PD-AAW-872

INFORMATION MEMORANDUM FOR THE ACTING SENIOR ASSISTANT ADMINISTRATOR, S&T

THRU: Acting DAA/S&T, Bernard Chappick DATE: August 28, 1981

FROM: S&T/EY, Alan B. Jacobs
S&T/ED, David Sprague

SUBJECT: Recommended S&T Support of Photovoltaic Power for Rural Satellite Project

Summary: This memo presents our views on the appropriateness of photovoltaic technology for the Rural Satellite Program (RSP) and our intention to fund jointly: (1) the initial design and prototype development of a suitable system and (2) the replication of that system in the RSP. No new fundings is needed for step (1), rather the existing funding and project authority of the Photovoltaic Development and Support Program would be used. The RSP would fund the replication, Step (2) in FY 82. The following points are made in the memo:

- Present cost figures for photovoltaic power for RSP are considerably lower than has been estimated, making PV cost-competitive.
- Success in using PV energy would help to overcome barriers to adoption of the satellite technology.
- Proposed action would be in concert with AID strategy of assisting the private sector to penetrate overseas markets for development applications.
- Action would underscore our determination to use life-cycle costs in planning projects.
- Transfer of advanced renewable energy would be promoted.
- Existing authority not yet subobligated is available.
- Early budget cuts in RSP caused elimination of hardward R&D; consequently, RSP would be hard-pressed to pick up total PV cost, including prototype system.

Proposed Action: It is proposed that $200,000 of funding authority currently available in the existing PASA with NASA but not yet subobligated, be applied to the procurement and deployment of one PV power system for remote earth stations as part of the AID Rural Satellite Program. In FY 82, S&T/ED will arrange to finance the procurement of the first replication. Your concurrence is requested.

Discussion: With reference to your comments on photovoltaic (PV) power for remote earth stations (memo of July 20, 1981, copy attached), we offer the following:

First, a clarification is in order regarding the proposed cost of a PV power system for an earth station given in S&T/EY's memo of July 9, 1981 (copy attached). The value you quoted, $240,000 per PV system, was actually meant to cover two earth stations; hence, the unit cost per PV system was to have been $120,000. We regret that the memo was not clear in that regard.

Recent information appears to have improved the economics for this application owing to two factors. First, the power requirements for the earth stations have decreased due to the anticipated use of higher efficiency equipment and the use of voice-actuated transmitters. These changes were made by Teleconsult, the A.I.D. contractor for the Rural Satellite Program, upon continued pressure from RSP staff to find ways to lower power requirements, an effort which benefitted greatly from the strong involvement of the NASA/Lewis Research Center personnel. This reduced the daily energy requirement from 7200 to 5400 watt-hours per day with a corresponding reduction in PV array from 4 to 2.6kW (peak). Second, recent bids for the PV health applications indicate lower than expected PV module prices and significant cost-sharing by industry (and a five-year warranty on the system). A cost breakdown for a typical PV power system for earth station applications is given in Annex A based on these recent quotes.

The combined effect of the reduced power requirements and the recent lower price quotes reduces the recurring cost of a PV powered station to $82,000 including shipping, installation and monitoring provisions (compared to the previous $120,000 estimates). Without the monitoring, needed only to document the demonstrations, the cost is further reduced to about $70,000. (These figures assume that all components and services are from U.S. sources.) For comparison, Teleconsult's recent estimate of the cost of fuel alone for a diesel-powered earth station in the Philippines (Palawan Island) was about $23,000 per year. For the scaled-down electrical requirements under consideration, calculations given in Annex B indicate a total operating cost of about $12,000 per year for the diesel generators. (This does not include the capital cost of the equipment.) On the other hand, even with its high first cost, the PV system offers an "annualized" cost of about $11,000 assuming a 20 year life and 15% discount rate ($14,000 if a 10 year life is assumed). Furthermore, the capital cost of the PV system could conceivably be reduced from $70,000 to about $51,000 (see Annex C) if the host country were to use indigenous materials for structure, fencing, etc. and local labor for installation. (The latter is quite realistic based on our experience at Tangaye, Upper Volta.) It therefore appears that PV systems are <u>at least competitive</u> today for remote applications requiring relatively small amounts of power.

If industry continues its trend of reducing prices through automation and improved processing techniques, future replication costs could be as low as $35,000 within three to five years (Annex C). Many industry sources claim this is already possible assuming sufficient production volume by virtue of the "learning curve" effect and economies of scale. The cost of diesel electricity, on the other hand, will no doubt continue to increase.

It is important to note that potential users are still unsure as to the economic viability of PV systems and are reluctant to purchase these systems because of their high first cost. The U.S. PV industry, while clearly ahead of other industrialized countries in terms of technology, has been behind them in packaging and marketing complete systems. (Reference: Financial Times, "World Solar Markets,"London, March 1981). Recent communication with potential suppliers such as Motorola and Arco Solar indicate that they perceive this application as a large future market and would welcome participation with the U.S. Government through funding of cost-shared pilot projects to enable them to penetrate this market sector. With our present emphasis on private sector support, it appears that this is an area meriting further consideration.

The provision of a photovoltaic power supply is not included in the current planning for the A.I.D. Rural Satellite Program. However, we strongly endorse the use of photovoltaic technology in this Program and believe that this inter-office collaboration will be mutually beneficial. A joint effort under which S&T/EY supports the initial design and deployment of the prototype system and S&T/ED supports the recurring costs for the first replication would appear to be an appropriate approach. S&T/EY would demonstrate that the equipment is available and proven and S&T/ED would finance the purchase of an operational system for use in its program.

While no hardware support of prototype demonstrations is provided in the redirected PV project, NASA-LeRC has informed us that there are approximately $250,000 of funds available from the original $2,500,000 authorization. This is due to the lower than expected bids for the PV medical clinic applications. These funds were earmarked for hardware purchases and contracted monitoring services from the private sector

Based on our best estimates at this time, it appears that the $250,000 would cover both the nonrecurring cost (for design and development) and the recurring cost for the deployment of PV systems for two earth stations, assuming industry cost sharing is included. It is recognized that NASA personnel would have to provide installation, training, monitoring and reporting in this instance since funding available for the contracting effort is limited.

The long-term implications for the development of rural telecommunications are very significant. Supplying diesel fuel is one of the biggest constraints to the operation of networks in remote rural locations. It is for that reason that this collaborative effort was designed over a year ago. Since early budget cuts in the satellite project caused the elimination of a planned hardware R&D element, the NASA activity has been especially welcome. As indicated above, photovoltaic energy sources create a front-end cost while reducing operating costs for the LDCs. The LDCs are extremely sensitive to the higher operating costs and the difficulty of fuel delivery if diesel generators are used.

Accordingly, it is proposed that $200,000 of funding authority, currently available in the existing PASA with NASA but not yet subobligated, be applied to the procurement and deployment of one PV power system for remote earth stations as part of the AID Rural Satellite Program. In FY 82, S&T/ED will arrange to finance the procurement of the first replication. The rationale for this recommendation is as follows:

a) Existing authority not yet subobligated is available;

b) Reduced power requirements for earth station equipment argue that PV systems are cost-competitive today relative to diesel electric generation;

c) This action would be in concert with A.I.D.'s strategy of assisting the private sector in penetrating overseas markets for development applications;

d) This action would underscore our determination to use life-cycle costing in planning projects;

e) The transfer of advanced renewable energy technology would be promoted;

f) There is a high probability of success which would serve to overcome institutional and other barriers to the adoption of this technology.

Your concurrence of this proposed action is requested.

Attachments:
1. Annex A
2. Annex B
3. Annex C
4. Action Memorandum, July 9, 1981
5. Comments from C. Farrar, July 20, 1981
6. Action Memo, July 27, 1981

APPROVED _____ DATE 10/2/81

DISAPPROVED _____ DATE _____

Clearance:
S&T/PO, T. O'Keefe _____ Date 10/14

JJBosken/STOth:8/26/81:235-9020

ACTION MEMORANDUM FOR THE ACTING SENIOR ASSISTANT ADMINISTRATOR (S&T)

FROM: S&T/EY, Alan B. Jacobs DATE: July 9, 1981

Problem: Your approval is needed to authorize funding for the continuation of the Photovoltaic Development and Support Program (936-5710).

Background: The Photovoltaic Development and Support Program (PVDSP) was initiated in FY 79 as a five-year program with funding and program continuation to be contingent on periodic reviews and evaluations. NASA's Lewis Research Center (LeRC), under a PASA, implements the project which is conducted in coordination with the Department of Energy.

The status of the program and proposed continuation activities were summarized in a prior memorandum prepared on May 22, 1981. This memorandum was cleared by ASIA, LAC, Near East and appropriate offices in S&T (nee DSB); the information contained therein will not be repeated here.

Due to overall budget austerity, a changed emphasis for S&T programs and further evolution of the role of S&T, it is appropriate to redirect the PVDSP in the following way:

(1) to give greater emphasis to providing technical assistance to USAID missions through the NASA personnel,

(2) to permit the program to be more responsive to field needs,

(3) to enable the NASA technical experts to identify cost-effective applications of the technology in the total AID program and, based on their technical expertise, to recommend adoption of the technology where specifically appropriate,

(4) to assure coordination, proper engineering analysis and maximum dissemination of the results of the overall Agency use of photovoltaic technology,

(5) to avoid unnecessary duplication in demonstrations and field testing,

(6) to require greater cost-sharing between the S&T/EY-funded PVDSP and AID projects funded from other sources.

The history of the program indicates that the desired redirection can be successfully accomplished:

- Under a prior project, NASA/LeRC managed a co-financed effort in Upper Volta, 52% of the funding from USAID and 48% from DSB.

- Under the existing project, NASA/LeRC personnel assisted USAID/Tunisia in planning a $1 million USAID-funded project to apply and demonstrate photovoltaics. Under an amendment to the PVDSP PASA and with these USAID funds, NASA/LeRC is the overall project manager for the country-specific effort.

- Again under the existing project, NASA/LeRC is assisting USAID/Egypt to plan and design a major photovoltaic program. When it is completed and approved, NASA/LeRC is expected to manage the project implementation.

- The NASA/LeRC team, in its extensive travels to AID missions and interactions with USAID and host-country personnel, has demonstrated its sensitivity to the conditions in developing countries, its professionalism in dealing with the technical and personal aspects of in-country work, its interest in and commitment to the task and its awareness of AID goals and programs.

In the redirected program, direct support of prototype demonstrations will be significantly reduced, the core staff of the NASA/LeRC technicians will be maintained and the travel budget will be expanded to permit more technical assistance TDY's to USAID missions. Program-funded travel is considered an important element; without it the goal of stimulating greater mission use of the technology will be hindered due to restricted USAID invitational travel budgets.

The budget for FY 81 and FY 82 activities is attached. It includes support for seven person years of effort each year, twelve individual TDY's per year and applications of the technology to communication projects in two countries, the Philippines as part of the S&T/ED Rural Satellite program and Indonesia (cable request attached). The personnel to be funded will be responsible for the on-going activities of the project (health systems application) as well as undertake the activities authorized for this continuation. The initial one-time cost of system design warrants communications applications in two countries which results in a signficant lowering of the per-application cost.

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Recommendation: That you approve the continuation of the PVDSP by signing the attached PAF.

Approved: _____

Disapproved: _____

Date: _____

Attachments:
1. Cable (Jakarta 7230)
2. Budget Table and Discussion
3. PAF

BUDGET

		FY 81	FY 82
I.	Personnel		
	7 person years @ $48,400/year (FY 81), 50,800/year (FY 82)	$338,800	$355,600
II.	Travel		
	International 12 trips/year @ $7,500/trip (RT air travel, $2,500; per diem, 30 days, $100/day)	90,000	90,000
	Domestic 12 trips/year @ $275/trip (RT air travel Cleveland/ Washington $200, per diem, 1 day, $75/day)	3,300	3,300
III.	Communication Application		
	System design	160,000	
	Philippine Application	240,000	
	Indonesia Application		240,000
	TOTAL	$832,100	$688,900

Discussion of Budget Elements

Personnel

To handle the workload of on-going activities and to undertake the communication application and expanded technical assistance of this authorization, seven person-years of effort will be expended each year. The overall project manager of the PVDSP devotes essentially full time to the project (one person year each year). A project officer is given responsibility for each major activity (country health applications, planning teams, etc.) (a total of three person years each year). Project engineers (two person years) provide expert engineering guidance and administrative and secretarial assistance (one person-year) is obtained as appropriate. These figures represent the level of effort; more than seven individuals will be involved in the project activities since NASA/LeRC employs its considerable technical resources on an as-needed basis to satisfy specific requirements of each project.

For planning purposes NASA/LeRC uses the following salary calculations for reimbursable work for federal agencies. Actual salary costs however are billed to each reimbursable project. To the salary for each person who is directly supported by a project, NASA/LeRC adds an overhead figure for in-house technical support, computer facilities, procurement, etc. For FY 81, this planning figure is $48,400/person year total ($38,600 salary and $9,800 overhead). For FY 82 the figure is $50,800/person year ($40,000 salary and $10,800 overhead).

Travel

The estimated travel budget assumes three trips per region, twelve per year. Round trip air fare from Cleveland is estimated to be $2,500/trip; per diem costs of $100/day, 30 days per trip. In addition to the international travel, periodic visits to Washington will be needed for project reviews, etc. Twelve such trips are budgeted at $200 for air travel and 1 day each @ $75/day.

Communication Application

The basic design of the system to be used to power the ground station for the Rural Satellite program is estimated to cost $160,000, a one-time only cost. Based on the recent proposals for the Tunisia project and for the health applications project, a system cost of $30/watt is assumed. To meet the demand for 24 hour operation of the ground stations, a 4,000 watt array is envisioned for a total cost of each ground station of $120,000 including servicing and monitoring. Two such stations in each of two countries (Philippines and Indonesia) are proposed.