(NASA-CR-163803) POINT FOCUSING THERMAL AND ELECTRIC APPLICATIONS PROJECT. VOLUME 1: EXECUTIVE SUMMARY (BDM Corp., McLean, Va.) 97 p HC A05/MF A01 CSCL 10A

N81-12547

Unclas

G3/44 29402

POINT FOCUSING THERMAL AND ELECTRIC APPLICATIONS PROJECT

WORKSHOP FOR POTENTIAL MILITARY AND CIVIL USERS OF SMALL SOLAR THERMAL ELECTRIC POWER TECHNOLOGIES

HELD AT
The BDM Corporation
McLean, Virginia
September 11-14, 1979

VOLUME I

EXECUTIVE SUMMARY

Prepared for the
U.S. Department of Energy
Through an Agreement with
National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

JPL Contract 955354

POINT FOCUSING THERMAL AND ELECTRIC APPLICATIONS PROJECT

WORKSHOP FOR POTENTIAL MILITARY AND CIVIL USERS OF SMALL SOLAR THERMAL ELECTRIC POWER TECHNOLOGIES

HELD AT
The BDM Corporation
McLean, Virginia
September 11-14, 1979

VOLUME I
EXECUTIVE SUMMARY

Edited by
Karen E. Landis
The BDM Corporation

Prepared for the
U.S. Department of Energy
Through an Agreement with
National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

JPL Contract 955354

The workshop described in this document was carried out by The BDM Corporation for the Jet Propulsion Laboratory, California Institute of Technology, and was sponsored by the Department of Energy by agreement with the National Aeronautics and Space Administration.

Proceedings reports of working groups represent the concensus of each group. They are not necessarily the opinions of any single individual. They do not represent the official policy of any agency represented.

Question and answer sessions are presented in summary form following each presentation. Only the person questioned has been identified.

The detailed workshop proceedings are presented in Volume II - Workshop Proceedings.

FOREWORD

This is a summary of the proceedings and results of the Jet Propulsion Laboratory Workshop for Potential Military and Civil Users of Small Solar Thermal Electric Power Technologies. The workshop was held for the Department of Energy at The BDM Corporation in McLean, Virginia on September 11-14, 1979. The workshop, and integrative study and presentation, was prepared for JPL's Point Focusing Thermal and Electric Applications Project under contract number 955354.

The BDM Program Manager was Mr. J. Scott Hauger, who served as Workshop Chairman. He was assisted in the preparation of this summary by Ms. Karen Landis, the Workshop Coordinator.

Proceedings reports of the working groups represent the concensus of each group. They are not necessarily the opinion of any individual participant. They do not represent an official policy of any agency represented.

ABSTRACT

This Executive Summary describes the background and objectives used for the Workshop for Potential Military and Civil Users for Small Solar Thermal Electric Power Technologies, held September 11-14, 1979, at The BDM Corporation in McLean, Virginia. Also included is a summary of the results and conclusions developed at the workshop regarding small solar thermal electric power technologies.

ACKNOWLEDGEMENTS

The contributions of those who attended the workshop are gratefully acknowledged. The success of the workshop was due to the information exchange generated by each presenter and attendee.

This document was complied and edited by Karen E. Landis, Workshop Coordinator/Program Manager under the direction of J. Scott Hauger, Associate Manager for Military Energy Programs.

Dean Wingfield provided helpful technical support. Katrina Robey was responsible for preparing the manuscript.

WORKSHOP FOR POTENTIAL
MILITARY AND CIVIL USERS OF
SMALL SOLAR THERMAL ELECTRIC
POWER TECHNOLOGIES

VOLUME I - EXECUTIVE SUMMARY
TABLE OF CONTENTS

Section		Page
	FOREWORD	v
	ABSTRACT	vii
	ACKNOWKLEDGEMENTS	ix
	TABLE OF CONTENTS	xi
I	SUMMARY	I-1 to I-3
II	THE WORKSHOP	II-1 to II-4
	A. Origins	II-1
	B. Workshop Scope	II-1
	C. The Technology	II-2
	D. Participants	II-2
	E. Proceedings	II-3
	F. Objectives	II-3
III	RESULTS	III-1 to III-8
	A. Overview	III-1
	1. The Technologies and Military Requirements	III-1
	2. Applications Scope	III-1
	3. Cost Goals	III-2
	4. Barriers to Realization	III-2
	B. Some Specific Findings	III-4
	1. Portable Power Systems	III-4
	2. Isolated Power Systems	III-6
	3. Military Facilities Power Systems	III-6
	4. Implementation	III-7

Appendix A WORKSHOP PARTICIPANTS. . . . . A-1 to A-7

Participants A-1
Guest Speakers A-7

Appendix B PRESENTATIONS ABSTRACTS. . . . . B-1 to B-63

(Presentations by Mr. Marienthal, Mr. Adams, and Senator Domenici are presented in their entirety)

Appendix C AGENDA . . . . C-1 to C-5

SECTION I
SUMMARY

The Jet Propulsion Laboratory (JPL) Workshop for Potential Military and Civil Users of Small Solar Thermal Electric Power Technologies was held for the Department of Energy on September 11-14, 1979. The workshop was made up of 65 invited attendees, representing the military and industrial users, government, and technology developers. In addition to presentations by fourteen participants who served as resource personnel, keynote addresses were made by Martin Adams, Deputy Program Director for Solar Geothermal Electric and Storage Systems, U.S. Department of Energy; George Marienthal, Deputy Assistant Secretary of Defense for Energy, Environment, and Safety; and Senator Pete V. Domenici (R New Mexico).

The workshop was held to bring together users, system developers, and decision makers with potential interest in developing solar thermal power technologies to meet military and related civil power needs. These include portable, isolated, and military facility applications. Workshop objectives were:

1) To examine military and related civil power applications to determine their suitability for small solar thermal electric power technologies,
2) To examine the scope and economics of military and related civil applications, and
3) To determine the institutional prerequisites for development and effective application of solar thermal electric power technologies to these applications.

It was the finding of the workshop that:

1) Small solar thermal electric power technologies may satisfy military and civil requirements for portable engine generators, for remote and isolated (non-grid) power plants, and eventually, for some installation power plants. Solar thermal electric power technologies offer potential advantages over existing power plants and over other alternative technologies. Systems may be

made to run quieter, more efficiently, and with lower infrared emissions than existing power plants. The engine generators are potentially multifuel, lightweight, and simple, offering subsequent logistical advantages. Solar collectors can displace twenty percent or more of petroleum fuel consumption. Because systems would use hybrid solar/fuel heat sources, no storage system or excess collector size would be required.

2) The scope of domestic and worldwide portable and isolated power requirements is sufficient to provide a meaningful and potentially important market for solar thermal power technologies.

3) The economics of portable and isolated military power systems indicates that these applications become cost effective at prices from 140-240 percent higher than competing utility prices for facilities power systems.

4) The major barriers to successful development and utilization of solar thermal electric power technologies may not be technical, but institutional. Existing procedures and programs must be altered if an accelerated displacement of fossil fuels is to be realized through the application of these technologies. The military procurement and R and D structure which has evolved since World War II is not oriented to the accelerated development and procurement of fuel-saving systems which cannot become cost effective before an initial market exists. Special executive, and perhaps legislative, authorization and procedures are needed, the equivalent of a military "fast track," if the potential benefits of solar thermal electric power technologies are to be realized during this century.

Specific needs are two:

1) Clear authority and funds for the U.S. military to purchase and utilize solar thermal energy technologies for valid military applications when cost effectiveness will not occur until after a continuing market has been established; and

2) Clear authority for the military laboratories to develop and accelerate test and evaluation of new systems so that:

   a) They can be engineered for military use, and

   b) An operational reliability evaluation can be made.

Civil laboratories are not prepared or oriented to carry out these functions. Military laboratories have the ability, the manpower and the experience to do so, but lack the clear authority and appropriated funds. If it is the policy of the U.S. Government to accelerate development and use of power systems which can reduce national dependence on petroleum, then the Government must assume a larger proportion of the risk of accelerated engineering and procurement.

SECTION II
THE WORKSHOP

A. ORIGINS

In 1978, the Jet Propulsion Laboratory carried out discussions with the U.S. Navy's Civil Engineering Laboratory concerning Navy uses for solar thermal electric power systems. This led to the establishment of a joint engineering experiment (the Military Module Power Experiment) under JPL technical direction to test and demonstrate hybrid solar thermal power plants for isolated applications.

In the same year, as part of its support to the Defense Advanced Research Projects Agency, The BDM Corporation initiated and performed a study of the applicability of solar thermal technology applicabilty to military power needs. This study emphasized portable power applications and led to the development of a concept of a modular, multi-fuel, military engine generator with a solar option.

During 1979, it became increasingly evident that there existed a potential market for solar thermal technologies in non-utility applications. As the single largest purchaser of engine generators for portable, isolated, and facilities applications, the military services represented a coherent and knowledgeable source for determining how solar thermal electric power technologies might satisfy that market. The idea of a workshop which would bring together the users of non-utility power plants with technology developers was developed within this context.

B. WORKSHOP SCOPE

Because of the similarity of civil portable and isolated power applications to military engine-generator use, the workshop was structured to include military and related civil users. Limited program resources led to an approach which involved the detailed characterization of military applications, and an attempt to compare civil power needs to this baseline. The workshop proceedings confirmed the validity of this approach: civil applications for portable, isolated, and emergency power seem to resemble very closely peacetime military uses in scale, duty cycle, and operational requirements.

Military facilities power requirements were included in the workshop to permit the incorporation of all military uses in a single overview. Civil facilities were not included as a separate category. JPL sponsored a workshop for small community utility electric power systems in September, 1977 and will hold a workshop for industrial users in April, 1980.

C. THE TECHNOLOGY

The workshop was concerned with portable, remote, emergency, and military facility applications for point focusing distributed receiver (PFDR) solar thermal electric power systems. These systems consist of a heat engine generator mounted at the focal point of a parabolic dish collector. Such power systems would utilize solar heat when direct sunlight is available, and would burn fuel where it is not. Fuels might be petroleum distillates or synthetic liquid fuels, synthetic gases, and natural gas. Fuel flexibility is an inherent and valuable characteristic of the technology. Unlike other solar power concepts, no storage subsystem is required.

