plentiful (renewable) resources. The plan also provides for timely assessment of R&D effort towards Army energy goals and objectives which include:

a. Reducing energy consumption 35 percent by the year 2000 by reducing energy consumption in mobility operations 10 percent by FY 85 with zero growth to the year 2000 with no degradation to readiness.

b. Reducing dependence on nonrenewable and scarce fuels by the year 2000 by developing the capability to use synthetic or alternate fuels for mobility operations petroleum requirements, and increasing efficiency on nonrenewable energy dependent mobility systems by 15 percent with no degradation to readiness.

c. Attaining a position of leadership in the pursuit of national energy goals.

C.2 THE PLAN.

C.2.1 Mobility fuel consumption. In FY 77, the Army consumed about 765 million gallons of petroleum: 58 percent was for heating oil; the remaining 42 percent was divided among jet fuel, diesel fuel, and motor gasoline. The mobility consumption of the Army's petroleum usage is 45 percent.[1] The mobility portion is allocated as shown in figure C-1. The category designated as other includes

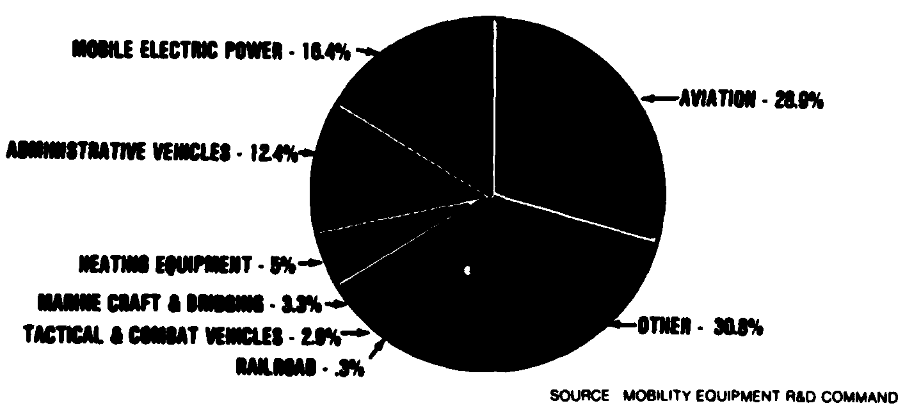


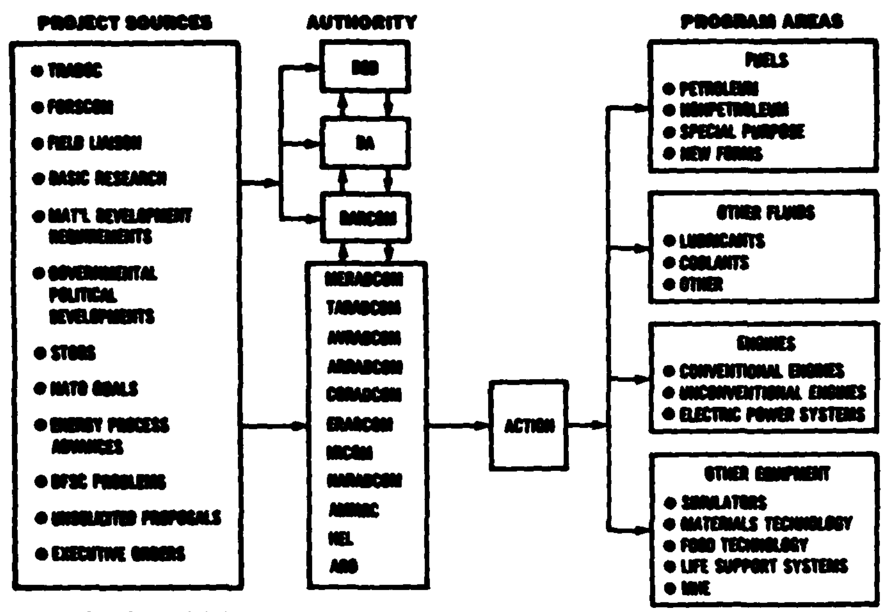
Figure C-1. MOBILITY FUEL CONSUMPTION

[1]In terms of total energy consumed, mobility operations account for only 17 percent.

materials handling equipment, construction equipment, water purification equipment, field kitchens, field laundries, field refrigeration, fuels handling equipment, etc.

C.2.2 Plan framework.

The framework for Mobility Energy R&D established for the plan is shown in figure C-2. The four program areas shown are structured to allow inclusion of any type of project.



SOURCE MOBILITY EQUIPMENT R&D COMMAND

Figure C-2. FRAMEWORK FOR MOBILITY ENERGY R&D PROGRAM

The technical performance plan, based on the four program areas shown in figure C-2, is shown in figure C-3. Besides the normal R&D and T&E phases, a Production and Standardization (P&S) and Demonstration phase have been included. The Production and Standardization phase is important for the fuels portion; and the Demonstration phase is included to identify existing and future cooperative efforts between DOE and DOD (DA) such as the solar photovoltaic DOD demonstration program.

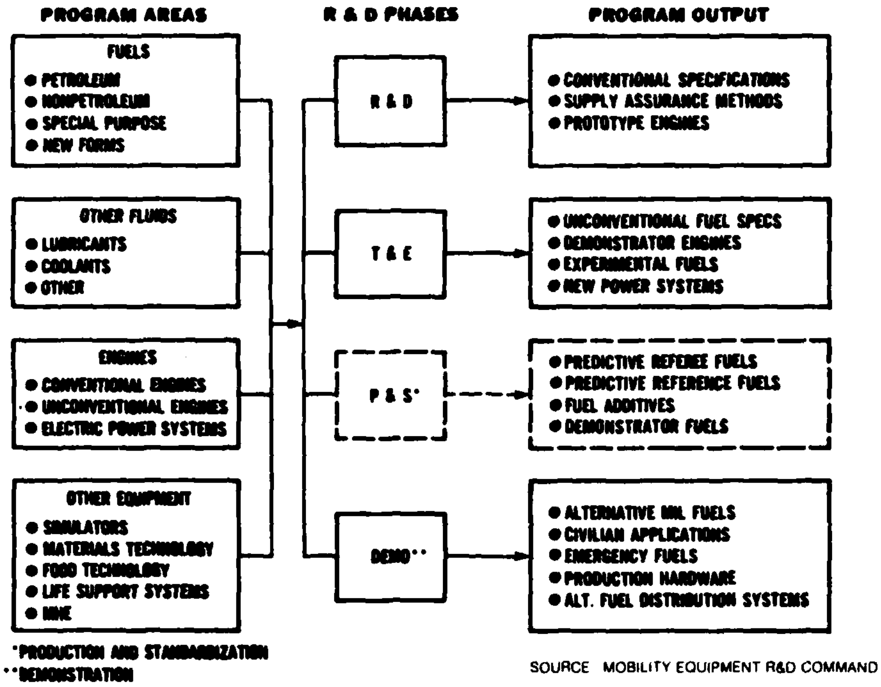


Figure C-3. PERFORMANCE PLAN FOR MOBILITY R&D PROGRAM

The technical performance plan interaction and coordination effort is shown in figure C-4. An important feature shown on this figure is the assessment activity. The assessment activity includes development of a methodology to allow a quantified assessment of funded and unfunded programs/projects, establishing a workable data base, conducting a needs analysis, determining gaps and voids, and making recommendations of new or modified efforts.

C.2.3 Plan development. The process of developing the Army Mobility Energy R&D Plan included requesting and receiving recommendations for energy/energy related projects from all DARCOM R&D Commands. Seventy-nine inputs were received. They were subjectively assessed for "energy relevance" and assigned values as shown in figure C-5. They are summarized in figures C-6 through C-8, and are cataloged into the four program areas shown in figure C-2. They are further identified as funded or unfunded.

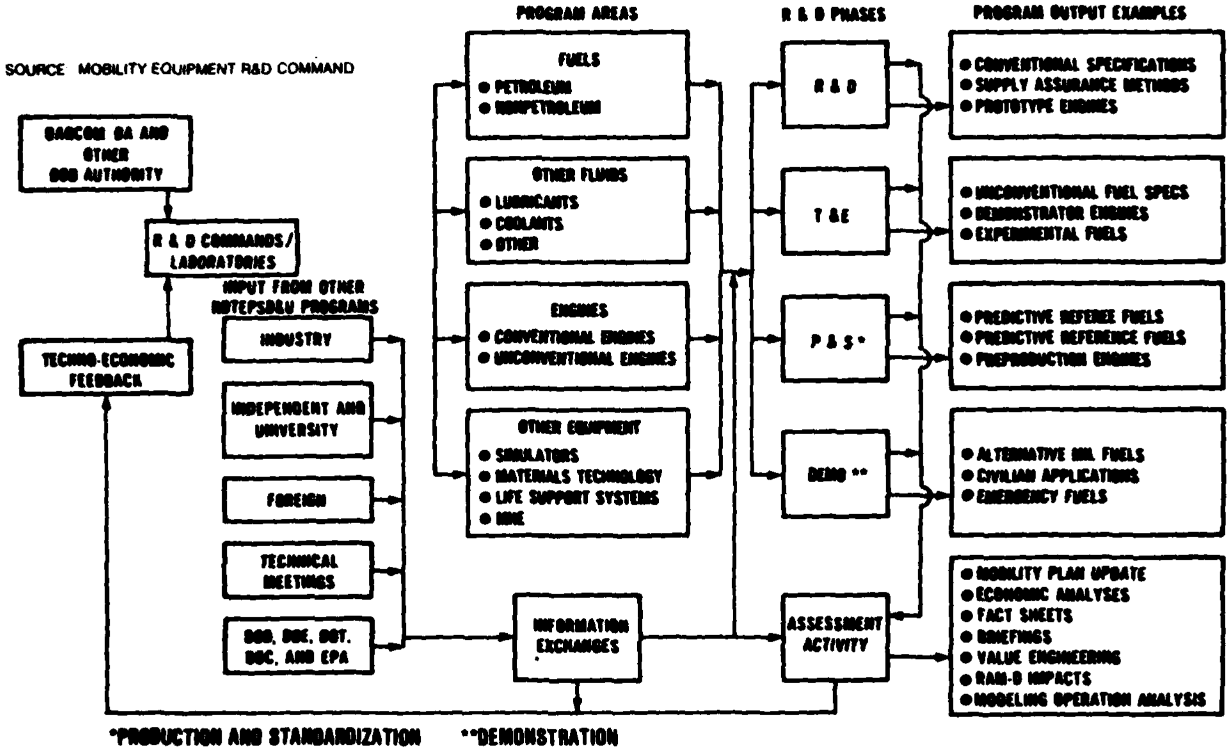


Figure C-4. MOBILITY ENERGY R&D PROGRAM TECHNICAL PERFORMANCE

VALUE

5 -MUST PROGRAM, SHOULD BE FUNDED, EXCELLENT ENERGY SUPPORT

4 -HIGH POTENTIAL, SHOULD BE FUNDED, HIGH ENERGY SUPPORT

3 -GOOD, FUNDED IF MONIES EXIST, GOOD ENERGY SUPPORT

2 -MARGINAL, LIMITED SUPPORT TO ARMY ENERGY GOALS

1 -UNDECIDED, NEED TO EXAMINE IN FY80 TO DETERMINE IF IT SHOULD REMAIN IN ENERGY PLAN

0 -NOT ENERGY RELATED

NOTE: Makes no judgment on project to meet Army requirements; only its contribution to Army mobility energy R&D.

Figure C-5. ASSESSMENT VALUE (ENERGY RELEVANCE) FOR MOBILITY ENERGY R&D

COMMAND OBJECTIVE TITLE	CMD	ENGY REL	RD CAT	PROJ	CFY	BFY	TFY
ENZYMATIC HYD OF CELL MATLS	NAR	4	6.1	AH52	100	150	150
FUEL STABILITY & TEST DEVELOPMENT	MER	4	6.2	AH20	100	75	100
ALTERNATE/SYNTHETIC FUELS	MER	5	6.2	AH20	300	2165	430
HIGH ENERGY FUELS	MER	3	6.2	AH20	100	75	100
GASOHOL EVALUATION	MER	4	6.2	AH20	130	0	0
MILITARY FUEL MONITOR	MER	1	6.3	D150	0	0	100
HIGH ENERGY FUELS	MER	3	6.3	D150	0	0	200
USER ACCEPTANCE TESTING OF FUELS	MER	1	6.3	D150	0	0	350
OTHER FLUIDS							
LONG LIFE COOLANT SYSTEM	MER	2	6.2	AH20	100	100	125
USE OF RECYCLED OILS	MER	2	6.2	AH20	100	90	50
LONG LIFE COOLANT SYSTEM	MER	2	6.3A	D150	0	0	200

Figure C-6. FUELS/OTHER FLUIDS - TESTING AND EVALUATION - FUNDED ($K) (AS OF 3 DEC 79)

COMMAND OBJECTIVE TITLE	CMD	ENGY REL	RD CAT	PROJ	CFY	BFY	TFY
MACI ENGINE PROGRAM	TAR	1	MACI	4301	700	1000	0
ENGINE COMBUSTION RESEARCH	ARC	1	6.1	BH57	1119	1343	1612
ENGINE CONCEPTS FOR ALT FUELS	TAR	5	6.2	N	0	900	1000
VARIABLE CAPACITY ENGINE	AVR	3	6.2	AH76	190	190	245
IMPROVED HELICOPTER ENGINES	AVR	5	6.2	AH76	50	0	0
ADVANCED HEAT ENGINES	MER	4	6.2	AH20	130	113	130
CERAMIC COMPONENT TECHNOLOGY	AMM	4	6.2	AH84	265	275	300
MULTI-FUEL ENG FOR TAC/COMB VEH	TAR	5	6.2	AH91	0	900	1000
ADV TURBINE COMPONENTS	TAR	4	6.2	AH91	314	422	521
ADVANCED HEAT ENGINES	MER	4	6.3	DG11	1650	1600	500
AGT-1500 FUEL ECONOMY PROGRAM	TAR	3	6.3A	DG07	1950	0	0
ADIABATIC DIESEL ENGINE	TAR	4	6.3A	N	566	3700	0
ADV 1000 HP DIESEL ENGINE	TAR	3	6.3A	D607	0	2500	0
IMPROVED HELICOPTER ENGINES	AVR	5	6.3A	D447	0	837	5661
MULTI-FUEL ENG FOR TAC/COMB VEH	TAR	5	6.3A	DG07	0	1150	3000

Figure C-7. ENGINES-FUNDED ($K) (AS OF 15 AUG 79)

COMMAND OBJECTIVE TITLE	CMD	ENGY REL	RD CAT	PROJ	CFY	BFY	TFY
HEAT ENGINE VEH SYS MATLS	AMM	3	DOE	DOE	750	0	0
TRANSMISSIONS/TRANSFER ASSEM	TAR	1	MACI	D607	400	400	0
ELECTRIC VEHICLE EVALUATION	TAR	4	MACI	4331	27	27	27
RADIAL VS BIAS PLY TIRES	TAR	2	MACI	6003	450	530	30
SIMPLIFIED TEST EQUIP FOR IC ENG	TAR	2	PAA	D632	9500	0	0
EFFICIENT MOBIL LAUNDRY EQUIP	NAR	0	PIP	0112	0	125	0
SAMARIUM-COBALT GEN TECH	HOL	3	6.1	N	100	0	0
FUEL CELL POWER PLANTS	MER	5	6.1	AH51	480	320	320
ELECTRONIC DEVICES RESEARCH	ERA	0	6.1	AH47	320	310	320
EFFICIENT MOBILE ELEC PWR SYS	MER	3	6.1	AH51	120	80	80
EFFICIENT ENV CONTROL EQUIP	MER	3	6.2	AH20	150	200	114
RADIATION PRESERVATION OF FOODS	NAR	2	6.2	AH99	1020	1000	750
EFFICIENT MOBILE ELEC PWR SYS	MER	3	6.2	AH20	600	530	550
FUEL CELL POWER PLANTS	MER	5	6.2	AH20	300	220	270
REDUCTION OF FOOD WEIGHT/BULK	NAR	0	6.2	AH99	67	145	135
IMPROVEMENT IN FOOD PACKAGING	NAR	0	6.2	AH99	30	0	0
THERMOPROCESSED FIELD MEALS	NAR	0	6.2	AH99	200	160	146
AIRDROP SIMULATION	NAR	2	6.2	D283	120	200	200
COMPOSITE STRUCTURAL VEH COMPS	AMM	2	6.2	AH84	100	0	0
LIGHTWEIGHT SUSPENSION COMPS	AMM	0	6.2	AH84	300	350	250
SAMARIUM-COBALT GEN TECH	HOL	3	6.2	N	165	100	0
POWER SOURCES FOR ELEC DEVICES	ERA	0	6.2	AH94	739	650	880
ADV COMPOSITE MATLS/STRUCTURES	TAR	2	6.2	AH91	315	321	275
FUEL CELL POWER PLANTS	MER	5	6.3	DG11	394	1320	2390
ADV HYDROMECH TRANSMISSION	TAR	3	6.3A	D395	1300	1840	0
CONTRASTING GROUND COVER	MER	0	6.3A	8201	100	150	150
EFFICIENT MOBILE ELEC PWR SYS	MER	3	6.3A	DG11	550	0	0
EFFICIENT FIELD OVEN/GRIDDLE	NAR	1	6.3A	D610	83	120	0
SAMARIUM-COBALT GEN TECH	HDL	3	6.3A	N	0	250	0
ADV TACTICAL POWER SOURCES	ERA	0	6.3A	DG10	861	1460	1300
EFFICIENT ENV CONTROL EQUIP	MER	3	6.4	DL39	500	500	872
RADIATION PRESERVATION OF FOODS	NAR	2	6.4	DL47	2499	2134	1060

Figure C-8. OTHER EQUIPMENT-FUNDED ($K) (AS OF 15 AUG 79)

C.2.4 Management.

The management of the Army Mobility Energy R&D requires no change at the DA or DARCOM level, and can be executed through existing programs/projects. However, during the yearly DA/DARCOM RDT&E reviews, energy projects should be highlighted.

The Mobility Equipment R&D Command (MERADCOM) will update the plan, do general nature coordination, develop the assessment methodology, do needs analysis, develop necessary data base, and make appropriate program recommendations.

C.3 PROGRAM THRUSTS. Three major programs were identified as particularly relevant to the Army energy goals and objectives: Alternative Fuels, Fuels and Lubricants, and Engine Development.

C.3.1 Alternate fuels.

The FY 80, FY 81, and FY 82 programs for the shale oil derived portion of the alternative fuel program are shown in figures C-9, C-10, and C-11. The other major effort in the Alternative Fuels Program, Gasohol Evaluation, is shown in figures C-12 and C-13.

FUNDING	TASK	FUNDED, $K	UNFUNDED, $K
6.2	LABORATORY CHARACTERIZATION	500	-0-
6.2	COMPONENT & ENGINE TESTING	300	-0-
6.2	TOXICOLOGICAL/SAFETY ASPECTS	250	-0-
6.2	FUEL HANDLING & GROUND SUPPORT EQUIPMENT	350	-0-
	FULL-SCALE ENGINE ENDURANCE TESTING		
6.2	o GROUND ENGINE SYSTEMS	300	-0-
6.2/6.4	o AIRCRAFT ENGINE SYSTEMS (100/1300)	100	1,300
6.3A	ENGINEERING PILOT FIELD TESTS	-0-	-0-
6.2	SYSTEMS ANALYSIS & OPERATIONS CONSIDERATIONS	250	-0-
6.2 /6.3A	ACCELERATED FUEL-ENGINE QUALIFICATION METHODOLOGY (745/1000)	199	1,546
	TOTAL	2,249	2,846

NOTE: FY 80 program assumes plus-up funding of 1999K & fuel procurement costs provided by DOE, DOD, or OPA funds.

Figure C-9. FY 80 PROGRAM ALTERNATE SYNTHETIC FUELS SHALE SYNFUEL EFFORT (AS OF 3 DEC 79)

FUNDING	TASK	FUNDED, $K	UNFUNDED, $K
6.2	LABORATORY CHARACTERIZATION	250	-0-
6.2	COMPONENT & ENGINE TESTING	365	-0-
6.2	TOXICOLOGICAL/SAFETY ASPECTS	200	-0-
6.2	FUEL HANDLING & GROUND SUPPORT EQUIPMENT	350	-0-
	FULL-SCALE ENGINE ENDURANCE TESTING		
6.2/6.3A	o GROUND ENGINE SYSTEMS (100/300)	400	-0-
6.4	o AIRCRAFT ENGINE SYSTEMS	-0-	3,400
6.3A	ENGINEERING PILOT FIELD TESTS	350	-0-
6.2	SYSTEMS ANALYSIS & OPERATIONS CONSIDERATIONS	250	-0-
6.3	ACCELERATED FUEL-ENGINE QUALIFICATION METHODOLOGY	-0-	1,258
	TOTAL	2,165	4,658

NOTE: FY 81 program assumes funding in FY 80 & fuel procurement costs provided by DOE, DOD, or OPA funds.

Figure C-10. FY 81 PROGRAM ALTERNATE SYNTHETIC FUELS SHALE SYNFUEL EFFORT (AS OF 3 DEC 79)

FUNDING	TASK	FUNDED, $K	UNFUNDED, $K
6.2	LABORATORY CHARACTERIZATION	200	-0-
6.2	COMPONENT & ENGINE TESTING	200	-0-
6.2	TOXICOLOGICAL/SAFETY ASPECTS	100	-0-
6.2	FUEL HANDLING & GROUND SUPPORT EQUIPMENT	150	-0-
	FULL-SCALE ENGINE ENDURANCE TESTING		
6.2/6.3A	o GROUND ENGINE SYSTEMS (100/250)	350	-0-
6.4	o AIRCRAFT ENGINE SYSTEMS	-0-	1,800
6.3A	ENGINEERING PILOT FIELD TESTS	350	-0-
6.2	SYSTEMS ANALYSIS & OPERATIONS CONSIDERATIONS	250	-0-
6.3A	ACCELERATED FUEL-ENGINE QUALIFICATION METHODOLOGY	200	-0-
	TOTAL	1,800	1,800

NOTE: FY 82 program assumes funding in FY 81 and receipt of incremental funding. Same position on fuel procurement.

Figure C-11. FY 82 PROGRAM ALTERNATE SYNTHETIC FUELS SHALE SYNFUEL EFFORT (AS OF 3 DEC 79)

FUNDING	TASK	FUNDED, $K	UNFUNDED, $K
6.3A	STORAGE EFFECTS ON GASOHOL	-0-	110
6.2	MATERIALS COMPATIBILITY	10	230
6.3A	ENGINE DYNAMOMETER TESTING	-0-	165
6.3A	CONTROLLED FLEET TESTING	90	490
6.3A	EVALUATING EFFECTS WITH OTHER EQUIPMENT	-0-	200
	TOTAL	100	1,195

Figure C-12. FY 80 PROGRAM - GASOHOL EVALUATION (AS OF 3 DEC 79)

FUNDING	TASK	FUNDED, $K	UNFUNDED, $K
6.3A	STORAGE EFFECTS ON GASOHOL	-0-	120
6.2	MATERIALS COMPATIBILITY	-0-	30
6.3A	ENGINE DYNAMOMETER TESTING	-0-	20
6.3A	CONTROLLED FLEET TESTING	-0-	910
6.3A	EVALUATING EFFECTS WITH OTHER EQUIPMENT	-0-	150
	TOTAL	-0-	1,230

Figure C-13. FY 81 PROGRAM - GASOHOL EVALUATION (AS OF 3 DEC 79)

C.3.2 Engine development.

The funding profiles for recommended Army engine development are shown in figure C-14 with both funded and unfunded displayed. It became obvious in developing an Army engine program that the DA policy accepted from the "Wheels Study" for vehicle engines needs to be re-examined in light of the recent developments in energy, particularly petroleum energy, and the emphasis on conservation, efficiency, and use of alternative fuels. The basic thrusts of the engine program should encompass:

- R&D to develop multifuel engines and engines capable of operating on multisource fuels.
- R&D to develop engines that use other than conventional liquid fuels.
- Improving efficiency of existing engines through new engine component developments and economic retrofit.

	FY80	FY81	FY82	FY83
MERADCOM				
FUNDED	1,780	1,713	630	1,040
UNFUNDED	700	1,500	1,500	2,500
AVRADCOM				
FUNDED	240	1,027	5,906	9,325
UNFUNDED	6,110	21,910	27,319	17,433
TARADCOM				
FUNDED	2,830	9,572	5,521	7,500
UNFUNDED	4,560	5,600	2,000	

Figure C-14. ARMY ENGINE/HARDWARE RDTE PROGRAMS ($K) (AS OF 27 NOV 79)

C.3.3 Other efforts. Other efforts that are proposed for consideration and planning during CY 80 are:

- Contingency planning for the transition from petroleum to synthetic fuels.

o Increasing the use of simulator in training (designed for maximum energy efficiency).

o Modification or selection of automotive engine lubricating oils and other fluids for use with alternative fuels and for conservation.

C.4 CONCLUSIONS. The conclusions or findings based on an assessment of the Army Mobility Energy R&D efforts, as they exist today, are:

o The Army needs a better coordination process within the R&D community, at the DA level, and outside DA.

o The Army needs to actively support and seek funding, or continue funding, for energy relevant programs, especially alternative fuels, fuels and lubricants, and engine development.

o The Army needs to reconsider that portion of the "Wheels Study" that essentially prohibits engine development work.

o The Army organization and project structure is adequate to accomplish the R&D.

o A methodology for determining "Energy Relevance" assessment needs to be developed.

o There is possibly limited funding for efforts toward petroleum conservation (reduce petroleum consumption by 10 percent by 1985).

$1400K in FY 80	(6.2 and 6.3A)
$1915K in FY 81	(6.2 and 6.3A)
$200K in FY 82	(6.2)

However, it also may be that in fact, Mobility Energy R&D may not positively contribute toward this goal; particularly, if many of the major projects introduce hardware into the field; e.g., the XM-1 consumes fuel at a much higher rate than the M-60.

Current funding for the Army goal of improving efficiency of (engines) mobility systems 15 percent by the year 2000 is low now:

\$7654K in FY 80	(6.1, 6.2, 6.3A)
\$11790K in FY 81	(6.1, 6.2, 6.3A)
\$9713K in FY 82	(6.1, 6.2, 6.3A)

When compared to total requested funds:

\$12744K in FY 80	(funded and unfunded)
\$26820K in FY 81	(funded and unfunded)
\$32107K in FY 82	(funded and unfunded)

The funding for the Army goal of developing the capability in mobility operations to use alternative/synthetic fuels by the year 2000 appears to be funded at about one-half of the total requested. The largest shortfall is for qualification of Army aircraft on alternative fuels. A complete discussion of the funding situation is contained in the Army Energy Research and Development Plan.

APPENDIX D

PUBLIC AFFAIRS PLAN

D.1 PURPOSE. To provide public affairs support for the Army Energy Plan and for the implementation of Army energy conservation programs and policies.

D.2 OBJECTIVES. The objectives of the Public Affairs Plan are to:

a. Inform internal and external audiences through the use of all available media resources of the Army's plans, goals, and achievements in energy conservation.

b. Inform the internal audience of the need to exercise initiatives in conserving energy.

c. Demonstrate to the general public and the media the Army's concern for conserving energy and its contributions to the nation's overall energy conservation efforts.

d. Obtain feedback to insure understanding of the Army Energy Plan and to refine continuing public affairs programs.

D.3 EXECUTION. Guidelines and assignments for the execution of the Public Affairs Plan are outlined below.

D.3.1 General.

a. Public affairs programs may use informational materials provided by all staff agencies and commands.

b. Informational materials for national release will be coordinated with the Office of the Chief of Public Affairs (OCPA), ATTN: SAPA-PP.

c. Close coordination will be maintained between OCPA, DA Staff agencies, and all major commands to provide maximum public affairs support for the Army Energy Plan.

d. Public affairs programs should be developed, established, and executed in accordance with ARs 360-5, 360-61, 360-81, 11-27, and the Army Energy Plan.

D.3.2 Responsibilities.

D.3.2.1 DA Staff Agencies.

a. Comply with the provisions of paragraph 4b, CSR 360-1.

b. Provide a knowledgeable spokesperson to respond to media queries about tests/evaluations/studies/programs/policies/accomplishments pertaining to energy conservation which have been or are being conducted through the respective staff agencies.

c. Use staff agency media to disseminate information about Army energy programs.

D.3.2.2 ODCSLOG.

a. The Army Energy Office (DALO-TSE) will provide fact sheets, information briefs, and similar materials for use in preparing news releases and feature articles.

b. Provide a knowledgeable spokesperson to respond to queries or requests for interviews from the media about the Army Energy Plan and energy conservation programs in general.

D.3.2.3 OCPA.

a. Coordinate and monitor the provisions of the Army Energy Plan and provide additional guidance as required.

b. Ensure that all appropriate public affairs resources are used in disseminating information about Army energy conservation programs and in executing the Army Energy Plan.

c. Coordinate through the Office of the Assistant Secretary of Defense (Public Affairs) all information materials for release to the national media.

d. Respond to queries from the media and public.

D.3.2.4 OCAR and the National Guard Bureau (NGB). Develop public affairs support, as appropriate, for Army Reserve and Army National Guard execution which fully responds to the objectives of the Army Energy Plan.

D.3.2.5 Major Commands (MACOMs).

a. Develop and execute command, public information, and community relations programs to support the objectives of the Army Energy Plan.

b. Forward appropriate or newsworthy informational materials to SAPA-PP for clearance and/or release to the national media.

c. Ensure that subordinate elements develop, establish, and execute public affairs programs to support the objectives of the Army Energy Plan.

APPENDIX E

ARMY ENERGY COSTS - THE LONG-RANGE OUTLOOK

E.1 GENERAL. The decade of the 1970s has been marked by rising prices for energy sources. The cost per unit of crude oil, coal, and natural gas based fuels has risen considerably faster than any other commodity, stimulating double digit inflation and considerable budget stress. This document recognizes the need for long-range energy policy and planning several years in advance of implementation of programs to reduce energy consumption. The Cost of Energy Resources Forecasting System (CERFS) model was designed to provide accurate forecasts of future energy costs over a long-range time horizon. Energy unit costs are calculated over a 20-year period using cost increases as dictated by the model. The theoretical work behind CERFS is detailed in the Senior Honors Thesis "Price Dynamics of Resource Exhaustion" by Thomas Howard of Dartmouth College.

E.1.1 Forecast assumptions. Four sets of forecasts are presented here. The first assumes a slow rate of inflation and generates outyear energy prices assuming a 6 percent rate of inflation. The second set of forecasts incorporates a moderate inflation scenario, averaging 8 percent over 20 years. The third set of predictions is based upon a rapid inflation rate which maintains a 10 percent rate of inflation. It should be noted here that CERFS assumes that energy costs will rise faster than the cost of other goods within the US economy. Thus, the actual increase in the price of energy will be faster than these inflation rates. The fourth set of forecasts is based upon the Office of the Secretary of Defense's escalation rates for fuel prices. This does not constitute a forecast so much as it represents how much of the budget is currently being set aside for the purchase of energy sources. It will soon become clear that these budget plans will fall short of actual energy costs.

