UNCLASSIFIED

65p.

Agency for International Development

PROJECT PAPER

386Ø465ØØ42Ø1

INDIA - Application of Science and Technology to Rural Development

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: A (A = ADD, C = CHANGE, D = DELETE)

PP

2. DOCUMENT CODE: 3

3. COUNTRY ENTITY: INDIA

4. DOCUMENT REVISION NUMBER:

5. PROJECT NUMBER (7 digits): 386-0465

6. BUREAU OFFICE: A. SYMBOL: ASIA; B. CODE: 4

7. PROJECT TITLE (Maximum 40 characters): ASTRD

8. ESTIMATED FY OF PROJECT COMPLETION: FY 81

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 78; B. QUARTER 3 (Enter 1, 2, 3, or 4); C. FINAL FY 78

10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL						
(GRANT)	(150)	( )	(150)	(2000)	( )	(2000)
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY		150			2000	2000
OTHER DONORS						
TOTALS				2000	2000	4000

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY 78 F. GRANT	E. 1ST FY 78 G. LOAN	H. 2ND FY ___ I. GRANT	H. 2ND FY ___ J. LOAN	K. 3RD FY ___ L. GRANT	K. 3RD FY ___ M. LOAN
(1) ST	750	879		2000					
(2)									
(3)									
(4)									
TOTALS				2000					

A. APPROPRIATION	N. 4TH FY ___ O. GRANT	N. 4TH FY ___ P. LOAN	Q. 5TH FY ___ R. GRANT	Q. 5TH FY ___ S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1)					2000	
(2)						
(3)						
(4)						
TOTALS					2000	

12. IN-DEPTH EVALUATION SCHEDULED: MM 08 YY 79

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

1 (1 = NO, 2 = YES)

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: Alexander [signature]

TITLE: Director, ASIA/PD

DATE SIGNED: MM 05 DD 05 YY 78

15. DATE DOCUMENT RECEIVED IN AID W, OR FOR AID W DOCUMENTS DATE OF DISTRIBUTION: MM 05 DD 05 YY 78

AID 1330-4 (3-78)

Table of Contents

		Page
PART I	Summary and Recommendations	
PART II	Background and Project Description	3
	A. Background	3
	B. Project Description	7
PART III	Project Analysis and Selection Criteria	9
	A. General Feasibility Considerations	10
	B. Criteria for Project Selection	
	C. Financial	14
	D. Environment	14
PART IV	Implementation Planning	15
	A. Administrative Arrangements	15
	B. Implementation Arrangements	18
	1. Implementation Schedule	18
	2. Procurement	19
	3. Disbursement	20
	4. Project Approval Procurement and Disbursement Process	20
	C. Evaluation	21
Annex A	Rural Energy in India	
Annex B	Illustrative Projects	
Annex C	Project Checklist	
Annex D	611(e) Determination	
Annex E	Project Approval Document	

PART I. Summary and Recommendations

A. Grantee and Implementing Agency

The Grantee will be the Government of India. The Implementing Agency will be the Department of Science and Technology.

B. Grant

The amount of the grant will be $2.0 million with a three year disbursement period.

C. Purpose

The purpose of the grant will be to increase Indo/U.S. collaboration in the testing and application of science and technology to India's rural development effort (with special emphasis being placed on technologies appropriate to the rural setting, i.e., culture, work force and skill base, economic system).

D. The Project

The grant will be to develop, test and apply technologies which fall under the general parameters and priority area identified by the Indo/U.S. Joint Commission and criteria jointly developed by AID and the GOI to insure that project funded by the grant have application to rural development in India. Project activities could include application of alternative energy, agricultural research, conservation technologies, nutritional and medical research. The criteria and project selection considerations generally include:

1. As the primary consideration projects will be judged on the relevance of the concerned technology to immediate problems in rural areas, i.e., basic research on technologies not well developed will not received priority consideration.

2. Cost/Benefit - In selecting a project, relative costs and benefits will be considered to the extent possible.

3. Timeframe - Projects should have a near or medium term benefit to the target population.

4. Direct vs. Indirect Costs and Benefits - Projects with more direct and therefore more certain costs and benefit will receive priority in funding considerations.

5. Implementation - Projects will be judged on their appropriateness for implementation or delivery to rural areas.

6. Income potential - Finally projects must show reasonable potential for increasing the income of the rural poor.

E. Purpose of AID Assistance

AID grant funds will supplement Rupee funds for approved project and will finance foreign exchange costs of project execution. Such costs will include: equipment and materials, workshops, professional consultancies and exchanges.

F. Other Donor Assistance

Since this grant could finance virtually any project area within Joint Commission priorities, which fall into the above mentioned criteria, a listing of other donors is not practical. Once projects are approved, if other donors are active in that project area, full coordination will be maintained.

G. Issues

There are no unresolved project issues.

H. Statutory Criteria

The grant meets all applicable statutory criteria.

I. Summary of Findings

Technical Feasibility and soundness of technical financial, social, economic and environmental considerations of projects will be insured through the project selection criteria, GOI screening process and AID project concurrence mechanism. The criteria and selection mechanisms are judged to be sound and the projects will benefit the rural population of India.

J. Recommendation

That a grant of $2.0 million be approved for the "Application of Science and Technology to Rural Development".

PART II. Background and Project Description

A. Background

Indo/U.S. scientific and technical cooperation dates back to the days following Indian Independence in 1947. Prior to that most Indian scientists were trained in the United Kingdom and maintained close ties with their British mentors and colleagues. At the end of World War II and with emergence of the U.S. not only as the leading world power but also as a world leader in science and technology, Indian scientists and engineers started to turn increasingly to the U.S. Initially the relationships were informal, largely through the influx of large numbers of Indian students of science and engineering to U.S. universities where they obtained advance degrees. Many stayed in the U.S. and pursued academic and scientific careers. Many returned to India and assumed positions in leading Indian universities and governmental research institutes. They brought with them new ideas, techniques and organizational concepts learned in United States which they tried to apply within the local educational and scientific establishment. However, these efforts were often frustrated by the entrenched, traditional system of Indian education, patterned after the British system, which allowed little room for innovation and limited the support of independent scientific research.

In the late 1950s and early 60s when the U.S. mounted a large assistance program, this factor was recognized by initiating a number of projects designed to build institutions in India that would be more in keeping with the demands of an emerging modern society. Under AID auspices several projects were initiated that involved extensive collaboration between U.S. and Indian scientists and institutions and that were designed to improve Indian capabilities to provide adequate training and research facilities within the country and to ultimately reduce Indian dependence on foreign science and technology. To cite a few examples:

The Establishment of Agricultural Universities in India

This was done by providing the assistance of selected U.S. land-grant universities who sent teams of administrators, teachers and researchers to India to help organize the educational and research programs and also provided advance training for younger Indian faculty members in the U.S.

The Establishment of the Indian Institute of Technology in Kanpur.

A consortium of leading engineering universities in the U.S. provided visiting professors, administrators, modern scientific equipment as well as training for promising students and young faculty members in the U.S. This program also actively sought and encouraged the return to India of many promising U.S. trained Indian scientists and engineers who had remained in the U.S. and had obtained employment with leading universities or industrial laboratories.

A Science Education Improvement Project

This was aimed at modernizing and upgrading the teaching of science, mathematics and engineering to Indian schools and colleges through special refresher courses for science teachers and through assistance to local efforts to revise curricula and syllabi. This effort was closely linked to the U.S. programs of science education improvement sponsored by the National Science Foundation which eventually took over the management of this program in India. NSF provided U.S. science education specialists who served as consultants and coordinators for local curriculum development and training programs in India.

On the whole these programs had a definite impact on scientific research and education in India. The U.S. supported agricultural universities and IIT Kanpur are now recognized as leading centers in India. The broader science education programs created an awareness in India of the need to involve leading university scientists in the improvement of science teaching at the lower levels: colleges, secondary schools, and even elementary schools. A fringe benefit of these programs was the development of professional ties and contacts between institutions and scientists in both countries. These ties have continued well beyond the termination of these programs.

Parallel to the effort of providing technical and financial assistanee, the U.S. started to utilize excess foreign currencies (U.S. owned Rupees) under PL-480 for scientific research and related activities. In contrast to the AID program, this program emphasized scientific benefits to the U.S. from research conducted in India by Indian scientists in collaboration with U.S. scientists. Presently some 10 U.S. government agencies receive Congressional appropriations of excess foreign currencies which they use in India and several other countires for projects related to their domestic mission. Projects funded under this "Special Foreign Currency Program" include a large number of agricultural research projects funded through ARS/USDA, medical researfh funded by NIH/HEW and many basic and applied research projects funded by NSF, NBS, Smithsonian, EPA, etc. This program continues to foster active collaboration between Indian and U.S. scientists and also frequently supports the participation of U.S. scientists at national and international scientific meetings and conferences in India.

For over 10 years India and the U.S. have been operating a modest program of exchanges of scientists. The implementing agencies are the Council for Scientific and Industrial Research (CSIR) for India and the National Science Foundation (NSF) for the U.S. This program involves mainly short term visits of senior scientists for the purposes of exchanging information and developing cooperation.

There was a phase-out of the AID program by 1973 and the Special Foreign Currency Programs reached a low point at about the same time. In an attempt to provide continuity to Indo-U.S. relations and revive traditional ties, the two countries in 1974 agreed to establish a Joint Commission for Indo-U.S. Cooperation. The purpose of this Joint Commission was to "explore the possiblities of fostering mutually advantageous cooperation between the two countries in the economic, commercial, scientific, technological, educational and cultural fields". Three subcommissions were established in (a) economic and commercial cooperation, (b) scientific and technological cooperation, and (c) education and cultural cooperation. The Joint Commission meets normally once a year. The three subcommissions also meet annually at which time they suggest and review areas of cooperation.

The S&T Subcommission initially identified the following areas for cooperation:

agriculture

energy and natural resources

health

electronics and communications

environment

exchanges of scientists and information

At later meetings of the S&T Subcommission, additional areas for cooperation were suggested and some of the previously agreed areas were further refined. Even though the mandate to the Joint Commission is to identify and recommend projects beneficial to both countries there is an increased awareness of slecting areas for collaboration which are particularly relevant to India's development. To cite a few that have been suggested:

Arid lands research

Small industrial technologies

Water resources

Integrated energy systems for rural areas

Remote sensing for development

Quick growing trees for fuel, forage and raw materials.

The Joint Commission meetings, although useful in establishing a continuing dialogue and identifying scientific aress for potential collaboration, have so far not lead to a significant increase in Indo/U.S. scientific collaboration. The main reason for this has been the lack of a central fund available to U.S. governmental technical agencies for the support of projects involving international cooperation. Consequently, many of the U.S. "domestic mission" agencies must justify their expenditures as logical extensions of there domestic programs, which is usually difficult to do, especially if such activities have a significant "technical assistance" element or are more directly beneficial to India and India's development efforts. These factors severely limits the ability of U.S. agencies to commit adequate

dollar funding for cooperative projects. The availability of special foreign currency funds to a number of U.S. agencies alleviates this problem somewhat. However, by the very nature of the Rupee SFC program, limitations on the use of these funds are imposed, i.e. for local costs only. They can be used only for direct support of projects in India and for travel and per diem of U.S. collaborators to and in India. Support of the U.S. dollar costs of collaborative projects is rarely available a situation which severely restricts potential collaborative efforts.

For the reason stated above AID has an excellent opportunity to assist in filling at least a portion of this gap by providing much needed dollar funding for selected Joint Commission-sanctioned activities.

B. Project Description

1. General

The proposed grant will be available to finance projects and activities in the areas of science and technology. The grant will be bound by these general parameters:

a. Indo/U.S. Joint Commission
Projects and activities financed under the proposed grant must be within the priority areas established by the Joint Commission.

b. Government of India
Projects and activities financed under the proposed grant must be within the priorities of the GOI.

c. U.S. Agency for International Development
Projects and activities financed by the proposed grant must satisfy the criteria for project selection, i.e. the Application of Science and Technology to Rural Development as defined in Part III. of this P.P.

The GOI, based on these parameters and the selection critieria, will after grant obligation select projects for grant financing. AID will concur in the selection.

Projects and activities financed by the proposed grant will include women as participants as appropriate.

A detailed discussion of projects which the grant might finance is in Annex B.

2. Purpose

The purpose of the grant will be to increase Indo/U.S. collaboration in the testing and application of science and technology to India's rural development efforts.

AID can play a significant role within the framework of the Indo/U.S. Joint Commission and its subcommissions by selectively supporting activities that clearly relate to India's economic and social development. (Projects of intrinsic merit and mutual benefits to both countries will continue to be supported by the responsible agencies on both sides with U.S. funds provided by the SFC funds and, hopefully, some direct dollar contributions from other agencies).

AID's current mandate, to assure that its assistance programs benefit the poorest segments of society, leads to the obvious conclusion that any new program in India should be directed towards the rural areas where the large majority of India's poor reside.

Furthermore in limiting the project to "Application of Science and Technology to Rural Development' one can readily identify areas where science and technology can make a significant contribution towards upgrading the living standards and productivity of India's rural population.

The primary occupation in the rural areas is agriculture. Therefore the first efforts should focus on those areas of potential cooperation which increase productivity and efficiency in agriculture or areas related to agriculture, e.g., efforts to improve nutrition, health, and basic education.

Projects illustrating the potential applications of science and technology towards the solution of these problems are in Annexes A and B. Some of these projects emphasize the production of energy from non-conventional sources to provide for irrigation as well as domestic use. Others deal with reversing the environmental impact caused by rapid deforestation due to the extensive use of firewood for cooking and heating. In general the activities will relate to the development, production and testing of small and inexpensive units that could be used to serve small rural population units ranging from individual homes to villages.

AID stands to derive significant benefits from this proejct in terms of its overall effort to assist the poorest countries of the world. Many of the rural development problems encountered in India exist in other countries. However, in contrast to many other LDCs, India has a well-developed scientific/technological research and development (R&D) infrastructure which is willing and ready to contribute skills, management and experience to apply science and technology towards the solution of its most pressing economic and social problems. The experience gained from the proposed project in India will be extremely useful to AID in considering and developing similar projects elsewhere.

3. Outputs

Specific projects are not yet approved for financing under the grant, while the Indians and U.S. have numerous ideas and in some cases are preparing proposals. Until projects are fully developed and approved for financing, project outputs cannot be quantified. Types of outputs which might be expected would probably include:

- upgraded or enhanced technical skills by Indian scientists and technologists including, short-term training, scientific exchanges, workshops
- available technical equipment
- new appropriate technology (hardware and/or systems) developed in real-life operational milieu
- socio-economic studies of new technologies acceptance and adaptation

PART III. Project Analysis and Selection Criteria

As already discussed, specific projects or R&D topics under the grant have not been approved and therefore a detailed project description is not presented. In place of the description, AID is using a "selection criteria" approach which will ensure that each project approved for financing meets AID criteria and FAA Section 611, as appropriate. The criteria takes into consideration issues of technical, financial and economic feasibility, as well as social soundness and environmental impact. The criteria

will be negotiated in detail with the GOI preparatory to project agreement execution. The GOI has agreed to the following criteria concepts in principal.

Annex B presents a more detailed discussion of the criteria and how they would be applied against various types of projects in ghe energy field.

A. General Feasibility Considerations

The goal of this project is to contribute to rural development in India, giving special weight to improving the conditions of life of that segment of the rural population now living in poverty by Indian standards.

The grant is for support of projects in the application of science and technology to rural development. Development impact is measured by increased real income of rural people. The increase in income can take one or more of three forms: (1) increased returns of labor or of capital owned by rural people; (2) increased consumption of publicly provided goods and services such as health care, potable water, education, lighting; (3) increased time available for other activities without compensating sacrifice of material goods and services.

The emphasis on the rural poor does not mean that projects should benefit only the poor, nor would any specific division of benefits between the poor and not-so-poor be required. However, projects not clearly benefiting the poor would not be considered, and among projects for which all other things are equal, those showing more benefit to the poor would be weighted more favorably than those showing less.

Benefits may be direct or indirect and may become available over the short, medium or long term. For example, projects which raise the productivity of rural labor by increasing the amount of energy applied per unit of labor yield direct benefits. Such projects may also yield indirect benefits. For example, increased spending by people who directly benefit from the projects will generate higher income for local suppliers of goods and services (multiplier effect). Forest management projects to increase the supply of firewood (a direct benefit) may also reduce erosion damages to irrigation systems (an indirect benefit). For some projects indirect benefits may be very important. They must always be taken into account when evaluating and selecting projects.

The words "short term", "medium term" and "long term" have no precise meaning when used to describe projects. They are significant in expressing relationships among projects, however, because the longer the benefits of projects are deferred the less valuable they are. Moreover, there generally is more uncertainty about the benefits of long term projects than of short term projects. The uncertainty probably is greater for research than for production projects. However, the projects to be considered under the grant discussed here call for the application of science and technology to rural development so the uncertainty concerning these projects should be substantially less than were wholly novel ideas at issue. Nevertheless, the uncertainty concerning these projects will be large and likely will be greater the longer project benefits are deferred.

Emphasis in the grant is on the application of science and technology to rural development, indicating projects to promote new patterns of resource management in rural areas. No project is likely to succeed in doing this, no matter how well conceived, unless rural people understand the new patterns of resource management and believe that they will benefit from them more than from established patterns. The people no doubt will be much influenced by effects on their income in each of the three dimensions discussed above; however, they likely will be concerned also with effects of the new patterns on established social and political relationships.

B. Criteria for Project Selection

The above discussion suggests the following general criteria for project selection. While these criteria present a framework for selection, they do not provide a hard and fast rule. It is anticipated that the GOI/IGG will develop an objective weighting system to apply the criteria. It is not AID's intention however to impose such a system on the GOI as a condition. It is AID's wish that attention be paid to including professional women in project selection and implementation.

1. Technical Evaluation. The emphasis on applications of science and technology means that projects for research on the scientific or technical frontier generally would receive low priority. Project for support of well known and already widely applied science or technology generally also would receive low priority. Favored projects would be those involving scientific and technical ideas tested in laboratories or limited field trials but which require more extensive field testing and modifications to make them applicable on a wide scale. Proposed technologies should be "appropriate" in the sense of being (or having the potential to be) well adapted to the particular social and cultural context in which they are to be supplied and

of human and other resources. This criterion likely will favor technologies which use more of local resources and require less maintenance. More generally it will favor less "sophisticated" technologies than would otherwise be the case. Application of this criterion does not mean, however, that "sophisticated" technologies, or components of technologies, would never pass review. In some instances such technologies may be more "appropriate" than any other. For example, highly advanced instrumentation may be most appropriate for monitoring chemical processes in biogass digesters under village conditions.

2. Cost/Benefit Analysis. All project proposals naturally will include estimates of the direct costs of undertaking them. Because the projects involve application of innovative scientific and technical ideas, quantitative estimates of indirect costs and of both direct and indirect benefits likely would be subject to wide margins of error. While estimates of benefits and indirect costs should be made when there is a reasonable basis for doing so, quantification of these benefits and costs should not generally be expected. Consequently, judgment frequently, if not usually, will substitute for numbers in evaluating the relative attractiveness of projects.

3. Timeframe. Every project proposal should carry statements about the timing of the flows of benefits and costs. In general, the costs and benefits, particularly the benefits, of longer term projects should be considered subject to greater uncertainty than the costs and benefits of shorter term projects. It is not practicable and it would not be wise to try to reflect this uncertainty in formal discounting of projects. It is suggested, however, that between two projects for which the present values of net benefits are judged to be about the same, the shorter term project generally should be favored.

4. Direct and Indirect Costs and Benefits

Every project proposal should distinguish between direct and indirect costs and benefits. Indirect costs would include, e.g., losses of income of gatherers of firewood induced by a biogass project. Indirect benefits would include increased wages and employment in village industries stimulated by the project. Environmental costs and benefits may be direct or indirect. For example reduced eroison damages resulting from an energy substitute for firewood would yield indirect environmental benefits. Water related diseases (e.g. malaria) spread by an irrigation proejct would yield direct environmental costs.

The state of costs of the project should include those required for implementation, indicating the amount and kinds of professional skills needed to accomplish this and where they would be obtained. (See Fifth criterion).

Indirect costs and benefits, being indirect, likely will be more difficult to estimate, hence subject to greater uncertainty, than direct costs and benefits. It is suggested that between two projects for which the present value of net benefits (both direct and indirect) are the same, the project with the highest proportion of direct benefits and costs generaly should be favored.

5. Implementation Plans. Since the projects to be considered are for the application of science and technology to rural development, each project proposal should include a statement of how the proposed technology would be disseminated and adapted in rural areas. Implementation here means testing the proposed technology under field conditions to collect information required for modifications to make the technology economical and acceptable to villagers on a wide scale. The implementation statement should indicate: (a) how the proposed technology would alter existing patterns of resource management in rural areas and (b) the mechanisms (for example, economic incentives, educational programs) for inducing rural people to accept the new technology. The analysis of mechanisms for inducing acceptance of the proposed technology is necessary even when the technology would directly increase the incomes of rural people, since the people's perception of this benefit may not be the same as that of the project planners. Hence the people may need to be persuaded even in this case. Other projects (e.g., reforestation) may reduce directly received benefits, at least temporarily, but be justified by the greater indirect benefits (e.g. reduced erosion damages). Despite their social desirability, such projects likely will be resisted by villagers, at least initially. Consequently, analysis of the acceptance problem would be an especially important part of the proposal for such projects.

The problem of acceptance when direct benefits are reduced, even if temporarily, is so large that projects with this characteristic should carry an extra burden of showing that the gains of indirect benefits are clearly and substantially greater than the decline in direct benefits.

Analysis of the acceptability to villagers of the proposed technology involves socio-economic issues. It would be expected, therefore, that social scientists would be included among the professionals needed for implementation of the project.

6. Income Potential. Every project must show potential for increasing the income of the rural poor in one or more of the three dimensions of income discussed in Section A. above.

C. Financial

Projects proposals approved by the GOI will include a detailed time phased budget. Costs will be broken into local costs and foreign exchange costs and will identify those foreign exchange costs the AID grant will finance. Projects will not be financed by the grant unless other funding requirements for the project can be met. The requirement of FAA Section 110 will be met on a project by project basis unless AID otherwise agrees in writing.

The grant will only finance foreign exchange costs of approved projects. These costs will include the following:

1. Import of equipment and materials

2. Salaries and related costs of U.S. personnel

3. Per diem and support costs of Indian personnel visiting the U.S.

4. Registration, fees, tuition of Indian personnel in U.S.

Since projects are not yet approved a budget breakdown of the $.2.0 million grant is not available. It is important to understand however that the grant is viewed as the first of a series of such grants. The $2.0 million is considered reasonable at this time. It is anticipated that the $2.0 million will finance about 10 projects over the next two years.

A three year disbursement period is requested.

D. Environment

An Environmental Assessment or Environmental Impact statement will not be required. This is based on Reg. 16, para 216.2 which states that in projects for controlled experimentation for the purpose of research which is confined to small areas and is carefully monitored, EIS's and EA's are not required.

PART IV. Implementation Planning

A. Administrative Arrangements

1. The Indo/U.S. Joint Commission

The Joint Commission meets once a year to discuss areas of cooperation. Neither the Joint Commission nor the subcommission have permanent staff. Therefore, while the Joint Commission and the three subcommissions will establish general priority areas for grant activities and will review progress of projects, they will not approve projects.

2. GOI Administrative Arrangements

The GOI will be the grantee and within the GOI the Department of Science and Technology will be the implementing agency. An Inter-Governmental Group formed specifically for the grant project will coordinate GOI inputs.

a. Inter-Governmental Group - The IGG will meet periodically through the life of the grant. They will:

(1) Provide final GOI technical approval of projects.

(2) Establish grant priorities.

(3) Serve as the coordinating mechanism within the GOI.

The IGG will have permanent ex officio and ad hoc members. The chairman will be the Secretary of the Department of Science and Technology and will have as a permanent member, the Department of Economic Affairs. Other members will include the Department of Agricultural, Department of Heavey Industry, Department of Agricultural Research and Education, Ministry of Energy, Ministry of Health, Ministry of Village Industries, etc. When projects are proposed which involve specialized agencies, they will be invited to attend the IGG.

The Department of Science and Technology will serve as the secretariat to the IGG.

b. Department of Economic Affairs

Acting on behalf of the GOI the DEA Ministry of Finance will be the grantee. The DEA will provide final GOI funding approval for projects under the grant based on IGG technical approval. DEA is in a unique position within the GOI to coordinate Rupee and foreign exchange funding requirements for projects.

c. Department of Science and Technology

The DS&T will be the Implementing Agency for the grant. While DS&T is primarily concerned with science and technology matters, and not directly with economic and commercial or educational and cultural cooperation, the GOI feels that because of its high level staff position in the government reporting directly to the Prime Minister and its general responsibilities for science and technology in India, DS&T is best situated to take central implementation responsibility for grant assisted projects.

As the Implementing Agency, DS&T will perform the following functions:

(1) Be the GOI authorized representative for authorizing expenditures in accordance with DEA and IGG approved projects.

(2) Function as secretariat for the IGG including:

(a) Arrange annual evaluations

(b) Serve as focal point within GOI for participating institutions and professionals

(c) Monitor progress of joint projects

(d) Serve as main contact for AID regarding grant activities

(e) Maintain accounts on expenditures, procurement, training, exchanges, etc.

(f) Prepare activity reports for Joint Commission and subcommissions

(g) Assist participating institutions and professionals, as needed, to expedite activities under joint projects

3. AID Administrative Arrangements

While AID will be the primary USG Agency involved in the overall grant, involvement by USG technical agencies is anticipated, e.g., NSF, DOE, NASA, NBS, ARS/USDA, etc., on specific project areas.

Functions of AID will include:

1. Concur in project proposals and issue Implementation Letters which provide information on procurement, disbursements, mechanisms for scientific exchanges, consultancies, participation at workshops, etc.

2. Approve tender documents and awards for equipment and material procurement.

3. Make disbursements from the grant for approved project activities at request of GOI Implementing Agency (DS&T).

4. Participation in annual evaluations.

5. Maintain liaison with GOI and USG agencies associated with grant activities.

6. Assist Implementing Agency (DS&T) and participating institutions and professionals, as needed, to expedite activities under joint projects funded by the grant.

A.I.D. Staffing

It is AID's strong feeling that these functions will require a full-time AID employee in New Delhi and that appropriate action should be taken to create such a position and staff it ASAP.

Authorities

Full authorities are being delegated to the mission for the implementation of project. As regards this project responsibilities and authorities will include:

1. Concurrence in projects.

2. Approval of tenders and awards, as appropriate.

3. Issuing Implementation Letters.

4. Making disbursements, as appropriate.

B. Implementation Arrangements

1. Grant Implementation Schedule

The following schedule is for the first $2.0 million grant. If grant activities proceed as planned, a second grant will be considered possibly in FY 1980.

Grant Approved AID/W	June 15, 1978
Project Agreement Signed	July 15, 1978
Implementation Letter No. 1 issued	July 21, 1978
First Project Approved	September 1, 1978
First Annual Evaluation	February 1, 1979
Second Annual Evaluation	February 1, 1980
(Second Grant Prepared)	(April 1, 1980)
Final Disbursement First Grant	June 1, 1981
Final Evaluation First Grant	February 1, 1982

2. Procurement

Procedures for procurement of equipment and materials under the proposed grant will vary from project to project depending on the participating institutions and the nature of the project and materials to be purchased. Procurement may be done by U.S. government agencies (USDA, NASA, GAS, etc.), by GOI agencies (the Directorate of Supplies and Disposal, the India Supply Mission in Washington) or by private U.S. or Indian institutions (universities, research institutes, etc.).

Regulations governing procurement will depend on the institution doing the procurement. If a U.S.G. Agency does it U.S. Federal Procurement Regulations will be followed. If other than a U.S.G. agency is to do the procurement AID Country Contracting Procedures will be followed, i.e., Handbook 11.

The project proposals when submitted to AID for concurrence will specify who will do the procurement, what will be procured and what the estimated cost will be. AID will then issue an Implementation Letter providing among other things, procurement instructions. AID will approve all tenders including specifications and awards.

Because of the complexities in using formal tendering procedures for a large number of small valued items which will probably be used for ten or more projects, AID will increase from $50,000 to $100,000 per transaction the upper value limit for "small value procurement". This will permit the GOI to request bids from a reasonable number of suppliers and make competitive awards based on most reasonable bid for transactions estimated to be $100,000 or less. By increasing this limit, delays on project execution, so often experienced in the past, with projects involving procurement of relatively sophisticated often times prototype but small value equipment, is expected to be greatly minimized. The Mission has authority to waive formal advertising requirements.

It is also likely that air freight of most items will be cost effective. The Mission will on a case by case basis determine in considering costs, risk of damage and timing air shipment is justified.

3. Disbursement Procedures

Grant funds for approved projects will be disbursed in a variety of ways depending on the participating organizations, the nature of the project and what the funds will be used to purchase:

a. Equipment and Materials - A standard letter of credit/letter of commitment or direct letter of commitment will be used to disburse against procurement where a non-U.S. agency is the procurement agent. Use of the mission controller as the disbursing agent will be maximized. If a U.S.G. agency performs the procurement, a disbursing authroization (DA) procedure will be used.

b. Professional Services/Training - The mission controller will use a standard PIO/T or PIO/C procedure for funding other than commodity and commodity oriented services unless AID otherwise agrees.

AID may also on occasion use a direct reimbursement approach.

4. Project Approval, Procurement and Disbursement Process

a. Project Approval

1. Joint Commission sets priority areas for cooperation.

2. Implementing Agency informs potential participating institutions of grant availability, priorities, criteria, procedure for proposal submission.

3. Joint Project proposal is submitted to Implementing Agency (DS&T Secretariat).

4. Inter-Governmental Group meets to consider and approve project proposal from technical standpoint and compliance with criteria.

5. Department of Economic Affairs (DEA) reviews proposal from financial standpoint and provides final GOI approval.

6. USAID reviews project and issues Implementation Letter to DEA concurring in project and providing guidelines/information on procurement, disbursements, and any other information felt helpful in AID's relationship to project.

7. DEA forwards copies of USAID Implementation Letter to Implementing Agency (DS&T) with additional specific guidance, as required.

8. Participating organizations are formally informed of project approval by DS&T.

b. Procurement/Disbursement Equipment and Materials

9. (a) If GOI agency will do procurement, Implementing Agency (DS&T) sends indent to agency with copy of Implementation Letter.

(b) If U.S. agency will do procurement, Implementing Agency (DS&T) sends authorization to USAID requesting USAID to prepare and forward required documentation to U.S. agent.

(c) If private organization will do procurement, Implementing Agency (DS&T) provides GOI/USAID instructions on procurement to agency, Implementing Agency request USAID to establish Letter of Commitment, private organization obtains import license and establish Letter of Credit bank (or USAID controller can act as disbursing agent.)

10. Implementing Agency and USAID will approve tender documents or procedures including detailed specification before tenders are issued.

11. Implementing Agency and USAID approve awards.

12. On the basis of award approval and the presentation of agreed to payment documentation to the disbursing agent, commercial bank or USAID controller, payment will be made to the suppliers of the equipment.

C. Evaluation

The grant proposes joint annual evaluations prior to annual meetings of the Indo/U.S. Joint Commission. The evaluation will review activities under the grant, as follows:

1. Progress of projects in achieving these objectives.

2. Effectiveness of criteria and application of criteria in selecting projects.

3. Administrative effectiveness of project selection and procurement procedures, training, etc.

4. Requirements for grant funds.

5. New areas in which grant might be effectively used.

6. Any issues concerning grant relationship to Indo/U.S. Joint Commission.

7. Specific implementation problems on either GOI or U.S. side.

AID will assist the DS&T, as needed, in organizing the evaluation and developing agenda items.

ANNEXES

*Annexes A and B were prepared by an A.I.D. consultant team and do not necessarily reflect GOI or A.I.D. policies or opinions.

ANNEX A

RURAL ENERGY IN INDIA

A. Rural Energy Situation

1. Sources of Energy

Rural India is self-energized. Approximately 90 percent of its energy is from local sources: human (10) and animal (14) work, wood (40), crop residues (10), and cattle dung (16). Only 10 percent of its energy is imported in the form of petroleum, coal, or electricity.*

Of total energy consumption in rural India, between 30 and 40 percent is attributable to fuelwood, between 10 and 20 percent to crop residues, and between 15 and 20 percent to cattle dung. Generally speaking, less dung is used in the South and in the hills than in the plains of the North.

---

*There is no universal agreement regarding precise figures but the above percentages and Table 1 represent a widely accepted view according to Roger Revelle, "Energy Use in Rural India", Science, 4 June 1976. Revelle may be high in his human labor estimates: See Ashok V. Desai, "India's Energy Consumption: A Statistical Appraisal", IDS, Sussex. Revelle may under-estimate the contribution of animal work. See Ramesh K. Bhatia. There is some evidence wood consumption has been over-estimated in the past while vegatable residue consumption has been under-estimated. See NCAER, "Survey of Rural Energy Consumption in Northern India", February, 1978. Much confusion over percentages and relative magnitudes arises from use of gross energy inputs, effective energy outputs, and coal replacement values. The thicket is dense but see Joseph J. Harrington, "Alternative Sources of Energy in the Rural Environment", Harvard U., July, 1977.

TABLE I

Estimated Energy Used In Rural India[2]

Source of Energy	Annual Energy Used (kcal x 10^{14})						
	Agriculture	Domestic Activities	Lighting	Pottery, Brick Making, Metal Work	Transportation and Other Uses	Totals	%
Human Labour	0.59	0.39		0.01	0.09	1.08	9.5
Bullock Work	1.35				0.26	1.61	14.1
Firewood and Charcoal		6.78		0.75		4.60	40.3
Cattle Dung						1.86	16.3
Crop Residues						1.07	9.4
Sub-Totals from Local Sources:	1.94	7.17		0.76	0.35	(10.22)	(89.5)
Petroleum & Natural Gas							
Fertilizer	0.35					0.35	3.1
Fuel	0.08		0.42			0.50	4.4
Soft Coke		0.14				0.14	1.2
Electricity							
Hydro	0.03		0.01			0.04	0.4
Thermal	0.12		0.05			0.17	1.5
Sub Total from Commercial Sources	0.58	0.14	0.48			(1.20)	(10.5)
Total, Local and Commercial	2.52	7.31	0.48	0.76	0.35	11.42	(100.0)
Total Daily Per Capita (kcal)	1.57×10^3	4.55×10^3	0.30×10^3	0.47×10^3	0.22×10^3	7.11×10^3	
%	22	61	4	7	3		(100.0)

2. Uses of Energy

Women are the major energy users in rural India; some two-thirds of total energy used is for domestic activities excluding lighting. Most of this is used for cooking although women's activities other than cooking and water and space heating also require energy. Lighting with kerosene and electricity uses some 4 percent of total energy use. 20 - 25 percent is consumed in agriculture, 5 - 10 percent in rural industry, and less than 5 percent in transport, construction, services, and other activities.

Agricultural energy inputs are approximately equally divided between local and commercial (non-local) sources. Increase in commercial energy inputs to rural areas can be expected to occur predominately in agriculture (fertilizer and irrigation) for some time.

3. The Rural Energy Crisis

There is little evidence that rural people have any perception of an energy crisis. Unlike the urban "energy crisis" spawned by the institution of more rational pricing of limited petroleum resources, the rural energy crisis is but one facet of changing population and ratural resource balances in rural India. It is a crisis of development.

What are its aspects? First, energy is used inefficiently which means, because sources are local, that a great deal of human effort is wasted in fuel gathering. To give but one example, wood is burned in stoves with efficiences of less than ten percent.

Second, too little energy is used in agricultural and craftwork production. In order to increase food, fiber, and fuel production and to increase jobs, more energy in the forms of fertilizer, water lifting, and mechanical power is required. Although it is conventional for Western technicians to assume that this means more chemical fertilizer, diesel and electrical motor pumps, and tractors, it is likely to be more rational to complement these commercial energy inputs with animal and plant manures; solar, wind, water, biogas, and improved animal-powered water lifting; and more

efficient agricultural and artisanal implements. These all mean more effective energy is applied to production whether or not the commercial energy statistics so suggest.

Third, women and children are the major energy users. They work hard: Indian women expend as much energy in work as a British coal miner according to Roger Revelle. The labor of children to fetch water and fuel is exceedingly valuable and provides an incentive for larger families. The drudgery of many tasks relegated to women prevents more productive and satisfying pursuits.

Fourth, the soil wealth of India is currently being mined at what is frequently asserted to be an alarming rate by burning of dung with its nutritive value and by deforestation, the consequences of which are desert encroachment, soil erosion, and increased flooding. Furthermore, such large scale inefficient burning is a major contributor to air pollution (on both the micro and macro levels).

Fifth, lack of effective energy has important health implications. Incomplete combustion of dung, wood, and vegetable wastes creates hazards to eye and lung health. Inaccessibility of clean drinking water is a cause of waterborne disease and of diseases that could be prevented by increased cleanliness. The arduous labor of the Indian farmer and housewife strains the ability of the food production system to supply sufficient nutrients to the body as long as food production is held back by ineffective and insufficient energy use.

4. Rural Energy Priorities

The above discussion suggests three major energy needs of rural India: water lifting, fertilizer, and cooking fuel. Cooking fuel is valuable for its own sake and to release dung for fertilizer. Its presence on the high priority list arises from cooking's predominant place in energy consumption. Water lifting is crucial because of health implications and the large irrigation in increasing agricultural production and thus sound well being. Fertilizer is required for soil maintenance and as a second key element in agricultural production.

Lesser priorities include the following:

a) increased effective mechanical power for agriculture,

b) transport,

c) hot water for cleaning,

d) crop post-harvest treatment including drying,

e) household, craft, and small-scale industry (heat and mechanical power),

f) water desalination,

g) space heating, and

h) electricity for lighting and communications purposes.

In terms of energy source development, the following priorities suggest themselves on the basis of: a) availability of technology, b) low cost, c) dependence on and enhancement of local skills and resources, and d) environmental compatability.

1) Improve efficiency of energy use across the board, starting with chulas and including manure handling, water management, plows, bullock carts, traditional water-lifting devices, gur making, pottery, lime and brick kiln operation, and lamps.

2) Utilize cattle dung, human excrement, and plant residues in a scientific manner to produce fertilizer while at the same time producing combustible gas for cooking and driving irrigation pumps and nutrient feed for algal/fish ponds. This priority area is given importance by GOI in their biogas program.

3) Increase productivity of village forest, waste, or fallow lands to grow fuelwood for village use while at the same time maintaining soil fertility and increasing those lands' output of animal fodder: through edible leaf protein, inter-cropping of grasses, or separate production of high yielding fodder and fuelwood.

4) Complement higher efficiency chulas, biogas, and fuel woodlots with a program to develop and disseminate solar cookers to supplement other cooking materials. Where hot water is required, cheap solar water heaters should also be included.

5) Pure water for drinking requires energy in two ways: solar stills for desalination where necessary and solar, wind, biogas, or hydraulic ram pumps for lifting.

6) The cheapest way to increase irrigation in India is improved water management, including drip irrigation and various water harvesting techniques. Then low-lift pumping without need for massive construction works is indicated using improved animal-powered pumps and wind/solar/hydraulic energy.

7) Develop a wide range of other devices to supply energy from renewable sources such as: solar electric generators, micro-hydro units, windmills, biomass conversion devices, crop dryers, and refrigeration units.

The real point to be made is that items (1) - (6) involve for the most part known technologies, meet critical needs, and can be the most significant new contributors to rural India's energy development starting immediately. Oil, coal, and electricity distribution to rural areas to do the jobs that need to be done does not appear possible within any reasonable timeframe, nor desirable over a longer timeframe. The second point is that each of the technologies is best implemented at the local level; adaptation to local circumstances is a must. You can't cook chapatis with a steam cooker and you can't cook with a solar cooker either.

5. Energy Analyses

A major characteristic of a rural energy strategy is its role as a component of a village energy system (or more broadly - a village development) plan. A village energy analyses could be an integral part of an AID/DST rural energy development project.

To see why, consider the deforestation phenomenon in hill Himalaya. Forest cover is reduced because a) expansion of cropland (onto steeper soils), b) removal of forest fodder in excess of replacement, and c) removal of fuelwood in excess of replacement. Each of these "causes" of deforestation has its own energy and social linkages with the rest of the village ecosystem. One-dimensional attempts to solve the problem lead to such actions as fencing the forest and replanting. Such attempts invariably fail. What is needed is a multi-dimensional attack that <u>might</u> comprise some or all of the following features:

-- improved wood stoves,

-- solar cookers,

-- biogas plants/solar warmers,

-- irrigation for food/fodder,

-- hydro/wind/solar electric generation for pumping and nitrogen fixation

-- fodder dryers,

-- forest management for increased fuel/fodder production, and

-- a considerable amount of community organization and (probably) land reform

In order to understand future energy needs and the linkages between economic development and energy, it is necessary to probe deeper into typical rural systems of natural resource use. A useful organizing tool in such an exercise is a village energy budget done for typical villages in each of the major identified agricultural systems of the nation. The first step, therefore, is to characterize India by regions according to energy-related criteria; e.g., a village off the grid, rice cultivation predominating, deforested hills, and high rainfall.

The energy budget itself considers the following elements of a village ecosystem: Forest, pasture, cropland (irrigated and non-irrigated), livestock, and household. Energy flows between these elements are

estimated from known statistics of household size; livestock population; forested, grassland, and cropped areas; and use of chemical fertilizers. These data are specified to energy flows by use of generalized coefficients.*

The next step is to relate economic and social development in each area to energy development by identifying energy bottlenecks to improving the quality of life. These bottlenecks are best viewed as economic development or natural resource management problems and relate to improvements in public health, agricultural or foresty productivity, or environmental quality. In most cases, all these factors will be relevant. Biogas production, for example, improves sanitation if coupled with a night-soil collection system, improves agricultural productivity through better use of an alternate fuel, and improves water quality by treatment of human and animal wastes in the digester.

Energy contributions to development can then be related to possible energy sources - not excluding conventional energy sources. Such energy sources can be matched to needs in terms of quantity and spatial and temporal patterns. It is imperative that full recognition be given to the need to match energy sources to end-use needs rather than assuming one energy source (for example, electricity) is best suited to all energy requirements for a rural area.

An example of the development approach to energy analysis is the report of the Seminar on Small Scale Hydropower Development in Nepal which began from a recognition of the severity of the natural resources degradation problem -- deforestation, erosion, and flooding -- and analyzed the causes of the deforestation. It was found deforestation occurred because of a) expansion of agricultural land, b) forest biomass removals for animal feed, and c) fuelwood extraction. It was calculated that, if productivity on existing cropland could be improved with irrigation and fertilization and if hay drying could be provided, then pressures on forest land from cropland expansion and animal foraging could be substantially reduced. This would permit proper management of forests to increase productivity as fuel-woodlots.

---

*Ideally, some activities under this project will involve village studies of actual (measured) energy use.

In order to increase cropland productivity and to dry hay, energy is necessary in the forms of mechanical power for pumping, fertilizer, and heat. Given the abundance of hill-streams in Nepal, this energy can come from hydropower with augmentation in selected cases by biogas and wind. Hydropower can produce electricity to drive pumps and make fertilizer by the "electric arc process". Surplus heat can be used for crop drying. Power can also be used for supplying potable water to villages.

The purpose of such an analysis of the energy implications of development needs is to move beyond the conventional approach which projects energy needs based on current use and trends of the past. In the suggested approach, energy is viewed as an input to development, not as an end in itself.

6. An A.I.D. Role

A.I.D. can assist in a modest way achievement of more effective utilization of local energy resources in rural India.

First, a positive A.I.D. stance can have a favorable psychological impact on policy and opinion leaders. At the moment, it is the popular notion that solar energy is for the 21st century in spite of its providing 90 percent of rural India's energy right now. The tremendous potential of efficiency increase, biogas, biomass utilization, and solar energy in general needs to be better known.

Second, A.I.D., by its outsider role, can provide support to non-official organizations or to government/university agencies that would not ordinarily be in line to receive GOI funding for projects. This is especially true of multi-disciplinary R&D work as well as projects with a local focus and an organizing component. This A.I.D. role will only be significant, however, if A.I.D. acts as somewhat of a catalyst in sponsoring this work. Otherwise, it is probable all project support will proceed along conventional channels.

Third, exchange of S&T people will not only improve everyone's knowledge of the state of the art but will also bring together Indians who might otherwise not meet and work together because of institutional constraints. Americans in Indian institutions can act as catalysts.

Fourth, Americans may be willing to go places and do things that professional Indians may not; install a micro-hydro unit in a remote hill village in cooperation with a local volunteer group, for example.

Fifth, and this is the essential point -- while the real efforts will be in villages and certainly not involve dollars, there is a need for sophisticated knowledge of technology to assist local efforts at adaptation to produce appropriate technology. For example, the life of a water turbine can be significantly increased by application of resin coating. The turbine is basic metal-working technology. The resin is a high-technology product readily and inexpensively applied to the wheel.

There is a need for a constant interchange between village doers and university R&D people: a two-way interchange. The Chinese say "science walks on two legs". A.I.D. can help support the high technology leg and can encourage the other.

7. Workshops

One important means for the Grant to achieve its purpose is to organize with DS&T or other appropriate GOI agencies a series of workshops focussed on problem areas. These workshops will bring together Indian and U.S. experts and doers and will aim to produce proposals. There are many possible topics. Illustrative topics include:

-- solar cookers,

-- improved stoves,

-- micro-hydro,

-- solar cell applications,

-- transport efficiency

-- women and energy, and

-- biomass conversion techniques

A strong case should be made for inclusion of non-officials in these workshops. Furthermore, some workshops might have a regional/state focus to better relate to local needs.

ANNEX B

ILLUSTRATIVE PROJECTS

Proposed Projects

What follows is a brief description of a limited number of sample projects in the areas of rural energy and village industries with their major strong and weak aspects highlighted.

1. Operational Research on Solar Energy Utilization in Western Rajasthan

An agriculture-emphasis request for rupee funding of such a project has been received by USDA from Central Arid Zone Research Institute, Jodhpur. Discussions with Dr. H. P. Garg in Jodhpur revealed that modest dollar expenditures were origianlly envisioned but not included in the USDA proposal because of unavailability of dollars from that source. Partially, as a consequence of confusion as to what does constitute an acceptable project proposal for U.S. funding, the written proposal itself is not sufficiently detailed for complete evaluation at this time. There are also ambiguities in scope. One proposal examined, for example, was for three years and Rs. 25,36,860; it involved five institutions in different parts of India and emphasized crop drying. Another proposal was restricted to CAZRI and five villages of Western Rajasthan and requested Rs. 5,49,230. It is this latter proposal that is described here.

Five villages in western Rajasthan, a semi-arid to arid region, are being selected for field testing of the following solar devices:

i) solar cookers (oven type), 10 per village, in houses without cattle,

ii) biogas plants, 5 or 10 per village, in houses with minimum of 5 head of cattle,

iii) solar stills, 1 per village each of whch has brackish water supply,

iv) wind pumps, 2 - 3 per village,

v) solar fruit/vegetable dryers,

vi) solar water heaters for biogas slurry, bathing, and clothes washing.

Relatively low cost versions of the solar ovens, stills, dryers, and water heaters are now operating in one village together with a biogas plant, drip irrigation system, and improved horticultural practices. The five selected villages will be in an area with saline water, no irrigation, and limited numbers of trees and cattle. In other words, they will be villages where energy supply is considered a significant socio-economic and environmental problem.

The Project is designed to:

a) install, operate, and evaluate the devices already developed at CAZRI,

b) evaluate different types of gobar gas plants (including "Chinese" type) and solar cookers,

c) develop efficient, low-cost designs for fabrication and use of devices,

d) lead to extension of improved solar devices in demonstration regions in western Rajasthan,

e) encourage entrepreneurs to enter the solar appliance business, and

f) train personnel to design (for local conditions), install and maintain solar devices.

The socio-economic division of CAZRI will be involved in monitoring efforts to an extent yet to be delineated. Expected benefits include job creation from village fabrication, retention of nutrient value of cow dung and plant residues, reduction of pressure on trees and, therefore, on soil (desertification protection), vastly improved drinking water supply, and reduced firewood gathering time. Indirect social costs relating to shifting use of cow dung and wood have not been identified.

The proposal as submitted to ICAR/USDA includes no dollar budget because it was understood no dollars were available. Dr. Garg indicated, however, that an earlier proposal had requested foreign instruments for solar radiation measurements and methane gas analyses. Total budget was $67,000. It is understood that none of the required instruments are currently available in India.

In addition, Dr. Garg indicated interest in an exchange of scientists between CAZRI and U.S. institutions on a short-term basis followed by a joint workshop to exchange ideas about how to gain maximum advantage from such a field testing project. This would require small dollar amounts.

As Table 3 indicates, such a project shows high promise from an A.I.D. viewpoint. CAZRI could be in a position immediately to exchange scientists as part of the start-up phase leading to a plan of work. It is recommended that extension, entrepreneurial development, and socio-economic evaluation (based upon a thorough pre-project survey) be significant project components.

2. Development of 12 KW Solar Thermal Power Plant

A fairly detailed joint proposal for such a project has been submitted by the Jet Propulsion Laboratory (JPL) and Bharat Heavy Electricals L&D (BHEL) to USDOE which has recommended the project on technical grounds. USDOE funding is not available, however. The project is strongly endorsed by DS&T, and by the U.S. Embassy Science Counsellor. It is the product of nearly two years of JPL/BHEL discussions under Into-U.S. Joint Commission auspices and is taken seriously by the S&T Subcommission almost as a showpiece project. The dollar component is relatively high: $645,000 over three years of which $200,000 is U.S. equipment costs; $360,000 in U.S. personnel costs (6 person years); $50,000 is for Indian per diem in U.S.; and $30,000 is for U.S. computer time and travel costs. In addition $78,000 in SFC rupees for international travel is requested. GOI rupee costs are expected to total some Rs 8 million. The project is clearly a financially significant one for both BHEL and JPL.

The project as currently envisioned is to develop a small solar thermal electric generating capability for Indian villages. The proposed system includes a parabolic two-axis tracking concentrator, a heat engine (Rankine cycle initially with hopes of using Stirling cycle in phase 2), an electric generator, and thermal storage. Design output is 12 KW.

The following are objectives of the Project:

a) develop a means to electrify villages remote from the grid,

b) provide opportunity for mutual exchange of technology and experience between U.S. and Indian solar scientists,

c) train Indian staff and technicians in design, installation, and operation of solar thermal power plant, and

d) use experience with plant to design a second generation plant for commercial production.

The proposed Project is of interest to the U.S. because it forms an important component of the "distributed system" alternative to the highly uncertain but currently preferred "power tower". Each module of a "distributed system" would be a 10 KW mini-powerplant of the type proposed to be funded by A.I.D. It is apparently not of high research and development priority for USDOE in light of emphasis being placed on power tower development but its modularity makes it potentially attractive both as a remote power plant and as an element of the distributed system.

The Project covers three phases extending over five years; only the first two phases form the proposal as submitted to USDOE. Phase I (1½ years) involves environmental studies, initial techno-socio-economic study including site selection, purchase of a 7.5 KW commercially available system, operation of experimental test syste, design of 12 KW Rankine prototype system, and development of detailed project plan. Phase 2 (1½ years) involves design, fabrication, assembly and installation of first prototype in village; testing of prototype; more detailed techno-socio-economic studies, performance testing in U.S. of 1 KW Stirling engine, and design of first commercial model.

The rationale for a 12 KW power plant for remote Indian villages is not clear but it appears to be the same as for rural electrification: to bring electricity to villages for irrigation water lifting, rural industry and the lights and appliances of social/community facilities. The same questions raised with regard to the economic, distributional, and stimulation of rural enterprise effects of rural electrification can be raised about a solar power plant project. It is, however, aimed at remote (and, therefore, presumably poorer) villages and it does utilize a renewable source of energy.

One of the fundamental issues involving the electrification of rural areas is the degree to which the high quality energy form of electricity is matched to village energy needs. No analysis accompanies the proposal to illuminate this issue; the implicit assumption rests undisturbed that electricity must be good and that 12 KW is better than 1 KW (but less good than 24, 36, 48 ... KW). What is needed, and this comment can apply to all of the proposals put forwarded, is observation and analysis of current patterns of energy use, development needs, and the <u>best</u> energy source development <u>combination</u> to meet those needs.

If it is proposed, for example, to have 1 KW for lighting and community television (educational), 4 KW for a flour mill, 2 KW for drinking water pumping, and 5 KW for an irrigation pump, then, it is possible to determine the best mix of technologies which might be 1 KW solar cells, 4 KW micro-hydro, 2 KW wind pump, and 5 KW solar thermal pump. Or, it might be 12 KW solar power, at least partially, because of the flexibility thus provided. That flexibility is almost certain to be costly, however, and it cuts two ways, for the more centralized a power source, the less control accrues to users.

The technology proposed to be developed in this project exists now, but not as a power plant unit, and certainly not as a power plant unit designed for low capital and maintenance costs. To develop such a unit is a primary objective of the project. It is not clear that A.I.D. has a mandate to support research this far from cost-effective applications.

The project proposal assumes that little or nothing is currently known about patterns of village energy use. It would be useful to see preliminary analysis of energy storage requirements, for example, with comparisons of thermal and electrical storage on a cost basis. It would also be useful to see a justification of the 72 KWH design output which seems somewhat optimistic for most of India.

The proposal makes no cost comparisons with other means of doing the same job nor does it project costs. This is true of all the other proposals seen except for the photovoltacis proposal. The scope of techno-socio-economic studies is currently being refined and clarification.

As Table 3 indicates, this project's ranking is not high for the following reasons:

a) There is no evidence presented that costs can be reduced sufficiently to provide a favorable B/C,

b) A village trial would not begin for two years and multi-village trials are out of the question for at least five years because of costs,

c) Project is environmentally appropriate and its decentralized application could enhance local control but it is basically a technology that depends on central provision and maintenance of the device. It is not, therefore, socially appropriate.

d) There are not expected to be significant indirect costs. Indirect benefits from

provision of drinking and irrigation water, lights and community television could be large.

3. Field Test and Demonstration of Solar Cells for Education and Water Pumping

This proposal originated from Central Electronics Ltd, (CEL) which is a GOI (DS&T) enterprise given full responsibility for coordination, proposal evaluation, institutional capabilities identification, project monitoring (currently nine proposed projects from as many institutions around the country are under DS&T/CEL consideration), and solar cell production. The proposal went to NSF and ERDA in 1975 and was again discussed with ERDA in 1976. Since that time, it has lain dormant for lack of U.S. interest although it is apparently enthusiastically supported by DS&T.

The Project envisions field testing of solar cells in 100 - 200 villages. Each village would be provided a 70 W panel for educational television in a community facility. In addition, some 30 villages would have an average 1000 W panel for drinking water or irrigation pumping.

The Project would provide actual field experience over a three year period with both U.S. and Indian solar cells. Concentrating systems might be included. Alternative pump configurations (for example, with and without battery storage) can also be tested.

There are currently 2400 villages participating in the rural educational television program, about evenly divided among clusters around transmitters in Rajasthan, Bihar, Onissa, M.P., A.P., and Karnataka. 700 of these villages are not electrified. In these villages, each TV set has four batteries for power. At any time, two of these batteries are in a service center for recharging. Solar cells would eliminate two batteries for each TV set and would make unnecessary periodic recharging.

Solar powered pumpsets would be fielded during the first 18 months in or near agricultural universities, then in villages. Some would be intended for drinking water supply, others for small farmer irrigation. Sites would be chosen near the TV clusters and in areas where solar irrigation is expected to be competitive soon.

A total of 40 - 5- KWP of U.S. solar cells are proposed to be purchased from several manufacturers so field comparisons can be performed. This is expected to require nearly $500,000. In addition, approximately $20,000 is budgeted for U.S. DC pumpsets unavailable in India. Instrumentation is anticipated to cost some $50,000 and exchange of scientists another $50,000. Thus the total foreign exchange budget is roughly $600,000 over three years. Details of U.S. collaboration have yet to be arranged.

Indian solar cells would be fielded together with U.S. cells during the project's second 18 months, when approximately 10 KW are expected to be available.

CEL also has a proposal pending for a pilot solar cell manufacturing plant costing $3.5 million, possibly funded by UNDP or UNIDO. They anticipate production of 1 MW of panels by 1981 - 82 at cost of Rs. 50/WP and 100 MW by 1986 at Rs. 10.

This Project, like the preceding, will supply electricity to rural (remote) villages. It differs, however, in that it supplies power in a modular, size-tailored fashion to specific devices that are deemed best operated from such an energy source. This extreme form of decentralized electrification has the disadvantage that any complementarities in use that could lead to higher load factors (through diversity) cannot be taken advantage of without physically shifting the panels. Such diversity complementarities are not often seen in rural India, however.

The proposed Project requires more detail before it can be fully evaluated, especially with regard to water pumping, site selection and organization of field testing and monitoring. U.S. collaborating institutions must also be identified and their input to a joint proposal solicited. Given evidence at hand, however, the project appears likely to meet A.I.D. criteria as indicated in Table 3.

The Project proposal supporting documentation shows photo-voltaics to be competitive with diesel/petrol alternatives on a straight financial cost basis - when solar cell prices reach Rs. 10 WP. This is expected to occur within five years. For lighting, educational television, and other applications especially in remote areas where fuel supply and engine maintenance are difficult, the breakeven cost is often considerably higher so that the technology is nearly competitive on a financial basis right now. Thus, expected B/C ratios based on direct benefits and costs are favorable.

In addition, indirect costs are negligible (no air, water, or noise pollution) while indirect benefits from water supply, provision of social and educational services, and employment creation will be substantial.

The Project is applications oriented; there is no component of laboratory technological research. Purpose is to field test and modify as necessary available technology. Field testing would begin immediately after village selection and by 1982, the nationwide impact could be enormous if solar cell costs behave as predicted by USDOE.

The Project focuses on poor, remote villages but does not necessarily benefit the poorest in those villages. Because of the emphasis on micro-irrigation, however, solar cell-powered ¼ - ½ horsepower pumps would be ideally suited to the needs of the small farmer with fewer than two hectares of agricultural land. As with all technologies, however, institutional mechanisms would have to be devised to ensure that such farmers do, in fact, reap the intended benefits.

The Project as proposed receives mixed reviews as to appropriateness. It does not use local materials or fabrication although manufacture in India with little import of raw materials is possible. It has a very high initial cost so that small farmer financing is possible only with assistance. It can, however, easily be maintained and adapted to local needs within a village. Its modular character makes adaptation to changing circumstances particularly easy.

4. Comments on Other Possible Projects

There are a large number of possible projects in addition to the three discussed above. In order to illustrate certain points regarding criteria and implementation, several of these have been selected for brief review. Not all of these represent proposals and are, in fact, expressions of interest in proposals.

a) Thin Film, Heterojunction Solar Cells

This joint proposal by IIT, Delhi, and University of Delaware involves research into CdS solar cells. Request is for $45 - 90,000 over three years plus $10,500 in SFC funds.

The proposal from a technical point of view is highly worthy of support. It is, however, a strictly laboratory effort with results extremely uncertain. Even with favorable results, the environmental and health problems caused by cadmium use, and the exceedingly limited supplies of the material in India, militate against any further A.I.D. consideration of the proposal.

b) Solar Drying of Agricultural Products

This joint proposal by Annamalai University and Colorado State University involves (i) assessment of drying demands of agricultural products, current practices, and climatic factors; (ii) use of assessment by Colorado State University to apply or to modify existing U.S. solar technology for Indian applications with modifications by the Indian team as necessary; (iii) construction of prototype units in India using CSU generated design specifications and fabrication methods; and (iv) a field monitoring program during the third year to measure the effectiveness of prototype units.

The proposal has been recommended by USDOE but funds are unavailable. Request is for $160,000 over three years but breakdown is not known. SFC funds total $30,000. The most recent proposal description made available is dated 12/30/76 and does not include CSU. It is understood a joint proposal is being prepared. The original proposal (submitted to NSF for SFC funding) included collaboration with several U.S. institutions in addition to CSU. This remains an excellent idea.

The Annamalai University Department of Mechanical Engineering has proceeded to build a proto-type one-ton-per-day paddy drier and to install it in a government Food Corporation of India rice mill near the University (which is in Chidambaram, Tamil Nadu). Their cost comparisons with the current use of furnace oil show a savings of Rs. 7500 per year with their drier. The department has published a number of papers on parboiled paddy drying and has produced three PhD dissertations on the subject.

The Project is certainly worthwhile for A.I.D. to support. The following suggestions should make it even more responsive to A.I.D. criteria:

1. The emphasis on big mills and their need is not likely to directly aid the rural poor or, in fact, any farmers. There may be a major need for small driers for paddy; there certainly is for other products.

2. The M. E. Department of Annamalai has apparently had some years of effort in developing low cost devices. There should be an emphasis on this in the proposal.

3. A useful product of the project could be a survey of India's crop drying needs (expressed as a function of cost of drying). This should especially focus on the needs of the small farmer.

4. Field testing of a prototype has already begun. Talk of waiting until the third year should be discarded and units should be fielded from the start in different situations.

5. Local fabrication from easy-to-understand drawings should be stressed. Field units should be so constructed.

c) Medium Temperature High Efficiency Tracking and Non-Tracking Solar Energy Collectors for Rural and Industrial Applications

This Project has a proposal dated 1/27/78 jointly written by University of Houston; 115, Bangalore; and PAU, Ludhiana. It has been approved without funding by USDOE. Request is for $420,000 over five years. ($100,000 the first year of which $35,000 is UH salaries, $5500 equipment and supplies, and $18,000 subcontract to determine state of art of selective coatings in U.S.).

The proposal is for a two-phase project extending over five years. Each phase is for three years with a one-year overlap. The first phase is prototype development; the second is demonstration and commercialization.

The project aims to review the state of the art and work collaboratively to develop cost effective collectors for medium temperature heating (150° C.). Such collectors are needed for steam production, thermal power production, pumping, and refrigeration. Techniques to be investigated include selective coatings, tracking concentrators, fresnel lenses, and evacuation of the receiver. In the second phase (beginning year three) system will be developed and demonstrated for pumping and process heat production.

The proposal concept is sound and should be A.I.D. supported.

d) Vapour Absorption Refrigeration System with Conventional Flat Plate Collectors

This proposal has apparently been rejected by DOE. Grounds for rejection are not known. It was jointly prepared by IIT, Madras, and University of Florida (Dr. Erich Farber). Design, fabrication, and testing of absorption refrigeration systems will be done for 1 ton and 10 ton plants of intermittent and continuous types. One ton units will be tested in the U.S. and India simultaneously to provide guidance for design of the ten ton units.

In addition to this proposal there has also been an informal proposal to develop compact ice makers such as the one developed at University of Florida. Roorkee University is working on ice maker development.

Refrigeration units for cold storage of fruits, vegetables, and fish and other products may be a useful application of solar energy. Preliminary economics look favorable for many situations. If it can be demonstrated that benefits will flow to the rural poor (which is certainly not the case with most uses of refrigeration but could be for health centers and fishery or agricultural cooperatives), then, A.I.D. should favorably consider proposal in this area.

e) Micro-hydro Development in Assam and U.P.

No proposal of this nature has been submitted. The reason is probably because there is no central government agency or institution interested in small scale hydro-power development. Non-official groups do have some interest, however, and AVARD (Association of Voluntary Agencies for Rural Development) has informally suggested such a project. They are unclear what might be involved but have dispatched a consultant civil engineer to Assam to explore possibilities. The U.P. State Planning Unit (PRAD) is also interested in feasibility of such units in the hills of U.P.

A.I.D. assistance, in which AVARD and PRAD expressed interest, could have the following elements:

i) pay one or two U.S. consultants with experience in manufacture and installation of small-scale hydropower units to come to India to work for several weeks or months with PRAD and an AVARD member group in assessing possibilities in their region,

ii) send several Indians from PRAD and the AVARD group to the U.S. to see manufacture, installation, operation of small scale units,

iii) import sample units from the U.S.,

iv) support redesign of PRAD hydro power unit for lower costs with particular focus on reducing cost of civil works,

v) support analysis of the socio-economic implications of micro-hydro and how it complements other energy development, and

vi) support training of people to locally manufacture turbines.

The difficulty may be that non-official groups will not be encouraged by the Joint Commission to apply for A.I.D. project support. This would be unfortunate and A.I.D./W should take steps to ensure such proposals a fair hearing. In this particular case, however, support could presumably be given through PRAD and the U.P. state government.

f) Village Industrial Development

The livelihood of village artisans and consequently the economy of villages has been declining for some time because of lack of suitable power machinery to compete with large-scale factory machinery. True rural development in India depends upon more energy inputs deployed more efficiently.

An A.I.D. role in this area is limited but could have a significant impact. To illustrate this, there will be briefly described several industrial development S&T needs specifically identified by M.K. Gang of the Appropriate Technology Development Association in Lucknow. Gong was earlier with the U.P. government (PRAD) and was responsible for developing the whitewear, pottery and small-scale capital sugar industries that effectively compete with large-scale units and that contribute to village well-being.

The strategy of M.K. Gang is to emphasize three elements in development of a successful village industry able to be replicated on a wide scale as were whitewear and crystal sugar. First, careful attention must be given to product selection. The product must be competitive and in demand. Second, a technology must be developed that can produce the desired product at competitive costs and can provide a living earning to the user. This technology will often be a power-assisted item of machinery. Third, an organizational structure must be devised to disseminate the technology and ensure its availability to the artisans for whom it was intended.

There are two needs for U.S. assistance. First is for design and development engineers, materials specialists, and chemical process engineers, on a short-term basis to look at specific problems and suggest solutions. Second is for funding for prototype units. (This second need would be primarily for rupees, however).

One example of a specific S&T need is for a more durable material for guides and linings of small-scale, centrifugal rice mills. There are currently more than 50,000 rice hullers in the country that are being forbidden continued operation because of high losses. Unless they are replaced by a more efficient and economical alternative, the large "modern" mills based in towns will capture the entire trade, leaving villages once again abandoned.

An entrepreneur in Kangrer has developed a new type of mill: centrifugal impact sheller, that has a yield higher than "modern" mills and that is well suited to village scale opertion. The rice husk guides and rubber linings, against which the highly abrasive husks impact, wear out rapidly and a more durable material is required. Perhaps a U.S. consultant can suggest the appropriate material. The cost is low; potential is great.

Another example is a proposal for a paper making project with a central pulping unit servicing village, small-scale cylinder-type paper lifters developed in India. The project will be paper for school books. The need is for assistance to do a feasibility study of a tree/grass pulp mill of appropriate size and compatible with local land use.

5. Conclusions

a) Analyses of village energy systems (present and future) for representative socio- and eco-systems should be undertaken by an Indo-U.S. group as an integral part of this S&T for Rural Development Project.

b) The following projects appear to meet A.I.D. criteria and should be encouraged to submit detailed proposal:

-- solar energy utilization in western Rajasthan and four other areas of India,

-- solar crop drying (Annamalai U.),

-- medium temperature solar collectors (115, Bangalone and PAU, Ludhiama), and

-- field test and demonstration of solar cells for educational television and water pumping.

c) The heterojunction solar cell proposal should be rejected.

d) The 12 KW power plant proposal (JPL/BHEL) should be considered with the following modifications:

-- reduction in scope of funding to include only equipment procurement of prototype units and restrained exchange of scientific personnel,

-- elimination of large-scale salary support of full-time U.S. researchers,

-- incorporation of socio-economic analysis of alternatives including power plant cost reduction forecasts compared with conventional and non-conventional alternatives, and

-- emphasis on low cost, low maintenance technological possibilities.

e) Project focusing on improving efficiency of energy use should receive priority and should be solicited. Such projects could include wood stoves, agricultural implements, transport, fertilizer application, and combustion of crop residues.

f) High priority should also be given to development of biomass energy proposals that might include:

-- species selection for an integrated fuel/fodder production plan that maintains soil fertility

-- review of conversion technologies and identification of priority technologies for R&D in India,

-- improved utilization of most common crop residues, especially bagasse, coconut husks, savdust and rice husks,

-- means to increase use of plant feedstock to biogas digesters, and

-- development of village woodlots.

g) Workshops could be organized by DS&T/A.I.D. on a series of topics from which proposals are expected, for example:

-- biogas (instrumentation/monitoring needs, microbiology, international information dissemination, plant feedstocks, public health implications of human excrement utilization),

-- micro-hydro (hydraulic ram design improvements, low-cost civil works, water wheels for small industry, hydroelectricity, and

-- water lifting technologies (wind, solar thermal, photovoltaic, animal, human, biogas).

h) The preiminent role of women in rural energy use should be explicitly recognized through funding earmarked for women's projects to better understand how women use energy and how this might change and to monitor women's reactions to energy devices such as solar cookers, smokeless or higher efficiency chulas, biogas burners, and improved water supplies. Institutions such as Sri Avinashilingam College for Women, Coinibatore, that now do excellent nutrition work should especially be encouraged.

i) Priority should also be given to establishment of a project to provide consultancy services to groups developing machinery for use by village artisans, for example: spinning, rice milling, paper making, sugar making, and wool spinning. Focus should be on meeting requests for design or materials advice for specific, well-defined purposes where the major tasks to develop an economical, small-scale piece of machinery have already been accomplished.

TABLE 2: Appropriate Technology Characteristics

	3a: Solar Energy Utilization in Western Rajasthan	3b: 12KW Solar Thermal Power Plant	3c: Solar Cells for ETV and Water Pumping	4a: Thin Film, Heterojunction Solar Cells	4b: Solar Drying of Agricultural Products	4c: Medium Temperative Solar Collectors	4d: Solar Refrigeration	4e: Micro-hydro	4f: Village Industrial Development
1. Low capital costs	+	–	–	–	?	?	?	+	+
2. Use of local materials	+	–	–	–	+	?	–	–	–
3. Job creating	+	–	+	–	–	?	–	+	+
4. Affordable by small farmer or group of farmers	+	–	+	–	–	–	–	+	+
5. Can be understood, controlled, and maintained by villagers without high level of education	+	–	+/–	–	+	?	–	+	+/–
6. Can be produced in village	+	–	–	–	+	–	–	–	–
7. Can be produced in small metal-working shop	+	–	–	–	+	+	+	+	–/+
8. Fosters cooperative activities	–	+/–	+/–	?	+	?	+	+	+
9. Is flexible and adaptable to altered circumstances	+	+	+	+	+	?	?	?	?
10. Practical plans can be made available at low cost or free with no necessity for further payment (of royalties, consultants, shipping, etc.)	+	–	–	–	+	+	+	+	+
11. Will be understandable enough to suggest improvements and innovations to users	+	–	+	–	+	–	–	+	+
12. Develop local skills and ingenuity	+	–	–	–	–	+	–	+	+
13. Benefits will accrue to locality	+	–	–	–	–	+	–	+	+
14. Is environmentally compatible	+	+	+	+	+	+	+	+	+
15. Does not depend on centralized, complex system of distribution and control	+	–	–	–	+	+	+	+	+
16. Addresses important environmental problem (e.g., deforestation or desertification)	+	?	+	–	–	+	–	+	+
17. Forms component of strategy for development suggested by village energy systems analysis	? +	? –	? +	? +	? –	? +	? –	? +	? +

TABLE 3: Evaluation of Selected Projects Against A.I.D. Criteria

	3a: Solor Energy Utilization in Western Rajasthan	3b: 12KW Solor Thermal Power Plant	3c: Solor Cells for ETV and Water Pumping	4a: Thin Film, Heterojunction Solor Cells	4b: Solor Drying of Agricultural Products	4c: Medium Temperative Solor Collectors	4d: Solor Refrigeration	4e: Micro-hydro	4f: Village Industrial Development
Expected favorable B/C	+	-	+	-	+	?	?	+	++
Timing	+	-	+	--	+	+	+	+	+
Applications oriented	+	-	+	-	+	?	?	+	+
Increase income rural poor	+	-	?	-	-	-	-	?	+
Appropriate	+	-	+/-	+/-	+/-	+	+/-	+	+
No significant indirect costs	+	+	+	-	+	+	+	+	+
Significant indirect Benefits	+	+	+	+	?	+	?	+	+

Annex C

INDIA

Application of Science and Technology to Rural Development

PROJECT CHECKLIST

A. GENERAL CRITERIA FOR PROJECT.

1. App. Unnumbered; FAA Sec. 653(b); Sec. 671

(a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure	(a) A Congressional notification was sent in May 1978. (b) No, see (a), above.
2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	(a) AID and the GOI are using a selection criteria approach to projects that will be funded under the grant. The criteria takes into account requirements of Sec. 611. (see PP, page 11). (b) Same as (a) above.
3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	No liquidation is required.
4. FAA Sec. 611(b); App. Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per *the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?*	Not applicable.
5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified the country's capability effectively to maintain and utilize the project?	Yes.
6. FAA Sec. 209, 619. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. If assistance is for newly independent country, is it furnished through multilateral organizations or plans to the maximum extent appropriate?	Project financed under the grant are not expected to be of a regional or multilaterial nature.

7. FAA Sec. 601(a); (and Sec. 201(f) for development loans). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.

(a) Procurement of commodities financed by the grant will be imported, probably all from the U.S. (b) Some projects financed by the grant will be executed by private instutitions. (c) No effect expected. (d) No effect exepcted. (e) Project will improve the efficiency of rural industry and agriculture. (f) No effect expected.

8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

Grant funds are expected to be spent almost entirely in the U.S.

9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.

India is expected to contribute well over 25% of the costs of projects assisted by the grant. U.S.owned Rupees will supplliment local costs of some projects.

10. FAA Sec. 612(d). Does the U.S. own excess foreign currency and, if so, what arrangements have been made for its release?

Yes, the U.S. is using these rupees for joint Indo/U.S. projects and has plans for their eventual liquidation.

11. *ISA 14. Are any FAA funds for FY 78 being used in this Project to construct, operate, maintain, or supply fuel for, any nuclear powerplant under an agreement for cooperation between the United States and any other country?*

No.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(c); Sec. 111; Sec. 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production, spreading investment out from cities to small towns and rural areas; and (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions?

a. The grant is directed towards appropriate technology projects which are directly applicable to rural development and improve the lives of the rural poor.
b. In some cases the project will have a direct effect on local institutions, e.g., universities, research organizations.

B1

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: [include only applicable paragraph -- e.g., a, b, etc. -- which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.]

(1) [103] for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; [103A] if for agricultural research, is full account taken of needs of small farmers;

(2) [104] for population planning or health; if so, extent to which activity extends low-cost, integrated delivery systems to provide health and family planning services, especially to rural areas and poor;

(3) [105] for education, public administration, or human resources development; if so, extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, or strengthens management capability of institutions enabling the poor to participate in development;

(4) [106] for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is:

(a) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;

(b) to help alleviate energy problem;

(c) research into, and evaluation of, economic development processes and techniques;

(d) reconstruction after natural or manmade disaster;

(e) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;

(f) for programs of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.

The grant will focus on technologies appropriate to India's rural development effort and the application thereof. Priority grant consideration will be in the areas of rural energy development (b).

(5) [107] by grants for coordinated private effort to develop and disseminate intermediate technologies appropriate for developing countries.

c. FAA Sec. 110(a) Sec. 208(e). Is the recipient country willing to contribute funds to the project, and in what manner has or will it provide assurances that it will provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?

Yes. All local costs will be funded by the GOI except for some U.S. owned rupees which are expected to be used. The 25% requirement will be more than met.

d. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?

No.

e. FAA Sec. 207; Sec. 113. Extent to which assistance reflects appropriate emphasis on; (1) encouraging development of democratic, economic, political, and social institutions; (2) self-help in meeting the country's food needs; (3) improving availability of trained workerpower in the country; (4) programs designed to meet the country's health needs; (5) other important areas of economic, political, and social development, including industry; free labor unions, cooperatives, and Voluntary Agencies; transportation and communication; planning and public administration; urban development, and modernization of existing laws; or (6) integrating women into the recipient country's national economy.

The grant could conservably effect areas 2-6. See the body of the Project Paper (page 6) for priority areas of the Indo/U.S. Joint Commission.

f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.

The grant will use Indian and U.S. intellectual resources to develop, test and apply appropriate technolgoy for application in rural areas of India. The grant will directly benefit the needs of the rural poor and take into account local capacities.

B1

g. FAA Sec. 201(b)(2)-(4) and -(8); Sec. 201(e); Sec. 211(a)(1)-(3) and -(8). Does the activity give reasonable promise of contributing to the development: of economic resources, or to the increase of productive capacities and self-sustaining economic growth; or of educational or other institutions directed toward social progress? Is it related to and consistent with other development activities, and will it contribute to realizable long-range objectives? And does project paper provide information and conclusion on an activity's economic and technical soundness?

The grant will assist in financing projects that will contribute to economic development and more efficient use of India's resources. The grant is fully consistent with India's development objectives and should contribute to its long term objectives. The criteria presented in the PP will insure that projects selected for financing are economically and technically sound.

h. FAA Sec. 201(b)(6); Sec. 211(a)(5), (6). Information and conclusion on possible effects of the assistance on U.S. economy, with special reference to areas of substantial labor surplus, and extent to which U.S. commodities and assistance are furnished in a manner consistent with improving or safeguarding the U.S. balance-of-payments position.

The grant will be spent for foreign exchange costs, most of which will be of U.S. source and origin.

Annex D

INDIA—APPLICATION OF SCIENCE & TECHNOLOGY TO RURAL DEVELOPMENT

CERTIFICATION PURSUANT TO SECTION 611(e) OF THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

I, Alfred Bisset, principal officer of the Agency for International Development in India, having taken into account among other things the maintenance and utilization of projects in India previously financed or assisted by the U.S. and the commitment of the Government of India to carry out effective programs do hereby certify that in my judgment India has the financial and human resources capability to implement, maintain and utilize effectively the subject capital assistance project for the Application of Science andTechnology to Rural Development.

Alfred Bisset

Alfred Bisset, AID Affairs Officer
India

3/15/78
Date

2

UNITED STATES OF AMERICA

AGENCY FOR INTERNATIONAL DEVELOPMENT

American Embassy, West Building, Chanakyapuri,
New Delhi-110021, India

Telephone : 690351
Telegrams : 'USAID'

November 24, 1978

Mr. S.N. Kao
Director
Department of Economic Affairs
Ministry of Finance
North Block
New Delhi

386-465

Dear Mr. Kao:

Subject: Technologies for the Rural Poor
AID Project Grant No. 386-0465
Implementation Letter No. 3

Pursuant to the request contained in your letter of November 21, 1978, the terminal date for meeting conditions precedent under Section 4.3 of the Project Grant Agreement for the subject Grant is hereby extended until January 23, 1979.

Sincerely,

John L. Withers

John L. Withers
Director

UNITED STATES OF AMERICA

AGENCY FOR INTERNATIONAL DEVELOPMENT

American Embassy, West Building, Chanakyapuri,
New Delhi-110021, India

Telephone : 690351
Telegrams : 'USAID'

January 24, 1979

Mr. S. N. Kao
Director
Department of Economic Affairs
Ministry of Finance
North Block
New Delhi

Dear Mr. Kao:

Subject: Technologies for the Rural Poor
AID Project Grant No. 386-0465
Implementation Letter No. 4

The document submitted by your letter of January 20, 1979, containing the procedures and guidelines to be followed by the Inter-departmental Committee for processing projects financed under the subject Grant is satisfactory to AID. Thus all conditions stipulated under Section 4.1 of the Project Grant Agreement have now been fulfilled and funds are available for disbursement.

Sincerely,

John L. Withers

John L. Withers
Director