The major limiting factor of PFDR technology in portable, and perhaps other isolated applications, may be the size of the dual axis tracking dish. The dish size selected by JPL for initial evaluation is approximately 12 meters in diameter. This corresponds to an engine size of 15-25 KW. Other system configurations exist. For example, a single heat engine could be supplied with working fluid from a field of collectors. However, discussions at the workshop centered on the modular distributed generation approach.

D. PARTICIPANTS

Workshop participants included representatives of (1) the Army, Navy, Air Force and Department of Defense; (2) federal and local government agencies representing potential users such as the National Park Service, the Agency for International Development, and the Hawaii State Energy Office; (3) potential industrial users of remote and portable power systems; (4) manufacturers who might produce systems; and (5) the Department of Energy and the Jet Propulsion Laboratory, charged with developing the technology. Participation was by invitation only. A complete list of participants is provided in Appendix A.

E. PROCEEDINGS

The core of the workshop was four working groups. These consisted of ten to fifteen professionals from diverse backgrounds who considered portable applications, isolated applications, military facilities applications, and implementation requirements for PFDR solar thermal electric power systems.

In joint session, the workshop considered fourteen presentations on the technology, applications requirements, technology development, and implementation. A military applications overview was presented by the Conference Chairman, Mr. J. Scott Hauger. This study was prepared for JPL to provide a basic informational overview of military power requirements. Addresses were made by Mr. Martin Adams of the Department of Energy, The Honorable George Marienthal of the Department of Defense, and Senator Pete V. Domenici.

Workshop participants were able to question each speaker. Working sessions were held after each group of presentations. Appendix B contains a complete agenda for the workshop. A separate volume, Workshop Proceedings, contains the presentations, synopses of question and answer sessions, and working group reports.

F. OBJECTIVES

It was the aim of the workshop, by bringing together professionals representing users, developers and policy makers, to stimulate interchange of goals and knowledge at an early stage in the research and development process. Potential users could learn enough about future systems to define requirements for developing technologies. Laboratory personnel could get an appreciation for applications requirements in time to allow design choices to incorporate those needs. Both could learn the institutional factors which must be addressed before any system intended for military use could be made available for manufacture, test, and procurement.

In addition to these general goals, the workshop and associated study were to accomplish three specific objectives.

(1) Determine military and related civil power applications which are suitable for small solar thermal electric power technologies,

(2) Examine the scope and economics of these applications, and

(3) Determine the institutional prerequisites for accelerated development and application of these technologies to meet military and related civil needs.

SECTION III
RESULTS

A. OVERVIEW

1. The Technologies and Military Requirements

There was a strong concensus of workshop participants that solar thermal technologies have an excellent potential to meet military and related civil power requirements. The heat engines associated with solar thermal systems can be developed to meet the deficiencies which have been recognized in current diesel systems. A solarization kit would add the advantages of fuel conservation to those of low emission, quiet operation, and multi-fuel capability. The logistical advantages of reduced fuel consumption would be substantial for both remote and portable power plants.

The technical suitability of solar thermal power systems for remote applications was taken as established. Modularity, hybridization, and the possibilities for cogeneration were attractive for military facilities applications. The demonstration of a portable power system which could be operated in a liquid fuel mode and configured for solar utilization when required was recommended as a technology development goal.

2. Applications Scope

The potential military market for heat engine generators is at best 140 MW/year for systems 15 KW and larger. Of these, at least 33 MW/year are suitable for solar utilization. The domestic market is at least ten times the military market, according to workshop estimates. Approximately the same proportion of civil and military systems are appropriate for solar utilization.

The versatility of the heat engines associated with solar thermal electric power technologies and their potential to be produced as a standard unit which can be configured to use a solar heat source or a liquid fuel source as appropriate, has very positive implications for these technologies' potential. The consequent operational flexibility is attractive to military utilization. The economics of mass production could be critical to accelerated commercialization as solar systems benefit from production of nonsolar units with interchangeable components.

3. Cost Goals

The economics of military and related civil power applications make them comparatively attractive for early utilization of solar thermal technologies. Baseline cost projections indicate equivalent uniform annual costs over a twenty-year life cycle as 120 mills/KWh (750 KW systems) to 240 mills/KWh (15 KW systems). This compares to a USAF grid electricity cost of 86 mills/KWh. The ratio of 1.4-2.4:1 should be consistent under other than baseline assumptions. The value of the solar array/receiver as a fuel saver is $2700/KW under baseline conditions (8 percent fuel escalation differential on a FY 79 base of $0.59/gal). Current indications are that these cost goals are within the potential of the technologies.

4. Barriers to Realization

The major barriers to realizing the potential for military applications of solar thermal electric power technologies were found to be institutional not technical. The workshop found that military applications exist now. Engineering development of collector-receiver and engine-generator subsystems is proceeding satisfactorily. Pre-existing military requirements exist which could be met by systems designed to meet military specifications. The economics appear to be favorable. Nonetheless, in a special session which evolved during the course of the workshop, Army, Navy, and Air Force representatives candidly agreed that under current procedures general military adaptation and procurement of solar thermal power technologies should not be anticipated for 15 to 20 years.

The problem as defined by the workshop was seen to be in the nature of a dilemma: it is the policy of the U.S. Government to accelerate the development and implementation of technologies which can displace the use of petroleum. In order for the Department of Defense to utilize systems, they must (1) be proven reliable through military testing, and (2) be cost effective. Obviously a new technology such as solar thermal electric power has not been proven reliable and can be cost effective only in mass production.

The workshop showed that military laboratories are eager to design and test solar technologies for military uses. Military agencies would be interested in ensuing systems if they could be procured. But representatives of the laboratories stated that they have neither the clearcut authority nor the DOD funds to accelerate military system design and reliability testing. Military procurement experts stated that they have neither the authority nor the funds to procure fuel saving technologies when petroleum burning systems of proven reliability are available at a cheaper rate.

Civil laboratories are unlikely to assume the cost and risk of developing and testing a military solar thermal electric power system when a market will not exist because of procurement policy. Manufacturers are unlikely to assume the cost and risk of developing and producing such a system unless a clear market exists for realizing a profit on their investment. Yet under current policy, a market will not exist until these things happen.

Two actions are necessary to escape this dilemma:

1) The military laboratories should be given the clear authority and funding to participate in the development of solar thermal power technologies for military applications. In particular, this should include:
   a) The utilization of DOE research to specify and develop component subsystems which are needed for portable, remote, and other military applications.
   b) The accelerated development of military standards for solar thermal electric power systems simultaneous with the development of civil systems by DOE.
   c) Provision for accelerated hardware reliability testing and re-engineering programs to establish an experimental background for accelerated procurement.
2) Clear authority and funds must be given the U.S. military to accelerate procurement of fuel saving technologies such as solar thermal electric. In other words, a military "fast

track" should be established. The fact that the first 10,000 or more units must be purchased before costs approach their potential minimum must be taken into account. Industry can armortize the cost of initial production over a large number of modules only if convinced that a market for a large number of systems exists. Since it is the U.S. Government, which for reasons of national security, is trying to accelerate production before that large market naturally evolves (20-60 years hence), then the government must be willing to take practical steps to share a major portion of the risk with industry. One way to do this is to allow procurement of the first systems at non-competitive costs to quickly armortize the investment in production capacity and to rapidly achieve cost economies through mass production.

The workshop noted that both executive and legislative routes were open to correct these institutional deficiencies. There exists an interagency agreement between DOD and DOE under which JPL is conducting a solar power plant experiment with the Navy. It is possible that this agreement could be amended to include other solar thermal activities. The military laboratory and procurement systems are responsive to executive orders and to Congressional authorization and appropriation. The recent Federal Photovoltaic Utilization Plan which was Congressionally implemented was recognized as a useful basis for legislation authorizing the accelerated development, test, and procurement of solar thermal electric technologies.

B. SOME SPECIFIC FINDINGS

1. Portable Power Systems

These include tactical systems, which are mobile systems (0.5 to 500 KW) and non-tactical or theater systems (750 KW). The former are typically assigned to troop units and move with the units. The latter belong to engineering agencies and are moved to a site for long term deployment. Once tactical combat units and their generators are eliminated as unsuitable for deployment of a solar array, system requirements for tactical and theater systems are similar. Combat systems are primarily small (10 KW) and account for less than 20 percent of systems 15 KW and larger.

Tactical systems have the most stringent operational requirements. Any military system which meets them should be suitable for general military use. These include, based on current systems and requirements: (a) size (0.9-1.5 ft^3/KW); (b) weight (18-25 lb/KW); (c) emissions (desired nondetectable acoustic signature at 100 meters, minimum possible infrared emissions, and low visible profile); (d) hardness (able to withstand tests simulating transportation vibrations, jars, and drops); (e) start time (15 minutes under all weather conditons); and (f) reliability, availability, maintainability (95 percent reliability over 24 hours, 97 percent availability, 600 hours mean time between overhaul, 250 hours between scheduled maintenance).

Colonel A. G. Rowe, Department of Defense Project Manager for Mobile Electric Power, and other workshop participants, discussed the commonality of heat engines developed for solar and non-solar applications. The Portable Power Working Group recommended development of such hybrid engines with a "solarization kit." This kit would be standardized, and include a hybrid receiver, a foldable concentrator, structural mounting components, and a power regulating module.

Civil applications were found to be similar to noncombat military systems. A hybrid system with a solar option has similar potential for retailers and renters of portable power systems.

Military procurement of portable systems 15 KW and larger will be approximately 100 MW/year. A minimum of 23 MW of these are suitable for solar utilization. The civil market is thought to be at least ten times these figures.

2. Isolated Power Systems

Isolated or remote systems are used at fixed sites which generate their own power. They are typically small (15-1000 KW) and geographically isolated. The cost of fuel delivery can increase operating expenses by 25 to 500 percent, but varies so greatly that no average figure is available. Availability, reliability, and maintainability are often critical. The Defense Communications Agency, for example, permits no more than 53 minutes per year unscheduled down time. Duty cycles are typically continuous. The annual military procurement rate is approximately 11 MW. Perhaps 10 MW are suitable for PFDR solar thermal electric power systems.

The technical feasibility and desirability of solar thermal electric power technologies for isolated applications was taken as established. Major questions concerned system availability and cost. There is only one planned experimental construction and test of such a system, the U.S. Navy, JPL 100 KW system planned for Yuma Marine Air Station, Arizona. Unless the accelerated test and procurement of these petroleum conserving technologies is authorized, this general application does not seem likely in the foreseeable future.