E.1.2 Forecast scenarios.

E.1.2.1 Scenario one - slow economic inflation. Even with the assumption of fairly slow economic inflation of 6 percent, large gains are predicted to be obtained by achieving the goals of the Army Energy Plan. Costs under this scenario are expected to reach $1.6 billion by FY 85 and $5.2 billion by the year 2000. This assumes, of course, that the goals of the Army Energy Plan are met. If, on the other hand, these goals are not met, and the Army continues to consume fuels at the rate they did during FY 79, then costs would reach $1.8 billion in FY 85 and as much as $7.9 billion in the year 2000. Thus, a cost avoidance of $195 million should be gained in FY 85 under this scenario, while a figure of $2.7 billion would be achieved by the end of the century. Even under this assumption of slow economic inflation cumulative cost avoidance then totals $17.9 billion. These figures are summarized in table E-1.

E.1.2.2 Scenario two - moderate economic inflation. This scenario represents an 8 percent rate of inflation and is considered the most likely combination of future energy prices and general inflation rates. In a sense, the first and third forecasts "bracket" this set of predictions as a "buffer" of possible outcomes. Costs again rise dramatically in this scenario. By FY 85, the Army should expect to be spending $1.78 billion for energy assuming that the Army Energy Plan goals are met. The annual cost of energy will then rise to over $7.6 billion by the turn of the century. The costs without meeting these goals are even greater, $1.99 billion and $11.6 billion, respectively. This implies an expected cost avoidance of $219 million in FY 85 and $3.9 billion in FY 2000. The cumulative cost avoidance under this scenario then adds up to a staggering

$24 billion which certainly warrants much attention, and should be used as an incentive to fund programs necessary to accomplish the goals set forth in the Army Energy Plan. These numbers are best pictured in table E-2.

E.1.2.3 Scenario three - rapid economic inflation. This scenario incorporates a very rapid rate of inflation, resulting in double digit (10 percent) inflation for each energy source for the entire 20-year forecast horizon. It is certainly hoped that actual costs incurred will not be so steep, but this forecast can then be considered an upper limit to the set of all possible outcomes. Costs under this set of conditions rise to $1.98 billion by FY 85 and then to $11.3 billion by FY 2000. If energy consumption were to remain at 1979 levels, then these costs would be $2.2 billion and $17.1 billion, respectively. Cost avoidance would then be $319 million in FY 85, $5.9 billion in FY 2000, and cumulatively would total almost $33 billion. These costs are encapsulated in table E-3.

E.1.2.4 *Scenario four - prevailing acceptable escalation pattern*. This scenario uses the prevailing acceptable, albeit constrained, fuel escalation figures as imposed by the various levels of the executive branch. Historically, these rates have been below those that have occurred. Using these escalation figures, unit energy costs have been calculated over the 20-year interval, as they were in the three preceding scenarios. Thus, the quantities represent the proposed budget for OSD for energy over the next 20 years. Even though the quantities are somewhat low when compared with the estimates previously generated, the budgetary costs still rise dramatically. Budgeted costs then rise to $1.3 billion by FY 85 and to $2.1 billion by FY 2000. If energy consumption were not reduced as called for in the Army Energy Plan, then these figures would be $1.4 billion and $3.2 billion, respectively. Cost avoidance under this scenario adds up to $156 million in FY 85 and over $1 billion at the turn of the century.

Cumulatively, this adds up to $8.8 billion saved by reducing energy consumption. These numbers are best pictured in table E-4.

E.1.3 Comparison. If scenario four costs are compared with the second cost scenario, the budgeted amounts fall short of actual energy costs by over $400 million in FY 85 and by $5.5 billion in FY 2000. If there is no reduction in energy consumption, then the shortfall would add up to $600 million in FY 85 and $8.3 billion at the turn of the century. Clearly this discrepancy will have to be eliminated, either by raising the budget, reducing energy consumption even further, or by a combination of both these methods.

E.2 SUMMARY. Together, these four scenarios illustrate what lies ahead for energy costs. Under any set of figures, the cost avoidance generated by reducing Army energy consumption is significant. In the three forecasts, cost avoidance totals are from $17.9 to $33 billion over 20 years, differing only in the degree of economic inflation yet to be encountered. Budgeted amounts will lag actual costs, but the difference will be made up through budget increases or redoubled efforts to conserve energy. The incentives for energy conservation are great, and will not decrease with time. With total cost avoidance of $24 billion expected, the Army Energy Plan is more than justified on economic grounds.

Table E-1. SCENARIO ONE - SLOW ECONOMIC INFLATION (6 PERCENT)

Year	Army Goals Met	FY 79 Level Consumption	Annual Cost Avoidance
1980	$1025	$1045	$ 20.6
1981	1115	1160	45.7
1982	1220	1293	73.2
1983	1334	1441	107.1
1984	1460	1608	147.9
1985	1588	1783	195.0
1986	1731	1978	246.6
1987	1886	2194	308.4
1988	2054	2436	381.5
1989	2238	2704	466.7
1990	2424	2986	562.0
1991	2623	3298	674.6
1992	2841	3643	802.7
1993	3075	4026	950.8
1994	3327	4450	1123.0
1995	3578	4892	1314.3
1996	3848	5380	1532.3
1997	4136	5917	1780.9
1998	4443	6510	2067.8
1999	4775	7164	2389.3
2000	5154	7886	2731.6
Cumulative Summary *	$55874	$73796	$17922

* Projected fuel cost by year ($ millions)

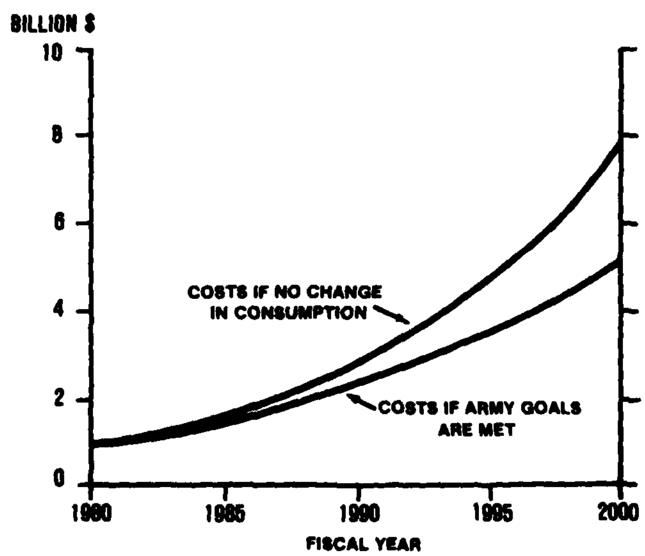


Table E-2. SCENARIO TWO - MODERATE ECONOMIC INFLATION (8 PERCENT)

Year	Army Goals Met	FY 79 Level Consumption	Annual Cost Avoidance
1980	$1044	$1065	$ 21.0
1981	1161	1209	47.7
1982	1295	1372	77.7
1983	1443	1559	115.9
1984	1604	1766	162.7
1985	1777	1996	218.6
1986	1975	2256	281.1
1987	2193	2550	357.7
1988	2434	2884	450.4
1989	2701	3262	560.9
1990	2982	3670	687.6
1991	3289	4130	840.3
1992	3630	4648	1018.2
1993	4014	5243	1228.3
1994	4426	5904	1477.5
1995	4851	6612	1761.2
1996	5316	7407	2091.5
1997	5824	8301	2476.1
1998	6371	9299	2928.1
1999	6979	10425	3446.5
2000	7628	11568	3940.1
Cumulative Summary *	$72937	$97126	$24189

* Projected fuel cost by year ($ millions)

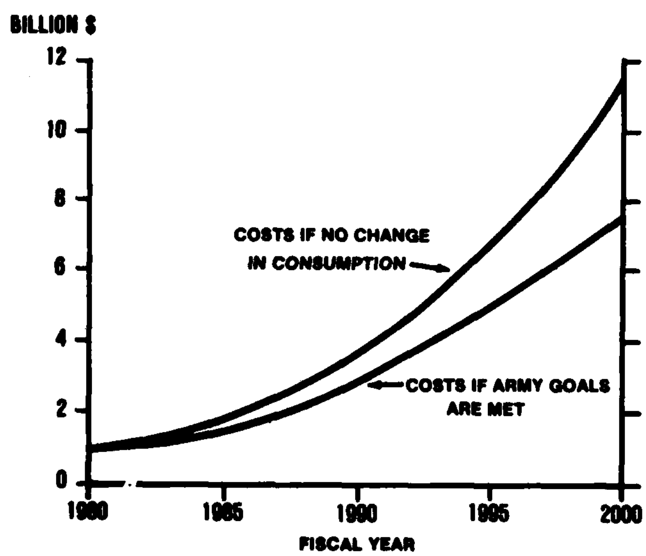


Table E-3. SCENARIO THREE - RAPID ECONOMIC INFLATION (10 PERCENT)

Year	Army Goals Met	FY 79 Level Consumption	Annual Cost Avoidance
1980	$1063	$1085	$ 21.4
1981	1201	1251	49.4
1982	1365	1446	81.9
1983	1549	1673	124.4
1984	1758	1936	178.3
1985	1984	2228	244.0
1986	2245	2565	319.7
1987	2539	2954	414.3
1988	2871	3402	531.3
1989	3246	3920	673.9
1990	3650	4491	841.3
1991	4100	5147	1047.3
1992	4609	5901	1292.4
1993	5179	6767	1587.8
1994	5816	7761	1945.4
1995	6492	8854	2361.9
1996	7240	10089	2849.1
1997	8080	11516	3435.5
1998	9009	13147	4137.9
1999	10052	15013	4960.7
2000	11264	17148	5883.9
Cumulative Summary *	$95313	$128294	$32982

* Projected fuel cost by year ($ millions)

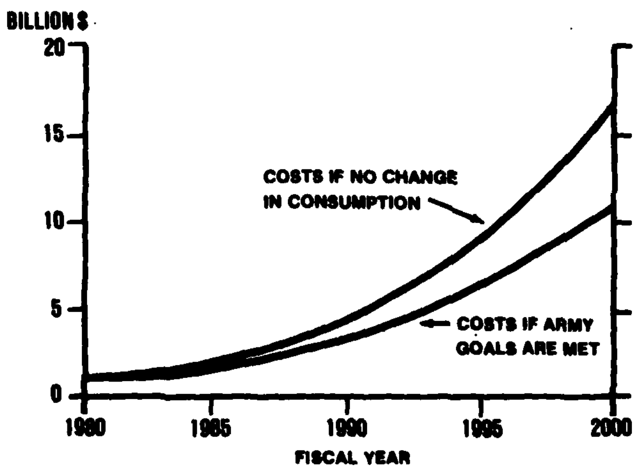
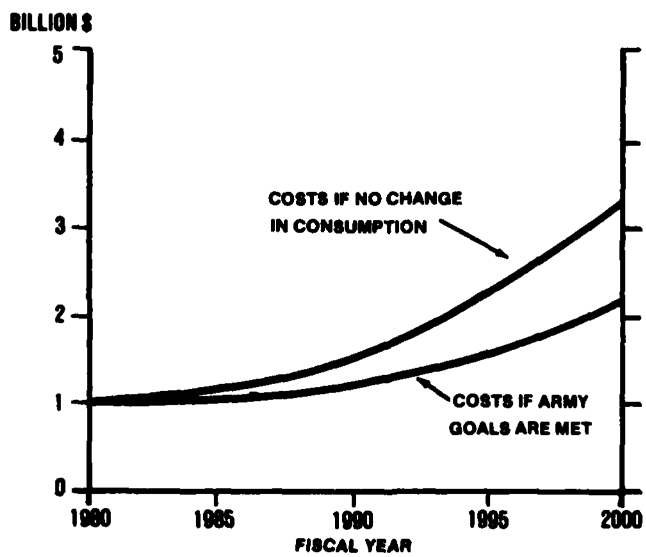


Table E-4. SCENARIO FOUR - ARTIFICIALLY CONSTRAINED ECONOMIC INFLATION

Year	Army Goals Met	FY 79 Level Consumption	Annual Cost Avoidance
1980	$ 997	$1017	$ 20.1
1981	1059	1103	43.6
1982	1121	1189	67.4
1983	1177	1272	94.6
1984	1230	1354	124.7
1985	1273	1429	156.1
1986	1321	1508	187.1
1987	1369	1591	221.7
1988	1418	1678	260.0
1989	1469	1770	301.3
1990	1520	1866	346.0
1991	1575	1970	395.2
1992	1631	2079	447.9
1993	1688	2193	505.1
1994	1746	2314	567.9
1995	1805	2441	636.3
1996	1865	2575	710.2
1997	1927	2717	790.0
1998	1989	2866	877.8
1999	2054	3024	970.1
2000	2135	3190	1054.8
Cumulative Summary *	$32368	$41146	$8778.1

* Project fuel costs by year ($ millions)



APPENDIX F

FEDERAL ENERGY LEGISLATION

PUBLIC LAW	APPROVED	DESCRIPTION
93-28	4/30/78	To extend and amend the Economic Stabilization Act of 1970 (Sec 2 (a) Authority to Allocate Petroleum Products).
93-153	11/16/73	To amend section 28 of the Mineral Leasing Act of 1920, and to authorize a trans-Alaska oil pipeline, and for other purposes.
93-159	11/27/73	Emergency Petroleum Allocation Act of 1973, to authorize and require the President of the United States to allocate crude oil, residual fuel oil, and refined petroleum products to deal with existing or imminent shortages and dislocations in the national distribution system which jeopardize the public health, safety, or welfare; to provide for the delegation of authority; and for other purposes.
93-182	12/15/73	Emergency Daylight Saving Time Energy Conservation Act of 1973, to provide for daylight saving time on a year-round basis for a 2-year trial period, and to require the Federal Communications Commission to permit certain daytime broadcast stations to operate before local sunrise.
93-236	1/2/74	To authorize and direct the maintenance of adequate and efficient rail services in the Midwest and Northeast regions of the United States, and for other purposes.
93-239	1/2/74	To conserve energy on the Nation's highways. (National speed limit 55 mph.)
93-249	2/8/74	To provide for advancing the effective date of the final order of the Interstate Commerce Commission in Docket No. MC 43 (Sub-No. 2). (Seeks to alleviate a serious and pressing transportation problem by requiring carriers to reimburse their owner-operators for all increases in the price of fuel over the base period May 15, 1973, etc.)
93-275	5/7/74	Federal Energy Administration Act of 1974, to reorganize and consolidate certain functions of the Federal Government in a new Federal Energy Administration in order to promote more efficient management of such functions.

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PUBLIC LAW	APPROVED	DESCRIPTION
93-316	6/22/74	To authorize appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities and research and program management, and for other purposes. Authorized space and nuclear research and technology, $79,700,000 of which $1,000,000 is designated for research on hydrogen production and utilization systems; also authorizes $1,000,000 for research on ground propulsion systems.
93-319	6/22/74	Energy Supply and Environmental Coordination Act of 1974, to provide for means of dealing with energy shortages by requiring reports with respect to energy resources, by providing for temporary suspension of certain air pollution requirements, by providing for coal conversion, and for other purposes.
93-322	6/30/74	Special Energy Research and Development Appropriations Act, 1975, making appropriations for energy research and development activities of certain departments, independent executive agencies, bureaus, offices, and commissions for the fiscal year ending June 30, 1975, and for other purposes.
93-383	8/22/74	Housing and Community Development Act of 1974, to establish a program of community development block grants, to amend and extend laws relating to housing and urban development, and for other purposes.
93-386	8/23/74	To clarify the authority of the Small Business Administration, to increase the authority of the Small Business Administration, and for other purposes.
93-403	8/30/74	To amend the Natural Gas Pipeline Safety Act of 1968, as amended, to authorize additional appropriations, and for other purposes.
93-404	8/31/74	Making appropriations for the Department of the Interior and related agencies for the fiscal year ending June 30, 1975, and for other purposes. (Has funds for energy and minerals.)
93-409	9/3/74	Solar Heating and Cooling Demonstration Act of 1974.
93-410	9/3/74	To further the conduct of research, development, and demonstrations in geothermal energy technologies, to establish a Geothermal Energy Coordination and Management Project to provide for the carrying out

PUBLIC LAW	APPROVED	DESCRIPTION
		of research and development in geothermal energy technology, to carry out a program of demonstrations in technologies for the utilization of geothermal resources, to establish a loan guarantee program for the financing of geothermal energy development, and for other purposes.
93-426	9/30/74	To amend the Defense Production Act of 1950 and to establish a National Commission on Supplies and Shortages Act of 1974.
93-434	10/5/74	To amend the Emergency Daylight Saving Time Energy Conservation Act of 1973 to exempt from its provisions the period from the last Sunday in October 1974 through the last Sunday in February 1975.
93-438	10/11/74	Energy Reorganization Act of 1974, to reorganize and consolidate certain functions of the Federal Government in a new Energy Research and Development Administration and in a new Nuclear Regulatory Commission in order to promote more efficient management of such functions.
93-479	10/26/74	To authorize the Secretary of Commerce and the Secretary of the Treasury to conduct a study of foreign direct and portfolio investment in the United States and for other purposes.
93-482	10/26/74	To amend the Tariff Schedules of the United States to provide for the duty-free entry of methanol imported for use as fuel, and for other purposes.
93-485	10/26/74	To amend the Atomic Energy Act of 1954 as amended, to enable Congress to concur in or disapprove international agreements for cooperation in regard to certain nuclear technology.
93-500	10/29/74	To amend and extend the Export Administration Act of 1969.
93-503	11/26/74	To amend the Urban Transportation Act of 1964 to provide increased assistance for mass transportation systems.
93-511	12/5/74	To extend the Emergency Petroleum Allocation Act of 1973 until August 31, 1975.
93-523	12/16/74	To amend the Public Health Service Act to assure that the public is provided with safe drinking water, and for other purposes. (Part C - Protection

PUBLIC LAW	APPROVED	DESCRIPTION
		of Underground Sources of Drinking Water refers to regulation (A) the underground injection of brine or other fluids which are brought to the surface in connection with oil or natural gas production (B) any underground injection for the secondary or tertiary recovery of oil or natural gas.)
93-577	12/3/74	Federal Nonnuclear Energy Research and Development Act of 1974, to establish a national program for energy research and development in nonnuclear energy sources.
93-627	1/3/75	Deepwater Port Act of 1974, to regulate commerce, promote efficiency in transportation, and protect the environment, by establishing procedures for the location, construction, and operation of deepwater ports off the coasts of the United States, and for other purposes.
93-643	1/4/75	To authorize appropriations for the construction of certain highways in accordance with title 23 of the United States Code, and for other purposes (contains uniform national speed limit).
93-646	1/4/75	To amend the Export-Import Bank Act of 1945, and for other purposes.
94-12	3/29/75	Tax Reduction Act of 1975, to amend the Internal Revenue Code of 1954 to provide for a refund of 1974 individual income taxes, to increase the low income allowance and the percentage standard deduction, to provide a credit for personal exemptions and a credit for certain earned income, to increase the investment credit, and the surtax exemption, to reduce percentage depletion for oil and gas, and for other purposes.
94-99	9/29/75	To extend the Emergency Petroleum Allocation Act of 1973. (Extends to November 15, 1975.)
94-133	11/14/75	To extend for 1 month until December 15, 1975, the Emergency Petroleum Allocation Act.
94-152	12/16/75	Extending for 2 years, through June 30, 1977, provisions of the Defense Production Act.
94-153	12/16/75	To amend the effective date of the Defense Production Act Amendments of 1975.

APPENDIX F (Cont)

PUBLIC LAW	APPROVED	DESCRIPTION
94-163	12/22/75	Providing standby emergency authority to assure that the essential energy needs of the United States are met.
94-165	12/23/75	Making Appropriations for the Department of the Interior (FEA Appropriations included.)
94-185	12/31/75	To extend, until June 30, 1976, the Renegotiation Act.
94-187	12/31/75	Authorizing funds for the Energy Research and Development Administration through September 30, 1976.
94-197	12/31/75	To revise the method of providing for public remuneration in the event of a nuclear incident.
94-220	2/27/76	Effectuates the provisions of the Defense Production Act Amendments of 1975 on November 30, 1975, except that the provisions relating to voluntary agreements shall take effect 120 days after enactment of the Act.
94-227	3/11/76	Authorizes the President to invite the States of the Union and foreign nations to participate in the International Petroleum Exposition to be held at Tulsa, Oklahoma, from May 16, 1976, through May 22, 1976.
94-258	4/5/76	National Reserves Production Act of 1976, authorizes the Secretary of the Interior to establish on certain public lands of the United States national petroleum reserves, the development of which need to be regulated in a manner consistent with the total energy needs of the Nation, and for other purposes.
94-269	4/16/76	ERDA authorization increased for FY 76 and transition period.
94-291	4/22/76	Nuclear Regulatory Commission Authorizations.
94-332	7/1/76	Extend Federal Energy Administration until July 30, 1976.
94-370	7/26/76	Amend Coastal Zone Management Act of 1972.
94-373	7/31/76	Department of the Interior and Related Agencies (FEA) Appropriations for FY 77.

APPENDIX F (Cont)

PUBLIC LAW	APPROVED	DESCRIPTION
94-377	Passed over Presidential veto 8/4/76	Amend Mineral Leasing Act of 1920.
94-385	8/14/76	Energy Conservation and Production Act (FEA Extension and other energy matters).
94-413	Passed over Presidential veto 9/17/76	Electric Vehicle Research, Development, and Demonstration Act of 1976, to authorize in ERDA a Federal program of research, development, and Demonstration to promote electric vehicle technology.
94-455	10/4/76	Tax Reform Act of 1976.
94-477	10/11/76	Amends the Natural Gas Pipeline Safety Act and authorizes appropriations for FY 77.
95-2	2/2/77	Emergency Natural Gas Act of 1977, to authorize the President to order emergency deliveries and transportation of natural gas to deal with existing or imminent shortages.
95-52	6/22/77	Export Administration Amendments of 1977, to amend the Export Administration Act of 1969 to extend its authorities and to provide for stricter controls over exports of nuclear material and technology.
95-58	6/29/77	National Sea Grant Program Act Authorization, FY 78.
95-63	7/5/77	National Advisory Committee on Oceans and Atmosphere Act of 1977.
95-70	7/21/77	Energy Supply and Environmental Coordination Extension Act of 1977, to extend FEA and coal conversion.
95-74	7/26/77	Interior FY 78 appropriation.
95-77	7/30/77	Extension of oil and gas leases to permit drilling on ultra-deep well in Wyoming.
95-83	8/1/77	Amends the Public Health Service Act to authorize appropriation for FY 78 for biomedical research and related programs.
95-87	3/10/77	Surface Mining Control and Reclamation Act of 1977, to regulate surface coal mining operations through a permit program administered by the Secretary of the

APPENDIX F (Cont)

PUBLIC LAW	APPROVED	DESCRIPTION
		Interior. Requires applicants to meet minimum environmental protection performance standards.
95-88	8/3/77	Provides for establishment of cooperative programs with developing countries in new energy technologies. Emphasis is on research and development and use of small decentralized, renewable energy resources for rural areas.
95-91	4/8/77	Department of Energy Reorganization Act, to establish a Department of Energy in the executive branch by the reorganization of functions within the Federal Government in order to secure effective management and to assure a coordinated national energy policy and for other purposes.
95-92	8/4/77	Cuts off funds for any country delivering or receiving nuclear enrichment equipment, materials or technology, unless all items are placed under multinational management when available.
95-93	8/5/77	As part of useful work experience for unemployed youths, this act includes assistance in energy conserving measures and in the weatherization of low-income family homes.
95-95	7/10/77	Clean-Air Act Amendments of 1977, to provide a simple 1-year extension of current auto standards.
95-96	8/7/77	Public Works Appropriations, FY 78.
95-110	9/20/77	Abolishes Joint Committee on Atomic Energy.
95-113	9/29/77	Promotes solar energy use on American farms. Authorizes agriculture research to conduct research into solar applications for farm needs.
95-124	10/7/77	Includes provisions for development and promulgation of specifications, building, standards, design criteria and construction practices to achieve appropriate earthquake resistance for new and existing structures with priority given to nuclear power plants.
95-143	10/26/77	Contains two non-proliferation provisions: (1) Any export/import bank loan involving nuclear power shall lay before Congress for 25 days before final approval. (2) Establishes system for Secretary of State to report undesirable, foreign nuclear actions

PUBLIC LAW	APPROVED	DESCRIPTION
		to the bank for consideration in approving future nuclear related financial transactions.
95-153	11/4/77	Marine Protection Research and Sanctuaries Act, Title II contains ocean dumping research and development (R&D) provisions.
95-155	11/8/77	Environmental Research, Development, and Demonstration Authorization Act of 1977; EPA FY 78 Authorization.
95-158	11/8/77	A resolution approving the Presidential decision on the Alaska natural gas transportation system.
95-159	11/8/77	Includes amendments to tariff schedules of the US to permit the duty-free importation of crude petroleum crude shale oil from Canada.
95-164	11/9/77	Amends Federal Mine Safety and Health Amendments Act to promote safety and health in the mining industry and to prevent recurring disasters in the mining industry.
95-183	11/15/77	Authorizes appropriations for FY 78 National Security programs operating expenses, including weapon activity, nuclear explosive application, special materials production, laser fusion, and program management and support.
95-190	11/16/77	Safe Drinking Water Act Amendments of 1977.
95-202	11/23/77	Directs the VA to conduct a study to determine the most effective methods of using VA loan and loan guarantee to aid and encourage veterans to install solar heating/cooling or hot water equipment or energy conservation equipment.
95-209	12/13/77	Nuclear Regulatory Commission FY 78 Authorization.
95-217	12/27/77	Water Pollution Control Act Amendments of 1977.
95-236	2/21/78	Increases funding for remedial action programs relating to uranium mill tailings removal in Grand Junction, Colorado.
95-238	2/25/78	Authorizes operating expenses for fossil energy, solar, geothermal, conservation R&D, environment and safety research, and nuclear development programs.

PUBLIC LAW	APPROVED	DESCRIPTION
95-240	3/7/78	Provides supplemental appropriations for Federal agencies, including FEA and ERDA for FY 78. Provisions include fundings for Clinch River Breeder Reactor, DOE relocation move and for the special crisis intervention program to provide assistance for low income to meet high fuel bills.
95-242	4/10/78	Declares it US policy to: seek stronger and more comprehensive commitments to anti-proliferation principles; strengthen International Atomic Energy Agency (IAEA); assure adequate nuclear fuel supply; include a safeguard guarantee for transfer of nuclear material.
95-253	4/27/78	Resolution proclaiming May 3, 1978 as Sun Day.
95-273	5/8/78	Ocean Pollution Research Program Act.
95-279	5/15/78	Contains provisions which give the Secretary of Agriculture several options to encourage the production of gasohol.
95-297	6/19/78	Prohibits specified unfair practices in the marketing of automotive gasoline. Directs the FTC to report to Congress on methods to promote competition in the marketing of gasoline and to prescribe rules for establishing and displaying octane ratings.
95-315	7/4/78	Creates a solar and renewable energy sources loan program within the Small Business Administration.
95-319	7/11/78	Amends the Consumer Product Safety Act to establish an interim consumer product safety rule relating to the standards for flame resistance and corrosiveness of certain insulation.
95-356	9/8/78	Directs the Secretary of Defense to encourage utilization of solar energy where practical and economically feasible. Requires that 25 percent of all new military facilities, except housing, include solar energy systems to the extent that such a system is cost effective. Requires that all new military family housing include solar energy systems, where such a system is cost effective.
95-372	9/18/78	Requires a 5-year leasing program; gives coastal states an increased role in Federal outer continental shelf decisions; establishes unlimited absolute liability for oil spill damage; provides for a two-step decision process to separate exploration from development and production; and authorizes new

APPENDIX F (Cont)

PUBLIC LAW	APPROVED	DESCRIPTION
		leasing systems and requires their use in an experimental basis.
95-426	10/6/78	Contains provisions directing the Secretary of State to demonstrate solar energy and other renewable energy technologies in Foreign Service buildings abroad.
95-434	10/10/78	Authorizes the Director of National Science Foundation: (1) To determine the need to provide support under this Act for a study of the feasibility of transmitting solar energy to Earth using orbital structures manufactured from lunar or asteroidal materials. (2) To determine the impact of such a study on Foundation activities. (3) If it is determined that a study is necessary, to conduct it directly or by means of grant or contract.
95-456	10/13/78	Prohibits rate discrimination amoung customers of the Southeastern Power Administration.
95-465	10/17/78	Department of Interior and related agencies appropriations for FY 79.
95-474	10/17/78	To amend the Ports and Waterways Safety Act of 1972; to increase the use of vessels of the US to carry imported oil; to establish standards for safe tanker transportation of oil.
95-476	10/18/78	Contains provisions adding the installation of solar heating and cooling and the application of a resitial energy conservation measure to the list of purposes for veterans' home improvement loan guarantees.
95-477	10/18/78	Authorizes appropriations for the Environmental Protection Agency for environmental research, development, and demonstration activities for FY 79.
95-482	10/18/78	FY 79 continuing appropriations; includes appropriations for Public Works, water and power development and energy research.
95-509	10/24/78	Authorization for National Security Programs.
95-533	10/27/78	Expresses the consent of Congress to an amendment of the constitution of New Mexico to provide a method for executing leases and other contracts for the

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PUBLIC LAW	APPROVED	DESCRIPTION
		development and operation of geothermal steam and waters on lands granted or confirmed to such state.
95-554	10/30/78	Authorizes the Secretary of Interior to acquire Federal coal leases or rights to Federal coal leases by purchase, exchange or condemnation upon finding that development of the lease would: (1) Result in unacceptable damage to other resource values. (2) Conflict with a previously unconsidered specific proposal for use of the land for public purposes.
95-577	11/2/78	Authorizes the Architect of the Capitol to install solar collectors for furnishing a portion of the energy needs of the Rayburn House Office Building annex no. 2.
95-590	11/4/78	Requires Secretary of Energy to develop research development and demonstration programs concerning the use of solar photovoltaic energy systems. Requires Secretary to formulate definitive performance criteria concerning solar photovoltaic systems. Establishes a solar energy data bank and a Solar Photovoltaic Energy Advisory Committee.
95-601	11/6/78	Authorizes appropriations to the Nuclear Regulatory Commission for FY 79 for nuclear reactor regulation, standards, development, inspection and enforcement, nuclear materials safety and safeguards, nuclear regulatory research, program technical support and program direction and administration.
95-604	11/8/78	Directs the Secretary of Energy to enter into agreements under which the Federal Government would pay up to 90 percent of the cleanup and storage costs of uranium mill tailings; provides for Federal ownership of uranium waste disposal site and gives the states the authority to concur in the type of clean-up activity and location of disposal sites for tailings.
95-617 through 95-620	11/9/78	This series of laws comprises the "National Energy Act" to establish a comprehensive national energy policy.
95-617		Public Utilities Regulatory Policy Act of 1978 provides for: rate design standards, consideration of rate design standards, retail policies for natural gas activities, cogeneration, wholesale provisions, aid to states and consumer representation, small hydro-electric facilities, expediting

PUBLIC LAW	APPROVED	DESCRIPTION
		legislation for crude oil transportation systems, and other significant miscellaneous provisions.
95-618		Energy Tax Act of 1978 provides for: residential insulation and conservation tax credits, residential solar tax credits, exemption of gasohol from excise tax, gas guzzler tax, geothermal energy and geopressured natural gas tax provisions, minimum tax exclusions for intangible drilling costs, business energy tax credits, denial of tax benefits for new oil and gas fired boilers.
95-619		National Energy Conservation Policy Act of 1978 provides for: utility conservation program for residences, weatherization grants for low income families, solar energy loan program, energy conservation loan program, grant programs for school and hospitals, energy audits for public building appliance efficiency standards, civil penalties relating to automobile fuel efficiency, and other significant miscellaneous provisions.
95-620		The Power Plant and Industrial Fuel Use Act of 1978 provides for: prohibition of new large oil and gas fired boilers, restrictions on existing large coal boilers, restrictions on users of natural gas for boiler fuel, pollution control loan program, and other significant miscellaneous provisions.
95-621		The Natural Gas Policy Act of 1978 provides for: price controls, deregulation of certain gas, incremental pricing, emergency authority and curtailment priorities.

