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ENERGY INITIATIVES REVIEW
DEPARTMENT OF DEFENSE

DOCUMENTS

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HEARING
BEFORE THE
SUBCOMMITTEE ON
MILITARY CONSTRUCTION AND STOCKPILES
OF THE
COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE
NINETY-FIFTH CONGRESS
SECOND SESSION

DECEMBER 18, 1978

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EMERGENCY INDUSTRIES REVIEW
DEPARTMENT OF DEFENSE

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ENERGY INITIATIVES REVIEW DEPARTMENT OF DEFENSE

MONDAY, DECEMBER 18, 1978

U.S. SENATE,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON MILITARY
CONSTRUCTION AND STOCKPILES,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:05 a.m., in room 212, Russell Senate Office Building, Senator Gary Hart, chairman, presiding.

Present: Senator Gary Hart.

Also Present: James C. Smith, professional staff member; Jeanie Killgore, clerical assistant; and Terry Johnson, assistant to Senator Hart.

OPENING STATEMENT BY SENATOR GARY HART, CHAIRMAN

Senator HART. These hearings will come to order.

About a year ago, this subcommittee held a set of hearings to examine the potential for the Department of Defense to assist in solving the energy crisis. At that time, I indicated that the subcommittee felt that the Defense Department, with its unquestioned technological expertise, could contribute significantly in several areas.

First, military installations are essentially Federal communities, and therefore, in my opinion, military installations offer an excellent opportunity to test new energy devices or procedures to demonstrate the potential application on a nationwide basis. I have in mind, for example, large total energy systems; biomass or refuse derived fuel power plants; large scale computerized utility monitoring and control systems, and so forth.

Second, the Defense Department is large enough to create a market for new devices—such as solar panels or photovoltaic cells. Once the Defense Department creates such a market, the economic law of supply and demand should take over to reduce unit costs and thereby expand the market.

Finally, I look to the Defense Department to accelerate public acceptance of new energy devices and new energy ideas. The Defense Department is made up of 3 million people—located throughout the United States and around the world—and if these individuals see and appreciate successful energy innovations, they will foster widespread acceptance of change by the general public.

A year after our initial hearings, I am more convinced than ever that there is a role—a significant role—for the Defense Department, working in concert with the Department of Energy and the Congress, to help resolve our energy crisis.

Several things have occurred since, and as a result of our hearings last year, which I think are significant and which I want to explore during this hearing today.

First, the Departments of Defense and Energy have been working together both formally and informally and have developed a joint set of energy initiatives which we hope to explore in some depth here today. Formal coordination channels have been established between the two departments and more importantly I sense that at the working level there is a professional exchange of ideas that can only speed up progress.

Second, we have proposed several legislative initiatives that were accepted by Congress and signed into law by the President which have the potential to significantly accelerate solar technology and the use of geothermal and other renewable energy sources. We intend to discuss today these provisions of law; how they will be implemented and what the impact will be.

Notwithstanding these accomplishments, I am still seriously concerned that we are not doing enough. It is not at all clear that we are moving as fast as we should in several areas and I am not satisfied that adequate resources are being applied to avoid unnecessary delays. We intend to get into specifics in this regard and hope to see if we can't resolve some of the bottlenecks.

This is an open hearing and the public record, as usual, will be kept open for 7 days to permit the filing of additional information to be considered for inclusion in the printed record.

Our first witness here this morning is the Under Secretary of the Department of Energy, Mr. Dale Myers. We are pleased to have you with us and proceed as you will.

STATEMENT OF DALE D. MYERS, UNDER SECRETARY, U.S. DEPARTMENT OF ENERGY; ACCOMPANIED BY DR. BENNETT MILLER, PROGRAM DIRECTOR OF SOLAR, GEOTHERMAL, ELECTRIC, AND STORAGE SYSTEMS

Mr. MYERS. Mr. Chairman, I would like to cover the statement and then open the hearing for questions, if it is acceptable to you.

Senator HART. That is fine.

Mr. MYERS. Mr. Chairman, I am Dale Myers, Under Secretary of the Department of Energy. You asked us to discuss our energy technology and supply activities as they relate to the energy problems faced by the Department of Defense.

Dr. Bennett Miller, the Program Director of Solar, Geothermal, Electric and Storage Systems is with me here today.

We welcome the opportunity to participate in these hearings. Since I last reported to you on January 26, 1978, we have worked closely with the Department of Defense to establish joint energy programs.

Let me begin by briefly reviewing our recent activities. In late 1977, and early 1978, I met with Deputy Secretary Duncan and the Under Secretaries of the three services to discuss how best to work together. Later George Marienthal, Deputy Assistant Secretary of Defense for

Energy, Environment, and Safety; Dr. Ruth Davis, Deputy Under Secretary of Defense for Research and Engineering; and Bob Thorne, Assistant Secretary of Energy Technology held a series of meetings which resulted in:

1. The signing of a memorandum of understanding between the Department of Energy and the Department of Defense to establish general procedures for cooperative activities.
2. A proposed agreement to encourage shale oil development and to assure the Department of Defense of adequate supplies of shale oil in the near term for test and evaluation purposes in military aircraft.
3. The initiation of several joint energy initiatives.
4. An inventory of joint projects, to be updated periodically.

DOE-DOD MEMORANDUM OF UNDERSTANDING

Let me elaborate. In my opinion, the signing of the DOE-DOD memorandum of understanding on October 19, 1978, will enhance the national security; reduce U.S. dependency on foreign energy supply; insure expanded use of renewable and abundant domestic energy resources; and promote energy conservation efforts.

Joint DOE-DOD activities will include research, development, and especially demonstration. DOE and DOD program coordinators have been appointed to supervise and review cooperative efforts, and to make recommendations to the Department Secretaries.

Bob Thorne has been the coordinator for the Department of Energy and since his resignation, those duties will be assumed by John Deutch, who has been designated as Acting Assistant Secretary for the Energy Technology area.

OIL SHALE COOPERATIVE PROGRAM

We in the Department of Energy share the concerns of the Department of Defense that future energy resources are assured for the mobility of the Armed Forces. We are putting together a memorandum of understanding on the synthetic mobility fuels program which will formally establish a cooperative program for DOD and DOE to identify and develop liquid hydrocarbon fuel sources.

The cooperative synthetic fuel program will seek to provide all liquid hydrocarbon fuels suitable for use in military mobile equipment. The initial emphasis will be on assessing the ability of an oil shale industry to produce refined products that meet DOD specifications.

There are two important issues facing us, one short and one longer term. In the next few years we must obtain sufficient oil shale crude and refined product—perhaps as much as a million barrels over 5 years—to permit the DOD to conduct a comprehensive and definitive test and evaluation program. A clear understanding of the characteristics of the new shale fuels is essential if widespread use in the armed services is to become a reality.

The question then arises as to how the DOD may secure adequate fuel for its test program. A significant part of that requirement perhaps can be obtained from the combination of the DOE-industry cost shared research projects and the prototype developments scheduled for Federal lease tracts, if these projects proceed successfully as now planned. We have reached an agreement to provide DOD with crude

oil from these DOE projects. It will be up to DOD to store the oil and get it refined. Naturally, the DOE will provide technical assistance in the refining process to assure the oil meets military specifications.

We estimate that potential production from our oil shale research and development test projects could amount to a total of 650,000 to 800,000 barrels over a period of about 3 years. This could go a long way toward satisfying DOD's needs. DOD would cost share the oil from DOE, ship it, and store it. If this oil is made available to DOD, then the short-term issue is resolved.

Assuming the DOD test and evaluation program is successful, large quantities of shale oil would be required by DOD over the long term. DOE supports a policy of anticipating and preparing for this DOD long-term requirement.

The long-term issue regarding oil shale production is this: How can DOE stimulate larger scale commercial production so that DOD and the civilian economy will have available the requisite reliable large supply of shale oil. The granting of entitlements to synfuels is one positive step which already has been taken. Some additional incentives, however, probably will be needed before industry will move ahead with commercial scale facilities.

One option, which may be proposed in DOE's 1979 legislative package, is a \$3 per barrel tax credit for shale oil producers. Under this tax credit approach, however, the Government would not necessarily have title to the product, and arrangements for its purchase by DOD would have to be made directly with the industry.

Another option, therefore, might be to couple with the tax credit a long-term commitment by DOD to buy shale oil from the plants that come on line.

The alternative of a Government-owned, contractor-operated (GOCO) oil shale plant is not endorsed by the administration. Under the GOCO approach, the oil would of course be owned by the Government, but our judgment is that the GOCO approach will not encourage development of the most efficient processes for producing shale oil by the industry.

We in DOE understand and agree on the importance DOD attaches to alternative fuel sources. Our dependence on imports for so much of our oil makes swift development of alternatives imperative.

We will continue to press forward with oil shale development in consonance with the sense of urgency expressed by DOD and in balance with a rate of progress consistent with a full understanding of processes that are environmentally acceptable. In addition, we believe shale oil has potential as a major contributor to civilian energy supplies.

JOINT DOD—DOE ENERGY INITIATIVES

A DOD—DOE working group was established in February 1978 to inventory joint energy projects, and to help define new energy initiatives of greatest potential value to the two agencies. The objective was to identify and evaluate initiatives which will assist:

DOD in reducing its consumption of energy and its dependence on foreign sources of oil; and

DOE, in accelerating the development and early commercialization of new energy technologies: (1) by gaining experience in the construc-

tion, operation and maintenance of new systems, and (2), by enabling manufacturers to get on the "learning curve" through early DOD buys.

Many initiatives were proposed for consideration. These proposals were carefully reviewed and evaluated on the basis of such criteria as:

Technical feasibility—is the technology in hand, or is further R. & D. necessary?

Cost effectiveness—is the technology cost effective, or is there a high probability of its becoming cost effective in the near future?

Ease of transferability—can the technology be transferred readily to other military bases? Can it be transferred readily to the civilian sector?

Net energy savings—will the technology lead to a significant energy savings (especially in mobility fuels)?

Environmental/institutional barriers—are there any barriers which will hinder the introduction of the technology? Do we have a schedule of activities which we believe will ameliorate these barriers?

Potential impact on national security—will the technology have a significant impact on national security in future years?

Potential impact on commercialization—will use of the technology by the military have a significant impact on early commercialization in the civilian sector?

As a result of this initial screening process, the following initiatives were selected for more detailed consideration:

- Photovoltaics,
- Solar heating and cooling of buildings,
- Geothermal electric,
- Wood-fired central heating plant,
- Geothermal space heating,
- Fluidized bed combustion system,
- Lignite gasification system, and
- DOE-DOE showcases.

Many of these I discussed broadly with this subcommittee last year. Let me add just a few comments to express DOE policy.

We concur in the DOD decision to use a private developer to exploit the geothermal resources at the Naval Weapons Center.

We share the belief that industry is ready, willing, and able to exploit high temperature geothermal resources suitable for generating electric power. DOE will follow the progress of this project with great interest and will provide technical assistance, as needed.

The photovoltaics and solar heating and cooling initiatives are already underway as part of the larger Federal photovoltaics utilization program (FPUP) and the solar heating and cooling demonstration program—Federal buildings. Over \$1,500,000 has been currently identified for DOD photovoltaics projects. That is a continuing activity with DOD in identifying those areas. In fact, since this has been printed, it has gone up a little. At the same time, \$4 million in solar heating and cooling demonstration projects also have been identified.

We concur in the implementation of a wood-fired central heating plant to be installed at Fort Stewart, Ga. DOE will provide \$300,000 in fiscal year 1979 for the design and development of the total wood-burning system concept—including wood-gathering and processing technology. We intend to provide an additional \$125,000 in fiscal

years 1982 and 1983 for test and evaluation of the system, subject, of course, to the availability of funds.

We also concur in the geothermal heating initiative at Hill Air Force Base, Utah, and will provide \$500,000 in fiscal year 1979 for investigating the geothermal source and drilling the initial production well.

With respect to the fluidized-bed coal-fired boiler initiative at McClellan Air Force Base, and the low Btu coal gasification initiative at Minot Air Force Base, it is our position, based on a recent review within DOE, that these technologies are near commercial status and DOD can best pursue them directly with commercial vendors. Needless to say, DOE will be available to provide any technical assistance necessary during the DOD development processes.

The three showcase initiatives—at McClellan Air Force Base, Sewells Point, and Red River Army Depot/Lone Star Army Ammunition Plant—all have excellent potential for demonstrating energy saving and fuel substitution technologies. We have not yet determined precisely which technologies will be demonstrated, but we are prepared to fund each of them with up to \$500,000 in fiscal year 1979 for phase 0 studies.

In summary, a balanced program of joint initiatives is now underway. The Department of Energy is providing \$7,800,000 for the first year's activities. We are confident that both agencies will reap significant benefits from these initiatives, DOE from the standpoint of gaining on line, real time data.

Let me emphasize that this is only the first step in what we view as a long-term, productive partnership. We intend to seek out other initiatives which can be incorporated into this program—and especially into the three showcases. We also will encourage consideration of high risk, high payoff projects.

INITIAL INVENTORY OF ON-GOING JOINT PROJECTS

It is seldom that one writes on a clean slate. In the same vein, DOE-DOD joint programs did not start during the past year, but have been underway between DOD and DOE—and its predecessor organizations—for some time. In order to capture the variety and nature of these programs—and to provide us with a management tool—we commissioned TRW to provide us with an inventory of joint DOE-DOD projects, as of June 1978.

This survey found 93 such projects—49 with the Navy, 23 with the Army, 11 with the Air Force, and 10 combined Army/Air Force/Navy projects. In the majority of cases, the Department of Energy provided funding to the Department of Defense for these programs. More specifically, approximately \$14 million was provided to the Navy in fiscal year 1978, \$6 million to the Army, and \$2,200,000 to the Air Force, for a total commitment of \$22,200,000.

These joint programs cover such diverse activities as:

Army testing of lithium-metal sulfide batteries and flywheel storage in vehicles.

Army assistance in the applications of advanced materials to gas turbine, Stirling, and other heat engines.

Army assessment of effects of methanol fuels on engine lubricants and wear.

Navy investigation of high magnetic fields generated by the compression of magnetic flux by liquid metal liners for plasma confinement—a promising alternate approach to fusion energy.

Air Force research, design, and fabrication of equipment to demonstrate attainment of high MHD efficiency.

Solar demonstrations in Army/Air Force exchange facilities and family housing.

I believe this sampling of projects clearly indicates that DOD-DOE cooperative activities are alive and well today. The purpose of the MOU and the recently established initiatives program is to build on this existing program base and to establish a management system that will assure the best use of resources in both agencies.

EVOLVING DOD-DOE COMMUNICATIONS CHANNELS

In addition to coordination at the Assistant Secretary level, we have developed many informal channels of communication at the project and management levels. For instance, DOD has requested DOE assistance in providing inputs—such as fuel escalation factors—and developing a cost-benefit methodology that will not put solar energy at a disadvantage in comparison with other forms of energy, many of which have received or are receiving subsidies in one form or another. Realizing the critical nature of this problem with respect to the fiscal year 1979 military construction authorization bill, we have set up an ad hoc task group to investigate the problem and provide guidance to the Department of Defense.

In my opinion, the channels of communication being developed will be sufficient to achieve our stated objectives. I am encouraged by the enthusiasm and the cooperative attitude I detect in both agencies. Working together, we can go a long way toward solving energy problems critical to national defense, and to the entire economy of the Nation.

Let me thank you again, Mr. Chairman, for this opportunity to report on the progress we have made during the past year in expanding DOE-DOD cooperative efforts in the development of alternative energy technologies.

I will be pleased to receive your questions.

Senator HART. Thank you very much, Mr. Secretary. I think your presence here this morning indicates the importance that the Department of Energy attaches to this entire range of activities, and I think your statement was a very good one, very helpful to us.

Let me ask some somewhat random questions. You spent some time in the early part of your statement talking about oil shale possibilities, and more particularly, several options that could be used to stimulate oil shale production. Are you prepared at this point to indicate how much of our budget will be allocated in this regard in fiscal 1980, at least a ball-park figure?

Mr. MYERS. No; I am not. The 1981 budget, of course, is still under consideration, and we are not in the position to cover that area. We are, of course, working very hard on the legislation that we expect to propose for oil shale support.

I think you are aware that my view of the oil shale industry is that they have an active and stimulating program with several different companies, with several different projects, and different approaches

to the oil shale activity. Our activities within the Department of Energy are to continue to stimulate through cost-shared programs, improved R. & D. approaches that will give us a better environmental break in the overall picture. We have a very heavy emphasis on the environmental aspects and what we can do in the Department of Energy to help understand and ameliorate the environmental issues associated with oil shale.

You will see in all of our activities strong emphasis and strong ties between our environmental group and our energy technology people in that area. We do not have an approved program yet for the 1981 budget period.

Senator HART. On page 5 of your statement, you discuss two or three options for incentives for Government action for stimulation of the private industry, and one of those was, of course, a measure that the Senate passed, the tax credit approach. It is one that I have proposed and may propose again, having to do with particular importance to these hearings this morning, DOD guarantee purchase and perhaps a premium price for shale oil.

Do you know what the administration position on these options will be and, if so, can you tell us?

Mr. MYERS. We in the Department of Energy don't see anything incompatible between a guarantee buy and tax credit approach as long as the price comes out the same for the two product approaches involved. There are no windfalls involved in such an approach. We really haven't worked out the specifics of how they would interact to a point where we would be prepared to make a specific proposal in that area. My own feeling is that there is every indication that some additional incentive will be required in addition to entitlements, and that whether it is in the form of a tax credit, a guaranteed buy, or a combination of the two, just isn't clear yet, but something of the nature of a \$3 incentive probably is going to be required here.

Senator HART. In addition to the guaranteed purchase?

Mr. MYERS. Well, I think if you had a tax credit you could still have a guaranteed purchase coupled with that and would not create a price for the product above the world market price of crude oil. Those are the things we are looking at now to see how that system could be balanced.

It is and has been the position of the administration that the tax credit should for a limited period of time and in the early capital expenditure period of the industry while they are putting their first modules on line. Something of that nature in the area of a guaranteed buy could fit right in with that, we think.

Senator HART. How far along is the technological work about the adaptability of shale oil for military use? You indicate generally in here a couple of points of continued research in this regard.

Mr. MYERS. I think I would rather defer to the Department of Defense on the use of the shale oil itself in its mobility equipment. We have made available to the Department of Defense about 80,000 barrels in the last year, which are now in storage for use by Department of Defense in tests in mobility equipment.

There is general agreement that we will produce and make available the crude oil, the basic product, and that the Department of Defense then would set up a test program for that material.

Senator HART. In some respects I think perhaps the most important part of your statement is the top of page 8 where you list about half

a dozen or more initiatives for what you call more detailed consideration.

Do I understand that of those ranging from photovoltaics to lignite gasification that about just under \$8 million is being spent; is that correct? I think you have a figure later on of \$7.8 million?

Mr. MYERS. Yes; that is \$7.8 million of the 1979 budget so far identified in these areas.

Senator HART. Let me ask you about solar. It is an area that the subcommittee has been concerned about, as you know. We had section 804 in last year's bill which required the Department of Defense to consider solar energy systems if they could be shown to be cost effective over the life of the facility.

Shortly after the Congress adopted that provision, Secretary Schlesinger called me to express his endorsement and support for that initiative and indicated that your Department would do every thing it could to carry it forward.

We now have had several months to analyze that provision and I would be interested in your specific feelings and those of the Department about that provision and what the potential implications of it are for a solar industry in this country?

Mr. MYERS. We think it is a very important and productive provision. The application of these solar energy initiatives in the construction of the homes and buildings in which the Department of Energy is involved will without question aid in stimulating and maturing the solar energy industry.

The place where the Department of Energy feels that it can be of most help is in aid to the Department of Defense in the cost effectiveness analyses that are involved. We, for example, in the Department of Energy, have included in our cost effectiveness analyses the same rules that would apply to a consumer when he is making his own judgment as to the application of the solar energy hot water heater or solar cooling system to his own installation, which means that he takes into consideration the tax credits involved in the National Energy Act.

We now are applying those same general rules within the Department of Energy for our judgments as to the cost effectiveness of a product that will be put into a Department of Energy facility. We would suggest that those kinds of analysis be included in the Department of Defense cost effective analysis because in our case, we are looking at the stimulation of the industry and the cost effectiveness as the consumer would look at it.

Certainly in the case of the DOD, they generally have looked at their cost effectiveness only from the standpoint of the tradeoffs within the Department of Defense, with their budget and their rules. We are trying to help them in the cost effective analysis to show cost effectiveness in a slightly different light, one that is certainly in the national interest and, I think, consistent with the intent of this act.

Senator HART. So your Department is in fact helping Defense implement this section in terms of at least guidelines and market formulas, and so on?

Mr. MYERS. Yes; we have a task force with the Department of Defense to develop the criteria that will be used to identify the cost effectiveness of the systems. We hope we can bring in some of the factors that will aid in showing cost effectiveness of some of the solar

systems in the light of how they may be applicable to the consumer outside of DOD. That way I think we can actually obtain a better view of the solar energy applications and, that of course, would aid the Department of Energy by getting more of these things installed and, therefore, help mature the solar energy industry.

It is a chicken and egg problem. We need to get the installations to mature the industry, to get more, I guess, out of the industry on how to reduce the cost of their products, which in turn will make them more cost effective. Whether we can really be subtle enough in cost effectiveness analysis to include such things as the impact of DOD buys on the eventual cost of the product is not clear, but we are looking at ideas like that, too.

Senator HART. But you would agree that in terms of one of the purposes of our initiating that section in the law, that it can't help but benefit or stimulate the market, the mass market?

Mr. MYERS. No question about it, Senator, the DOD buys are important.

Senator HART. In this connection, the Department of Energy, I think, is preparing new energy standards for the design of new facilities and it is my understanding that those standards would specify the maximum energy consumption per unit per area per year, which would utilize a formula including considerations of the type of facility and climatological area and so forth. But I also understand that these standards won't be ready for application until 1981 or 1982, following supplementary test programs.

Do you see any reason why the Department of Defense couldn't adopt these standards immediately and serve as a testbed for your agency in this regard?

Mr. MYERS. I certainly think that the concept should be considered. Our development of these standards is just getting under way now and it would seem that the ideas should be considered by all the Government agencies in the development of their new building designs. I am not sure that the standards are well enough defined now to be a direct design criteria for DOD, but I think it is something that we should look at and work on with the DOD as a possibility.

Senator HART. If you would do that I think it might prove very beneficial, even if those standards still are in the formative stage. It seems to me that using the kind of cooperative relationship that has developed between the two agencies in this area, that the Department of Defense, we will ask them about that later—might be the ideal instrument for determining whether those standards in fact can work, and at least we would have a running start at them before 1981 and 1982.

Let me ask you a quick question.

Mr. MYERS. Excuse me.

Senator HART. Yes.

Mr. MYERS. One consideration is that the standards must be integrated into State and local standards and those of the building industry suppliers. Thus there needs to be a very close tie to that side, to the private sector, in developing these standards.

The work that we should be doing with DOD, in my view, would be more in the area of developing technical information that could be applied to the standards. I think that is what you had in mind here, wasn't it?

Senator HART. Also that, but also to determine whether in fact the standards that you are developing can work. I think the DOD could be the laboratory for that. That is the point. And obviously having construction all across the country, even outside the country, you get all the variety of circumstances that one might expect, and if standards don't work in San Antonio you take them back to the drawing board, that is all I am suggesting.

Of course, the Department of Defense does rely very heavily on local contractors in many respects and so there you get the laboratory circumstances.

Let me just ask two or three questions on photovoltaics. In the fiscal 1979 Department of Energy authorization, I think there is about \$12 or \$12½ million for procurement of photovoltaics, and the Department of Defense has the vast majority of those photovoltaic applications. Can you account for the fact that only \$1½ million of that money has found its way to DOD purchase of photovoltaic systems, based on page 9 of your testimony?

Mr. MYERS. Could I have Dr. Bennett Miller cover that?

Senator HART. Yes, Dr. Miller.

Mr. MILLER. Senator, I think that we are in the process now of bringing forward to the agency a proposal for spending a fair fraction of the remaining \$10½ million of that \$12 million authorization, so I don't think there is going to be any problem in fiscal 1979 in spending those appropriated funds.

Senator HART. Well, I am sure you will find a way of spending them.

Mr. MILLER. Precisely the way it was intended by the law.

Senator HART. Keep us abreast of that. I think we would like to follow that on a close basis.

Mr. MILLER. Certainly.

Senator HART. The national energy legislation, or National Energy Act, provided \$98 million for Federal photovoltaic procurement over the next 3 years. Do you have any idea how much the Department of Energy will spend for these types of purchases next year of that \$98 million?

Mr. MYER. In 1979?

Senator HART. Yes. If you don't know off the top of your head—

Mr. MYERS. We will get that.

Senator HART. Provide that for the record.

[The information follows:]

The Department plans to disperse the full \$15 million to the various agencies/departments in fiscal year 1979, in addition to the \$12.2 million carryover from fiscal year 1978.

Mr. MYERS. I might say that the photovoltaic program covers a fairly heavy activity in the development of our current silicone-based systems, strong research in alternative systems because it is another area in which we are going to have to get some breakthroughs to get the cost down, and then these production buys to stimulate the industry. So the element is broken up in those three areas.

I think perhaps a stronger emphasis is needed on these alternate approaches than we have had previously. You will see when we get this for you in the record. It seems that there are new ideas, new stimulating ideas, coming along that could be very important in reducing the cost of photovoltaics. This is in addition to the general progress we have been making, including strong support of new tool-

ing, to drive the cost of photovoltaics down. So emphasis on R. & D. and research are coming into this program as it develops here.

Senator HART. How many of the potential photovoltaics application which the Department of Defense has already identified will be funded next year?

Mr. MYERS. I think, as Dr. Miller said, we have identified over \$1½ million worth now, and I think these reviews are continuing.

Mr. MILLER. Yes, sir.

Mr. MYERS. We will furnish for the record the specifics of that, the numbers that have been considered that we have funded.

[See question 3c, p. 13.]

Senator HART. One other request. The subcommittee is looking at or constantly looking for new energy legislative initiatives through the military construction program which, as you know, is sizable every year and particularly that could be enacted or implemented in the next session of the Congress. If you or your department have ideas or suggestions in that regard, we would certainly welcome them and would hope that you would keep in touch with the subcommittee on a fairly constant basis in this regard.

If you think there are areas that either you as a single agency or you in connection with the Department of Defense could benefit from additional Federal legislation, this is certainly a place where we would want you to come very quickly.

Thank you again, Secretary Myers and Dr. Miller, for your presence here this morning. I think it is very significant that you were here, and I think it was a fine statement.

Mr. MILLER. Thank you.

Mr. MYERS. Thank you.

Senator HART. We will, of course, have some additional questions for you in writing. We will provide those to you.

[The questions, with answers supplied, follow:]

Question 1. Last year, I sponsored an amendment to the National Energy Act which will require all new and existing federal buildings to maximize their energy efficiency and, where justified on the basis of a systematic assessment of the life-cycle costs of alternative energy systems, to utilize solar and other renewable energy technologies.

Question 1a. Is DOE working with DOD, which accounts for nearly 90 percent of the energy consumed by the federal government, in implementing this program? For example, has DOD participated in the development of the life-cycle cost formula required by this legislation?

Answer 1a. DOE is working closely with DOD, as well as other Federal agencies, in improving the energy efficiency of Federal buildings. More specifically, representatives of DOD have reviewed drafts of procedures and guidelines concerning life cycle costing methodology, the conduct of preliminary energy audits, and the preparation of ten-year buildings plans. Their comments and suggestions have been considered and included where appropriate. We will continue to consult with DOD as well as other Federal agencies in implementing the provisions of NECPA.

Question 1b. This initiative requires that "preliminary energy audits" of all sizable federal buildings be performed during the current fiscal year to identify and correct the most egregious examples of energy waste in the federal government. What is the status of these preliminary energy audits?

Answer 1b. Procedures for the conduct of preliminary energy audits are being prepared in DOE as required by NECPA. As mentioned above, DOD and other Federal agencies have been consulted in the development of these procedures. Some agencies have already completed audits of many of their buildings. It is anticipated that most Federal buildings with 30,000 or more square feet of floor space will have been audited by the end of Fiscal Year 1979.

Question 1c. Executive Order 12003, issued by the President last year, requires that all new federal buildings achieve a 45 percent improvement in their energy efficiency by 1985 over comparable buildings 10 years earlier. Additionally, this executive order requires a 20 percent improvement in the energy efficiency of existing buildings by 1985. How will DOE integrate this executive order with the federal building provisions of the National Energy Act, which require all federal buildings to be 100 percent life-cycle cost-effective by 1990?

Answer 1c. We do not believe that these requirements are inconsistent but rather complementary. The building goals provision of the National Energy Act are placed directly on the Federal agencies. DOE, however, will influence agency actions by establishing the life-cycle cost methodology which must be used and by the requirement that agencies report their activities annually to the Department for inclusion in a report to Congress.

Question 1d. Do you believe that OMB Circular A-104, which requires a 10 percent discount rate for new, renovated or leased structures, provides sound guidance in determining the life-cycle cost of alternative energy systems, such as solar energy?

Answer 1d. A DOE Task Force is currently studying the question of the appropriate discount rate to use for determining the life-cycle cost of solar energy systems. We expect the Task Force to complete its study within a month, and to develop a methodology for incorporating the full national benefits of solar utilization into the cost/benefit analysis procedure.

Question 2. In 1977, Congress authorized and appropriated \$12.2 million for the purchase of photovoltaic energy systems. Although DOE is the lead agency in implementing this program, the Department of Defense has identified the vast majority of cost-justified photovoltaic applications. In Secretary Myers' testimony, however, he indicated that DOD has been allotted only \$1.5 million for photovoltaic purchases under this program and that, in point of fact, these purchases, which were authorized for fiscal 1978, have not yet been made. How do you account for this?

Answer. Federal agencies submitted proposals to DOE for cost-effective photovoltaic applications on Federal facilities. The DOD funding was based on the extent of projects proposed that were acceptable under the cost-effective criterion and other evaluation factors. The selected projects are ready to be funded but carry-over funds from fiscal year 1978 have not yet been reallocated to DOE by OMB.

Question 3. The National Energy Act provides \$98 million over the next 3 years for the purchase and installation of photovoltaic energy systems.

Question 3a. What is the status of this program?

Answer 3a. Funds have been authorized and appropriated; however allocation from OMB to the Department has not occurred. We are proceeding with implementation on actions required of DOE by the legislation. Fiscal year 1979 funding is estimated to be \$15 million.

Question 3b. Is DOE cooperating with DOD in implementing this program?

Answer 3b. An interagency working group has been established and operative since the spring of 1978. The DOD is a key participant in this activity. Several workshops have been conducted with the various agencies to familiarize them with the program and answer any questions they might have.

Question 3c. How many of the cost-justified photovoltaic applications already identified by DOD will be funded next year under this program?

Answer 3c. The DOE has received additional DOD proposed applications. The extent of projects selected for future funding, along with proposed applications from other agencies, has not yet been established.

Question 4. What is your opinion on the advisability of requiring that DOD utilize photovoltaic energy systems where cost-justified and consistent with the performance and mission requirements of a given project? In your judgment, would such a procurement program accelerate the development of low-cost photovoltaic energy systems in this country?

Answer 4. DOD and other Federal agencies have considerable applications for photovoltaics that may be cost-justified. The NEA provides up to \$98 million over 3 years to pursue and develop this potential market. Such use of photovoltaic energy systems is expected to help accelerate the development of low-cost systems for more widespread use.

Question 5. Section 804 of Public Law 95-356 requires DOD to consider solar energy systems if they can be shown to be cost effective over the life of the facility. Secretary Schlesinger personally called me shortly after the provision was successfully enacted to express his endorsement. You have now had several months to

analyze the provision. How do you feel about Section 804 now? What are the potential implications for the solar industry? (Be specific on estimated dollar impact on the design and solar construction industry.)

Answer 5. The consideration to use solar energy where cost effective continues to be endorsed by DOE. The DOE has not conducted an analysis of the potential implications for the solar industry. Such an analysis could only realistically be accomplished by DOD upon establishing the extent of cost effective applications to be implemented.

Question 6. Were you involved in helping DOD put together implementing instructions?

Answer 6. The DOE did not assist DOD in developing implementing instructions.

Senator HART. Our next two witnesses are representing the Department of Defense. First, Mr. George Marienthal, Deputy Assistant Secretary of Defense for Energy, Environment, and Safety with the Office of the Assistant Secretary of Defense for Manpower; and Mortimer M. Marshall, Director of Construction Standards and Design, Office of the Assistant Secretary of Defense.

Gentlemen, welcome. Proceed as you wish. I think, Mr. Marienthal, you have a rather lengthy statement, two statements. You may wish to condense those.

STATEMENT OF GEORGE MARIENTHAL, DEPUTY ASSISTANT SECRETARY OF DEFENSE, ENERGY, ENVIRONMENT, AND SAFETY, OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE, MANPOWER, RESERVE AFFAIRS, AND LOGISTICS; AND MORTIMER M. MARSHALL, DIRECTOR OF CONSTRUCTION STANDARDS AND DESIGN

Mr. MARIENTHAL. Thank you, Mr. Chairman.

With your permission, I would like to summarize my statement and have my entire statement, however, submitted for the record.

Senator HART. Without objection.

Mr. MARIENTHAL. I am George Marienthal, the Deputy Assistant Secretary of Defense for Energy, Environment, and Safety, from the Office of the Assistant Secretary of Defense for Manpower, Reserve Affairs, and Logistics. I will provide the update on the overall defense energy program, with particular emphasis on DOD-DOE energy initiatives. Mr. Mort Marshall, Director of Construction Standards and Design, in the Office of the Deputy Assistant Secretary of Defense for Installations and Housing, will then discuss the current status of our specific energy-related efforts in the military construction and facilities area.

We welcome this opportunity to provide the subcommittee with our accomplishments in energy-related areas over the past year. In the interest of time, we will not repeat the information that we previously provided. Rather, we will concentrate on those areas where significant changes have occurred over the past year.

PROGRAM MANAGEMENT

We have devoted a significant portion of our effort over the past year to strengthen and articulate our energy program management responsibilities. We have issued definitive energy management goals and objectives through 1985 and specific energy management actions that we will focus on in 1979. The long-range goals and objectives

cover many items: Energy conservation goals, such as 45 percent reduction in energy usage in new buildings and a 20-percent energy usage reduction in existing buildings; installation energy supply goals, such as the goal to obtain 10 percent of our installation energy from coal, solid waste, and biomass by 1985; and mobility fuel supply goals, such as to devise with the Department of Energy a national strategy which will minimize the danger of disruption to our liquid hydrocarbon fuel supplies.

We will soon publish a DOD energy management plan which will outline our overall energy management organization, program, and processes. The organizational section will identify the DOD energy players, their roles, and their responsibilities. The energy program section will highlight defense energy use and costs as well as DOD energy goals. This section will describe the programs designed to achieve these goals.

The final part of this plan will cover the energy management process itself to tie together energy policy guidance, the mechanics of the program operation, and the DOD programing, planning, and budgeting system. It will also include an overview of our cooperative efforts with the DOE.

Each military department has published comprehensive energy program plans. The plans have improved our ability to concentrate on those energy management areas which have the highest priority, and I will provide an update on the past year for the overall Defense energy program with particular emphasis on the energy initiatives with the Department of Energy.

Let me now summarize our progress in energy conservation.

In terms of overall results, we achieved a 2.2 percent reduction in defense energy usage in fiscal year 1978 compared to fiscal year 1977. This reduction was achieved even though the relatively severe last winter seasons reduced the energy conservation contribution from our installations and facilities. Our continued aggressive energy conservation program at our installations will result, however, in a significant energy utilization reduction in subsequent years.

In the areas of research and development, for longer term availability of mobility fuels, we have completed the acquisition and refining of 72,500 barrels of crude shale oil into military specification products to be tested in our equipment. We have also completed a study on the future availability of fuels to meet defense mobility energy requirements. The study examined synthetic fuel alternatives to natural petroleum products and established an action plan for the future that Deputy Secretary Duncan approved. The study was fully coordinated with DOE and supports DOE's efforts in shale oil.

The fiscal year 1979 DOD Appropriation Act deleted the \$6 million that the military departments proposed for energy R. & D. This will have an adverse impact on our ability to adapt energy technologies to DOD use and to exploit energy R. & D. opportunities unique to DOD. These funds may have been inadvertently deleted in the conference between the Appropriations Committees.

In our role as a user of energy technology, we have recently consummated an overall memorandum of understanding with the Department of Energy which provides the policy framework and procedures of effective, cooperative programs. I provided a copy of this memorandum of understanding to you on October 30, 1978. The

magnitude of the cooperation which currently exists between Defense and Energy is significant. Currently, there are almost 100 distinct efforts underway.

We are involved in almost every energy technology. We have significant programs in solar heating and cooling, photovoltaics, and synthetic mobility fuels. We have continued our program to promote the use of refuse-derived fuels and currently have five boiler plants operational or under construction to burn RDF. We have tested, and now burn regularly, wood pellets as a boiler fuel at Kingsley Field, Oreg. Based on the success of this conversion, the military departments will consider conversion to wood pellets at other installations.

We recently issued a policy statement which assigns lead military departments for each of the energy technologies in which Defense has a significant interest. This assignment will provide much higher visibility and permit more effective concentration of our available resources on key energy technology areas.

Let me now describe, if I may, our 1979 energy management priorities, what we will be working on in 1979 to assure that we continue our aggressive, focused energy programs. We have prepared a set of priorities for 1979. Those priorities are divided into four categories, or bands of actions, and reflect our concern with energy supply, energy technology leading to conversion and energy conservation.

The priority action items are based upon our assessment of progress in energy management to date, our longer term goals, and the most important next steps to achieve these goals. Each category, or band of actions, reflects what DOD believes needs the most management attention in 1979.

Band I is petroleum supply assurance. The Department of Defense needs to know exactly how it and the Department of Energy will cope with supply disruptions in the short term. Mechanisms exist, such as the Defense Production Act. Supplies from the strategic petroleum reserve should become available. DOD will develop with the Department of Energy specific procedures and agreements to provide an orderly, responsive triggering of the actions necessary to obtain priority allocation. That is band I.

Our highest priority is band II to develop an energy research and development plan for mobility fuels.

Military equipment is now significantly dependent on natural petroleum products. There will be a transition period over the next 20 to 35 years however. In that time frame, natural petroleum products will be more and more difficult to obtain.

"Fuel transition" may be the single most important technological challenge we face. As liquid fuels derived from oil shale, coal, or tar sands reach the marketplace, the DOD must be prepared to use them. DOD must also work on the longer term objective of entirely new energy sources. Those R. & D. efforts, which I described, must be performed within the framework of an overall plan, which will be fully developed in 1979.

The band III priority actions are the energy technology demonstration projects with the Department of Energy: The Department of Defense and the Department of Energy have completed preliminary planning on eight major demonstration initiatives. The two Departments have identified projects in solar, photovoltaics, geothermal electric, geothermal space heating, wood fueled central powerplants, coal

gasification using lignite as the fuel, fluidized bed coal combustion, and finally, three installations to become "showcases" of energy technology.

Those projects are significant. When implemented, they should be valuable to the Nation, because they will demonstrate a wide variety of energy conversion technologies which have application throughout the country. They will be important to the Department of Defense because, through technology, DOD will have reduced its reliance on scarce fuel resources.

The military departments have identified project officers for each of the initiatives. The project officers are to work with their counterparts at the Department of Energy to develop detailed implementation plans.

Band IV, which I inadvertently left out of my prepared statement, describes optimization of our utility bills. Let me insert that, if I might, at this juncture, Mr. Chairman. Band IV is the optimization of utility bills, falling right below the DOD/DOE initiatives. The band includes all of the actions needed to conserve fuel and reduce peak usage.

The end result of these actions is to minimize DOD energy costs. These actions have been placed in band IV and not higher up in the priority scheme, not because they are unimportant, instead, they have been so important through the years that the Department of Defense has devoted much time and attention to them already. We have made a lot of progress and the necessary programs and systems for further achievement are already in place. We plan continued emphasis on them during 1979.

Let us return for a moment to the band II and III priorities which are joint technology projects with the Department of Energy.

These priorities directly involve the Department of Defense—Department of Energy initiatives which have developed as a result of this subcommittee's previous hearings.

The general DOD policy for the conduct of energy initiatives in cooperation with DOE is that we are willing to provide the test bed for one of almost any initiative. This, of course, is subject to the effect on DOD mission and the availability of resources.

As a general rule, we believe that the DOD resources committed to any large initiatives, should not exceed the 10-year direct benefits to DOD based on accepted life cycle costing procedures. I will now discuss the eight major initiatives beginning with oil shale.

The oil shale initiative is the first step in the cooperative effort with DOE to prepare DOD for the transition from petroleum to synthetic fuels in the future. The DOD plan for oil shale is contained in the mobility fuel plan, entitled the DOD shale oil task force report, which I mentioned earlier.

A major part of this plan is the acquisition of approximately 1 million barrels of products derived from crude shale oil for test in military equipment. The Department of Energy offered, and I have accepted, to provide DOD with the output of the DOE shale oil production tests over the next 3 years at a nominal cost. This could amount to 800,000 barrels of crude shale oil, in addition to the 72,500 barrels we already have. We are also in the final stages of negotiating of another memorandum of understanding with DOE which will

cover all our cooperative programs to provide DOD with the capability to use synthetic fuels in the future.

The solar heating and cooling initiative is a segment of the Federal energy initiative for the demonstration of solar heating and cooling systems in Federal buildings that you asked about earlier. We understand that DOE currently has \$46 million appropriated for this program and that we will receive a portion of that \$46 million out of the 1978-79 authorization.

In addition we have our solar photovoltaic program underway. The photovoltaic program is also one of the Federal energy initiatives in the NEA. Over \$12 million was authorized and appropriated to DOE in fiscal year 1978 to buy photovoltaic systems to be installed at Federal sites.

We have provided our plans to the Department of Energy and we expect to move out on that program very, very shortly. We have a DOD photovoltaic program office in the Army to provide central management for the DOD portion of this initiative. A market analysis has indicated a large DOD potential when the price of photovoltaic systems drops to \$4-\$8 per peak watt output.

The wood-fired boiler initiative involves the installation of a central steam heating boiler at Fort Stewart, Ga., fired with wood scraps from forestry operations on the installation. Like many DOD installations, Fort Stewart has extensive land required for the conduct of training and other mission operations. Much of the land is planted with timber which is subjected to a carefully controlled forestry operation. These operations produce wood wastes which have a relatively high energy content. We plan to process about 1,700 tons of wood waste per month to fire the boiler.

Estimated annual fuel savings to DOD are \$300,000. DOE will provide \$300,000 in fiscal year 1979 for the engineering and design of the boiler, and the Army proposes to program for the costs of the new boiler construction cost in the fiscal year 1981 military construction budget. DOE will also provide funds after the boiler installation is completed for test and evaluation.

The geothermal electric initiative involves the production of a known geothermal source at the Naval Weapons Center, China Lake, Calif., contained within the fee-owned land under the control of the Navy. Over the past 4 years, DOE, or its predecessor ERDA, in cooperation with the Navy, has sponsored investigative work on the geothermal potential in this area.

Our plan is to contract with a private developer, selected on a competitive basis, to undertake the exploitation and development at his cost, and provide an equitable portion of the energy produced, in the form of electrical power, to DOD installations at a nominal charge.

The draft environmental impact statement has been completed and is in circulation now, and we plan to initiate the selection process for a private developer early next year.

The geothermal heating initiative will at the outset involve the production of a single hot water well to heat a large warehouse at Hill Air Force Base, Utah. This initiative could be expanded later to provide hot water heating for additional facilities. There are a number of DOD installations which appear to have a hot water geothermal potential of 120° to 180° F. DOE has agreed to provide \$500,000 for the definition of the geothermal source and drilling of the

well, and the Air Force will provide for the distribution lines, heating system modifications in the warehouse, and contribute to the well drilling and definition. We hope to have this initial geothermal heating initiative completed in calendar year 1979.

We have selected one installation in each military department to receive emphasis for the incorporation of various energy conservation and energy supply techniques and systems. These showcase installations will provide a demonstration site and operational data on these techniques and systems which will facilitate their use in other DOD installations and other sectors. The three showcases have already been mentioned by name by Mr. Myers. I won't repeat those now.

Each of the military departments has prepared rather extensive preliminary development plans for its showcase installation. Additional detailed analysis of individual energy conservation and energy supply technique or system is required, however.

DOD has provided \$500,000 for each showcase to conduct this next phase of showcase initiative development. When this phase is completed, DOD and DOE will make a final decision on the energy techniques and systems to be incorporated at each showcase installation.

The Air Force proposed an initiative to install a coal gasification plant to supply gas for the central heating boilers at Minot Air Force Base, N. Dak. These packaged boilers are presently fired with natural gas, and the coal gasification plant, which would produce low Btu gas from lignite, would provide a substitute fuel. The total estimated cost for gasification plant to process 41,000 tons per year of lignite and produce over one-half trillion Btu's of gas is \$14 million, which the Air Force proposed to share equally with DOE.

Our major interest in this initiative was to demonstrate a means to convert packaged boilers, characteristic of most boilers used at DOD installations, to coal. It is not feasible to convert packaged boilers, designed to use gas or oil, to burn coal directly. The use of lignite, a low grade coal, which is abundant but difficult to use for direct burning applications, was an additional feature of this initiative. DOE's review of this initiative, in light of the availability of low Btu coal gasification technology and its commercialization plans, has resulted in its further study.

The Air Force also proposed as an initiative the installation of three fluidized bed boilers to burn coal at McClellan Air Force Base, Calif. Each boiler would have an output of about 200,000 pounds of steam per hour, and the estimated total cost, with the central steam supply system, would be over \$100 million. We proposed to program for two-thirds of these costs.

The DOE commercialization plan for fluidized bed boilers is based on the demonstration of a few boilers for representative industrial applications. These applications would be selected on the probability that successful demonstration would lead to significant application of fluidized bed boilers in the industry.

DOE believes that the benefits of the McClellan demonstration are not sufficient to offset the reduction in benefits from its planned commercialization program which would be required to support this initiative. The Navy does have a cooperative program with DOE to install a prototype fluidized bed boiler at the Naval Training Center, Great Lakes, Ill.

In closing, Mr. Chairman, I trust that this overview of the Department of Defense's energy and activities provides you with the information desired. Our accomplishments and planned future actions are commensurate, I believe, with your goals to maintain an aggressive energy program which produces concrete results in terms of benefits to the Department of Defense and to the Nation as a whole.

We followed through on the energy initiatives in a positive manner with total cooperation and support from the Department of Energy. We will continue to explore additional energy initiatives which can be undertaken in cooperation with the Department of Energy to our mutual advantage.

Thank you.

Senator HART. Thank you, Mr. Marienthal, for a fine statement.

I just observed that whereas there seems to be in the President's home State an excess of wood scraps, for that purpose, that there is also a considerable amount of sunlight in the State of this subcommittee chairman, and I am sure you will take that into consideration in locating your solar test facilities in the future. [Laughter.]

I do have a number of questions but I think we will go to Mr. Marshall's statement; then I will ask those questions of both of you.

[The prepared statement follows:]

PREPARED STATEMENT OF GEORGE MARIENTHAL, DEPUTY ASSISTANT SECRETARY OF DEFENSE (ENERGY, ENVIRONMENT AND SAFETY)

DEFENSE ENERGY PROGRAM

Mr. Chairman, distinguished members of the Committee.

I am George Marienthal, the Deputy Assistant Secretary of Defense for Energy, Environment and Safety, from the Office of the Assistant Secretary of Defense for Manpower Reserve Affairs, and Logistics. I am responsible for overall Department of Defense energy policy and serve as the focal point for energy matters, which include our cooperative energy programs with the Department of Energy.

You asked us to provide an update of the information that we provided to you in your hearings on the Department of Defense energy initiatives which were held in late 1977 and early 1978. I will provide the update on the overall defense energy program, with particular emphasis on the energy initiatives. Mr. Mort Marshall, Director for Construction Standards and Design, in the Office of the Deputy Assistant Secretary of Defense for Installations and Housing, will then discuss the current status of our specific energy related efforts in the military construction and facilities area.

We welcome this opportunity to provide the Subcommittee with our accomplishments in energy related areas over the past year. We have made a number of solid advancements.

We also have some problem areas that we will present for your consideration. In the interest of time, we will not repeat the information that we previously provided. Rather, we will concentrate on those areas where significant changes have occurred over the past year, to provide you with an up-to-date status of our energy activities.

Program management

We have devoted a significant portion of our effort over the past year to strengthen and elucidate our energy program management responsibilities. We have issued definitive energy management goals and objectives through 1985 and specific energy management actions that we will focus on in FY 1979. The long range goals and objectives covered many items: energy conservation goals, such as 45 percent reduction in energy usage in new buildings and a 20 percent energy usage reduction in existing buildings; installation energy supply goals, such as the goal to obtain 10 percent of our installation energy from coal, solid waste, and biomass by 1985; and mobility fuel supply goals, such as to devise with the Department of Energy a national strategy which will minimize the danger of disruption to our liquid hydrocarbon fuel supplies.

We will soon publish a DOD energy management plan which will outline our overall energy management organization, program, and processes. The organiza-

tional section will identify who the DOD energy players are, their roles, and responsibilities. The energy program section will highlight defense energy use and costs as well as DOD energy goals. It will describe the program design to achieve these goals. The final part of this plan will cover the energy management process itself to tie together energy policy guidance, the mechanics of the program operation, and the DOD programming, planning and budgeting system. It will also include an overview of our cooperative efforts with the DOE.

Based on my guidance and in line with their individual needs, each military department has published comprehensive energy program plans. The plans have improved our ability to concentrate on those energy management areas which have the highest priority.

Conservation

In terms of results, we achieved a 2.2 percent reduction in defense energy usage in fiscal year 1978 compared to fiscal year 1977. This reduction was achieved even though the relatively severe last two winter seasons reduced the energy conservation contribution from our installations and facilities. I have established a zero growth policy for our mobility fuels which, coupled with our continuance of an aggressive energy conservation program at our installations, should result in a continued energy utilization reduction in subsequent years.

In mobility fuels, we are well along in our analysis of the conversion of JP-4, a naphtha based fuel unique to the military system, to JP-8, a kerosene based fuel similar to the jet fuel that the commercial airlines use.

We have a conversion program underway for our forces in Europe. The initial phase of this program is the conversion of Air Force bases in England. In concert with our NATO allies, we will begin conversion of our forces in Continental Europe in the next two years. This conversion to JP-8 will enhance safety, interoperability, and fuel availability.

Research and development

For longer term availability of mobility fuels, we have completed the acquisition and refining of 88,000 barrels of crude shale oil into military specification products to be tested in our equipment. We have also completed a study on the future availability of fuels to meet defense mobility energy requirements. The study examined synthetic fuel alternatives to natural petroleum products and established an action plan for the future that Deputy Secretary Duncan approved. The study was fully coordinated with DOE and supports DOE's efforts in shale oil.

The fiscal year 1979 DOD Appropriation Act deleted the \$6 million that the military departments proposed for energy R&D. This will have an adverse impact on our ability to adapt energy technologies to DOD use and exploitation of energy R&D opportunities unique to DOD. These funds may have been inadvertently deleted in the conference between the appropriations committees.

Energy technology demonstration

In our role as a user of energy technology, we have recently consummated an overall memorandum of understanding with the Department of Energy which provides the policy framework and procedures for effective, cooperative programs. I provided a copy of this memorandum of understanding to the Chairman on October 30, 1978. The magnitude of the cooperation which currently exists between Defense and Energy is significant. Currently, there are almost 100 distinct efforts. The Department of Energy will discuss these efforts further in their testimony.

We are involved in almost every energy technology. We have significant programs in solar heating and cooling, photovoltaics, and synthetic mobility fuels. We have continued our program to promote the use of refuse derived fuels and currently have 5 boiler plants operational or under construction to burn RDF. We have tested, and now burn regularly, wood pellets as a boiler fuel at Kingsley Field, Oregon. Based on the success of this conversion, the military departments will consider conversion to wood pellets at other installations.

We recently issued a policy statement which assigns lead military departments for each of the energy technologies in which Defense has a significant interest. This assignment, in conjunction with the management procedures for the cooperative program with DOE which I have issued as the DOD program coordinator, will provide much higher visibility and permit more effective concentration of our available resources on key energy technology areas.

1979 Energy management priorities

To assure that we continue our aggressive, focused energy program, I have prepared a set of energy management priorities for calendar year 1979. These management priorities are divided into four categories, or bands of actions, and reflect our concern with energy supply, energy technology leading to conversion, and energy conservation. The priority action items are based upon our assessment of progress in energy management to date, our longer term goals, and the most important next steps to achieve these goals. Each category, or band of action, reflects what DOD believes needs the most management attention in 1979.

Band I. Petroleum supply assurance—short to midterm

In 1973, the United States imported 35 percent of its petroleum supplies; in 1978, we imported almost 50 percent. This means increased vulnerability to petroleum supply disruptions. The world tension which would accompany a significant supply disruption would demand a high state of military readiness. Increased readiness means increased military fuel consumption at the very time the rest of our society must cut back. This factor makes the problem more difficult and even more important to solve.

The Department of Defense needs to know exactly how it will cope with supply disruptions in the short term. Mechanisms exist, such as the Defense Production Act. Supplies from the strategic petroleum reserve should become available. DOD will develop with the Department of Energy specific procedures and agreements to provide an orderly, responsive triggering of the actions necessary to obtain priority allocation of petroleum products.

Band II. Energy research and development plan for mobility fuels

Military Equipment is now significantly dependent on natural petroleum products. There will be a transition period over the next 20 to 35 years, however. In that timeframe, natural petroleum products will be more and more difficult to obtain.

In the very long term, the DOD may need to build weapon systems which can run on hydrogen or some other non-hydrocarbon fuel. For the foreseeable future, however, the DOD is wedded to liquid hydrocarbon fuels.

"Fuel transition" may be the single most important technological challenge we face. As liquid fuels derived from oil shale, coal, or tar sands reach the market place, the DOD must be prepared to use them. DOD must also work on the longer term objective of entirely new energy sources. Those R&D efforts must be performed within the framework of an overall plan, which will be fully developed in 1979.

Band III. Energy technology demonstration projects with the Department of Energy

The Department of Defense and the Department of Energy have completed preliminary planning on eight major demonstration initiatives. The two departments have identified projects in solar, photovoltaics, geothermal electric, geothermal space heating, wood-fueled central power plants, coal gasification using lignite as the fuel, fluidized bed coal combustion, and, finally, three installations to become "showcases" of energy technology.

Those projects are significant. When implemented, they should be valuable to the nation, because they will demonstrate a wide variety of energy conversion technologies which have application throughout the country. They will be important to the Department of Defense because, through technology, DOD will have reduced its reliance on scarce fuel sources.

The departments have identified project officers for each of the initiatives. The project officers are to work with their counterparts at the Department of Energy to develop detailed implementation plans. Considerable progress is highly likely in this area during 1979.

Department of Defense—Department of Energy initiatives

The Band II and Band III priorities directly involve the Department of Defense—Department of Energy initiatives which have developed as a result of this Subcommittee's previous hearings. As I indicated in my letter of October 30, 1978, to the Chairman, we are now prepared to provide specific information on the selected initiatives.

The procedure that we used to finally arrive at these initiatives was iterative and has involved the continuous close interaction between DOD and DOE.

The general DOD policy for the conduct of energy initiatives in cooperation with DOE is that we are willing to provide the test bed for one of almost any initiative. This, of course, is subject to the effect on DOD mission and the avail-

ability of resources. As a general rule, we believe that the DOD resources committed to any large initiative, should not exceed the 10-year direct benefits to DOD based on accepted life-cycle costing procedures.

Oil shale

The oil shale initiative is the first step in the cooperative effort with DOE to prepare DOD for the transition from petroleum to synthetic fuels in the future. The DOD plan for oil shale is contained in the mobility fuel plan, entitled the DOD Shale Oil Task Force Report, that I mentioned earlier. A major part of this plan is the acquisition of approximately 1 million barrels of products derived from crude shale oil for test in military equipment.

The Department of Energy offered, and I have accepted, to provide DOD with the output of the DOE shale oil production tests over the next 3 years at a nominal cost. This could amount to 800,000 barrels of crude shale oil, in addition to the 88,000 barrels we already have. We are also in the final stages of consummation of another memorandum of understanding with DOE which will cover all our cooperative programs to provide DOD with the capability to use synthetic fuels in the future.

Solar Heating and Cooling

The solar heating and cooling initiative is a segment of the federal energy initiative for the demonstration of solar heating and cooling systems in federal buildings. The authorization for this initiative was contained in the National Energy Act which was recently signed into law. We have provided considerable assistance to DOE in the preparation for this initiative. We understand that DOE currently has \$46 million appropriated for this program.

We are unable at this time to provide exact information on the extent to which we will be involved, however. There may be a tendency to limit the DOD involvement in view of the substantial number of solar heating and cooling installations which would be required in new DOD buildings as a result of the solar provision of the FY 1979 Military Construction Act.

Photovoltaics

The photovoltaic program is also one of the federal initiatives contained in the National Energy Act. Over \$12 million was authorized and appropriated to DOE in FY 1978 to buy photovoltaic systems to be installed at federal sites. We initially provided our plans and candidate installations to DOE for this program in April 1977. Due to the requirement in the law that the individual candidate installations be cost effective, only a limited number of DOD sites will be approved, with a cost of about \$2 million. We anticipate receipt of DOE approval for these first DOD sites in January 1979.

I have chartered a DOD photovoltaic program office in the Army to provide central management for the DOD portion of this initiative. A market analysis has indicated a large DOD potential when the price of photovoltaic systems drops to \$4-\$8 per peak watt output. We will continue to work with DOE to further the commercialization of photovoltaic systems where they are commensurate with DOD requirements.

Wood-fired boiler

The wood-fired boiler initiative involves the installation of a central steam heating boiler at Fort Stewart, Georgia, which would be fired with wood scraps from the forestry operations on the installation. Like many DOD installations, Fort Stewart has extensive land required for the conduct of training and other mission operations. Much of this land is planted with timber which is subjected to a carefully controlled forestry operation. These operations produce wood wastes which have a relatively high energy content. We plan to process about 1,700 tons of wood waste per month to fire the boiler.

Estimated annual fuel savings to DOD are \$300,000. DOE will provide \$300,000 in Fiscal Year 1979 for the engineering and design of the boiler, and the Army proposes to program for the \$8 million estimated construction cost for the new boiler in the Fiscal Year 1981 military construction budget. DOE will also provide funds after the boiler installation is completed for test and evaluation.

Geothermal electric

The geothermal electric initiative involves the production of a known geothermal source at the Naval Weapons Center, China Lake, California, contained within fee owned land under the control of the Navy. Over the past four years, DOE, or its predecessor ERDA, in cooperation with the Navy, has sponsored investigative work on the geothermal potential in this area. Our plan is to contract with a

private developer, selected on a competitive basis, to undertake the exploitation and development at his cost, and provide an equitable portion of the energy produced, in the form of electrical power, to DOD installations at a nominal charge.

The draft environmental impact statement has been completed, and we plan to initiate the selection process for the private developer early next year. Controlled development of this geothermal source will permit the continued use of these lands for the Naval Weapons Center's mission and, at the same time, produce needed electrical power for the California grid. The provision of electrical power to DOD installations will reduce DOD utility costs, also.

Geothermal heating

The geothermal heating initiative will initially involve the production of a single hot water well to heat a large warehouse at Hill Air Force Base, Utah. This initiative could be expanded at a later date to provide hot water heating for additional facilities. There are a number of DOD installations which appear to have a hot water geothermal potential of 120° to 180°F. DOE has provided \$500,000 for the definition of the geothermal source and drilling of the well, and the Air Force will provide for the distribution lines, heating system modifications in the warehouse, and contribute \$100,000 to the well drilling and definition. We hope to have this initial geothermal heating initiative completed in Calendar Year 1979.

Showcase installations

We have selected one installation in each military department to receive emphasis for the incorporation of various energy conservation and energy supply techniques and systems. These showcase installations will provide a demonstration site and operational data on these techniques and systems which will facilitate their use in other DOD installations and other sectors. The Army showcase is the Red River Army Depot and Lone Star Army Ammunition Plant complex at Texarkana, Texas. The Navy showcase is the Sewells Point complex at Norfolk, Virginia. The Air Force showcase is McClellan Air Force Base near Sacramento, California. Each of the military departments has prepared rather extensive preliminary development plans for their showcase installation. Additional detailed analysis of individual energy conservation and energy supply technique or system is required, however.

DOE has provided \$500,000 for each showcase to conduct this next phase of the showcase initiative development. When this phase is completed, DOD and DOE will make a final decision on the energy techniques and systems to be incorporated at each showcase installation.

Coal gasification

The Air Force proposed an initiative to install a coal gasification plant to supply gas for the central heating boilers at Minot Air Force Base, North Dakota. These packaged boilers are presently fired with natural gas, and the coal gasification plant, which would produce low Btu gas from lignite, would provide a substitute fuel. The total estimated cost for a gasification plant to process 41,000 tons per year of lignite and produce over one-half trillion Btu's of gas is \$14 million, which the Air Force proposed to share equally with DOE. Our major interest in this initiative was to demonstrate a means to convert packaged boilers, characteristic of most boilers used at DOD installations, to coal.

It is not feasible to convert packaged boilers, designed to use gas or oil, to burn coal directly. The use of lignite, a low grade coal, which is abundant and difficult to use for direct burning applications, was an additional feature of this initiative. DOE's review of this initiative, in light of the availability of low Btu coal gasification technology and their commercialization plans, has resulted in its further study.

Fluidized bed boiler

The Air Force also proposed as an initiative, the installation of three fluidized bed boilers to burn coal at McClellan Air Force Base, California. Each boiler would have an output of about 200,000 pounds of steam per hour, and the estimated total cost, with the central steam supply system, would be over \$100 million. We proposed to program for two-thirds of these costs. The DOE commercialization plan for fluidized bed boilers is based on the demonstration of a few boilers for representative, industrial applications.

These applications would be selected on the probability that successful demonstration would lead to significant application of fluidized bed boilers in the industry. DOE believes that the benefits of the McClellan demonstration are not sufficient to offset the reduction in benefits from their planned commercialization program which would be required to support this initiative. The Navy does have

a cooperative program with DOE to install a prototype fluidized bed boiler at the Naval Training Center, Great Lakes, Illinois.

Initiative management

With the approval of the initiative package, the DOE program coordinator and I have assigned responsibility for continued development of each initiative to designated project officers in our respective organizations. These individuals will be responsible to carry out our agreed upon actions on each initiative. Within DOD, the assignment of project officers was made in accordance with our lead military department concept for energy technologies.

In closing, Mr. Chairman, I trust that this brief overview of the Department of Defense's energy activities provides the Subcommittee with the information desired. I believe that our accomplishments and planned future actions are commensurate with our goal to maintain an aggressive energy program which produces concrete results in terms of benefits to DOD and the nation. I believe that we have followed through on the energy initiatives in a positive manner with total cooperation and support from the Department of Energy. We will continue to explore additional energy initiatives which can be undertaken in cooperation with DOE to our mutual advantage.

STATEMENT OF MORTIMER M. MARSHALL, DIRECTOR, CONSTRUCTION STANDARDS AND DESIGN

Mr. MARSHALL. Mr. Chairman, members of the committee, I am pleased to appear here today to discuss the DOD energy programs and energy conservation efforts as they relate to DOD facilities. I am appearing in place of Deputy Assistant Secretary Perry Fliakas, who presented the DOD statement last year. Mr. Fliakas regrets his inability to be here today, but he is in Europe consulting with NATO members on facilities problems and that meeting could not be deferred.

Although the major portion of energy used in the DOD is for the operation and training of the defense forces, about 39 percent of our annual energy consumption in the United States is for the operation of our facilities. Over and above our responsibility to do our part in the national energy conservation effort, we are most anxious to accomplish significant energy reductions in order to obtain needed relief from the rapidly increasing annual utilities cost. Indeed, many of our energy conservation efforts were initiated prior to the oil embargo of 1973 as utilities cost reduction efforts. Our office and the comparable offices in the three military departments have devoted a large effort to energy conservation, and we are proud of our leadership in the Federal sector in this work. Now, I would like to detail some of our efforts.

In his statement to this committee last year, Mr. Fliakas pointed out our involvement over the past 20 years in utilities cost reduction and in energy conservation. Hence our position is known and need not be repeated. What I feel would be most helpful to the committee at this time is an overall updating of our activities since last year.

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

For the fiscal year 1980 military construction program, we are continuing our requirement that all ECIP projects must have a benefit-to-cost ratio greater than one. In addition, we have a requirement that the program achieve an average annual energy savings of at least 49 mega Btu per \$1,000 of investment. The minimum acceptable project must have an energy-to-cost ratio of 22 MBtu saved per \$1,000 investment.

The ECIP projects proposed for fiscal year 1980 include a number of basic energy conservation methods such as insulation, storm windows, replacing windows with insulated wall panels, temperature controls, modifications to heating, ventilating, and air-conditioning systems, waste heat recovery systems, solar screens, and higher efficiency lighting. We remain convinced that we must decrease the energy losses from each building using proven engineering techniques, if we are to make any significant long-term energy reduction. We believe that if all of our buildings are reasonable energy users then the total amount of energy consumed also will be reasonable.

The fiscal year 1980 ECIP also includes a few advanced technology monitoring and control systems (EMCS). We believe that EMCS units are probably the most valuable single tool available in the energy conservation effort. The DOD has developed a tri-service specification for EMCS and it is our opinion that the units now being obtained are definitely superior to the off-the-shelf units procured 3 to 5 years ago. There is a definite improvement in the technology of the EMCS equipment available today and the tri-service specification is directed to the unique requirement of military installations. Concurrent with improved performance we expect lower maintenance costs.

The Military Subcommittee of the House Appropriations Committee directed that an audit be made of the ECIP effort to date and we have requested the Defense Audit Service (DAS) to conduct this work. The committee requested a report by March 1, 1979, and we expect to meet that requirement. The DAS is reviewing project costs, energy savings, dollar savings, and other aspects of the program. We will, of course, furnish your committee a copy of our final report along with any new guidance needed to improve and strengthen the program.

USE OF NATURAL GAS, OIL, AND COAL

Since 1972, DOD policy has required an increase in the use of coal and a decrease in the use of natural gas. Since April 1976 we have:

(a) Limited the use of natural gas to very small heating units (maximum of 5 mega Btu per hour output).

(b) Required boilers above 50 MBtu per hour to be capable of ready and economical conversion to coal or other solid fuel.

(c) Required individual boilers above 100 MBtu per hour output to burn coal or other solid fuel. (Since the Power Plant and Industrial Fuel Use Act of 1978 requires boilers of 100 MBtu input to burn a solid fuel, we have modified the DOD guidance on this point.

(d) Required new boiler plants above 150 MBtu per hour to burn a solid fuel. This compares to the Power Plant and Industrial Fuel Use Act of 1978 requirement for plants of 250 MBtu.

For over a year now the Air Force has been burning processed wood pellets at Kingsley AFS in Oregon. The Army is proposing wood chip burning facilities at Fort Stewart, Ga., and Red River Arsenal, Tex. We are encouraged with developments with wood to date and believe that wood will play an important part in our efforts to use renewable and noncritical fuels.

We have a serious problem related to our need to reduce the number of military installations with mission oriented facilities wholly dependent on heating plants which can burn only natural gas. Unfortunately the era of plentiful and cheap natural gas has left us a legacy of many

installations which have heating plants with only a single fuel—natural gas.

About 4 years ago we began a program to reduce this dangerous dependence on a single fuel by requiring natural gas only plants to add an oil standby capability and to install a 30-day oil supply at all oil burning facilities. Notwithstanding the examples of the past two winters, our problem appears to be an inability on our part to convince the Congress of the urgency of this requirement and of the correctness of our solution to use oil as an alternate fuel.

We believe this to be true because last year the Congress denied modest requests by the Army for funds to provide an oil standby capability on the grounds that such projects would be unnecessary eventually when the plants were converted to coal. As we noted last year before this committee, perhaps 90 percent of our boiler inventory is composed of packaged boilers which are physically incapable of being converted to coal. All natural gas only boilers are in this category and therefore could never be converted to coal.

In addition, these plants are generally small or medium size (below 50 MBtu per hour) and therefore far below the 250 MBtu per hour minimum size required for coal plants by the Power Plant and Industrial Fuel Use Act of 1978. Further, after careful engineering analysis it is our position that because of the high cost of pollution abatement equipment, the labor intensity, and other factors, that coal-fired plants below 100 MBtu per hour cannot be justified.

Accordingly, our only alternative is abandonment of all small natural gas plants and the construction of a new central plant or subcentral plant at each installation at a cost of from \$25 to \$50 million each. For example, the fiscal year 1979 military construction program included a new coal plant for F. W. Warren Air Force base at a cost of \$24.3 million and this is a small installation.

As reported to this committee last year, a total conversion to coal by the DOD would require in excess of \$3 billion. Realistically we believe such a program could not be achieved in less than 20 years even if the value of the existing packaged boilers was to be ignored.

Therefore, we earnestly solicit the understanding and support of this committee for our immediate requirement to insure a strong defense posture by installing standby oil firing capability on installations with heavy concentrations of natural-gas-only boilers and located in areas where we could expect natural gas problems of availability or distribution within the next 5 to 8 years.

METERING

The Congress directed a test program of metering in family housing. We have installed meters on about 10,000 housing units of Army, Navy Air Force, and Marine installations in five different climatic zones. Our office, working with engineers from the four services developed norms for appliances, lighting, and domestic hot water.

Norms were developed, using industry and DOD data, for small quarters and for larger quarters. Heat gain and loss data for the quarters were developed by the Army's Civil Engineering Research Laboratory (CERL) energy computer program known as BLAST—building load and system thermodynamics. CERL also developed formulas to be used in conjunction with actual daily measurements

of heating and cooling degree days to determine norms for heating and air-conditioning where applicable.

The Navy developed a mock billing program using a central computer which receives data from all test installations. The program began operation on October 1, 1978. As in any new program effort there have been a few problems, but we believe these have been satisfactorily corrected or will be corrected very soon.

A report to the Congress on this test program is required by January 1980, and tentatively we expect to meet this requirement.

REVISIONS TO DOD CONSTRUCTION CRITERIA MANUAL

We are continuing our efforts to update our construction criteria manual. An area of special interest at this time is the matter of energy budgets for new buildings which are required by Executive Order 12003 to use 45 percent less energy in 1985 than similar buildings in 1975. By law, DOE is required to set new building energy budgets by August 1, 1979. The advance notice of proposed rulemaking on these energy budgets was published in the Federal Register on November 21, 1978. Budgets are not set for all types of buildings yet.

We have been working for some time on energy budgets for Defense buildings. While we are not convinced that the seven climatic zones being used by DOE are the best available breakout, we have been using these zones in our work in order to be able to make a comparison with the DOE numbers. In comparing our energy budget guides with the DOE preliminary numbers, we note that we are slightly lower in all categories which were published, and at this time we foresee no problem in complying with the proposed Federal standards.

It is our intention to publish DOD energy budgets in the near future as interim criteria. We further propose to collect design data from the military departments in all cases where their designs vary by more than 10 percent from our interim criteria. Analyzing these variants should give us a more realistic base to use for our final criteria.

There are two impacts from Executive Order 12003 and the proposed Federal energy budgets for new buildings. First, we see an added design cost required to analyze the many energy-conserving alternatives and combinations. This is of special concern in larger buildings where we may be considering 20 to 25 separate conserving systems or techniques. There is an interdependence between many systems.

In other cases, the effectiveness of one system will be directly affected by one or more other systems. For example, consider the case where a building includes a computer facility which operates all winter and requires air-conditioning. Using the air source heat pump principle, we could directly cool the computer room and use the rejected heat to heat office space on the periphery of the building. An alternative would be to capture condenser water heat from a central chiller. This now identifies further alternatives of using the captured condenser water heat directly, as a booster to a conventional system or as part of a water source heat-pump system.

The problem is more complex if the computer operation is only 16 hours per day instead of 24, or if it is 24 hours per day but only 5 or 6 days per week. There is also the design problem of determining the savings of each successive system since each system savings must

be based not on the original energy consumption but on the consumption as reduced by all preceding systems. In all probability we shall need to use an energy computer system to accomplish these analyses, especially for larger buildings. In this regard, we are looking to the Army's BLAST computer program as a lower cost method of accomplishing these. The second impact will be felt in added construction cost. As we see the situation now, these added costs should average 4 to 5 percent.

SOLAR

Last year we informed the committee of the problems we had experienced in trying to implement the DOD-DOE 50 unit residential solar energy demonstration program. At that time, we also indicated that we were planning three projects in a joint effort with DOE to build central solar collector fields at Fort Polk, Bolling Air Force Base here in Washington, and Newport Naval Station in Rhode Island to support blocks of 20 to 40 houses. I am pleased to report that we have awarded the Fort Polk project and expect this project to become operational in November 1979.

In addition, we now have in preparation a report on both DOE and DOD solar activities required by the House Armed Services Committee. This report is scheduled to be submitted by the end of December. A copy will also be furnished this committee.

In summary, the report shows that we now have:

Projects under design.....	56
Projects under construction.....	21
Projects operational.....	26
Total.....	103

Guidance has been issued to the military departments on the implementation of section 804 of Public Law 93-356 which requires DOD to use solar energy systems in family housing and other facilities when it is found to be cost effective. A copy of this guidance is being provided for the record. We will propose some minor changes to the legislative language next year to (1) relate the solar requirement to "buildings" in the program rather than to all "facilities." This change will allow us to exclude that portion of the program that is not susceptible to solar systems; that is, roads, runways, piers, dredgings, utilities, et cetera; (2) we will also propose a change in the definition of "cost effectiveness" to allow us to consider the systems on a life cycle cost basis rather than a simple recoupment of the "initial investment" over the life of the structure.

While we are still not without problems in this rapidly changing field, we remain convinced of the need to proceed at a reasonable pace and thereby accelerate the arrival of reliable, cost-effective solar systems.

This concludes my formal statement, Mr. Chairman.

Senator HART. Thank you very much.

Mr. Marienthal, your statement was a very good one, and it appears that there has been significant progress across the board since last year. In your statement you refer to long-term "energy management goals and objectives and short-term specific energy management actions for fiscal year 1979."

If you could provide details of both of those for the record and tell us how they were derived, it would be extremely helpful to us.

Mr. MARIENTHAL. I will be happy to do that; yes, sir.

[The information follows:]

MARCH 1, 1978.

MEMORANDUM

Defense Energy Program Policy Memorandum (DEPPM) No. 78-2

For: Secretaries of the Military Departments; Director of the Joint Staff; Director, Defense Logistics Agency

Subject: Defense Energy Goals and Objectives

Purpose.—To establish management goals and objectives for the Defense energy program.

Background.—To provide direction of effort, DEPPM 78-1 was published to set forth the energy actions, in broad terms, which must be pursued to develop a sound energy program. The next step is to establish a framework of specific goals and objectives through which those actions are to be accomplished.

Discussion.—The basic goals for energy conservation in facilities have been mandated by Executive Order 12003. In addition, there are other areas of concern in which specific goals can and should be established. A list of goals and objectives and the time frame for their accomplishment is enclosed.

Policy.—Defense policy is to reduce energy usage and to reduce dependency on nonrenewable energy resources through programs of conservation measures and projects which do not impair the training, readiness and combat capability of strategic and tactical forces. To achieve a sound energy program, the enclosed goals and objectives will apply. You should develop plans and programs to implement these goals and objectives.

JOHN P. WHITE,
Assistant Secretary of Defense
(*Manpower, Reserve Affairs and Logistics*).

Enclosure.

DEPARTMENT OF DEFENSE

ENERGY MANAGEMENT GOALS AND OBJECTIVES (FEBRUARY 1978)

Conservation

The basic conservation goals as set forth in Executive Order 12003, July 20, 1977, are:

To achieve in Defense-owned existing buildings a reduction of 20 percent in the average energy use per gross square foot of floor area in 1985 from the average energy use per gross square foot of floor area in 1975. This goal shall apply to all buildings for which construction was or design specifications were completed prior to the date of issuance of DOE guidelines.

To achieve in Defense-owned or leased new buildings a reduction of 45 percent in the average annual energy requirements per gross square foot of floor area in 1985 from the average annual energy use per gross square foot of floor area in 1975. This goal shall apply to all buildings for which design specifications are completed after the date of issuance of DOE guidelines.

To exceed the minimum statutory requirement of 15USC2002 for fleet average fuel economy in the Defense passenger automobile fleet by 2 miles per gallon for Fiscal Year 1978, 3 miles per gallon for Fiscal Year 1979 and 4 miles per gallon for Fiscal Year 1980 and beyond.

The following Defense goals are established to complement and facilitate attainment of the above mandated goals:

To obtain a reduction of at least 12 percent in existing buildings through the Energy Conservation Investment Program (ECIP).

To obtain the additional 8 percent reduction in existing buildings through service developed programs and initiatives, e.g., increased administrative measures and supervision, improved management, more efficient operation and maintenance of utilities systems, and accomplishment of small-scale conservation projects with O&M funds available to the commands and installations.

To establish a metering program and to conduct energy audits/surveys/engineering analyses as necessary to identify and monitor energy consumption levels in DOD facilities. DOD metering and audit policy will be issued following publication of DOE guidelines.

To develop a representative list of energy conservation measures, systems and equipment for DOD buildings. The list will be provided to each installation for use in identifying potential conservation projects.

The goal for operational usage by training, tactical, and strategic forces is to limit the level of energy consumption in 1985 to that for operational usage in 1975. To achieve this goal, services will take action:

To improve the efficiency of propulsion systems through design of new equipment and economic retrofit of old equipment.

To increase the efficiency of mobile equipment use in operations and training.

To increase the use of simulators in training. Simulators shall be designed for maximum energy efficiency and energy recovery.

Supply-Installation Energy

The following goals are established for installation energy usage:

To obtain at least 10 percent of DOD installation energy from coal, coal gasification, solid waste, refuse derived fuel, and biomass by 1985.

To obtain 1 percent of DOD installation energy by solar and geothermal means by 1985.

To equip all natural gas only heating units and plants over 5 mega btu per hour output with the capability to use oil or other alternate fuel by 1982.

To have on hand at the beginning of each heating season a 30-day fuel supply for all oil only, oil-natural gas, and coal heating units over 5 mega btu per hour output and to maintain this supply level throughout the three coldest months of the year.

Supply-Mobility Fuels

The following goals are established to assure adequate fuel supplies to meet DOD mobility requirements. The goals recognize the continued DOD dependence on liquid hydrocarbon fuels, especially for mobility needs, over the next 25-30 years; the potential for disruption of oil supplies; and the national need to develop alternate fuels.

To devise with the Department of Energy a national strategy which will minimize the danger of disruption to DOD liquid hydrocarbon fuel supply. This strategy will include:

A clear statement of DOD mobility fuel requirements.

A Secretarial-level DOD-DOE agreement which delineates responsibilities.

Procedures for priority allocation of mobility fuels to DOD under the Defense Production Act and other managerial mechanisms.

Joint efforts to develop alternate fuel sources (e.g., oil shale) if required to meet DOD mobility requirements.

Continued build-up of the Strategic Petroleum Reserve to the 1 billion bbl level and provisions for DOD priority use, if required.

To do research and development on propulsion systems capable of using a broad range of conventional and synthetic fuels.

To develop adequate fuel specifications and fuel testing methods for a large slate of mobility fuels.

To adjust the fuel logistics structure in DOD as necessary to match changing fuel supplies.

To plan for the transition from petroleum to synthetic fuels in the future.

Senator HART. Last year you projected and at that time I questioned, a 3-percent increase in Department of Energy consumption through fiscal year 1985, but on page 4 of your statement you advise that the department has achieved a 2.2-percent reduction in fiscal year 1978 despite a very severe winter.

How can you account for that reduction and what are you now projecting for the future as far as energy consumption is concerned?

Mr. MARIENTHAL. Right. If I could read what I said last year, one sentence from last year's testimony. I said, "We must, therefore, report a projection of slight upward growth in petroleum consumption through fiscal year 1985 of a little more than 3 percent."

So I was projecting a rise in petroleum consumption between then, a year ago, and 1985, and I am afraid I am going to have to stick to that projection of a slight rise in petroleum. Why? Because we are fairly conservative and we don't want to come in and tell you we are going to reduce petroleum significantly because we just can't project that.

When you look at how we use energy you will see that two-thirds of our overall energy consumption is petroleum. Two-thirds of the total. Slightly more than two-thirds, actually. And yet only a small portion of that is used in our installations; like, say, 5 percent.

The bulk of all the petroleum we use is in our mobile forces, and as we project contingencies between now and, say, 1985, it would be unfair for us to say we are going to reduce petroleum consumption since our total fleet depends on petroleum.

So, in all honesty, we had to project a slight rise based on our analysis of the past. You can't ratchet down on our facilities in petroleum and make any significant impact on petroleum reductions since the bulk of it between now and 1985 anyway is in our mobile forces.

One of our goals and objectives is to hold our military operations energy use constant between 1975 and 1985. That is the goal. We don't want to use any more in 1985 than we used in 1975. We have a 10-year level of zero growth, and if we make that, fine. But in all honesty, I would like to stick with that projection.

Senator HART. Well, just so I have straight in my mind the two statistics. The 3-percent increase in energy consumption—

Mr. MARIENTHAL. Petroleum consumption.

Senator HART. It is petroleum, not energy?

Mr. MARIENTHAL. No, sir, we are going to go way down in petroleum.

Senator HART. The 2.3-percent reduction in fiscal year 1978 was?

Mr. MARIENTHAL. Total energy.

Senator HART. On page 6 of your statement, you discuss energy R. & D. funds which you, I think, charitably say were inadvertently deleted by the Congress, by the DOD Appropriations Committee. What have you done about that, or what do you think you can do about it?

Mr. MARIENTHAL. As I understand it, we have put it in the supplemental and we hope that it works its way over here and gets approved. I believe the status on the supplemental is that it hasn't gone.

Senator HART. Yes; that is carrier's supplemental?

Mr. MARIENTHAL. Yes, sir.

Senator HART. Maybe we can design a carrier that burns wood chips or something like that. Both you and Mr. Marshall spoke of burning wood pellets at Kingsley Field in Oregon. What is the investment in that effort? How much investment is involved; and secondly, didn't the Air Force just announce they were closing that field?

Mr. MARIENTHAL. The investment involved in that effort was minimal, hardly any front-end cost. I believe we had to worry about storing the pellets so they didn't get rained on and the like, but a very, very modest investment up front. Thus, the main cost was how much did it cost to buy the wood pellets, which we get now for \$22 per ton, significantly less than coal there. Moreover, we weren't achieving air pollution emission standards with coal but are achieving them with the wood pellets.

On the second part of that question, the Air Force is preparing to publish a draft environmental impact analysis, or in essence a negative declaration, which says we have assessed the environmental impact of possible changes to the mission at Kingsley, and found

that it will not be significant. We will not do a formal environmental impact statement. The assessment will be out in the public record shortly, I believe.

But I don't believe there has been any announcement on closing, not yet. I don't even know if that is in the cards, but some environmental analysis work has been done.

Senator HART. You have the following reference in your remarks to "a policy statement which assigns lead military departments for each of the energy technologies." Could you provide that policy statement to us for the record?

[The information follows:]

OFFICE OF THE SECRETARY OF DEFENSE,
Washington, D.C., October 2, 1978.

DEFENSE ENERGY PROGRAM POLICY MEMORANDUM (DEPPM), No. 78-6

Memorandum for designated Energy Officials of the Office of the Secretary of Defense, Joint Chiefs of Staff, Military Departments, and Defense Logistics Agency.

Subject: Assignment of Lead Service Responsibilities for Energy Technologies.

Purpose.—To assign lead service responsibilities for key energy technologies of interest to the Department of Defense (DOD). This supplements, and where in conflict, supersedes the DOD energy-motivated research and development guidelines set forth in the July 22, 1974, "Management of Defense Energy Resources Phase II Report."

Discussion.—The increased involvement of DOD in energy technologies to meet mission requirements, to meet mandated and cost beneficial energy conservation goals, and to provide DOD unique capabilities in support of the national energy programs, requires that DOD energy technology efforts be effectively managed and coordinated. Further, the application to Defense purposes of energy technologies developed by the Department of Energy and industry requires careful management and coordination.

Policy.—Lead military departments will be designated for each key energy technology of significant interest to DOD. The designation of lead military departments is attached. The responsibilities of the lead military departments are:

What:

Establish coordination mechanisms.

Develop coordinated DOD-wide program plans, objectives, and implementation responsibilities.

Encourage, through the Defense Energy Policy Council, emphasis on most important areas.

Promote efficient use of DOD resources.

Sponsor the development of specifications, standards, handbooks, or other mechanisms to promote the beneficial use of energy technologies.

Provide for technology transfer to include the exchange of information.

How:

Identify, for the Defense Energy Policy Council, the responsible project officer in the lead military department and in other interested military departments.

Establish or use existing interdepartmental groups to coordinate activities and develop draft plans, policies, specifications, and standards.

Prepare and provide to the Defense Energy Policy Council an energy program plan which describes the DOD-wide progress and plans or the energy technology. DOD-wide resources will be shown and identified as to military department or defense agency responsibility and budget allocations.

Reports:

DOD-wide plans and progress to be provided to the Defense Energy Policy Council on the same schedule as the military department's energy program plan.

Each military department will report its program efforts within its budget and energy program plan.

Provide additional status reports as mutually agreed upon and as required.

Report any policy matters which require resolution to the Defense Energy Policy Council.

Other military departments will provide support to and coordinate with the lead military department.

GEORGE MARIENTHAL,
Deputy Assistant Secretary of Defense (Energy, Environment & Safety).

RUTH M. DAVIS,
*Deputy Under Secretary of Defense for Research and Engineering
(Research and Advanced Technology).*

Attachments.

LEAD MILITARY DEPARTMENT ASSIGNMENTS

DEPARTMENT OF THE ARMY

Photovoltaic energy systems for terrestrial applications.
Multifuel engines other than for fixed wing aircraft and ship propulsion.
Solar heating and cooling systems for buildings.
Computer programs to determine energy characteristics of buildings.
Wood-fired boilers.
Energy storage and distribution systems for fixed facilities.
Energy conserving structures and construction technology.
Advanced heating and air-conditioning systems.
Advanced low head hydropower.
Nuclear power systems for land based applications.
Electric vehicles.

DEPARTMENT OF THE NAVY

Geothermal energy (heat and electrical power).
Co-generation/total energy system.
Energy monitoring and control systems.
Multifuel/high efficiency ship propulsion systems.
Refused derived fuels.

DEPARTMENT OF THE AIR FORCE

Multifuel/high efficiency aircraft propulsion systems.
Colloidal boiler fuels.
Fuel cells.
Energy storage for mobile/portable systems.
Advanced technologies to burn coal in fixed facilities.
Wind energy.

TABLE 4.—DOD ENERGY-MOTIVATED R. & D. PARTICIPATION GUIDELINES

Operations	Research	Exploratory development	Advanced engineering development
I. Aircraft operations—Air Force lead:			
A. Improved propulsion aircraft turbines with reduced specific fuel consumption.	Lead.....	Lead.....	Lead.
B. Improved aerodynamic drag reduction.....	do.....	do.....	Do.
C. Multifuel capability.....	do.....	do.....	Do.
D. Alternate fuel for aircraft operations:			
1. Syncrudes.....	Incentivize.....	Incentivize.....	Incentivize.
2. Hydrogen and methane.....	Monitor.....	Monitor.....	Monitor.
E. Improved aircraft operational procedures.....	Lead.....	Lead.....	Lead.
II. Ship operations—Navy lead:			
A. More efficient ship propulsion:			
1. Improved efficiency conventional powerplants: diesel and steam.	do.....	do.....	Do.
2. Advanced gas turbines.....	do.....	do.....	Do.
3. Advanced topping cycle such as supercritical carbon dioxide Brayton cycle.	Monitor.....	Monitor.....	Monitor.
4. Turbine driven superconducting generator motor propulsion driven systems.	Lead.....	Lead.....	Lead.
5. Nuclear ship propulsion (less reactors).....	do.....	do.....	Do.
B. Multifuel capability.....	do.....	do.....	Do.
C. Burn less critical fuels:			
1. Syncrude fuels.....	Incentivize.....	Incentivize.....	Incentivize.
2. Other alternate fuels.....	Monitor.....	Monitor.....	Monitor.
D. Combined chemical dash power and nuclear cruise power systems.	Lead.....	Lead.....	Lead.
E. Reduction in nonpropulsive energy consumption—improved conversion efficiency:			
1. Total energy/waste heat recovery systems.....	Participate...	Participate...	Monitor.
2. Integrated energy/waste/water management system.....	do.....	do.....	Do.

TABLE 4.—DOD ENERGY—MOTIVATED R. & D. PARTICIPATION GUIDELINES—Continued

Operations	Research	Exploratory development	Advanced engineering development
III. Installations and buildings—all services and ARPA:			
A. Optimum utilization of technology and equipment:			
1. Conduct analyses of DOD buildings and installations to determine the optimum way to invest available DOD energy conservation dollars to maximize Btu saved per dollar.	Monitor.....	Monitor.....	Do.
2. Conduct further performance and economic analyses on primary and supplementary heating and cooling; provide buildings for trial use.	.....do.....	.....do.....	Do.
3. Total energy systems that recover and use waste heat.	Participate.....	.....do.....	Do.
4. Improve efficiency base and building energy (heating and cooling) distribution systems.	Incentivize....	Incentivize....	Incentivize.
5. Optimum location of new buildings and site placement.	.....do.....	.....do.....	Do.
6. Energy independence for remote bases.....	Lead.....	Lead.....	Lead.
B. Advanced technology:			
1. Advanced power plants of improved efficiency that are convertible to substitute fuels such as coal and syncrude.	Monitor.....	Monitor.....	Monitor.
2. Advanced methods of energy storage and distribution.	.....do.....	.....do.....	Do.
3. Alternate energy sources and fuels (e.g., solar, geothermal, nuclear).	.....do.....	.....do.....	Do.
IV. Ground operations—Army:			
A. Vehicles:			
1. Stratified charge gasoline engines.....	Participate....	Participate....	Participate.
2. High-performance high-speed diesel engines with good efficiency over a wide load range.	.....do.....	.....do.....	Do.
3. Open cycle gas turbines with recuperators to increase efficiency.	.....do.....	.....do.....	Do.
4. Multispeed lockup transmissions with high efficiency and smooth operation.	.....do.....	.....do.....	Do.
B. Mobile electrical power systems:			
1. Stirling engine—generators.....	Lead.....	Lead.....	Do.
2. Small fuel cells.....	.....do.....	.....do.....	Do.
3. Efficient turbo-alternators.....	.....do.....	Participate....	Do.
C. Multifuel capability:.....	.....do.....	Lead.....	Lead.
D. Advanced fuels and power systems:			
1. Refined syncrude fuels.....	Incentivize....	Incentivize....	Incentivize.
2. Hydrogen.....	Monitor.....	Monitor.....	Monitor.
3. Closed Brayton regenerative gas turbines.....	Participate....	Participate....	Participate.
4. Fuel additives (e.g., methanol).....	.....do.....	.....do.....	Do.
5. Nuclear energy systems such as nuclear powered total energy depots and radioisotope power generators.	.....do.....	.....do.....	Do.

Senator HART. On page 10 of your statement, you mentioned eight major demonstration initiatives. Those are the same, I think, as Secretary Myers had in his statement. We have a number of details on those that we would like to have from you, and particularly including who the project officers are, how they may be contacted, and the scope of each of the initiatives and schemes, costs, and potential benefits, and we would like all of that if you would. We will give you a specific shopping list there if you could provide those for us.

[The information follows:]

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE,
Washington, D.C., October 18, 1978.

HON. ROBERT THORNE,
Assistant Secretary for Energy Technology,
Department of Energy, Washington, D.C.

DEAR MR. THORNE: This is to provide you with the preliminary development plans for the Department of Defense (DOD)-Department of Energy (DOE) initiatives that you and I tentatively approved on June 6, 1978. We have reviewed these preliminary development plans with the military departments and DOE personnel. I believe that we have completed all the efforts which can be reasonably accomplished at our level on the initiatives. We should now decide which initiatives should be continued and assign further implementation to our respective designated project officers.

Based on my evaluation, which included consideration of the DOE comments, my recommendations are as follows:

The geothermal electric initiative at the Naval Weapons Center, China Lake, California, continues as planned. DOD will carry out the implementation with DOE support, as required. There are no unplanned budget impacts on either DOD or DOE.

The photovoltaic and solar heating and cooling initiatives should be allowed to proceed as currently planned. We are concerned that the currently planned DOD share of the total DOE resources available for these initiatives is not commensurate with the potential DOD market for photovoltaic systems or DOD's status as the major claimant of federal buildings and equipment. A high level DOE review of this situation is warranted. DOE has funds to conduct these initiatives, however.

The wood-fired central heating plant initiative at Fort Stewart, Georgia, should be approved for implementation. We will require \$300,000 from DOE for design in fiscal year 1979 and a total of \$125,000 in fiscal year 1982 and 1983 for test and evaluation. DOD will budget \$8 million for the procurement and installation of the boiler in fiscal year 1981.

The geothermal heating initiative at Hill Air Force Base, Utah, should be implemented on the basis that the currently planned single source well and system to distribute and heat one 217,000 square foot warehouse be completed in fiscal year 1979. The DOD and DOE project officers should prepare a cooperative program to expand this initiative as soon as the characteristics of the geothermal source are identified. As we envisage this effort, DOE would provide \$500,000 for the investigation of the geothermal source and drilling of the initial production well. DOD will provide \$100,000 for drilling and casing the well and will fund all costs of the distribution lines and building heating system associated with the initial effort. Funds required for the follow-on effort will be identified in the plan that our respective project officers will prepare.

The fluidized bed coal fired boiler initiative at McClellan Air Force Base, California, should be implemented. The DOD need for the three 200,000 pound per hour boilers and the DOE desire to promote the commercialization of fluidized bed boilers of this size provide the basis for this major cooperative program. DOD proposes to program \$80 million in fiscal year 1981 for two-thirds of the boiler construction costs and all the steam distribution costs if you will commit DOE to program \$22.67 million in fiscal year 1981 to cover one-third of the boiler costs. In addition, we propose that we share the fiscal year 1979 design costs of \$6.16 million on the same ratio as the equipment, that is, DOD will provide \$4.11 million and DOE will provide \$2.05 million. Your staff has expressed concern with the magnitude of resources required for this initiative. We are equally aware of the magnitude. The cost of this initiative will require a substantial portion of the total Air Force's facilities budget for fiscal year 1981. We will require a prompt decision on your part to enable us to incorporate this initiative into the DOD budget.

The low Btu coal gasification initiative at Minot Air Force Base, North Dakota, should be implemented. The potential to use this process to convert packaged oil and gas boilers to coal is very attractive to DOD and could have a major national impact. Unfortunately, DOD was unable to retain the \$7 million in the fiscal year 1980 budget since DOE was unwilling to program its share of \$7 million. DOD will make every attempt to accommodate the \$7 million in the fiscal year 1980 program, or if this is not possible, to include it in the fiscal year 1981 budget if you will commit DOE to program \$7 million in the DOE fiscal year 1980 budget. I recommend that the \$840,000 required for design be shared equally between DOD and DOE and be made available in fiscal year 1979. We need your determination on this project in the very near future to permit us to make the necessary budgetary adjustments.

I defer my recommendations on the proposed "showcase" installations until we receive the presentations on what the military departments propose. As you know, the Army and Air Force will present their proposals to us on October 19th, and the Navy will arrange for their presentation shortly thereafter.

I would appreciate receipt of your agreement to the recommended courses of action for the initiatives at an early date. Upon receipt of your concurrence or our agreement on alternatives, I will arrange for the DOD project officers to work with the DOE project officers to execute expeditiously our agreed upon actions on each initiative. I have attached the names of the DOD program officers for each initiative should you or your staff desire any additional information. We

have provided Dr. Ted Mock with copies of the preliminary implementation plans and additional material which has been developed.

Please call me if I can be of any further assistance.

Sincerely,

GEORGE MARIENTHAL,
Deputy Assistant Secretary of Defense
(Energy, Environment & Safety).

Attachment.

DESIGNATED DOD PROGRAM OFFICERS

Geothermal electric initiative at Naval Weapons Center, China Lake, Calif.:
Dr. Carl Austin, Code 266, Naval Weapons Center, China Lake, Calif.

Photovoltaic initiative: Mr. Donald Faehn, MERADCOM, Attn: DRDME-ES, Fort Belvoir, Va.

Solar heating and cooling initiative: Mr. M. M. Marshall, Director of Construction Standards and Design, OSD (MRA&L), Pentagon, Washington, D.C.

Wood-fired Central Heating Plant at Fort Stewart, Ga.: Mr. R. D. Winn, Office of the Chief of Engineers, Attn: DAENMPO-U, Washington, D.C.

Geothermal Heating at Hill Air Force Base, Utah: Capt. Mike M. Aimone, USAF (Mr. Fred Beason), Attn: AFESC/DEB, Tyndall AFB, Fla.

Fluidized Bed Coal Fired Boiler at McClellan AFB, Calif.: Capt. Mike M. Aimone, USAF (see above address).

Low Btu Coal Gasification at Minot AFB, Calif.: Capt. Mike M. Aimone, USAF (see above address).

Showcase, McClellan AFB, Sacramento, Calif.: Capt. Mike M. Aimone, USAF (see above address).

Showcase, Red River Army Depot/Lone Star Army Ammunition Plant, Texarkana, Tex.: Mr. Richard A. Roane, Attn: SDSRR-TS, Texarkana, Tex.

Showcase, Sewells Point Complex, Norfolk, Va.: Cdr T. Martinelli, USN, Code 111, Director for Energy Utilities, NAVFAC Engineering Command, 200 Stovall St., Alexandria, Va.

INFORMATION PAPER

Subject: Army Energy Showcase—RRAD/LSAAP.

FACTS:

1. OASD Memorandum, dated 19 May 1978 established RRAD/LSAAP as Army Showcase installation as part of the DOD/DOE joint initiative program.

2. RRAD/LSAAP, located near Texarkana Texas is an industrial site combining production, manufacturing and storage operations.

3. Showcase will demonstrate energy technologies that have application in the civilian industrial sector as well as defense industry.

4. Proposed major thrust areas and conceptual study costs are:	<i>Thousands</i>
a. BIO mass conversion.....	\$25
b. Alternate transportation fuels.....	25
c. Lignite fired central steam plant.....	129
d. Solar conversion.....	50
e. Terratecture.....	100
f. Energy Conservation.....	50

5. Agreed upon funding requirements are shown below:

	<i>Thousands</i>
Fiscal year 1979:	
Army.....	\$476
DOE.....	500
Fiscal year 1980:	
Army.....	6,778
DOE.....	500
Fiscal year 1981:	
Army.....	1,300
DOE.....	800
Fiscal year 1982:	
Army.....	1,500
DOE.....	200
Fiscal year 1983:	
Army.....	500
DOE.....	0

The Army is funded for fiscal year 1979 and programmed for fiscal year 1980. DOE is in process of transferring \$500K to Army for fiscal year 1979.

6. Conceptual studies will address potential energy impact of each thrust area.

SEWELLS POINT CONSERVATION SHOWCASE

THE STUDY

\$225,000—fiscal year 1977.

Battelle Columbus.

Results:

Identified high payback potential actions in a heterogeneous environment.
Pointed the way to continuing action.

THE INDUSTRIAL COMMUNITY

General:

4,528 acres.

\$2.4 billion plant accounts.

2,377 Buildings.

1,219 Vehicles (Gov't owned).

Population:

47,000 afloat, military.

14,400 civilian employees.

16,500 ashore, military.

Family quarters:

2,400 units.

12,000 residents.

Barracks/BOQ:

8,500 spaces.

87 ships homeported (increasing).

20 aircraft squadrons.

ENERGY USE, FISCAL YEAR 1978

Fixed—Utilities:

Electricity, 455,779 mwh	\$12, 523, 442
Fuel oil, 5,128,985 mbtu	9, 841, 078
Natural gas, 304,141 mbtu	844, 703

(Energy only)	23, 209, 273
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Other utilities and O&M	9, 049, 241
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Total utilities, 10,720,162 mbtu	32, 258, 514
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Maximum demands:

Electricity—9,000 kw in house generation; 96,000 kw commercial.

Heating—783 mbtuh.

SHOWCASE INITIATIVES

Cogeneration/gasification.

Heat pump/ground water sink.

EMCS simulation.

Microprocessor optimization.

Solar boiler water preheater.

Solar supplementary energy source.

Cases.

Hot gas recovery.

Air conditioning tune-up.

Energy system training.

COGENERATION/GASIFICATION

Description.—Central Steam/Electric Plant: 8 boilers; 10,000 kva extraction steam turbines. Coal Gas Fired Combined Cycle Plant: two stage gasification; gas turbine; waste heat recovery. Output: 114 mbtuh electric, 240 mbtuh steam. Efficiency, 71 percent.

Benefits: Reliable fuel supply; substitute coal for oil; use lower heat value coal; annual energy savings, 326,000 bbl foe, 20 percent reduction. Annual cost savings—\$7.8 million.

Funding schedule:	<i>Thousands</i>
Engineering (12 months) -----	\$300
Design (18 months) -----	6,600
Construction (45 months) -----	78,400
Post construction eval (12 months) -----	150

HEAT PUMP/GROUND WATER HEAT SINK

Description: 1,892 units; Willoughby housing, 440 units, 12 unit groups; 2-4 brm. town houses; shallow well ground water heat pump; 3 groups of 12 town houses; 2 alternative systems.

SOLAR PREHEATER

Funding schedule:	<i>Thousands</i>
Engineering study (8 months) -----	\$18
Design (8 months) -----	60
Construction (12 months) -----	880
Post construction eval -----	5

SOLAR SUPPLEMENTAL

Description: Navy exchange; heating; air conditioning; solar heating and cooling.

HEAT PUMP/GROUND WATER HEAT SINK

Benefits: Energy savings: 52-69 percent natural gas; 53-62 percent electricity. Compares individual and group systems; utilize renewable energy.

Funding/schedule:	<i>Thousands</i>
Engineering Study (6 months) -----	\$75
Design (7 months) -----	250
Construction:	
Water—air (24 months) -----	2,000
Water—Water (24 months) -----	2,500
Post construction eval -----	60

EMCS SIMULATION

Description: Install two emcs; apply control algorithm; develop and test simulation program; modify algorithm re. actual results.

Benefits: Optimized Control Strategies, Navy/DOD/Industry; education of EMCS users; guidance for industry.

Funding/schedule: Engineering study:	<i>Thousands</i>
Design (6 months) -----	\$100
Hardware/Installation (3 months) -----	75
Post construction eval (18 months) -----	50

MICROPROCESSOR OPTIMIZATION

Description: Significant savings in small buildings; test types of microprocessors; demonstrate benefits by type and building function.

Benefits: Annual energy savings est.—20,900 mbtu; identify application parameters; improve user acceptance.

Funding/schedule:	<i>Thousands</i>
Engineering study (3 months) -----	\$3
Design (4 months) -----	5
Hardware/Installation (8 months) -----	200
Post construction eval (18 months) -----	50

SOLAR PREHEATER

Description: Salvage Fuel Steam Plant, 42 million gal. of Make-up Water; solar preheating system, 20,000 square feet, preheat 21 million gallons, 50 F.

Benefits: High volume, low temperature requirement; 12,600 mbtu annual savings.

SOLAR SUPPLEMENTAL

Benefits: Optimizes solar supplemental with mechanical back up; evaluates cost effectiveness; annual energy savings: 5,800 mbtu; 160 mhw.

Funding/schedule:	Thousands
Engineering Study (8 months)-----	\$20
Design (9 months)-----	80
Construction (15 months)-----	1, 100
Post construction eval-----	5

C.A.S.E.S. (COMMUNITY ANNUAL STORAGE ENERGY SYSTEM)

Description: CINCLANTFLT compound, diverse heating/cooling loads; remote "sub-community"; C.A.S.E.S. heats and cools from central storage facility; storage facilities exist.

Benefits: 80 percent potential energy savings; higher efficiency cooling; existing equipment adaptable; cheaper "off-peak" energy storage; reduces demand and plant size; "community" size demonstration.

Funding/schedule:	Thousands
Engineering Study (12 months)-----	\$95
Design (6 months)-----	900
Construction (24 months)-----	15, 000
Post construction eval (24 months)-----	100

HOT GAS RECOVERY

Description: Enlisted dining facility; 30 tons refrigeration; 90 tons central air conditioning; system to recover heat from refrigerant.

Benefits: 420 mbtu annual energy savings; utilize waste heat; allow optimal sizing of mechanical equipment.

Funding/schedule:	Thousands
Engineering study (2 months)-----	\$2
Design (2 months)-----	2
Construction (2 months)-----	12
Post construction eval-----	1

AIR CONDITIONING TUNE-UP

Description: evaluate large systems; identify conservation opportunities; optimize retrofit techniques.

Benefits: Annual energy savings—30 percent (126,000 mbtu); universally applicable retrofit guidelines.

Funding/schedule:	Thousands
Engineering study (6 months)-----	\$150
Design (6 months)-----	60
Retrofit (2-12 months)-----	1, 000
Post action eval (12 months)-----	40

SYSTEMS TRAINING

Description: NTTC—utilities conservation; correspondence/resident; new energy systems; new techniques/incentives.

Benefits: 2 percent overall savings (165,000 mbtu); improved system reliability especially new systems; universally applicable.

Funding/schedule:	Thousands
Course development (24 months)-----	\$300
Operation (year)-----	75

SUMMARY

[In thousands of dollars]

	Study	Design	Construction
Cogeneration/gasification-----	300	6, 600	78, 400
Heat pump/ground water sink-----	75	250	2, 000
EMCS simulation-----	10	75	2, 500
Microprocessor optimization-----	3	5	50
Solar boiler water preheat-----	18	60	200
Solar supplementary energy-----	20	80	880
CASES-----	95	900	1, 100
Hot gas recovery-----	2	2	15, 000
Air-conditioning tuneup-----	150	60	12
Energy system training-----		300	1, 000
Total-----	673	8, 332	175

¹ Per year.

POINT PAPER ON McCLELLAN AFB ENERGY SHOWCASE INITIATIVE

The purpose of the McClellan energy initiative is to provide a technical display that will give high visibility to applications of advanced energy resource management procedures and selected new energy supply and conservation measures. Will provide stimulation in energy initiatives to industry, Congress, and the general public.

The showcase initiative is estimated to cost more than \$222 million.

Cost to be shared between DOD and DOE.

DOE has verbally committed \$500,000 to complete initial feasibility study. Notification for determination of interest published in Commerce Business Daily, November 14, 1978.

Costs based on fiscal year 1977 estimates escalated to start of construction.

The showcase initiative is developed around demonstration of the high technology coal burning technique.

Coal-fired fluidized-bed boiler is to be used for central heating plant.

Provides for centralization and upgrade of base utilities.

Showcase also demonstrates advanced energy conservation and alternate energy source technologies.

BACKGROUND PAPER ON THE McCLELLAN AFB SHOWCASE INITIATIVE

1. The purpose of the McClellan AFB initiative is to provide a technical display which will give high visibility to applications of advanced energy resource management procedures and selected new energy supply and conservation measures. The desired outcome is to provide both information and stimulation in these energy initiative areas to industry, Government and reserachers, Congress, and the general public.

2. The initiative has been briefed at various levels of the AF, OSD, and DOE. DOE has verbally committed \$500,000 to complete a comprehensive feasibility study to validate the showcase concept, cost, environmental considerations, and preliminary design criteria. A Commerce Business Daily notification for a determination of interest was published on 14 Nov. 78. A statement of work for this feasibility study is in the final draft stages and will be completed by mid December. AE selection is planed during early January.

3. The preliminary conceptual plan, the October revised edition, was submitted to OSD for their review and transmittal to DOE on 1 December. This concept plan suggested a \$222 million level of effort as shown below:

System technology:	Approximate cost (million of dollars)
Utilities centralization.....	154.97
Energy conservation.....	15.99
Alternate energy sources.....	6.70
Data gathering.....	1.37
Miscellaneous energy measures.....	15.41
Contingencies.....	27.07
Feasibility study.....	.50
Total.....	222.05

4. These costs are based on FY77 estimates escalated to start of construction and includes design costs. These costs shall be validated during the feasibility study.

5. The central theme of this showcase initiative is the utility upgrade/centralization of a conventional natural gas-fired central heat plant to coal-fired utilizing atmospheric Fluidized Bed Boiler Technology. The concept plan calls for centralization of chilled water, steam, compressed air and electric cogeneration from this central plant. Furthermore, this showcase initiative demonstrates advanced energy conversion and alternate energy source technologies.

Senator HART. Now, on page 12, you discuss the Departments' policy for cooperative efforts with DOE. Is that policy written down?

Mr. MARIENTHAL. Yes, sir, it is written and we would be happy to send you a copy of that for the record.

[The information follows:]

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE,
Washington, D.C., December 15, 1978.

DEFENSE ENERGY PROGRAM POLICY MEMORANDUM (DEPPM), No. 78-8

Memorandum for designated energy officials of the Office of the Secretary of Defense, Military Departments, Joint Chiefs of Staff, and Defense Agencies.
Subject: Department of Defense-Department of Energy memorandum of understanding (MOU).

Purpose.—To implement the enclosed October 19, 1978, memorandum of understanding between the Department of Defense (DOD) and the Department of Energy (DOE) which provides for a broad range of cooperative energy activities. The MOU will help achieve the energy goals of the United States and, ultimately, enhance national security.

Applicability.—The provisions of this Defense Energy Program Policy Memorandum apply to the Office of the Secretary of Defense, the military departments, and defense agencies (hereinafter referred to as DOD components).

Policy.—The Department of Defense-Department of Energy MOU establishes the general conditions under which DOD components will undertake specific cooperative arrangements with the DOE to improve energy efficiency and fuel availability within the DOD and to use the expertise in both departments to carry out projects of mutual interest.

Cooperative efforts may be undertaken only when the benefits to the DOD are commensurate with the anticipated expenditures of DOD resources. Consideration may be given to cooperative efforts where DOD has unique resources or capabilities essential to the conduct of DOE programs. Such efforts will require the prior approval of the DOD Program Coordinator, however. Use of DOD resources to support activities under the MOU will be done according to the references in enclosure 3.

Responsibilities.—The Deputy Assistant Secretary of Defense (Energy, Environment and Safety) shall:

Serve as the Program Coordinator to carry out the liaison activities of the MOU (see enclosure 2);

Identify to the DOE Defense fuel requirements necessary to support peacetime readiness and wartime operations of the strategic and tactical forces;

Collaborate with the DOE to ensure that DOE programs, to include the Strategic Petroleum Reserve, assure the peacetime readiness and wartime operational needs of the strategic and tactical forces;

Conduct semiannual reviews of DOD-DOE cooperative efforts;

Release, in coordination with the DOE Program Coordinator, information to the public on joint DOD-DOE programs and projects which are implemented under the MOU;

Provide support to DOE in budget justification and hearings before the Office of Management and Budget and the Congress on joint activities;

Review the MOU annually to determine whether it should be continued, modified or terminated; and,

Maintain copies of all executed agreements subordinate to the MOU.

The heads of DOD components shall:

Develop procedures to assure that agreements subordinate to the MOU which provide the operational, fiscal, and management guidelines are consistent with provisions of the MOU and established DOD policies (see enclosure 3);

Designate a program coordinator to interface with the DOD program coordinator;

Provide copies of all current executed subordinate agreements to the DOD Program Coordinator within 30 days of the issuance of this DEPPM;

Provide the DOD Program Coordinator an analysis of each agreement using the report format at enclosure 4 within 30 days after the end of the second and fourth quarters each fiscal year;

Provide copies of all newly executed subordinate agreements to the DOD Program Coordinator within 30 days after their consummation;

Assist the DOD Program Coordinator's semi-annual review of all DOD-DOE cooperative efforts to determine their adequacy and to measure their achievements;

Assure that adequate resources are available to fulfill the provisions of all agreements; and,

Establish a central repository and review process to assure that all agreements are in compliance with this DEPPM. Notify promptly the DOD Program Co-

ordinator should the DOD component or DOE fail to comply with the terms of the agreement. This notification shall include:

- a brief statement of the problem
- nature of corrective action proposed, and
- any recommended action for the DOD Program Coordinator.

Information requirements.—The report requirements outlined in this DEPPM have been assigned Reports Control Symbol DD-M(SA) 1511.

Implementation.—This Defense Energy Program Policy Memorandum is effective immediately.

GEORGE MARIENTHAL,
Deputy Assistant Secretary of Defense
(*Energy, Environment and Safety*).

Enclosure.

II. PURPOSE

This Memorandum of Understanding establishes the general conditions under which DOE and DOD will undertake specific cooperative arrangements to meet two basic goals: improving energy efficiency and availability within DOD; and utilizing DOD and DOE expertise and facilities to carry out projects of mutual interest.

III. ENERGY LEGISLATION

The DOE has responsibility with respect to energy programs under such legislation as the "Federal Nonnuclear Energy Research and Development Act of 1974" (P.L. 93-577), the "Energy Reorganization Act of 1974" (P.L. 93-438), the "Solar Heating and Cooling Demonstration Act of 1974" (P.L. 93-409), the "Electric and Hybrid Vehicle Research Development, and Demonstration Act of 1976" (P.L. 94-413), and the "Department of Energy Organization Act" (P.L. 95-91). These statutes also provide for the participation of the DOD in Federal energy programs under the jurisdiction of the DOE.

IV. SCOPE OF COOPERATIVE PROGRAMS

Cooperative energy activities undertaken by DOD and DOE are designed to: enhance national security; reduce United States dependency on foreign energy supply; ensure that renewable and abundant domestic energy resources can be utilized; and promote energy conservation efforts. These activities will include research, development, demonstration, and other projects. In this context:

A. DOD will identify to DOE its requirements for fuel necessary to support the peacetime readiness and wartime operations of the strategic and tactical forces;

B. DOD will use its expertise and facilities as mutually agreed in research, development, and demonstration programs in support of DOE, within its authority and in accordance with DOD policies and procedures;

C. DOE will collaborate with DOD in ensuring that DOE's programs, including the Strategic Petroleum Reserve Program, help to assure the peacetime readiness and wartime operational needs of the strategic and tactical forces;

D. DOE will assist DOD in identifying significant potential areas of energy saving within DOD and will advise DOD of advances in energy related technologies that have potential application to DOD;

E. DOE will review DOD's annual list of energy related research, development, test, and evaluation projects to ensure duplicate projects are not initiated and will advise DOD of the results of that review; and

F. DOE will use its expertise and facilities as mutually agreed to participate in research, development, and demonstration programs, in accordance with established DOE policies and procedures.

V. IMPLEMENTATION

The Secretary of Energy and the Secretary of Defense each will designate a Program Coordinator who will serve as the principal liaison officer between the two departments. The Program Coordinators will conduct reviews of cooperative efforts at least semiannually and will report recommendations based on these reviews to the Secretary of Defense and the Secretary of Energy.

Specific programs and projects will be implemented through subordinate agreements between the concerned parties. These agreements will provide the operational, fiscal, and management guidelines necessary to carry out specific programs and projects. Each department will establish procedures to assure that these

subordinate agreements are consistent with this Memorandum of Understanding and each department's policies. The DOD and DOE Program Coordinators will maintain copies of all executed subordinate agreements, including those between the Military Departments and the DOE.

VI. PROCUREMENT POLICY

Activities undertaken under the provisions of this Memorandum of Understanding may involve contractual arrangements with non-governmental entities. When such arrangements are necessary, they will be consistent with the legal authority of the department for whom the activities are undertaken. Contracting shall be done pursuant to the regulations of the contracting department. The department for whom the activities are undertaken shall identify in the proposed interagency agreement or task order any of its policy requirements with which such arrangement must be consistent. When any of the requirements of the department for whom the activities are undertaken are in conflict with regulations, procedures, or policy of, or legislation applicable to, the contracting department, the issue shall be resolved jointly at appropriate levels within the two departments and the resolution shall be reflected in the interagency agreement or task order for the specific activity undertaken.

Contracts awarded by DOD under this Memorandum of Understanding shall include patent provisions as provided by either Section 9-107.7 or Section 9-107.8 of the Defense Acquisition Regulation as appropriate to comply with DOE statutory patent policy.

VII. PUBLIC INFORMATION COORDINATION

Except for requests made under the Freedom of Information Act (5 U.S.C. 552), arrangements for timely release of information to the public regarding projects and programs implemented under this Memorandum of Understanding will be by mutual agreement between the DOE and DOD Program Coordinators.

VIII. INFORMATION EXCHANGE AND BUDGET COORDINATION

Consistent with existing data disclosure policies, there will be a free exchange of information between the DOE and DOD, and the two departments will coordinate with each other to facilitate consistent development and use of energy related information. DOD and DOE will provide to each other support in budget justification and hearings before the Office of Management and Budget and the Congress with respect to joint activities.

IX. AGREEMENTS PRESENTLY IN EXISTENCE

Interagency agreements between the DOD and any of the agencies whose functions were assumed by DOE on October 1, 1977, will remain in effect until terminated or renegotiated. This Memorandum of Understanding supersedes the Memorandum of Understanding, dated January 15, 1977, between DOD and the Energy Research and Development Administration.

X. EXCLUSIONS

The following are excluded from this Memorandum of Understanding:

- A. All intelligence and nuclear safeguards matters.
- B. All nuclear weapons matters including related nuclear material production activities. DOD will comply with DOE policies pertaining to the use of the DOE weapon laboratories for nonweapon work.
- C. All Naval reactors and related activities.
- D. Civil works activities of the U.S. Army Corps of Engineers performed in accordance with existing agreements.
- E. All matters pertaining to the Federal Energy Regulatory Commission.

XI. AMENDMENT AND TERMINATION

A. This Memorandum of Understanding will be reviewed annually by DOE and DOD to determine whether it should be continued, modified or terminated.

B. This Memorandum of Understanding may be terminated or amended by mutual agreement of DOE and DOD. Normally, a minimum of 90 days advance written notice of proposed termination will be provided.

XII. EFFECTIVE DATE

This Memorandum of Understanding is effective when signed by both departments.

JAMES R. SCHLESINGER,
Secretary of Energy.

Date: *September 8, 1978.*

C. W. DUNCAN, Jr.,
Deputy Secretary of Defense.

Date: *October 19, 1978.*

THE SECRETARY OF DEFENSE,
Washington, D.C., October 19, 1978.

HON. JAMES R. SCHLESINGER,
Secretary of Energy, Department of Energy,
Washington, D.C.

DEAR JIM: This is to return to you a signed copy of the Department of Defense—Department of Energy Memorandum of Understanding (MOU). I have designated George Marienthal, Deputy Assistant Secretary of Defense, Energy, Environment and Safety (Manpower, Reserve Affairs and Logistics), as the Program Coordinator to carry out the liaison activities under the Memorandum. George Marienthal will have the necessary authority within the Department to carry out this important function.

I look forward to continued excellent cooperation between our Departments. I am confident that our joint efforts will enhance the national security and help achieve the nation's energy goals.

Sincerely,

C. W. DUNCAN, Jr.,
Deputy Secretary of Defense.

Enclosure.

ENCLOSURE 3

DOD Directive 1000.17, "Department of Defense Personnel Assigned to Duty Outside the Department and Supporting Non-DOD Activities," May 31, 1977.

DOD Directive 4000.19, "Basic Policies and Principles for Interservice, Interdepartmental and Interagency Support," March 27, 1972.

DOD Directive 4165.61, "Intergovernmental Coordination of Department of Defense Land and Facility Plans and Projects," December 16, 1976.

DOD Directive 4275, "Acquisition and Management of Industrial Resources," July 13, 1978.

Senator HART. I am interested particularly in the reference to limiting the Department of Defense to one of almost any initiative, I think is the way you put it.

Mr. MARIENTHAL. That is correct, I said the Department of Defense is willing to try one of almost anything in the energy area.

Senator HART. Why one and why just 10 years?

Mr. MARIENTHAL. We think the one makes good business sense in that if that particular technology looks promising then we should do one of it and—

Senator HART. It would be my point of trying to find out whether it looks promising if you try it once?

Mr. MARIENTHAL. Looks promising on paper and see if it looks promising with hardware and steel and concrete, in operation. That is what we aim to accomplish in the process, and results and impacts. The notion is one of attempting to avoid duplication within the Department, since there are limited R. & D. dollars for energy within the Department of Defense.

To make sure that we are managing those R. & D. dollars properly we have to keep a limit on; that is the thrust.

The 10-year figure refers to the normal business practice of providing some goal or target to our subordinate units. We thought the 10-year payback period was the most effective way to provide that goal. It makes explicit the fact that our investment dollars are not free.

Senator HART. Well, let me make two observations. One is a one-of-a-kind approach is not the way we test our weapons systems for sure. We are not about to produce and deploy cruise missiles upon the basis of one test, and I would hope the Department would apply the same kind of test standards to energy conservation and new energy technologies that it does to its weapons systems tests.

Second, the 10-year limitation, I understand, is a normal practice, but the problem with that it discriminates against technology such as a solar where life cycle costing techniques and so on already indicate that you are not going to see the benefits unless you incorporate at least the timeframe at least twice as long, maybe even more.

The life of a solar system is more than 10 years and it pays itself out over its life, 20 to 30 years, so what I am concerned about is, one, that limitation on the number of tests or types of technology, and two, that arbitrary 10-year limit which discriminates against certain energy technologies.

Mr. MARIENTHAL. Yes, sir.

Senator HART. And I would hope you would take that into consideration.

Mr. MARIENTHAL. I understand that guidance. We will factor it in.

Senator HART. You indicate that there may be a tendency—this is your language—to limit the DOD involvement in applying the solar provisions of the National Energy Act, but last year you told us, as I recall, that DOD has 98 percent of all Federal building space. Why should the Department of Defense participation in that act and that program be limited?

Mr. MARIENTHAL. That is a good question. I think Secretary Myers indicated this morning that the percentage of our involvement is rising. As I understand it, though, when you combine 1978 and 1979 dollars, you come up with about a \$46 million figure of which we were originally slated to receive about \$4 million. I think one of the reasons for that was that we already had our marching orders in the 1979 Military Construction Authorization Act and we were going to be doing solar in any event. You had already given us those orders, and here NEA came up with this addition so they could get more bang for their buck, if you will, by limiting DOD and pushing it more, say, in the Post Office or the VA or other types of agencies. We were already involved in it up to our necks, if you will, with the other act.

Senator HART. I hope it works out that way.

You have plans for, as you indicated, a wood-burning powerplant at Fort Stewart, and I think you estimate the fuel savings at about \$300,000. Is that a net figure and does that figure take into consideration the costs of harvesting and processing the wood?

Mr. MARIENTHAL. The \$300,000 fuel savings is mentioned as fuel savings. I don't know if this is a net savings. I will find out and supply that.

Senator HART. If you will let us know.

Mr. MARIENTHAL. I certainly will.

[The information follows.]

The \$300,000 is for the total fuel savings per year. The net savings will not be known until further studies are completed to identify the costs of operating the wood-fired plant.

Senator HART. I think last year we received information on a possible wood-burning powerplant for the Mississippi Army Ammunition Plant. Where does that project stand?

Mr. MARIENTHAL. The Mississippi Army Ammunition Plant is a brandnew ammo plant, as you know, and its timing was such that it was not a good candidate for one of our major initiatives within the Department of Energy. So it was not on the list you reviewed this morning. The wood burning proposal for the Mississippi Army Ammunition Plant is still viable. It will still be fueled with wood as of this morning but the timing on it is post-1985. Therefore, it is not on the list you saw this morning.

Senator HART. On pages 16 and 17 you talked about the geothermal initiatives with China Lake. Do you have any estimates on the savings that may accrue to the Department of Defense on that project?

Mr. MARIENTHAL. Not at this time, Mr. Chairman. It is premature. We just developed a draft impact statement for review and negotiations with responsible contractors. It is due for next year and there is no way to tell until we get into the detailed negotiations what the potential for the resource is. That is still unknown at this time.

Senator HART. Keep us informed, if you would.

Mr. MARIENTHAL. Yes, sir.

Senator HART. And then later on you talked about the coal gasification plant proposed for Minot, and I think a fluidized bed boiler project at McClellan. It is my understanding that DOE is not going to participate in the funding of those. Do you intend to go forward with both of them in any case?

Mr. MARIENTHAL. On lignite gasification using lignite at Minot, there is a medium to high likelihood we will go ahead anyway on that one. In other words, Air Force will strongly consider proceeding in spite of the lack of DOE interest in that project.

On the fluidized bed boiler project at McClellan, I would say there is less likelihood, although it remains a possibility. The kicker there is it is a very, very expensive proposition. As I mentioned in my statement it would cost about \$100 million total and that is a considerable investment.

Senator HART. Mr. Marshall, let me ask you a couple of questions on your statement.

On page 2 you discuss the energy savings requirements for a conservation project. I think the standard is 49 million Btu savings per \$1,000. Can you translate that 49 million Btu into dollars and are you talking about a benefit to cost ratio?

Mr. MARSHALL. In dollars, from a savings standpoint, of dollars, that is roughly \$125 per 49 million Btu. So if we looked at our total program and figured the total number of million Btu or trillion Btu that we expect to save, if we could use \$2½, roughly, as per million Btu saved, that would show you the total savings for the program.

Senator HART. Say that again, \$2½ per million Btu's saved?

Mr. MARSHALL. Yes, sir.

Senator HART. Now, on pages 5 and 6 you dwell at some length on a project that this subcommittee recommended deleting last year, providing converting gas boilers to oil. We took that action because

three were ongoing studies at Fort Sill and Fort Riley, as I recall, which looked at total energy requirements at these bases.

Now, our premise was that since the studies were underway, the gas to oil conversion projects were premature, and, as I recall, the Army didn't object to our deletion of those projects.

In that context, could you account for the rather strong nature of your plea here and what is the status of the basewide energy studies?

Mr. MARSHALL. Well, let me address the plea first, if you will, Senator. We feel and have felt very strongly that because of these boilers and these plants being packaged plants and not conceivable to convert to solid fuels that we need an insurance capability and that is what we were looking at in this plea to support the 30-day supply of oil.

With regard to basewide energy studies, we have underway some 40 studies between the Departments of the Army and the Navy, 31 Army installations, 6 DOD installations under study by Army, and 3 additional bases being studied by Navy, basewide energy studies, and these are pilot studies in the Navy.

In addition to that, the Air Force is well along on doing computer analysis on energy use for all of their buildings over 30,000 square feet, I can't give you this morning the exact status of these studies, but I will be happy to do that for the record for you.

Senator HART. If you would.

[The information follows.]

BASE WIDE ENERGY STUDIES

Army.—Basewide energy studies were initiated for three installations in the South Atlantic area in July 1977. To date, AE contracts have been awarded to include a total of 37 installations. A list of installations under contract is attached and the status of progress.

All known techniques of energy conservation which are reasonable, practical and economical, including operational methods and procedures as well as physical facilities which will reduce energy consumption are being investigated. The results of these studies will prioritize ECIP or MCA projects in an orderly manner that will provide the best energy use for the installation.

Some early on accomplishments of these studies have resulted in the submission of several 1391s' for ECIP projects. If these projects are approved for execution, energy consumption reductions could result in the following:

- a. Ft. Rucker—33 percent (incl. solid waste heat recovery).
- b. Ft. Knox—17 percent.
- c. Ft. Gordon—15 percent.
- d. Ft. Benning—15 percent.
- e. Ft. Jackson—17 percent.
- f. Redstone Arsenal—11 percent.

The Army has expended \$7.5 million from OMA funds through fiscal year 1978 to accomplish these studies on 31 Army installations in CONUS (full scope of work on 13 of these installations and partial scope of work on 18 of these installations). It has no funds programmed in fiscal year 1979 for this purpose. \$15.0 million is programmed in fiscal year 1980, fiscal year 1981, and fiscal year 1982 for conduct of these studies.

These studies have proved to be very essential in programming viable ECIP projects and in determining maximum cost effectiveness. The method followed to date in aggregating a large number of installation studies into a single contract has resulted in the present estimate of a total cost of \$45 million to conduct such studies for all Army installations in CONUS.

Base wide energy studies	Completion (percentage)
Army installation:	
Fort Campbell.....	70
Fort Rucker.....	70
Redstone Arsenal.....	70
Fort Gordon.....	65
Fort Benning.....	65
Fort Jackson.....	65
Fort Knox.....	65
Fort McClellan.....	20
Fort Monroe.....	18
Fort Dix.....	25
Fort Belvoir.....	25
Fort Eustis.....	18
Carlisle Barracks.....	25
Fort Lee.....	20
Fort Ritchie.....	18
USMA.....	25
Fort Myer.....	25
Fort McNair.....	25
Cameron Station.....	25
Fort Bliss.....	10
Fort Sill.....	10
Fort Hood.....	30
WRAMC.....	15
Fort Detrick.....	15
Defense Depot, Memphis.....	15
Defense Construction Supply Center, Columbus.....	15
Defense Electronic Supply, Dayton.....	15
Defense Personnel Support Center, Philadelphia.....	15
Defense Depot Tracy.....	10
Defense Depot Ogden.....	10
Dugway PG.....	10
Fort Lewis.....	10
Presidio of San Francisco.....	10
Fort Carson.....	20
Fort Riley.....	20
Fort Leavenworth.....	15
Fitzsimmons AMC.....	25

Navy.—A study of the Naval complex at Norfolk has been accomplished by an energy consultant. Results from this study are being used to develop ECIP projects and as a basis to study other installations served as a pilot to develop a scope of work for further studies to be accomplished by consulting engineers. The first of these new studies was awarded in December 1978 for Cecil Field, Fla. The results of the Cecil Field study will be used to further refine the scope of future studies.

Air Force.—The Air Force initiated a program in March 1978, to model by computer, the energy consumption of all existing Air Force buildings over 30,000 square feet in the fifty states. There are about 1,925 buildings involved at some 110 installations. This effort is about 80% complete at this time and studies of all buildings should be completed by the end of March 1979. The TRACE computer program, a commercial system, is being used with detailed building input data developed by Air Force engineers. The program is providing information as to the energy each building should be using in its present condition as well as the energy savings, life cycle cost, etc. for each of 2 or 3 retrofit candidates. These retrofit candidates are selected by the engineering team surveying each building as the most promising based on the condition and situation of each building. Since the engineering team survey of the building is more intensive than a preliminary survey, additional energy conservation possibilities are often identified and many times these can be evaluated inhouse.

An effort will be made to collate the final results to determine if patterns of building functions, types of construction, climatic zones and other major areas might be developed which would be useful in highlighting prime energy conservation targets in buildings less than 30,000 square feet.

The principal product of the overall effort will be the selection of projects for the ECIP with priorities established for all projects.

Senator HART. You understand our purpose there was (1) not to move forward while those studies were underway, and (2) that we were looking beyond the question of should you burn oil or should you burn something else, but the question of whether total energy systems might make some sense.

Mr. MARSHALL. We understand that, Senator. However, we felt that at the same time we needed, while these studies are proceeding, that we need to be able to keep the missions going at these bases if we have winters like we have had in the past 2 years or had some other things to fail that give us a shortage of natural gas.

Senator HART. You take some exception, I think, on page 8 of our statement to the Department of Energy so-called energy budgets. Could you explain what energy budgets are?

Mr. MARSHALL. They are the energy consumption factors to be used in designing a building based on a square foot area of the building, so many thousand Btu's per square foot on an annual basis.

The exceptions that we took had to do with the climatic zones that are published in the Federal Register. We are not quite sure that they are the right ones. However, we are following those and our interim guidance that I mentioned in my statement on energy budgets is just about ready to be published and I would be happy to submit a copy of this for the record, and we believe that if we can implement these early on, that we will gain some experience in this area that will be supportive to the DOE effort during this period while their standards are reviewed.

Senator HART. And you are working with them on that, on developing those standards?

Mr. MARSHALL. No sir, we are not. I think that the effort that Secretary Myers addressed is a long-term effort that is going on and not one that is a short-term implementation factor. We will, of course, review as all other Government agencies will review, and comment on the proposed standards as published in the Federal Register.

Senator HART. What about the idea of using the Department or the Department of Defense being the laboratory for implementation of those standards or working them out, the question I raised with him?

Mr. MARSHALL. I think, Senator, that the implementation of our standards will serve as that laboratory base because one of the reasons, one of the other problems that we may have, and we are in the process of reviewing the proposed standards by DOE now, is really in taking the facilities that are addressed in the proposed DOE standards and having a uniform comparison to the kinds of facilities that we build.

Many of their standards address the kind of facilities that are not in the DOE inventory or are not utilized the same as they are in the commercial enterprise. For example, take motels as one example. We cannot compare the energy use of motels to that of BEQ's for example, because BEQ's are long-term occupied facilities and, of course, we have a large inventory of these. Motels are designed for short-term use and I think it would be inappropriate for that standard for motels to be applied to BEQ's.

Senator HART. Well, I think we are going to want to follow your experiences in this regard very closely.

Mr. MARSHALL. Anticipated implementation of this interim design criteria building energy budgets is around the first of January and

we intend to track the results of this implementation through the next several fiscal years and any feedback we can get in problem areas or whatever, we will then revise and update the criteria to try to eliminate those.

Senator HART. Last year you gave somewhat, it seemed to me, shocking figures on the cost of DOD solar projects. Now, on page 10 of your statement you indicated you have awarded a housing project for the solar field at Fort Polk.

Could you give us some comparisons using last year's solar costs with this experience at Fort Polk?

Mr. MARSHALL. Yes; sir. If you will recall, last year I reported per unit cost on solar energy ranging from about \$23,000 for the Shepherd Air Force Base project that we awarded up to around \$89,000 to \$90,000 a unit for some of the projects.

Fort Campbell is an example that we did not award and a range between that. The project at Fort Polk came in at about \$25,000 a unit. So, that gives you an idea of what the differences in the cost have been. We still think this is probably a high cost but we believe the project will give us some learning experience and be a good demonstration for the use of solar fields isolated from the units.

Senator HART. What principal difference was there that permitted a savings of 300 to 400 percent?

Mr. MARSHALL. Well, we think one was larger size of the project, of course; the other, we think, this is a new project, a new housing project, in which the solar field is completely isolated from the housing constructor's participation except for an interconnection at the house units.

In other words, the houses are being constructed under our normal turnkey procedure. We did include in that particular portion of the project a changeover from air-to-air heat pumps to water-to-air heat pumps and put in the piping for the demonstration of the solar hot water energy throughout the project. From that point on the project bid for the solar field was bid as a separate entity and is being constructed by a contractor who has had some experience in solar energy.

Senator HART. As I recall, that has been one of the problems.

Mr. MARSHALL. That has been our problem in the past.

Senator HART. I am glad to hear you say you think the \$25 is still excessive, because I visited a home of one of my constituents who just installed that equipment, I think for about 2 times less than that or 2½ times less than the commercial equipment on the market. So I think we can still do better.

Mr. MARSHALL. We believe so too, Senator.

Senator HART. On implementation of section 804, in last year's act, you apparently think the language of that section precludes you from using life cycle costing. Is that correct or not?

Mr. MARSHALL. Yes sir, it is. Our interpretation of the language at any rate, and our interpretation of what the intent of the language was to be, we believe based on the hearings last year, and the way the language was written, that it was the intent of this committee to stimulate the solar industry by getting as many projects as we could going and that since you took care in defining cost effectiveness on the basis of recoupment of the initial investment cost, the interpretation by us and our legal counsel was that it was not the intent to include

life cycle cost procedures involving operations and maintaining costs, and the discount factors and so forth that are normally used in implementing this legislation.

Senator HART. All I can do is take exception with that interpretation and cite paragraph (c) of that section which says that "For the purpose of the section, a solar energy system shall be considered to be cost effective if the original investment cost differential can be recovered over the expected life of the facility."

Mr. MARSHALL. Well, sir, I will be happy to buy that interpretation.

Senator HART. That is not an interpretation, that is the law.

Mr. MARSHALL. I will be happy to buy that as meaning life cycle cost if you say that is what it is. It will certainly impact on the numbers of projects that will be implemented in the 1979 legislation. It will reduce them by some number.

Senator HART. What number?

Mr. MARSHALL. Well, I can't tell you at this point in time, but I would suspect that in the family housing area that it would probably eliminate every project that now says we will have some solar energy in it. May I say that our implementing instructions pointed out to the military departments that they should not consider O. & M. costs, they should not consider the normal life cycle cost approach, but should only consider the initial investment cost and fuel savings involved over the life of the structure.

As a result of that, first of all, before I give you the result of the impact of that on family housing, the legislation said for other military facilities that the requirement would become effective 90 days after implementation, so, therefore, all design starts December 7, 1978, and later would consider this approach in family housing because you recognize that we were building by the turnkey basis on the most part, that we were in a position to implement the criteria right away for family housing.

Analyses have been done on the 7 family housing Navy projects, I mean Army, Navy projects, and 3 Army projects, and all 10 of these projects now have solar energy proposed to be included with payback periods within the life of the structure.

If we go to the normal life cycle cost procedure on these projects, the payback periods will in all probability exceed the 25-year life of the structure.

Senator HART. You will provide us copies of the guidance in this regard, will you not?

Mr. MARSHALL. Yes sir, I have it right here.

Senator HART. And our report which accompanied the bill says as follows:

The Committee expects to be kept advised of implementing guidelines for this new section as they are developed.

I am not clear as to whether or not that admonition was followed.

Section 610 provides that solar systems will be incorporated if they are cost effective, and solar systems are defined to be cost effective if their cost differential can be amortized over the expected life of the facility.

The committee recognizes that this provision will result in facilities with higher than usual cost. Design costs will probably increase by one to two percent of the construction costs and solar systems will increase the initial investment cost an estimated 10 to 20 percent. The committee feels that this premium is worthwhile in view of the potential national benefit.

Last year, you advised that several military installations are being studied with a view toward optimizing total energy requirements. Could you provide for our record a list of those bases that are undergoing total energy studies and tell us in general what the progress is on that?

Mr. MARSHALL. Yes sir, I will be happy to do that.

[The information follows:]

ENERGY

TOTAL ENERGY (TE) STUDIES

(TE is also know as Co-Generation)

Army.—In September 1974 studies were initiated to determine the feasibility of the use of total energy (TE) for several projects in fiscal year 75 and 76. Several of these studies indicated that TE was feasible however by the time the studies were completed the project was either under construction using a conventional heating and cooling plant or there were not sufficient funds available in the project to award and construct the TE plant. At four installations, Fort Stewart, Fort Leonard Wood, Fort Benning (Sand Hill) and Fort Bragg the studies were expanded to determine the feasibility of a basewide application of TE. The Fort Stewart, Fort Leonard Wood, and Fort Benning studies are complete and the results indicate that a large TE plant is feasible. For Fort Stewart, the study recommends a coal fired 27.5 Megawatt plant to supply all the electrical power requirements and the waste heat recovered would provide the heating and cooling requirements for a discrete part of the installation. The study indicates a LCC saving of 14 percent and an energy saving of 15 percent when compared with the conventional system over a 25-year period. The cost is approximately 40 million dollars (1977 price). The Fort Leonard Wood study recommends a coal fired 65 Megawatt plant to supply all the electrical power requirements and the waste heat recovered would provide the heating and cooling requirements to the core area of the installation. The study indicates a LCC saving of one percent and an energy saving of 15 percent when compared with the conventional system over a 25-year period. The cost is approximately 65 million dollars. The Fort Benning study recommends a coal fired 15 Megawatt plant to supply all the electric power requirements and the waste heat recovered would provide the heating and cooling requirements to the Sand Hill area. The study indicates a LCC saving of 30 percent and an energy saving of 30 percent when compared with the conventional system over a 25-year period. The cost is approximately 20 million dollars.

Basewide energy studies are being conducted at 31 Army installations. The standard scope of work for conduct of a basewide energy study includes conduct of technical and economic feasibility studies of utilizing total energy or selective energy plants (TE/SE). These basewide energy studies can be incrementally funded and conducted. Basewide energy studies at 12 installations presently underway and full funded for a full scope-of-work study includes technical and economic feasibility studies on use of TE/SE plants. The TE/SE study on one of these bases was done separately (Fort Benning), as noted above. Basewide energy studies presently underway and partially funded on a full scope of work basis at an additional 18 installations presently do not include technical and economic studies on use of TE/SE plants. These study contracts will be fully funded as funds become available.

TE/SE studies are underway now on the following bases:

Fort Bragg, N.C., Fort Campbell, Ky., Fort Rucker, Ala., Redstone Arsenal, Ala., Fort Gordon, Ga., Fort Jackson, S.C., Fort Knox, Ky., Fort McClellan, Ala., Fort Hood, Tex., Dugway Proving Grounds, Utah, Fort Lewis, Wash., Presidio of San Francisco, Calif., Fitzsimons AMC, Colo.

TE/SE studies will be inaugurated on the following bases as soon as funds are available:

Fort Monroe, Va., Fort Dix, N.J., Fort Belvoir, Va., Fort Eustis, Va., Carlisle Barracks, Pa., Fort Lee, Va., Fort Ritchie, Md., USMA, New York, Fort Myer, Va., Fort McNair, D.C., Cameron Station, Va., Fort Detrick, Md., Fort Carson, Colo., Fort Riley, Kans., Fort Leavenworth, Kans., WRAMC, D.C.

Navy.—The initial site selected for a TE study was NAS Jacksonville and this effort is now about 90 percent complete.

The following installations are all programmed to be studied in fiscal year 1979 with the first contract to be awarded in February 1979:

NWS, Yorktown, Va., NOS, Indianhead, Md., NADC, Warminster, Pa., NE&TC, Newport, R.I., PWC, San Francisco, area, NAS, Memphis, Tenn.

Air Force.—The Air Force has recently completed a total energy study for Offutt AFB, Nev. The results of the study were favorable to installing a total energy plant at Offutt AFB. Study results are currently being reviewed and used to develop programming documents for future year projects.

Senator HART. Now, to either or both of you, just a couple of questions in the solar area.

It is my understanding that the Department has numerous industrial process heat applications which could readily be met with solar energy. Has DOD surveyed its facilities to determine where solar energy would make sense for industrial process heat and/or total energy system or cogeneration on its bases?

Mr. MARIENTHAL. In a limited number of cases we have looked at the application of solar for our industrial processes but by and large we have not done it to the extent that that question implies. There are just a couple of instances which we have done that. Normally, not only for the solar but for the cogeneration—

Senator HART. I am particularly interested in the provisions in the National Energy Act requiring new and existing Federal buildings to maximize energy efficiency and to use solar and other renewable energy technology, and we have covered that a little bit, but I would like to maintain contact with you on the Department's effort in this regard.

Executive Order 12003 requires that by the mideighties, 1985, new Federal buildings achieve a 45-percent movement in their energy efficiency and 25-percent improvement in existing buildings.

Can you tell us how this order would be integrated with the Federal building provisions of the National Energy Act which require 100-percent life cycle energy efficiency in all Federal buildings by 1990?

Mr. MARSHALL. Sir, we are in the process of designing buildings currently to meet the 45-percent reduction by 1985. We have been with the military departments and they have implemented guidance to their divisions requiring that all new buildings design starts target the 45-percent goal.

Senator HART. We will really flag that for you because I think perhaps people are paying attention to the Executive order and may have missed the provisions of the law, the National Energy Act, which is substantially more stringent, although it does provide an extra 5 years for achievement. So I would encourage you to keep that in mind as well.

Mr. MARSHALL. Yes, sir.

Senator HART. As with Secretary Myers, we have a number of other questions that I think can best be answered for the record. We will provide those to you.

[The questions, with answers supplied, follow:]

ENERGY

Senator HART. Last year, I sponsored an amendment to the National Energy Act which will require all new and existing federal buildings to maximize their energy efficiency and, where justified on the basis of a systematic assessment of

the life-cycle costs of alternative energy systems, to utilize solar and other renewable energy technologies.

Is DOD, which accounts for nearly 90 percent of the energy consumed by the federal government, cooperating with the Department of Energy in implementing this program? For example, has DOD cooperated with DOE in developing the life-cycle cost formula required by this legislation?

This initiative requires that "preliminary energy audits" of all large federal buildings be performed during the current fiscal year to identify and correct the most egregious examples of energy waste in the federal government. What is the status of these preliminary energy audits in DOD?

Executive Order 12003, issued by the President last year, requires that all new federal buildings achieve a 45 percent improvement in their energy efficiency by 1985 over comparable buildings 10 years earlier. Additionally, this executive order requires a 20 percent improvement in the energy efficiency of existing buildings by 1985. How will the Department of Defense integrate this Executive Order with the federal building provisions of the National Energy Act, which require all federal buildings to be 100 percent life-cycle cost effective by 1990?

Mr. MARSHALL. We are cooperating with DOE in implementing this program and a DOD representative has been meeting with DOE personnel working on the development of the life-cycle cost formula.

The Energy Conservation Investment Program (ECIP) which we initiated with the FY 1976 Military Construction Program, required the facilities engineer at each military installation to conduct "preliminary energy audits" in order to develop ECIP projects. Accordingly, all preliminary audits of large buildings and most smaller buildings (above 5000 square feet) have been completed. In addition preliminary audits have been completed for most family housing units. The information relating to these audits usually is kept at the installation level since the information is of primary concern to the facilities engineer. In addition the information on some 380,000 buildings would be much too voluminous to be forwarded to headquarters.

On October 21, 1977, we issued ECIP guidance and a specific format and method for determining the life-cycle cost of candidate ECIP projects. Our existing criteria for evaluating ECIP projects is designed to develop the most cost effective projects first. In calculating life-cycle costs for various candidate ECIP projects, the facilities engineers are already identifying many retrofit efforts which are not cost effective for particular buildings on particular installations. Using these data and information developed by the base wide energy studies now underway, we expect to develop lists, by climate zones, of retrofit projects for each of a number of repetitive type facilities, which are probably cost effective. Similar lists will be developed for retrofit projects which are probably not cost effective on a life-cycle cost basis. For example, if we determine that storm windows are not cost effective on a life-cycle cost basis for BOQs and BEQs at Ft. Stewart, Georgia, it would be reasonable to assume that this feature would also be not cost effective for BOQs and BEQs at Fort Gordon and Fort Benning, Georgia. Of course, special facilities and marginal projects in repetitive facilities will require individual analyses to determine life-cycle cost effectiveness.

Considering the very large inventory of DOD buildings in the United States alone, about 380,000 buildings, we view the requirement of all buildings to be 100 percent life-cycle cost effective by 1990 to be a very difficult effort.

Senator HART. You have provided a copy of your guidance to the Services on the implementation of this provision. I assume the Services, in turn, must have developed implementing instructions for their construction agents. Please provide those implementing instructions for the record.

Mr. MARSHALL. The Department of the Army implemented the DOD guidance on MILCON projects by their memorandum of 14 November 1978 which forwarded to their field agencies a Draft Engineering Technical Letter (ETL) and Engineering Instructions. Family housing guidance was implemented by their memorandum of 15 December 1978.

The Department of Navy implemented the DOD guidance for both family housing and MILCON by their messages of 5 September 1978 and 2 November 1978 to the appropriate field offices.

The Department of Air Force implemented the DOD guidance by their Design Instruction No. 1 dated 27 October 1978.

Copies of this guidance are attached for the record.

Attachment.

DEPARTMENT OF THE ARMY,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D.C., December 15, 1978.

Subject: Fiscal year 1979 Army Family Housing Program—Criteria for Solar Involvement.
See distribution.

Transmitted herewith for implementation are two copies of the Solar Criteria for subject program as developed during the conference held in OCE on 6-7 December 1978. Draft copies of this criteria have been forwarded informally to the Districts responsible for designing the fiscal year 1979 Family Housing projects. RFP's for these projects are to be forwarded to HQDA (DAEN-MPE-H), WASH DC 20314, for review ASAP after incorporation of the solar criteria.

For the Chief of Engineers:

LEE S. GARRETT,
Chief, Engineering Division,
Military Programs.

REQUEST FOR PROPOSAL SOLAR SYSTEM FOR FAMILY HOUSING

SOLAR CRITERIA—PART I: PROJECT REQUIREMENTS FOR FORT STEWART, GA.

1.1

1.2 Scope of work.

1.2.1 Design and construct a complete solar domestic water heating and space heating systems for 132 two-bedroom family housing units. The solar design shall provide not less than 10.07 GJ of domestic hot water for each dwelling unit on an annual basis and not less than 5.61 GJ of space heating requirement for each dwelling unit on an annual basis. The system will be liquid type. Thermosyphon type will not be used nor is a drain-down system permitted.

1.2.1.1 Environmental data:

Degree days	-----	-----	-----
Entering Water Temperature	-----	-----	-----
pH of Water	-----	-----	-----
Design water temperature	-----	-----	-----
Monthly Insolation Data ¹	-----	-----	-----
January	-----	May	September
February	-----	June	October
March	-----	July	November
April	-----	August	December

¹ Obtain from Family Housing Solar Analysis, dated November 1978, p. 10, prepared by U.S. Army Engineer District, Fort Worth.

1.2.2 The solar collectors will be of the commercially available off-the-shelf type. The collectors may be unit mounted or site mounted and the systems may be grouped, central or individual housing units. The collectors, whether unit mounted or site mounted, shall be architecturally compatible with the house and the environment. Note the solar architectural compatibility is part of design effort and proposals will be evaluated accordingly. The solar system will be designed and installed to withstand wind loads specified in Paragraph 1—. Collectors using wood frames will not be permitted.

1.2.3 The thermal energy control storage tank, if provided, will be above grade.

1.2.4 The solar system(s) will be interfaced with the conventional domestic hot water system and space heating system to be provided for each living unit.

1.2.5 The solar systems will be designed in accordance with the applicable portions of the Department of Housing and Urban Development (HUD) Intermediate Minimum Property Standards Supplement for Solar Heating and Domestic Hot Water Systems (1977 Edition), except as modified herein. Conditions listed "generally as unacceptable" in this manual will not be accepted.

1.2.6 The conventional fueled equipment (water heaters are GFE, furnaces are contractor furnished) provided will be sized to supply 100 percent of the domestic hot water requirement and space heating requirement in the event the solar system is inoperative.

1.3 Solar system controls.

1.3.1 Operating control strategy, which includes a differential thermostatic controller, will be provided in narrative or flow diagrammatic form and the solar will be interlocked with the conventional system controls so that the solar will carry the load to the maximum and the conventional to the minimum. This sequence of operation will be shown on the proposal and final design drawings. The purpose of the control system is to automatically maximize the use of solar energy. All automatic valves will be shown.

1.3.2 A narrative of the controller operation and the philosophy involved will be presented in the response to the RFP for evaluation and the narrative will be accompanied by a "flow chart of control strategy" for easy understanding of the narrative.

1.4 Equipment Performance Data will be provided by the proposer for all the equipment to be furnished and installed in the solar system, including stagnation temperature, outgassing temperature, and pressure rating of the solar panels. The collector efficiency data will cover a range of solar intensities and temperature conditions, and the data will have been verified by an independent nationally recognized testing organization in accordance with ARI Standard 910, unless the collectors have been previously certified as conforming to ARI Standard 910. Other data required for solar collectors will be engineering drawings, manufacturer's literature and photographs to aid the Government in evaluating the proposals.

1.5 The proposal will include recommended maintenance procedures and schedules. If the information is not based on experience, this fact will be made known.

1.6 The domestic water heating systems will be designed using non-toxic antifreeze solution in the solar collector loop or recirculation will be provided for freeze protection. If non-potable heat transfer fluid is used, two heat exchangers or two-wall separation between the non-potable solution and the potable water will be provided. Automatic refill of the collector loop fluid system will not be permitted, either for domestic hot water system or for the space heating system.

1.7 Cleaning, Testing, Balancing and Adjusting.

1.7.1 Each solar system in each living unit will be cleaned and readied for testing, balancing and adjusting.

1.7.2 Each solar system will be tested, adjusted and balanced in accordance with Paragraph —. The contractor will submit for approval testing procedures which will verify system performance. The testing will be performed on ten percent of the systems, as selected by the Contracting Officer.

1.8 Operation and Maintenance Manuals: (To be developed by the District, requirement for successful proposer only).

1.8.1 Operation and Maintenance instructions requirement will be referenced or will be written similar to the standard operation and maintenance requirements by the District.

1.8.2 Complete requirements for preventive maintenance will cover antifreeze agent, corrosion inhibitor, vents and relief valves, and leaks and other items critical to the performance of the solar system.

1.9 Design Reviews:

1.9.1 Design submittals of these systems shall specifically address at least the following items:

- a. Prevention of unvented air pockets in lines.
- b. Provision for access to collector panel areas for installation and repairs and maintenance.
- c. Effect of the wind and seismic on mounting or support structures for the collectors.
- d. Location and use of vacuum, pressure, and air vent relief valves.
- e. Balanced flow circuiting.
- f. Protection from galvanic action and corrosion.
- g. Quality, quantity and installation of insulation.
- h. Provision for thermal expansion and thermal shock.
- i. Location of heat exchangers and sensors.
- j. Differential set for pump operation.
- k. Control Strategy.
- l. Refill of fluid loop.
- m. Automatic over-temperature control.
- n. Provision of drains at all low points in the lines and access to the drains.

DEPARTMENT OF THE ARMY,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D.C., November 14, 1978.

Subject: Solar energy design/construction requirements.
See distribution.

1. Public Law 95-356, "Military Construction Authorization Act, 1979" requires that solar energy system(s) be installed on new military facilities to the extent that engineering/economic analysis demonstrate such systems to be cost effective.

2. Inclosed for your interim use on MCA projects that start design on or after 7 December 1978, is a DRAFT Engineering Technical Letter (ETL) implementing the requirements of Public Law 95-356. Supplementary DOD/DA requirements are also incorporated into the DRAFT ETL.

3. The DRAFT ETL will remain in effect until the completed ETL is issued and distributed through normal channels.

For the Chief of Engineers:

LEE S. GARRETT,
Chief, Engineering Division Military Programs.

DISTRIBUTION

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ENGINEER TECHNICAL LETTER 1110-3—ENGINEERING AND DESIGN

EVALUATION OF SOLAR ENERGY

1. *Purpose.*—This letter provides guidance for solar energy application for all MCA projects that start design on or after 7 December 1978.

2. *Applicability.*—This letter applies to all field operating agencies having Army military construction responsibility for CONUS installations (including Hawaii). Application of this letter for overseas/OCONUS installations will only be as specifically directed in Engineering Instructions by project and location.

3. *Background.*—

(a) With the pressure of continuing demand/requirement to reduce nonrenewable fuel consumption, it is necessary to investigate the potential use of solar energy for MCA facilities requiring heating, air conditioning, or domestic hot water. Executive Order 12003, dated 20 July 1977, established energy conservation goals for new and existing Federal facilities. Title III of Public Law 94-285, the "Energy Conservation Standards for New Buildings Act of 1976," redirects Federal policies and practices to assure reasonable energy conservation features will be incorporated in Federally financed new buildings.

(b) The Military Construction Authorization Act, 1979, Public Law 95-356 in Section 804 requires that 25 percentum, based on the estimated dollar value of the construction cost, of all new facilities except family housing (family housing requirement is 100 percentum) that are placed under design shall include solar energy systems to the extent that engineering analyses demonstrates it is cost effective. The law makes this requirement effective ninety days after enactment of

the act. The law was enacted 8 September 1978; therefore, all design starts on or after 7 December 1978 are subject to these requirements. DOD requires a summary of the engineering analysis be furnished prior to initiating final design. Essentially the Act requires that an engineering/economic analysis must be made as part of the design process for all military projects. Those projects for which solar energy applications are determined to be cost effective are to be designed as solar energy projects. For the purpose of the engineering/economic analysis, a solar energy system shall be considered cost effective if the original investment cost differential can be recovered over the "expected" life of the facility. Further the Act stated that only the initial cost of the systems is to be considered in determining cost effectiveness; hence, if the 25 year energy (operating costs) savings exclusive of any maintenance and replacement costs, exceed the original investment cost differential, the original cost differential is to be considered recovered and the solar energy application becomes cost effective.

(c) The need to conserve non-renewable/fossil fuel supplies is evident. The need to use/demonstrate solar energy systems is complex. Primarily solar energy systems must be used to conserve fossil fuel supplies; but it is also an important goal to advance the state-of-the-art. Industry must be assisted in establishing production of standardized solar components and subsystems as catalog products with warranted outputs and efficiencies. However, only a part of the solar energy system components needs advance state-of-the-art development. Solar energy systems include much more than solar collectors, piping, storage and heat exchangers. Military facilities designs should take advantage of passive solar design techniques (building orientation, amount and location of windows, et cetera) and designers should consider future installation of solar systems when they become more cost effective by carefully designing new facilities (roof slopes, HVAC systems, et cetera) so that they lend themselves to solar retrofit.

4. Guidance.—

(a) The inclosed Engineering Instructions requires the preparation of engineering/economic analysis for solar energy application for Army buildings. These engineering/economic analyses shall be prepared as part of and along with the concept design for the project. As a result of the engineering/economic analysis the concept design and the project Code "B" ENG Form 3086 cost estimate shall be modified.

(b) The extent of the required engineering/economic analyses for each project will require an exercise of judgement as the potential of solar energy utilization. Hence each analysis must be carefully managed to assure that the level of investment in the analysis itself is commensurate with the benefits anticipated to assure that unnecessary evaluation efforts will not be made on obviously ineligible projects.

(c) The final design of solar projects approved by HQDA (DAEN-MPE) via the final design authorization shall implement/finalize the recommendations of the engineering/economic analysis unless specifically directed otherwise.

5. *Action to be taken.*—The application of solar energy to Army facilities will be in accordance with the inclosed Engineering Instructions. A statement regarding the technical and economic feasibility of this developing technology as it applies to each project will be reported as an additive at the time the Budget Control Data (ENG Form 3086) are submitted. Each construction project incorporating a solar energy system shall clearly show the type of functional purpose of the system (domestic hot water; space heating; domestic hot water and space heating; and domestic hot water, space heating and space cooling) and its cost including installation. If more than one system is involved in a single project, the type and cost of each shall be displayed separately. This guidance will be applied to all project designs.

6. *Implementation.*—This letter will have routine application as defined in paragraph 6c, ER 1110-345-100.

For the Chief of Engineers:

LEE S. GARRETT,

Chief, Engineering Division, Military Programs.

ENGINEERING INSTRUCTIONS FOR SOLAR ENERGY APPLICATION FOR ARMY BUILDINGS TO PROVIDE DOMESTIC WATER HEATING, SPACE HEATING AND SPACE COOLING

1. General engineering/economic analysis guidance:

a. These engineering instructions for solar energy application require the preparation of documentation in the form of an engineering/economic analysis to

determine the extent that solar energy systems are cost effective for each of the following systems:

- (1) Domestic water heating.
- (2) Space heating.
- (3) Domestic water heating and space heating.
- (4) Domestic water heating, space heating and space cooling.

b. It is important that the preparation of the engineering/economic analysis does not delay the design process, and that the analysis be completed early enough to influence budget data submission for final DD Form 1391 updating. Candidate systems will be evaluated on a life cycle cost basis using the life cycle cost procedures contained in the HQDA (DAEN-MCE-U) document "Engineering Instructions for Preparation of Feasibility Studies for Total Energy, Selective Energy, and Heat Pump Systems," dated 1 July 1977, except as modified by paragraph 1d hereinafter and by use of the energy cost escalation rates as shown on the table below:

ENCLOSURE 1

[In percent]

Energy source	Annual escalation rates (apply to today's initial cost to obtain program year cost)		Differential escalation rates (use for life cycle cost studies)
	Fiscal year 1979-80	Fiscal year 1981-83	
Fuel oil.....	16	14	3
Natural gas and LPG.....	15	14	8
Electricity.....	16	13	7

The solar system(s) recommended for final design will be based on the results of the engineering/economic analysis of various suitable solar energy utilization systems. Reasons for rejecting other systems from further consideration will be noted in the analysis. This will serve to document that suitable engineering/economic analyses have been made, and to indicate clearly the methods followed and the basis for the decisions made regarding the solar systems. A summary of the engineering/economic analysis will be prepared and forwarded to HQDA (DAEN-MPE-E), WASH DC 20314. The summary documents for each of the systems considered will include a brief description of the systems, a code "B" ENG Form cost estimate, the discounted payback period, the life cycle cost and a brief narrative pro/con discussion leading to and including the recommended system, if any. Final design will not be started until approved by HQDA (DAEN-MPE).

c. These engineering instructions are in addition to instructions issued for a particular facility for the development of conventional heating, ventilating, air conditioning and plumbing systems in accordance with TM 5-810-1, TM 5-810-5 and DOD 4270.1-M. The applicable portions of U.S. Department of Housing and Urban Development (HUD) Intermediate Minimum Property Standards Supplement for Solar Heating and Domestic Hot Water Systems (1977 Edition) shall be used as a guide in making the required engineering analysis. Site specific solar radiation and other weather data of DOD's authorized weather service (see page IV of TM 5-785, Engineering Weather Data, 1 Jul 78) shall be used in making the required engineering/economic analysis. Since solar energy is intermittent in its availability, Army facilities will be provided with conventional systems sized to carry the entire building energy requirements. It is not considered prudent at this time to design the conventional system to supply only the portion of the energy that the solar cannot deliver on an annual basis. The most economical alternative for the conventional system(s) should be selected in accordance with normal procedures as set forth in AR 11-28 as supplemented by ETL-1110-3-296.

d. The recommended solar energy system must be cost effective. For permanent type facilities in the MCA program an "economic" life of 25 years is ordinarily assumed for investment (life cycle cost) type calculations. Accordingly for solar energy economic calculations, the life expectancy or "expected" life of facilities used in determining cost effectiveness shall be 25 years. The following procedures should be followed to determine the cost effectiveness of the solar energy system(s) alternatives:

(1) The most economical conventional system(s) that are compatible to solar energy application(s) shall be selected in accordance with normal procedures considering life cycle costs.

(2) Solar energy system(s) alternatives that are compatible to the most economical conventional system(s) shall then be identified and evaluated using the 25 year "expected" life of the facility. The recommended solar energy/conventional system(s) will be the one(s) with the lowest life cycle cost if the original investment cost differential is recovered. If the 25 year energy (operating cost) savings, exclusive of any maintenance and replacement costs exceed the original investment cost differential, the original cost differential is to be considered recovered and the solar energy application becomes cost effective.

(3) Congress has expressed (in Senate Report No. 95-847, "Military Construction Authorization FY 1979") the concern that ". . . there appears to be a reluctance by the DOD to incorporate solar systems on a large scale because they are not "cost effective." In order to reconcile this concern additional calculations shall be made to determine the point in time, the discounted payback period, when the original solar energy investment cost differential is recovered. This point in time shall be highlighted in the engineering/economic analysis and in the project funding submission. Until such time as the HQDA (DAEN-MPE-E) document "Engineering Instructions for Preparation of Feasibility Studies for Total Energy, Selective Energy and Heat Pump Systems" is revised to include methodology to calculate the discounted payback period, the use of the technique described in the Energy Research and Development Administration's document ERDA-76/130 "Life Cycle Costing Emphasizing Energy Conservation" is recommended. However, when performing the present value type calculations as required by DA/DOD criteria (based on OMB Circular No. A-94) it is not to any significant mathematical advantage to consider payback beyond 40 years. The most promising solar energy/conventional system(s) will be the one(s) with the shortest payback period for those applications where payback is determined to be in excess of 25 years but not more than 40 years.

(4) If the original investment cost is not recovered using an "expected" life of 25 years or less, then the solar energy application(s) under consideration shall be considered as not to be cost effective. In these cases, final design (when authorized) will proceed using conventional system(s) exclusively.

2. Solar engineering guidance:

a. Special attention will be directed to the architect-engineer firm's capabilities and expertise in the field of solar energy application. If such expertise does not exist, outside consultants will be retained by the architect-engineer firms.

b. Project specifications will be written to permit all types and configurations of the state-of-the-art solar collectors that can qualify for the temperature of the transfer fluid required.

c. Adequate freeze protection during winter operation will be provided by design. Adequate over-temperature protection will be provided by design to preclude damage to solar collectors resulting from no load or stagnation temperature.

d. The circulation systems, in addition to operational controls, will be provided with monitoring devices such as recording flow meters, pressure gages and thermometers, watt-hour meters, and totalizing pyranometer to permit visual monitoring of system performance. Based on the experience of the solar consultants and as approved by the District other useful monitoring devices may be added.

e. The solar systems will be designed for proper interface with the conventional systems and the solar/conventional systems will be provided with operational controls and instrumentation for automatic changeover from one to the other.

f. The solar/conventional system will be designed to use solar energy to the maximum extent with the supplementing conventional system used to the minimum extent. The controls for the solar/conventional system will be the most simple appropriate to the type of functional purpose of the system. Thus the solar/conventional when constructed as designed, will permit the construction contractor to develop and then test system operating and maintenance procedures include and/or considered the following items:

(1) Check that control philosophy matches the desired modes of operation.

(2) Verify that collector loop controls recognize solar input, collector temperature and storage temperature.

(3) Verify that controls allow the collector loop and the utilization loop to operate independently.

(4) Check that control sequences are reversible and will always revert to the most economical mode.

(5) Check that controls are as simple as possible within the system requirements. Complex controls increase the frequency and possibility of breakdowns.

(6) Check that all controls "fail safe."

g. The project plans and specifications will clearly define in detail, how the solar system is to operate, including control logic/philosophy, all modes of operation

and what quantities of energy savings it is designed to produce. The construction contract will be required to develop detailed operation and maintenance procedures for the solar/conventional system based on the plans and specifications in conjunction with data on the installed equipment, controls, etc. The design A/E contract will require that the construction contractor's detailed operation and maintenance procedures be reviewed to assure that the intent of plans and specifications are met. After approval by the Contracting Officer, the final operating and maintenance procedures will be submitted by the contractor to Contracting Officer, compiled as an Operating and Maintenance Manual, not later than 30 days after beneficial occupancy.

h. The design and construction contracts will contain requirements for post-construction data collection and evaluation of the performance of the solar/conventional system(s). The solar/conventional system(s) shall be monitored for a period of time not to exceed one calendar month in order to evaluate the solar system. Monitoring shall include visual observations of the components in the system under each mode of operation, recording of data from devices specified above, and tests as necessary to evaluate the performance of the solar/conventional system. A written report will be prepared detailing the actions taken and the results of the evaluation. The District will determine who will do the monitoring, (1) the design A/E firm or (2) the construction contractor. Five copies of the written report shall be furnished to the Contracting Officer within 60 days after beneficial occupancy. The report will evaluate the adequacy of the system and operating procedures under actual operating conditions and shall include, if necessary, recommendations to improve system operation and/or efficiency.

3. Solar project bid document guidance:

a. When preparing the bidding documents for those facilities where solar energy system(s) have been determined by engineering/economic analysis to be cost effective the following bid schedule will be developed.

(1) BASE BID—The facility with complete conventional domestic hot water, heating and/or cooling system(s) designed to accept the solar system(s) described in the additive bid package at a later date with a minimum impact on the then existing structure including existing system(s). This means for example, such item as roof mounting pads, piping stubouts, pipe chases and equipment room space for electrical panels, chillers, etc., are to be included in this original construction package.

(2) ADDITIVE BID—The facility with complete conventional domestic hot water, heating and/or cooling system(s) as described in the above base bid with the solar system(s) determined by engineering/economic analysis to be cost effective. Award of this additive item will be subject to the reasonableness/acceptability of the bid and to the availability of funds.

4. Solar system design guidance:

a. Domestic water heating:

(1) The solar system for domestic water heating will be designed to provide a minimum of 35 percentum of the domestic water requirement on an annual basis and in addition, if a larger requirement, to be capable of heating the domestic cold water a minimum of 30 degrees F above winter supply temperature.

(2) The domestic water heating system will be designed preferably using non-toxic antifreeze solution in the solar collector in geographical areas where there is a possibility of freezing. If toxic heat transfer fluid is used, two heat exchangers or two wall-separation between the toxic solution and the potable water shall be provided.

(3) Provisions will be made for automatic shutoff of the solar collector pump when available solar energy is inadequate to increase the water temperature above that of the incoming supply water.

(4) Thermal energy storage will be provided and sized to meet the design load of not more than one day. However, this requirement may be modified to suit the climatic conditions and/or the economic trade-offs between storage capacity and collector area. The heated water will be piped to the inlet of the conventional water heater/storage tank.

(5) Solar collectors will be off-the-shelf items suitable for water heating.

b. Space heating.

(1) The space heating system will be designed to provide, as a goal, at least 25 per centum of the space heating requirement, on an annual basis, using off-the-shelf solar collectors. Every effort should be made to raise the 25 percentum goal based on engineering/economic analysis.

(2) Thermal energy storage will be provided with capacity sized for not more than one day requirement. However, this requirement may be modified to suit

climatic conditions and/or the economic trade-off between storage capacity and collector area.

c. Domestic water heating and space heating:

(1) The solar design will be a combined domestic water heating and space heating system.

(2) The domestic water heating system will be designed in accordance with the guidance established in paragraph 4a above.

(3) The space heating system will be designed in accordance with the guidelines established in paragraph 4b above.

(4) Thermal energy storage will be provided with capacity sized for not more than one day requirement for space heating and domestic water heating. However, this requirement may be modified to suit climatic conditions and/or the economic trade-off between storage capacity and collector area.

d. Domestic Water Heating, Space Heating and Space Cooling:

(1) Under this category, the solar design may be a combined domestic water heating, space heating and space cooling system, or the domestic water heating can be independent, not combined with space heating or cooling.

(2) The design guidelines for domestic water heating and space heating in paragraph 4a and 4b will be followed, as applicable.

(3) Because of today's state of technology solar cooling, systems should not be considered for facilities with a total air conditioning load of less than 40 tons unless prior approval is obtained from the Deputy Assistant Secretary of Defense (Installations and Housing) via normal channels.

(4) Space cooling by solar will be accomplished by absorption water chillers. The solar system design will be based on providing 240 degrees F water from the solar collectors. The project specification shall allow absorption chillers that are capable of operation on water below 240 degrees F without crystallization. A minimum temperature will not be established in the specification or in the drawing.

(5) Thermal energy storage will be provided with capacities sized for not more than one day energy requirement.

5. Architectural guidance:

a. A qualified consultant will be selected to determine whether site mounted or building mounted systems shall be designed to be architecturally compatible with the total environment.

b. Solar panels should be ground mounted wherever possible in order to minimize damage to roof systems caused by roof penetrations and maintenance activities:

(1) When ground mounted, the collectors will be placed upon structural steel supporting frames. The structural steel frames will be elevated so that the deck level supporting the collector panels will be above the surrounding ground at a height to provide adequate headroom to perform maintenance and to permit control of vegetation beneath the collector panels. Adequate provisions will be made for protection against vandalism. The steel supporting frames will include adequate steel deck grating walkways for maintenance and inspection purposes.

(2) If the solar collectors must be located on the roof of a building, frequent access to the roof will be required for maintenance and observation. This access will be provided for convenient use but must be controlled to discourage unauthorized use. The roofing membrane will be adequately protected from damage by foot and other traffics associated with installations. Permanent protective walkway and servicing strips will be provided from the roof access point to the panel installations as appropriate. Strips will be a minimum of 36 inches wide.

4. Structural guidance:

a. Solar panels and associated system elements on the exterior of the building will be designed to support the dead and live loads, and anchored so as to resist positive and negative wind pressures, uplift and turbulence forces derived from shape or configuration and positions of the panels based on the design wind speed, in accordance with the requirements in ETL 1110-3-257. The adequacy of the structural framing systems and the solar panel assembly system will be checked for the dead and live loads and the combination loads of wind, dead and live loads.

b. In evaluating the capability of existing roof slab and roof framing system or structural framing elements to carry additional dead and live loads caused by the solar system components, the strengthening of structural framing as appropriate will be provided where necessary to carry the added loads down to the foundation. Roof penetrations shall be kept to the practicable minimum.

SOLAR ENERGY GUIDELINES FOR MCON/MCNR PROJECTS FOR FISCAL YEAR 1981

1. The Military Construction Authorization Act of FY 1979 directs increased emphasis on use of solar energy systems in military construction and requires

that 25 percent of the estimated value of new construction facilities (except family housing) placed under design shall include solar energy systems where determined to be cost effective.

2. For family housing the Authorization Act requires that all family housing (commencing with FY 1979 program) shall include solar energy systems to the extent that engineering analyses demonstrate its cost effectiveness.

3. Accordingly, all new building facility projects in the FY 1981 MCON/MCNR program shall be examined for solar energy applications for domestic hot water space heating, and/or cooling. An engineering analysis of each project shall be conducted to determine economic solar energy feasibility. Where solar systems are determined to be cost effective by economic analysis, the solar system shall be designed as supplementary systems and will be included as an additive bid item. A solar energy system shall be considered to be cost effective if the original investment cost differential can be recovered over the expected life of the facility.

4. Design of buildings is expected to take advantage of passive solar design techniques and, in addition, include consideration of future installation of active solar systems when they become more cost effective by carefully designing the new facilities so that they lend themselves to solar retrofit. In view of the impact of solar applications of building design, the selection of an A/E firm for a project design shall consider as a factor of selection the A/E firm's demonstrated experience in the design of solar energy systems.

5. Each project in the FY 81 MCON program shall include documentation relative to the results of a solar analysis. Detailed solar evaluation data shall be included in each preliminary engineering design to support design considerations incorporated and decisions regarding the selection or non-selection of solar systems.

6. Additional guidance for the solar energy program for MCON/MCNR and family housing will follow.

SOLAR ENERGY GUIDELINES FOR MILCON PROGRAMS

A. COMNAVFAECOM Alexandria Virginia MSG 051930Z September 1978.

B. HUD Intermediate MPS for solar heating and DHW systems (1977 edition).

1. Ref A forwarded policy and impact of FY 1979 MCON Auth Act with respect to solar energy applications for the FY 1981 MILCON program.

2. The above policy and emphasis to incorporate solar systems has equal application to FY 1980 projects recently authorized for design and also for earlier FY 1980 projects wherein the project design currently underway can be modified to include solar. Congress has advised that progress in the implementation of use of solar systems will be closely scrutinized during the FY 1980 MCON hearings. Accordingly, all FY 1980 projects in which solar systems have not been incorporated shall be reevaluated IAW revised solar guidance (para 3) and clearly documented in witness data or ADMSG with reasons for rejection. For projects in which solar systems are proposed in FY 1980 program, request ADMSG scope and cost if not previously identified as separate line item on DD Form 1391.

3. OSD solar energy guidance for the MILCON program is as follows. This guidance applicable to both FY 1980 and 1981 programs:

a. Solar system shall be considered cost effective if initial investment cost of solar (exclusive of any maint and replacement cost) can be recovered with energy savings over the life of facility (25 years).

b. Fuel escalation rates shall be as follows: (The 10 percent discount factor shall not be applied)

ANNUAL ENERGY ESCAL RATES

[In percent]

	Fiscal year 1979-80	Fiscal year 1981-83	Fiscal year 1984 and beyond
Fuel and oil.....	16	14	8
NG and LPG.....	15	14	8
Elect.....	16	13	7

c. Solar applications shall consider options for (1) space heating, (2) domestic hot water, (3) both space heating and domestic hot water, and (4) solar cooling systems for A/C Load over 40 tons.

d. The minimum annual contribution to be achieved from solar should be 25 percent for space heating and 35 percent for domestic hot water. Design of solar systems should be optimized.

e. Solar systems shall be designed as additive bid items. When the addn of a solar system results in project cost in excess of auth. NavFac approval is required for award of solar bid item.

f. For bachelor housing the cost of solar system, where incorporated within building 5 foot line, is chargeable to five foot line cost. However, waiver of stat limits, wherever reqd, is expected. The cost of solar systems are not reflected in bachelor housing stat limits. Accordingly, solar costs shall be identified as separate item.

g. Guidance for solar system analyses is included in reference B. Site specific solar radiation and other weather data of Navy's authorized weather service shall be used in the engineering analyses.

4. To assist in replying to Congressional inquiries during FY 1980 MCON/MCNR program hearings, and to provide req'd solar reports to OSD for FY 1981 projects, the following summary info is required for all FY 1980/1981 projects in which solar systems are being incorporated. Info shall be forwarded to NavFac (Code 052) NLT 31 Dec 78 for 1980 projects, and prior to NTP for final design for FY 1981 projects:

A. Project Location/P-NO/Title.

B. Type solar system (DHW/Space HTG/Cooling).

C. Type and area of collectors.

D. Solar system cost.

E. Average annual energy savings (MBTU's and cost).

F. Percent energy contribution from solar system.

G. Payback (in years) of solar system cost.

5. For FY 1979 family housing projects, NAVFACENGCOM is currently conducting prelim solar studies and analyses. Based upon results of these studies, approval of OSD will be solicited for appropriate incorporation of solar hot water and heating systems. Upon receipt of OSD approval EFDIS will be advised of solar systems to be included in each family housing project.

DESIGN INSTRUCTION NO. 1, FISCAL YEAR 1981 MILITARY CONSTRUCTION PROGRAM

1. This is the first of a series of numbered design instructions for the FY 81 Military Construction Program. It provides general guidance for design and contract award of FY 81 MCP projects to be assigned to the Corps of Engineers, Naval Facilities Engineering Command and the Air Force. Subsequent directives will authorize design of specific projects and will identify the responsible Air Force Regional Civil Engineer and the design and construction agent. These follow-on instructions will also provide the scope and programmed amount (PA) for each project. Specific design consideration to be emphasized in development of the FY 81 projects are identified in the attachment to this letter.

2. We must assure that Air Force projects receive appropriate attention and scheduling by our design agents and that each project is processed and designed in the most efficient and timely manner possible. Air Force impediments to timely design and contract award must be totally eliminated. Complete and accurate criteria must be available on a timely basis to assure early initiation of the design process. Timeliness and quality in the communication of Air Force requirements to the designer are the keys to effective and efficient design. For those projects being designed by the Corps of Engineers and NAVFAC, our design reviews should concentrate on the *functional aspects* of the design. The time to make a thorough functional review is at the early preliminary stage. From the Air Force (client) standpoint, this review is the most important, since any subsequent functional/criteria changes will most likely result in design completion slippage and added cost. Major command and base civil engineers should personally assure a meaningful review at this stage to minimize design changes after the preliminary review. It is also important that the using activities be fully briefed on their responsibilities in the design process. The user requirements should have been clearly defined in the project book prior to project submittal and should be clarified, within the approved project scope, not later than the predesign conference phase.

3. The following design management targets have been established. Target costs are intended to represent average program expenditures; however, individual project expenditures will require careful scrutiny.

a. The anticipated contract costs target is established as a maximum of 90 percent of the PA. The costs associated with contingency reserve, surveillance, inspection and overhead incurred during the construction phase must be considered in establishing the individual project target.

b. The total planning and design cost target is established as seven percent of the PA. This includes A-E contract costs, in-house design cost, design agency overhead costs, and all investigative efforts relating to design. This target applies to the program average. Each AFRCE and major command assigned AFRCE responsibility will develop procedures to track design costs on a project and program-wide basis. Periodic reports of adherence with this goal will be required. Release of projects for early design will severely strain the P313 budget, requiring special attention to design costs.

4. Design of projects in the FY 81 MCP should be scheduled to insure 25 percent design completion of the dollar volume of construction by 1 December 1979, 50 percent by 1 February 1980, 75 percent by 1 May 1980, 90 percent by 1 August 1980, and 100 percent by 1 January 1981. This effort should assure us of 25 percent construction contract awards by 1 December 1981, 50 percent by 1 February 1981, 75 percent by 1 March 1981, 90 percent by 1 April 1981, and 100 percent by 1 June 1981. These dates and associated percentages constitute our management (MBO) goals for the FY 81 MCP.

5. It is the desire of Congress to have project designs substantially underway prior to requests for authorization and appropriation. To meet this requirement, all FY 81 MCP projects must be at least 35 percent designed when the program is submitted to Congress in January 1980. OSD intends to disapprove projects solely upon the status of design. The Congressional interest in actual design cost estimates mandates that those having AFRCE responsibility carefully review CWEs especially those deviating substantially (plus or minus 10 percent) from PAs. Reporting of revised CWEs must be timely and reflect the AFRCE's professional opinion of the expected costs, rather than an automatic submittal of the design agent's figures. Every effort must be made to keep project information current monthly in the RCS: HAF-PRE (AR) 7124 Report (AF Form 1959) and to keep AF/LEEEC informed of substantial 35 percent design cost deviations.

6. We plan to issue the design authority on FY 81 projects over \$4 million early in January 1979 and issue authority for the majority of the remaining line items in early April 1979. This early start will allow us to validate cost estimates and defend project costs estimates during Congressional hearings. To this end, special attention will be given to insuring that the Early Preliminary Design cost estimate accurately reflects the expected cost of the project projected to the anticipated bid opening (October 1980). If available prior to submittal of the FY 81 MCP to OSD, these costs will be used in revising programmed amounts. Our goal of quality design and construction accomplished in a timely manner, can be achieved only through mutual support and cooperation.

For the Chief of Staff:

HARRY P. RIETMAN,
Associate Director,
Directorate of Engineering and Services.

DESIGN CONSIDERATIONS

1. *Criteria.* Projects will be designed in accordance with the Project Book (PB), DD Form 1391, and OSD/AF criteria. Specific review comments made by this headquarters will be reflected in the design. Concurrence of the major command will be obtained if there are major functional deviations from the basic design considerations provided in the PB unless the deviations are required to meet the mandatory provisions of the Congressional DD Form 1391 or OSD/AF criteria. The major command will be notified of such deviations. Non-availability of criteria has been a source of difficulty in previous years in meeting design targets. To insure that all levels are aware of this impediment to timely design completion, the AFRCE will notify the major command and AF/LEEE when lack of criteria precludes further processing.

2. *Design development.* Determination of the need for and scheduling reviews is an AFRCE responsibility. Design reviews and conferences will be held to the absolute minimum required to ascertain functional adequacy, special technical requirements and adherence with criteria.

a. Review procedures:

(1) Generally, designs will be reviewed at the early preliminary stage and at 90 percent completion (unchecked finals). Complex or difficult designs normally require additional review at 60 percent completion. The AFRCE determines the need for 60 percent reviews.

(2) Attachment 3 to AFR 89-1 outlines the preparation and content of the early preliminary design submission. The primary review will be made by the

major command and base at this stage. These reviews should be conducted with a basic view toward increasing functional suitability, improving safety and fire protection, and providing greater economy. Emphasis must be placed on this early functional review to minimize design breakage. It is incumbent upon command and base civil engineering to insure that the using activity recognizes fully the vital need to have its desires known during PB preparation, pre-design conferences and at the early preliminary design stage. Only in rare instances, with extenuating circumstances, should new requirements be identified or accepted, after the early preliminary design review.

(3) AFRCEs will provide copies of the unchecked final design including CWE to major commands and bases for information and review, as appropriate. The purpose of this review is to validate functional requirements. All design comments must be included in the Air Force 95 percent design review since design changes will not be accepted subsequently. When the established construction costs exceed funds available, the command and base will assist in identifying deductive items to reduce the cost while still providing a complete and useable facility that satisfies mission requirements.

b. Review times:

The following review times (ref AFR 89-1 Chapter 4) will be used for planning purposes and will be adhered to by the major command:

Early preliminary (30 percent) and regular preliminary (60 percent) design review times: Calendar days, composed of:	Days
Mail time.....	5
Review ¹	17
Mail time ¹	3
AFRCE consolidation.....	5
Total.....	30

Concepts (20 percent), where used, and unchecked finals (90 percent) design review times: Calendar days, composed of:	Days
Mail time.....	5
Review.....	9
Telephone coordination.....	1
Total.....	15

¹ Use telephone to coordinate review comments between major commands and AFRCE when possible.

All review comments must be sent to the AFRCE. *None will be sent to the design agency by the base or major command either directly or by information copies.* The AFRCE will consolidate and transmit all approved review comments to the agent.

3. *Architect-engineer services.* The Armed Services Procurement Regulations require that the need for architect-engineer services be published in the Commerce Business Daily for projects in the United States, its possessions and Puerto Rico when the expected fee will exceed \$10,000. Design agents should be requested to expedite this notification to reduce overall administrative processing time. Architect-Engineer contracts will provide optional phases as directed by the AFRCE. Contracts with options will normally be used since it permits the government to halt a design that falls out of the program and also avoids tying up large amounts of A-E funds in an obligated status before they are really needed. Options are identified as follows:

Option 1—Early preliminary design (30% complete).

Option 2—Preliminary working drawings (60% complete) and specifications.

Option 3—Final design (90% complete) and specifications.

Option 4—As-built drawings.

Option 5—Comprehensive Interior Design Services. (Requirement for this option will be designated in the appropriate design instruction or may be requested in accordance with para 9.)

4. *Defense Contract Audit Agency (DCAA) Audits.* To reduce overall delay in awarding A-E contracts, DCAA audits should be expedited. AFRCEs should work closely with the agents and the regional DCAA offices to insure that inordinate delays to contract award are not caused by the audit. A-E negotiations may be initiated prior to receipt of DCAA comments (oral or written); however, these negotiations should not be concluded until DCAA comments are received, discussed with the A-E and incorporated as appropriate into his final proposal.

5. *Cost saving techniques:*

a. Design. Use of site adaptations, and definitive drawings will assist in reducing design costs. Our goal is to provide quality designs within programmed dollars. Professional attention must be given to aesthetics, both interior and exterior, architectural compatibility, building orientation, functional efficiency, and material and system selections. Facility designers must meet functional requirements and achieve an optimum balance among aesthetic consideration, operation and maintenance costs, energy conservation measures, and material and systems durability. Designs should incorporate building systems or other pre-engineered methods to the maximum extent feasible, with clear guidance given designers concerning the need to produce a workable design within the construction funds available. Early notification by the design agent/A-E of cost problems and design options is mandatory to enable management decisions to be made and minimize design breakage.

b. Bid Packaging. Simple bidding packages will result in more and better bids. Numerous schedules tend to discourage proposals from smaller contractors. Deductives will not be used. Additives will be used discriminately and limited in number. Normally no more than four additives should be specified. Bidding additives should be selected such that they can be clearly delineated in contract drawings to minimize confusion by the contractor in bid preparation. Care must be taken to insure that complete and fully useable facilities result and that the requirements presented to the Congress in defense of the projects are satisfied with each contract award. Statutory requirements concerning notification to Congress of scope reductions made will be explicitly adhered with. To this end, all additive items will be submitted to AF/LEEE; however, design will continue and additives will be retained unless advised otherwise. Early identification of these items by the designer/agent will preclude contract award delays. Bid packages for all FY 81 MCP vertical construction will include identification of costs to the 5-foot line.

6. Siting. Changes in proposed siting are of special concern for reasons of cost, design/construction schedules, and facility useability; therefore, all requests for resiting after a design instruction has been issued will require AF/LEEE approval. Each request must be accompanied by the following:

a. Revised PB and DD Form 1391.

b. Site plan showing both original and new siting proposals.

c. Justification for resiting on the basis of improved economics, safety, and/or function.

d. Revised estimates of design cost and time.

Major commands are responsible for submitting and justifying requests for resiting.

7. *Special interest items.* Projects identified by HQ USAF as "Special Interest" will be designated in the appropriate design instruction. These projects will require submittal of concept (20 percent), regular preliminary (60 percent) and unchecked final (90 percent) design documents to HQ USAF/LEEE.

8. *Economic studies.* All architectural and engineering design will be based on comparative cost analysis. These studies should include, but not be limited to, those design features of the facility which contribute most to the construction cost and environmental impact. AFR 178-1, Economic Analysis and Program Evaluation for Resource Management, contains additional guidance, specifically in Attachment 2 which identifies values to be used in comparing costs. For projects having an estimated cost over \$300,000, the project file maintained by the design agent shall provide suitable documentation to verify that the necessary economic studies have been made. HQ USAF/LEEE will indicate in the design directive when to use the life cycle design technique for a particular project.

9. *Architectural treatment.* Special emphasis is to be placed on the quality of the architectural design. A prime requirement of the design shall be the attractiveness of both the interior and exterior. Special attention must be given to the selection of colors and finishes to insure that Air Force personnel live and work in an aesthetically pleasing environment. Consideration must be given to providing interior design services in accordance with HQ USAF/PRE letter 20 May 1976, Interior Design Policy. For appropriated funded projects, comprehensive interior design services will not be authorized without written approval of HQ USAF/LEEE. The request for approval must specify the amount of funds the facility OPR has available for purchase of furnishings. New facilities will be designed to complement and blend with the architectural character of existing facilities that are to remain. The architectural style of existing permanent facilities that reflect the character and culture of the region should be preserved and incorporated into new facilities.

10. *Fire protection systems.* Fire protection systems and features required by AFM 88-15 will not be deleted from the project design, unless specifically authorized. When engineering judgment, cost, or other factors indicate that deletion or identification as a bid additive is warranted, prior approval of HQ USAF/LEEE is required.

11. *Physically handicapped provisions.* Provisions for the physically handicapped will be included in all facilities unless the facility is for the exclusive use of able-bodied military personnel. Facilities are to be designed in accordance with all provisions of ANSI A117.1 and AFM 88-15, para 1-23.

12. *Automated data processing (ADP) projects.* AFRCEs and Commands should insure that all ADP projects are reviewed by the AF Data Automation Agency/DE at Gunter AFB, Alabama. AFDA/DE is the executive advisor to the AFRCEs for all Phase IV MCP construction projects. As executive advisor, AFDA/DE is responsible for functional adequacy of Phase IV project plans and specifications. AFRCEs should forward to AFDA/DE, for review and comment, Phase IV design documents specified in AF/PREE letter, 9 Jan 1978, FY 80 MCP Technical Guidance No. 1. AFDA/DE should also be advised of significant Phase IV facility project design conferences.

13. *Clubs and open mess facilities.* The Air Force Military Personnel Center (MPC) has a consultant with experience in open mess facility design to assist in the design of these projects at the PB and/or preliminary review stages. His services can be used during PB preparation as well as in pre-design and early preliminary review conferences. The AFRCE will obtain from the design agent and forward to the major command and MPC a site plan and floor plan for approval as soon as possible after design commences but prior to the completion of early preliminary design. Copies of these coordinated, approved plans will be forwarded to AF/LEEE by the AFRCE. Design should continue during staffing of the review/approval of the floor plan.

14. *Bachelor housing.* Basic Air Force criteria remain to provide as a minimum, semi-private baths for E-2/E-4 personnel (one bath per two rooms). (Ref AFM 88-15 IMC 78-3 and AFM 86-2 IMC 78-1.) Since the unit costs of these facilities are statutorily limited, it is imperative that a "cradle-to-grave" monitoring approach be applied to dorm and OQ projects. Our goal is to provide a private bath for each room. During the design phase, the plans will reflect a private bath as an additive item. If the final CWE to the 5-foot line exceeds the statutory limit by more than 10 percent, the private bath additive item will be deleted. AF/LEEE must be notified as soon as CWEs exceed statutory limits.

15. *Chapels.* Chapels will be designed in accordance with Air Force Definitive which will be issued by AF/LEEE for each project, and AFR 265-2. Complete justification and approval by AF/LEE and AF/HCB is required for any deviations.

16. *Site investigations.* Site investigations will be sufficiently thorough to insure that design details are compatible with the project site, and unforeseen conditions will not cause construction delays.

17. *Environmental conditions.* Special attention will be given to environmental factors in the design and construction of Air Force facilities in accordance with AFRs 19-1 and 19-2. With respect to overseas installations, the environmental quality standards of the host country will be conformed with, as a minimum. For projects having pollution abatement features, the AFRCE will obtain necessary Environmental Protection Agency (EPA) coordination and concurrence on the designs.

a. Environmental factors will be carefully examined during design and during studies of alternative means of satisfying requirements.

b. Important historic, scenic and archaeological sites, and other areas of special interest relating to natural wildlife and plant life will be preserved to the extent practical.

c. Necessary measures will be taken to minimize all forms of environmental pollution and meet the most stringent of Federal, State and local environmental quality standards, particularly with regard to air and water pollution.

d. The maintenance and enhancement of environmental quality will be given full consideration early in the decision making/planning process along with economic, social and technical factors. This involves identification of ecological, quality of life and other environmental factors which should be considered in design.

e. In accordance with Public Law 91-190, and Executive Orders 11514 and 12088, design must consider those measures necessary to eliminate or minimize degradation of the environment during construction operations.

f. Necessary coordination will be obtained and maintained with the State and area-wide clearing houses/comprehensive health planning organizations as re-

quired by OMB Circular A-95. Contact should be established at the earliest time. Discussions may include the scope of the project, providing there is no discussion of fiscal year or dollar amount involved. References: (1) HQ USAF/PRE letter 21 April 1977, Interagency/Intergovernmental coordination of Land, Facility and Environmental Plans, Programs and Projects, (2) HQ USAF/PRE message 171340Z Nov 1977, same subject as ref 1, (3) HQ USAF/PRE letter 29 June 1978, same subject as ref 1, and (4) AFR 86-1, paragraphs 3-9, 4-22 and 4-29c. These references will be superseded by AFR 19-9 when published.

g. Project sitings and land use designations will be consistent with the Air Installation Compatible Use Zone (AICUZ) land use compatibility guidelines for expanded clear zones, accident potential zones and noise zones (1dn, if available, otherwise NEF or CNR). Use AFM 19-10, Planning in the Noise Environment, for guidance. Provisions for noise attenuation, where required, will be incorporated in the design and requests for criteria waivers must be forwarded to AF/LEEV (info copy to AF/LEEE).

h. Design must be in accordance with HQ USAF/LEEP letter, 17 August 1978, Implementation of E.O. 11988, Flood Plain Management, and E.O. 11990, Protection of Wetlands, programming consideration, and "Flood Hazard Evaluation Guidelines for Federal Executive Agencies." (May be obtained from the United States Water Resources Council, 2120 "L" Street, N.W., Washington, D.C., 20037.) Projects requesting funds for flood proofing must comply with the requirements of AFM 86-1, paragraph 4-16.

i. All project designs must comply with Federal, State and local air, water, and noise pollution abatement standards. The AFRCE must assure that required environmental coordinations are accomplished.

j. Water Pollution Abatement Facilities. Design of Wastewater treatment facilities will insure compliance with the Environmental Protection Agency's or State's National Pollutant Discharge Elimination System (NPDES) permits, as issued to the installations involved. Industrial waste collection system to be connected to sanitary systems will meet current EPA pretreatment standards and comply with requirements of AFM 88-15. Established AF criteria and requirements will be complied with in all cases.

k. Clean Air Act Amendments of 1977. Section 188 of the 1977 amended Clean Air Act requires Federal facilities to comply with State procedural requirements concerning permits for military construction projects. The Air Force must obtain permits, where required, by State or local regulations promulgated pursuant to the Clean Air Act, to construct and/or operate facilities that emit pollutants. The Air Force must pay fees to obtain permits from State or local authorities where required by appropriate pollution control regulations. For MCP projects, the BCE will contact local permitting authorities to assure sufficient funds are included in the project to meet all requirements and keep appropriate AFRCE advised. After design has been authorized, the AFRCE will assume construction permitting responsibility. AFRCEs will assure that construction permits are finalized prior to award of the project. AF/PRE letter, 17 Oct 1977, Clean Air Act Amendment of 1977, provided guidance on obtaining permit to construct facilities that emit air pollutants.

18. *Energy conservation.* In consideration of the serious national energy shortage and escalating utility costs, design must incorporate features that can reduce energy consumption. AFM 88-15 includes specific criteria.

a. Architect-engineers and in-house designers must have latitude to develop independent energy conserving proposals for consideration. These alternate proposals to further reduce energy consumption (over the reduction expected for the facility if designed in strict conformance with the criteria presented) will be submitted with the early preliminary design. These proposals should indicate the expected energy reduction as well as the effect on facility construction and operation costs. These proposals will be evaluated by the AFRCE in conjunction with the major command and will be incorporated into the design if a fully useable and functional facility will result, consistent with fund availability.

b. A computer energy systems analysis will be required for all new buildings and major building rehabilitation projects which are:

(1) Heated and mechanically cooled and have an estimated cost of \$1,000,000 or 10,000 square feet gross area.

(2) Heated only with a gross area over 40,000 square feet.

c. The computer study should provide an annual energy budget figure for each building in total BTU/sq ft of area. This should be compared with figures obtained for other similar buildings in the local region to insure the most energy efficient facility is provided. GSA has reported that 55,000 BTU/sq ft for office

buildings is reasonable. The budget figures should be readily available for submission to AF/LEEE if necessary.

d. For all new buildings, the goal shall be a reduction of 45 percent in the average annual energy use per gross square foot of floor area from the average energy use per square foot of floor area in 1975.

e. Solar energy installations for new facilities, even if included in the Project Book (PB), will only be implemented if specifically directed by HQ USAF/LEEE. It is our objective to have at least one solar energy installation at each major air base so that the engineering staff can gain experience and maintenance data. Nominations by MAJCOMs and AFRCs are encouraged. With the continuing depletion of fossil fuel supplies, the possibility exists that our project designs and/or existing facilities must eventually look to solar energy systems. The designer should consider this and design facilities he considers candidates for future solar system in a manner that will simplify their future conversion. This should include building orientation, roof structure, mechanical systems, etc.

f. Each Energy Conservation Investment Program (ECIP) project will be re-evaluated to assure compliance with the following:

(1) All projects must be cost effective; i.e., must amortize within their economic life.

(2) All FY 81 MCP projects must produce an Energy to Cost ratio (E/C) of MBTUs of energy saved yearly per thousand dollars of current working estimate investment equal to or greater than 20. The ECIP for FY 81 will be developed to comply with both the minimum and average E/C Ratio established within the DOD. Therefore, any significant deviation from the ratios identified in the DD Form 1391 submitted to OSD must be brought to the attention of AF/LEEEU.

(3) Executive Order 12003 and recent legislation require an economic analysis based on present worth techniques to determine a benefit/cost ratio for each project. The benefit/cost ratio must exceed 1.0 for each project submitted. AF/PREE letter, 17 Nov 1977, Design Instruction No. 1A, FY 79 MCP and AF/PREE letter, 24 Jan 1978, FY 1980-FY 1985 MCP Guidance No. 1, provided a method for determining the benefit/cost ratio applicable to most ECIP projects which will satisfy this requirement. Where a project requires a more detailed approach, use AFM 178-1 Economic Analysis and Program Evaluation for Resource Management as a guide. The 17 November 1977 AF/PREE letter also provided fuel escalation rates which may be used in determining benefits when better data derived from local conditions and experience is not available, and provided single amount and cumulative uniform series discount factors for a discount rate of 10 percent and differential escalation rates of 0, 5, 7, and 8 percent. Non-energy connected monetary savings are also appropriate for inclusion in the economic analysis.

(4) DOD policy requires replacing natural gas heating systems with coal or fuel oil systems where possible except for individual boilers or warm air furnaces less than five Mega BTU per hour output. Current natural gas heating systems, except as noted above, will be evaluated for energy cost saving on the basis of equivalent fuel oil or coal prices including anticipated escalation.

(5) Energy conversions:

(a) For purposes of calculating energy savings, the following conversion factors will be used:

Purchased electric power, 11,600 BTU/kwh.

Distillate fuel oil, 138,700 BTU/gal.

Residual fuel oil, use average thermal content of residual fuel oil at each specific location.

Natural gas, 1,031,000 BTU/1000 cu ft.

LGP, propane, butane, 95,500 BTU/gal.

Bituminous coal, 24,580,000 BTU/short ton.

Anthracite coal, 28,300,000 BTU/short ton.

Purchased steam, 1,390 BTU/lb.

(b) Purchased energy is defined as being generated off-site. For special cases where electric power or steam is purchased from on-site sources, the actual average gross energy input to the generating plant plus distribution losses may be used but in no case shall the power rate be less than 10,000 BTU per KWH or the steam rate be less than 1200 BTU/lb.

(c) The term coal does not include lignite. Where lignite is involved, the Bureau of Mines average value for the source field shall be used.

(d) Where refuse derived fuel (RDF) is involved, the heat value shall be the average of the RDF being used or proposed.

(e) When the average fuel oil heating value is accurately known through laboratory testing for a specific military installation, that value may be used in lieu of the amount specified in paragraph (5)(a).

(f) Full energy credit may be taken for conversion from fossil fuels or electric power to solar, wind.

(6) Validation studies should be available for transmission to AF/LEEE if requested.

(g) *Utility Meters (Energy).* The continuing increasing emphasis on energy consumption and conservation of available resources requires that all new buildings and major renovations of existing buildings include utility meters. The purpose of the meters is to establish bench marks of current energy consumption which will assist the Base Energy Conservation Committee in reducing facility energy consumption. Attention can also be drawn to expensive operations even though only minimum local authority may exist to change the operation. All new buildings included in the FY 81 MCP will have utility meters included in the project design. If a particular local condition warrants a variation from this policy, a waiver must be obtained from AF/LEEE. Water meters are excluded from this policy and will only be included in the project design if determined necessary by the AFRCE.

(h) *Energy Saving with Landscaping.* The designer should be encouraged to consider energy savings that can be derived through proper landscaping and facility operation. The use of land forms and plant material can result in significantly lower fuel costs. Deciduous trees can provide protection from the summer sun while letting sunshine through during winter months. Blacktop parking areas absorb large amounts of heat from the sun that can result in higher energy requirements to air condition adjacent buildings. Use of alternate or light colored material in conjunction with trees can reduce these energy requirements for cooling. Use of earth berms properly planted can act as wind and sun screens as well as adding to esthetics, privacy and sound control. Design proposals to incorporate energy associated landscaping will be evaluated by the AFRCE and may be included in the design, consistent with fund availability.

19. *Air conditioning waivers.* When the PB identifies an air conditioning requirement which is not authorized by AFM 88-15, Chapter 6, an economic study of the difference between the authorized system and the proposed system will be conducted by the designer. This analysis will be made prior to proceedings with the design of the proposed system. Should this study not justify the proposed system, the AFRCE will so advise the major command and proceed with design of the authorized system. If the study supports one, an AF Form 1066 will be prepared and processed in accordance with AFM 88-15, Chapter 6.

20. *Occupational Safety and Health Act.* All designers for Air Force construction will produce drawings and specifications which are consistent with (equal or better) the standards issued by the Department of Labor under Section 6 of the Williams-Steiger Occupational Safety and Health Act.

21. *Value engineering.* Value engineering (VE) is considered an integral part of project design. However, design agents must obtain Air Force (AFRCE) clearance for VE studies on a case-by-case basis where sufficient evidence exists that one would indicate cost savings while maintaining desired functional utility. VE studies must be conducted in accordance with AFR 89-1 and prior to review of 95 percent plans and specifications to minimize design delay. The results of each study will be provided to the appropriate AFRCE for approval prior to being incorporated into final project design.

22. *Construction times.* Optimum construction times appropriate to the type of facility, geographical location and lead time of required materials will be specified in construction contracts. Construction time periods will be established jointly by the AFRCE and the construction agent with full consideration of the operational need date as established by the major command.

23. *As-built drawings.* Those projects of sufficient complexity to warrant preparation of as-built drawings will be identified by the AFRCE on design directives to the design agents. When as-built drawings are required, completion within 90 days after signing of the DD Form 1354 will be specified. Record drawings maintained by a BCE should be current and reflect as-built conditions of completed facilities. Out-of-date record drawings can result in incorrect designs for future projects and costly unnecessary change orders. This need may be met by transferring the resident engineer's set of marked up shop drawings or original design drawings to the base civil engineer upon project completion. The command, after construction has progressed sufficiently, will determine whether or not as-built drawings are required. This determination will be based on the number and complexity of changes to the original drawings. The major command

will request the design/construction agent to implement the as-built option (if previously identified) or negotiations will be undertaken to provide these documents. Otherwise, minor corrections will be accomplished as staff time permits, by the base civil engineer from marked up drawings as outlined above.

24. *Design instructions.* Subsequent Design Instructions will be more specific in nature and will identify individual projects authorized for design. A computer DI will be issued approximately quarterly which will address all projects authorized for design to that date. Between computer DIs, additions and changes will be made by message. Message changes will note that a particular PA/Scope is being changed or that a new project is authorized for design. The computer DI will only reflect the current PA/Scope and will not include notes on interim changes. Computer DIs will be consolidated for all Major Commands and numbered sequentially starting FY 81 DI #2. Interim message changes will be separated into geographical regions (CONUS, Alaska, Europe and Pacific) but will not be numbered.

a. Current OSD guidance generally disallows package programs. Thus, pollution and energy conservation items will be handled as regular line items. Programmed amounts authorized for pollution abatement projects will not be applied to other projects within a station total authorization. Also, energy conservation projects will not be reduced in scope at the expense of other projects in a station total authorization. Any packaging that OSD permits will be identified on the DI.

b. DI message instructions will identify projects that may require 612 Congressional notification prior to award or A-E design contracts. Section 801 of Public Law 95-356 increased the A-E notification limit to \$250,000. Responsible AFRCEs should evaluate the projects identified and notify AF/LEEEC of the best estimate of A-E fee or that 612 notice is not required. AF/LEEEC will notify affected AFRCEs when A-E selection may proceed. The computer DI will note projects that have outstanding 612 actions.

c. The computer DI will reflect in the notes the grade mix for Airman Dorms. The mix reflected E1-E4/E5-E6/E7-E9; i.e., for a project with a Scope of 410 MN (400: E1-E4, 6: E5-E7, and 4: E8-E9). The note would be-Grade Mix 400/6/4.

d. FY 99 reflects projects not in a current year program but authorized for continued design. These projects are high candidates for a future year program and are authorized for design to 100 percent unless otherwise noted. If something has happened to change the status of a project, such as the need to use a revised/updated guide specification, the design percentage and completion date should be adjusted and design proceed.

e. DI and Design and Construction Management Report (AF Form 1959) designations. The following designations have been established to assist in managing various special types of projects/programs. Type designation is entered by AF/LEEEC on the AF Form 1959 in place of the Major Command (Block No. 6, AF Form 1959).

(1) ZAP: Projects such as DOD Schools and emergency MCP projects are reflected in this designation.

(2) ZSP: This designator is used for projects that have designs stopped. These projects will be reflected in the FY in which the project was last active; i.e., a project authorized for design as a FY 79 project, moved to FY 80 and then stopped will be reflected as a FY 80 ZSP project. Final PA, CWE, design percentage when stopped, etc., will be reflected. When a project is to be stopped, the AFRCE will cancel design at a point considered to be in the best interest of the Government, normally based on the A-E contract's next economic cut-off point.

(3) ZMC: MCP (P-341) projects below \$500,000 at specified locations. These projects are not identified in ZMC until the program and project amounts are approved. The designation will not be used for exigent P-341 projects.

(4) ERG: 1976 Energy projects only.

(5) POL: 1972 through 1976 Water and Air Pollution projects only.

(6) VVO: Munitions Security improvement package programs (Overseas).

(7) VWS: Munitions Security improvement package programs (Stateside).

(8) VWW: 1974 through 1976 package programs for Radar, Satellite Communications facilities, and Technical Control facilities.

(9) SFO: Special projects such as Solar Observation facilities, Space Track Observation facilities, Special Operations facilities, etc.

(10) SFZ: 1975 and 1976 package programs for NAVAID facilities, flight Simulator facilities, Global Position Systems, etc.

25. *Airfield lighting.* The approach and threshold lighting intensities and configuration are now being changed on the commercial airports. USAF is now

flight-testing these changes and an evaluation will be made for Air Force concurrence. Until a policy has been published, contact AFESC/DEE for latest guidance before design has started.

26. *Signage.* The achievement of attractive and uniform interior and exterior signage is an important objective of the Air Force's environmental enhancement program. The proper use, design and placement of signs can heighten people's sense of awareness of the environment. To this end, the AFRCE should assure that designs comply with HQ USAF/LEEEES signage guidance.

27. *Flightline facilities.* To enhance survivability and ensure capability to carry out operational missions, flightline buildings at forward operating bases should contain minimum exterior glass. In addition to this requirement, it is incumbent upon the AFRCE to assure that facility designs for forward operating bases contain applicable survivability features to meet operational needs. Refer to AFM 88-15, para 1-19.

28. *Roof design.* Flat built-up roofs continue to experience premature failure and excessive maintenance problems. New materials and installation methods now make sloping roofs a prime candidate for new facilities and for retrofitting of existing facilities with deteriorated built-up roofs. Professional practice in surrounding communities is a helpful indicator. If the community has a large percentage of sloping roofs, the Air Force should consider the advantages. AF/PRE letter, 20 Jan 1977, Built-up Roof—Replace by Retrofit and Design, provided guidance on design of sloping roofs. Where structure and span permit the designer will consider use of sloping roofs.

29. *Reporting design progress.* The following guidelines (AFR 89-1, Chapter 3) will be used when reporting design status in Blocks 38 and 39 of the AF Form 1959 for conventional designs. The design completion percentages noted at the end of the following actions will be used as applicable:

- a. HQ USAF/PRE design instruction issued to the AFRCEs or major commands. (1 percent).
- b. AFRCE or major command design instruction issued to the design agent. (2 percent).
- c. Notice to proceed issued to the A-E by the design agent, or in-house design starts. (3 percent).
- d. Concept plan, early preliminary working drawings, design analyses, and outline specifications issued by the designer. (30 percent).
- e. Concept or early preliminary review comments forwarded to the design agent. (35 percent).
- f. Regular preliminary working drawings, design analyses, and updated cost estimate and outline specifications issued by the designer. (60 percent).
- g. Regular preliminary review comments forwarded to the Design Agent. (65 percent).
- h. Final design (working drawings, design analyses, cost estimates, and specification) completed by the designer. (90 percent).
- i. Final design review comments forwarded to the design agent. (95 percent).
- j. Corrected final design accepted by the Air Force. (100 percent).

30. *Facility solar energy guidance for military facilities (other than family housing).* Section 804 of Military Construction Authorization Act, 1979, Public Law 95-356 requires that 25 per centum, based on the estimated dollar value of the construction cost of all new facilities except Family Housing that are placed under design shall include Solar Energy Systems to the extent that engineering analysis demonstrate cost effectiveness. The law requires that these provisions are effective ninety days after the date of the enactment of the Act. The law was enacted 8 September 1978; therefore, all design starts (A-E award) on or after 7 December 1978 are subject to these requirements. HQ USAF/LEEE will indicate in the design directives which projects are to be evaluated for solar application. The parameters for accomplishing the required engineering analyses are as follows:

- a. Reference Documents: The applicable portions of HUD Intermediate Minimum Property Standards for Solar Heating and Domestic Hot Water systems (1977 edition) shall be used as a guide in making the required technical analyses.

Senator HART. How have you modified your instructions to AE firms to accommodate this provision? Do you require that AE's have demonstrated capability in the area of solar design?

Mr. MARSHALL. The Military Departments implementing guidance on Section 804 includes instructions to A/E firms to accommodate this provision and requires that A/E firms have demonstrated capability in solar or include appropriate outside consultants as a part of their team.

Senator HART. Provide for the record the statement of the scope of work showing the solar requirement for a typical AE contract that has been awarded since the provision came into application. If none have been awarded provide a sample of how you would expect a typical scope of work to be modified to accommodate the solar provision.

Mr. MARSHALL. Attached is a copy of the A/E Scope of Work for a proposed dental clinic at Fort Leavenworth, Kansas which includes the requirement to accomplish the economic analyses for solar systems. This scope of work will vary from project to project, however the solar requirement is considered to be typical. [Attachment.]

DENTAL CLINIC ADDITION/ALTERATION—8 DTR

SCOPE OF WORK

1. Description of the project:

a. The project, designated Project No. 83, Dental Clinic Addition/Alteration—8 DTR, consists of design for construction of an 8 dental treatment room (DTR) addition and alteration to an existing permanent 12 DTR clinic to match existing masonry structure, including a basement for utility service lines to dental treatment rooms. Alterations to the existing clinic building shall include necessary utilities, storm drainage, paving, curbs and gutters, site preparation, communications, and heating from existing central plant. The Architect-Engineer shall include a central high volume oral evacuation system. The mechanical/electrical system of the existing 12 DTR clinic shall be upgraded to meet current Corps of Engineers Standard Criteria. Life/Safety fire protection and provisions for the physically handicapped shall be updated.

b. The Architect-Engineer also shall prepare a concept design study and economic analysis for each of the following solar energy application systems:

- (1) Domestic water heating.
- (2) Domestic water heating and space heating.
- (3) Domestic water heating, space heating, and space cooling.

The above solar systems shall be designed for a capacity to service the existing and new dental clinic.

2. *Authorization.* The project is authorized by Directives Nos. 11 and 12, Job No. Design-78-MCA-Kansas City District, dated 13 June 1978 and 17 July 1978, respectively. The Architect-Engineer shall make reference to this authority in all design analyses.

3. *Work to be performed by the architect-engineer.* The Architect-Engineer shall perform and shall assume all responsibility for the accuracy and completeness for the following design work and services in connection with the above-described facility in accordance with criteria and instruction specified hereinafter and Appendix B which is attached hereto and made a part thereof. Quality of design work accomplished under the contract will be a determining factor in consideration of the Architect-Engineer for future work.

a. Title I services.

(1) Concept design (first submittal):

(a) Necessary site and utilities investigations and field surveys to determine site preparation requirements.

(b) Sketch of site plan, building plan, building cross section, and building elevations, as required by subparagraph 4a(1) of DAEN-MCE-A Engineering Instructions for Design of Dental Clinic 8-Chair Addition and Alterations, Fort Leavenworth, Kansas, FY 80, PN 83, dated 5 June 1978, hereinafter referred to as Dental Clinic Engineering Instructions.

(c) Furnish the services of the Project Manager and Project Architect to attend a review conference at the Kansas City District Office for coordination of comments on the dental clinic design of subparagraph 3a(1)(b).

(d) Preparation of Energy Analysis for the existing dental clinic, in accordance with Presidential Executive Order 12003, dated 21 July 1977, BTL 1110-3-295, and ETL 1110-3-296 to reduce energy consumption by 20 percent.

(2) *Solar study.* Preparation and submission of twenty (20) copies of a Solar Energy Study, in accordance with DAEN-MPE-E letter dated 14 November 1978, subject: Solar Energy Design/Construction Requirements, and DAEN-MCE-U Engineering Instructions for Preparation of Feasibility Studies for Total Energy, dated 1 July 1977.

(3) Concept Design (second submittal):

(a) Necessary field surveys and measurements required for preparation of detailed topographic maps in accordance with subparagraph 12.d of Appendix B.

(b) Preparation of detailed topographic maps of the project site and submission of three prints immediately upon completion thereof.

(c) Preparation and submission of twenty-five (25) copies of the 40 percent concept design of the dental clinic, including approximately 60 percent completed drawings; however, equipment, casework, and communication drawings should be 90 percent completed. Preparation of the 40 percent concept design also shall include a design analysis with design calculations, list of guide specifications required for final design, and estimate (Code B) in accordance with subparagraph 12f of Appendix B and subparagraph 4a(2) of the Dental Clinic Engineering Instructions.

(d) Furnish the services of a maximum of five technically qualified representatives to attend a concept review conference to be held in the Kansas City District Office.

Senator HART. What do you expect the impact of this provision be to—specifically, what will it mean in terms of the numbers of AE firms involved in solar system design, what will the solar system design load be annually in terms of dollars, and what will be the dollar impact on the solar industry when the designs go to construction?

Mr. MARSHALL. All projects having an apparent potential for design will be analyzed as part of the project concept designs. It is expected that this could involve approximately 300 AE firms DOD-wide. In terms of dollars it is expected that the added annual cost of solar design will be between \$6 and \$10 million dollars.

The dollar impact on the solar industry after designs have been completed will vary depending on the magnitude of the annual program, types of facilities involved, and the kind of solar system meeting the cost effective requirements. Our best estimate at this time is that the potential dollar impact on the solar industry will be in the range of \$50 to \$100 million annually.

Senator HART. Would you provide for the record a comprehensive example of how the cost effective analysis required by Section 804 would be done? Explain the assumptions supporting your analysis and for each variable explain the source of your data and how the variable was derived (e.g., what escalation rate are you using for fuel costs and what is the source of that rate?).

Mr. MARSHALL. The example we are using is for the Navy's 28-unit FY 1979 family housing project at Centerville Beach, Calif. This analysis was accomplished by the "Solcost—Solar Energy Design Program" computer program using Navy program inputs. Since Section 804 does not mention life cycle costs, or maintenance, repair and operational costs, the only cost factor in the example is the 25-year fuel cost escalated in accordance with guidance developed within the DOD. This guidance was issued in a memorandum dated October 21, 1977. This guidance was issued in the absence of any other Federal guidance and are to be used where better local data are not available. These data were developed specifically to meet DOD requirements and are based on our costs and methods of procurement. The escalation factors for natural gas or LPG are:

	<i>Percent</i>
Fiscal Year 1979 and 1980.....	15. 0
Fiscal Year 1981, 1982, and 1983.....	14. 0
Fiscal Year 1984 and beyond.....	8. 0

You will note in se example that LP gas (LPG) is the auxiliary energy source and therefore the above factors would apply.

The example is attached.

[Attachment.]

SOLCOST—SOLAR ENERGY DESIGN ROGRAM

[User title—Sample exercise, CENTERVILLE BEACH, space and water solar with propane backup vs. all propane]

Date of run.....	78/10/17
Time of day for run.....	15. 16. 43
Program version.....	MOD4
Date of last revision.....	04/24/78

Note: Solcost is Maintained by Martin Marietta Corp., Denver, Colo. Listing of user inputs and Solcost default values. Site location code—REK; latitude=40.8; tilt angles 55.0; liquid solar system with 1.5 gal. storage per square foot of collector; Col. Effic. Intercept=.70, Effic. is .30 at del T/Flux=.5 HR-F-square foot/Btu (F sub R TAU ALPHA=.70 and F sub R UL=.80 Btu/HR-F-square foot); input space heat U-VALUE=5.25 Btu/(F-DAY-square foot); floor AREA=1227; square foot computed service hot water load=.046 MILLION Btus/day; auxiliary energy—LP gas; and length of analysis 25.0 years.

	Solar system	Reference system
Initial cost, (Fixed ¹)	0	0
Initial cost, (square foot ¹)	63.25	
Down payment, (percent of initial cost)	100.0	100.0
Loan term, (years)	20.0	20.0
Interest rate, (percent)	9.0	9.0
Discount rate, (percent)	0	0
Income tax rate, (percent)	0	0
Property tax rate, (percent of initial cost)	0	0
Insurance rate, (percent of initial cost)	0	0
Maintenance rate, (percent of initial cost)	0	0
General inflation, (percent per year)	0	0

¹ 380 per unit for first 1,000,000, units.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Solar system type	1	1	1	1	1	1	1	1	1	1	1	1
Solar sys. eff.	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Col. inlet temp.	115	115	115	115	115	115	115	115	115	115	115	115
Pef. fuel type	LPG	LPG	LPG	LPG	LPG	LPG	LPG	LPG	LPG	LPG	LPG	LPG
Pef. system eff.	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Daily load-mil Btu.	0.16	0.15	0.15	0.14	0.12	0.11	0.10	0.10	0.10	0.11	0.13	0.15
Mean min temp, F.	41	42	43	45	48	51	52	53	51	49	45	43
Mean max temp, F.	54	54	55	56	56	60	61	61	62	60	58	55
Percent poss. sun.	40	44	50	53	54	56	51	46	52	48	42	39
Heating deg. days	546	470	505	438	372	285	270	257	258	329	414	499

Note: Energy cost data (step 1 of input schedules) LP gas.

SOLOCOST INSOLATION SUMMARY FOR TILT=55 DEGREES

	Ave. daily horizontal insolation (Btu/square feet)	Clear day horizontal insolation (Btu/square feet)	Ave. daily collector insolation (Btu/square feet)	Clear day collector insolation (Btu/square feet)
January	551.5	976.1	1,012.9	2,198.3
February	805.0	1,355.2	1,237.6	2,419.2
March	1,194.6	1,873.9	1,465.6	2,503.7
April	1,496.6	2,270.1	1,451.2	2,279.0
May	1,681.6	2,523.0	1,372.5	2,051.4
June	1,795.6	2,636.7	1,363.8	1,962.8
July	1,647.4	2,555.1	1,302.6	1,994.2
August	1,378.3	2,265.0	1,243.4	2,096.6
September	1,240.6	1,902.8	1,396.2	2,284.4
October	859.5	1,379.7	1,223.7	2,208.5
November	594.6	1,026.0	1,038.0	2,148.3
December	476.0	853.4	919.1	2,052.1

SYSTEM PERFORMANCE AND COST SUMMARY FOR 55 TILT ANGLE

Collector area (square feet)	Solar energy fraction	Solar system cost	Rate of return on equity [in percent]	Net present worth of solar savings ¹	Lifetime cost savings (undiscounted)
30	0.115	\$1,942.50	2.4	\$940.44	\$940.44
60	.224	3,885.00	2.3	1,761.35	1,761.35
120	.432	7,770.00	2.1	3,110.27	3,110.27
150	.536	9,712.50	2.0	3,765.27	3,765.27
210	.726	13,597.50	1.8	4,666.75	4,666.75
240	.816	15,540.00	1.7	4,986.78	4,986.78
270	.887	17,482.50	1.5	4,837.30	4,837.30
330	.959	21,367.50	.7	2,770.82	2,770.82
360	.974	23,310.00	.3	1,211.34	1,211.34

¹ Net present worth of solar savings=present worth of net cash flows (for a 0.0 percent discount rate) minus the down payment.

ENERGY BALANCE BY MONTH FOR 240 FT² COLLECTOR

Month	Fraction by solar	Average useful solar per day (BTU/day-square feet)	Total useful solar energy (million BTU/Month)	Auxiliary energy (million BTU/Month)	Conventional system energy (million BTU/Month)
1.....	0.596	395.6	2.94	2.85	7.06
2.....	.755	484.5	3.26	1.51	6.16
3.....	.862	542.1	4.03	.92	6.68
4.....	.848	494.8	3.56	.91	6.00
5.....	.832	427.4	3.18	.92	5.46
6.....	.939	419.2	3.02	.28	4.59
7.....	.938	398.8	2.97	.28	4.52
8.....	.950	396.7	2.95	.18	4.40
9.....	1.000	508.7	3.04	0	4.34
10.....	.989	471.0	3.50	.06	5.06
11.....	.718	403.1	2.90	1.63	5.78
12.....	.506	365.5	2.72	2.74	6.63
Totals.....			30.08	12.29	66.68

Notes

Conv. energy and solar auxiliary energy are gross values (i.e., they include tank insulation and/or combustion loss). Storage and component sizes for a 240 ft² system.
Solar storage tank capacity, 360, gal.
Collector size optimization by solocest. Collector type=flat plate 1 glass selective best solar collector size for tilt angle of 55, degree is 240 ft². Solar system costs (dollars)—0; fixed, 15,180; collector, 360; storage financial scenario—non-profit organization.

CASH FLOW SUMMARY

Year	Fuel/util. savings (A)	Maint., insur. prop. tax (B)	Depreciation (C)	Loan interest (D)	Income taxes (E)	Loan payment (F)	Net cash flow (G)
0.....							-15,540
1.....	225	0	NA	0	NA	0	225
2.....	259	0	NA	0	NA	0	259
3.....	296	0	NA	0	NA	0	296
4.....	337	0	NA	0	NA	0	337
5.....	384	0	NA	0	NA	0	384
6.....	415	0	NA	0	NA	0	415
7.....	448	0	NA	0	NA	0	448
8.....	484	0	NA	0	NA	0	484
9.....	523	0	NA	0	NA	0	523
10.....	565	0	NA	0	NA	0	565
11.....	610	0	NA	0	NA	0	610
12.....	659	0	NA	0	NA	0	659
13.....	712	0	NA	0	NA	0	712
14.....	769	0	NA	0	NA	0	769
15.....	830	0	NA	0	NA	0	830
16.....	897	0	NA	0	NA	0	897
17.....	969	0	NA	0	NA	0	969
18.....	1,046	0	NA	0	NA	0	1,046
19.....	1,130	0	NA	0	NA	0	1,130
20.....	1,220	0	NA	0	NA	0	1,220
21.....	1,318	0	NA	0	NA	0	1,318
22.....	1,424	0	NA	0	NA	0	1,424
23.....	1,538	0	NA	0	NA	0	1,538
24.....	1,661	0	NA	0	NA	0	1,661
25.....	1,793	0	NA	0	NA	0	1,793
Total.....	20,512	0	NA	0	NA	0	4,972

NOTES

Payback time for fuel savings to equal total investment, 22 years; payback time for net cash flow to offset down payment, 22 years; net present worth of solar savings, \$4,986.78; rate of return on net cash flow, 1.7 percent; annual portion of load provided by solar, 81.6 percent; and annual energy savings with solar system, 31.1 million Btu's.
Income tax=tax rate×(A-B-C-D); net cash flow=A-B-E-F; above payback times based on undiscounted dollars; year 0 entry in net cash flow column is down payment.
Pl.t 1—discounted savings vs. Collector area.

Senator HART. Were you assisted in developing your cost effectiveness analytical technique by anyone outside of DOD? If so, explain.

Mr. MARSHALL. No, the analytical technique was determined within the DOD. As noted above by the example presented in answering question number six, we

have used existing computer programs designed for solar work but the input decisions were made by the DOD. The computer program was used in order to eliminate the lengthy procedure required to do the analysis normally.

Senator HART. In his testimony, Mr. Marshall requested a change in the legislative language of Section 804, to limit this provision strictly to structures (as opposed to runways, missile silos, etc.). What would be the impact of this modification in terms of DOD's utilization of solar energy?

Mr. MARSHALL. The reason for the request to change the legislation to apply to buildings is to insure that a balanced and rational approach to the installation of solar systems is used. While the impact will vary from year to year depending on total program composition (i.e., buildings versus other facility types). For example, in analyzing the Navy's potential FY 81 program it was found that only 13 percent of the program, on a dollar basis, has the potential for the application of solar energy systems. It is expected that this anomaly will occur throughout DOD from time to time.

Senator HART. Is DOD considering photovoltaic energy systems—as well as solar thermal systems—in implementing Section 804? What is your opinion of the advisability of requiring that DOD utilize photovoltaic systems where cost-justified, and consistent with the performance and mission requirements of a given project?

Mr. MARIENTHAL. We are not considering photovoltaic energy systems in implementing Section 804. Military construction solar applications are suitable primarily for solar thermal systems. Current state of the art photovoltaic systems, because of their high cost, are limited in application to remote sites and specialized uses, such as battery charging. As you know, the DOD is a major user of photovoltaic systems. We have submitted a large number of proposed photovoltaic applications to DOE for approval under the photovoltaic initiative of National Energy Act.

The DOD would use photovoltaic systems where cost justified and consistent with mission requirements. I don't think the extent of DOD photovoltaic system use would depend upon whether or not we were directed to use cost justified and mission compatible equipment.

Senator HART. Why has DOD established a 10-year payback limitation in determining whether or not to utilize new energy technologies? Is this not, in fact, detrimental to solar and other energy technologies which, despite minimal operating and maintenance costs, have larger up-front costs which result in longer payback periods?

Mr. MARIENTHAL. The 10-year payback limitation is a basis to negotiate the cost sharing of energy technology projects with DOE. It reflects the fact that the DOD has many competing uses for its money, and that we must invest our money prudently. We have been concerned that existing, cost-benefit evaluation methodology may be based against new technology investments. For that reason we have initiated with DOE a review of this problem, with the objective of developing a more suitable evaluation procedure. Secretary Myers mentioned this effort in his statement. When revised formulae are developed, and approved by DOE and the Office of Management and Budget, we will use them.

Senator HART. Do either of you have any concluding remarks you wish to make?

Mr. MARIENTHAL. No, sir; thank you very much, nice to be here this morning.

Mr. MARSHALL. Thank you.

Senator HART. We appreciate your testimony.

[Whereupon, at 11:05 a.m., the subcommittee was adjourned subject to the call of the Chair.]