3. Military Facilities Power Systems

Except for the occasional use of portable systems, military facilities electric power falls into two categories: utility grid power and emergency/back-up generators. The military maintains at least 600 MW of back-up generation capability, representing perhaps 30 MW annual procurement. Overall, U.S. military installations purchase power which represents approximately 5,000 MW of generating capacity.

Emergency systems are primarily back-up units for critical facilities such as operations centers, runway lighting, etc. They typically operate only a few hours per year. Their duty cycles are such that solar PFDR systems are not appropriate. However, a standard engine subsystem, once again, could fulfill these requirements if rapid startup times or a small storage subsystem are incorporated.

All non-remote, U.S. military installations purchase power. Cost is the critical requirement. Current projections, utilizing U.S. Air Force baseline assumptions indicate annualized costs for the period 1980-2000 to be 86 mills/KWh. Where both backup and grid power are maintained, the cost is 90 mills/KWh.

Military interest in applying solar thermal power technologies to facilities applications was apparent at the workshop. The Facilities Power Working Group believed that facilities applications represent the best applications for these systems. The cogeneration potential is especially attractive. Modularity and hybridization were found to be positive attributes and the versatility of utilization of a single system to utilize several heat sources to produce electricity, steam, or shaft power (e.g., for compressors or pumps).

Tradeoffs between utility purchase and "within-the-fence" generating systems remain to be made. Peak load shaving and sell-back implications remain to be explored. Moreover, there are specific problems of implementation which the federal government must address if military installations are to utilize these systems on an accelerated schedule, i.e., before the year 2000-2020. These are discussed next.

4. Implementation

The Implementation Working Group agreed that rapid development and application of solar thermal electric power technologies was desirable to further national energy goals. Nonetheless, they had difficulty identifying an explicit commitment to accelerated utilization or a clear statement of such policy either within DOD or the federal government as a whole. The need for a firm executive policy statement and a clear commitment of DOD and DOE assets to the achievement of practical utilization of such petroleum saving technologies is needed to crystallize action.

Until now, the Department of Defense has not established general authority, procedures, or funding to develop or implement new technologies for facilities, portable, or remote energy. Although isolated steps have been taken within certain DOD agencies, notably the military laboratories and R&D Commands, the only integrated program to develop and utilize new technologies has been the preliminary accomplishments of the Federal Photovoltaics Utilization Program, which was established by Congressional initiative, and is limited to a single technology.

The working group realized that the military laboratory and procurement systems did not evolve in an environment which called for the accelerated implementation of energy technologies. Yet there was a strong concensus that military structures should not be changed nor new ones created for the purpose of implementing solar thermal technology. The societal and institutional inertia that resists change also exists in DOD, yet such barriers may be overcome with appropriate incentives and executive and Congressional direction.

In order to accelerate the utilization of solar thermal technologies within the Department of Defense, it is necessary to utilize expedited DOD development, test, and procurement procedures. A supplemental program evolving from the Federal Photovoltaic Utilization Program could be set up. In this way, the minimum 20 year RDTE-Procurement cycle could be cut in half while still assuring proper reliability testing. Industry and the market place cannot do it alone. The DOD equivalent of incentives which are being employed in the civil sector must be applied. A military "fast track" should be established.

Among the specific supporting recommendations of the working group were these:

1) An FPUP-type program be established for solar thermal electric technologies by executive branch interagency agreement or by legislation as required.
2) A comprehensive multiyear program plan for development, test, and procurement/utilization of PFDR technologies be produced and approved.
3) Congress should be kept informed of the views of those familiar with solar thermal technologies. Industry should assume some of the responsibility for informing Congress of technical progress.
4) Small business and state and local governments need to become involved and incentives will be required to secure their participation.

APPENDIX A
WORKSHOP PARTICIPANTS

JPL SOLAR THERMAL ELECTRIC POWER USERS WORKSHOP

PARTICIPANTS

WORKING GROUP KEY:

I = Portable Systems
II = Isolated Systems
III = Military Facilities
IV = Implementation
N = At Large

Alhorn, Lee — I
The BDM Corporation
2600 Yale Boulevard, SE
Albuquerque, NM 87106
(505) 843-7870

Alper, Marshall — N
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91107
(213) 577-9[illegible]25

Batty, Tom — I
Directorate of Combat Development
U.S. Army Engineer Center & School
Ft. Belvoir, VA 22060
(703) 664-3784/4314

Belote, Calvin — II
The BDM Corporation
7915 Jones Branch Drive
McLean, VA 22102
(703) 827-5063

Bluhm, Steven A. — III
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91107
(213) 577-9387

Borgo, Pete — III
The BDM Corporation
7915 Jones Branch Drive
McLean, VA 22102
(703) 827-7800

Bourke, Roger — N
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91107
(213) 577-9534

Bowser, Richard — II
National Park Service
18th and C Streets, NW
Washington, DC 20240
(202) 523-5166

Braun, Gerald — N
U.S. Department of Energy
Solar Thermal Power Branch
Mail Stop 404
600 E Street, NW
Washington, DC 20585
(202) 376-1934

Buck, Champlin F. LTC — IV
DARPA/TTO
1400 Wilson Boulevard
Arlington, VA 22209
(202) 694-3580

Carr, Millard — N
Naval Facilities Engineering Command
Code 1113
200 Stovall Street
Alexandria, VA 22332
(703) 325-0102

Chingari, Gastone — II
Illinois Institute of Technology Research Institute
1825 K Street, NW
Washington, DC 20006
(202) 296-1610

Conant, Frank D. Jr. — N
The BDM Corporation
7915 Jones Branch Drive
McLean, VA 22102
(703) 827-5173

Connolly, James J. N
Chairman, SEIA
c/o Sanders Associates, Inc.
95 Canal Street
Nashua, NH 03061
(603) 885-5525

Danziger, Robert IV
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91107
(213) 577-9398

Delaney, Larry IV
The BDM Corporation
7915 Jones Branch Drive
McLean, VA 22102
(703) 827-7652

Dill, Norman II
Defense Communications Engineering Center
Code R320
1860 Wiehle Avenue
Reston, VA 22090
(703) 437-2251

Edwards, Richard III
Science Applications, Inc.
8400 Westpark Drive
McLean, VA 22102
(703) 821-4523

Friesema, Stuart II
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91107
(213) 577-9325

Garrett, Fred T. Jr. II
J. E. Sirrine Company
South Carolina Division
216 South Pleasantburg Drive
Greenville, SC 29606
(803) 298-6000

Grabbe, Eugene M. II
State of Hawaii
Dept. of Planning & Economic Development
P.O. Box 2359
Honolulu, Hawaii 96804
(808) 548-4195

Gregg, David IV
L-367, University of California
Lawrence Livermore Laboratory
Post Office Box 808
Livermore, CA 94550
(415) 422-7337

Gupta, Yudi N
Science Applications, Inc.
8400 Westpark Drive
McLean, VA 22102
(703) 827-4783

Hall, David C. CAPT III
Energy Projects Officer
Dept. of the Air Force
Sacramento Air Logistics Center (AFLC)
2852 ABG/DEES
McClellan AFB, CA 95652
(916) 643-4914

Hamilton, Jeffrey T. II
Vice President, Engineering & Program Development
Solar Thermal System Division of EXXON Engineering, Inc.
Post Office Box 592
Florham Park, NJ 07932
(201) 765-4290

Hauger, J. Scott N
P.O. Box 2760
Reston, VA. 22090
(703) 435-3735

Hays, Richard A. N
White Sands Missile Range
ATTN: ARMTE-AN
White Sands, NM 88002
(505) 678-1161

Heimann, John III
The BDM Corporation
7915 Jones Branch Drive
McLean, VA 22102
(703) 827-7677

Herrera, Gilbert I
DEL Manufacturing Company
905 Monterey Pass Road
Monterey Park, CA 91754
(213) 264-0860

Honneywell, Richard 2d LT I
AFAPL/POE
Wright-Patterson AFB., OH 45433
(513) 255-6235

Huang, Louis II
Code L63
Civil Engineering Laboratory
NCBC
Port Hueheme, CA 93043
(805) 982-4207

Huffman, Fred III
Thermo Electron
85 First Avenue
Waltham, MA 02154
(617) 890-8700

Jacobsen, Alan S. III
Booz, Allen & Hamilton, Inc.
Energy & Environment Division
4330 East West Highway
Bethesda, MD 20014
(301) 951-2200

Kannapel, George D. III
Suntec Systems, Inc.
2101 Wooddale Drive
St. Paul, MN 55119
(612) 735-7600

Kaplan, George N
U.S. Department of Energy
Solar Thermal Power Branch
Mail Stop 404
600 E Street, NW
Washington, DC 20585
(202) 376-1935

Kiceniuk, Taras II
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91107
(213) 577-9419

Kuehn, Thomas N
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91107
(213) 577-9393

Landis, Karen N
The BDM Corporation
7915 Jones Branch Drive
McLean, VA 22102
(703) 827-7653

Levin, Richard II
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91107
(213) 577-9539

Mackay, Robin II
Garrett Air Research Corporation
9851 Sepulveva Blvd.
Los Angeles, CA 90009
(213) 670-0131

Manasse, Fred K. IV
University of New Hampshire
College of Engineering and
Computer Engineering
Kingsbury Hall - 101
Durham, NH 03824
(603) 862-2460

Marriott, Alan T. N
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91107
(213) 577-9366

Marusak, Tom J. I
Mechanical Technology Incorporated
968 Albany-Shaker Road
Latham, NY 12110
(518) 456-4142, ext. 255

Nadolski, Tom II
The BDM Corporation
7915 Jones Branch Drive
McLean, VA 22102
(703) 827-7792

Nelson, Rick IV
Acurex Corporation
485 Clyde Avenue
Mountain View, CA 94040
(415) 964-3200

Pahno, Arthur N
U.S. Army
Office of Chief of Engineers
Forrestal Building
ATTN: DAEN-MPR
Washington, DC 20314
(202) 693-6919

Perry, Mark I
The BDM Corporation
7915 Jones Branch Drive
McLean, VA 22102
(703) 821-5130

Phillip, Eugene III
Defense Communications Agency
ATTN: Code 470
Washington, DC 20305
(202) 692-6385

Poole, Alan N
Department of State
Agency for International Development
Office of Energy
Washington, DC 20523
(703) 235-9020

Purcell, Blaine IV
Texas Technical University
Center for Energy Research
7714 Finns Lane
Lanham, MD 20801
(301) 459-6974

Rannels, James E. N
U.S. Department of Energy
Solar Thermal Power Branch
Mail Stop 404
600 E Street, NW
Washington, DC 20585
(202) 376-1939

Resner, Michael E. N
U.S. Department of Energy
Solar Thermal Power Branch
Mail Stop 404
600 E Street, NW
Washington, DC 20585
(202) 376-1941

Revere, Bill I
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91107
(213) 577-9289

Ritzcoven, Pete IV
HQS, Naval Materiel Command
Navy Energy and Natural Resources
Research and Development Office
Washington, DC 20360
ATTN: MAT 08T3
(301) 743-4320

Rhodes, George IV
The BDM Corporation
2600 Yale Boulevard, SE
Albuquerque, NM 87106
(505) 843-7870

Scribner, Dean II
U.S. Coast Guard
Office of Energy
Comandant (G-DSA-3)
Washington, DC 20590
(703) 426-1050

Sprague, Robert W. III
U.S. Borax Research
412 Crescent Way
Anaheim, CA 92801
(714) 774-2670

Tabb, J. Duane II
U.S. Department of Interior
Bureau of Land Management
18th and C Streets, NW
Washington, DC 20240
(202) 343-6941

Truscello, Vincent N
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91107
(213) 577-9367

Waugh, Vernon H. Jr. I
Curtis Engine & Equipment, Inc.
6120 Holabird Avenue
Baltimore, MD 21224
(301) 633-5161

Weglarz, Lawrence I
DOD Project Manager
Mobile Electric Power
7500 Backlick Road
Springfield, VA 22150
(703) 664-2057

Weisiger, Joseph N
U.S. Department of Energy
Solar Thermal Power Branch
Mail Stop 404
600 E Street, NW
Washington, DC 20585
(202) 376-1940

Wilson, James H. I
U.S. Steel Research Laboratory
Mail Stop 67
125 Jamison Lane
Monroeville, PA 15146
(412) 372-1212, ext. 2145

Young, Steve III
Science Applications, Inc.
8400 Westpark Drive
McLean, VA 22102
(703) 821-4495

Zelinger, Stan II
OMNIUM-G
1815 Orange Thorpe Park
Complex B
Anaheim, CA 92801
(714) 879-8421

GUEST SPEAKERS

Adams, Martin
Deputy Program Director for
 Solar, Geothermal, Electric &
 Storage Systems
U.S. Department of Energy
Mail Stop 404
600 E Street, NW
Washington, DC 20585
(202) 376-4424

Domenici, Pete V. (Senator, R-NM)
2317 Dirksen Senate Office Building
Washington, DC 20510
(202) 244-6621
(Paul Gilman - legislative aide)

Marienthal, George
Deputy Assistant Secretary of
 Defense for Energy, Environment
 and Safety
U.S. Department of Defense
Pentagon
Washington, DC 20301
(202) 695-0221

Rowe, Alvin G. COL
Project Manager
Mobile Electric Power
7500 Backlick Road
Springfield, VA 22150
(703) 644-3031

APPENDIX B

PRESENTATION ABSTRACTS

AND

COMPLETE TEXTS OF

KEYNOTE ADDRESSES

INTRODUCTION

HEAT AND ELECTRICITY FROM THE SUN USING PARABOLIC DISH COLLECTOR SYSTEMS

By

V. C. Truscello, A. N. Williams,
Jet Propulsion Laboratory

This paper addresses point focus distributed receiver (PFDR) solar thermal technology for the production of electric power and of industrial process heat, and describes the thermal power systems project conducted by JPL under DOE sponsorship. Project emphasis is on the development of cost-effective systems which will accelerate the commercialization and industrialization of plants up to 10 MWe, using parabolic dish collectors. The characteristics of PFDR systems and the cost targets for major subsystem hardware are identified. Markets for this technology and their size are identified and expected levelized bus bar energy costs as a function of yearly production level are presented.

The three primary elements which make up the project (i.e., R&D, technology development, and applications development) are described along with the strategy required to reach cost goals through time-phased development components and subsystems.

Contracting by the project with universities and industrial organizations for both hardware development and system studies is described, as is the planned test program for PFDR components and subsystems at the JPL desert test site. The relationship of these activities to the subsequent Engineering Experiment phase is explained, where numerous experimental power plants will be integrated into various user environments. Power levels are being selected as appropriate to the sites to be chosen, which are expected to be utility, isolated load and industrial applications. Engineering Experiment No. 1 will be a 1 MWe power plant for a small community utility application and designed by industry to utilize some of the first generation PFDR hardware being developed by the project. This will

be followed by a series of small (about 100 kWe) engineering experiments (EE No. 2 series) aimed at the near-term isolated load market. The first of these experiments is a military application.

The third series of experiments (EE No. 3 series) is planned for the industrial market. Initial experiments in this market will be performed with very small plants (equivalent of about 20 kWe) and will include thermal, electric and combined (cogeneration) applications. The initial experiments in this series will utilize existing commercially available dish technology. Although not a specific part of the JPL development program, an example of this type of experiment is a small experiment co-funded by the Southern New England Telephone Company and DOE for an industrial site in Connecticut utilizing the Omnium-G module. This unit will be operational in early CY 1980. Experiments in all three series will follow an improved technology path with each new experiment utilizing the then current state of the art dish-engine technology. Verification of economic readiness of PFDR technology is expected to result from the completion of these experiments in the 1990 time period.

GUEST SPEAKERS

DOD ENERGY MANAGEMENT

By

George Marienthal
Deputy Assistant Secretary of Defense
(Energy, Environment & Safety)

I. INTRODUCTION

It's a real pleasure to be here this morning and help you kick off your workshop for potential military and civilian users of small solar thermal electric power technologies.

This workshop is a real milestone. It is the first workshop that DOE has helped sponsor which has looked to the Department of Defense early in a technology development phase so that our application requirements could influence systems design. We appreciate it.

This type of cooperative effort between DOD and the Department of Energy has and will produce significant benefits for each of our organizations. We recognize that technology efforts are denoted to specific applications. DOE's R&D is often more general, but we can help give some focus to DOE's programs and provide a testbed for demonstration of energy technology applications.

We encourage working level cooperation between our laboratories and the national laboratories. They will benefit our own missions and will contribute significantly to the realization of the President's energy goals.

I am especially pleased to speak to all of you, because we are very much interested in small scale energy systems which will promote energy independence and reduce our reliance on local utility systems.

As you all know, we have established a military standard family of mobile electric power generators to satisfy many of our specific requirements for remote power needs.

MERADCOM is our program manager for this effort and has done a splendid job over the last five years in this capacity.

Standardization of military mobile electric power generators is indeed in the best interest of availability, interchangeability of parts, maintainability, and reduced logistic support.

Even with our emphasis on standardization, we believe that the application of new energy technologies will help to satisfy our enormous appetite for energy--especially for our remote and portability needs.

Energy technology demonstration is important to the Department of Defense and to the nation's energy program as well. I will describe our energy technology demonstration effort in a little greater depth in a few minutes.

To discuss energy in the context of my responsibilities for energy, environment, and safety, I'll answer your question before you ask it. Management of energy, environment, and safety is quite compatible. Their programs, while mutually exclusive, often lend support to one another.

II. OVERVIEW

Our energy program is aggressive and well balanced. My following remarks will give you an overview of:

(1) How defense energy resources are managed at the DOD policy level;

(2) How we are organized and how our management structure is integrated with the military departments;

(3) How our energy program dovetails with Department of Energy programs;

(4) What our goals and objectives are;

(5) What our programs are to achieve them; and

(6) What our long-range plans are to assure a continued energy supply under all circumstances.

III. DOD ENERGY MANAGEMENT

Our energy organization is decentralized, but it is functionally structured to handle energy contingencies, develop energy policy, and design long-range energy plans and programs.

While my office serves as the focal point for all DOD energy matters, specific energy program managers include:

(1) DLA/DFSC for bulk POL procurement,

(2) DASD (I&H) for military construction & ECIP,

(3) DUSDR&E (R&AT) for energy research and development, and

(4) DUSDR&E (AP) for GOCO conservation programs.

DOD energy policy is coordinated through the DEPC senior level policy council comprised of:

(1) OSD principals,

(2) Military departments (Spec. Ass'ts. for Energy.)

(3) JCS (Director, J-4)

(4) DLA/DFSC (Director, DLA and Commander, DFSC).

We have assigned lead service responsibilities to the military departments for key energy technologies to:

(1) Enhance energy management,

(2) Ensure better coordination, and

(3) Provide a means for technology transfer.

I will cover this lead service concept a little more in depth later.

IV. SCOPE OF DOD ENERGY PROGRAM

While we use tremendous amounts of energy--80 percent of all federal consumption--we rely heavily on petroleum. Petroleum accounts for nearly 70 percent of defense energy consumption. Last year, we used 252 billion barrels of oil equivalent. 170 million barrels were petroleum. The Air Force was the biggest user at 57 percent. Navy and Marine Corps used 33 percent, and Army used 10 percent.

Operationally, our energy usage looks like this:

- Aircraft operations is our biggest--last year's use was 113 million barrels alone.

Our energy is expensive. Last year we paid more than four billion dollars for it, and we estimate that it will cost nearly six billion in 1985. This estimate may be quite conservative, however.

DOD's consumption since 1973 has decreased 30 percent while the costs have continually increased. Last year DOD reduced energy consumption nine percent under FY 1975, the baseline year for measuring energy conservation in the federal government.

(1) 12 percent mobile operations, and

(2) 4 percent in facilities.

V. MANAGEMENT GOALS AND OBJECTIVES

We have divided our goals and objectives into two groups:

(1) Supply, and

(2) Conservation.

Our supply and conservation goals cover both installations and mobility operations. These are our installation energy supply goals. They cover the use of more plentiful energy resources and alternate fuel capabilities for our facilities.

Our mobility goals are designed to (Slide 11):

(1) Minimize supply disruptions and,

(2) Achieve capability to use a greater range of fuels.

Our installation energy conservation goal is to achieve a 20 percent energy reduction in our existing buildings by 1985. We plan to do this with:

(1) ECIP ($1.5 billion retrofit program), and

(2) Other efforts (ECMS, energy awareness, etc.).

For mobility operations, we will limit our operational energy use to what we used in 1975. We will do this with:

(1) More efficient propulsion systems,

(2) More efficient use of equipment, and

(3) Greater use of simulators.

VI. 1979 ENERGY PRIORITIES

We have divided our 1979 goals into four priority groups, or bands, of action.

(1) Priority Group I

(a) This covers the formulation of management and regulatory mechanisms with DOE to assure essential defense fuel requirements are met during periods of supply disruption--we are doing this now. We are working closely with DOE and developing an energy emergency management system.

(2) Priority Group II is the energy R&D plan for mobility fuels.

(a) OUSDR&E, under our overall management, will develop this plan.

(b) This plan will cover improved fuel economy and the use of synthetic liquid fuels derived from coal, shale, and tar sands.

(3) Priority Group III is energy technology demonstration with DOE support.

(a) Our objective for this priority group is to identify, evaluate, and pursue joint energy initiatives with the Department of Energy which will help us:

(1) To reduce our energy consumption and dependency on foreign sources of oil, and

(2) Accelerate the development and early commercialization of new energy technologies. We can do this through the experience we gain in the construction, operation, and maintenance of new systems. This will enable manufacturers to get on the learning curve through early DOD buys.

(b) Our initiatives include:

(1) Oil shale test program;

(2) Solar federal buildings programs;

(3) Photovoltaics--you are all familiar with Don Faehn's work at MERADCOM, I'm sure;

(4) Geothermal electric plant (China Lake, CA);

(5) Geothermal space heating (Hill AFB, Utan);

(6) Wood burning heating plant (Ft. Stewart, GA); and,

(7) Showcases of energy technology at:

(a) McClellan AFB, California,

(b) Army Lone Star Ammunition Plant, Texas, and

(c) Sewells Point Naval Complex, Virginia.

(4) Priority Group IV is designed to optimize energy use through energy conservation programs such as:

(a) Energy conservation investment program, and

(b) Energy conservation and management.

VII. ENERGY TECHNOLOGY APPLICATION

Our program effort to use advanced energy technology in military applications covers both mobility and facilities energy.

(1) Mobility Energy

(a) Aircraft--ceramic turbine blades,

(b) Ships--hull coating, and

(c) Ground systems such as advanced mobile electric power generators.

(2) Facilities

(a) Conservation technologies--relamping, and

(b) Energy conversion technologies--refuse derived fuel.

The lead service responsibilities for key energy technologies I spoke of earlier will greatly help us achieve our energy goals and objectives. We have assigned the:

(3) Army

(a) Photovoltaic energy systems,

(b) Multifuel aircraft propulsion systems (excludes fixed wing or ship),

(c) Wood-fired boilers,

(d) Energy conserving structures and construction technology,

(e) Solar heating and cooling,

(f) Advanced low head hydropower,

(g) Computer programs to determine energy characteristics of buildings,

(h) Nuclear power for landbased applications, and
(i) Electric vehicles.

(4) Navy has responsibility for:
(a) Geothermal energy,
(b) Co-generation,
(c) Energy monitoring and control systems,
(d) Refuse derived fuel, and
(e) Ship propulsion systems.

(5) The Air Force is assigned:
(a) Wind energy,
(b) Fixed wing aircraft propulsion systems,
(c) Colloidal boiler fuels,
(d) Fuel cells,
(e) Advanced technologies to burn coal, and
(f) Energy storage for mobile systems.

VIII. CONCLUSION

In summary, our energy management program covers:

(1) Energy supply to ensure energy requirements to support mobility operations and our installations,

(2) Energy conservation to reduce energy consumption in mobility fuels and utility energy sources that support our installations, and

(3) Energy technology applications to better use depletable energy resources and to demonstrate the feasibility of new energy technologies.

The challenge of the Defense energy management program in the:

(1) Near- and midterm is to assure adequate fuel through supply and conservation initiatives, and for the

(2) Longer term, will be to avail ourselves of more secure, plentiful energy resources through technological advances.

I am confident that with the continued support of industry, such as The BDM Corporation and the Department of Energy, the Department of Defense will continue to be a leader in the pursuit of national energy goals.

SMALL RENEWABLE ENERGY SYSTEMS AND THE PURSUIT OF INDEPENDENCE

By

Martin R. Adams
Deputy Program Director
for Solar, Geothermal, Electric
and Storage Systems
Department of Energy

Mr. Marienthal, Mr. Chairman, workshop participants...I am particularly pleased to be here this morning, for I have been convinced for some time that we must, as a nation, place a great deal of emphasis on SMALL, marketable, renewable energy systems if we are to retain our accustomed independence at the family, community and small industrial levels -- and I feel that you will also conclude in this workshop that such systems have a vital role to play in many military applications.

Perhaps you have heard of the ancient Chinese curse, "May you live in interesting times." For those of us in the energy business, 1979 has not been boring. Public interest and concern over the national energy picture is at its highest level since the 1973 embargo. Over the past five to six years we've had almost a continual shortfall in one fuel or another -- but the gasoline shortage this summer really hit us where it hurts; in our personal independence. For the first time, we as individuals, have more directly felt the energy constraints that some businesses and communities have encountered earlier, and have had to stop and plan real changes in our lives. Sometimes it was relatively insignificant, like planning the family schedule around whose car is odd or even, or taking a bus to work. On the other hand, a family which was considering buying a house fifty miles from their place of work may have had to resort to second thoughts. At the moment we have plenty of gasoline, but we know that it will never be 40 cents a gallon again.

When this country was founded we were promised life, liberty and the pursuit of happiness. Somehow we've come to equate these values with the right to cheap, abundant energy from depletable fuels. We tend to forget that many of our forebearers ran their lives on whatever the individual family or small community was able to gather in and that most of their fuel sources were renewable. Until the coming of a nationwide rail network made it possible to distribute coal to every home, the colonial family and the Western homesteader lived pretty much the same. Homes were heated with wood fires. Land transportation and agriculture ran on horses, mules, oxen, and people. Wind moved boats on river and ocean. Lighting came from bear fat or whale oil or beeswax or sheep tallow. Water power ground wheat into flour and spun wool and cotton into yarn for clothes. When we went to war, we used horses and mules to haul artillery and wind and galley slaves at sea. This first age of "Small Renewable Energy Systems" lasted a remarkably long time and never died out in the more remote parts of the United States. Henry Ford was a long-time advocate of alcohol from farm crops as a motor fuel, reasoning that this would take up the slack in wheat production as horses were phased out. West Virginia coal was shipped to Washington on mule barges via the C&O Canal until 1924. Windmills supplied electric power and irrigation pumping on farms until the 30's, when they were replaced by rural electrification programs. Boise, Idaho, began heating homes with geothermal energy in the 1890's; this system is still functioning, although many homes went "modern" with natural gas later on. Solar hot water heaters were popular in Florida before cheap depletable fuels came along.

Perhaps by coincidence, the discovery of large quantities of oil and gas in this country occurred during the heyday of the giant trusts. A consumption economy made a lot of sense at the time -- the consumer enjoyed a warmer home and the ability to get around fast, and the industries profited. During this period the United States was transformed into a world power, partly on the basis of our large domestic energy resources and complex distribution systems. We rationed gasoline during the Second World War, but we didn't have to fight out the consequences of an embargo to win the war. Even as we started importing cheap Middle Eastern crude to take care of more and more of our needs, we became smug about our energy future. The Sherman Anti-Trust Act and the progressive income tax diminished the power of individual energy resource companies, but the age of conspicuous consumption went on and on.

Meanwhile, individual Americans became accustomed to energy that was not only cheap but convenient. No need to go out and feed and water and curry Old Paint every morning -- just drive him around the corner and fill him up every couple of days. Chopping wood is something you do to add a little atmosphere to the parlour. A flick of the switch turns night into day and winter into summer and summer into winter. Don't waste valuable personal energy on striking matches, brushing teeth, or opening cans: an electric appliance for every task. Even now, the most popular wedding present in D.C. is a machine that performs a dozen tasks that used to be done with a paring knife or a hand-operated egg beater. Need to get away from it all? If you don't have a camper, you can still load up the family car or hop on a plane and head for the beach or the hills.

The price we've paid for all this convenience is the loss of our independence, of control over our lives. Indeed, we are dependent upon access to the oil resources of the Middle East, a politically volatile region in the shadow of the Soviet Union. The military implications of our vulnerability are becoming more clear daily. The possibility of Soviet control of the Middle East oil tap can no longer be ignored.

This presents a particularly difficult energy problem to our military. To be a deterrent, we must be prepared to defend the Middle East and Persian Gulf and the sea lanes without having access to fuels from these areas. Energy independence of our military forces is now a requirement if they are to be a deterrent. In addition, because of the quantity of energy resources used by the military, conversion to alternate fuel sources, where possible, becomes an important factor in meeting the nation's energy goals. Many such opportunities lie in the SMALL solar applications category.

I understand that the Department of Defense will convert 19 percent of their energy needs to more abundant solid fuels by 1985 and 1 percent to solar or renewable sources.

These are important goals, for the goal for solar (and other renewables) amount to 50MW in 1985.

The Department of Energy is assisting industry in developing large central energy conversion systems in solar thermal, photovoltaics, ocean thermal and geothermal areas. These involve electric power production systems up to 100 megawatts and more. They are also targeted for large process heat and large fuels and chemical production. In their respective areas of application, they all have national importance.

But the renewable energy activities that are exciting to me are the small, individually operated, system applications. Among others, we now have a solar thermal system pumping irrigation water in New Mexico; a small photovoltaic system providing electric power to an Indian village in Schucholi, Arizona, and a 200 KW wind turbine in operation at Culebra, Puerto Rico.

In keeping with this, this workshop is devoted to solar thermal electric power applications ranging from a few megawatts down to 15 kilowatts in size. More particularly, it involves parabolic dish (or point focusing) technology, one of our most promising concepts for small community, small industrial and military applications. The importance of this technology stems from its high potential efficiency, and from its characteristic modularity. These characteristics make it a "high perfomer", one that is easily mass produced and that has a minimum in field installation costs. JPL is technically managing this program for DOE and is doing a fine job.

Most of you are also aware of the cooperative DOE/DOD activity in developing a 100 KW experiment for the U.S. Navy Civil Engineering Laboratory that JPL is also managing as part of our solar thermal applications activity. It is an exciting project and is an important step in the dish technology program. But you will hear more about this during the workshop.

For now I'd like to sum up. I am convinced that we must place a great deal of emphasis on SMALL renewable energy systems if we are to retain our independence as individuals, and on a community and small industrial basis. As a nation, we have the resources to do this job -- and are well underway. This workshop is an integral step in this process and I wish you much success in meeting your objective over the next few days.

APPLICATIONS OVERVIEW

PRECEDING PAGE BLANK NOT FILMED

MILITARY APPLICATIONS FOR ELECTRIC POWER SYSTEMS - AN OVERVIEW

By

J. Scott Hauger
Program Manager, Military Energy Programs
The BDM Corporation

Military applications for electric power can best be investigated by operational categorization based on mobility, duty cycle, and mission imposed operational constraints. These categories are:

- Tactical Combat and Combat Support Systems
- Theater Nontactical Transportable Systems
- Remote Systems
- Emergency/Standby Systems
- Facilities and Permanent Installations

Tactical systems have the most stringent operational requirements which limit the use of solar energy to garrison and special applications. Multifuel heat engines appear very attractive, raising the potential of a functional solar capability. Point focusing systems are operationally feasible for many theater and most remote applications. The attractiveness of solar power systems will be primarily a function of the escalating cost of fuel. Emergency systems' duty cycles are incompatible with solar availability, but the need for such systems can be reduced if modular solar power systems are used to provide self-sufficiency to critical military facility applications. Solar thermal electric power can be operationally compatible with and economically attractive for fixed facilities application but no new bases are anticipated and Congressional appropriation for replacement is not anticipated.

Total military power requirements in the first four categories are at least 1700 MW, with an annual procurement potential of 130 MW. The plant requirements for all of these systems can potentially be satisfied by Stirling or Brayton cycle thermal electric power systems. Solar provided heat is consistent with the plant requirements of approximately 23 per cent of annual procurement, or 29 MW. A further 30 MW/year is potentially feasible if self-sufficiency of critical military power requirements is funded by Congress. A decision to seek total base self-sufficiency would generate perhaps 220 MW annual procurement.

Cost goals vary with assumptions, but are most sensitive to escalating fuel costs. A baseline scenario assuming 8 per cent annual fuel escalation (the current USAF assumption) indicates system goals of 120-210 mills/kwh for most military applications, and 86-93 mills/kwh for fixed facilities applications. The benefit of solar provided heat should not be tested against current systems, because successful solar thermal electric power development implies more efficient heat engines, against which fuel savings must be tested. A baseline scenario indicates array/receiver cost goals of \$900-\$2700/kw, depending on duty cycle, for hybrid systems, and \$600-\$1800/kw for pure solar systems with storage.

SOLAR THERMAL ELECTRIC POWER SYSTEMS IMPACT ANALYSIS AND REQUIREMENTS DEFINITION STUDY

By

Dr. Yudi Gupta
Science Applications, Inc., McLean, Virginia

Solar thermal electric power systems have the potential to supply power for industrial, commercial, institutional, and utility applications and to reduce consumption of non-renewable fossil fuels. SAI is currently under contract to JPL to analyze the impacts of solar thermal electric systems and to define requirements in terms of system cost, performance, and design which are necessary for the development and utilization of solar electricity. The results to date and the discussion here relate primarily to electric-only applications in the 1-10 MWe range.

The impacts analysis and requirements definition of solar thermal electric systems is an extremely complex analysis for even a single application. Several key steps are involved. It is first necessary to evaluate the status of solar thermal electric technology, to identify promising applications, and to characterize important site/region variables. In addition, these interrelated tasks must be developed quantitatively in terms of system cost/performance models, load models and characterization of user energy and financial needs, and models on site/region characteristics including hourly weather tapes. It is then possible to perform detailed impact assessments and identify key system requirements.

The approach taken by SAI reflects each of these key steps. The emphasis here is on the general nature of the application, the data requirements, and the key parameters which must be addressed for an effective solar thermal electric requirements definition.

A variety of technologies are currently under investigation for each STEP subsystem, each with its own set of design parameters and cost/

performance characteristics. The presentation slides provide a few brief examples of collector design parameters, thermodynamic cycles, current engine availability, and key environmental parameters that influence the system.

These environmental parameters are directly related to regional considerations. Data profiles for each of the major meteorological variables have been derived by SAI for the U.S. Two primary parameters which affect system cost/performance are direct normal insolation, and cost of conventional electricity. The cost-effectiveness (present worth) of a solar system for a given configuration is generally proportional to the product of these two parameters; hence, SAI has used this product as a cost-effectiveness parameter to develop, in conjunction with insolation, a regionalization of the U.S. for large grid-connected applications. Various classes of applications have quite different energy requirements based on their key mission requirements. The profitability orientation of manufacturing establishments, for example, stands in sharp contrast to the defense mission of military installations, or the concern of utilities for reliable power generation.

A detailed analysis of potential industrial applications was performed based on energy consumption, electricity costs, load shapes, insolation, and representative solar system performance and costs.

Load profiles are an important consideration for analyzing the impacts of solar thermal electric systems. SAI has developed a large data base of load profiles for various applications. In line with the interests of many of the workshop attendees, it is interesting to note that military installations provide a mix of activities whose energy demands are very similar to civilian energy consumption patterns. Military loads reflect a mix of residential activities, 24-hour continuous industrial and equipment loads, and one or two shift administrative and commercial-type activities. Military installations are considered to be a favorable application because of the desire to be independent of utility outages, the availability of manpower for operation and maintenance, the availability of funding if mission requirements are met, and the orientation towards long-term economics.

REQUIREMENTS FOR ISOLATED POWER SYSTEMS

COMMUNICATIONS SITES APPLICATIONS AND REQUIREMENTS

By

Eugene Phillip
Defense Communication Agency

Military Handbook 411 establishes performances requirements and configurations for power systems supporting DCS stations. In addition to cost, RAM, power quality and auxiliary power requirements are stringent power availability requirements.

As is stated in the handbook, the primary power supply, auxiliary power supply, and distribution system shall be engineered so as to provide 99.99% availability (exclusive of scheduled outages) to the technical load bus and not in excess of 53 minutes total outage time during any one year. Computer supported systems require even greater standards, where a voltage reduction to 75% of normal for only a fraction of a cycle constitutes an outage. The conventional UPS systems are expensive, complex, and reasonably inefficient. In making a design selection from several possible configurations, particular communication subsystem requirements should be considered.

In conjunction with communications facilities are many power requirements. Research is being done in the area of unattended communications facilities to determine the feasibility of integrating multiple sources of power into a consolidated alternate power system. The power sources would consist of photovoltaic cells, thermo-electric generators, and batteries. Raw power generation is not the only power requirement that must be considered. Environmental control systems which provide heating, cooling, and dehumidification are essential to uninterrupted communication operations. The power requirements for these systems cannot be neglected.

In addition to the aforementioned constraints and requirements is the survivability aspect. The DCS has a wartime role which must take into account at least partial operation under the effects of nuclear weapons, chemical and biological warfare, electronic warfare, conventional weapons, sabatoge, and other unauthorized entry.

In conclusion, the Defense Communications System has a full range of possible applications for alternate power systems. The special requirements of availability and survivability must be considered. At this time the most practical application appears to be unattended microwave repeater stations. DCEC has tasked the Army to develop an integrated system for such an application, consisting of photovoltaic cells, thermo-electric generators, and batteries. The success of this should open the door to other larger applications.

ISLAND APPLICATIONS OF SOLAR POWER SYSTEMS

By

Eugene M. Grabbe
Dept. of Planning and Economic Development
State of Hawaii

Solar thermal power can play an important role in island energy supply, especially if the plant is designed to match the local environment, power requirements and social expectations. Hawaii's Governor, George R. Ariyoshi, has set a goal of energy self-sufficiency, and all counties of the State are developing individual energy self-sufficiency programs. In response to a recent U.S. Department of Energy proposal request, a ten-megawatt solar repowering system has been proposed for the Island of Kauai. We are also awaiting DOE's one-megawatt solar thermal power plant Request for Proposal.

Hawaii works closely on energy and other matters with the other U.S. Pacific Islands. We have cooperated in solar planning with Guam, American Samoa, the Commonwealth of the Northern Marianas, and the Trust Territory of the Pacific Islands. Pacific Islands range from large, mountainous, heavily-populated islands, such as Hawaii's Oahu, to small, sparsely-settled Micronesian atolls.

The major thing all the U.S. Pacific Islands have in common is a high dependency on imported oil. We have no indigenous fossil fuel resources, either petroleum, natural gas, or coal. Hawaii is over 90 percent dependent on oil for energy; the other U.S. Pacific Islands are completely dependent on oil.

Furthermore, each island's electric grid is independent. Even in heavily-populated and technically-advanced Hawaii, there are no inter-island utility interties. In Hawaii, we have among the highest electricity rates in the nation, ranging from over five cents per kilowatt-hour for the first 100 kilowatt-hours per month on Oahu, the most densely-populated island, to nine cents per kilowatt-hour on the Island of Molokai.

In Micronesia and the Northern Marianas, U.S. government subsidies keep the customer's electricity cost at approximately three cents per kilowatt-hour, although it costs over seven cents per kilowatt-hour to generate. This policy was adopted to encourage economic development, and some island governments have considered changing it to more accurately reflect the cost of power generation.

All of the U.S. Pacific Islands have a deep interest in reducing their dependence on oil imports, and increasing their use of indigenous, essentially inexhaustible resources such as solar radiation. These islands have the highest annual average insolation rate in the nation.

The Pacific Islands thus share two important characterisitics: an ample solar radiation resource, and a great need to reduce oil imports. Both of these factors will encourage the use of solar thermal power. However, there is another shared factor which will limit solar thermal development: lack of land area.

Being so limited in land area, real estate is one of Hawaii's major commodities. With the demands of a growing population, including more housing, roads, recreation areas, and agriculture, it will be difficult and expensive to obtain large contiguous areas for solar thermal power development. The land situation and the lack of inter-island utility interties tends to favor smaller solar power plants, sized and sited to meet local needs.

Almost all of the electricity in the Pacific Island territories is generated by diesel equipment, much of it antiquated. In most cases, electricity is only available in the population centers, leaving the villages without power. Often the general capacity is sufficient to support electric lights and communication devices, but not enough for refrigeration, which has serious effects on the islands' economy and the health of their people.

A factor which must be considered when designing equipment for island environments is the corrosive quality of salt-laden air. Hawaii's many mountains help deflect the wind, and corrosion is not a serious problem inland. The Pacific atolls, however, have no mountain masses to isolate them from salty winds: the entire islets are, in effect, shoreline.

SOLAR THERMAL POWER SYSTEMS IN DEVELOPING COUNTRIES

By

Alan Poole
Office of Energy
Agency for International Development

The range of electric power systems and associated generating subsystem choices in LDC's is as large and diverse as in the developed world. On the one hand we have integrated grids supplying rather large urban loads, such as in southern Brazil where resources, economics, and system size have combined to create the world's larget power generating station, Haipu Binacional. On the other hand, we have large populated areas with no grid and very little power generation.

To date, AID has shown virtually no interest in urban systems. This situation is beginning to change as AID is slowly moving into urban/industrial energy systems.

Until very recently, AID and other donor programs to supply electricity to rural areas meant essentially only one thing--the establishment of a grid. This strategy was not very hospitable to careful analysis of specific priority applications to determine how little capacity could be installed since the objective was to uncover as large a latent demand as possible in order to spread the heavy investment in subtransmission and distribution. As a consequence, cost benefit analysis consisted of a shotgun fired at a multiplicity of miscellaneous uses, many of which certainly did not immediately impact the productivity of the local economy.

This does not mean that these "nonproductive" uses are undesirable, and we anticipate that classical rural electrification will proceed. However, there is also an argument that given limited financial resources and the large number of settlements with virtually no power, it is both more equitable and more efficient economically to pinpoint "strategic" welfare or productivity enhancing loads throughout a country. In this case it is quite possible that even with a higher unit cost per delivered KWh more strategic loads can be supplied with a given rural electrification investment budget than with the classical approach. This kind of thinking seems to be gaining favor with time, and it is, of course, good news for those interested in technologies adapted to decentralized applications. This approach, however, requires that we have a clearer idea of just what these loads and their specifications are. It also puts on pressure to develop technologies which are better adapted to rural requirements than the current generation of diesel generating sets.

A RELATED SOLAR THERMAL APPLICATION

SOLAR THERMAL PRODUCTION OF MOBILITY FUELS

BY

D. W. Gregg, R. W. Taylor and J. H. Campbell
Lawrence Livermore Laboratory
Livermore, California

A preliminary evaluation of the technical and economic feasibility of solar thermal production of mobility fuels has been performed. The analysis indicates that there are three areas where solar thermal energy could provide a major assist in the production of mobility fuels in the near to intermediate term. They are Solar Coal Gasification, Solar Oil Shale Retorting and Solar Steam Flooding of Oil Fields. It is assumed that solar assisted production of mobility fuels starting from a fossil fuel resource will be more economically viable in the near to intermediate term than solar fuel systems that start from CO_2 and H_2O. This presentation deals with two of the three above-mentioned areas: Solar Coal Gasification and Solar Retorting of Oil Shale. Both analytical and recent experimental results obtained at the White Sands Solar Furnace are presented.

REQUIREMENTS FOR PORTABLE POWER

MILITARY THEATRE APPLICATIONS AND REQUIREMENTS FOR ADVANCED ENERGY CONVERSION TECHNOLOGY

By

Richard G. Honneywell, 2d Lt, USAF
and Thomas E. Hausfeld
U.S. Air Force Air Propulsion Laboratory

The advent of Advanced Energy Conversion Technology, fostered by the Department of Energy, may allow the U.S. Military to enhance its ability to operate in hostile theatre environments. The perceived threat to many operational units is twofold; the ease of power system detection and unit destruction, and the non-availability of power due to system failure or interuption of fuel supplies. The operational command must evaluate and quantify this threat. If a sufficient threat exists, the desired characterisitics of the new power system must be linked to the characteristics of state of the art or evolving technologies. Then an appropriate development program can possibly be formulated to provide the advanced system. An example is made of the Air Transportable Hospital. It is concluded that Advanced Power Systems will be used in the DOD theatre operations if they have the desired characteristics to enhance system survivability and maintainability and are replacing systems in a timely and cost effective manner.

ARMY MOBILE ELECTRIC POWER:
APPLICATIONS AND REQUIREMENTS

By

C. Sherman Grazier
Chief, Support Branch Headquarters
U. S. Army Engineer Center

This presentation covers the following subject areas:

- Army mobile electric power requirements
- Available MEP systems
- Extent of Army MEP usage
- MEP problems
- Operational constraints
- Liquid fueled/solar heated system
- Operation design criteria
- Non-vehicular fueled system
- Modular system vs. single unit system

The Army currently has three Department of Army approved requirements documents for MEP items. Two requirements documents are being considered for approval. One requirement is for a family of military design, multipurpose electric power plants providing power ratings and frequency options. This must be a system which is multipurpose, simple to operate and maintain, highly reliable and durable, and low in fuel consumption. The second requirement document was prepared to allow expedited development of a gas turbine driven member of the family of military design electric power plants.

Current electric power generating sources are extremely susceptible to aural and IR detection, endangering personnel and equipment in their vicinity. They hamper the using units' ability to listen for enemy activity. A generator set that is difficult to detect by visual and aural means will enhance the combat capability of friendly tactical units. The third document provides for these generators.

The overall goal of the two requirements being prepared is to reduce the types of generators to 60 Hz AC units with standardized distribution systems delivering power to using equipment. Power requirements other than 60 Hz AC will be provided by use of solid state power conditioners located at the using equipment.

Assuming that complaints received from field users can be related to problems with the current MEP sets, the greatest problems reported deal with reliability and noise. DOD is also trying to reduce the requirement for gasoline on the battlefield. In view of uncertainties in availability of liquid fossil fuels, new fuels and engines than can use them should be a high priority research item. A potential problem also under investigation is infrared emissions.

The Army must be prepared to fight worldwide in all climates, day or night, against well-trained and equipped opponents, in a nuclear environment, and WIN. Thus natural operational constraints exist. Others are the result of technical considerations. Military standards and specifications have been developed in an effort to standardize equipment. These concern mobility, fuels, reliability and maintainability, noise emissions, infrared emissions and visual signature.

In theory an engine that can use any form of fuel found locally to drive a generator should be ideal. For installation or semi-permanent power requirements such a flexibility in choice of fuels can result in system design and operational cost savings. Heat engines can be called multi-fuel engines in that they can, by using different combustion equipment, burn several types of fuels.

Modularity provides maximum potential of flexible arrangement to achieve a total power requirement. A family of appropriately sized single unit generators provides the modularity required. The number of modules that can be combined is limited primarily by available transport.

RENTAL APPLICATIONS AND REQUIREMENTS

By

Vernon H. Waugh, Jr.
Curtis Engine and Equipment, Inc.

For the past thirty years, Curtis Engine has been selling and renting Engine Powered Generators. Our facilities produce custom built generator sets from 5 kilowatts to one megawatt. Although the reasons for "Rental" can range widely, they can be put into two categories:

A. A temporary need for electrical service. ("Temporary" users).

B. A need for power at more than one location to meet a specific need or needs. ("Mobile" users).

The rental unit has advantages of availability, convenience, and economics. It is available immediately. Economics will play an increasing role in the Rental Market. The utility is increasing the cost for temporary service to meet their actual cost. In the past, the charges for temporary service were below actual cost for the utility to install the temporary lines. Additionally, the utilities are starting to charge for demand or peak times.

Due to the higher charges from the utility during the coal strike in 1978, and the increased demand charges, a clothing manufacturer provided 50% of his own power using a rental generator. Using a total cost program of Rental, Fuel, Maintenance, and Repair the "Rental Power" was 10 to 12% lower than the utility power.

In 1978, 22 cents of every Rental Dollar was spent in equipment maintenance, 4 cents for onsite repairs and 18 cents for preventive maintenance.

In today's market there are approximately 250 generators in an active rental market for the Baltimore-Washington area. Nationally, there are estimated to be 3000 generators, 15 kilowatt or larger in the rental market.

From a logistic standpoint of supplying fuel and fuel tanks, a solar system would reduce or eliminate this problem. The safety problem of storage of flammable fuels would be eliminated. Maintenance, repair, and operation of the diesel or gasoline engine would be eliminated. Ninety-five percent of service problems with rental generators are with the engine drive end of the generator set. Environmental problems of noise and exhaust pollution would also be eliminated.

A solar unit would require a high degree of foolproofing and vandal-proofing, like an engine powered unit. A multi-fuel system would be the best marketing tool to introduce the solar system. The user would have the advantages of solar and the peace of mind that the backup system would supply its needs.

REVIEW OF CURRENT
APPLICATIONS EXPERIMENTS

THE JPL ENGINEERING EXPERIMENT NO. 1
SMALL COMMUNITY SOLAR THERMAL POWER EXPERIMENT

By

Taras Kiceniuk

A brief history of the Small Community Solar Thermal Power Experiment is given, beginning with the concept definition studies and brought up to date with a current status report. The various candidate systems from the first study phase are described, as are the steps which led to the recent selection of the Rankine cycle for the engine which is to drive the generator mounted at the focus of each of the parabolic dishes in the collector field.

THE JPL ENGINEERING EXPERIMENT NO. 2

By

Richard Levin
Louis Huang

The Thermal Power Systems Office of the U.S. Department of Energy (DOE) is responsible for developing the technology for low cost, long life, reliable solar thermal electric power systems suitable for a wide range of terrestrial applications. To accomplish this goal DOE established program offices within the Thermal Power Systems Branch in two primary areas of solar thermal energy: large thermal power system applications, and small thermal power system applications. The latter is managed by the DOE Small Thermal Power Systems Section. The PFTEA Project is one of three projects formed at the Jet Propulsion Laboratory (JPL) to support this Section at DOE.

The general goal of the PFTEA project is to establish the technical, operational, and economic readiness of small power systems for a variety of applications in the power range below 10 MWe. Power Systems are to be developed to the point where subsequent commercialization efforts can lead to successful market penetration.

The Engineering Experiment No. 2 (EE No.2) Series is a major experimental activity within the PFTEA Project. EE No. 2 is planned as a series of small (100-200 kWe) solar thermal power experiments, each of which is meant to address a separate isolated load application.

The EE No. 2 series of experiments will employ point focusing distributed receiver technology with emphasis on electric and thermal power applications. The program will be closely integrated with other JPL activities with the objective of technically demonstrating the technologies being developed under those projects.

The first experiment in the EE No. 2 Series (EE No. 2a) has been initiated and is cosponsored by the U.S. Navy under the auspices of the

Civil Engineering Laboratory (CEL). CEL and JPL have worked together to develop system requirements. EE No. 2a will be a modular system using a hybrid fired Brayton cycle energy conversion. Subsequent experiments will test slightly different versions of similar hardware in different applications which are now being selected. The engineering experiments will be designed, installed, and operated to permit JPL to better understand solar thermal plant applications and technical feasibility.

IMPLEMENTATION

DOD STANDARDIZATION & IMPLEMENTATION

BY

Colonel A. G. Rowe
Project Manager, Mobile Electric Power

The Mobile Electric Power (MEP) project officially began in 1967 with the mission to minimize the makes and models of mobile electric power sources and maximize standardization while managing procurements. A DOD family of generators was established with provisions for evolution. The number of makes and models declined over 75% in five years accompanied by a correspondingly large drop in generator support items. There are now about 40 standard mobile electric generators designed to meet all of DOD's needs. A five year procurement plan has been forecast. Quality is maintained and technical consultation provided to determine the best generator for the application. Development is continually underway attempting to close the gap between the advent of new technology and its introduction into the generator family.

MANUFACTURER AND PRODUCTION IMPLEMENTATION OF SMALL SOLAR THERMAL ELECTRIC POWER TECHNOLOGIES

By

James J. Connolly
President
Solar Thermal Division
Solar Energy Industries Association

The primary motivating factor in private industry's decision to make a production decision is Return on Investment (ROI).

Modern business analysis shows high technology return on investment in a product oriented business can be measured by nine (9) parameters. The key parameters are capital, investment, market identification, market share, product cost growth, and product quality. In addition, maintainability, reliability and service are given careful consideration before capital intensive production decisions are made.

These factors often in industry take precedence over technical innovation and component optimality. To this point these factors applied to Small Thermal Electric Power Systems have not yet yielded positive production decisions on the part of private industry.

A program is proposed where Domestic Policy Review Board's 3 quad BTU goal for solar thermal by the year 2000 can be reached. This program also establishes the framework for causing positive production decisions on the part of U.S. industry.

"THE ROLE OF CONGRESS"

By

Senator Pete V. Domenici (R-NM)

Good morning! When I accepted your invitation to speak at your solar workshop, I had no idea I would be getting up with the sun to be here.

As I understand it, you have been spending several days talking about solar thermal electric technologies from the standpoint of what the users of these technologies need and what the producers have to offer. The users, in this case, are different groups within the Federal Government; and as such, I would like to speak with you about the role of Congress in promoting and encouraging this "market" activity. After all, who holds the purse strings?

Generally speaking, you could characterize solar power as the apple pie issue of the Congress' eye. There are very few Congressmen who would vote against a piece of solar legislation on the floor of the House or Senate where they are truly under the scrutiny of their constituencies. This would lead you to believe that any solar bill introduced in the Congress was bound to pass. Why, you might expect the Washington Monument to be covered with solar cells if it were not for the crucial role that Congressional Committees play in molding such legislation. Committees such as the Senate Energy Committee, the House Commerce Committee, and the House Science and Technology Committee have the job of doing the substantive work and real analyses that go into good solar legislation.

A question that frequently comes to my mind in the hearings we hold in the Energy Committee is: Why do we need this legislation? That may sound like an obvious question with an equally obvious answer; but, in making public policy decisions on what incentives we are to provide for solar development, we have to craft the legislative remedy for the specific constraint to solar use. These constraints are many, and they are often not simply overcome.

They include:

Economic Constraints

1. High initial capital costs
2. Long payback on investment
3. Risk of consumer indifference

Institutional Constraints

1. Lending institutions (FNMA and GNMA)
2. Prohibitive utility rate structures

Regulatory and Legal Constraints

1. No right to sunlight
2. Higher property taxes due to solar equipment resulting in longer payback

The incentives to overcome these constraints are many and, as I will describe, sometimes appear to have little to do with a specific constraint. I should also note that the Federal Government is not alone in its desires to promote solar use. Since 1974, 22 states have passed laws exempting solar equipment from sales taxes. Another 27 states have lowered the property taxes on solar equipment. Several states like my own, New Mexico, support solar R&D and encourage the development of solar industries.

At the Federal level, a number of steps have been taken to assure the consuming public that this developing industry is an honest one. Legislation calling for performance standards and certification procedures has been passed and a number of direct economic incentives were included in The National Energy Act such as:

1. An income tax credit for solar equipment
2. Likewise, a business tax credit
3. Loan support for heating and cooling equipment
4. $100 million for solar devices in federal buildings
5. $98 million for federal purchase of photovoltaic cells

These last two provisions of The National Energy Act may seem somewhat unusual if our goal was to promote the use of solar in the private sector, but they were designed to do just that.

Not only was the tool of federal procurement used to foster widespread demonstration of the utility of these different solar technologies, but these programs were a way to promote the industries. In the instance of the photovoltaic procurement, the goal was to promote the industry and, therefore, lower the cost of the technology by bringing the industry along its "learning curve." This program's intent may appear to be obvious to you and most virtuous at the same time. Remember though that similar approaches had never been pursued to benefit the civilian population. The Defense Procurement Act was designed to promote certain industries vital to the National Defense, not industries vital to the consuming citizen.

The idea of federal procurement of solar technologies goes to the heart of what you must have been discussing over the past few days. I am sure for the industry representatives the question of whether this "tool" will be used in the future must be an important one.

In this regard, I must discuss with you some of the different philosophies I see expressed on the Energy Committee as we work on solar legislation.

There are those Senators who believe that the marketplace should be allowed to work and the Federal Government has no role in the promotion of the solar industry. Those Senators are a small minority; and, as time goes on, they would appear to be growing smaller as we gradually realize that the development of alternative energy sources is in the national interest.

Other Senators believe R&D is as far as we should go in the promotion of solar energy by the Federal Government. Obviously, support of this new industry by cost effective federal procurement goes beyond this and even beyond simple demonstration programs. The key to the acceptance of this strategy has been that the procurement is on a "cost effective basis." Because of this, and the realization by many Congressmen that solar technologies have wide applications even under this constraint, I believe you will find further encouragement of federal procurement in the solar area.

APPENDIX C
AGENDA

POINT FOCUSING THERMAL AND
ELECTRIC APPLICATIONS PROJECT

JPL SOLAR THERMAL ELECTRIC POWER USERS WORKSHOP

The BDM Corporation
The BDM Corporation Conference Center
(Westbranch Facility)
Chairman - J. Scott Hauger

AGENDA

Tuesday, September 11, 1979

INTRODUCTION

6:00 pm	Welcome and Introduction	JPL	T. Kuehn
6:15 pm	Point Focusing Distributed Receiver Solar Thermal Power	JPL	V. Truscello
7:30 pm	Introduction of Working Groups	BDM	J. S. Hauger
8:00 pm	Reception		

AGENDA

Wednesday, September 12, 1979

KEYNOTE SPEAKERS

8:15 am	Welcome	BDM	Earle C. Williams President, The BDM Corporation
8:30 am	DOD Keynote Speaker	DOD	George Marienthal, Deputy Asst. Secretary of Defense for Energy, Environment & Safety
9:00 am	Questions/Discussion Period	DOE	Martin Adams, Deputy Program Director for Solar, Geothermal, Electric & Storage Systems
9:45 am	Coffee Break and Questions		

APPLICATIONS OVERVIEW

10:00 am	Military Applications for Solar Thermal Electric Power Systems	BDM	J. S. Hauger
10:30 am	Solar Thermal Electric Power Systems Impact Analysis and Requirements	SAI	Y. Gupta
11:00 am	Questions/Discussion Period		
11:30 - 12:50 pm	Working Lunch/Group Meetings		

REQUIREMENTS FOR ISOLATED POWER SYSTEMS

1:00 pm	Communications Sites Applications and Requirements	D.C.A.	E. Phillip
1:30 pm	Island Applications and Requirements for Solar Power Systems	State of Hawaii	E. Grabbe
2:00 pm	Developing Country Applications and Requirements	AID	Alan Poole
2:30 pm	Coffee Break and Questions		

AGENDA

Wednesday, September 12, 1979

A RELATED SOLAR THERMAL APPLICATION

3:00 pm	The Production of Mobility Fuels	LLL D. Gregg
3:30 pm	Questions/Discussion Period	
3:45 - 5:05 pm	Group Meetings	
5:15 pm	Summary and Adjournment	
7:00 pm	WORKSHOP DINNER TYSONS CORNER HOLIDAY INN	

AGENDA

Thursday, September 13, 1979

8:15 am	Coffee		

REQUIREMENTS FOR PORTABLE POWER

8:30 am	Military Theater Applications and Requirements	USAF APL	Lt. R. Honneywell
9:00 am	Questions and Coffee Break		
9:30 am	Portable Power Applications and Requirements	U.S. Army TRADOC	T. Batty
10:00 am	Rental Equipment Applications and Requirements	Curtis Engine	V. Waugh
10:30 am	Questions/Discussion Period		
11:00 - 1:20 pm	Working Lunch/Group Meetings		

REVIEW OF CURRENT APPLICATIONS EXPERIMENTS

1:30 pm	Engineering Experiment I	JPL	T. Kiceniuk
2:00 pm	Engineering Experiment II	JPL USN	R. Levin L. Huang
2:30 pm	Coffee Break and Questions		

IMPLEMENTATION

2:45 pm	Informal Panel Discussion: Implementation of DOD Research and Development	USAF USN USN	CPT. D. Hall P. Ritzcoven M. Carr
3:45 pm	Standardization and Implementation	PM-MEP	Col. A. Rowe
4:15 pm	Questions/Discussion Period		
5:30 pm	Summary and Adjournment		

AGENDA

Friday, September 14, 1979

8:15 am	Coffee		

IMPLEMENTATION

8:30 am	Introductory Remarks		
8:45 am	Manufacturers' and Production Implementation	SEIA	J. Connolly
9:15 am	The Role for Congress	U.S. Congress	Senator Pete V. Domenici (R N.M.)
10:00 am	Coffee Break and Questions		
10:45 - 12:20 pm	Group Meetings/Working Lunch		

GROUP REPORTS

12:30 pm	Group I Report
1:00 pm	Group II Report
1:30 pm	Group III Report
2:00 pm	Group IV Report
2:30 pm	Summary and Closing Remarks