APPENDIX G

BIBLIOGRAPHY

Army Regulations

AR 10-5, "Organization and Functions, Department of the Army," 1 November 1978.

AR 11-27, "Army Energy Program," 20 July 1976.

AR 20-3, "Inspections and Investigations: Department of the Army Special Subjects for Inspection," 8 November 1977.

AR 200-10, "Army Environmental Program," 28 December 1976.

AR 210-4, "Installations: Carpooling and Parking Controls," 16 November 1977.

AR 420-10, "Facilities Engineering: General Provisions, Organizations, Functions, and Personnel," 20 December 1977.

AR 420-49, "Facilities Engineering: Heating Energy Selection and Fuel Storage, Distribution, and Dispensing Systems," 18 November 1976.

AR 703-1, "Coal and Petroleum Products Management: Coal and Petroleum Products Supply and Management Activities," 15 September 1978.

Miscellaneous Publications.

"A National Plan for Energy Research, Development, and Demonstration: Creating Energy Choices for the Future," ERDA, Government Printing Office, 1976.

"A Time to Choose: America's Energy and the Future," Ford Foundation, Ballinger Publishing, 1974.

"Analysis of the Proposed National Energy Plan," Office of Technological Assessment, Congress of the United States, US Government Printing Office, August 1977.

"Army Installation Energy Requirements in CONUS," Engineers Study Group, Office, Chief of Engineers, January 1975.

"Army Installation Sampling and Projections," Engineer Study Group, Office, Chief of Engineers, January 1975.

"Building Heating Energy Consumption at Fixed Facilities," US Army Facilities Engineering Support Agency, Fort Belvoir, Virginia, 20 June 1977.

"Buildings and Community Systems Program Approval Document," Energy Research and Development Administration, 30 September 1976.

"Characterization of Energy Usage on Military Installations," Hollis, Harold D. and Nida, Anthony V., US Army Facilities Engineering Support Agency, Fort Belvoir, Virginia, 22 October 1974.

"Combat and Logistics Elements, 1980 Division," Army Logistician, Fort Lee, Virginia, November/December 1977.

"Compilation of US Army Engineer Solar Energy Construction Projects," 12 September 1977.

"Defense Energy Initiatives Plan" (Draft), Office of the Secretary of Defense, 12 October 1976.

"Energy," Business Communications Company, Inc., Stamford, Connecticut, Spring/Summer 1976.

"Energy," The Futurist, Volume VIII, No. 1, pp. 4-27, World Future Society, Washington, DC, February 1974.

"Energy and the Future," Hammond, A. L., Metz, W. D., and Maugh, T. H., Washington: AAAS, 1973.

"Energy Audit Procedures," Energy Research and Development Administration, 1976.

"Energy Conservation at Government Field Installations," LCD-76-229, General Accounting Office, 19 August 1976.

"Energy Conservation at Government Field Installations - Progress and Problems," Comptroller General of the United States, 19 August 1976.

"Energy Conservation Guidelines for the Operation of Controlled Humidity Warehouses," Department of the Army Pamphlet No. 205-1, US Army AG Publications Center, Baltimore, Maryland, September 1976.

"Energy Fact Book," Tetra Tech, Inc., for the Director, Fleet Analysis and Support Division, Office of Naval Research, May 1979.

"Energy in Focus, Basic Data," Federal Energy Administration, Washington, DC, May 1977.

"Energy in Peoples Lives," (Draft), Newman, Dorothy K. and Wachtel, Dawn Day, 18 April 1975.

"Energy Information Digest-Book Data on Energy Resources, Reserves, Production, Consumption, and Prices," 95th Congress, US Government Printing Office, July 1977.

"Energy Interrelationships," Handbook, Federal Energy Administration, June 1977.

"Energy Legislative Summary," 94th Congress, 15 October 1976.

"Energy Legislative Summary," 95th Congress, 10 August 1977.

"Energy Management in Health Care Institutions," US Government Printing Office, 1975.

"Energy Section of the Systems Acquisition Strategy Study," Headquarters, Air Force Systems Command, Andrews Air Force Base, Maryland, 21 April 1977.

"Federal Energy Administration Annual Report, 1975/1976," Washington, DC, US Government Printing Office.

"Identifying Retrofit Projects for Buildings," Federal Energy Administration, Washington, DC, Government Printing Office, September 1976.

"Implementing Coal Utilization Provisions of Energy Supply and Environmental Coordination Act," Federal Energy Administration, April 1976.

"Long Range Program Report," Facilities Engineering Support Agency, Fort Belvoir, Virginia, 15 January 1975.

"Management of Defense Energy Resources," Report of the Defense Energy Task Group, Office of Assistant Secretary of Defense (I&L), Washington, DC, 15 November 1973.

"Management of Defense Energy Resources, Phase II Report," Defense Energy Task Group, Office of Assistant Secretary of Defense (I&L), Washington, DC, 22 July 1974.

"Military Applications of Photovoltaic Systems," US Army Mobility Equipment Research and Development Command.

"Petroleum/2000," Oil and Gas Journal, Tulsa, Oklahoma, August 1977.

"Possible Programs, Studies, etc., to Achieve Objectives (Mobility Operations)," US Army Mobility Equipment Research and Development Command, 10 November 1977.

"Progress in the Harvard Business School Energy Project," Staubaugh, Robert B., Jr., Harvard Business School Bulletin, Boston, Massachusetts, March/April 1977.

"Short Range Program Report," Corps of Engineers, Fixed Facility Energy System, RDT&E Program, Facilities Engineering Support Agency, Fort Belvoir, Virginia, 24 July 1977.

"Status Report (NATO) Rational Use of Energy Program," Energy Research and Development Administration, National Technical Information Service, Springfield, Virginia, June 1976.

"Summary of Conference Findings for ERDA Conference on Technical Opportunities for Energy Conservation in Buildings Through Improved Controls," Arthur D. Little, Inc., Cambridge, Massachusetts.

"Technical Assistance Program Resources Guide/Energy Extension Service," Energy Research and Development Administration, May 1977.

"The Impact of Energy and Other Trends on Defense Transportation to the Year 2000," Military Traffic Management Command, Washington, DC, June 1977.

"The National Energy Plan," Executive Office of the President, Washington, DC, US Government Printing Office, 29 April 1977.

"The National Energy Outlook," Shell Oil Company, March 1973.

"Total Army Goals," Memorandum, Headquarters, Department of the Army, Washington, DC, 21 September 1977.

"United States Energy Through the Year 2000," Bureau of Mines, Department of the Interior, December 1975.

"Vehicular Energy Conservation Program," Douglas Aircraft Company, Long Beach, California, March 1975.

"The National Energy Plan II," US Department of Energy, Washington, DC, Government Printing Office, May 1979.

"The National Energy Act," US Department of Energy, Washington, DC, Office of Public Affairs, November 1978.

"Summary of Major Energy Legislation of the 95th Congress," Department of Energy, Washington, DC, Legislative Research and Analysis Division, Office of Congressional Affairs, December 1978.

"Annual Report to Congress 1978, Volume Three, Forecasts, US Department of Energy, Washington, DC, Energy Information Administration, 1979.

"Annual Report to Congress 1978, Volume Three, Supplement One, Mid-term Energy Projections for the United States," Energy Information Administration, 9 July 1979.

"Annual Report to Congress 1978, Volume Three, Supplement Two, Mid-term Energy Projections for the World," Energy Information Administration, 9 July 1979.

"International Energy Statistical Review," Central Intelligence Agency, Washington, DC., National Foreign Assessment Center, 2 May 1979.

"Energy Supply and Demand in the Mid-term: 1985, 1990, and 1995," US Department of Energy, Washington, DC, Energy Information Administration, April 1979.

GLOSSARY

AAP	Army Ammunition Plant
AEO	Army Energy Office
AERDP	Army Energy Research and Development Program
AGE	Advisory Group on Energy
API	American Petroleum Institute
AR	Army Regulation
ARNG	Army National Guard
ASA(IL&FM)	Assistant Secretary of the Army (Installation, Logistics, and Financial Management)
ASD(MRA&L)	Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics)
ATS	Annual Training Site
AVRADCOM	United States Army Aviation Research and Development Command
Btu	British Thermal Unit
CERL	Construction Engineering Research Laboratory
CIA	Central Intelligence Agency
CNGB	Chief, National Guard Bureau
COE	Chief of Engineers
CONUS	Continental United States
CPA	Chief of Public Affairs
CRF	Combat Readiness Flying
CSR	Chief of Staff Regulation
DA	Department of the Army
DARCOM	United States Army Materiel Development and Readiness Command
DASD(EE&S)	Deputy Assistant Secretary of Defense (Energy, Environment, and Safety)

DCSLOG	Deputy Chief of Staff for Logistics
DCSOPS	Deputy Chief of Staff for Operations and Plans
DCSPER	Deputy Chief of Staff for Personnel
DCSRDA	Deputy Chief of Staff for Research, Development, and Acquisition
DEIS	Defense Energy Information System
DLA	Defense Logistics Agency
DOD	Department of Defense
DOE	Department of Energy
ECIP	Energy Conservation Investment Program
ECRAS	Energy Consumption, Reporting and Analysis System
ECS	Equipment Concentration Site
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
FEA	Federal Energy Administration
FHMA	Family Housing Management Account
FORSCOM	United States Army Forces Command
FY	Fiscal Year
GNP	Gross National Product
GSA	General Services Administration
HHG	Household Goods
HQAFSC	Headquarters, Air Force Systems Command
HQDA	Headquarters, Department of the Army
HTGR	High-Temperature Gas Cooled Reactor
ILS	Integrated Logistic Support
IPR	In-process Review
kW	Kilowatt

LMFBR	Liquid Metal Fast Breeder Reactor
LPG	Liquified Petroleum Gas
MACOM	Major Command
MBtu	Million British Thermal Units
MCA	Military Construction, Army
MCAR	Military Construction, Army Reserves
MCARNG	Military Construction, Army National Guard
MERADCOM	United States Army Mobility Equipment Research and Development Command
MILCON	Military Construction
MMT	Manufacturing Methods and Technology
MTT	Manufacturing Testing Technology
NAE	National Academy of Engineers
NARADCOM	United States Army Natick Research and Development Command
NAS	National Academy of Sciences
NGB	National Guard Bureau
OACSI	Office, Assistant Chief of Staff for Intelligence
OAPEC	Organization of Arab Petroleum Exporting Countries
OASA(IL&FM)	Office, Assistant Secretary of the Army (Installations, Logistics, and Financial Management)
OASD(MRA&L)	Office, Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics)
OCA	Office, Comptroller of the Army
OCE	Office, Chief of Engineers
OCAR	Office, Chief Army Reserve
OCPA	Office, Chief of Public Affairs
OCNGB	Office, Chief National Guard Bureau
ODCSLOG	Office, Deputy Chief of Staff for Logistics

ODCSOPS	Office, Deputy Chief of Staff for Personnel
ODCSRDA	Office, Deputy Chief of Staff for Research, Development, and Acquisition
OJCS	Organization of the Joint Chiefs of Staff
OMA	Operation and Maintenance, Army
OPEC	Organization of Petroleum Exporting Countries
OSD	Office of the Secretary of Defense
OTSG	Office of The Surgeon General
PAED	Directorate of Program, Analysis, and Evaluation, Office of the Chief of Staff
PDM	Program Decision Memorandum
POC	Point of Contact
POL	Petroleum, Oil and Lubricants
POM	Program Objectives Memorandum
QRIP	Quick Return on Investment Program
R&D	Research and Development
RDF	Refuse-Derived Fuel
RDTE	Research, Development, Test and Evaluation
SAG	Study Advisory Group
SFTS	Synthetic Flight Training System
SGFP	United States Army Health Facility Planning Agency
SPR	Strategic Petroleum Reserve
STOG	Science and Technology Objectives Guide
TARADCOM	United States Army Tank-Automotive Research and Development Command
TECOM	United States Army Test and Evaluation Command
TRADOC	United States Army Training and Doctrine Command
TSG	The Surgeon General

UFR	Unfunded Requirements
UH	Utility Helicopter
USALEA	United States Army Logistics Evaluation Agency
USAEIGHT	Eighth United States Army
USAR	United States Army Reserve
USAREUR	United States Army, Europe
USGS	United States Geological Survey

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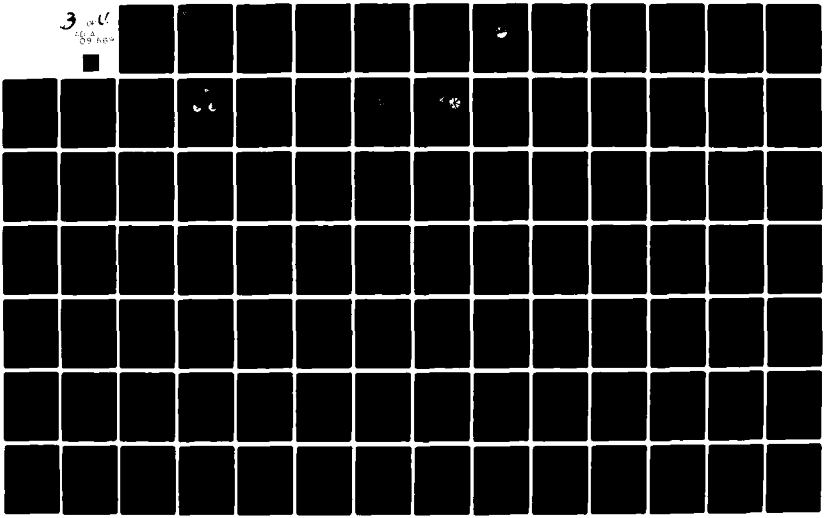

SUPPLEMENTARY

INFORMATION

AD-A109569

DEPARTMENT OF THE ARMY
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR LOGISTICS
WASHINGTON, D.C. 20310

DALO-TSE

09 DEC 1981

SUBJECT: Update of the Army Energy Plan

SEE DISTRIBUTION

1. Attached is an update of the 8 August 1980 Army Energy Plan. The update gives the latest energy figures available and updates the description of all the current Army energy programs.

2. The update was made to allow for page for page substitution. Distribution is being made in the same number of copies as the basic plan. If additional copies of the update or copies of the basic plan are needed, please contact:

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3. Addressees who are energy coordinators should insure their commander's and the Facilities and Mobility energy coordinators' plans are updated. The update will allow visibility with your commander for both your plan and your energy effort.

FOR THE DEPUTY CHIEF OF STAFF FOR LOGISTICS:

Charles E. St. Arnaud

1 Incl

CHARLES E. St. ARNAUD
Colonel, GS
Chief, Army Energy Office
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Energy and Troop Support

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Changes in "Army Energy Plan," August 1981

REMOVE the following pages from the existing plan:

1-3, 1-4, 1-5, 1-6, 1-11, 1-12, 1-13, 1-14, 3-1, 3-2, 3-3, 3-4, 3-17, 3-18, 3-19,3-20;

replace with new pages furnished with this notice.

REMOVE all of Chapter 4, all of Appendix A, all of Appendix B, all of Appendix C, and all of Appendix D; replace with material furnished with this notice.

Chapter 4	-	57 pages
Appendix A	-	7 pages
Appendix B	-	9 pages
Appendix C	-	15 pages
Appendix D	-	3 pages

INSERT this page inside front cover upon completion of the change.

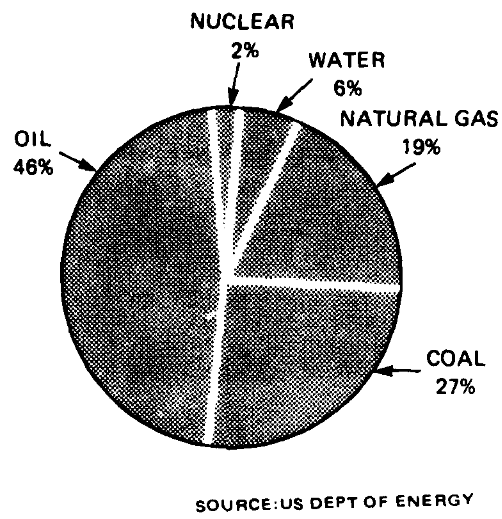


Figure 1-2. WORLD ENERGY CONSUMPTION

$1.80 per barrel on January 1, 1970, to almost $40.00 per barrel on December 31, 1980. This constitutes an exhorbitant 2000-percent rise in price. The problems of energy supply interruptions have not abated in the U.S. since then. Domestic coal production came to a standstill during the 1976 coal miners' strike. The Iranian revolution in the winter of 1978-79, and the Iraqi-Iranian War of 1980-81 slowed these nations' oil exports, creating yet another shortfall in the world oil supply. Supply interruptions, inadequate allocation of crude oil, and shortages of products based on crude oil have become the rule, rather than the exception.

1.1.3 The Global Energy Predicament. While the crisis of 1973 was politically motivated, the real issue with respect to the world's energy situation lies in the fact that the principal oil consumers are not the major oil producers.

Geographical distribution of proved and probable crude oil reserves, estimated by the U.S. Department of Energy, places 64 percent of the world's oil in the Middle East and Africa. The combined reserves of the entire Western Hemisphere, along with Western Europe, make up only 19 percent of the world's total reserves.

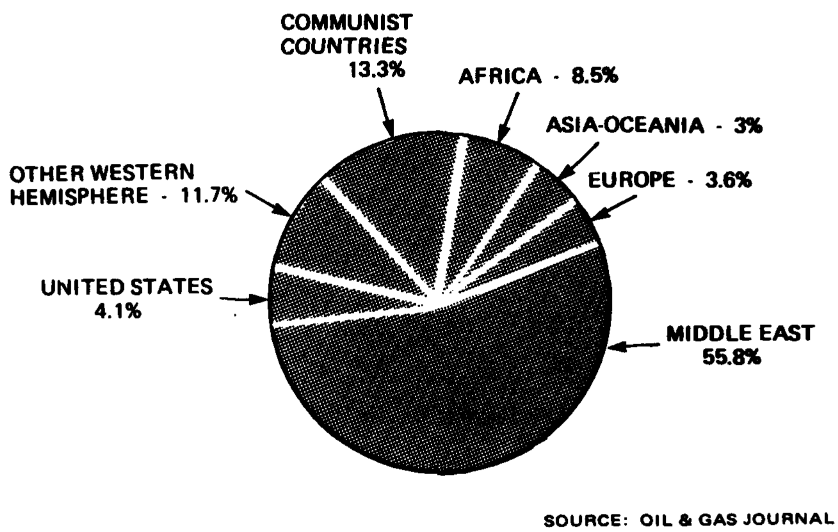


Figure 1-3. DISTRIBUTION OF ESTIMATED, PROVED, AND PROBABLE WORLD PETROLEUM RESERVES

The U.S. has a mere 4 percent of the total (figure 1-3). The long-term energy predicament is that oil reserves are nonrenewable. Crude-oil-based fuels will cease to be economically available in the future. Thus, alternative forms of energy will soon become a necessity. This fact of impending exhaustion is also true for natural gas and in the longer term, coal.

1.1.4 World Oil Depletion. The oil depletion date is the time when the available resources are below the amount necessary to maintain existing world consumption patterns. This constitutes a shortfall in supply. The exhaustion date is when the world has consumed the total of present and ultimately discovered, recoverable oil reserves. As oil reserves are depleted, production can be expected to decline. Theoretical exhaustion dates have been projected based on the length of time that varying levels of production and consumption rates could continue until oil supplies have been totally exhausted. The various estimates of future consumption and the remaining reserves available are no more than informed opinions. New extraction techniques, changing oil prices, conservation measures, and national growth and consumption rates are among the many parameters which, when varied, provide differing theoretical exhaustion dates. Estimates of proven reserves vary for similar reasons. Consequently, a broad range of estimates of both proven and theoretical reserves have been examined.

Four alternative oil consumption growth rates have been used to determine possible exhaustion dates (figure 1-4). The shaded area represents the Energy Research and Development Agency's (ERDA)[1] 1976 estimated spread of total oil resources available. The ERDA upper limit represents the greatest amount of oil resources that are estimated to exist. The ERDA lower limit represents the least

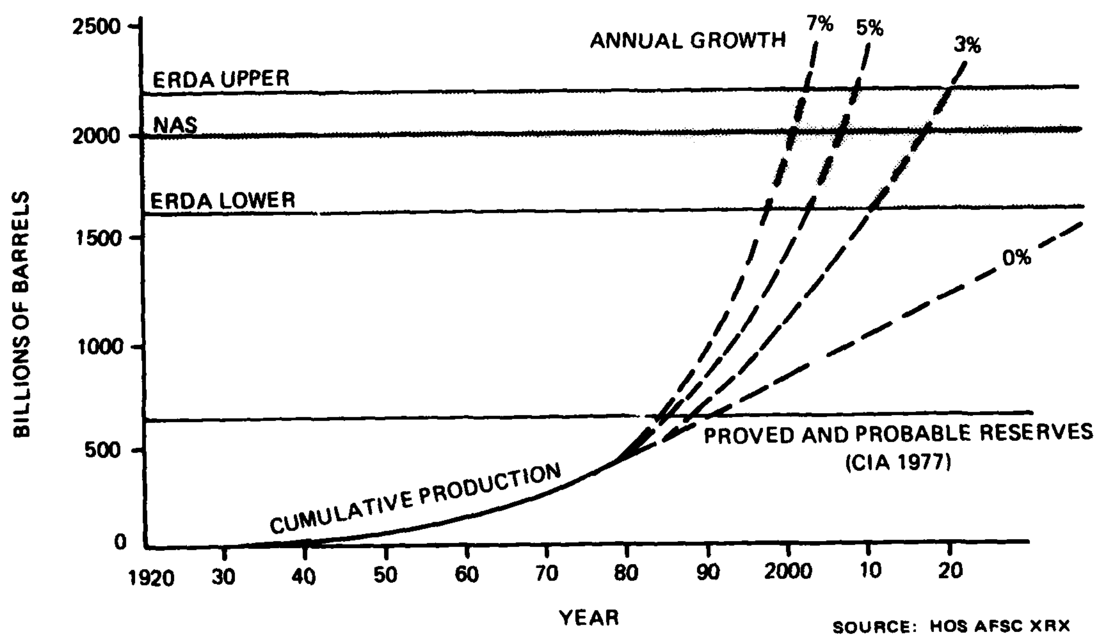


Figure 1-4. USE OF WORLD PETROLEUM RESOURCES

[1]ERDA became part of the Department of Energy (DOE) in 1977.

amount of petroleum reserves considered to exist. The dark line within the shaded band represents the 1975 estimate of the National Academy of Sciences.

It is significant to note that the exhaustion dates are relatively insensitive to reduced growth rates. The difference between exhausting the shaded upper and lower bounds of the ERDA predicted exhaustion rate vary by about 5 tc 10 years, depending upon the growth rate assumed. Reducing the historical growth (6.7 percent) to 5 percent would delay exhaustion by about 5 to 6 years, with exhaustion occurring between the years 2000 and 2010. Using a 3 percent growth rate, exhaustion would occur no later than 2020. By these extrapolations even if zero growth in consumption could be achieved, worldwide supplies would be totally exhausted by the middle of the next century.

Both the ERDA and the CIA estimates of proven reserves indicate that about half of the total resources have already been found. If, however, no new oil were discovered, these reserves could be exhausted from as early as the mid-1980s to the early 1990s. The unlikelihood of this occurring, however, is demonstrated by the available projections of world production (figure 1-5). Current world production is approximately 22 billion barrels per year, and it is expected to peak at about 40 billion barrels per year (paragraph 1.2.3) in the 1990s. Thereafter, as total predicted reserves are depleted, production is expected to decrease.

1.1.5 Alternative Sources of Oil. Oil shale and bituminous tar sands both contain considerable amounts of recoverable oil. In 1979, the world total oil recoverable from oil shale was estimated by the Institute of Gas Technology (IGT) to be 1.9 trillion barrels. Of this total, it is estimated that 54 percent can be found in the US, 81 percent in the Western Hemisphere, with Western Europe having much of the remainder at 9 percent. Estimated oil deposits in oil shale

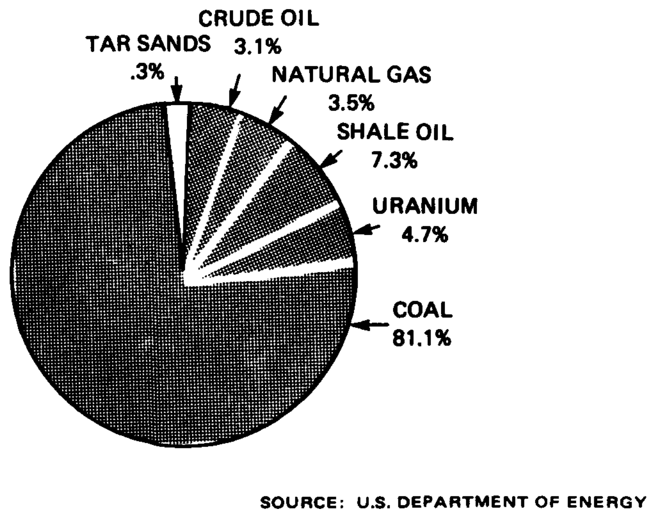


Figure 1-8. DISTRIBUTION OF RECOVERABLE NONRENEWABLE RESOURCES BY TYPE

in 1970. During this period, America's gross national product rose 102 percent and energy consumption virtually doubled. Because oil and gas were cheap and abundant, little concern was given to energy conservation. In fact, higher energy consumption was, in many cases, stimulated by Government regulations. Our current American way of life has been shaped in large part by our increased energy consumption.

With less than 6 percent of the world's population, the U.S. consumes more than 30 percent of the world's energy. The U.S. uses more energy per dollar of the gross national product than any other industrialized nation, more than doubling the consumption per capita of most western European nations.

1.2.2 CY 80 Energy Consumption Patterns and Trends. In 1980, U.S. energy consumption by end-use sector (industry, residential, and transportation) (figure 1-9) indicated that oil was used heavily by all three sectors, but almost

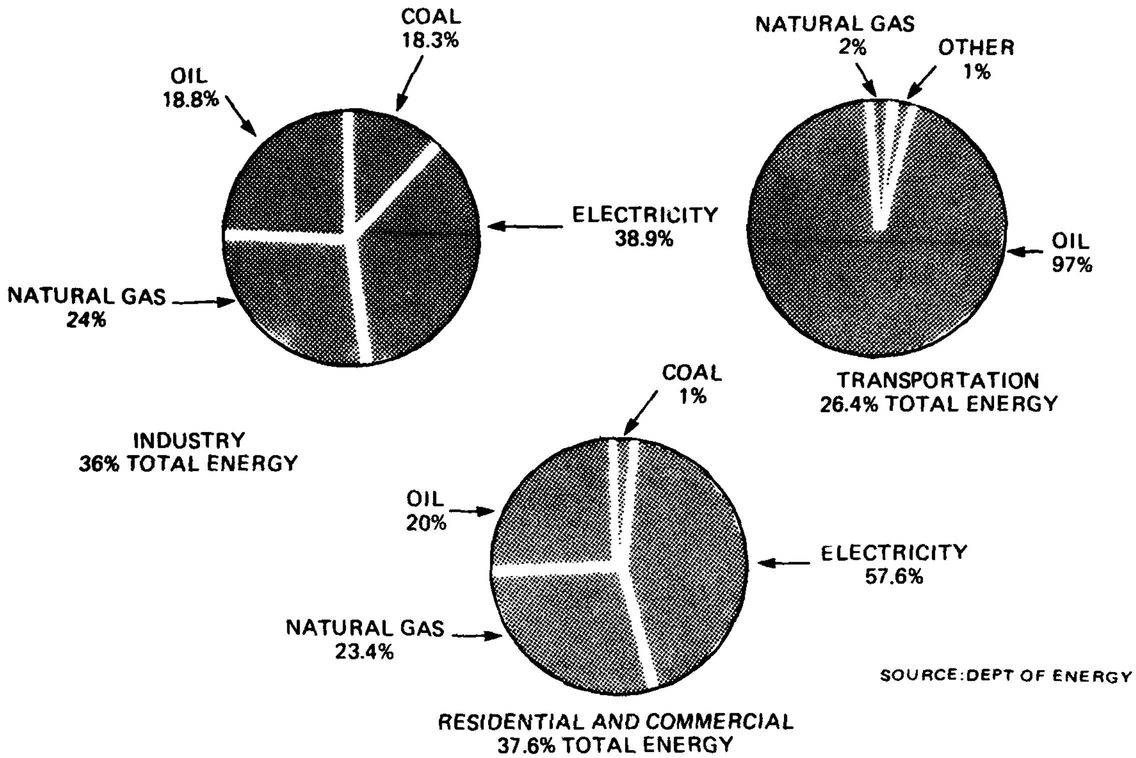


Figure 1-9. U.S. ENERGY CONSUMPTION BY SECTOR, CY 1980

half of the total liquid petroleum was used in transportation. This is true because no economically feasible substitute fuel was available for the internal combustion engine. Coal is used principally by electric utilities and industry. Natural gas is a preferred fuel for residential and commercial use because it is a clean and efficient fuel for heating. Nuclear energy is used in generating electricity.

The consumption of electricity accounted for 32.2 percent of total domestic energy consumed in 1980. Oil and natural gas accounted for 10.8 percent and 15.1 percent, respectively, of total energy used in generating electricity. The percent of electricity generated by coal increased 3.0 percent from the 1979 level to the 1980 level of 50.8 percent. The remainder of the generating sources were nuclear energy, 11.0 percent; hydroelectric power, 12.1 percent; and other sources, about 0.24 percent.

It is important to note that conversion of energy from any fuel to generate electrical energy is a relatively inefficient process. Energy is lost each time a conversion takes place. Edison Electric Institute estimates that about 70 percent of the energy contained in fossil fuel used to generate electricity is lost in a chain of conversion and transmission processes before the end use of the electrical energy occurs. As the electricity is converted by the end user to heating a resistor or powering a motor, energy provided by the original source is further reduced. Thus, significant energy efficiency improvement opportunities exist in the generation, transmission, and utilization of electricity regardless of the source energy.

Oil consumption grew at an average annual rate of 4.4 percent from 1947 to 1973. The Arab oil embargo forced the price of oil to triple in 1 year and also precipitated an immediate drop in consumption. Domestic demand for refined petroleum products dropped by 1 million barrels per day between 1973 and 1975. In 1976, however, the trend turned upward and oil consumption grew by 6.7 percent. Natural gas consumption decreased from its peak in 1971 through 1980 although the rate of decrease has slowed.

Coal consumption has decreased steadily from 1950, when coal constituted 38 percent of total energy consumed, until 1973, when the trend reversed because of its comparative price, despite increased restrictions on extraction methods and processes, and more stringent environmental standards. In 1980, coal consumption constituted 20.6 percent of total energy consumed, as shown in table 1-1.

Table 1-1. DOMESTIC ENERGY CONSUMPTION BY TYPE OF FUEL

YEAR	TOTAL (QUADS)	PERCENT OF TOTAL					
		PETROLEUM[1]	COAL	NATURAL GAS[2]	HYDRO-ELECTRIC POWER	NUCLEAR POWER	OTHER[3]
1950	34.0	39.7	38.0	18.1	4.2	—	—
1955	39.7	44.1	29.1	23.2	3.5	—	—
1960	44.6	45.0	22.8	28.5	3.7	—	—
1961	45.3	45.2	21.9	29.2	3.7	—	—
1962	47.4	44.8	21.5	29.8	3.9	—	—
1963	49.3	44.5	21.7	30.1	3.6	0.1	—
1964	51.2	43.7	22.0	30.5	3.7	0.1	—
1965	53.3	43.6	22.3	30.2	3.8	0.1	—
1966	56.4	43.2	22.2	30.8	3.7	0.1	—
1967	58.3	43.5	21.1	31.3	4.0	0.1	—
1968	61.8	43.8	20.5	31.7	3.8	0.2	—
1969	65.0	43.7	19.6	32.4	4.1	0.2	—
1970	67.1	44.0	18.9	32.8	4.0	0.3	—
1971	68.7	44.5	17.5	33.2	4.2	0.6	—
1972	71.9	45.8	17.3	32.0	4.1	0.8	—
1973	74.7	46.6	17.8	30.4	4.0	1.2	—
1974	73.0	45.8	17.9	30.2	4.5	1.6	—
1975	70.6	46.4	18.2	28.2	4.6	2.6	—
1976	74.2	47.3	18.4	27.4	4.1	2.8	—
1977	76.5	48.6	18.4	26.1	3.3	3.5	0.1
1978	78.6	48.6	18.0	25.3	4.0	3.8	0.3

[1]INCLUDES NATURAL GAS LIQUIDS
[2]DRY NATURAL GAS
[3]INCLUDES COKE IMPORTS, GEOTHERMAL, ETC.

SOURCE: [illegible]
[illegible] ADMINISTRATION 1976
US DEPT OF ENERGY 1977 1978

NOTE: THOSE NOT LISTED CONSTITUTE LESS THAN ONE-TENTH OF ONE PERCENT.

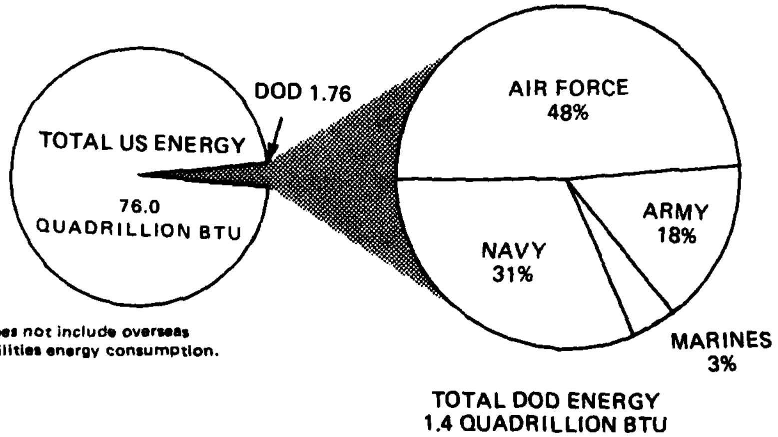
1.2.3 Oil Resources, Reserves, and Depletion. Increased consumption and lower domestic production of oil has led the US to increased dependence on the world oil market. This increases the vulnerability of the US to an interruption of import supplies critical to our energy requirements. In 1978, total imports averaged 8.1 million barrels of oil per day. This was 45 percent of US's consumption. By December 1979, oil imports had increased to 8.3 million barrels

CHAPTER 3

THE ARMY ENERGY SITUATION

3.1 BACKGROUND. To address the Army energy situation, it is necessary to place it in perspective with the DOD energy environment as well as that of the Nation. DOD accounts for approximately 1.76 percent of the total national energy consumption (figure 3-1), and 82 percent of the total Federal Government energy consumption.

SOURCE: ARMY ENERGY OFFICE



*Does not include overseas facilities energy consumption.

Figure 3-1. *DISTRIBUTION OF DEFENSE ENERGY, FY 80*

While the overall DOD energy consumption is approximately 1.76 percent of the total U.S. consumption, the percentage for petroleum consumption is approximately 2.5 percent. In terms of daily consumption, DOD consumes approximately 677,000 barrels of oil equivalent (BOE). Liquid petroleum requirements are 67.3 percent of that amount or nearly 1/2 million barrels of oil per day, thereby underscoring the importance of petroleum to DOD operations. War, or the imminent threat of war, could cause these requirements to be doubled or tripled. The crucial importance of petroleum to DOD operations, coupled with the fact that at present approximately one-half of the U.S. consumption is imported, make a reliable supply of petroleum of prime concern to DOD. Of the 1.4 quadrillion Btu's of energy consumed by DOD in FY 80, the Army consumed about 18 percent, the Marine Corps 3 percent, the Navy 31 percent, and the Air Force 48 percent, as shown in figure 3-1.

Of the Army's annual usage of energy, 84 percent is consumed in facilities operations and 16 percent in mobility operations (figure 3-2). Facilities operations consumption is that energy utilized to heat, cool, ventilate, and light buildings and provides for building process loads as well as that energy consumed in industrial operations. Mobility operations include the energy used to move the Army and to conduct its operations and training in the field. Relative to the Army, the Navy and Air Force consume a proportionally greater share of their total consumption in their mobility operations, 63 and 72 percent respectively, as shown in figure 3-2.

3.1.1 DOD Goals, Objectives, and Strategies. In support of national objectives, DOD established a goal in FY 74 to reduce energy consumption by 7 percent over FY 73. In FY 75, the goal was set at 15 percent savings using the FY 73 consumption level as the base figure. The goals for FY 76 through FY 80 were established at zero growth as compared with FY 75. The DOD goals have been exceeded by a comfortable margin in each instance as shown below:

FY	Savings Goal	Savings Achieved
74	7% (base FY 73)	25%
75	15% (base FY 73)	26%
76	0 (base FY 75)	7%
77	0 (base FY 75)	3%
78	0 (base FY 75)	9%
79	0 (base FY 75)	10%
80	0 (base FY 75)	4.2%

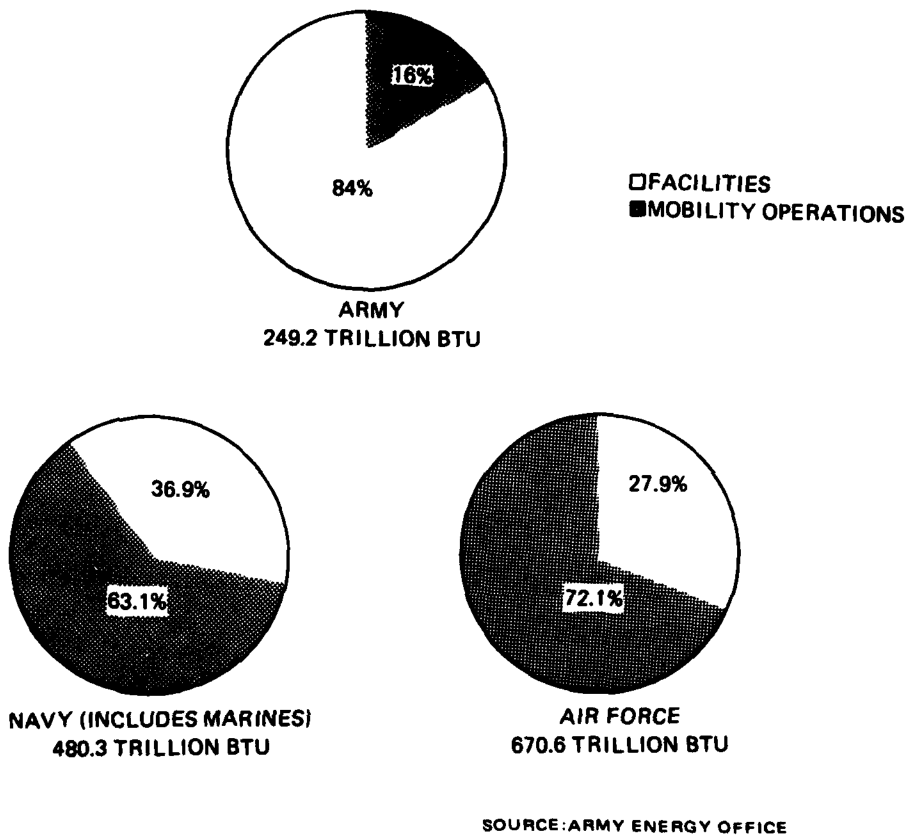


Figure 3-2. DISTRIBUTION OF ENERGY WITHIN SERVICES, FY 80

The Department of Defense Energy Management Plan (DEMP), dated 1 March 1981, presents an overview of the DOD energy management program. The DEMP is designed to: (1) achieve national energy goals and objectives, which the Congress and the President have mandated, as well as greater self-sufficiency; (2) reduce energy costs; and (3) ensure the operational readiness of the strategic and tactical forces. The program covers three distinct but interrelated areas:

a. Supply of energy required to support mobility operations and installations.

b. Energy conservation to reduce energy consumption in mobility fuels and utility energy sources that support installations.

c. Energy technology applications to better utilize more plentiful energy resources and to demonstrate the feasibility of new energy technologies.

3.1.2 DOD Energy Organization. After the 1973 Arab oil embargo, a Directorate for Energy was established in DOD under the Assistant Secretary of Defense for Installations and Logistics. On 15 August 1977, the energy management function and the Directorate for Energy were placed under the Office of the Deputy Assistant Secretary of Defense for Environment and Safety. At the same time, that office was redesignated the Office of Deputy Assistant Secretary of Defense for Energy, Environment, and Safety (ODASD(EE&S)) and the Directorate for Energy became the Directorate for Energy Policy (figure 3-3).

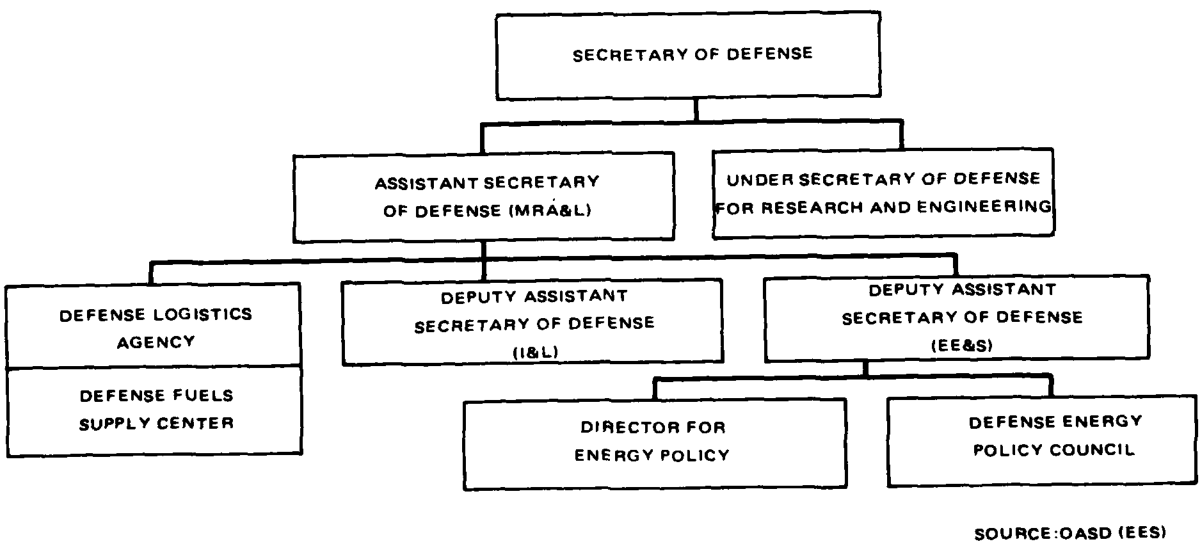


Figure 3-3. DEPARTMENT OF DEFENSE ORGANIZATION FOR ENERGY MANAGEMENT

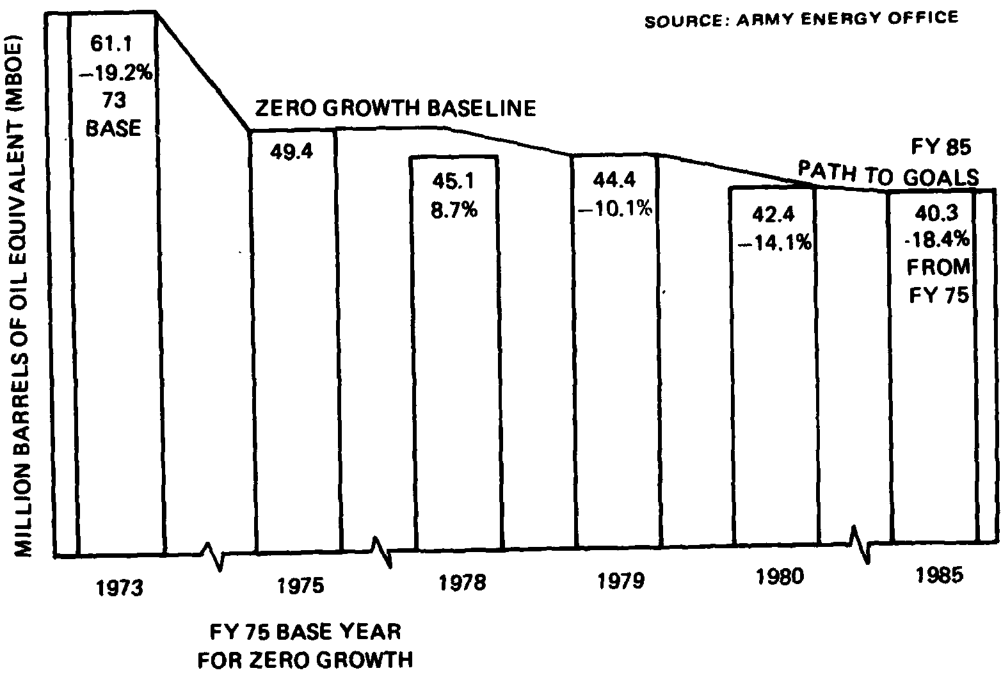


Figure 3-5. ENERGY CONSUMPTION

The Army met the DOD and Army zero growth objective in FY 76 and 77, and again in FY 78 by a reduction of 8.7 percent compared to FY 75 despite record-setting low temperatures during that period. Energy consumption in FY 80 was further reduced to 14.1 percent below FY 75 which is below the straight line glide path to FY 85 goals. Consumption of energy by major command is shown in figure 3-6.

C1

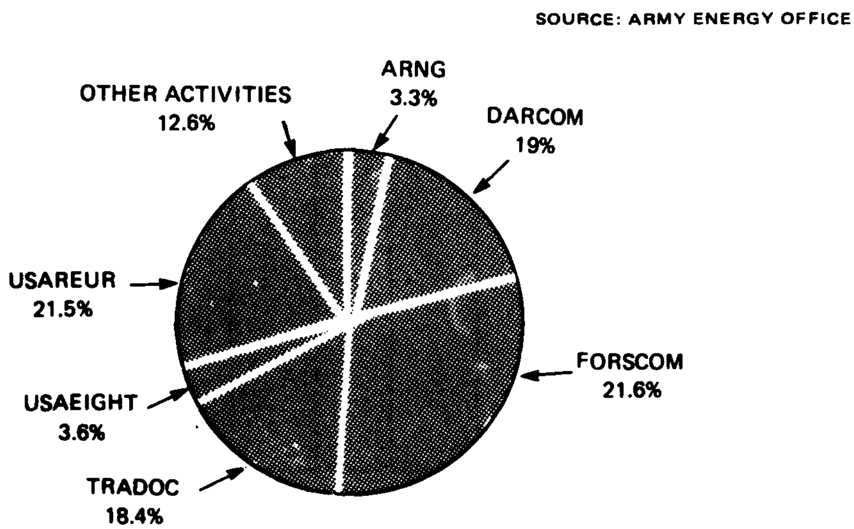


Figure 3-6. ENERGY CONSUMPTION BY MAJOR ACTIVITY, FY 80

Energy consumption by energy resource is shown in figure 3-7. Petroleum fuels represent the largest single energy source and are the principal energy resources used in mobility operations. The breakout of petroleum fuels shows that 52 percent are consumed as heating fuels. Petroleum heating fuels when coupled with natural gas, purchased electricity, coal, liquid petroleum gas (LPG), and purchased steam represent total energy consumed in facility operations and account for 83 percent of total Army energy.

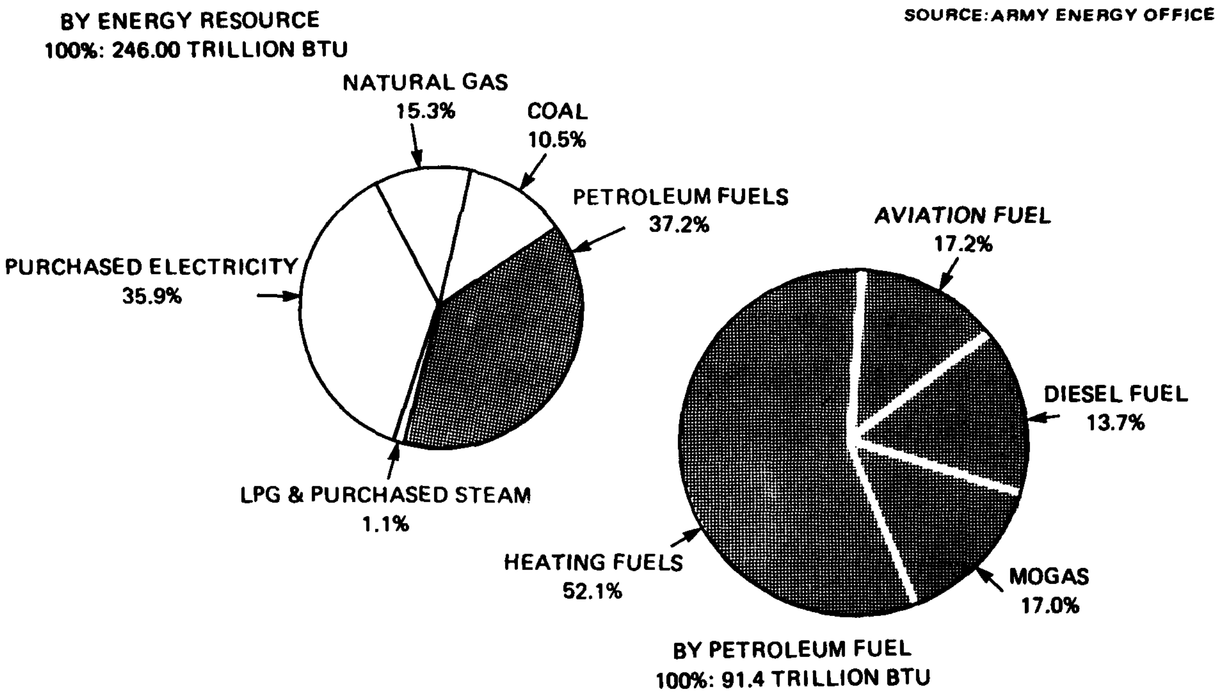


Figure 3-7. ENERGY CONSUMPTION BY RESOURCE, FY 80

A reduction of 10 percent in energy consumption in the facilities area would have about the same impact on the Army's total energy consumption as a reduction of 50 percent in energy consumption in mobility operations. This fact, when coupled with the number of available alternative energy sources, makes the facilities operations area the more desirable target for conservation, investment, and research and development efforts to reduce total Army energy consumption.

3.4.1.2 Long-Range Considerations. To meet the Army goals for the year 2000, several changes are required in the energy consumption by resource. As petroleum fuels are replaced with shale oil derivatives or synthetic liquid fuels such as alcohol, existing distribution systems and engines with or without modification may continue to be utilized. The percentage of total energy consumed as coal (11.1 percent) and electricity (34.6 percent) are expected to increase while the combination of LPG and purchased steam decline.

Army energy consumption (figure 3-7) is compiled based upon the original form in which the Army purchases it. Accordingly, in the long term, the use of electricity could be understated to the extent that the Army could generate its own electricity through hydropower, coal or biomass fired powerplants. Likewise, the use of gas could be distorted to the extent that the Army generated its own synthetic gas from coal or other sources.

3.4.2 Costs.

3.4.2.1 Long range prospects. Using the best available information, energy unit costs have been projected by the Cost of Energy Resources Forecasting System (CERFS) to the year 2000 in yearly increments. Cost projections have been prepared based upon meeting the Army's long-range energy consumption goals. Two sets of forecasts generated by CERFS are discussed here. A more detailed discussion is included in appendix E.

The first set of forecasts represents anticipated energy costs over the next 20 years, while the second set of forecasts incorporates the price escalations projected by the Office of the Secretary of Defense (OSD). Under the anticipated conditions, costs would increase over 800 percent to $7.6 billion by FY 2000 despite a decrease approaching 35 percent in total energy consumption. If the Army did not make this effort to conserve fuels, the cost in FY 2000 would be expected to exceed $11 billion. The cost per MBtu in 1973 averaged $0.89. In 1975 it had risen to $2.01, and it is expected to increase to $8.20 by 1985 and to $40 by the year 2000. Budgeted amounts similarly rise significantly, but fall short of the expected energy costs. Using the prevailing acceptable fuel

CHAPTER 4

ARMY ENERGY PROGRAMS

4.1 SUMMARY.

4.1.1 Introduction. In compliance with Executive Order 12003, dated 20 July 1977, which directed the Federal Government to set the example for the nation in energy conservation, the Army Energy Program was reviewed to determine what revisions were necessary to comply with Presidential guidance and what the revised program would cost. Outlined below are brief summaries of the Army programs, which are covered in greater detail in later sections of this chapter. The funding required for these programs in the near term, FY 83 to FY 87, totals $1,367.3 million (table 4-1).

Table 4-1. SUMMARY OF ARMY ENERGY PROGRAM REQUIREMENTS ($ MILLION)

APPN/PROJ	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FY 83-87
MILCON	125.1	151.3	250.7	190.0	197.3	219.9	1,009.2
ECIP	(106.7)	(151.3)	(141.7)	(144.0)	(146.3)	(148.9)	(732.2)
CONV	(18.4)	(0.0)	(109.0)	(46.0)	51.0	(71.0)	(277.0)
OMA	15.3	8.8	6.0	6.0	6.0	0.00	26.8
EEAP	(14.5)	(8.0)	(5.2)	(5.2)	(5.2)	(0.00)	(23.6)
MGMT	(.3)	(.3)	(.3)	(.3)	(.3)	(0.00)	(1.2)
ENERGY INFO	(.5)	(.5)	(.5)	(.5)	(.5)	(0.00)	(2.0)
PROC							
ECAM	8.3	6.0	8.0	8.0	8.0	8.0	38.0
RDT&E	21.4	53.6	52.6	58.6	63.9	64.6	293.8
FACILITY	(3.2)	(4.6)	(4.1)	(3.8)	(3.5)	(4.2)	(20.2)
MOBILITY	(15.3)	(47.0)	(54.2)	(54.2)	(60.4)	(60.4)	(270.0)
DOD/DOE	(2.9)	(7.0)	(.5)	(.6)	(.0)	(.0)	(3.1)
TOTAL PROGRAM REQUIREMENTS	170.1	219.7	317.3	262.2	275.2	292.5	1,367.3

4.1.2 Ongoing programs.

4.1.2.1 Energy Conservation Programs. The Army's energy conservation goal for FY 76, 77, and 78 was to maintain zero growth in energy consumption over that of FY 75. The FY 80 goal was to reduce the energy consumed by 8 percent from the FY 75 base. The Army achieved this goal with a total energy consumption in FY 80 of 14.1 percent less than in FY 75 and 30.6 percent below FY 73. Executive Order 12003 established a goal to reduce energy consumption in existing facilities by 20 percent (Btu/ft^2) by FY 85 using FY 75 as the base year. The Army achieved through FY 80 a 16.9 percent reduction in Btu/ft^2 in existing facilities. The AAGE established a 20 percent absolute (Btu) energy reduction goal for fixed facilities to be achieved by FY 85 using FY 75 as the base year. The Army has achieved a 14.33 percent reduction in energy consumption at fixed facilities through FY 80. Energy savings have been achieved through a combination of energy-saving techniques in the facility and mobility operations areas such as installation of storm windows, insulation, temperature controls, energy monitoring and control systems, heat recovery equipment, adherence to 55 mph speed limit, improved motor vehicle management, combining operational and administrative flying requirements, and use of flight simulators.

While total energy consumption has been decreasing at fixed facilities, the use of electrical energy has generally been increasing. Electrical energy consumption increased 1.8 percent through 1979 compared to that of FY 75 but showed a decline in FY 80 of 1.24 percent. Even though a decline was achieved in FY 80, the means to reduce consumption of electrical energy have become a high priority in meeting Army energy goals.

Army contractors are being motivated to develop and submit value engineering changes which will reduce overall energy costs to the Army. Value engineering clauses outlined in the Defense Acquisition Regulations.provide incentives for contractors to reduce operating costs, including energy savings on equipment and newly constructed facilities. The army's effort to make contractors and procurement and technical personnel more aware of this potential should greatly increase these cost- and energy-saving benefits.

4.1.2.2 Training and Operations. The Army's policy is to conserve the maximum amount of energy consistent with allocating and utilizing those resources necessary to maintain the required state of readiness. The post-Vietnam phasedown, with its accompanying reduction in force and reduced industrial, operational, and training activities, has helped reduce the Army's consumption of energy. Another assist in achieving energy savings while attaining the Army's readiness objective has been and continues to be increasing the use of training simulators and simulations. Advance planning to leave equipment onsite, the use of small wheeled vehicles to represent large tracked tactical vehicles, and improved petroleum (POL) handling techniques are some of the additional means being used to accomplish energy savings in the training environment. Training simulators reduce consumption of mobility fuels and help reduce total Army energy consumption; however, simulators increase electrical consumption at fixed facilities.

4.1.2.3 Administrative Automobiles. The Army's goal to have 97 percent of the sedan fleet composed of compact and subcompact vehicles by the end of 1980 has been set back because of lack of funding for replacement vehicles. The goal remains, but the target date--a function of funding--has been extended to FY 82, to be adjusted further if necessary. Concurrent action is intended to adjust procurement of administrative vehicles in conformance with Presidential guidance on gasoline consumption goals for the nation's automobiles.

4.1.2.4 Energy Engineering Analysis Program (EEAP). These studies are the key to meeting National, Presidential, DOD and Army energy goals. The studies will provide the impetus for integration of energy conservation, energy use, and energy control systems, and will result in the optimum use of the energy resources available. The objectives of these studies are to--

a. Develop a systematic plan of projects that will result in the reduction of energy consumption in compliance with the objectives set forth in the Army Facilities Energy Plan (AFEP) without decreasing the present standard of living.

b. Use and incorporate applicable data and results of related studies, past and current, as feasible.

c. Develop coordinated Basewide Energy Systems Plans for each military installation.

d. Prepare Program Development Brochures (PDB's), DD Forms 1391, and supporting documentation for feasible energy conservation projects at each installation.

e. List and prioritize all recommended energy conservation projects.

f. Develop an energy systems overlay to the installation master plan, if required.

4.1.2.5 The Quick Return on Investment Program (QRIP). Another Army program designed to conserve energy and reduce costs is the Quick Return on Investment Program (QRIP). The program provides a centralized source of funds for timely financing of "Quick Return" investments. The proposal for a project under the program must--

a. Be for at least $3,000 but cannot exceed $100,000.

b. Be self-amortizing within 2 years.

c. Produce hard-dollar savings which can be reflected by reductions in the benefiting appropriations.

d. Be concurred in by the MACOM energy office.

4.1.2.6 The Energy Conservation Investment Program (ECIP). The objective of ECIP is energy reduction through retrofit of existing facilities. The early phases of ECIP, which started in FY 76, included the most easily accomplished energy saving installation operations projects. The follow-on programs are more sophisticated. They include such projects as energy monitoring and control systems, boiler controls, and heat recovery equipment. The current criteria for justifying and prioritizing ECIP projects is the ratio of energy saved to dollars invested or E/C ratio.

4.1.2.7 Energy Conservation and Management Program (ECAM). ECAM is a procurement-funded energy conservation program which applies to Government-owned contractor-operated (GOCO) plants only and is analogous to ECIP. ECAM will continue to fund for Government-owned, Government-operated (GOGO) plants.

4.1.2.8 Facility Solid Fuel Conversion Program. Based on the President's policy to reduce dependence on critical fuels and his desire that executive agencies set the example, all large boiler plants on Army installations are being considered for conversion to solid fuel. AR 420-49, 18 November 1976, "Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems," was rewritten to emphasize the Army's need to increase the use of solid fuels.

4.1.2.9 Dual Fuel Program. All natural-gas-only heating units and plants with over 5 MBtu/hr output are being modified to have the capabilty to use oil in addition to natural gas. In view of potential curtailment of fuel oil like that experienced during the Iranian crisis of 1979, oil-fired-only heating units and plants are being modified to have the capability to use natural gas in addition to oil.

4.1.2.10 Alternate Sources of Energy. The Army has an active program to increase its use of coal, wood, solar power, and refuse-derived fuels (RDF) to furnish its energy needs. Wood/coal plants are programed for Red River Army Depot, Texas and Fort Stewart, Georgia. Studies are being conducted to investigate the feasibility of the Army entering into cooperative agreements with industry and utilities where the Army would furnish wood fuels from its timberlands, provide real estate for plant siting, etc., in return for favorable utility rates and/or thermal energy. Heat-recovery incinerators are also being included in the MCA program to reduce dependence on critical fuels. Although high cost estimates have restricted progress on solar energy projects, the Army has urged the Office of the Secretary of Defense to seek expanded DOE support for demonstration projects. The Army is moving ahead on those projects that can be reasonably justified.

4.1.2.11 Army Energy Demonstration Center. Under the overall umbrella of the DOD-DOE Memorandum of Agreement, 19 October 1978, and the Defense Energy Program Policy Memorandum (DEPPM) 78-8, the Army designated the Red River Army Depot-Lone Star Army Ammunition Plant complex in Texas as the principal installation for demonstrating advanced energy conservation/alternate fuel concepts. This jointly funded program by DOE and the Army is demonstrating the effectiveness and commercial potential of selected energy initiatives to reduce the dependence on critical fuels. In addition to adapting solar energy systems to industrial requirements, the major technology thrusts include biomass (the use of wood waste for solid, liquid, and gaseous fuels), alternate transportation concepts (gasohol and electric powered vehicles), photovoltaic battery charging stations, terratecture, lignite, boiler fuels, and specific energy conservation measures.

4.1.3 Long-Range Programs (FY 86-2000).

4.1.3.1 Installation Operations. By the year 2000 only 17 percent of the Army's real property will have been replaced with new, more energy-efficient buildings. As a result the Army's ability to meet energy goals will depend on retrofitting existing facilities to make them more energy-efficient. Reducing dependence on critical fuels through energy conservation and increased reliance on solid fuels will require a dedicated MCA program to convert or replace existing heating plants. Command emphasis must be placed on energy conservation.

4.1.3.2 Mobility Operations. Readiness is the big factor in determining what sacrifices, if any, can be made in mobility operations to offset the decreasing availability and the increasing costs of current sources of energy. The Army is headed for increased mechanization of its force structure with a commensurate impact on fuel consumption. In order to compensate for this, the Army long-range mobility operations programs are considering lighter weight vehicles, improved engine performance and the utilization of synthetic and alternate fuels. The bottom line is that an adequate state of readiness will be maintained.

4.1.3.3 Training. Readiness is of equal concern in determining the extent of training programs as it is in mobility operations. Training concerns the readiness of the individual or unit to do the job. Training is a major consumer of energy; consumption can be reduced through two programs which prevail now and will continue to prevail in the future. They are: (1) the constant search for ways and means of reducing unnecessary movement of troops and equipment, and increasing efficiency in use of existing equipment and facilities through training; and (2) the greater use of simulators and simulations as training devices. The Army will continue vigorous pursuit of both programs in the long-range period.

4.1.3.4 Research and Development. Long-range Army energy R&D programs will seek effective energy conservation measures, alternative energy sources, and improved energy management techniques for military facilities. In mobility operations, the Army R&D projects will concentrate on areas that will contribute toward meeting the Army's goals to reduce energy consumption and dependence on petroleum-based fuels.

4.2 INSTALLATION OPERATIONS.

4.2.1 General. The Army is vigorously pursuing a multifaceted energy reduction program. Thus far, all of the broad program objectives have been met. Figure 3-2 indicates that installation operations or facilities consume 84 percent of the Army's total energy, with mobility operations consuming the balance of 16 percent. It is quite apparent from these figures that the Army's greatest potential for energy reduction exists in installation operations. The Army Facilities Energy Plan is summarized at appendix A.

In installation operations, the Army has reduced its total energy consumption, but at the same time significant increases in cost have occurred due to higher prices. If the Army had continued to use energy at the same rate as in 1973, it would have cost almost $1.85 billion more than the actual cost through 1980. This indicates the major impact that installation operations energy reduction has had from a budgetary standpoint.

The Army is continuing to exploit most of the low-cost opportunities for energy reduction, such as: reducing heating temperatures (65° F during working hours and 55° F during nonworking hours in offices, and lower temperatures in warehouses and other facilities where occupancy and activity permit); raising cooling temperatures (thermostats set no lower than 78° F); and reducing lighting levels to the minimum of 50 footcandles. The Army is also operating equipment during off-peak hours, consolidating activities into the minimum number of buildings, weatherstripping, caulking leaks, reducing hot water temperature levels, and fine-tuning mechanical equipment to achieve better efficiency. Other energy related actions that have been taken or that are under way are; the processing of exigent MCA projects for energy reduction, updating AR 420-49 to provide policy guidance on fuel selection for new facilities and conversion of existing equipment, establishing a moratorium on electrical resistance heating, publishing guidelines on the use of waste oil as a fuel, and promoting the use of solid fuels. Future energy reductions will depend increasingly on additional funding.

Concurrent with energy reduction, the Army must also ensure that energy supplies are available to meet minimum essential needs and ensure against total interruption of utilities services. Consequently, the Army has a program for stockpiling fuel at major heating plants. Although not directed toward energy conservation, this program is an essential part of the overall program to ensure continuity of essential supplies and operations.

The Army Energy Office is developing an Energy Coordinators Manual for distribution in FY 82 designed as a guidebook in energy management at Army facilities for facility engineers, installation energy conservation officers, and building managers.

4.2.1.1 Short-Range Facility Goals. The Army's FY 85 facility energy goals are to reduce energy consumption and to reduce dependence on critical fuels. These goals are:

a. Reduce absolute facility energy consumption (Btu) 20 percent. This will be achieved by:

(1) Twenty percent reduction in energy consumption (Btu/ft^2) in existing facilities.

(2) Forty-five percent reduction in energy consumption (Btu/ft^2) in new buildings.

(3) Design to meet energy targets (Btu/ft^2) for building envelopes in new construction.

(4) Energy reduction through improved energy management.

(5) Renewable energy source substitution.

b. Reduce dependence on critical fuels by:

(1) Thirty percent reduction in use of petroleum based fuels.

(2) Fifteen percent of facility energy derived from solar, coal, RDF, and biomass fuels.

(3) Improvement in efficiency of building and industrial plant process systems.

4.2.1.2 Long-Range Facility Goals. The Army's energy goals for the year 2000 are:

a. Reduce installation absolute facility energy consumption (Btu) 40 percent.

b. Reduce dependence on critical fuels by--

(1) Reducing use of natural petroleum fuel by 75 percent through a combination of--

(a) Absolute reduction in energy consumption,

(b) Conversion to solid fuel (coal, biomass, and RDF),

(c) Conversion to renewable energy sources (solar, geothermal, wind), and

(d) Conversion to synthetic liquid fuels.

(2) Developing the capability to use coal gas, wood gas, and other synthetic gases to reduce dependence on natural gas.

4.2.2 Funding. Executive Order 12003 requires that energy consumption in existing facilities be reduced by 20 percent on a Btu-per-Square-foot basis by 1985, with FY 75 as the base year. The Army's funding to meet this requirement is being achieved largely through a separately identified MCA program entitled the Energy Conservation Investment Program (ECIP). It is currently planned to achieve about 12 percent of the EO 12003 goal by ECIP. The remaining 8 percent reduction is to be achieved through improved energy management and energy conservation projects at installation levels.

In order to identify, in a systematic manner, what energy conservation measures must be utilized to achieve this 20-percent reduction, the Army initiated a program in FY 77 to conduct energy engineering analyses at all CONUS active installations. Through FY 81, studies have been funded for 164 Army installations to develop an integrated basewide energy use and control system. From these studies and others that follow, a program will be developed and prioritized based upon meeting energy reduction goals at minimum costs.

ECIP funding priorities for FY 76-78 were largely determined on the basis of amortization. Individual projects with early dollar amortization were given the highest priority, resulting in deferral of many worthy projects which had a potential for high energy savings rather than quick payback. For programs starting with FY 79, funding criteria have been changed and projects are required to amortize within the life of the facility or the retrofit action, rather than within a specified number of years. Projects are then prioritized on the basis of MBtu's of energy saved per year per thousand dollars invested--an E/C ratio.

Executive Order 12003 further stipulates that a 45-percent reduction in the use of energy by new facilities will be achieved by 1985, again measured against energy use per square foot by existing facilities in 1975. This will be achieved by installing additional insulation, using solar screening, introducing heat recovery systems and enthalpy control, and improving energy management systems.

4.2.3 Alternate Source of Energy.

4.2.3.1 Solar Energy Demonstration and Construction. The Military Construction (MILCON) Authorization Act, 1979, established the initial requirements to undertake solar energy engineering/economic evaluations for program projects. Where found to be cost-effective, the Act required that these solar energy systems be installed. The following year the MILCON Authorization Act, 1980, continued the solar requirement and also amended the United States Code by adding the following: Chapter 159 of Title 10, United Stated Code, is amended by adding at the end thereof the following new section:

"2688. Use of solar energy system in new facilities.

"(a) The Secretary of Defense shall require that all new facilities (including family housing) placed under design after the date of the enactment of the Military Construction Authorization Act, 1980, shall include consideration of solar energy systems in those cases in which solar energy has the potential to save fossil-fuel-derived energy. All contracts for construction resulting from such design shall include the requirement to furnish and install solar energy systems if such systems can be shown to be cost-effective.

"(b) For the purpose of this section, a solar energy system shall be considered to be cost-effective if the original investment cost differential can be recovered over the expected life of the facility."

Prior to the enactment of MILCON Authorization Acts of 1979 and 1980, the Army, using only DOD funds, constructed ten solar projects; three additional projects are now under construction. In addition, (and prior to the MILCON Acts of 1979 and 1980) two other projects were constructed and one other project is now under construction as a joint DOE/DOD-funded solar demonstration program effort. As a result of the 1979 and 1980 MILCON Acts, one project was constructed and nine other projects are being constructed. In addition, approximately 100 other program projects were evaluated and were found not to be cost-effective. In 1980 as part of DOE Solar in Federal Buildings Demonstration Program, the Army received design and construction funds from the DOE for solar energy systems in six MCA program projects.

In October 1980, when both the MILCON Authorization Act, 1981 and the MILCON Appropriations Act, 1981 were enacted, each contained solar energy requirements. The following depicts the requirements of the two 1981 MILCON Acts:

AUTHORIZATION ACT

"Section 804, Section 2688(b) of title 10 U.S. Code, is amended to read as follows:

"(b) For the purpose of this section, a solar energy system shall be considered to be cost-effective if the original investment cost differential can be recovered over the expected life of the facility using accepted life-cycle costing procedures. Such accepted life-cycle cost procedures shall include:

(1) the use of undiscounted, constant dollars in all calculations;

(2) an assumption that any additional maintenance costs incurred as a result of the installation of a solar system will be offset by a corresponding reduction in the maintenance costs for a conventional backup system; and

(3) the use of realistic assumptions with regard to the rate of inflation on the cost of fossil fuel as compared with the general rate of inflation, but in no event may the assumed general rate of inflation be greater than the assumed rate of inflation on the cost of fossil fuel."

APPROPRIATIONS ACT

"Section 116. During the current fiscal year none of the funds available to the Department of Defense for military construction or family housing shall be available to furnish or install solar energy system in new facilities (including family housing) unless such systems can be shown to be cost-effective using the sum of all capital and operating expenses associated with the energy system of the building involved over the expected life of such system or during a period of 25 years, whichever is shorter, and using marginal fuel costs as determined by the Secretary of Defense and at a discount rate of 7 per centum per year."

The design of MCA 1981 program projects was initiated typically in the second half of CY 1979 and the solar evaluation were based on the then-current criteria contained in the 1979 MILCON Authorization Act. Based on the solar guidance contained in the 1979 Act, 32 program projects were found cost-effective and were included in the MILCON 1981 program, and construction funds were provided. The cost-effectiveness requirements of the 1981 Authorization Act were essentially the same as in the 1979 Authorization Act, hence all 32 projects remained valid solar projects. However, the cost-effectiveness requirements of the 1981 Appropriations Act differed substantially from those in the 1979 Authorization Act and only one of the 32 solar projects actually met the requirements of the 1981 Act and could be advertised for construction.

As a result of the conflicts in the two 1981 MILCON Acts, the DOD (OASD(MRA&L)ID) issued guidance on 29 December 1980 requiring that for 1982 and beyond, solar energy applications shall be programed for accomplishment, if cost-effective, using the guidance in the 1981 Authorization Act.

The design of 1982 MILCON projects initiated in the second half of CY 1980 followed the solar guidance in the 1980 MILCON Authorization Act. Based on the 1980 Authorization Act guidance, 22 MCA 1982 projects were included in the 1982 MILCON program and are currently awaiting Congressional action. From House and Senate bills/committee reports currently available (through 1 June 1981), it appears that the Congress is going to revise the United States Code to follow the guidance/requirements contained in the MILCON Appropriations Act, 1981. It is expected that, if Congress does revise the United States Code to follow the solar guidance in the 1981 MILCON Appropriations Act, there will be few if any solar energy projects in the 1982 MCA program.

The Army solar projects completed and under construction include reserve centers, bachelor enlisted quarters, bachelor officer quarters, dining facilities, dental clinic, indoor swimming pool, academic buildings, hospitals, family housing units, maintenance shops, administration buildings and a range operations center. These solar energy projects are all located south of 40° north latitude with the greatest concentration in the Texas-Louisiana area. The solar systems installed are applications of space heating, domestic hot water service, process water heating/preheating and air-conditioning. Most or all of the solar systems were not installed with sufficient monitoring equipment, hence it is not possible at present to readily determine energy savings.

4.2.3.2 Refuse-Derived Fuel (RDF). The resources Conservation and Recovery Act of 1976 requires that Federal agencies use RDF as a primary or supplemental fuel to the maximum extent practicable. Additionally, AR 420-49 (18 November 1976) requires that RDF be considered in the future for all large boilers which burn solid fuel. Also, large boilers which are constructed to burn oil will be designed to permit conversion to coal/RDF combination, if required at some future date. Generally, this will apply to boilers over 50 MBtu/hr in output capacity. There are relatively few boilers this large being installed in Army facilities. The FY 79 Army construction program included a modular refuse-fired heat-recovery incinerator at Fort Eustis, VA. This consists of two 20-ton per day refuse burners in an incinerator connected to one steam-generating, water-tube-type package boiler which will provide steam to the existing steam supply system at a post boiler plant. Solid waste which is processed through a shredder is to be burned. Future MCA programs include the following projects:

FY 80 MCA Program

Fort Knox, KY - Heat-recovery incinerator.

Fort Leonard Wood, MO - Solid waste incinerator with heat recovery.

FY 81 MCA Program

Redstone Arsenal, AL - Solid waste incinerator with heat recovery.

FY 82 MCA Program

Fort Dix, NJ - Solid waste incinerator with heat recovery.

Fort Rucker, AL - Solid waste incinerator with heat recovery.

Fort Gordon, GA - Solid waste incinerator with heat recovery.

4.2.4 Other Installation Actions.

4.2.4.1 Medical Facilities. As a result of guidance from the U.S. Army Health Facility Planning Agency (SGFP), the Office of Chief of Engineers (OCE) has written medical facilities interior design criteria to minimize energy use without compromising patient care. Additionally, the SGFP has recommended to OCE that solar energy be used in medical and dental facilities when feasible.

Because of the wide variety of energy sources and the ages of health care facilities, medical activities have been directed to work with the installation facility engineer to maximize energy conservation on an installation-by-installation basis. As improved methods of energy conservation are surfaced, these methods will be incorporated in pertinent regulations for utilization at medical facilities. A study, Fixed Facilities Energy Consumption Investigation, conducted by the Corps of Engineers, is currently under way at Forts Belvoir, Carson, and Hood to determine the energy consumption patterns at typical medical facilities on an installation. The Surgeon General (TSG) desires to establish a true baseline of energy consumption for existing buildings at medical facilities utilizing the results of the study. Evaluation of the data obtained from metering will identify specific areas that require automatic controls monitors which will permit highly reliable energy conservation control.

4.2.4.2 Improved Troop Support. A principal energy conservation objective is to insure that the latest energy conservation technology is being considered and applied during the design and construction phases of new commissary stores. Also, an energy conservation program has been developed for recently constructed commissaries and for commissaries in buildings neither designed nor constructed as commissaries. Refrigeration equipment is the major consumer of energy in commissary stores, and has the highest potential for energy savings through the application of effective conservation measures. The commissary at Fort Riley, KS, has been designated as a test facility for energy conservation procedures to be used in the modernization of existing commissary stores. The invitation for bid for construction of new commissaries includes the requirement for maximum use of energy conservation subsystems.

A second, equally important energy conservation objective is the development of a program by the Troop Support Agency to advise and assist commands and installations in conserving energy in dining facilities, laundry/dry-cleaning facilities, clothing sales stores, and troop issue support activities.

In the laundry/dry-cleaning facility area, an energy checklist has been developed which is being used during technical assistance visits to identify conditions where energy is being wasted. Where waste is observed, corrective acitons are recommended, and in many instances on-the-spot corrections are achieved. Heat reclamation equipment is now specified for modernization/new construction of laundry/dry-cleaning facilities, and such equipment has been installed in the new facilities at Schofield Barracks, Fort Dix, and Walter Reed Hospital. In addition, existing facilities are phasing in the use of low-temperature detergents that require 140° F water instead of 160° F water. One energy/cost-saving device under consideration is a tunnel washer which utilizes

3/4 gallon of 140° F water for a pound of wash, compared to the conventional washer which requires 3-1/2 gallons of 160° F water for the same job.

4.2.4.3 Improved Uniforms. The Army has adopted, or has under consideration, several items of clothing that will allow personnel greater comfort in the normal temperature range and greater flexibility in coping with temperature variations, permitting fuel savings for both heating and cooling offices and buildings. Already adopted are durable press uniforms which will eliminate energy expended for pressing and reduce energy consumption for laundry. In addition, there are fabrics and uniform items under development that will have greater versatility and thus permit a reduction in the number of clothing items supplied to soldiers. Since many uniforms contain a high amount of polyester fiber, which is derived from petroleum, a reduction in the number of uniforms supplied will assist in reducing the nation's petroleum consumption.

4.2.5 Near-Term New Initiatives (FY 81-86).

4.2.5.1 Meeting Presidential Goals. In order to achieve the Presidential goal of a 20-percent reduction in energy consumption (Btu/ft^2) over FY 75 by 1985 in existing buildings, as stated previously, it is anticipated that ECIP projects will lead to reduction of about 12 percent of this goal, with the remaining 8 percent reduction to be achieved largely through improved energy management at installation levels and locally conducted repair and maintenance projects. The Energy Conservation and Management Program (ECAM) will do at procurement-funded installations what ECIP does at others and will also contribute to the 20 percent. The second Presidential goal is to reduce energy consumption on a Btu/ft^2 basis by 45 percent in new buildings by 1985, based on 1975 energy consumption figures. This will be achieved through more energy efficient architectural and mechanical design which will include installing additional insulation over and above that customary in previous years. Heat recovery systems as well as modern energy management systems will be introduced. Total and selective energy systems will be considered and successful construction procedures demonstrated by the General Services Administration (GSA) will be included in new buildings. The additional costs associated with meeting this goal will not be readily separable from the construction costs. The costs will be wrapped up in the estimated project costs. It is estimated, however, that the energy reduction requirement will require additional funds of up to 10 percent of the total project cost for complex, large energy-use facilities.

An additional goal is to reduce dependence on imported petroleum fuels through the increased use of coal, refuse-derived fuels, and biomass fuels. The Army policy for fuel selection is stated in AR 420-49, "Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems".

4.2.5.2 Energy Engineering Analysis Program (EEAP). The EEAP and the solid fuel conversion studies are the key to meeting the Army facility energy goals. These studies will provide comprehensive energy analyses on a basewide scale necessary to support the development of basewide energy systems. They will provide the impetus for integration of energy conservation, energy use, and energy control systems and will result in the optimum use of the energy resources available. Analyses are under way at 82 Army installations and essentially completed at 54 with preliminary results showing possible savings of 17 to 34 percent of total installation energy consumption. Actions are well under way in awarding additional contracts using programed FY 81 OMA funds to study approximately 28 more Army installations.

In addition to these relatively large-scale studies there is a necessity to analyze and evaluate new and innovative conservation devices and concepts that are continuously emerging as a result of the national emphasis on energy reduction. Collectively, Army installations spend hundreds of millions of dollars per year on such items without the benefit of an analysis that assesses the true energy savings benefits and cost effectiveness. Accordingly, an Energy Conservation Technical Information and Analysis Center (ECTIAC) has been established at USA Facilities Engineering Support Agency (FESA), Fort Belvoir, VA, to serve as a clearing house for the Army. This will ensure that the best energy conservation devices and concepts are identified and maximum effectiveness in their application is achieved. EEA funding is shown in table 4-2:

Table 4-2. ENERGY ENGINEERING ANALYSIS FUNDING ($M) OMA FUNDS

Description	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FY 83-87
Program Management	.3	.3	.3	.3	.3	.3	0.0	1.2
Basewide Energy	14.5	14.5	8.0	5.2	5.2	5.2	0.0	23.6
ECTIAC	.5	.5	.5	.5	.5	.5	0.0	2.0
Required Resources	15.3	15.3	8.8	6.0	6.0	6.0	0.0	26.8

4.2.5.3 <u>Facility Fuel Flexibility Program</u>. The Army has identified projects to implement OSD guidance to add oil-firing (dual-fuel) capability to single-fuel natural gas plants over 5 MBtu/hr capacity by FY 82. Conversion of these plants to coal burners has been considered and it has been determined that it would not be technically or economically feasible in the near term. Almost all of these plants are in the relatively low-capacity range and many contain packaged boilers which cannot be converted directly to coal.

As a result of stated policies (para 4.2.5.1), the Army has surveyed large boiler plants for conversion to solid fuel. A March 1974 field survey of all boilers over 20 MBtu/hr in CONUS indicated a total cost of approximately $90 million for either austere conversion of selected boilers or construction of replacement boiler plants to burn coal/solid fuel. Subsequent reviews have indicated that conversions would probably be limited to plants above 100 MBtu/hr in lieu of boilers over 20 MBtu/hr. The impacts of inflation and major changes in environmental standards since that estimate was made have vastly escalated the estimated cost, putting it in the range of $500+ million and extended the programed period beyond FY 85. The environmental considerations associated with such conversions add both delays and costs. MCA funding to begin major plant conversions at a limited number of installations has been requested in FY 80. This will be a long-term program extending beyond FY 85. Resources required to begin this program for the programed years are shown in table 4-3.

Table 4-3. SOLID FUEL CONVERSION FUNDING ($M) MCA FUNDS

	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FY 83-87
Required Resources	5.6	18.4	0.0	109.0	46.0	51.0	71.0	277.0

The program to provide 30-day oil storage capacity at heating plants over 5 MBtu/hr is almost completed. In addition, installations are keeping oil storage tanks filled to high levels to protect against unforeseen interruptions in supplies. CONUS installations which burn coal have been advised to increase storage to approximately 90-day supply levels based on winter consumption.

4.2.5.4 Energy Reduction in New Buildings. The additional costs associated with meeting the President's goal to reduce energy consumption in new Federal buildings by 45 percent based on an FY 75 consumption base will not be readily separable from the construction costs. The costs will be wrapped up in estimated project cost. It is estimated, however, that the energy reduction requirement will require additional funds of up to 10 percent of the total project cost for typical new structures. An integrated approach to facility design is being used to achieve the 45 percent reduction goal. This approach considers such factors as siting and orientation of the building; location within the building of energy using and energy rejection areas; passive and active solar energy; reduction of air infiltration; energy recovery devices; zoned heating and cooling systems; proper use of insulation and insulated windows; and the use of automatic energy monitoring and control systems.

A building simulation program called "Building Load Analysis Systems Thermodynamics (BLAST)" program which was developed through the Corps of Engineers' energy research and development program is used to validate designs. This program is operational on the Boeing Commercial Computer Service and the Control Data Corporation Cybernet. BLAST is a computer-assisted building simulation program that can be used to examine numerous design alternatives. BLAST is based on user-oriented input language and includes a library of common building materials and components used in military construction. Using weather tapes it computes the building loads based on the facility architectural design. It simulates air handling system design and the mechanical systems required to meet the loads. It includes solar energy and total energy systems in addition to conventional HVAC systems. The BLAST program is being used to establish FY 75 baseline data for energy consumption for various building types. Using this baseline data, BLAST will determine if new building designs will meet the 45 percent reduction goal established by Executive Order 12003 and the building energy targets established by DOE.

4.2.5.5 Energy Conservation Investment Program (ECIP). Executive order 12003 requires that energy consumption in existing Army facilities, including family housing, be reduced by 20 percent on a Btu/ft^2 basis by 1985, with FY 75 as the base year. The Army's funding to meet this requirement is being achieved through a separately identified military construction funded program titled the Energy Conservation Investment Program (ECIP). It is currently planned to achieve about a 12 percent reduction in energy consumption by expansion of ECIP. The remaining 8 percent reduction is to be achieved largely through improved energy management at installation levels and locally approved operation and maintenance projects.

The funding requirements necessary for the Army to meet its goals of reducing dependence on nonrenewable and scarce fuels (FY 81-86) are shown in table 4-4.

Table 4-4. ENERGY CONSERVATION INVESTMENT PROGRAM FUNDING ($M)
MILCON FUNDS

APPN	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FY 83-87
MCA	76.0	100.0	100.0	100.0	100.0	100.0	500.0
FHMA	27.2	43.8	34.2	36.5	38.8	41.4	194.7
MCAR/MCARNG	3.5	7.5	7.5	7.5	7.5	7.5	37.5
Required Resources	106.7	151.3	141.7	144.0	146.3	148.9	732.2

4.2.5.6 Family Housing. The Army's family housing inventory is a readily available source for conservation projects which can provide significant reductions of total Army natural gas consumption. These projects total $136.0 million for CONUS family housing only and include improving insulation, weatherstripping, installation of storm doors and windows as well as the installation of water-flow reducers, setback thermostats, time clocks for water heaters and flue-pipe dampers. Total family housing energy program requirements are shown in table 4-5 and in para 4.2.5.5, above.

Table 4-5. FAMILY HOUSING ENERGY CONSERVATION FUNDING ($M) FHMA FUNDS

	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FY 83-87
Required Resources	27.2	42.8	34.2	36.5	38.8	41.4	194.7

4.2.5.7 Metering. Utility meters have been installed in family housing units at Fort Eustis, Fort Gordon, and Yuma Proving Ground. A total of 4,008 electrical and fuel meters was installed in 2,494 family housing units. This was a test program to establish energy consumption base data in family housing. Problems associated with meter reading, maintenance and billing were analyzed. Data collection of family housing energy consumption was initiated 1 January 1979. A report on the family housing metering program was submitted to Congress in March 1980. The Naval Facilities Engineering Command had tri-service responsibility for preparing the report. Actual energy consumption will be compared to norms derived from computer simulation techniques.

4.2.5.8 Energy Conservation and Management Program (ECAM). ECAM is a procurement-funded energy conservation program which applies to Government-owned, contractor-operated (GOCO) plants only and is analogous to ECIP. ECAM will fund for energy conservation measures at active and inactive GOCO plants. ECIP will continue to fund for Government-owned, Government-operated (GOGO) plants. All ECAM effort will be developed in accordance with ECIP guidance in that minimum Energy-to-Cost (E/C) ratios and cost effectiveness criteria must be met. Energy conservation at GOCOs has been funded in the ECIP protram in FY 81 and prior years. Due to the need for an orderly transition and the more rigid Congressional requirements for the completion of design for procurement funded projects than for MCA projects, the earliest that procurement funded ECAM effort can commence is FY 82. In the interim, ECIP effort to correct energy problems at GOCOs will continue through FY 81. Funding for ECAM is shown in table 4-6.

Table 4-6. ENERGY CONSERVATION AND MANAGEMENT PROGRAM FUNDING ($M)

APPN	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FY83-87
Proc	8.3	6.0	8.0	8.0	8.0	8.0	38.0

4.2.6 Long-Range Programs (FY 86-2000).

4.2.6.1 General. Since 84 percent of the total energy used by the Army is consumed by installation operations, it is essential that maximum energy reductions be achieved in that area in order to insure that sufficient petroleum will be available for mobility operations requirements. The determination of what long-range facilities programs to pursue to meet the Army's long-range energy goals and objectives and to carry the major portion of the Army's energy reduction must be prefaced by the following broad assumptions and guidelines:

a. Assumptions:

(1) Force structure/stationing will remain basically the same.

(2) Real property inventory will grow slowly, and by the year 2000 only about 17 percent of the Army's existing inventory will be from new construction.

(3) Retrofit of existing facilities will be extensive in the near term and continuing.

(4) Cooperation will be essential in environmental areas, particularly on an interim basis, where direct coal combustion is utilized.

b. Guidelines:

(1) Natural gas, liquid petroleum gas, and oil derived from natural crude oil will gradually be replaced by alternate energy sources.

(2) Use of coal, biomass, and refuse-derived fuel will be increased.

(3) All feasible alternate sources of energy will be exploited.

(4) On-post gasification of coal and biomass will increase.

(5) A broad range of innovative techniques will be applied to new construction.

(6) New construction will include multiple-use facilities.

(7) New facilities will eliminate occupant control of internal temperatures.

(8) Total energy/selective energy systems, based largely on solid fuels, will be constructed at major installations.

4.2.6.2 Long-Range Outlook. The Army's facility operations programs for the long-range period will be limited to a great extent by the state of the art. The Army has under consideration many programs in its efforts to minimize the effect of energy shortages and high costs on military facilities and the Army mission. The Army remains current on the progress being made by private industry, continuously testing developments for possible inclusion in the Army's facility operations energy programs. Listed below are key areas of development which have potential as long-range programs for the achievement of the Army's facilities operations goals of reducing energy consumption 40 percent, and reducing the use of petroleum fuels 75 percent by the year 2000:

a. Construction.

(1) Increased underground construction.

(2) More multiple-use facilities.

(3) Decreased facility energy loss.

(4) Total energy and selective energy systems.

b. Utilities.

(1) Filtering and recirculation of air.

(2) Reclamation of waste energy.

(3) Use of solar energy for heating and cooling buildings.

(4) Use of biomass and waste-derived fuels as a fuel supplement or as a primary fuel.

(5) Use of nuclear energy for military facilities.

(6) Use of coal as the primary energy source for military facilities while meeting environmental standards.

(7) Increased utilization of heat pumps.

(8) Metering of all facilities to include family housing.

(9) Implementation of a 4-day, 10-hours per day, work week.

(10) Use of geothermal energy for heating and cooling.

(11) Use of wind-driven energy for heating and cooling.

(12) Increased utilization of coal and biomass gasification.

c. Management.

(1) Prediction, reporting, and analysis of energy consumption for a military installation.

(2) Control facility energy use with reliable automated energy control systems.

4.3 MOBILITY OPERATIONS.

4.3.1 General. The Army has several management programs designed to reduce energy consumption in mobility operations. They are:

a. POL management.

b. Traffic management.

c. Transportation management.

The above programs are all dedicated to the Army's energy management objective of conserving energy while maintaining readiness.

4.3.2 POL Management.

4.3.2.1 Mobility Fuel Consumption. Army mobility fuel consumption dropped dramatically in FY 74 as a result of conservation measures imposed during the 1973 oil embargo and the ensuing petroleum shortage. Except for a slight increase in consumption in FY 77, overall Army mobility fuel consumption has been reduced each year since 1973. However, diesel fuel and aviation fuel use is beginning to show an upward trend due to tactical training, equipment modernization, and operational readiness requirements. Since 1975, overall mobility fuel consumption has consistently been below the goal as shown in figure 4-1. In FY 78, with initial publication of this plan, a 10-percent reduction goal for FY 85 was established compared to the FY 75 baseline year. The Army presently is 12.53 percent below FY 75 consumption, but increases indicated above are reversing that trend. However, based upon input from major commands, further reduction of mobility fuels may begin to cut into operational readiness, which cannot be allowed. Based on this input, a concerted effort is being made at DA to recognize the absolute requirement for fuel efficiency even before it gets to the user. Regulatory changes have been recommended which will require that energy conservation/efficiency be made a requirement in the initiation of potential materiel systems. This would affect the preparation of documents such as Mission Element Need Statements (MENS), Letters of Agreement (LOA), Required Operational Capabilities (ROC), and Letter Requirements (LR). In addition, the ability to make fuel-efficient improvements on equipment already in the field is being developed through the

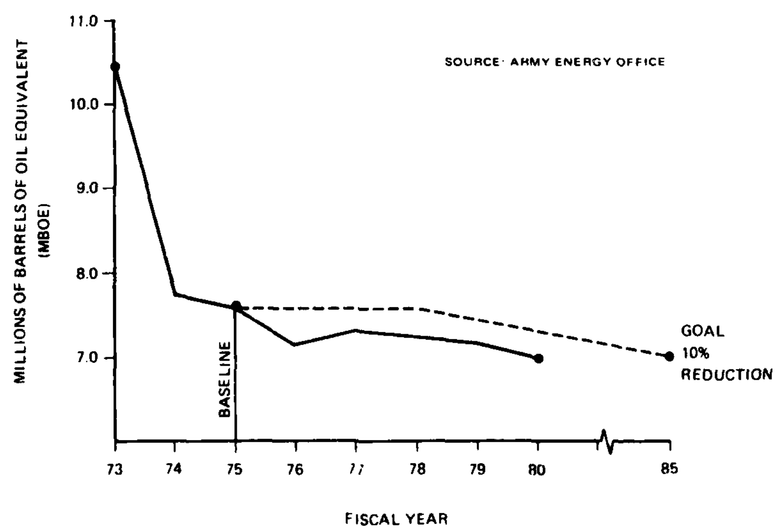


Figure 4-1. ARMY MOBILITY FUEL CONSUMPTION (MILLIONS OF BARRELS EQUIVALENT)

usé of a fast payback program specifically designed for initiatives in the energy area.

4.3.2.2 Reduction Initiatives.

The Army has initiated action in many areas in an attempt to reduce overall mobility fuels consumption. U.S. Army DARCOM Materiel Readiness Support Activity (MRSA) states that, to date, the Army Oil Analysis Program has provided no data that would permit extending oil change intervals. Some on-condition extensions have occurred. Physical property testing shows promise, and oil change intervals could possibly be extended to more than twice the present period, but as of this date, the only extension granted has been for one generator.

Transportation motor pools and tactical units have been directed to comply with the Clean Air Act provisions for inspection and maintenance. Compliance involves periodic testing of exhaust emissions to insure that emission contaminants are within Environmental Protection Agency certification parameters. These standards require that vehicle engines be properly tuned which will also provide the added benefit of reduced fuel consumption.

In the Army's evaluation of logistic acceptability and supportability of materiel systems under development or deployed, fuel economy is included as an important factor. Among ongoing actions stressing this factor is curtailment in the production of the 10-kilowatt (kw) turbine generator, due to a determination that the turbine uses three times as much fuel and costs three times as much as the diesel version of this generator. Since the turbine weighs less than half as much as the diesel, it will still be used where transportation weight is a factor.

Another fuel-saving development is a recent user/developer action to design a 1.5 kw tactical generator to run on methanol (alcohol) instead of gasoline or diesel fuel. Future developments will include larger generators using this fuel, resulting in further reduction in use of gasoline and diesel fuel.

The Army's Carpooling and Parking Controls Regulation, AR 210-4, expands the use of carpools and mass transit modes over one-car, one-person travel to and from work. Although this does not conserve Army energy, it does make a significant contribution to energy conservation and environmental quality on a national basis.

4.3.2.3 Army National Guard and U.S. Army Reserve Actions. The Army National Guard has initiated two programs designed to curtail POL consumption. The first program is energy allocation, based on FY 75 consumption, with some increase for aviation fuel necessitated by an increased flying hour program. An allocation is made to each state without regard for any specific type of fuel. To exceed this allocation, a state must present justification to and receive approval from the Chief, National Guard Bureau. The second program estimates fuel requirements in barrels. The program requirements for aviation fuel have increased because of aircraft modernization. Although the density of track and wheeled vehicles has increased considerably since 1975, the petroleum limits for FY 75 hold. Each state is held strictly responsible for energy conservation while meeting training readiness requirements.

The United States Army Reserve (USAR) actively participates in energy conservation measures that are operationally oriented and command influenced (e.g., POL, electricity, and other forms of energy conservation for installation/facility activities, training activities, etc.) as directed and managed by United States Army Forces Command (FORSCOM).

4.3.3 Traffic Management. In some instances the Army receives credit for energy savings only in terms of reduced cost for the service provided. In all cases, the energy savings assist in meeting the national goals. A number of traffic management actions have been taken with energy conservation spinoff benefits.

a. Stress adherence to the 55-mph maximum speed limit for motor vehicles.

b. Consolidate Army group passenger movements to make maximum use of carrier capability.

c. Increase use of surface transportation (bus/rail) for short-haul movement (450 miles or less) of Army passenger traffic.

d. Use scheduled commercial airlift in lieu of military aircraft, when it is available and meets requirements, and restrict use of special aircraft missions whenever possible.

e. Encourage consolidation of hold baggage with household goods (HHG) for surface transportation in international movements.

f. Establish an approval authority for air shipment of HHG, limiting air shipment to only those cases when hardship to service members would result.

g. Encourage service members to utilize the do-it-yourself method of moving personal property.

h. Maximize surface shipments of cargo whenever this method will prove responsive to requirements.

i. Encourage consolidation of cargo shipments and maximum use of capacity of vehicles, vessels, planes, and containers.

j. Carefully scrutinize requests for expedited modes and exclusive equipment use. Requests should be challenged where it does not appear warranted by logistical or security considerations.

k. Curtail TDY travel and utilize scheduled commercial surface carriers, wherever feasible, in lieu of commercial air, Government air or surface, or privately owned vehicles for passenger transportation.

4.3.4 Transportation Management.

4.3.4.1 Vehicle Management. During the FY 74 oil embargo and ensuing gasoline shortage, the Army initiated action to reduce the total number and size of the vehicles in its sedan fleet. On-hand, large, high fuel consumption vehicles will be replaced with smaller sizes through the normal replacement process as the large vehicles meet replacement eligibility criteria and the funding situation permits. Smaller sedans will assist in meeting the Army's gasoline consumption objective along with the improved gasoline mileage expected of newer models. Because of funding constraints, the Army did not buy the proposed quantity of replacement vehicles in FY 78, 79, 80, and 81. Consequently, the original goal to have 97 percent of the sedan fleet composed of compact and subcompact vehicles by FY 80 was not achieved. The goal has not changed but the target date - a function of funding - has been extended to FY 82, to be adjusted further if necessary. Table 4-7, using FY 77 as a base year, shows progress as of mid-FY 81 compared to the ultimate goal. Additionally, electric vehicles, scooters, and bicycles are being widely used for on-post courier, patrol and maintenance operations.

Table 4-7. ARMY SEDAN FLEET

	FY 77	FY 81*	Goal
Subcompact	364	499	364
Compact	4,483	6,485	10,837
Midsize	2,364	1,010	298
Large	4,913	3,198	25
TOTAL	12,124	11,192	11,524

Source: Army Energy Office
*As of 3/31/81

4.3.4.2 Aircraft Management. The following actions limiting aircraft utilization have had a definite impact on energy conservation:

a. Elimination of Combat Readiness Flying (CRF) requirements for aviators with less than 1,500 hours total time who are not in operational flying positions.

b. Introduction of Synthetic Flight Training System (SFTS) for Army aircraft. This greatly reduces actual flying time by substitution of synthetic flight time for CRF annual minimums and basic entry flight training. The Army has saved an estimated 18 million gallons of jet fuel in just the last 25 months. Additional savings are expected as more systems are introduced.

c. Consolidation of aircraft within company, brigade, and divisional-sized organizations--also consolidation in specific geographical areas. Amalgamation of aircraft will reduce aircraft usage through consolidation of missions without degradation of mission support.

d. Elimination of the minimum annual flying hour requirement to retain aircraft for administrative flying support purposes.

4.3.5 Near-Term New Initiatives (FY 80-85). One of the greatest challenges facing the Army in the near term is the selection and procurement of mobility equipment that insures no degradation in the state of readiness but maximizes fuel economy. The task is far from simple, particularly if the Army decides to restructure its 16 divisions, a decision which could be made as the result of tests at Fort Hood, Texas. The restructuring under consideration calls for greatly increased mechanization of the fighting force with highly mobile logistics support oriented well forward in the battle area. Studies conclude that a large percentage of the combat vehicles of the maneuver battalions will have to be replaced or extensively repaired during the first days of combat. The vast logistics fleet needed to support the fighting force will be subject to similar risk of early destruction.

Lack of sufficient data on wheeled vehicle energy consumption in an Army use environment caused the ASA(IL&FM) to issue a memorandum to the Director of the Army Staff in June 1977, suggesting that future wheeled-vehicle procurement give particular attention to the attainment of maximum fuel economies. To this end, and in furtherance of the President's energy conservation program, the memorandum further suggests that efforts be directed towards--

a. Purchase and test of commercially available vehicles in the military environment where adequate test data is not available.

b. Use of incentives which will encourage innovative design features and materiel usage to maximize fuel economy, with fuel consumption incorporated as a significant evaluation factor among established source selection criteria. It is further suggested that contracts include incentives that reward contractors for the achievement of fuel performance goals.

c. Conducting a comprehensive study directed at methods of attaining fuel economies in our wheeled-vehicle fleet.

Consistent with the above guidance, Army policy is being revised to require that energy requirements be (1) a documented evaluation factor in source selection of equipment development contractors, and (2) an agenda item, when appropriate, at decision reviews for equipment under development.

An important Army near-term energy-motivated program which meets the criterion of fuel economy is the M113A1 Armored Personnel Carrier modernization. The improved powerplant efficiency is expected to realize a 20- to 30-percent fuel savings which will have an even greater significance from a fuel economy standpoint, if the heavy division currently being tested is adopted by the Army.

The requirement imposed on the Armed Forces by DOD that they meet the substantive portions of state and local air quality regulations has caused the Army to develop an exhaust gas analyzer for use in inspection and maintenance (I&M) procedures for tactical and administrative wheeled vehicles. Early in FY 78, 500 of these systems were distributed to the field. This program for monitoring and analyzing the exhaust of each vehicle at intervals not to exceed the state requirement is expected to provide a fuel saving spinoff, by keeping vehicle engines properly tuned to meet primary standards for carbon monoxide and hydrocarbon emissions.

4.3.6 Long-Range Programs (FY 86-2000).

4.3.6.1 General. Readiness is the key word that motivates mobility operations programs. The capability of Army equipment, in well-trained hands, to best the enemy on the field of battle is the minimum acceptable standard. Energy consumption by this equipment is of major concern from the standpoint of the logistics effort necessary to keep it operational. A determination of what long-range mobility programs to pursue to meet the Army's energy goals and objectives while maintaining a high state of readiness must be prefaced by the following broad assumptions:

a. Force structure (total strength)/stationing will remain the same.

b. Army divisions will be restructured with emphasis on mechanization.

c. Current world East-West power balance will remain stable.

d. Synthetic fuels will replace petroleum-based fuels whenever possible.

4.3.6.2 Long-Range Outlook. Long-range planning has begun to be more closely scrutinized to incorporate the energy factor. The "Army Environment 1985-95" study by the Strategic Studies Institute, Army War College, contains numerous references to energy needs and resources as an item of major interest to the Army of the future. The Science and Technology Objectives Guide (STOG) will place greater emphasis and higher priority ratings on energy factors in the revision of STOG currently under way. As the principal users document, identifying force needs and requirements, the STOG plays an important role in establishing the parameters on which future equipment and weapons systems will be structured. These requirements are carefully analyzed in formulating specific weapon systems or equipment items to be incorporated into the Extended Planning Annex of the Program Objective Memorandum (POM). Thus, energy factors will enter directly into the long-range development cycle.

The incorporation of energy factors into the specifications for design and engineering of future Army combat mobility and operational requirements will require additional resources as well as tradeoffs of other requirement considerations. For this reason the specific nature of the Army's program in force structuring (equipment) will require very careful analysis and critical judgments. Many of the current high-mobility, high-maneuverability equipments have increased rather than decreased fuel requirements. A major example is the XM1 tank which is powered by a turbine engine. To achieve the higher speeds required by the user and to power the additional tank-bourne equipment, items will require much higher fuel consumption rates. This, in turn, will increase the logistic requirements factor in terms of the additional tankers, pipelines, pumps, etc., required to meet the increased needs. A similar statement may be made for most mobility made for most mobility equipment, whether land or air. Listed below are key energy projects under development. All will contribute to meeting the Army's mobility operations goals of reducing energy consumption to zero growth from FY 85 to the year 2000, and developing the capability to replace most, if not all, natural petroleum requirements with synthetic or alternate fuels by the year 2000, while increasing the efficiency of energy dependent mobility systems by 15 percent with no degradation to readiness.

a. Tire style versus fuel consumption.

b. Storage and delivery means for synthetic and alternative fuels.

c. Lighter weight vehicles.

d. Utilization of synthetic fuels.

e. Utilization of alternative fuels (gasohol, methanol).

f. Utilization of synthetic lubricants.

g. Energy-efficient diesel engines.

h. Battery-powered vehicles.

i. More energy-efficient engines and engine components.

4.4 TRAINING.

4.4.1 General. The Army, in conjunction with energy conservation goals, continues to allocate energy resources to training activities to the extent required to maintain readiness. The Army objective in meeting required readiness standards within the framework of energy conservation goals is to accomplish necessary training more efficiently and effectively.

4.4.2 Simulators. Simulators and simulation training devices are being developed by the Army to enhance training effectiveness, reduce training time and costs, and reduce energy usage.

4.4.2.1 Truck Driver Trainer. The truck driver training devices, in addition to providing improved training in a shorter period of time, will reduce the use of mobility operations energy. This device allows a student driver to practice many driving functions without the fuel and maintenance costs associated with using operational equipment. Not only will this reduce the energy consumed during training but fuel-efficient operation techniques will carry over into the everyday driving of both Army and personal vehicles.

4.4.2.2 Synthetic Flight Training System. Synthetic Flight Training System (SFTS) is an advanced state-of-the-art aviation training device. It has been demonstrated that it can reduce the cost to accomplish certain requisite training activities heretofore prohibited during actual flight. The newer generation of trainers (AH-1, AH-64) permits gunnery and missile firing training. This capability will afford a flight time offset in the training base and at the operational unit level.

4.4.2.3 Tank Systems and Fighting Vehicle Trainers. The training devices which help reduce mobility operations and energy consumption include the driver trainer and the conduct-of-fire trainer. The driver trainer duplicates the interior of the vehicle driver's compartment and permits the students to learn the controls and operator techniques without using the fuel associated with actual operation. The conduct-of-fire trainer permits realistic and effective training of gunners and commanders while supplementing or reducing live fire exercises currently required to achieve adequate levels of training. Accordingly, use of these trainers minimizes expenditure of ammunition, fuel, and operating costs associated with using actual vehicles.

The Army National Guard has also adopted the policy of macimum use of the mechanical simulators listed below in order to reduce energy consumption while maintaining unit readiness:

M55 laser device

M31 field artillery trainer

Sabot 81mm subcaliber device

Tank turret trainers

LAW 35 mm subcaliber device

Sand tables

Terrain boards

Pneumatic devices for mortars

6-wheel ATV combat vehicle simulators/train tracked vehicle operators

Flight simulators

4.4.3 Other Training Actions. Other actions in progress that are associated with troop training and exercises are:

a. Improving POL handling techniques to reduce waste and theft.

b. Consolidating garrison stay-behind detachments, thus reducing billet and support facility operating requirements.

c. Leaving equipment onsite when training will continue and troops must be returned to garrison.

d. Consolidating field training and range firing.

e. Moving heavy equipment on the most fuel-efficient vehicles.

f. Substituting nontactical vehicles for tactical vehicles wherever practical.

g. Developing 1/4-ton vehicle and/or dismounted training exercises in lieu of those using vehicles with greater energy consumption.

h. Utilizing dismounted troop movement when feasible.

The energy situation, the need for energy conservation, and training in energy conservation techniques are incorporated in the curriculums and training programs of all schools and training centers. Also, energy conservation is being stressed, on a continuing basis, in the Army Suggestion, Incentive Awards, and Command Information Programs. Promotional information for the Army-Wide Suggestion Campaign has emphasized the need for ideas to reduce costs and increase efficiency and economy of operations. Energy conservation has been among the major areas of concern.

4.4.4 Near-Term New Initiatives (FY 80-85).

4.4.4.1 Simulators. Utilizing simulators in lieu of a major item of equipment will play an ever-increasing role in training for the Active Army, National Guard, and USAR during this period and will make substantial contribution to energy and dollar savings in Army training. The Army will continue to develop and seek improvement in its current simlator inventory and to search for new areas of training in which simulators can be utilized. Listed in table 4-8 are the Army's estimated cost-avoidance for the near-term period through the increased use of flight simulators. Simulators currently under development with expected availability during the near-term period are:

Simulator	FY Availability
Observed Fire Trainer	1981
Tank Weapons Gunnery Simulator System	1985
Marksmanship/Tunnery Laser Device	1983
Command Group Simulator	1983
Flight Simulators	
AH-1FS	1979 - (Prototype fielded)
UH-60FS	1980 - 3d Qtr
AH-64FS	1982

Table 4-8. ESTIMATED COST-AVOIDANCE - USE OF FLIGHT SIMULATORS (FY 80-83) ($M)

		FY 81*		FY 82*		FY 83*	
		Hours	Dollars	Hours	Dollars	Hours	Dollars
	Flying	810,282		795,785		795,785	
UH-1	Simulator	183,000		186,000		186,000	
Savings	Total		29.8		30.3		30.3
	Flying	56,181		56,787		56,787	
CH-47	Simulator	3,658		4,200**		8,100**	
Savings	Total		1.9		2.2		4.3
			**CH-47 at Campbell 6/82-at Hood 8/82		***CH-47 in USAREUR 11/82		
	Flying	119,761		126,897		126,700	
AH-1	Simulator	3,122		3,356		3,375	
Savings	Total		0.5		0.5		0.5
	Flying	31,813		44,596		45,000	
UH-60	Simulator	550**		2,400***		3,500	
Savings	Total	simulator costs being determined		simulator costs being determined		simulator costs being determined	
		**OT Test 1st half FY		***OT Test through December			
	Flying	-0-		-0-			-0-
AH-64	Simulator	-0-		-0-			-0-
Savings	Total						
	Flying	1,018,037		1,024,065		1,024,272	
Grand	Simulator	190,330		195,956		200,975	
Total	Total						
	Savings		32.2		33.0		35.1

*Programed

4.4.4.2 Other Training Actions. The in-process revision of AR 350-1 (Army Training) will emphasize resource conservation in consonance with Army energy goals.

Several state National Guard training actions have been conducted and planned for the period FY 78-83 to assist in meeting energy conservation goals while still maintaining a condition of readiness. Among these are:

a. Idaho: completion in FY 79 of miniranges for subcaliber firing has reduced gasoline and diesel consumption for travel to regulation size ranges.

b. Illinois: construction of a weekend training site near Marseilles, Illinois, completed in FY 80, where equipment can be consolidated, thereby eliminating movement of many vehicles to and from the training site.

c. Arizona: planned construction in FY 81 of a bulk fuel dispensing system at decentralized facilities to reduce fuel consumption in refueling vehicles and equipment.

d. Washington: ongoing study to determine the economic advantage of installing air spoilers on cabs of trucks used to deliver equipment to units throughout the state.

e. Michigan: experimental program for an "Audio-Visual Conferencing System" has reduced travel to conferences or meetings but permit conferees to go to a central conference facility in their respective city and be able to communicate with each other from each location.

The USAR plans expansion of existing equipment concentration sites (ECS) at annual training sites (ATS) and construction of new ECS's where necessary to minimize the requirement for convoying vehicles to ATS for training. Currently designs are under way for providing new ECS's at Fort Carson, CO; Knox Field, AL; Fort Polk, LA; Fort Chaffee, AR; Los Alamitos, CA; and Seagoville, TX. Completion of these projects will help concentrate equipment near its area of usage/training and reduce movement of vehicles to and from the training sites.

4.4.5 Long-Range Programs (FY 86-2000). It is axiomatic that the keynote for success on the battlefield is a quality training program. However, a viable training program in the past has meant energy consumption on a large scale. The Army has two programs which are aimed at reducing energy consumption in training. These programs will continue to be pursued vigorously in the near-term and at this time they appear to offer the best opportunity for the savings in training energy consumption needed to meet the Army's long-range mobility operations goals. These programs are training energy conservation actions as outlined in paragraph 4.4.3, and the use of simulators, which are in use by the Active Army, National Guard, and Army Reserve. As new items of equipment are added to the Army's inventory during the long-range period, the Army will continue to actively pursue development and use of a full spectrum of simulations, simulators, and other training devices.

4.5 RESEARCH AND DEVELOPMENT.

4.5.1 General. Energy research and development in the Army is increasing in magnitude in direct proportion to the opportunities provided by developments in the private sector. The Army follows up on breakthroughs in the civilian sector in its search for new ways to reduce energy consumption. The Army Energy Research and Development Program (AERDP) consists of an Army Facilities Energy (R&D) Plan and an Army Mobility Energy (R&D) Plan. These plans are summarized at appendix B and C, respectively, and are discussed in the Army Energy R&D Plan dated 12 March 1981. The AERDP addresses two types of projects: energy-motivated projects and energy-related projects. Generally, facilities projects such as energy resources conservation and improved energy utilization for military installations and total energy/utility systems are energy-motivated. Mobility projects such as vehicle energy conservation and transmission and power systems are usually energy-related.

4.5.2 Army Energy R&D Programs (AERDP). The AERDP categories are four in number: Basic Research, Exploratory Development, Advanced Development, and

Engineering Development. Several projects are part of an extensive cooperative effort between the Army and DOE. In addition to the Joint Army-DOE effort, the Army, Navy, and Air Force are engaged in an energy R&D information exchange program designed to avoid duplication and to conserve energy.

4.5.2.1 Basic Research Program. The Research Program provides fundamental knowledge for the solution of identified military problems and forms the base for subsequent exploratory and advanced developments. In energy basic research, the technology of small engines for aircraft propulsion is being studied, with the payoff being reduced fuel consumption and cost. Power generation is being studied in terms of energy transformation, storage, and conversion systems for use in providing energy required for Army communication surveillance, fuzing, propulsion, and other critical applications.

Basic research on aircraft propulsion continues on aerodynamics, heat transfer materials sciences, and lubrication. Research also includes walls on primary lithium cells with new inorganic electrolyte solvent, direct oxidation hydrocarbon/ air fuel cells, magnetic field calculations in near-saturated media, computer-aided design for mobile electric powerplants, and superconductors to produce high-temperature material in forms suitable for applications to superconducting generators and motors.

4.5.2.2 Exploratory Development Program. The dominant characteristic of the exploratory development effort is that it is pointed toward specific military problem areas with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters. Energy exploratory development--

a. Includes the provision of propulsion technology for gas turbine engines.

b. Provides technological advances for the improvement of Army engine durability, fuel economy, fuel tolerance, simplicity, low emission, and compactness.

c. Improves on the technology of synthetic fuels and their utility as alternative fuels in Army surface and air powerplants.

d. Develops more efficient fuel cell systems.

e. Improves efficiency in energy use at Army facilities.

f. Identifies cost-effective alternate energy sources for use at Army installations.

g. Provides innovative facility-oriented energy management techniques.

During FY 80 exploratory development, the Army explored technologies that offered significant improvements in the small gas-turbine engines. Research investigated the sensitivity of new engine/systems components to alternative and emergency fuels, and continued research to develop cheaper and more efficient fuel cell systems. Also considered were the application of atomic, nuclear, and coal technologies to Army power needs and the efficient operation of energy systems with presently available resources.

4.5.2.3 Advanced Development Program. The Advanced Development Program includes all projects which have reached the stage of developing hardware and nonmateriel technological prototypes or techniques for experimental or operational test. The program includes advanced technological propulsion systems to insure satisfaction of mission requirements. Vehicle transmission/steering unit development provides for design development and testing of these systems and their associated subcomponents for both wheeled and tracked vehicles. Under energy conservation, the program evaluates and validates criteria for solar energy systems used for heating and cooling of buildings at military installations.

Aircraft engine efforts, begun in FY 76 in the 800-horsepower (hp) class advanced technology demonstrator program, will continue in FY 81. The vehicle transmission/steering unit development emphasizes development of the 600-hp hydromechanical transmission system for the 20-ton combat vehicle family. The vehicle engine program is concerned with developmental turbine diesel, rotary engines, and advanced high-performance diesel engine programs.

4.5.2.4 Engineering Development Program. This program includes those development projects which are being engineered for military service use but have not yet been approved for procurement or operation. It is characterized by major line item projects.

4.5.2.5 Near-Term New Initiatives (FY 81-86). In facilities R&D, short-term exploratory development in facilities energy technology will be pursued to support the President's goals for 20-percent reduction (Btu/ft^2) in energy consumption in existing buildings and a 45-percent reduction (Btu/ft^2) in energy consumption in new construction. This program will focus on:

a. Techniques for managing the use of energy

b. Installation energy consumption prediction to establish conservation goals

c. Evaluation of energy consumption for alternative design and operating conditions to provide a basis for energy system optimization and

d. Providing designers and facilities engineers with techniques for conservation investment maximization.

Additional facilities R&D new initiatives include the examination, field testing, validation or rejection of products, systems and techniques developed to improve efficiency, effectiveness, and economy of energy in military energy systems. Included for consideration in the examination are peak electrical demand, the efficiency of large boiler plants, detection of thermal loss, boiler convertibility, geothermal sources, low energy heat recovery, and nontactical generators.

The development of Army equipment requires a long leadtime, and as a result, the current and upcoming generation (FY 80-86) of equipment was not designed with energy consumption as a principal consideration. However, the Army is developing an expanded mobility R&D plan with emphasis on direct energy conservation, to include tactical wheeled vehicles. New initiatives in the mobility area involve fuel savings research into engine performance as well as improvements in mobility fuels and lubricants.

4.5.2.6 Long-Range Programs (FY 87-2001). The Army's long-range R&D facilities operations program is a continuing extension of the current and near-term orientation toward military energy technology which entails energy systems research designed to contribute to the achievement of the Army's long-range facility operations goals. The objectives of this research address the requirement to minimize the adverse impacts of increasing fuel cost and the decreasing availability of petroleum supplies for strategic, tactical, training, and routine Army operations. These objectives are the development of:

a. Effective energy conservation techniques to reduce energy consumption at military facilities.

b. Alternative energy sources for military facilities.

c. Techniques, procedures, and systems for effective management of energy resources used by the Army.

In the mobility operations area the Army's R&D will be a continuing effort to meet long-range mobility operations goals in reduction of both energy consumption and dependence on petroleum-derived fuels. General areas planned for reduction of energy consumption in field operations are:

a. Development of novel engine cycles and geometry for improved efficiency, especially at part-load.

b. Improvement of operational efficiency of internal combustion engines through development of diagnostic procedures and equipment.

c. Improvement of process control monitoring devices; e.g., "fluid pump," fluidic temperature, and fuel control sensors to optimize system efficiencies.

d. Improvement of operational efficiencies of internal combustion engines through incorporation of improved lubricants.

e. Extension of oil-change intervals for aviation and ground equipment.

f. Reduction of energy consumption in food processing by:

(1) Systems approach to energy management of food service operations.

(2) Reconstituting frozen foods.

(3) Utilizing packaging.

g. Development of improved laundry systems for conservation of energy and water.

h. Development of high-efficiency area-lighting equipment.

i. Elimination of unnecessary losses in electric power generation and utilization for military equipment.

Reduced dependence on petroleum fuels is to be pursued by:

a. Evaluation of synthetic fuels for aviation, automotive, and power generation.

b. Utilization of low-grade heat for alternate fuel production (by biological means).

c. Development of methods for production, storage, and utilization of coal/petroleum slurry fuel.

d. Production of methanol from municipal trash.

e. Application of solar energy for electric power (solar cells).

f. Investigation of new technology for high-efficiency hand-cranked generators.

g. Development of a high-power, fast-charge, lead-acid battery for peak load operation.

For a list of mobility operations projects being considered for implementation and funding in the long-range period, see appendix B. These projects have not been officially screened for relevance or priority.

4.5.3 Research and Development - Mobility Equipment. This category includes those research and development items initiated primarily to satisfy a validated need of the Army force in terms of accomplishing a specific combat or combat support mission. Except for the Army's portion of DOE/DOD joint initiatives such as photovoltaics and the development of specifications and testing methods for the use of synthetic fuels in military engines, these programs are justified on the basis of accomplishing this mission rather than their contribution to the achievement of the Army's energy goals. For this reason and because the portions of these programs that can be identified with reduced energy usage or reduced reliance on fossil fuels are at the task/subtask level, it is not possible to relate the programs' research and development funding directly to their contribution toward reduced energy usage. The Army's strategy for meeting its energy goals with respect to mobility equipment is to continue to manage these programs as an integral development while identifying and emphasizing the energy-relevant tasks and subtasks to ensure appropriate funding is provided for them.

4.5.3.1 Energy-Efficient Equipment. Army programs that contribute to energy efficiency or the use of more abundant energy resources include the following:

a. Fuel-efficient engines. The Army has several ongoing actions for fuel-efficient engines in combat vehicles. These programs include the AGT 1500 fuel economy improvements and an Adiabatic diesel engine. The AGT 1500 fuel economy improvements development will be completed in FY 82 and will move into application on production vehicles in FY 83. The adiabatic diesel engine (500-700 hp) promises to reduce fuel consumption by 30 percent while achieving a smaller, lighter propulsion system that is more powerful.

Also under development is a 10kW small gas turbine generator. Extensive progress has been made with this generator by; utilizing ceramics in improved components, increasing power density, improving the heat recovery system, and by engine operation at higher temperatures, which results in dramatic improvement in fuel economy.

An ongoing energy-related project worthy of spacial note is the previously mentioned improvement in powerplant efficiency for M113A1 armored personnel carriers. A new transmission, the Allison X-200, is to replace the Allison TX-100 transmission on the M113. The X-200 is far more efficient, providing an estimated 22 percent improvement in operating characteristics.

b. Suspension systems. The Army has a new suspension system under development called the Loopwheel. This new experimental suspension will cause a significant decrease in vehicle rolling friction if it is successful.

c. Electric power production. The Army is pursuing three major energy-related mobile electric power production RDT&E programs. The Army's fuel cell to be used as a power source to replace small gasoline-powered generators will reduce energy requirements by 75 percent. It will use a locally producible nonpetroleum synthetic fuel. The electric power production gas turbine ceramic component and gas turbine regenerative programs are aimed at improving performance as well as reducing fuel consumption.

4.5.3.2 Photovoltaics. A Defense Photovoltaic Program Office was established under Army direction in FY 79 to use terrestrial solar photovoltaic power systems in DOD. This initiative responds to legislation to promote federal agencies' use of solar cell equipment. Previous related efforts include a DOD and DOE demonstration program for solar cell applications and an analysis of the potential DOD market for such equipment.

An energy-motivated program of major significance to the Army is directed toward demonstrating the feasibility of solar cell (photovoltaic) energy conversion for a wide variety of military electrical power-consuming equipment. To date, several items of military equipment have been converted to solar cell power and transported to various military installations to be operated under more realistic military conditions. The Army is continuing participation with DOE in the Federal Photovoltaic Utilization Program by procuring and installing a large number of small- to medium-sized remote electric power systems throughout the Defense Department. The Construction Engineering Research Laboratory is studying the application of photovoltaic systems to military facilities. In FY 80, the Test and Evaluation Command designed and installed at Dougway Proving Ground a 4.5kw photovoltaic power system which powers a meteorological data collection station.

4.5.3.3 Synthetic fuels. The decreasing availability of fuel from conventional crude oil dictates investigation into other sources of mobility fuels to meet Army requirements for the foreseeable future. Conventional motor gasoline blended with alcohol (90 percent/10 percent mix), called gasohol, has been successfully used by both private individuals and state governments and offers many advantages. It is being used in Army administrative vehicles, and a thorough evaluation into its effects on tactical equipment is being made to qualify it as an acceptable fuel across the board. Synthetic fuels derived from oil shale, coal, and possibly tar sands, as well as blends of such synthetics with fuels refined from conventional crude-oil-based fuels, also are being evaluated to assess their ability to be used as alternate fuels as they become available.

4.5.4 DOE/DOD joint initiatives. The results of an investigation by the DOE/DOD joint initiatives working group identified nine initiatives which could be undertaken jointly by DOE and DOD. In addition to the initiatives, one installation in each service has been recommended to be a showcase installation. The initiatives that are wholly or partially within the Army's purview are:

(1) Photovoltaic development and utilization.

(2) A share of solar heating and cooling for buildings.

(3) Biomass-fired central heating plant.

(4) Pyrolysis plant for conversion of wood to liquid fuels.

(5) Use of synthetic mobility fuels.

(6) Energy "showcase" installation.

The division of funds between DOD and DOE for these initiatives is based on the use of DOE funds to cover research, development, design, testing, and high technical risk costs, and use of DOD funds to cover the capital costs of those projects that prove out, up to an amount equivalent to the estimated 10-year cost savings to DOD based on escalated future energy costs and straight-line present worth. Any additional capital costs would be allocated based on benefits which will accrue to DOD and DOE.

4.6 PUBLIC AFFAIRS

4.6.1 General. The public affairs aspects of the Army Energy Program has been given increased emphasis. The objectives and accomplishments of the program must be widely publicized in order to gain the awareness and support of the Army's internal and external audiences. A Public Affairs Plan (appendix D) which covers both the near-term and long-range periods has been developed to support the Army's energy plan as it evolves and is implemented. This plan provides for the dissemination and circulation of informational materials and outlines the responsibilities of the Office, Chief of Public Affairs, the Department of the Army Staff agencies, and the major commands.

As described in paragraph 4.6.4, the Secretary of the Army approved the establishment of the Army energy conservation award. It recognizes annually the Active Army, Army Reserve, and Army National Guard installations that show the greatest achievement in energy conservation. The intent is to develop a competitive spirit in the field.

Articles on Army energy initiatives have been published in several widely distributed civilian publications, as well as in Army Command Information media. The Army, in conjunction with the other services and DOD, also has taken action to produce a movie designed to get the message to the individual soldier.

An Army energy exhibit was designed and produced. It was first displayed at the annual AUSA meeting in Washington in October 1978. It was shown at the 6th, 7th, and 8th Energy Technology Conferences in Washington, D.C., and has been at DARCOM Headquarters, the DARCOM Facility Engineer Conference, the FORSCOM Facility Engineer Conference, the Worldwide RPMA Conference in New Orleans, Miami Beach EXPO '80, Detroit Energy EXPO, Houston EXPO 81, Tobyhanna Army Depot, USMA, and the Pentagon. The exhibit maintains a full schedule for showings across the country.

4.6.2 Energy Information Program. In support of the public affairs aspect of the Army Energy Program, one of the goals of this plan is to "expand energy conservation education/information and incentive programs for all civilian personnel and military personnel and their dependents." Annually, $200,000 will provide the resources necessary to further energy awareness in all employees and their dependents. This will be accomplished by; increasing the distribution of information packets, brochures, pamphlets; traveling exhibits; films; advertisements; and the establishment of an energy information exchange center. An informed energy consumer is the key to an effective Army Energy Program.

4.6.3 Energy Awareness. The Office, Chief of Public Affairs, has established "Energy Awareness" as part of its Annual Command Information Plan each year since 1977. This plan was used by all public affairs officers, and was supported by materials produced by DA, DOD, and DOE. The objectives of the plan are to make all members of the Army audience aware of the importance of energy conservation and of their responsibilities in that regard. In pursuit of the above-cited objectives, a wide variety of materials has been prepared and distributed. Joint OCPA/ODCSLOG publicity effort during CY 80 includes:

a. 68 news stories.

b. 24 radio spot announcements.

c. 41 ARNEWS features/messages.

d. 5 Commanders Call articles/features.

e. 3 one-minute TV spot announcements.

f. 15 pieces of artwork for Army editors.

The information disseminated topics on energy shortages, conservation, consumption, synthetic fuels, and strategic fuel reserves for use by some 400 Army National Guard, Reserve, and Active Army publications. It is estimated that 75 percent of these 400 publications used at least one article on energy in each 3-month period. A 1976 DOD study established that there is a potential readership audience for these materials of 35 million persons which includes Active and Reserve Army, National Guard, civilian employees, retirees, and dependents.

In addition to the efforts of The Office, Chief of Public Affairs, DA, on Energy Awareness, the Army Energy Office, DCSLOG, DA is developing an Army-wide Energy Awareness Program for initiation early in FY 82. This program is being designed to increase the entire Army community's awareness of the national energy problem, the DOD Energy Program, the Army Energy Program and the ways that the Army community can contribute to solving the problem. This program will utilize a variety of media and will include as a focal point an annual Energy Awareness Week and presentation of annual awards.

4.6.4 <u>The Secretary of the Army Energy Conservation Award</u>. An annual Army-wide Secretary of the Army Energy Conservation Award has been established. The objectives of the award are to provide added incentive to reduce energy consumption and to recognize the achievements of installations in exceeding energy reduction goals. Three awards will be presented annually to the Active Army,

Army National Guard, and Army Reserve installation which conducts the most outstanding energy reduction program during the preceding fiscal year. Fort Richardson, Fort McCoy and the Tennessee State NG were the recipients of FY 79 awards.

Criteria used to evaluate the installation's nomination is based on the following representive examples:

a. Methods and extent of implementing conservation measures: by command emphasis, training programs, publicity, energy suggestion, and car pooling programs, etc.

b. Short-term facilities retrofit: those accomplished, those budgeted, and those planned. Retrofit program should indicate cost and energy savings, either estimated or actual as applicable.

c. Long-term facilities retrofit: those budgeted, and those planned. Estimated cost and energy savings should be included.

d. Mobility operations fuel-saving schemes; e.g., use of simulations, consolidating unit movement activities: Each scheme should indicate actual or estimated fuel savings.

e. Results of energy conservation program: Results will be a comparison of the preceding fiscal year consumption against the designated base year consumption, as reported in the Defense Energy Information System (DEIS). The results may be adjusted for those installations which experience significant changes over which they cannot exercise control, such as mission changes, expansion of the installation, changes in tempo of operations, extensive new construction, or weather. The American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) guide will be used as a basis for computing adjustments.

4.7 REPORTING.

4.7.1 General. Presently, the Army relies primarily on The Defense Energy Information System (DEIS I and II) reports, which are concerned solely with energy consumption data for energy management information. The DEIS is designed to facilitate energy management by providing timely, up-to-date, reliable, and accurate information on all forms of energy except nuclear. For each energy resource, the system provides information on:

Quantity consumed.

Quantities on hand.

Prior FY/baseline period consumption.

Source of receipts.

Quantity sold to other services.

Usage by category.

Variance from the standard.

The DEIS further provides a means for evaluating energy consumption against established goals.

The DEIS procedure for reporting energy status applies to all Army activities including COE activities and the Army National Guard. Energy status of USAR activities is reported by host activities. The policies, procedures, and responsibilities concerning Army input to DEIS are outlined in chapter 5 of AR 11-27 and DOD Manual 5726.46. The reports are used by DOD and DA for management purposes and are furnished to non-DOD Federal departments and agencies and to Congress upon request. Therefore, it is mandatory that input data to DEIS be accurate.

In an effort to reduce computational errors and to meet Federal reporting requirements, ASD(MRA&L) Defense Energy Office has contracted to reprogram and restructure DEIS so that reports can be accepted in normal energy units of measure and the computations to convert them to Btu can be made by the Defense Logistics Agency computer to reflect Btu's per square foot for each reporting installation. Alternative and renewable energy sources will be added to the report also.

In addition to the DEIS I and II reports, the OCE receives annual reports, which summarize costs (including manpower, supplies, and energy) and quantity data. The Technical Data Reports cover fixed installation usage with the exception of Army National Guard and Army Civil Works activities. While these reports suffer from a time-lag factor, they are extremely useful to facilities engineers in managing their energy programs. An Annual Summary of Operations containing data compiled by Army installations is published and distributed to all installation engineers and other interested personnel.

4.7.2 DEIS I. DEIS I is a monthly report which reflects bulk petroleum fuels inventory, receipts, sales to DOD and non-DOD activities, and Army consumption and usage. The report is prepared as of 0800 hours local mean time on the last day of each month and reflects data to that time and date from the cutoff of the previous month.

4.7.3 DEIS II. DEIS II is a monthly report which provides information on utility-type energy resources. The report reflects inventories of coal and liquified petroleum gas (LPG), plus baseline and current consumption information on purchased electricity, natural gas, LPG, coal, and purchased steam, and includes data for tenants supported by the reporting agency.

4.7.4 New Reporting Initiatives. A recent Army Energy Management Study performed for the AEO, DCSLOG, DA, reflected a breakdown in the crossfeeding of information at the major command level. The study indicated the need for development of a command management information program in lieu of the present requirement of merely assuring the validity and timeliness of energy data for higher authority. The study recommended that appropriate information be forwarded periodically to the AEO as part of an overall energy management information program with the specific requirement that an annual narrative report outlining significant accomplishments and shortfalls be submitted by 31 December of each year from each major subordinate command.

The Construction Engineering Research Laboratory (CERL) is currently developing the Energy Consumption Reporting and Analysis System (ECRAS). The ECRAS is intended to be a single system for facility engineering energy consumption management and planning. It will employ energy utilization indexes to predict building energy consumption based on weather data and descriptive data on the facility. The final systems data base is bein designed to automatically provide the input data for a number of existing standard reports to include DEIS II. The intended benfits of the ECRAS include:

a. One-time entry of consumption data.

b. Budgeting by requirements.

c. Analysis of energy conservation program progress.

d. Automated reporting to higher headquarters.

e. Analysis of energy impact due to changes (actual or proposed) in real property inventory.

APPENDIX A

FACILITIES ENERGY PLAN

SUMMARY

A.1 INTRODUCTION.

A.1.1 Purpose. The purpose of this summary is to present the status of implementation of the Army Facilities Energy Plan (AFEP), dated 1 October 1978.

A.1.2 Relationship to the Army Energy Plan. The Army Energy Plan (AEP), dated February 1978, and revised 8 August 1980, provides a detailed background of the energy environment within which the Army must operate. The AEP has been augmented by messages from the Army Energy Office which demonstrate the urgency of the energy situation and the precarious balance of international and national policies pertaining to energy. The AEP directs development of detailed implementation plans which will support programing and budgeting documents. The AFEP further conveys the need for MACOM facilities energy plans and summaries of operations reports.

A.1.3 Enhancement of the Standard of Living. The enhancement of the standard of living for military personnel and their dependents is essential to attract and maintain an all-volunteer force. Unfortunately, the enhancement is directly related to, as in the civilian sector, the more prevalent ownership and use of convenient personal appliances, plus energy-intensive central air conditioning systems which are used throughout the modern modular barracks, and new family quarters. These higher living standards, combined with high-energy-consuming training aids like the modern flight simulators, computers, and computer terminals, have all resulted in increased electrical consumption. Therefore, more energy conservation is required in other areas both to meet goals and to continue to improve the quality of military life.

A.2 FY 80 ARMY-WIDE DATA.

A.2.1 Building Data. For purposes of standarization and the maintenance of an adequate audit trail, the size of each MACOM building floor area is that floor square footage that is specified by each of the MACOM's in their facility energy plan. The total size of building floor Army-wide that was maintained for FY 80 is 1,038 million square feet.

A.2.2 Energy Consumption. Energy consumption data were also obtained from the MACOM Facilities Plans. The data indicated that 208.5 trillion Btu were consumed by the Army MACOM facilities in FY 79. This represents a 9.99 percent reduction from FY 75. Table A-1 shows Army facility energy consumption by major command, and figure A-1 relates energy consumption by energy source. As can be seen from a review of figure A-1, the individual energy sources totals have all been reduced from the FY 75 totals as compared to FY 80 totals except for a slight increase in the use of electric in FY 78 and FY 79, and for steam in FY 79 and FY 80.

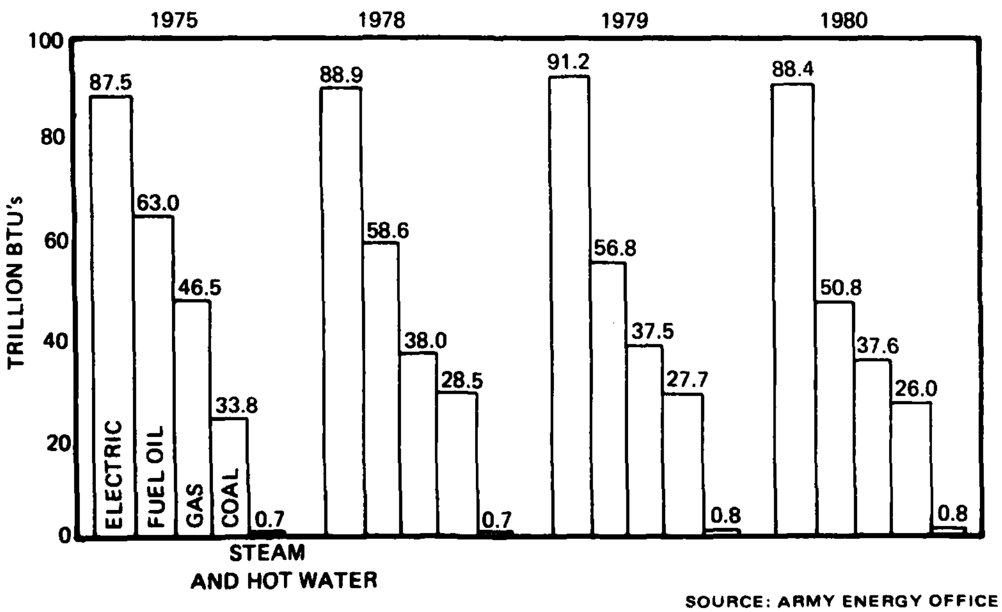


Figure A-1. ARMY FACILITY ENERGY USE BY ENERGY SOURCE

Table A-1. FACILITY ENERGY CONSUMPTION FY 75 - FY 80

	FY 75 Base Year	FY 78	FY 79	FY 80
COMMAND	TBTU	TBTU	TBTU	TBTU
DARCOM	62.4	47.9	46.7	43.9
MTMC	1.5	1.2	1.2	1.2
USAINSCOM	0.6	0.5	0.5	0.5
USAHSC	3.1	4.0	4.2	4.1
FORSCOM	53.5	53.8	52.1	48.6
USARJ	4.0	2.1	1.5	1.4
DAEN	1.1	1.1	0.9	0.9
MDW	1.2	1.1	1.0	1.0
EUSA	7.5	7.4	6.8	6.7
USMA	2.0	2.0	1.9	1.9
USAREUR	44.6	43.0	43.7	43.1
TRADOC	39.3	40.2	38.5	38.2
USACC	1.9	1.9	2.0	1.9
WESTCOM	2.1	2.5	2.8	2.7
SUBTOTAL	224.8	208.7	203.8	196.1
ARNG	2.6	2.7	2.9	2.5
OTHERS & COE PROCESS (ESTIMATED)	13.2	7.9	9.0	5.9
TOTAL ENERGY	240.6	219.3	215.7	204.5

Source: DEIS

A.3 ARMY PROGRESS TOWARD GOALS. In the facility operations, the Army has reduced overall energy consumption in FY 80 by 14.33 percent from FY 75, as stated above. The Army has reduced its Btu/sq ft by 16.9 percent in FY 80, compared to the FY 75 baseline figure. It is noted that DARCOM contributed a large part of the total savings. The DARCOM reductions result from an active conservation program and, to a presently undefined extent, from changes in mission and production.

A.4 MACOM PERSPECTIVES.

A.4.1 Energy Engineering Analysis Program (EEAP). The EEAP (formerly the Integrated Basewide Energy Studies (IBES)) is essentially complete at 54 installations and under way, in whole or in part, at over 82 installations. The implementation of the EEAP is proving to be the single most effective action taken to date to achieve our energy goals. Funding of the remaining EEAP will further help to replace the installation's undermanned and piecemeal efforts with a highly qualified and fully dedicated professional effort. This will provide precise definition of the installation's overall energy system and will result in early preparation of comprehensive, integrated, installation-wide energy conservation projects. The result should be maximum energy savings for minimum investments and the meeting of ECIP criteria. The ability to meet assigned FY-85 energy goals is strongly dependent on funding of the remainder of the EEAP.

A.4.2 Energy Conservation Investment Program (ECIP). The MCA includes funds that can be utilized by existing facilities to upgrade or retrofit current energy-intensive systems to convert them to a more energy-efficient operation. The Family Housing Management Account (FHMA) also has an ECIP account which provides for the retrofit of existing family quarters to reduce energy consumption. The FHMA ECIP is very important as the ongoing EEAP reveals that at a troop installation the family housing energy consumption accounts for 34 percent of the total electrical and heating energy consumed. See figure A-2 for typical energy distribution at Fort Hood, Texas. It also provides apprximately 50 percent of the potential opportunity to reduce energy consumption on the installation.

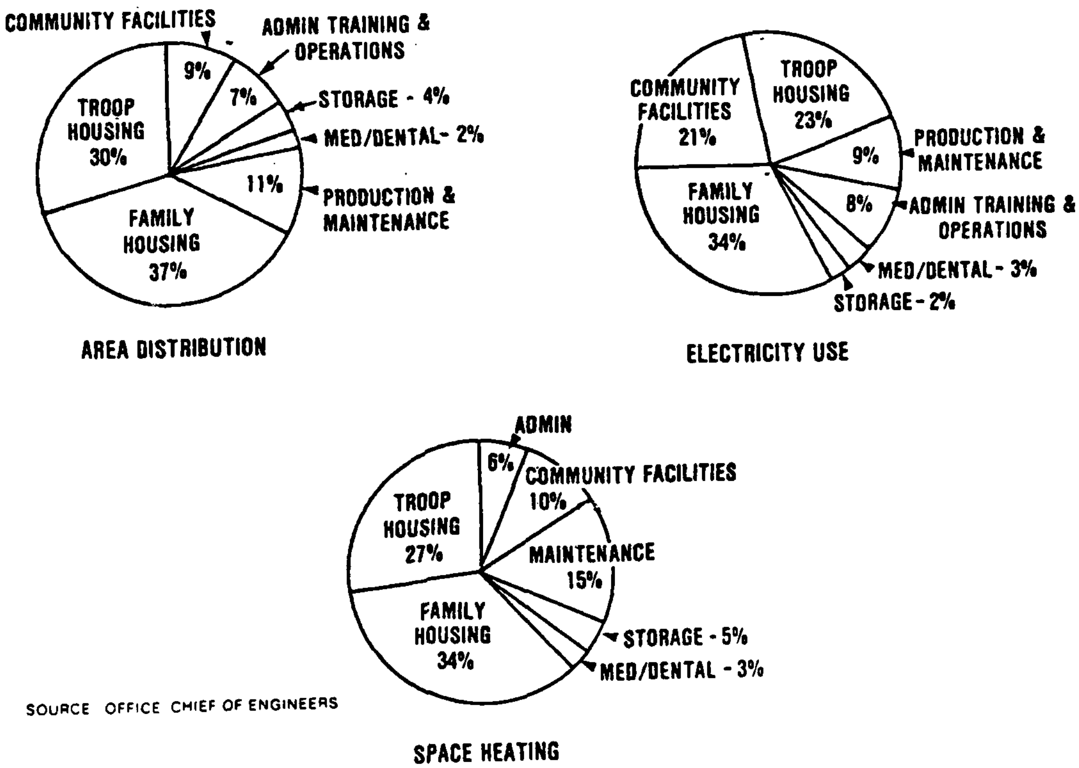


Figure A-2. DISTRIBUTION OF INSTALLATION ENERGY CONSUMPTION

The reduction in funding of the MCA ECIP and the FHMA ECIP below critical required levels will seriously jeopardize the attainment of the assigned energy conservation goals. This is particularly true in overseas MACOM's which have been excluded from ECIP funding in the program years prior to FY 81 (except where they consumed U.S.-source energy). They will have only 4 program years to achieve energy conservation goals through retrofit of existing facilities.

A.4.3 Personnel. An effective energy management program to reduce energy consumption in facilities requires a combination of administrative measures, increased supervision, improved management, public awareness programs, efficient operation and maintenance of utilities systems, scheduling of activities to minimize the use of energy, improved maintenance and calibration of equipment and controls, in addition to retrofit projects identified by the EEAP or installation personnel. The most fundamental obstacle to execution of the energy management program is the absence of a properly staffed and effective organizational structure to plan, implement, coordinate, and monitor total energy management programs. The MACOM's have partially identified their deficiencies in staffing which exceed a shortfall of 344 personnel. Without additional personnel, installations are prevented from realistically identifying energy deficiencies and properly programing for their correction.

A.4.4 Space Utilization. Responsibility for the proper utilization of facilities is a command function. Commanders are responsible for the proper, most efficient utilization of all facilities within their command through continuous planning and study, combined with an annual survey of occupied space. The building condition and degree of utilization are vital ingredients in the efficient management and implementation of an effective energy conservation program. The MACOM's and several installation commanders are paying renewed attention to these surveys and have found them profitable in reducing inefficient space and overall energy consumption.

A.4.5 General. Continuing energy shortages, combined with drastic increases in the costs of fuel, electrical power, and other utility services, require that conservation programs be given the highest priority and full commitment of all concerned. The very large expenditures required for ECIP, family housing ECIP, new energy-conservative construction, and energy management programs are absolutely essential if the Army is to achieve its energy goals by FY 85 and beyond. Managing an energy conservation program is difficult but executing the program without adequate resources is impossible.

APPENDIX B

ARMY FACILITIES ENERGY

RESEARCH AND DEVELOPMENT PROGRAM

SUMMARY

Scope

Development of products and systems to minimize adverse impacts on the Army's training and readiness mission due to rising energy costs and the decreasing availability of petroleum-based fuels.

Technical Areas

1. New Construction Energy Design Strategy - Development of tools, procedures, and technologies to insure that energy conservation is implemented cost-effectively at all stages of planning, design, and construction.

2. Installation Energy Conservation Strategy - Development of products and systems for implementing energy management and retrofit energy conservation techniques on military installations.

3. Installation Energy Systems Strategy - Development of the tools, procedures, and guidance to allow the Army to effectively design, procure, and use non-petroleum energy resources in new and existing Army facilities.

On-Going Program (FY 81-FY 82)

"New Construction Energy Design Strategy"

1. Validation of building energy analysis systems for evaluating heating and cooling design alternatives.

2. Identification of energy-sensitive decision points in the building design and delivery process.

3. Technique to use BLAST in concept design and with computer-aided design.

4. Evaluation of distribution systems.

"Installation Energy Conservation Strategy"

1. Evaluation of EMCS against Corps of Engineers Guide Specifications.

2. Development of a handbook of facilities energy use patterns.

3. Identification of retrofit conservation options for Army facilities built from standard design.

4. Strategy for implementing installation-wide energy conservation technologies.

5. Evaluation of retrofit conservation technologies.

"Installation Energy Systems Strategy"

1. Procedures for facilities and district engineers to use in evaluating the feasibility of solar energy systems for planned facilities.

2. Recommendations on fuels selection policy from present to year 2000.

3. Procurement and acceptance testing of heat-recovery incinerators.

4. Army installation energy storage systems (including annual cycle storage).

Mid-Term Program (FY 83-FY 88)

"New Construction Energy Design Strategy"

1. Energy analysis methods for long-range and master planning.

2. Energy analysis methods for use in sketch and concept design.

3. Methodology for use of energy analysis methods to provide energy-efficient facilities.

4. Advanced passive energy concepts.

5. Advanced energy system and control concepts.

6. Low-loss, reliable energy transmission and distribution systems for low-density building complexes.

"Installation Energy Conservation Strategy"

1. Facility Energy Data System.

2. System and procedures to establish priorities for energy conservation opportunities.

3. Upgrade existing HVAC control systems with new control algorithms and more reliable hardware.

4. Energy conservation techniques for industrial facilities.

5. Procedures to insure that buildings are operated energy-efficiently.

6. Standardize software and hardware for energy monitoring and control systems.

"Installation Energy Systems Strategy"

1. Procurement and acceptance specifications for solar energy systems.

2. Operation and maintenance procedures for solar energy systems.

3. Procurement and acceptance specifications for fluidized-bed combustion of solid fuels.

4. Expansion of technology for use of solid waste and biomass.

5. Procurement and acceptance specification for production and use of synthetic fuels.

6. Energy storage for facility energy systems.

7. Guide specifications for wind energy system design.

8. Operation and maintenance specifications for wind energy equipment.

<u>Long-Range Program (FY 89-FY 97)</u>

"New Construction Energy Design Strategy"

1. Advanced HVAC system and control concepts for low-energy and passive facilities.

2. Advanced energy analysis and design method for Army planners and designers.

"Installation Energy Conservation Strategy"

1. Automated system to generate energy consumption reports and predict energy consumption.

2. Procedures to test and evaluate energy monitoring and control systems.

3. Micro-computer applications to energy monitoring and control systems.

4. Procedures to permit full use of energy monitoring and control systems.

"Installation Energy Systems Strategy"

1. Applications of advanced solar energy systems to Army facilities.

2. Planning and design criteria for fuel plantations and biomass production.

3. Procedures to use hydrogen as a fuel at military installations.

4. Procedures for use of geothermal and photovoltaic energy systems.

5. Planning and design criteria for synthetic fuel heating plants.

6. Planning and design criteria for fuel-cell energy systems.

MISSION AREA	SUB AREA	TECHNICAL THRUST	PRODUCT/SYSTEM	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
Base Support	ENERGY	New Construction Energy Design Strategy	Military Construction Energy Design Strategy Program Development	81														
			Energy Analysis Methods for Army Planners and Designers	203	220	322	180											
			Energy Design Methodology Handbook		66	174	321	174	48									
			Advanced Building Envelope Concepts (Passive Energy Systems)				145	319	174									
			Advanced Heating, Ventilating and Air Conditioning Systems (HVAC) and Microelectronic Building Controls					298	413	513	290	320	480	390	220	110	500	
			Heating and Cooling Energy Distribution System Evaluation	40														
			Design and Construction of Low Energy Building (6.3A Demo)		[465]	[150]	[150]											
			Advanced Energy Analysis and Design Methods for Army Planner and Designers						350	450	350	500						
			Advanced Energy Distribution Systems				176	213	211	118								

C1

MISSION AREA	SUB AREA	TECHNICAL THRUST	PRODUCT/SYSTEM	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
	ENERGY		Microprocessor Application to Energy System Concept Design (Basic Research)	(65)														
			Optimum Air Flow In Hvac Fan Enclosure (Basic Research)	(45)														
			Basic Research, Energy Design Strategy		(60)	(40)	(50)	(50)	(60)	(65)	(75)	(90)	(100)	(120)	(120)	(130)	(140)	(150)
		Installation Energy Conservation Stragety	Installation Energy Conservation Stragety Program Development	169														
			Retrofit Conservation Alternatives for Standard Designs	78														
			Upgrading Existing Control Systems	144	150	104	160	19										
			Conservation Strategies for Industrial Facilities	90	211	101	100	27										
			Energy Conservation Operation of Existing Building		162	120	200											
			Handbook of Facility Energy Use Patterns	52														
			Energy Monitoring and Control System	83	199	120	156	134	189	200	230	490	520	680	490	260	180	

MISSION AREA	SUB AREA	TECHNICAL THRUST	PRODUCT/SYSTEM	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
			Facilities Energy Data System (FEDS)		123	222	206	244	45									
			Evaluation of Energy Conservation	150	220	285												
			Demonstration of Retrofit Package for Standard Design. (6.3A Demo)		[480]	[150]	[200]											
			Installation Wide Conservation Project (6.3A)		[1200]	[700]	[100]											
			Micro-Electrical Control Systems (6.3A Demo)			[607]	[399]	[399]	[200]									
		Installation Energy System Strategy	Army Facilities Fuel/Alternate Source Strategy	77														
			Procurement and Acceptance Specs for Direct Combustion of Solid Waste & Biomass	157	189	197	82	228	292	83								
			Procurement and Acceptance Specs for Fluidized Bed Combustion of Solid Fuels				253	287	212	181								
			Procurement and Acceptance Specs for Installation Production and/or Use of Synthetic Fuels					511	543	329	360	390	560	980	640	480	200	

MISSION AREA	SUB AREA	TECHNICAL THRUST	PRODUCT/SYSTEM	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
			Solar Energy Implementation Pgm	197	252	322	269	206	192									
			Energy Storage for Facility Energy Systems	58	100													
			Advances Solar Energy Application Program					248	224	290	320	260	180	90				
			Wind Energy Implementation Program				151	217	188	376								
			Geothermal Energy Implementation Plan					139	285	250	314							
			Photovoltaic System Implementation Program						349	350	350	250						
			Fuel Cell Utilization as Primary Power Source						140	210	240	340	320	150	60			
			Application of Advanced Renewable Energy Source Technology						180	240	410	290	110					
			Advanced Coal Use Strategy		142	179	173											
			Design of Fuel Plantatims for Biomass Production							380	410	530	620	840	1040	780	390	200
			Conversion Techniques for Hydrogen Energy Systems							220	340	420	730	840	680	490	280	170

MISSION AREA	SUB AREA	TECHNICAL THRUST	PRODUCT/SYSTEM	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
			Basic Research, Solid Fuels		(50)	(40)	(50)	(75)	(80)	(90)	(100)	(120)	(125)	(145)	(165)	(175)	(200)	
			Basic Research, Future Fuels			(40)	(50)	(75)	(80)	(90)	(100)	(110)	(120)	(125)	(145)	(165)		
			Army Applications of New Technology										500	670	1390	2950	4480	5790
			Advanced Residential Heating Systems (6.3A Demo)		[350]	[290]	[250]											
			TOTAL AT23 (6.1)	110	110	120	150	200	220	245	275	320	345	390	430	470	340	150
			TOTAL AT45 (6.2)	1597	2034	2146	2572	3264	4035	4190	3614	3790	4020	4640	4520	5070	5580	6160
			TOTAL AT09 (6.3A)	0	2495	1897	1099	399	200	-	-	-	-	-	-	-	-	-

APPENDIX C

ARMY MOBILITY ENERGY RESEARCH AND DEVELOPMENT PLAN

SUMMARY

C.1 INTRODUCTION. Energy is necessary to the Army in maintaining readiness to assure national security in peacetime, crisis, or war. The Army energy program, which is in concert with and in support of national energy goals, establishes the basis for reducing energy consumption, reducing dependency on conventional hydrocarbon fuels, and tasks the Army to obtain a position of energy leadership.

C.1.1 Purpose.

The overall objective of the Army Mobility Energy R&D Plan is to ensure a cohesive, coordinated program leading toward stronger mobility energy R&D that can respond to existing and future Army requirements to cope with the coordinated R&D energy programs and provide documentation for R&D resource allocation.

National security objectives can be achieved only if we are prepared to meet essential military energy requirements. The ability of the United States to deter armed conflict, to respond to military aggression, to field modern and effective weapons, to meet our worldwide commitments, even to exist as a nation, depends upon the availability of an adequate supply of energy of the type and quality to meet the needs of our armed forces. At the same time, the military must also be aware of and account for the needs of the economy.

C.1.2 Goals. The Army Mobility Energy R&D Plan, when implemented, should greatly assist the Army in supplying energy of the type, quality, and quantity for both short- and long-range timeframes. The plan concentrates on energy systems (structure, power sources, equipment) which will make more efficient use of fuels, reduce dependence on nondomestic fuels, and use less expensive and/or more plentiful (renewable) resources. The plan also provides for timely assessment of R&D effort towards Army energy goals and objectives which include:

a. Reducing energy consumption 35 percent by the year 2000 by reducing energy consumption in mobility operations 10 percent by FY85 with zero growth to the year 2000 with no degradation to readiness.

b. Reducing dependence on nonrenewable and scarce fuels by the year 2000 by developing the capability to use synthetic or alternate fuels for mobility operations petroleum requirements, and increasing efficiency on nonrenewable energy-dependent mobility systems by 15 percent with no degradation to readiness.

c. Attaining a position of leadership in the pursuit of national energy goals.

C.2 THE PLAN.

C.2.1 Mobility fuel consumption. In FY77 the Army consumed 765 million gallons of petroleum. By FY79 the Army had reduced this consumption by 12 percent to about 669 million gallons: 54 percent was for heating oil and the remaining 46 percent was divided among jet fuel, diesel, and gasoline. The mobility consumption of the Army's petroleum usage is 40 percent. In terms of total Army energy consumption, however, mobility operations account for only about 17 percent.

C.2.2 Plan framework. The framework for Mobility Energy R&D established for the plan is shown in Figure C-1. The four program areas shown are structured to allow inclusion of any type of project.

The technical performance plan, based on the four general program areas (fuels, other fuels, engines, and other equipment), shown in figure C-1, is shown in figure C-2. Besides the normal R&D and T&E phases, a Production and Standardization (P&S) and Demonstration phase have been included. The Production and Standardization phase is important for the fuels portion, and the Demonstration phase is included to identify existing and future cooperative efforts between DOE and DOD (DA) such as the solar photovoltaic DOD demonstration program.

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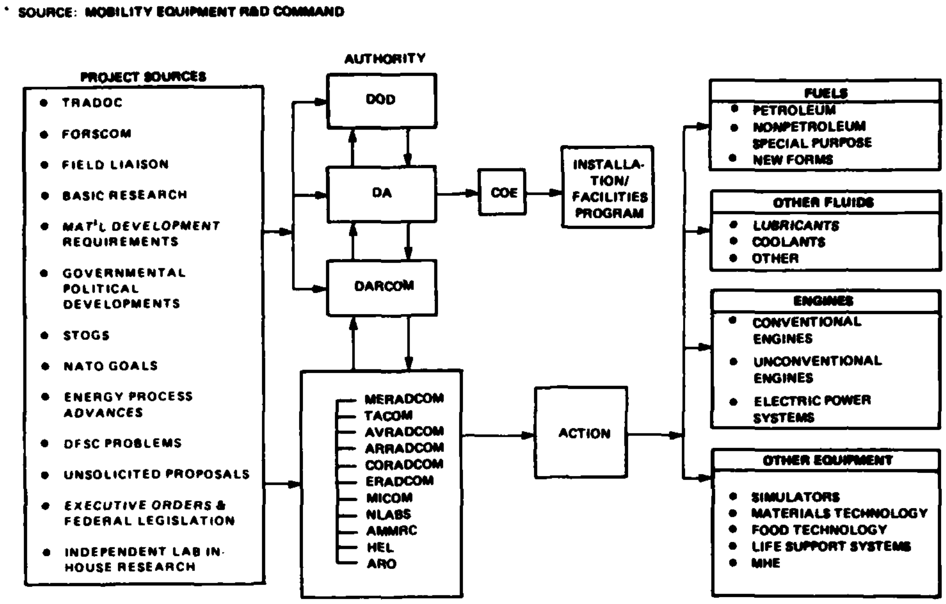

Figure C-1. Framework for Mobility Energy R&D Program

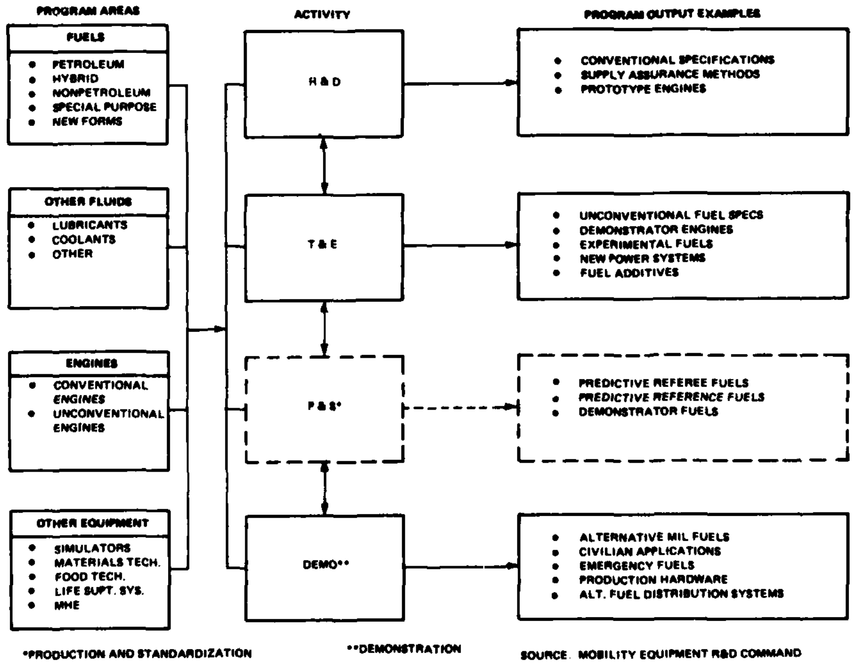

Figure C-2. Performance Plan for Mobility R&D Program

C1

An important feature of the technical performance plan interaction and coordination effort is the assessment activity shown in figure C-3. The assessment activity includes development of a methodology to allow a quantified assessment of funded and unfunded programs/projects, establishing a workable data base, conducting a needs analysis, determining gaps and voids, and making recommendations of new or modified efforts.

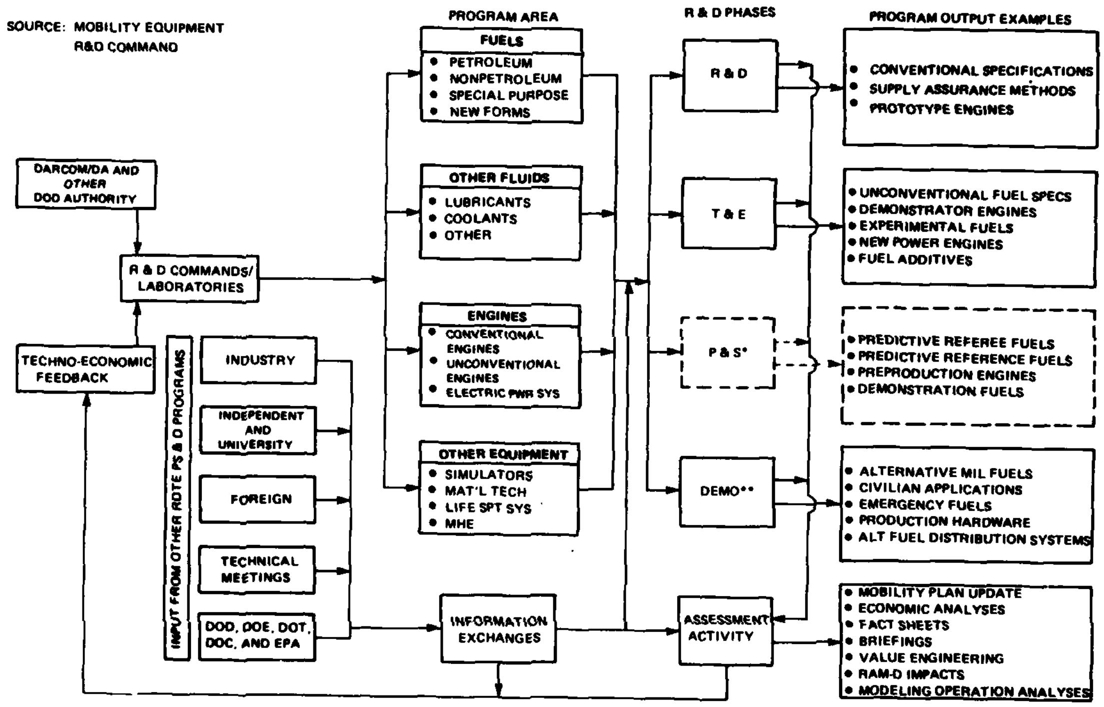

Figure C-3. Mobility Energy R&D Program Technical Performance

C.2.3 <u>Plan development</u>. The process of developing the Army Mobility Energy R&D Plan included requesting and receiving recommendations for energy/energy-related projects from all DARCOM R&D Commands. One hundred forty-nine inputs were received. They were subjectively assessed for "energy relevance" and assigned values as shown in figure C-4. They are summarized in figures C-5 through C-7, and are cataloged into the four program areas shown in figure C-1.

VALUE

5 -MUST PROGRAM, SHOULD BE FUNDED, EXCELLENT ENERGY SUPPORT

4 -HIGH POTENTIAL, SHOULD BE FUNDED, HIGH ENERGY SUPPORT

3 -GOOD, FUNDED IF MONIES EXIST, GOOD ENERGY SUPPORT

2 -MARGINAL, LIMITED SUPPORT TO ARMY ENERGY GOALS

1 -UNDECIDED, NEED TO EXAMINE IN FY80 TO DETERMINE IF IT SHOULD REMAIN IN ENERGY PLAN

0 -NOT ENERGY-RELATED

NOTE: Makes no judgment on project to meet Army requirements; only its contribution to Army mobility energy R&D.

Figure C-4. Assessment Value (Energy Relevance) for Mobility Energy R&D

TITLE	CMD	ENGY R&D	RD CAT	COMMAND OBJECTIVE PROJ	CFY	RFY	TFY
FUELS							
FUEL STABILITY & TEST DEVELOPMENT	MER	4	6.2	AH20	75	100	125
ALTERNATIVE/SYNTHETIC FUELS	MER	5	6.2	AH20	2165	430	700
HIGH ENERGY FUELS	MER	3	6.2	AH20	75	100	100
GASOHOL EVALUATION	MER	4	6.2	AH20	658	0	0
MILITARY FUEL MONITOR	MER	1	6.3	D150	0	0	100
HIGH ENERGY FUELS	MER	3	6.3	D150	0	200	0
USER ACCEPTANCE TESTING OF FUELS	MER	1	6.3	D150	0	350	1500
OTHER FLUIDS							
NON PETROLEUM-BASED HYDRAULIC FLUIDS	MER	1	MACI	3582	200	200	150
LONG-LIFE COOLANT SYSTEM	MER	2	6.2	AH20	100	125	125
USE OF RECYCLED OILS	MER	2	6.2	AH20	90	50	150
ANTIFREEZE EXTENDER/ CONDITIONER	MER	3	6.2	AH20	250	0	0
ALL SEASON TAC ENGINE OIL	MER	2	6.2	AH20	375	350	350
IMPROVED GREASE (GAA)	MER	1	6.2	AH20	110	225	325
IMPROVED FUEL STABILITY	MER	2	6.2	AH20	150	100	125
LONG-LIFE COOLANT SYSTEM	MER	2	6.3A	D150	0	200	0

Figure C-5. Fuels/Other Fluids - Testing and Evaluation - Funded ($K) (as of November 1980)

COMMAND OBJECTIVE TITLE	CMD	ENGY REL	RD CAT	PROJ	CFY	BFY	TFY
ENGINE COMBUSTION RESEARCH	ARO	1	6.1	BH57	1343	1612	1934
ENGINE CONCEPTS FOR ALT FUELS	TAR	5	6.2	AH91	900	1000	1500
VARIABLE CAPACITY ENGINE	AVR	3	6.2	AH76	190	245	0
ALT/MULTIFUEL ENGINES FOR MEP	MER	4	6.2	AH20	1500	1500	2500
ADVANCED HEAT ENGINES	MER	4	6.2	AH20	113	130	130
ADIABATIC DIESEL ENGINE	TAR	4	6.2	AH91	600	550	1440
MULTIFUEL ENG FOR TAC/ COMB VEH	TAR	5	6.2	AH91	900	1000	1500
ADV TURBINE COMPONENTS	TAR	4	6.2	AH91	0	521	1000
ADVANCED HEAT ENGINES	MER	4	6.3	DG11	1600	500	0
ADV 1000 HP DIESEL ENGINE	TAR	3	6.3	DG07	2600	0	0
FUEL-EFFICIENT ENGINE (FEE 500)	AVR	3	6.3	N	0	2	3
CH-47 EFFICIENCY IMPROVEMENT	AVR	3	6.3	D447	0.1	8.3	10.75
AGT-1500 FUEL ECONOMY PROGRAM	TAR	3	6.3A	DG07	750	1650	2200
ADIABATIC DIESEL ENGINE	TAR	4	6.3A	DG07	2577	4349	6000
IMPROVED HELICOPTER ENGINES	AVR	5	6.3A	D447	837	5661	9325
MULTIFUEL ENG FOR TAC/ COMB VEH	TAR	5	6.3A	DG07	0	2000	3500
ENGINE CONCEPTS FOR ALT FUELS	TAR	5	6.3A	DG07	0	2000	2500
MULTISOURCE FUEL ENGINES	AVR	5	6.4	DC72	8	6.6	5.4
ADVANCED HEAT ENGINES	MER	4	6.4	D194	0	0	910
UH-1 EFFICIENCY IMPROVEMENT	AVR	5	6.4	N	4.5	0.5	8

Figure C-6. Engines - Funded ($K) (As of November 1980)

COMMAND OBJECTIVE TITLE	CMD	ENGY REL	RD CAT	PROJ	CFY	BFY	TFY
ELECTRIC VEHICLE EVALUATION	TAR	4	MACI	4331	27	27	0
RADIAL VS BIAS PLY TIRES	TAR	2	MACI	6003	530	30	0
HYBRID FUEL CELL	MER	3	MACI	3787	225	250	0
COMPARATIVE ANAL/ MOBILE CONS	MER	3	MACI	5398	500	500	300
EFFICIENT MOBILE LAUNDRY EQUIP	NAR	0	PIP	C112	125	0	0
FUEL CELL POWER PLANTS	MER	5	6.1	AH51	320	320	320
ELECTRONIC DEVICES RESEARCH	ERA	0	6.1	AH47	310	320	320
EFFICIENT MOBILE ELEC PWR SYS	MER	3	6.1	AH51	80	80	80
MISSILE TECH - NONMETALLIC COMP	MIC	3	6.1	A214	250	250	275
RING LASER GYROS	MIC	2	6.1	N	250	500	0
SEALS/WEAR	AVR	5	6.1	AH45	81	86	91
EFFICIENT ENV CONTROL EQUIP	MER	3	6.2	AH20	200	144	100
EFFICIENT MOBILE ELEC PWR SYS	MER	3	6.2	AH20	530	550	550
FUEL CELL POWER PLANTS	MER	5	6.2	AH20	220	270	250
REDUCTION OF FOOD WEIGHT/BULK	NAR	0	6.2	BB10	300	300	500
IMPROVEMENT IN FOOD PACKAGING	NAR	4	6.2	AH99	65	65	100
AIRDROP SIMULATION	NAR	2	6.2	D283	200	200	200
LIGHTWEIGHT SUSPENSION COMPS	AMM	0	6.2	AH84	350	250	0
SAMARIUM-COBALT GEN TECH	ERA	3	6.2	N	100	0	0
POWER SOURCES FOR ELEC DEVICES	ERA	0	6.2	AH94	650	880	90
ADV COMPOSITE MATLS/ STRUCTURES	TAR	2	6.2	AH91	325	275	0
AERODYNAMIC DESIGN TECH	MIC	2	6.2	A214	50	400	0
BLOCKED ISOCYANATE LINERS	MIC	2	6.2	A214	100	0	0
THERMAL EMISSION PATTERNS	MIC	2	6.2	IL67	200	300	15
ENGINE MAINT TECHNOLOGY	MIC	3	6.2	N	300	500	30
VORTEX TUBE DEVICES	MIC	3	6.2	N	100	0	
ENERGY-EFF COMPUTER EQUIP	MIC	2	6.2	A214	150	150	10
TRACK RUBBER	TAC	3	6.2	AH91	225	300	0
CERAMIC COMPONENT TECH	AMM	4	6.2	AH84	275	300	275
PLASTIC PRODUCTION TECHNIQUE	MIC	3	6.2	N	250	0	0
ADV MATERIALS APPLICATION	AVR	3	6.2	AH76	98	113	0
ADV DIGITAL TECHNOLOGY	MIC	2	6.2	N	100	200	0
LOW-POWER CONS DIGITAL LOGIC	MIC	2	6.2	N	500	800	30

Figure C-7. Other Equipment - Funded ($K) (As of November 1980) (Sheet 1 of 2)

COMMAND OBJECTIVE TITLE	CMD	ENGY REL	RD CAT	PROJ	CFY	BFY	TFY
UTILIZATION OF OFF-PEAK GEN	MIC	2	6.2	N	200	200	20
WIND TUNNEL MODELS	MIC	2	6.2	A214	75	75	0
REDUCED SIM TESTING	MIC	3	6.2	N	30	50	6
ARMY MOBILITY ENERGY R&D PLAN	MER	-	6.2	AH20	200	110	0
FUEL CELL POWER PLANTS	MER	5	6.3	DG11	1320	2390	1058
FLUIDIC TEMP SENSOR	HDL	3	6.3	N	0	175	115
ADV HYDROMECH TRANSMISSION	TAR	3	6.3A	D395	1825	975	600
CONTRASTING GROUND COVER	MER	0	6.3A	DK82	150	150	200
EFFICIENT FIELD OVEN/ GRIDDLE	NAR	1	6.3A	D610	55	0	0
SAMARIUM-COBALT GEN TECH	HDL	3	6.3A	N	250	0	0
ADV TACTICAL POWER SOURCE	ERA	0	6.3A	DG10	1460	1300	1420
EFFICIENT ENV CONTROL EQUIP	MER	3	6.4	DL39	500	872	562
FUEL CELL POWER PLANTS	MER	5	6.4	D196	4260	1239	334

Figure C-7. Other Equipment - Funded ($K) (as of November 1980)
(Sheet 2 of 2)

C.2.4 Management.

The management of the Army Mobility Energy R&D requires no change at the DA or DARCOM level, and can be executed through existing programs/projects. However, during the yearly DA/DARCOM RDTE reviews, energy projects should be highlighted.

The Mobility Equipment R&D Command (MERADCOM) updates the plan, does general coordination, develops the assessment methodology, does needs analysis, develops the necessary data base, and makes appropriate program recommendations.

C.3 PROGRAM THRUSTS. Three major programs were identified as particularly relevant to the Army energy goals and objectives: Alternative Fuels, Fuels and Lubricants, and Engine Development.

C.3.1 Alternative fuels.

The FY81, 82, and 83 programs for the shale-oil-derived portion of the alternative fuel program are shown in figures C-8, C-9, and C-10. The other major effort in the Alternative Fuels Program, Gasohol Evaluation, is shown in figures C-11 and C-12.

TASK	AMOUNT, $K
LABORATORY CHARACTERIZATION	715
MICROBIOLOGICAL/ADDITIVE RESPONSIVENESS	50
COMPATIBILITY:	
MATERIALS	25
COMPONENT, FHE	100
COMPONENT, COMBUSTION EVALUATIONS	100
TOXICITY	145
ENGINE ENDURANCE TESTING:	
GROUND SPT EQUIP	200
VEHICLES	160
AIRCRAFT	150
LIAISON/COORDINATION	175
SYSTEMS ANALYSIS & ASSESSEMENT	50
	80
FUEL PREP/TRANS/STOR	100
TOTAL	2045

Figure C-8. FY81 Program Alternative Synthetic Fuels - Shale and Coal Synfuel Effort

TASK	AMOUNT, $K (SHALE)	(COAL)
LABORATORY CHARACTERIZATION	200	(600)
MICROBIOLOGICAL & ADDITIVE EVALUATIONS	-	(100)
COMPATIBILITY:		
MATERIALS	100	(150)
COMPONENT, FHE	150	(150)
TOXICITY	100	(250)
ENGINE ENDURANCE TESTING:		
GROUND SPT EQUIP	200	(300)
VEHICLES	200	(250)
AIRCRAFT	200	(125)
LIAISON/COORDINATION	250	(225)
VALIDATION FIELD TEST	350	-
SYSTEMS ANALYSIS	150	(120)
FUEL PREPARATION/TRANSPORTATION/STORAGE	200	(200)
	2100	(2470)
TOTAL	4570	

( ) = UNFUNDED

Figure C-9. FY82 Program Alternative Synthetic Fuels - Shale and Coal Synfuel Effort

TASK	AMOUNT, $K
LABORATORY CHARACTERIZATION	100
MICROBIOLOGICAL & ADDITIVE EVALUATIONS	0
COMPATIBILITY:	
MATERIALS	0
COMPONENT, FHE	0
TOXICITY	0
ENGINE ENDURANCE TESTING:	
GROUND SPT EQUIP	0
VEHICLES	
AIRCRAFT	500
LIAISON/COORDINATION	250
VALIDATION FIELD TEST	1000
SYSTEMS ANALYSIS	0
FUEL PREPARATION/TRANSPORTATION/STORAGE	500
TOTAL	2350

Figure C-10. FY83 Program Alternative Synthetic Fuels - Shale Synfuel Effort

TASK	FUNDED, $K
LABORATORY CHAR/COMPATIBILITY	88
ENGINE DYNAMOMETER/EQUIPMENT TESTING	200
TACTICAL FLEET TESTING	214
LIAISON	156
TOTAL	658

Figure C-11. FY81 Program - Gasohol Evaluation

TASK	FUNDED, $K
LABORATORY CHAR/COMPATIBILITY	0
ENGINE DYNAMOMETER/EQUIPMENT TESTING	0
TACTICAL FLEET TESTING	100
LIAISON	50
TOTAL	150

Figure C-12. FY82 Program - Gasohol Evaluation

C.3.2 Engine development.

The funding profiles for recommended Army engine development are shown in figure C-13 with total funded and unfunded displayed. It became obvious in developing an Army engine program that DA policy accepted from the "Wheels Study" for vehicle engines needs to be reexamined in light of the recent developments in energy, particularly petroleum energy, and the emphasis on conservation, efficiency, and use of alternative fuels. The basic thrusts of the engine program should encompass:

o R&D to develop multifuel engines and engines capable of operating on multi-source fuels.

o R&D to develop engines that use other than conventional liquid fuels.

o Improving efficiency of existing engines through new engine component developments and economic retrofit.

Command		FY80	FY81	FY82	FY83	FY84	FY85	FY86	FY87
TACOM									
	Funded	22173	11777	20070	26140	16809	17022	13402	-
	Unfunded	-	2952	1150	1650	4125	4150	2924	-
MICOM									
	Funded	100	-	-	-	-	-	-	-
	Unfunded	-	200	500	-	-	-	-	-
AVRADCOM									
	Funded	550	4937	20161	26925	20995	8000	5400	5000
	Unfunded	9315	4990	21096	28837	22838	14636	3000	-
MERADCOM									
	Funded	1780	1713	630	1040	1630	2530	-	-
	Unfunded	100	1500	1500	2500	2500	1500	-	-
ARO	Funded	1169	1343	1612	1934	2321	-	-	-
	Unfunded	-	-	-	-	-	-	-	-

Figure C-13. Army Engine/Hardware RDTE Programs ($K) (as of November 1980)

C.3.3 Other efforts. Other efforts that are proposed for consideration and planning during CY81 and beyond are:

o Contingency planning for the transition from petroleum to synthetic fuels.

o Increasing the use of simulators in training (designed for maximum energy efficiency).

o Modification or selection of automotive engine lubricating oils and other fluids for use with alternative fuels and for conservation.

C.4 CONCLUSIONS

The overall assessments or findings on the Army Mobility Energy R&D efforts, as they exist today, are:

a. The Army needs a better coordination process, within the R&D community, at the DA level and outside DA.

b. The Army needs to actively support and seek funding, or continue funding, energy-relevant programs, especially alternative fuels, fuels and lubricants, engine development, and material development.

c. The Army needs to reconsider that portion of the "Wheels Study" which essentially prohibits engine development work.

d. The Army organization and project structure is adequate to accomplish the R&D.

e. The methodology for determining "Energy Relevance" needs to be broadened to include projects that do not contribute immediately to the Army energy goals but have significant long-range potential (i.e., material development, combustion studies, carburetor, and fuel injection studies).

f. There is possibly limited funding for efforts towards petroleum conservation (reduce petroleum consumption by 10 percent by 1985, goal 1a) (see Table 6).

1,400K in FY80	(6.2 and 6.3a)
1,915K in FY81	(6.2 and 6.3a)
2,000K in FY82	(6.2)

However, Army Mobility Energy R&D may not positively contribute toward this goal, particularly if many of the major projects introduce hardware into the field; e.g., the M1 battle tank consumes fuel at a much higher rate than the M60 tank.

Current funding for the Army goal of improving efficiency of (engines) mobility systems 15 percent by the year 2000 is now low:

$184K in FY81	(6.1, 6.2, 6.3A)
$210K in FY82	(6.1, 6.2, 6.3A)
$113K in FY83	(6.1, 6.2, 6.3A)

When compared to total requested funds:

$6652K in FY81	(funded and unfunded)
$6971K in FY82	(funded and unfunded)
$6035K in FY83	(funded and unfunded)

The funding for the Army goal of developing the capability in mobility operations to use alternative/synthetic fuels by the year 2000 appears to be funded at less than one-half of the total requested. The largest shortfall is for qualification of Army aircraft on alternative fuels. A complete discussion of the funding situation is contained in the Army Energy Research and Development Plan, dated 12 March 1981.

APPENDIX D

PUBLIC AFFAIRS PLAN

D.1 PURPOSE. To provide public affairs support for the Army Energy Plan and for the implementation of Army energy conservation programs and policies.

D.2 OBJECTIVES. The objectives of the Public Affairs Plan are to:

a. Inform internal and external audiences through the use of all available media resources of the Army's plans, goals, and achievements in energy conservation.

b. Inform the internal audience of the need to exercise initiatives in conserving energy.

c. Demonstrate to the general public and the media the Army's concern for conserving energy and its contributions to the nation's overall energy conservation efforts.

d. Obtain feedback to ensure understanding of the Army Energy Plan and to refine continuing public affairs programs.

D.3 EXECUTION. Guidelines and assignments for the execution of the Public Affairs Plan are outlined below.

D.3.1 General.

a. Public affairs programs may use informational materials provided by all staff agencies and commands.

b. Informational materials for national release will be coordinated with the Office of the Chief of Public Affairs (OCPA), ATTN: SAPA-PP.

c. Close coordination will be maintained between OCPA, DA Staff agencies, and all major commands to provide maximum public affairs support for the Army Energy Plan.

d. Public affairs programs should be developed, established, and executed in accordance with AR's 360-5, 360-61, 360-81, 11-27, and the Army Energy Plan.

D.3.2 Responsibilities.

D.3.2.1 DA Staff Agencies.

a. Comply with the provisions of paragraph 4b, CSR 360-1.

b. Provide a knowledgeable spokesperson to respond to media queries about tests/evaluations/studies/programs/policies/accomplishments pertaining to energy conservation which have been or are being conducted through the respective staff agencies.

c. Use staff agency media to disseminate information about Army energy programs.

D.3.2.2 ODCSLOG.

a. The Army Energy Office (DALO-TSE) will provide fact sheets, information briefs, and similar materials for use in preparing news releases and feature articles.

b. The Army Energy Office is developing a comprehensive Army-wide Energy Awareness Program for initiation in FY 82 to increase the Army community's awareness of the national energy problem and the DOD and Army programs aimed at solving the problem. A focal point to be included will be an Energy Awareness Week and presentation of annual awards.

c. Provide a knowledgeable spokesperson to respond to queries or requests for interviews from the media about the Army Energy Plan and energy conservation programs in general.

D.3.2.3 OCPA.

a. Coordinate and monitor the provisions of the Army Energy Plan and provide additional guidance as required.

b. Ensure that all appropriate public affairs resources are used in disseminating information about Army energy conservation programs and in executing the Army Energy Plan.

c. Coordinate through the Office of the Assistant Secretary of Defense (Public Affairs) all information materials for release to the national media.

d. Respond to queries from the media and public.

D.3.2.4 OCAR and the National Guard Bureau (NGB). Develop public affairs support, as appropriate, for Army Reserve and Army National Guard execution which fully responds to the objectives of the Army Energy Plan.

D3.2.5 Major Commands (MACOMs).

a. Develop and execute command, public information, and community relations programs to support the objectives of the Army Energy Plan.

b. Forward appropriate or newsworthy informational materials to SAPA-PP for clearance and/or release to the national media.

c. Ensure that subordinate elements develop, establish, and execute public affairs programs to support the objectives of the Army Energy Plan.