PD HAD 498

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

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

PP

2. DOCUMENT CODE: 3

3. COUNTRY/ENTITY: Morocco

4. DOCUMENT REVISION NUMBER: 2

5. PROJECT NUMBER (7 digits): 608-0159

6. BUREAU/OFFICE: A. SYMBOL NE; B. CODE 03

7. PROJECT TITLE (Maximum 40 characters): Renewable Energy Development, II

8. ESTIMATED FY OF PROJECT COMPLETION: FY 86

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 80; B. QUARTER 2 (Enter 1, 2, 3, or 4); C. FINAL FY 85

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

A. FUNDING SOURCE	FIRST FY 80 B. FX	C. L/C	D. TOTAL	LIFE OF PROJECT E. FX	F. L/C	G. TOTAL
AID APPROPRIATED TOTAL	600		600	9,200		9,200
(GRANT)	(600)	( )	(600)	(9,200)	( )	(9,200)
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY		420	420		7,823	7,823
OTHER DONOR(S)		-	-		-	-
TOTALS	600	420	1,020	9,200	7,823	17,023

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	D. LOAN	E. 1ST FY 80-1 F. GRANT	G. LOAN	H. 2ND FY 82 I. GRANT	J. LOAN	K. 3RD FY 83 L. GRANT	M. LOAN
(1) ST	740	290		600		0		0	
(2) FN	740	290		1,494		2,425		1,500	
(3)									
(4)									
TOTALS				2,094		2,425		1,500	

A. APPROPRIATION	N. 4TH FY 84 O. GRANT	P. LOAN	Q. 5TH FY 85 R. GRANT	S. LOAN	LIFE OF PROJECT T. GRANT	U. LOAN
(1) ST	0		0		600	
(2) FN	1,881		1,300		8,600	
(3)						
(4)						
TOTALS	1,881		1,300		9,200	

12. IN-DEPTH EVALUATION SCHEDULED: MM 02 YY 83

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 YES

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: Harry Petrequin

TITLE: Acting Director, USAID/Morocco

DATE SIGNED: MM 09 DD 29 YY 82

15. DATE DOCUMENT RECEIVED IN AID W. OR FOR AID W. DOCUMENTS, DATE OF DISTRIBUTION: MM 10 DD 04 YY 82

AID 1330-4 (3-76)

RENEWABLE ENERGY DEVELOPMENT PROJECT PAPER

USAID PROJECT COMMITTEE

Gary Bricker, Chairman	Office of Technical Projects
Andres Acedo	Program Office
Jack Sleeper	Office of Agriculture
Abdelkader Guennouni	Office for Technical Projects

PROJECT ADVISORY COMMITTEE

Harry Petrequin	Acting Director, USAID/Rabat
George Corinaldi	Education Advisor
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William Erdahl	Program Officer

AID/W PROJECT REVIEW COMMITTEE

USAID PROJECT APPROVAL OFFICER

Harry Petrequin	Acting Director, USAID/Rabat

AID/W PROJECT APPROVAL OFFICER

W. Antoinette Ford	Assistant Administrator, NE

ABBREVIATIONS / ACRONYMS

CDER	Center for Renewable Energy Development (Centre de Développement des Energies Renouvelables)
GOM	Government of Morocco
IQC	Indefinite Quantity Contract
LOP	Life of Project
MEM	Ministry of Energy and Mines
NRECA	National Rural Electrical Cooperative Association
ONE	Office National de l'Electricité
OTP	Office for Technical Projects, USAID/Rabat
TA	Technical Assistance
RFP	Request for Proposals
NEAC	Near East Advisory Committee
RTI	Research Triangle Institute

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Phase II of the Renewable Energy Development Project

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ANNEX No. 1 : New Project Timing

MOROCCO RENEWABLE ENERGY DEVELOPMENT PROJECT PAPER AMENDMENT No. 2

I. Summary and Recommendations:

The purpose of this Project Paper Amendment is to increase the Life-of-Project funding by $2.5 million to cover costs directly attributed to a technical assistance contract which was higher than anticipated and to cover costs related to the selection of a more viable pilot project. The $2.5 million would also cover the effects of inflation. The revised budget appears as Table 4.

The Renewable Energy Development Project (608-0159) was designed to assist the GOM's Ministry of Energy and Mines (MEM) to create a Center for Renewable Energy Development (CDER) with the professional staff and facilities to carry out a wide range of applied research, pilot activities, studies and analyses to identify the most effective ways to exploit Morocco's renewable energy potential and develop programs to encourage its efficient use throughout the country. This project has been very closely monitored by both USAID/Rabat and the Government of Morocco (GOM) during the last 12 months.

It is apparent that the activities planned to ensure realization of the project's goals and purposes require an additional $2.5 million due to increased contractor management responsibilities, a revised site selection for a hydroelectric pilot project, and inflation.

USAID/Rabat carefully considered areas of potential re-design to bring costs within the original LOP funding level of $6.7 million, but has determined that the best alternative is to increase life-of-project (LOP) funding. The additional $2.5 million will bring the total LOP funding to $9.2 million which will assure an environment more conducive to foster project success.

Combined with the current schedule of obligations for the project, the additional $2.5 million will need to be allotted as follows: $0.20 million in FY '83, $1.0 million in FY '84, and $1.3 million in FY '85.

In short, the project is being implemented as approved and is fully consistent with U.S. policy objectives and AID's development strategy in Morocco. The required funding increase falls within USAID/Rabat's AAPL and is consistent with the Phase II Authorization in every regard except cost.

II. Developments Supporting a LOP Funding Increase:

A. T.A. Contract

With USAID assistance, CDER drafted an RFP for a host-country contract for long-term technical assistance. Pursuant to project approval guidance

many of the management tasks were included in the contractor's scope of work. In addition to furnishing technical assistance as described on pages 22-23 of the PP, the contractor is also responsible for A) local on-the-job training and academic training, B) procurement of several hundred pieces of laboratory equipment, C) specification/installation of two dozen pilot projects (except hydro) and D) design/management assistance for a $640,000 small projects' fund to provide T.A. and financing for private enterprise ventures in the renewable energy field.

There was unanimity among GOM selection committee members and USAID observers that the T.A. proposal submitted by Research Triangle Institute (RTI) was the most responsive to the RFP.

A factor contributing to the contract price was the lengthy experience of candidates proposed for resident and consultant positions. Each candidate easily had an average of 15 years of continuous scientific and commercial experience in renewable energy technologies.

The largest budget increase in the T.A. contract centered around laboratory equipment. In this regard, it should be noted that almost four years will have elapsed between the time AID first developed an illustrative renewable energy equipment list in late 1980 and the actual delivery of that equipment. The scientific instrumentation specified in the RFP is undergoing rapid improvement and sophistication leading to much higher costs.

Finally, while the RTI contract represents a 40% increase over the anticipated costs, some of that increase is due to the effects of inflation since the contract was signed 8 months late compared to the ambitious schedule put forth in Annex 3 of the PP. It is now recognized that the PP schedule for contracting did not reflect standard GOM processing which is quite protracted. (See revised schedule attached as Annex 1.)

In summary, the T.A. contract over-run is due to three causes: 1) AID's need to shift greater managerial responsibility to the contractor, 2) an RFP which encouraged the submission of the very best T.A. packages possible, and 3) delays leading to inflation which has particularly affected the procurement cost of hundreds of laboratory i' ms.

$640,000
number eliminated
in Auth. Pkg. draft

6

B. Confirmation of Small Hydro Demonstration:

USAID and GOM are developing three hydroelectric demonstrations virtually independently of the T.A. contractor. While it was initially presumed that management of this "tried-and-true" technology would move along rapidly, three consultancy efforts were finally required.

First an IQC developed proposals which missed the intent of the demonstration: to show the economic attractiveness of small-scale, run-of-the-river hydroelectric units located off-grid. Rather massive civil works projects insensitive to existing agricultural irrigation patterns were proposed.

These over-designed proposals were scaled down with the advice of a very experienced senior-level small hydro expert. During this second effort, the expert understood that he could propose no alternatives to the 3 identified sites and that he should do his best to reduce costs under these constraints. In view of the extraordinarily high projected costs per kwh at Msemrir, AID and ONE decided to reject Msemrir. The Msemrir demonstration would also have conflicted with farmers' inherited water rights. Also, USAID was aware that local complaints had been voiced to the Prime Ministry concerning another pilot project, Archbalou.

In light of these developments, USAID/Rabat sought a third and final opinion from two Moroccan firms working in tandem with the U.S. National Rural Electric Cooperative Association (NRECA). This approach succeeded in locating Tinkhar N'Ifni (an exceptional hydro site), in lieu of Msemrir and confirmed that conservative elements in Archbalou had been fearful that they could not divert water to irrigation in the event of drought. A "townhall" meeting among the Archbalou farmers, the Moroccan contract engineers, and elected officials concluded in a mechanical re-design which would allow daily manual control over electric generation such that the community retained absolute control of their spring.

USAID and ONE with CDER supervision have consequently agreed on the three hydro sites summarized below in Table No. 1. All three sites are in very remote mountainous regions far from any potential extension of the grid. Because of their common special feature of having year-round flowing spring water, they are self-sufficient and relatively prosperous examples of traditional rural communities practicing subsistence agriculture in a barter economy. Fortunately, none of the pilot projects will disrupt current agricultural productivity. (However, the residents of Archbalou may during very dry summers be forced to decide between electrical production and crop irrigation). All sites are economically superior to the only rational alternative -diesel generation. Tinkhar N'Ifni's kwh will cost 37% of a comparable diesel generator. (Line 12 divided by line 13).

The other two sites have hydroelectric costs which are about 85% that of installing diesel units. If the three villages had decided to install

TABLE 1 Summary of Hydroelectric Pilot Projects*

1.	Village Name	Tinkhar N'Ifni	Archbalou N'Kerdous	Tabant Ait Imi
2.	Province	Azilal	Errachidia	Taroudant
3.	Distance from Paved Road	120 km	60 km	75 km
4.	Population served	12,250	1,066	1,117
5.	Powerline Costs	$375,000	134,000	164,000
6.	Civil Engineering	292,000	134,000	352,000
7.	Machinery	456,000	84,000	361,000
8.	Total Installed Cost	$1,123,000	352,000	877,000
9.	Installed kw-capacity	750	65	200
10.	Cost of kw installed	$1,497	5,415	4,385
11.	Annual Hypothetical Investment Cost per ONE (20 year life)	$132,000	41,000	103,000
12.	Cost of kwh presuming 3,000 hours of annual plant factor	$0.059	0.213	0.172
13.	Cost of kwh from comparable Diesel Generator	$0.161	0.257	0.200
14.	Net Savings per kwh	$0.102	0.044	0.028
15.	Total"Avoided" 1) Costs over 20 years (Excluding calculation of Diesel oil inflation)	$4,590,000	171,600	336,000

1)-(3,000 operating hours/year for 20 years life x site's installed kw capacity x site's net savings per kwh).

* - developed with ONE

diesel-powered generators, they would have had to spend over $5.0 million during the ensuing 20 years to keep these units operating while the costs of the hydroelectric units is largely a one-time expense. It should be noted that these savings are very conservative because they presume the price of diesel fuel to be constant for 20 years. AID's contribution to the hydro projects covers machinery valued in 1981 at $ 901,000. Inflation plus contingencies would place our contribution at $1.1 million.

Because AID, CDER, and ONE have already committed themselves to the small hydro demonstrations, it has been determined that these commitments are virtually unavoidable. Still CDER and AID are distressed because such an emphasis on hydro to the detriment of the other renewable technologies would give a very unbalanced pilot project portfolio under the present budget. A comparison of Part 2 of Annex 17 of the PP with Table 1 above also points out that the Tinkhar N'Ifni site will involve a net increase of 11,000 beneficiaries over the Msemrir site. The actual generic social and economic benefits of small hydro are not expected to be particularly different from those described in the PP. However, the magnitude of the benefits has multiplied several fold.

C. Wind/Solar/Biomass Pilot Projects:

The other pilot projects and related activities (solar and wind, biomass, small projects fund, and evaluation) were valued in amendment No. 1 to the 608-0159 Project Agreement at $1.300 million. They should now cost approximately $1.430 due to inflation caused by the delay in arrival of the resident T.A. contract staff who must formulate definitive procurement specifications.

In summary, there are three major reasons for the $2.5 million short-fall: 1) the RFP for T.A. ranked proposal quality very high so that contract costs exceeded initial estimates substantially, 2) initial design advice led the GOM to reject one of the pilot projects with subsequent identification of a more energy efficient but costlier site, and 3) Phase II's ambitious scheduling did not prove to reflect realistic timing for host country contract procedures in Morocco.

The GOM has also felt the impact of these changes and has accordingly altered its budgetary projections to meet the same project goals. USAID/Rabat staff have reviewed CDER's and MEM's new budgets with the appropriate counterparts. As of this writing, the revised GOM budget is depicted below in Table 2.

Table 2: Change in GOM Contribution to 608-0159

(In millions of dollars)

	ProAg Amendment No. 1 - 8/26/81	Current GOM/CDER Estimates 8/82
CDER Design/Construction	2.420	2.581 1)
Land	200	200
Furnishings, Maintenance, Staff, Travel	860	2.400 2)
Hydro Projects	865	1.437 3)
Solar/Wind Projects	435	435
Biomass Projects	350	350
Small Projects	400	400
Evaluations	20	20
TOTAL	$ 5.550	$ 7.823

1)- Architect's contract

2)- Based on CDER operational and program budget approved by Finance Ministry (Increase largely due to dramatic salary increases associated with CDER's new para-statal status).

3)- See explanations in II. B. above.

III. Institutional and Beneficiary Impacts to be Assured under New LOP Funding Ceiling

Table 3 below indicates the revised budget for the U.S. contribution under the current authorized project ceiling of $6.7 million and reflects CDER priorities. Table 4 shows the desired budget for the Renewable Energy Project 0159 using the $9.2 million figure. Under the new ceiling valuable services can be assured via the T.A. contractor and many project goals such as staff training and demonstration projects could be thoroughly addressed.

Specific factors keyed to line items in Tables 3 and 4 are discussed below.

1. T.A. could be extended for a third year thereby allowing RTI's resident staff to provide more lasting advice and permitting a greater number of short-term consultancies in the field.

2. All of the laboratory equipment could be procured (instead of just three-quarters) and RTI would retain procurement responsibilities during the all important final year.

3. The locally based on-the-job training program could be extended a third year and the number of U.S. graduates increased to 12 as stipulated in the Project Agreement.

4. AID could honor its ProAg commitment to implement future solar and wind pilot projects.

5. With the supplemental funding available, AID would be able to honor Section 4.1.D. of the ProAg - Small Projects Fund. The prospect of this seed capital fund has already generated much interest among Moroccan businesses and agricultural sector seeking the rapid commercialization of renewables. The GOM would have to "close the door" to many private entreprises now eager to benefit from the potential technical advice and financing to be made available under the fund.

6. Finally, line item number 8, "Evaluations", could be retained in order to fulfill our covenant in the Project Agreement to have periodic evaluations conducted by competent yet desinterested parties.

TABLE 3:

"FINANCIAL PLAN FOR OBLIGATION OF PROJECT FUNDS
U.S. CONTRIBUTION ($000)

FISCAL YEARS (October 1 - September 30)

	'82*	'83	'84	'85	TOTAL
TOTAL A.I.D.	661	1,670	3,202	1,167	6,700
1. Center for Renewable Energy Developm.	(661)	(1,070)	(2,043)	(943)	(4,717)
a) Preparatory Studies/training (USAID)	611	-	-	-	611
b) Priority Equipment (USAID)	50	56	-	-	106
c) Technical Assistance (Contractor)	-	977	1,109	-	2,086
d) Lab. Materials (Contractor)	-	-	722	726	1,448
e) Training (Contractor)	-	37	212	217	466
f) Design & Construction	-	-	-	-	-
g) Land	-	-	-	-	-
h) Furnishings	-	-	-	-	-
i) Maintenance and Utilities	-	-	-	-	-
j) Staff Costs	-	-	-	-	-
k) International Travel	-	-	-	-	-
2. