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BY THE COMPTROLLER GENERAL

# Report To The Congress

OF THE UNITED STATES

## Management Problems Impede Success Of DOE's Solar Energy Projects

Despite Department of Energy efforts to improve management of its solar energy research and development projects, GAO found that these projects are continuing to experience cost increases, schedule slippages, and scope reductions.



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Stronger controls over project selections and administration are needed.

GAO makes several recommendations to the Department of Energy which would contribute to the solar projects' success.



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

This report discusses problems being experienced by the Department of Energy's solar energy research and development projects in meeting their cost, schedule, and scope objectives. The report identifies the need for better controls over project selection and administration to help improve the performance of these projects.

Copies of this report are being sent to the Director, Office of Management and Budget; the Secretary of Energy; and interested Members and Committees of the Congress.

  
Comptroller General  
of the United States

D I G E S T

GAO reviewed the Department of Energy's (DOE's) management of its solar energy research and development (R&D) projects and found that

- DOE has taken important steps to improve its R&D project management;
- solar projects are continuing to experience cost increases, schedule slippages, and scope reductions, despite the steps; and
- more complete implementation of DOE's management initiatives, as well as strengthened controls over solar energy R&D project selections and administration are needed to improve project success.

PAST PROJECT MANAGEMENT  
PROBLEMS AND RECENT EFFORTS  
TO IMPROVE

Historically, R&D projects supported by DOE and its predecessor agencies have been plagued by cost increases, schedule slippages, and scope reductions. Recognizing these past problems, DOE has taken the initiative to modify its management approach and supporting systems. It

- instituted decentralized management,
- established a formalized system which sets forth new principles and implementing mechanisms for managing projects as part of an overall program, and
- initiated a new automated contractor reporting system to help improve its capability to assess project and program performance. (See p. 6.)

GAO found that some projects were being selected primarily on the basis of satisfying external expressions of interest rather than the projects' potential contribution to the program. In addition, because of various management restrictions, project control, and hence effective project management, have been inherently more difficult to achieve. (See p. 23.)

GAO also found that effective project administration has been hampered by weak DOE contractor monitoring and delays caused by DOE's approach to project funding. On several occasions, project managers were not closely monitoring activities and as a result were not in a position to take action to lessen cost increases that eventually occurred. In addition, the absence of multi-year project funding commitments has impaired project stability and continuity.

Such instability and discontinuity have materially contributed to several schedule slippages and cost overruns, and in one case to such extensive reductions in project scope that project managers recommended project termination. Strengthened monitoring and more long-range funding arrangements could, therefore, help improve project performance. (See p. 31.)

#### RECOMMENDATIONS TO THE SECRETARY OF ENERGY

To ensure projects are selected which more closely and directly contribute to the success of DOE's solar energy program, the Secretary should direct the solar program office to:

--Expediently develop, finalize, and implement multiyear program plans for the overall solar program and each solar technology. These plans should be linked in chain fashion toward achieving the President's overall goal of meeting 20 percent of the Nation's energy needs from solar resources by the year 2000.

timeliness and accuracy of its automated data base.

To further curtail the project performance problems that are occurring, GAO recommends that the Secretary direct the solar program office to:

- Reemphasize the need for effective project monitoring.
- Consider expanding the use of long-term, multiyear funding commitments for solar projects, providing for periodic reexaminations to verify each project's merits. (See p. 37.)

MATTERS FOR CONSIDERATION  
BY THE CONGRESS

GAO's recommendations to the Secretary of Energy are aimed at correcting a number of problems which are impeding the successful management of solar energy R&D projects. Among these recommendations, GAO is calling for DOE to develop, finalize, and implement multiyear program plans for both the overall solar program and for each solar technology.

GAO believes that to be most effective, the plans should carry the highest level of review possible. In this connection, the Congress may wish to require DOE to submit its multiyear plans to the appropriate budgetary and oversight committees. Congressional consideration of these plans as part of the normal authorization and appropriations processes could help ensure that projects being selected are consistent with the achievement of the plans' objectives. (See p. 39.)

AGENCY, CONTRACTOR,  
AND GRANTEE COMMENTS  
AND GAO'S EVALUATION

GAO obtained comments from DOE, a contractor, and two grantees. DOE generally agreed with the recommendations contained in the report

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## CHAPTER 1

### INTRODUCTION

As the Nation searches for energy alternatives to reduce its dependence on increasingly expensive imported oil, the potential role of solar energy has become the focus of much public attention. While other alternatives such as nuclear power and expanded coal use are facing strong resistance on environmental grounds, solar energy offers the Nation an energy resource that is renewable and generally without adverse environmental consequences. Furthermore, since many different technologies can either directly or indirectly convert the sun's energy into useful form, solar energy can be employed widely across the Nation.

Solar energy, excluding hydropower, is now making only a small contribution toward meeting the Nation's energy needs. However, the potential for significantly expanded use exists. Everyday the continental United States receives solar radiation equivalent in energy to about 8 billion barrels of oil. From this theoretical availability, the Department of Energy (DOE) estimates that solar energy could provide the equivalent of over 8 million barrels of oil a day. Accordingly, the President has established a goal of meeting 20 percent of the Nation's energy needs from solar resources by the year 2000. 1/

Solar energy's ultimate contribution, however, will depend greatly on technological advancements and reduced costs. While certain solar technologies are currently at or near economic competitiveness, most will require aggressive research and development (R&D) efforts to become competitive and gain commercial acceptance. The Federal Government has assumed an expanding role in these efforts. The effectiveness of these Federal efforts will do much to determine when, and to what extent, solar energy begins to displace conventionally produced energy.

#### EXPANDING FEDERAL EFFORTS

Federal efforts in solar energy R&D have been expanding rapidly in recent years. Prior to 1974, Federal solar R&D activities were limited. However, when the price of oil quadrupled in late 1973 and concern over dwindling fossil

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1/This goal was set forth in the President's June 20, 1979, Solar Message and was based on results of the Domestic Policy Review of Solar Energy that was completed in Feb. 1979.

- biomass production and conversion systems that capture the energy contained in plant materials and animal residues for use as useable energy products;
- solar applications systems which seek through further development to improve passive and active heating and cooling systems for buildings, as well as process heat for agricultural and industrial uses; and
- solar power satellite systems that potentially could generate electric power in Earth orbit, transmit the power to Earth, and collect and convert it to useful energy on the Earth's surface.

The funding provided to each technology in fiscal years 1979-1980 and requested for fiscal year 1981 is set forth in the table below.

	Fiscal year		
	<u>1979</u>	<u>1980</u>	<u>1981</u>
	----- (millions) -----		
Solar thermal	\$ 98.3	\$121.0	\$117.5
Ocean thermal	41.1	40.0	39.0
Wind	59.6	63.4	80.0
Photovoltaics	103.8	147.0	140.0
Biomass	42.4	56.0	63.0
Solar applications systems development	41.0	53.0	51.0
Solar power satellite	6.6	5.5	-
Other (note a)	<u>13.1</u>	<u>13.7</u>	<u>17.4</u>
Total	<u>\$405.9</u>	<u>\$499.6</u>	<u>\$507.9</u>

a/Includes solar international activities, solar information systems, activities related to constructing the Solar Energy Research Institute facility, technology support and utilization, and program direction.

DOE's funding is used to support a large number of solar R&D projects. According to a DOE management document, a project is "a basic building block in relation to a program"



heavily funded projects. These projects are the Northwest Mississippi Junior College (NMJC) in Senatobia, Mississippi; the Mississippi County Community College (MCCC) in Blytheville, Arkansas; and the Natural Bridges National Monument (NBNM) located in the Canyon Lands National Park, Utah.

In solar thermal, we slightly modified this approach. The largest solar thermal project--the Ten-Megawatt Central Receiver in Barstow, California--was recently reviewed by DOE's Office of Inspector General. <sup>1/</sup> Therefore, to avoid duplicating that work, we excluded it from our review. The second largest solar thermal project--the Small Community Applications Experiment--was in an early conceptual design stage at the time of our review and provided limited opportunity for detailed analysis of that project's total management. After excluding these two projects, we selected for review the next three largest solar thermal projects. These projects are the Shenandoah Total Energy Experiment in Shenandoah, Georgia; the Crosbyton Solar Power Project in Crosbyton, Texas; and the Coolidge Deep Well Experiment in Coolidge, Arizona.

For each project, we examined project records, interviewed DOE project managers as well as contractor and/or grantee representatives, and visited project sites. We examined project selection and project performance in terms of cost, schedule, and performance objectives.

In addition to these six ongoing projects we also performed limited reviews of two projects that were either completed or terminated prior to our review. The two projects were the Five-Megawatt Solar Thermal Test Facility at Albuquerque, New Mexico, and the Large-Scale Solar Total Energy Project at Fort Hood, Texas. We examined the five-megawatt facility because it was the largest recently completed project in either the solar thermal or photovoltaics programs. We reviewed the Fort Hood project because it was a large project that after 4 years of effort had been terminated, and at the time of our review was being planned for a restart.

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<sup>1/</sup>This review resulted in a report entitled, "Report on the Management of the Ten Megawatt Solar Thermal Central Receiver Pilot Plant Project," dated June 20, 1980.

The Fort Hood project was designed to employ a solar total energy system to provide electricity, space heating, air conditioning, and hot water for a military barracks. This project has now been terminated. As discussed in a separate letter report we previously issued to the Secretary of Energy, <sup>1/</sup> the Fort Hood project was plagued with problems throughout its history. Initiated in 1974 based on an unsolicited proposal, project design and construction were originally planned to be completed by early 1979. However, after an investment of more than 4 years and over \$5 million, the project made little progress toward achieving its objectives. It became bogged down in design phases and was terminated in October 1978 before it reached the construction phase.

DOE planned to restart the project in early 1980 by funding another unsolicited proposal submitted by the same prime contractor that historically had been associated with the project. The project, as proposed, was to employ a completely different technology than had been originally proposed. However, following issuance of our report, the contractor withdrew its proposal in mid-December 1979, and DOE dropped its plans to restart the project.

DOE officials said DOE's historical project performance problems were attributable to weaknesses in the prior approach to project management. Under ERDA, they said there was a looser and less consistent system for managing projects. Projects were often managed out of headquarters and there were no requirements for either specific project plans or definitive multiyear program plans. Soon after DOE's creation, officials concluded that projects could not be effectively managed out of headquarters and that specific project and program plans were necessary to improve project results.

#### INITIATIVES TO IMPROVE DOE'S PROJECT MANAGEMENT APPROACH

Recognizing that problems have existed in the past, DOE has taken steps to improve its project management approach and supporting management systems. It instituted decentralized project management involving the transfer of day-to-day project management responsibility from DOE headquarters to field locations. DOE also established a new project management system which set forth new principles and criteria for initiating and conducting projects as part of an overall

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<sup>1/</sup>"Planned Contract Award for the Fort Hood Solar Project Should be Reconsidered" (EMD-80-37, Dec. 7, 1979).

In addition, the guidelines introduced the requirement for project charters. Project charters are agreements that formalize the working relationships on each individual project. They delineate the project manager's authority, set forth required reporting channels, and identify support to be furnished to the project manager by other participating organizations.

#### Program and Project Management System

DOE recognized that a variety of management tools were necessary to operate in the decentralized management framework. It specifically identified the need for baseline plans, appropriate management control systems, and timely feedback mechanisms for all levels of management. To help meet these needs, DOE instituted the Program and Project Management System (PPMS).

Initiated in May 1978 through interim guidelines, PPMS set forth the principles and implementing mechanisms by which DOE's programs and projects were to be developed, approved, and administered. As delineated in the interim guidelines, the system was designed to achieve a number of objectives. These include

- ensuring that all significant projects relate to clear, multiyear program objectives;
- providing a mechanism for determining priorities among programs and projects;
- avoiding major resource commitments prior to adequate project definition; and
- maintaining accountability for program and project success.

The interim guidelines introduced a number of implementing mechanisms to achieve system objectives. At the program level, managers were required to develop multiyear program plans that describe specific activities as part of an overall strategy to achieve national energy objectives. At the project level, managers were directed to establish and keep up-to-date project "baselines." Project baselines set out specific technical, cost, manpower, and schedule objectives which are tracked throughout the project's history. The system also provided for evaluating key personnel on the basis of achieving these objectives. Further, PPMS required that each significant project be organized into discrete phases, each phase separated by a decision point. Projects would then

UCRS replaced the multiple reporting systems formerly used in ERDA and other predecessor agencies with a single system. Useful data aggregates were not possible under the multiple reporting systems because of incompatible contractor reporting data. To alleviate the problem, DOE began developing guidelines for uniform reporting. UCRS is the systematized product of these reporting guidelines.

DOE made implementation of UCRS mandatory DOE-wide. However, we were told component organizations had the discretion to choose between manual or automated systems. The solar program office began in August 1977 to implement UCRS on a trial basis. Initially, the solar program office placed emphasis on developing a manual system. This system was characterized by manually intensive information gathering and assimilation efforts and, according to DOE officials, rarely provided information in time to meet critical data needs. Furthermore, these officials told us that the voluminous paperwork needed to control the system grew to unmanageable levels. It thus became increasingly evident that as the number of contracts grew, the manual system would become less effective. Therefore, the solar program office automated the system.

<u>Project</u>	<u>Original estimate</u>	<u>Current estimate</u>	<u>Increase</u>
	----- (millions) -----		
Shenandoah	\$13.5	\$26.4	\$12.9
Coolidge (note a)	<u>b/</u> 4.3	5.5	1.2
Crosbyton (note c)	2.4	4.8	2.4
NBNM (note a)	3.0	4.9	1.9
MCCC	6.3	6.8	0.5
NMJC (note c)	<u>7.7</u>	<u>7.7</u>	<u>-</u>
Total	<u>\$37.2</u>	<u>\$56.1</u>	<u>\$18.9</u>

a/Project construction complete; current estimate represents final spending.

b/Does not include a cost contingency factor which DOE says totalled \$650,000.

c/Project being funded in phases; current estimate represents project cost for approved phases only.

The largest cost increases have occurred on the Shenandoah project. Both design and construction costs have contributed to the increases. During the course of the project, preliminary and definitive design cost estimates have risen from about \$4 million to about \$10 million. Construction costs during this same period have increased from about \$7 million to about \$15 million. DOE believes the cost increases experienced on this project are overstated because the original estimate cited above as \$13.5 million should be \$16.4 million. In addition, it states the figure contains no estimate for contingencies or inflation and did not fully reflect all the R&D work that ultimately had to be performed. We chose the \$13.5 million figure because it was cited in the fiscal year 1979 budget submission to Congress as the projected total estimated cost for the project.

The cost increases shown on the Crosbyton project are attributable in large measure to expansion of the project's scope. Since the project's prime contract was signed in September 1976, six contract modifications have been approved. Five of these modifications added new elements to the project's scope. The modifications generally involved

availability and delays in awarding a site preparation and construction contract.

The MCCC schedule slippage was affected by early confusion within ERDA and DOE over funding of the project's conservation features. Although most of the MCCC project funding was to be provided by the photovoltaics program, DOE advised the college to seek funding from DOE's building conservation systems program for the project's building conservation features. However, the building conservation systems program office desired the inclusion of certain design features, including thick masonry walls, before agreeing to provide funding. That program office requested additional design analysis before it would accept the grantee's contention that its planned design was of equal conservation effectiveness. MCCC eventually completed the analysis which supported its viewpoint, but by this time, funds for the building conservation systems program had been applied elsewhere. The solar program office eventually provided funding for the MCCC conservation features.

#### SCOPE REDUCTIONS

The cost increases and schedule slippages we have identified, while already troublesome, could have been more severe had it not been for decisions to reduce project scope. In four of the six projects we reviewed, project design features were eliminated and performance capabilities reduced to hold down cost increases and help control slippages. The need to avoid large cost and schedule variances is clear. However, achieving these objectives at the expense of the project's contribution to advancing solar technology and demonstrating its potential might be questionable. Descriptions of the scope reductions we identified are provided below.

On the Shenandoah project, major scope reductions have been made. During the project's design phase, a one-third reduction in the project's planned solar collector field was approved, decreasing the number of collectors from 192 to 120. While contending that this scope reduction did not have a crippling impact on achieving original project goals, DOE field project managers told us that this reduction somewhat hampered the project's ability to assess the economic viability of the solar total energy concept being developed. They also told us that the remaining scope was the minimum necessary for a credible project, and that if any further reductions had to be made they would recommend project termination.

In March 1980, however, DOE project officials received an updated collector procurement and construction estimate

fixed total DOE spending for the project's first two phases at \$7.7 million. Recognizing that spending will not increase, the grant document prioritized the project's major elements as a basis for specifying the order in which tasks would be deleted if project costs increased. Under these terms, three elements--a solar-powered swine facility, a solar thermal system, and a solar pond-heat pump system will not be constructed. The grantee claims scope reductions were necessary because DOE funded the project below that which DOE knew was required for successful project completion. In this connection, the grantee contends a Government cost estimate indicated the project's first two phases would cost in excess of \$11 million. Relatedly, it states bids received for the solar pond-heat pump system were three to five times higher than estimates prepared by a DOE laboratory. Despite these scope reductions, the grantee has requested an additional \$14 million to extend the project through the last two phases.

we examined said their offices did not have sufficient authority to control the destiny of their projects.

Our detailed project reviews confirmed this observation. In some cases, we found that while projects were assigned to a DOE field office, that office had no real authority over the project's destiny because of management conditions established at the time of project funding. For example, on the NMJC and MCCC projects, DOE headquarters funded the projects through grants. When grants are used, the Government transfers funds and relinquishes directive authority over the activity being undertaken. In these instances, DOE therefore established a "hands off" management approach by the field office assigned management oversight responsibilities.

The extent of this desire to maintain a hands off management approach was exemplified on the NMJC project. Early in that project, the DOE field office assembled a group of advisors consisting of staff members from several national laboratories to help it monitor project progress. In July 1979, one of the advisors issued a memorandum to DOE's technical project manager which cited inadequacies in the project's management, outlined a number of specific technical concerns, and raised questions about the project's chances of success. After learning of the criticism, the grantee protested in writing to DOE headquarters about the memorandum's accuracy. Although the DOE field office project manager agreed that the memorandum was accurate and provided a good description of the project's status, the field office sent a letter to NMJC apologizing for the memorandum. The letter also pointed out that the field office had requested the advisor to refrain from such actions in the future. After learning of NMJC's complaints about the advisory group's role in the project, another advisory group member ceased his involvement in the project claiming that further participation would not be in the best interest of either his own organization or the photovoltaics program. Further, the grantee requested that a contractor hired to help DOE monitor the project be removed from involvement in the project, alleging that the contractor was a potential competitor to the grantee's prime contractor. This request was honored by DOE.

On other projects, we found that headquarters was retaining actual project control and key decisionmaking authority through its control over the flow of project funding. For example, on the Shenandoah project repeated changes in funding availability made by headquarters caused field project managers to direct the preparation of multiple design proposals which ultimately resulted in schedule slippages and cost increases. Similar funding availability problems adversely affected the NBNM project. Finally, the field



The determination of which projects were classified as significant was based on multiple criteria including large project size, critical schedule requirements, and high visibility or sensitivity.

The solar projects not deemed significant were not required to comply with system guidelines. DOE officials and the study group's report state that system implementation on the numerous remaining projects was desired, but voluntary. The report states, in addition, that uniform guidelines for application to other projects may be developed, if needed, after additional experience with the system has been gained on the significant projects. DOE officials told us that other projects could benefit from the application of system concepts, but that voluntary adoption has been minimal.

Even on solar projects where project management system implementation has been required, it has been delayed. Of the seven solar projects required to be managed under the system, project charters and project plans have not been approved on four projects. Implementation on one project--the Biomass Thermochemical Gasification Experimental Facility--has been delayed by uncertainties over the project's ultimate scope and technical approach. On another--the Small Community Applications Experiment--delays in achieving project decentralization slowed the establishment of a formal management structure. The other two projects--Shenandoah and the Solar Energy Research Institute Facility--have charters and program plans that are under review within DOE.

The Shenandoah project has been actively underway since mid-1977. A project plan and project charter were not prepared until September 1979, a point by which over \$9 million (about 70 percent of the original total cost estimate), had been obligated. Even at that time these required planning documents were only in draft form. The project plan was ultimately approved in March 1980. Moreover, as a result of the reductions in the project's scope and funding availability problems this plan is being revised. As of September 1980 the revisions had not been approved. The project charter, as of September 1980, was still being revised and had not been approved.

said they did not rely on UCRS as a monitoring tool, and one manager even suggested that UCRS be terminated.

#### WEAKNESSES IN CONTROLS OVER PROJECT SELECTIONS

Certain solar R&D project management difficulties now being experienced could have been reduced with improved controls over project selections. Solar projects are the principal efforts undertaken within the solar program to achieve program objectives. In the solar program, however, we found that the overriding basis for selecting some projects was not that project's potential contribution to the program. Instead, these projects were undertaken primarily to satisfy parochial needs and interests. Because of various management restrictions that have been applied on these projects, project control and hence effective project management have been inherently more difficult to achieve. We believe project selections made on this basis could be minimized if multiyear program plans were developed, finalized, and implemented, and if DOE's regulations governing unsolicited procurements were complied with more strictly.

#### Nonprogrammatic project selections

Of the six projects we reviewed, three projects--NMJC, MCCC, and Crosbyton--resulted from unsolicited proposals and were selected primarily in response to expressions of interest from local and congressional supporters. In each case, grantee and community needs and desires, rather than programmatic requirements, dominated the project initiation process. None of the three projects was conceptualized within DOE as an element of goal-oriented programmatic activities.

While the selection of the MCCC and Crosbyton projects was substantially influenced by external rather than programmatic considerations, the NMJC project probably presents the clearest example of this situation. In this case, during the spring of 1977, school officials began seeking an alternative energy source for their campus after natural gas curtailments forced periodic school closings the previous winter. As part of their effort, NMJC officials learned that Federal solar R&D funds had been provided to MCCC to meet its needs and, therefore, decided to seek funds for themselves. Accordingly, NMJC contracted with the technical firm used to prepare MCCC's successful proposal, prepared an unsolicited proposal of its own, and in August 1977 submitted the proposal to ERDA.

ERDA subsequently rejected the proposal because it proposed little technology that was not already being developed

## Project management restrictions

On the projects we identified where nonprogrammatic considerations dominated the selection process, management control restrictions were established at the projects' outset which reduced the potential effectiveness of project management. For example, two of the projects--NMJC and MCCC--were funded through grants and were exempted from detailed DOE management and direction. On the other project--Crosbyton--informal working relationships established during the selection process substantially reduced the role of the formal DOE project management hierarchy. The control problems experienced on these projects are discussed below.

### MCCC and NMJC grants

The MCCC and NMJC projects were funded through grants. As spelled out in 41 U.S.C. 504, the grant instrument is to be used by the Government whenever the principal purpose of a relationship is to transfer funds without expectation of direct benefit, and when no substantial involvement is anticipated between the Federal agency and the grantee during performance of the contemplated activity. In choosing the grant instrument to fund the projects, DOE relinquished control over the projects' expenditures and activities even before work actually began.

Our review disclosed that the decisions to fund these projects through grants were integrally related to the manner in which the projects were selected. The official project approval documents point out that the grant arrangements were chosen to maximize community involvement in the projects and limit the Government's involvement. On the NMJC grant, the justification further stated that because it was completely the college's proposal, it would be inappropriate for the Government to retain project direction authority. Officials told us, however, that the decisions to fund the MCCC and NMJC projects through grants were made in large measure because the projects had strong local and congressional support, and because DOE wanted a hands off management approach to limit the Government's responsibility if the projects failed or large cost overruns were experienced.

DOE was therefore strongly committed to a passive management approach on these projects. Officials stressed that DOE's project involvement in a grant arrangement is limited to assisting and monitoring. It has no directive powers.

We found that the lack of directive powers prevented DOE from exercising effective control over project expenditures

accounting system, most of the costs charged to that contract lacked adequate documentary support. It also determined that the grantee had made an approximate \$100,000 overpayment to the contractor. As a result of these and other irregularities identified, DCAA turned over its audit findings to the Department of Justice for investigation of possible fraud. The grantee contends the DCAA report contains numerous errors and that DCAA's actions in turning over their findings to the Justice Department were highly suspect.

#### Crosbyton project

We also found weakened DOE management controls on a project carried out by contract. The Crosbyton project, established through an unsolicited proposal, has been difficult for DOE to closely manage as a result of conditions established when the project was selected. While obligated to submit to more stringent management controls than required by grantees, the contractor on the Crosbyton project has been able to resist project control by DOE's field office.

From the project's outset, DOE has been unable to exercise close management control. Field managers told us that, as a general rule, less control can be achieved over projects initiated through unsolicited proposals. Our contacts with the contractor on this project support this observation. A contractor representative told us that when the Government does not have personnel competent and knowledgeable in the technology, (as he stated has occurred on this project), the Government should accept the contractor's technical project judgments. Accordingly, under these circumstances he believed it was his role to advise the Government on what should be done on the project rather than vice versa. In our view, DOE has the responsibility to exercise project control to protect the Government's interests. Nonetheless, the contractor has rejected several DOE steps to strengthen management controls as set forth below.

In an effort to improve its management control over the project, the DOE field office that has been assigned the responsibility for managing the project solicited technical monitoring assistance from Sandia Laboratories. In this capacity, Sandia requested the contractor to maintain management control documents known as Program Evaluation and Review Technique (PERT) charts. According to field office managers, the contractor has resisted these efforts. A contractor representative told us he has no contractual relationship with Sandia and hence is not obligated in any way to follow its directives. He also said the contractor regards Sandia as a competitor in the solar field. Accordingly, the contractor has refused to accept Sandia's role on the project and

In addition, we found that DOE has no overall solar program plan that ties together its multi-faceted solar activities into a goal-directed package. As we pointed out in a previous report, 1/ an overall plan is necessary to provide greater assurance that the President's goal of providing 20 percent of the Nation's energy needs from solar energy by the year 2000 will be attained.

Officials we spoke with attributed the delays in developing program plans to top management turnover and frequent reorganizations. In this connection, solar program responsibility since 1974 has moved from the National Science Foundation, to ERDA, to DOE. Within DOE several reorganizations have occurred which changed the solar program organization. In addition, there has been rapid turnover of the assistant secretary position primarily responsible for the solar R&D program. Since DOE's creation in October 1977, six different individuals have served in that position in an acting or confirmed capacity. Officials told us that establishing program plans in this turbulent atmosphere has proved difficult.

Lacking finalized multiyear program plans, there is considerably more likelihood that projects will be selected that do not directly and significantly contribute to program objectives. DOE project managers told us that such projects have proved more difficult to control and are also potentially damaging to projects that have been systematically linked to program objectives. When funds are diverted to undertake nonprogrammatically based projects, they diminish funding available for other projects.

Need for better compliance  
with regulations for approving  
unsolicited proposals

Tighter enforcement by DOE of its regulations relating to unsolicited proposals could also improve project selection controls. Externally initiated projects typically come to DOE in the form of unsolicited proposals. To control the approval of such proposals, DOE's regulations require that unsolicited proposals be evaluated in a fair and objective manner. Our review of photovoltaics and solar thermal projects, however, showed that some projects have been approved either without such evaluations, or in spite of evaluations that called into question the technical merits of the proposals. DOE's Office of Inspector General presented similar

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1/"20-Percent Solar Energy Goal--Is There a Plan to Attain It?" (EMD-80-64, Mar. 31, 1980).

On the MCCC and Crosbyton projects, technical evaluations were conducted. These evaluations, however, included a number of unfavorable comments, including those concerning technical deficiencies in the proposals. In spite of these comments, DOE approved the proposals and provided funding.

The results contained in DOE's Inspector General report on biomass projects closely parallel our findings with regard to the lack of adequate evaluation of unsolicited proposals. The report identified the need for DOE to "formulate and implement a system for conducting fair and objective evaluations of unsolicited proposals and to ensure that such evaluations are a key consideration in deciding whether or not to fund a particular project." This need was based on the report's identification of (1) biomass projects funded without evaluation or after receiving unfavorable reviews, (2) the failure of biomass program managers to follow objective procedures in obtaining evaluations, and (3) the failure to comply with procurement regulations regarding the proper justification for funding projects.

In commenting on this issue, DOE agreed with the need for stricter enforcement of its unsolicited proposal regulations and said its Procurement Directorate is increasing its scrutiny of non-competitive procurement justifications.

#### WEAKNESSES IN PROJECT ADMINISTRATION

Our review also disclosed weaknesses in DOE's solar R&D project administration. We noted that effective project administration has been hampered by weak DOE contractor monitoring and delays caused by DOE's incremental approach to project funding. Strengthened project monitoring and greater use of long-range funding arrangements could help ameliorate the difficulties currently being experienced on DOE's solar R&D projects.

#### Need for strengthened DOE project monitoring

An important function of project managers is to closely monitor project activities to ensure that projects are carried out in accordance with established baselines. As we pointed out in a previous section, effective project management and monitoring have been inhibited by restrictions imposed during the project selection process. While three of the six projects we analyzed were hamstrung by such conditions, three were not. On two of these latter three projects, however, we found that DOE's project monitoring and control were ineffective.

report, we found that previous contractor progress reports showed a pattern of overruns in its design manpower estimates. Project managers agree that closer monitoring of these reports could have indicated problems on the horizon and enabled corrective action to be taken before large cost overruns were experienced. DOE's technical project manager stated that, in retrospect, the project's design should have been "frozen" at an earlier date. Because the project's design was allowed to evolve, the contractor spent additional manpower and money seeking marginal design improvements. Project managers told us that closer monitoring did not occur because the field office staff was spread too thin and had responsibility for managing too many projects. In this connection, field office officials told us that 5 project managers were responsible for managing 67 projects.

Need for greater use of  
long-term project funding  
commitments

The manner in which DOE funds solar projects has also hampered its ability to carry out projects within established baselines. All of the projects we reviewed were multiyear projects, yet in three cases funding decisions were made on an incremental basis without any multiyear spending commitment. In the absence of such a commitment, there is no assurance that the funds necessary to complete the project within its established schedule will be available when required. Project stability and continuity can therefore be seriously impaired. On two projects, Shenandoah and NBNM, problems associated with funding availability materially contributed to the schedule slippages and cost overruns experienced.

Funding availability problems extended the Shenandoah project's completion date by almost 1 year and resulted in corresponding cost increases of more than \$4 million. During the preparation of funding plans for the project's definitive design, project officials proposed a fiscal year 1979 funding request of \$9.2 million that would enable project completion by July 1980. Headquarters solar program managers, while not questioning the validity of the project's total cost estimate, determined that only \$6.5 million would be available in fiscal year 1979. Based on this fiscal year 1979 funding availability, project officials prepared another design proposal and estimated project completion by March 1981. However, after this estimate was prepared, headquarters program managers notified field office project managers that only \$3.7 million would be available. This required the prime contractor to prepare another design proposal which stretched out the project's completion date to February 1982 and, as a result

## CHAPTER 5

### CONCLUSIONS, RECOMMENDATIONS, AND

### MATTERS FOR CONSIDERATION BY THE CONGRESS

#### CONCLUSIONS

Dependence on increasingly expensive and potentially unreliable supplies of imported oil exacts a heavy penalty on the Nation's economy and presents serious implications for the national security. In recognition of these problems, the Nation is making a growing commitment to developing solar energy. The President has established a goal of having 20 percent of the Nation's total energy needs met by solar energy by the year 2000.

Currently, however, solar energy is only making a small contribution toward meeting national energy needs. For solar energy to meet its expected contribution, technology must advance and costs must come down. While certain solar technologies are at or near economic competitiveness, most will require aggressive R&D efforts to become cost-effective and gain acceptance.

In this context, an effective Federal solar R&D program is essential. Research projects need to be systematically selected in accordance with a well-defined strategy designed to attain clearly defined and measurable program goals. Once undertaken, projects need to be closely managed to ensure that each project fulfills its planned role in implementing that strategy.

Our review of DOE's solar energy R&D project management showed that despite DOE's efforts to improve its project management system, significant problems remain. Although not entirely attributable to management weaknesses, we found that five of the six projects we reviewed were not meeting their cost goals and none were meeting their schedule goals. Also, project scopes were often being reduced to minimize these problems.

To improve DOE's solar R&D project management several steps need to be taken. Concerning project selections, controls over the selection process need to be strengthened. We found that the primary basis for selecting some solar R&D projects has been the desire to satisfy external needs and interests rather than on a determination of the projects' potential contribution to achieving program objectives and advancing solar technology. In addition to increasing the likelihood that solar R&D funds will be spent on efforts that have lesser technical merit and that less than an optimum use of solar funds will be achieved, projects selected



scheduled activities. Accordingly, project planning is hampered and project stability can be seriously impaired. On two of the projects we reviewed, less than anticipated funding was made available at critical points in the projects' schedules. These funding problems contributed to the schedule slippages and cost overruns that were experienced. We believe early project funding commitments, with periodic reexaminations to confirm the continuing merits of the project, could help resolve the problem.

RECOMMENDATIONS TO THE  
SECRETARY OF ENERGY

To ensure solar projects are selected which more closely and directly contribute to the success of DOE's solar energy program, we recommend that the Secretary of Energy direct the solar program office to:

- Expediently develop, finalize, and implement multi-year program plans for the overall solar program and each solar technology. These plans should be linked in chain fashion toward achieving the President's overall goal of meeting 20 percent of the Nation's energy needs from solar resources by the year 2000. The plans for each technology should include specific and measurable goals and definitive strategies for achieving those goals. The goals and strategies developed should be clear enough to enable DOE to rationally assess a proposed project's contribution to the plan as part of its project selection deliberations.
- Once the multiyear program plans are finalized, prospective projects should then be justified in terms of their specific potential contribution to achieving the goals set forth. Further, ongoing projects should be evaluated to ensure that each is making a contribution toward achieving the plans' goals and that optimum use of available funds is being achieved. As part of this process, the justification for any additional funding for the NMJC project should be closely scrutinized in light of continuing questions being raised concerning the project's merit and value to the solar program. If it is determined that the funds being sought to extend this project could be better spent elsewhere, the request for project extension should be turned down.

periodic reexaminations to verify each project's merits. Within this context, we believe the Shenandoah project should be specifically reexamined to determine whether the reductions that have been made in the project's scope need to be restored for the project to merit continued funding. If the scope reductions are sustained, project termination, as recommended by field project managers, might be the most prudent course of action.

MATTERS FOR CONSIDERATION  
BY THE CONGRESS

Our recommendations to the Secretary of Energy are aimed at correcting a number of problems which are impeding the successful management of DOE's solar energy R&D projects. Among these recommendations, we are calling for DOE to develop, finalize, and implement multiyear program plans for both the overall solar program and for each solar technology.

We believe that to be most effective in this purpose, the plans should carry the highest level of review possible. In this connection, the Congress may wish to require DOE to submit its multiyear plans to the appropriate budgetary and oversight committees. Congressional consideration of these plans as part of the normal authorization and appropriations processes could help ensure that projects being selected are consistent with the achievement of the plans' objectives.

--the recommendation for congressional review of DOE's multiyear program plans would likely compound the problem of parochial expressions of interest affecting the project selection process.

In addition to these concerns, DOE expressed concern relative to certain specific statements and facts presented in the draft report. The complete text of DOE's comments is included as appendix II.

We are encouraged by DOE's response to our recommendations and believe timely adoption of these recommendations will enhance the success of DOE's solar program. We carefully considered DOE's concerns. We generally found DOE's principal concerns to have limited merit and accordingly did not make the suggested changes which would have altered the basic thrust of the report. We did, however, make a number of changes to reflect DOE's comments on specific statements and facts. A detailed discussion of DOE's principal concerns and our evaluation follows.

With respect to our discussion of cost increases and schedule slippages, DOE contended that the projects we reported on were experimental in nature and as such were subject to unexpected cost escalations and schedule slippages. DOE further stated that cost and schedule objectives are not necessarily the best criteria for judging project success and added that these objectives often cannot be confirmed until a project is complete and operational. In support of its viewpoint, DOE cited the Fort Hood project as providing valuable information to the solar thermal program even though the project was terminated after 4 years and a \$5 million investment.

We generally found these points to have limited validity. As we discussed in Chapter 2, one of the reasons DOE instituted its management improvement initiatives was to help reduce the occurrence of cost and schedule problems. These initiatives were to be applied to R&D projects DOE-wide. In addition, we noted that prior to a 1978 review of the Shenandoah project, one DOE program manager, while recognizing several factors complicating the project's ability to meet its cost and schedule objectives, nonetheless stated to the project manager that "\* \* \* cost increases and schedule slippages for any reasons are unacceptable." Thus, it seems evident that DOE's somewhat relaxed viewpoint concerning cost increases and schedule slippages is not necessarily shared by those having responsibilities for program management and for providing guidance to managers of individual R&D projects. We similarly do not share this viewpoint and, accordingly, continue to believe that a project's cost and schedule

Further, if DOE's arguments were to have any credibility then serious questions could be raised as to whether the projects are being systematically overdesigned at the outset.

With respect to our discussion of decentralized management, DOE stated that to the degree feasible, solar project management is decentralized to field organizations. However, under decentralized management, headquarters still retains the responsibility to oversee and integrate the management of numerous projects into a cohesive program. Accordingly, DOE said when weighing an individual project manager's recommendations on a particular project, the impact on the entire program must be considered. We do not dispute the role of headquarters in managing the overall solar program. However, DOE as a matter of policy has decided that projects can best be managed by field locations closer to the project activity. For this policy to result in improved project management, its implementation must be complete. Partial implementation, with headquarters managers frequently overriding field judgments, can result in conflicting signals to contractors, muddled lines of communication, and confusion as to who is actually in charge.

DOE further contended that the report almost entirely overlooked the point that DOE has insufficient staff to adequately manage the solar program. Although the draft report pointed out that insufficient staffing was cited to us as a cause of the ineffective project monitoring we observed, we did not assess the overall adequacy of DOE solar program staffing. Accordingly, we are not in a position to comment on the validity of this DOE contention. We believe, however, that with more complete implementation of decentralized management, staff needs at the headquarters level could be lessened.

Regarding our discussion of DOE's incremental funding practice as a cause of problems experienced on the projects we reviewed, DOE commented that this is an accepted funding practice for R&D programs. It stated that while DOE's intent is to provide uninterrupted funding to projects, it is not always possible to do so within the changing priorities of the Federal Government. As an example, DOE cited the rescission of \$22 million from previously appropriated fiscal year 1980 solar program funds. We recognize that multiyear funding commitments cannot be used in all cases. In several previous reports, however, we have commented on the potential for expanding the use of full funding for various Federal

of the report or the recommendations. We have, however, reflected DOE's statement on page 22 of the report.

- DOE disputed the original cost estimate cited in the report for the Shenandoah project. We continue to believe the figure cited is correct since it is the one DOE provided in its fiscal year 1979 budget submission to the Congress. We have nevertheless recognized DOE's comment on page 13.
- DOE commented that the schedule delay cited on the Five-Megawatt Solar Thermal Test Facility was insignificant. We have reflected DOE's comment on page 6 of the report.
- DOE contended the original cost estimate for the Coolidge project cited in the report did not reflect a contingency factor. We qualified the cost estimate on page 13 of the report to recognize DOE's contention.
- DOE disputed a statement included in the draft report concerning the possibility of an additional \$90,000 cost on the NMJC project. We confirmed the validity of DOE's position and deleted this statement from the final report.
- DOE disagreed with a statement in the draft report that thick masonry walls were deleted from the MCCC project. Instead, DOE said this project element was only reduced in scope. We verified the accuracy of DOE's statement and made the appropriate change on page 16 of the report.
- DOE disputed a statement in the draft report that the cadmium sulfide photovoltaics system was deleted from the NMJC project in an effort to reduce costs. Instead, it said the system was reduced because of procurement difficulties unrelated to efforts to reduce costs. After verifying the accuracy of DOE's contention, we deleted the statement from the final report.
- DOE contended the draft report failed to recognize that under a grant, DOE's role is only to monitor and advise grantees. We believe the report adequately sets forth the limitations of DOE's control under grants on page 25 of the report. We, therefore, did not change the report's presentation on this issue.

CONTRACTOR AND GRANTEE  
COMMENTS

The contractor representative on the Crosbyton project and grantee representatives on the NMJC and MCCC projects were requested to comment on those portions of our draft report dealing specifically with their individual projects. We made these requests because these parties could be adversely affected by the report. On the Crosbyton project, verbal comments were received. On the NMJC and MCCC projects, verbal comments, followed by written confirmations, were received. The full texts of these written confirmations are included as appendixes III and IV.

For the most part, these comments addressed specific statements and facts presented in the report. As shown below, changes have been made in the body of the report to reflect these comments.

On the NMJC project, the major point made by NMJC was that the report should reflect its opinion that the project was knowingly and substantially underfunded by DOE at the outset. NMJC requested that a Government cost evaluation which estimated that project costs would be well above the grant award be included in the report. Relatedly, it stated that inordinately low Government cost estimates for one element of the project--the solar pond heat-pump system--led to the elimination of that element from the project scope. We have added statements on page 17 to reflect these comments.

NMJC also commented on the report's discussion of NMJC efforts to address criticisms of the project by DOE's project advisory group. It said the criticisms made by one member of the advisory group were inaccurate. A statement has been added to page 19 of the report to recognize NMJC's comment.

Concerning our discussion of various non-solar elements included in the project scope, NMJC contended that those elements were included by DOE, not NMJC. NMJC's position is included on page 24.

Finally, in commenting on our discussion of the use of project funds for NMJC overhead and irregularities concerning letter of credit withdrawals, NMJC stated that it had no reason to believe its actions were improper. It stated that once the problems were identified it took actions to reconcile them. This position is reflected on page 26 of the final report.

MCCC also had several comments on specific aspects of the report. First, MCCC stated that the decision to delete the

In addition to the specific comments, Crosbyton and MCCC project officials expressed concern over the draft's tenor. Crosbyton officials believed the draft report implied that selecting projects from unsolicited proposals was necessarily a bad idea. MCCC expressed the view that the draft unduly criticized the use of grants and inappropriately suggested that tighter Government management controls would improve project results. Each of these concerns is discussed below.

Crosbyton officials believe the draft represented a blanket indictment of the unsolicited proposal process. They recognized that the solar program has in a number of cases funded marginal quality proposals and that such practice is rightly criticized and should be stopped. However, they believed that in other instances, such as in their own project, DOE's program can be improved with the infusion of new ideas. They believed our draft did not adequately provide for this possibility and feared it could result in foreclosing any possibility for non-Government proposers to have their ideas objectively considered and ultimately funded.

Our intent in this report is not to close the door on the funding of unsolicited proposals. Certainly a medium for introducing new thinking into programs designed to develop new technologies is important. Providing the opportunity to technically explore the value of a potentially innovative approach through unsolicited proposals can be very beneficial to research programs. Many good ideas have been developed by pursuing such proposals. However, when such proposals are approved primarily for reasons other than their perceived technical merit, the danger of having less than an optimum use of available funds is increased. As we stated previously stricter enforcement of unsolicited proposal regulations should help safeguard against the approval of marginal projects.

MCCC expressed concern that our draft report criticized the use of grants and called for tighter Government controls over solar projects in the face of evidence that it believed could result in an opposite conclusion. It believed that the project results we reported showed that projects managed through grants and hence "taken out of the bureaucratic arena and placed in the hands of the private sector" achieved better cost results than those projects managed by DOE.

We do not intend in this report to cast a blanket indictment over the use of grants as a tool for conducting research programs. In some cases, new thinking, particularly in the area of basic research, can be better developed outside the confines of close governmental supervision and

DESCRIPTIONS OF PROJECTS REVIEWEDPHOTOVOLTAICSNorthwest Mississippi Junior College (NMJC),  
Senatobia, Mississippi

In response to an unsolicited proposal, the NMJC project was funded in December 1978 through a DOE grant to the Senatobia, Mississippi school. In a four-phase progression, the project is designed to ultimately supply all the electric and heating needs of the college. As currently designed, this energy will be supplied by employing photovoltaic systems, wood burning boilers, and a solar assisted heat pump. The photovoltaics portion of the project is planned to include four types of photovoltaic cells. These cells are planned to be used in a side-by-side manner so that the comparative performance of each cell type can be measured.

To date only two of the project's four total phases have been approved. These two phases are currently scheduled for completion in January 1981 at a total cost of \$7.7 million. The grantee has submitted a request for \$14 million to extend the project through the last two phases. DOE is now considering the request.

Mississippi County Community College (MCCC),  
Blytheville, Arkansas

Initially funded in August 1977, the objective of the MCCC project is also to meet the total electric and heating requirements of a college facility. Like the NMJC project, DOE funded the MCCC project through a grant to the local community college in response to an unsolicited proposal. The primary energy system feature of this project is the photovoltaic concentrating collector design.

As of September 1980, the project design had been completed and construction was nearing completion. The project schedule calls for the project to be completed by January 1981. The DOE funding through completion of the facility's construction is expected to total \$6.8 million. In response to an additional unsolicited proposal, DOE has agreed to provide an additional \$1 million to MCCC to operate the facility over a period of about 5 years.



Crosbyton Solar Power Project,  
Crosbyton, Texas

This project, undertaken in response to an unsolicited proposal in September 1976, is designed to develop and demonstrate a different kind of solar thermal technology. Most solar thermal systems use mirrors that follow the sun's position during the day and reflect the sun's heat to a fixed receiver. The technology used on the Crosbyton project reverses this approach. On this project, the mirrors are fixed and the receiver moves to follow the sun's moving reflection.

The ultimate objective of the project is to develop a five-megawatt electrical powerplant for the City of Crosbyton, Texas. As of September 1980 only the first of the project's two phases had been contracted. The phase one objectives are to construct a small-scale prototype of the larger system and develop a test module that will collect performance data needed to assess the technology's potential. The prototype system has been constructed and data is now being collected. Phase two, consisting of the final design and construction of the five-megawatt plant, will be contingent on favorable test and evaluation results from phase one. The DOE project manager told us that testing should be completed in early 1981. Project costs to date, through completion of phase one construction, are \$4.8 million. If phase two is funded, total project costs could reach about \$25 million.

Coolidge Deep Well Experiment,  
Coolidge, Arizona

This project, undertaken in response to requests by the State of Arizona for assistance in developing solar powered irrigation, was initiated in September 1977. The Coolidge project consists of the design, construction, and operation of a 150-kilowatt solar powered deep well irrigation facility. It uses a field of trough-shaped collectors to capture the sun's heat, and then converts that heat to electricity for powering three deep well irrigation pumps.

The facility's construction has been completed and the system began operating in November 1979. The total project cost was \$5.5 million.

This does not suggest that the solar development program should be a completely open loop effort, devoid of good management practice and firm goals or milestones. Project cost and schedule is a real concern to DOE management. However, the developmental nature of solar experiments is the major cause of the apparent cost increases and schedule slips cited by the report. Final designs are not generally available at the time of project initiation and cost and schedules are projected on the basis of the best available data. These costs often cannot be confirmed until a project is complete and operational. Changes in project scope usually reflect effective management practice to control costs and schedules and permit necessary technical changes, rather than the ineffective management that the report suggests.

Improving project management and control has been one of the major objectives of the solar program. The ability to monitor and control projects is largely dependent on the establishment of management systems and sufficient personnel to adequately monitor the program. Unfortunately, the report almost totally overlooks one of the major problems which has hindered the solar program offices: The lack of a DOE staff large enough to adequately handle the ever growing solar energy program.

The Office of Conservation and Solar Energy does not believe that all solar research and development projects should be required to comply with the Program and Project Management System (PPMS) requirements (draft DOE Order 5700.3) without close scrutiny on a case by case basis as to the expected benefits. For projects where PPMS is not implemented it should be used as a guideline for project management. The establishment of the Planning, Programming and Budgeting System (PPBS) within DOE is also expected to strengthen program management and control. Furthermore, since 1977 multi-year plans have been developed for the photovoltaic and solar thermal programs, the major subjects of this report. Projects that do not meet planned objectives are not funded. Annual Operating Plans and Solar Objectives documents covering all programs are also prepared. These documents are reviewed and tracked by higher management to ensure that activities and milestones are accomplished as planned. DOE agrees with the establishment of overall program goals, the development of budget submissions based on the PPBS system and multi-year plans and the measurement of progress against these goals.

The report makes comments on two additional solar projects: Coolidge and the 5MW test facility. Although it was necessary to reduce the collector field size on the Coolidge project, this project is meeting its objectives and providing all required data. The 5MW test facility was completed within cost, although with fewer heliostats than originally planned. However, as built it has proved capable of meeting our central receiver testing needs and has met its original objectives.

To the degree feasible, solar project management is decentralized to field organizations. However, the HQ program office is required to oversee and integrate the management of numerous projects at different field locations. The Headquarters program manager is responsible for integrating project management into the context of overall program management and must make decisions based on the needs of an ongoing program, not just a single project. For example when field organizations request additional funds to cover an overrun, impacts on all projects must be evaluated. Even when the HQ program office concurs with the field recommendation, there are other factors that must be considered in determining corrective action and these decisions should appropriately be made at the HQ level.

The GAO report criticizes the DOE practice of incrementally funding a project rather than fully funding the project when initiated. When a project is initiated, total cost is estimated and a multi-year funding plan is established. Key decision points are also identified for the continuance of the project into each succeeding phase. Within this framework incremental funding is an accepted practice for R&D programs. Research and development program funding is appropriated on an annual basis as part of the federal budget process. Although it is our intent to provide uninterrupted funding to each project it is not always possible to do so within the changing priorities of the Federal Government. In some instances, such as FY 1980, the Congress has rescinded funds previously appropriated (\$22.0M withdrawn and \$8.0M deferred) and created a major adjustment problem within the solar program that affected on-going projects. In the development of outyear budgets, projects that are incrementally funded receive priority over new starts if the project is worthy of continued support.

COMMENTS TO DRAFT GAO REPORT - "MANAGEMENT IMPROVEMENTS NEEDED  
TO CURTAIL PERFORMANCE PROBLEMS ON SOLAR PROJECTS"

Page 6 - The reduction in the amount of heliostats at the CRTF did not significantly affect the nominal power rating of 5MW. The deletion of heliostats necessitated that south (or circular) field heliostats be omitted (foundations and power and control circuits are provided). For experiments requiring illumination from a circular field, some of the far north heliostats would have to be moved. This will be an operating inconvenience, but nonetheless, the capability to test experiments requiring a circular heliostat field is provided. Regarding the overall project, none of the originally envisioned facility capabilities were eliminated or significantly reduced in maintaining the \$21.25 million total estimated cost.

Page 6 - The six month delay is considered insignificant in light of some of the construction problems which occurred and were beyond the control of the Government. The bankruptcy of the original structural steel supplier which caused a four month delay is the most notable uncontrollable construction delay.

Page 13, Table of Project Costs - The \$13.5 million estimate shown for Shenandoah did not include escalation or contingency. Also, considerable new work was added to the contract. R&D activities such as parabolic dishes, higher temperature heat transfer fluids and trickle oil storage systems were undertaken as part of the Shenandoah projects. Flexibility in the scope of work must be allowed to accommodate for unknowns inherent in R&D work. The increases in design costs are attributable in most part to these R&D related scope changes. The \$4.3 million cost for the Coolidge project does not include the 15 percent contingency of \$650,000 which brings the total estimated cost up to \$4.95 million compared to the current estimate at \$5.5 million or only \$500,000 (10%) over the original total estimated cost.

[See GAO note 2, p. 62.]

suggest ways to remedy the situation. It should not have been distributed outside the DOE project review team. The grantee, however, interpreted the memorandum as an order to perform certain tasks before proceeding with certain parts of the project. In order to prevent future misinterpretations, ORO instructed the project review team that all correspondence to the grantee would initiate from the DOE project manager's office.

Pg. 19 - Also in relation to NMJC, the GAO report incorrectly states that DOE removed a member of the DOE project review team from participating in the project in keeping with a "hands off management approach". In reality, the contractor employee in question was refrained from participating in the photovoltaic portion of the project because of a potential conflict of interest. [See GAO note 4, p. 62.]

Pg. 26 - The GAO report states that "the most glaring example of the effect of DOE's passive management on this (the MCCC) project was its inability to prevent the use of grant funds to pursue the use of an experimental battery system". This statement is not correct as the battery storage system was part of the original proposal funded by DOE. At the outset DOE realized the battery storage element of the project was developmental in nature and subject to all the uncertainties of such an effort. Although the battery developer could not produce a battery with the necessary efficiencies and reliability to fulfill the MCCC's requirement in time to be of use to the school, DOE was interested enough in the concept to enter into a prime contract with the battery developer for further development of this energy storage system.

Pg. 27, "Crosbyton Project" - The technical performance of Texas Tech University (TTU) has been very good. Having predicted a peak system efficiency of 65 percent, the system actually achieved a 63 percent peak efficiency at rated conditions. The contractor is aware that private industry in lieu of a university must take a lead role in commercializing this technology. The Government's control of this project has never been passive or weak.

Pg. 30 - The GAO report indicates a \$400,000 difference between the official grant amount authorized (\$7.3M) and the actual amount awarded (\$7.7M). GAO stated that no justification could be found for the additional \$400,000. We wish to point out that ORO received from DOE Headquarters a procurement request and appropriate justification for the \$7.7M amount. [See GAO note 4, p. 62.]

Pg. 51 - MCCC's proposal for \$2.8M to operate the facility over the next five years will be supported by DOE at a reduced level of \$1 Million.



**NORTHWEST MISSISSIPPI JUNIOR COLLEGE**  
Senatobia, Mississippi 38668

October 14, 1980

Office of the  
PRESIDENT

Mr. Bob Robinson  
United States General Accounting Office  
Room 5117  
441 G St. N.W.  
Washington, D. C. 20001

Dear Mr. Robinson:

I would like to make the following responses in regard to the audit report received in my office October 13, 1980:

The initial oversight stems from the fact that DOE (Oak Ridge Operations Office) independent cost estimate indicated that Phases I and II would cost in excess of \$11 million but funded these phases at the level of \$7.7 million. Northwest requests that this government cost evaluation be included in the GAO Report to give an unbiased opinion of the difficulties under which this program has operated and the magnitude of the program's accomplishments. [See GAO note, p. 64.]

With reference to page 17 the cost data for the solar pond provided by DOE Lawrence Livermore Laboratory was used in developing the projected cost estimates. Unfortunately, the magnitude of the costs for relocating the football field together with solar pond bids that were three to five times the LRL estimates have resulted in the elimination of the solar pond from Phases I and II.

With regard to page 19, it is the opinion of Northwest Mississippi Junior College that certain of the criticisms contained in the JPL memorandum were inaccurate and did not agree with project work statement requirements. As a result, Northwest protested these remarks.

With reference to pages 23 and 24, the actual project concept, as funded, reflected the "suggestions" made by Dr. Henry Marvin, the former director of DOE's solar R & D program. In spite of misgivings on the part of Northwest, DOE directed the inclusion of a solar pond, individual heat pump units, etc. The final configuration including the multiple photovoltaic systems and the wood burning system was DOE's rather than Northwest's configuration. Northwest simply followed DOE "suggestions" in order to rescue project approval.

The remark, as stated on page 25, that "decisions to fund the NWMJC projects through grants were made in large measure because the projects had strong local and congressional support, and because DOE wanted a hands off management approach



# MISSISSIPPI COUNTY COMMUNITY COLLEGE

BLYTHEVILLE, ARKANSAS 72315

Phone (501) 762-1020

October 21, 1980

Office of the President

Mr. Bob Robinson  
U.S. General Accounting Office  
A2-2200 Century XXI  
c/o Department of Energy  
Washington, D.C. 20545

Dear Mr. Robinson:

I received by express mail a copy of Mississippi County Community College Excerpts of Solar Projects Report - a draft of a proposed report prepared by the staff of the U.S. General Accounting Office. In your interoffice transmittal slip, you asked that I review this draft and be prepared to make any comments concerning it.

I will, of course, respond this afternoon to your telephone call; however, I felt that it would be appropriate to reiterate these comments in the form of a letter to you. First, I would make a general comment concerning the tenor of the report. I interpret that the General Accounting Office is not happy with the efforts of the Department of Energy in its R&D performance over the past few years. Further, I glean that the General Accounting Office highly disapproved of DOE's procedure in awarding grants instead of maintaining strict control over all of its major projects. I call your attention to the data reported in the first part of your report. Those projects which have been awarded as grants are the only ones without major overruns. Further, I would invite you personally to visit the site of Mississippi County Community College. In my opinion, this is the most intricate and complicated of all the projects underway, and it will finish within the next several weeks - in budget. You have explained the reasons for the time slippage. I submit that as adequate evidence.

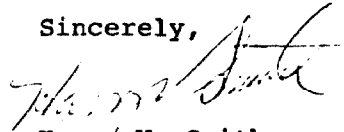
I personally do not appreciate being swept under the same rug with other projects. Again, I invite you to visit the site and see for yourself the results of a project

Final judgment in any case investigated by auditors does not lie in the hands of the auditors. Your statements imply that it does. In the opinion of the DCAA, the accounting system was inadequate, overpayment was made, and all payments should have been disapproved or suspended. In the opinion of the Project Manager, and as far as I know, some members of the staff at Oak Ridge agree, DCAA made obvious errors in its audit opinion. I suggest that you request from the DCAA auditors located in Chapel Hill, North Carolina, a copy of the letter from the Project Manager concerning their audit. Then you may draw your own conclusions.

In my opinion, the action on the part of DCAA is highly suspect. For example, they refused to even check the facts concerning a contract extension. Further, they turned over to the Department of Justice their report without substantiation of its findings, without notification to the Project Manager, and without giving the Project Manager an opportunity to reply beforehand.

It is the responsibility of the Project Manager to manipulate funds and schedule, and to some extent scope (with the concurrence of the DOE monitors), in order to meet the objectives of the project. I submit to you that the Mississippi County Community College project is succeeding in meeting its objectives. Before you print, I suggest you visit.

Sincerely,



Harry V. Smith  
President

HVS:lc

- GAO note 1: The project site was visited by GAO staff during our review.
- GAO note 2: This page reference has been changed to reflect location in the final report.
- GAO note 3: The statement referenced in this comment has been deleted from the final report.

(307182)



