1974

INTRODUCTION

In response to the national problem of potential shortages of energy the United States Army has instigated a number of short range programs and has tasked its planning staffs to seek out future procedures whereby Army logistics and operational plans recognize the critical energy shortages that may be experienced. In addition, the Army Scientific Advisory panel was asked to provide a Task Force on Energy to suggest Research and Development programs which might substantially reduce the energy needs of the Army both under peace-time conditions and during military operations. An ASAP Ad Hoc Task Force on Energy was formed and is composed of the following members:

Willis M. Hawkins, Chairman	Retired Senior Vice President of Science and Engineering, Lockheed Aircraft Corporation
Professor Howard C. Curtiss, Jr.	Dept. of Aerospace & Mechanical Sciences, Princeton University
Dean Ralph Fadum	Dean of Engineering, North Carolina State University at Raleigh
Dr. Marvin R. Gustafson	Assistant Associate Director for Military Systems University of California, Livermore
Dr. Paul Kruse	Corporate Research Center, Honeywell Corp.
Dr. William Rastoker	Professor of Metallurgy, University of Illinois

Through a series of meetings (See Appendix A for programs and presenters) the Army outlined its energy demands and projections, described its current R&D programs to reduce energy needs, and outlined its efforts to seek alternate sources of energy which would be useful both in a peace time environment and in military operations.

The Task Force is responding to its terms of reference recognized that there were many questions for which the Army should seek answers, and in the course of seeking such answers the Army would uncover the need for a number of analytical studies and would find additional improvements for a number of R&D programs. The list of questions which the Task Force evolved are:

1. When will the Army potentially run out of what kinds of fuel? Such an investigation must certainly be done within the context of mutual usage of such fuels across the D.O.D.

2. Are there unique new fuels that are peculiarly useful to the Army exclusive of other services?

3. Can the Army utilize lighter mobile equipment to save both operational and peace time fuels?

4. Can the use of simulators reduce energy demand for training and operational exercises?

5. Can more commonality of fuel usage with other services be achieved, thereby saving energy in the Logistics system?

6. Should the Corps of Engineers revise its standards for Federal Buildings and installations to save fixed installation energy demand?

7. Are there any other programs (similar to those implied by 6 above) wherein R&D programs sponsored by the Army would be of benefit to the civilian community? Inversely, are there any civilian needs that the Army could help fulfill with its "in-house" talents assuming sponsorship by other government agencies?

DISCUSSION

In seeking the most crucial areas for investigation, a total summary of DOD and Army energy requirements was developed. This is described in the chart which follows:

Figure 1: The DOD uses about 3.4% of the total National demand for Petroleum (Peacetime: as exemplified by FY 75 experience); the Army utilizes less than 10% of the DOD supply of petroleim products. This small percentage (a total of 575,000 barrels per day) suggests the importance of sharing standard fuel requirements and specifications with the Air Force and Navy wherever possible to avoid complicating the logistics system.

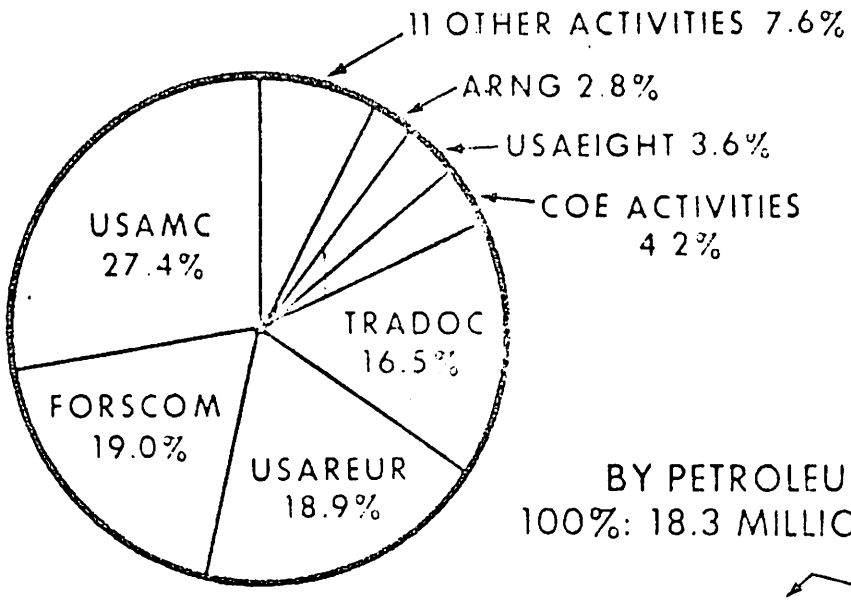
The breakdown of purely "Army" fuel required shows that 83% to 84% of the fuel used is not gasoline. This suggests that there is an opportunity for substantial standardization of fuels with other services. It also shows that gasoline at 16.8% of the total Army fuel requirement probably carries a substantial burden of overhead cost of lack of standardization. Finally, this Figure shows the very large percentage of the total petroleum supply which is used for non-transportation service -- heating, power generation, etc. (over 50%)

Finally, since petroleum is not the source of all energy within the Army, this chart has been compiled to show the major dependence of the Army on purchased power, coal, and natural gas. Over 60% of the energy used by the Army depends on sources other than petroleum.

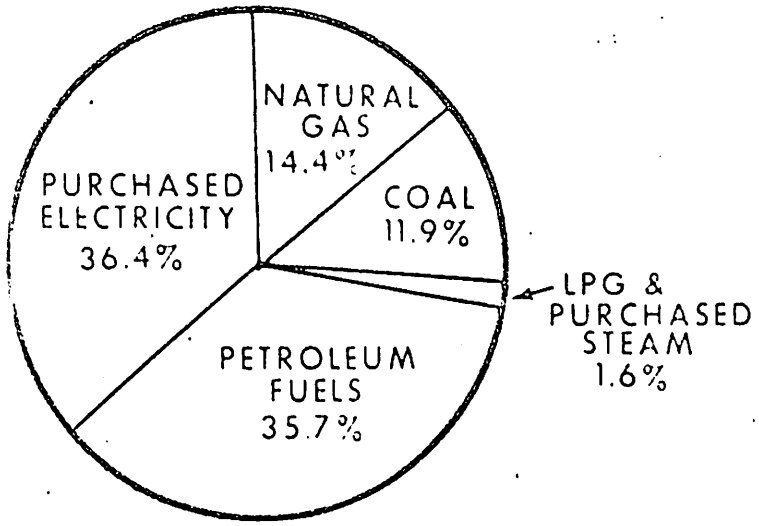
ARMY ENERGY CONSUMPTION FY '75

AS OF 1 SEP 75
SOURCE: DEFENSE ENERGY INFO SYSTEM (DEIS)

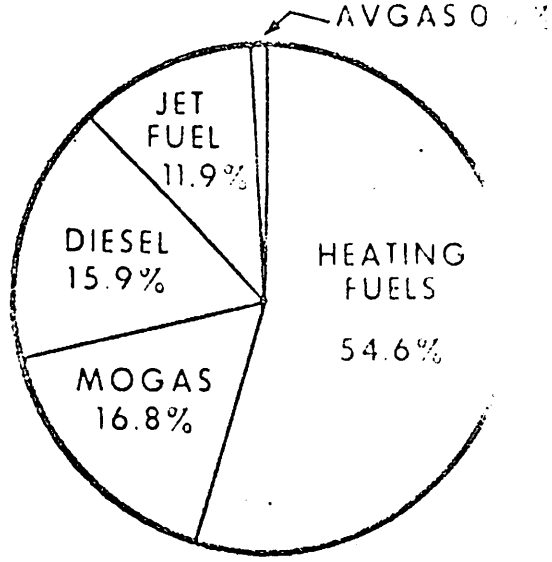
BY MAJOR ACTIVITY



BY ENERGY RESOURCE
100%: 292.4 TRILLION BTU



BY PETROLEUM FUEL
100%: 18.3 MILLION BARRELS



POTENTIAL R&D PROGRAMS

In seeking answers to the questions originally posed and reviewing the Army's R&D effort (as well as a number of programs which had been proposed) it was obvious that savings which might be made in the use of energy at fixed installations or for the production of power at bases, both fixed and operational should be accorded the highest priority. Although many programs have been suggested in the mobility field, it should be recognized that this is only 20% of the Army's energy demand. Within this framework the Ad Hoc Task Force suggests the following activities and programs for the Army.

1. New Initiatives for Fixed Installations

   a. Review of Codes and Standards for Construction

      The Corps of Engineers should review its codes and standards for buildings and their attendant heating and cooling systems. The level of activity within the Corps for both-Military and civilian construction offers an opportunity to demonstrate new technology and to determine the cost of incorporating new technology for saving energy in new construction. This kind of program can benefit both the civilian and military community and would have wide influence on the building as well as the energy industry.

   b. Demonstration of the Use of Waste Nuclear Products

      One of the most publicized deterrents to the development of additional nuclear power installations is the insistent contention by

the uninformed that waste nuclear products from these reactors constitute a major hazard in future years due to the difficulty in storage and control of such products. From Army (Corps of Engineers) sponsored studies it would appear that economical use of such materials for heating a few major fixed installations such as a base complex, hospital, or an ammunition plant is an entirely practical concept. The Army has the talent and the installations and could create one or more demonstration systems. Furthermore, the Army can designate installations where control of waste products is certain, thereby allaying the public fear that such materials will be sought and used by unscrupulous members of society. In addition, such a use of waste products will save a perceptible amount of fossil fuel. It is suggested that the Army instigate such a demonstration heating plant at a suitable installation. It is further suggested that, since such a development is of major importance to the civilian power industry, that ERDA be approached as the financial sponsor of, or a parter in, the program.

c. Formal Liaison with ERDA

Implicit in a and b above is the strong recommendation that the Army, with specific inclusion of AMC, the Corps of Engineers, TSG and DCSPER establish a formal, management level, cooperative program review system with ERDA and the energy programs of the other Federal agencies. The Army will thus benefit from the knowledge gained by ERDA in alternate power sources, improvements in the use of nuclear power, fuels research, insulation and heat exchanger research, etc. In addition, such management exposure will make each agency aware of opportunities for mutal programs like the Waste Nuclear Products Program suggestion above.

2. The Expanded Use of Diesel and Other Fuels

a. Small Automotive Diesel Engine

In the interests of standardization in the field the Army should institute the development of small diesel automotive power plants suitable for the 1/4 ton to 1 1/2 ton Army family of vehicles. Commercial power plants near this power range attest to the practicality of such a power plant and the Army could reduce the fuel quantity used (the specific fuel consumption (SFC) of the diesel engine is better than the SFC of the gasoline engine), reduce the amount of gasoline needed in the field and stockpiled for operational use, and improve its logistics posture with the other services. This might be a candidate for a joint program with ERDA.

b. Small Auxiliary Power Units (APU)

To extend standardized fuel use even further it is suggested that auxiliary power units of the 3 KW and lower class also be designed for use of diesel fuels. It is recognized that volume and weight favor gasoline power plants but the combination of SFC improvement, probably higher reliability and the standardization of field fuel supplies may easily be more important than the weight and volume of the unit itself. In the same vein the small APU makes an ideal vehicle for experimenting with different power cycles. It is suggested that an external combustion cycle engine may be ideal for such use. Its ability to use diesel fuel, its easy starting, and quiet running are all desirable attributes for an auxiliary power plant. The external burn engine can be truly multi-fuel.

c. Also a candidate for use in the 3 KW range of auxiliary power units is the fuel cell. These should be explored thoroughly due to their simplicity, quiet running, and, eventually, substantially lower cost.

3. Rededication of Army Vehicle Development to Save Weight

Over the years, in response to increasig combat requirements, and the necessity to hold down production costs, by utilizing conventional materials, Army vehicles have grown substantially in size and weight thereby increasing fuel consumption to maintain performance. New materials, new armor concepts, and an increasing ability within the Army to evaluate the necessity and cost of each requirement, suggests that new programs to develop lightweight combat vehicles may be propitious. It is suggested that the Army select a class of vehicle and develop a lightweight prototype to compete with a standard design. A thorough evaluation may suggest switching to the lightweight design with a commensurate saving in fuel.

4. Increased Dependence on Simulators for Training and Operational Combat Evaluations

Army training is sufficiently complex that the use of simulators for many training tasks has not, in the past, appeared to be economic. The state of the art of simulation has expanded enough, however, to suggest that a new look be taken at the real advances which might be possible. The

simulation concept should also be evaluated to replace actual troop exercises in the development of operational alternatives. This is an even more complex task but should be studied thoroughly.

CONCLUSIONS AND RECOMMENDATIONS

The Ad Hoc Task Force on Energy of the Army Scientific Advisory Panel has reviewed the Army use of energy and has the following suggestions:

1. The Army should instigate analytical studies of the seven questions posed in the introduction to determine whether there are profitable R&D programs which should be initiated beyond those suggested below.

2. The Army, particularly the Corps of Engineers, should initiate specific and continuing joint program reviews with ERDA to avoid duplication of effort, to determine whether useful joint programs should be created, and to follow R&D in alternate power sources in order to apply the results to Army programs when they are applicable.

3. The R&D programs which appear to offer immediate payoff for the Army are:

   a. A concentrated review and revision of Building Code Specifications by the Corps of Engineers to minimize energy requirements.

   b. A demonstration installation at a military base utilizing waste nuclear products from commercial type reactors for heating purposes.

   c. Investigation of the use, or development of, small diesel engines for 1/4 ton and 1 1/2 ton military vehicles.

   d. The development of diesel auxiliary power units in the 3 KW or lower size for field use. It is suggested that advanced power cycles be investigated (like external burn engines).

e. Rededication of Army development of lightweight vehicles. A test comparison under operational conditions of one type vehicle is suggested.

f. Investigation of simulators for more widespread training use and operational tactics evaluation.

ASAP AD HOC GROUP STUDY

Title: Army Efforts in Energy Research and Development

Problem: To develop and increase the efficiency and reliability of use of all energy sources to meet the needs of present and future generations, to increase the productivity of the national economy and strengthen its position in regard to international trade, to make the Nation self-sufficient in energy, and to advance the goals of restoring, protecting, and enhancing environmental quality.

Executive Committee Approval Date: May 1974

Chairman: Mr. Willis M. Hawkins

Members: Professor Howard C. Curtiss, Jr.
Dean Ralph E. Fadum
Dr. Marvin R. Gustavson
Dr. Paul W. Kruse, Jr.
Dr. William A. Rostoker

Army Staff Assistant: Mr. John Ratway

Meetings Held:

29 August 1974 - MERDC, Ft. Belvoir, VA
10 December 1974 - Pentagon, Washington, DC
31 January 1975 - Pentagon, Washington, DC

Attachment #6

DEPARTMENT OF THE ARMY
ARMY SCIENTIFIC ADVISORY PANEL
Washington, D. C. 20310

31 May 1974

Proposed Membership
AD HOC GROUP
on
ARMY EFFORTS IN ENERGY RESEARCH AND DEVELOPMENT

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31 May 1974

PROPOSED TERMS OF REFERENCE
AD HOC WORKING GROUP
ON
ARMY EFFORTS IN ENERGY RESEARCH AND DEVELOPMENT

1. Background:

Congress has declared that the general welfare and the common defense and security require that effective action to develop and increase the efficiency and reliability of use of all energy sources to meet the needs of present and future generations, to increase the productivity of the national economy and strengthen its position in regard to international trade, to make the Nation self-sufficient in energy, and to advance the goals of restoring, protecting, and enhancing environmental quality. (H.R. 11510: Energy Reorganization Act of 1973). The Department of Defense is responding to the Congressional declaration cited above. The Army staff has developed an Army Energy R&D program in response to requests from DDRE. There is some question as to the need for the Army to do some of the R&D efforts which have been proposed. The Army is principally an energy consumer. In that regard it is probably more important for the Army to monitor closely the efforts of industry and the scientific R&D community for applicable technology and then serve as a technological test bed for those developments having Army application. However, there are some areas where the Army involvement should entail investigation of all development levels to insure Army mission requirements are being met. In some cases, incentives may be required in the form of seed money or assured markets to induce industry pursual of areas of Army interest.

2. Terms of Reference:

a. What should the Army do in Energy R&D?

b. Identify gaps in the Army Energy R&D program.

c. Who in the Army should be working on the program?

d. Need to identify unique Army requirements.

e. Review Army's needs:

(1) What Energy R&D is necessary to meet the mission requirements of the Army?

(2) What current Army R&D programs are related to energy?

(3) Should the current energy-related R&D programs be expanded to more fully meet the Army's requirements?

(4) Is the Army engaged in energy R&D which would be more properly accomplished by industry?

f. Group efforts are to be completed no later than 31 January 1975.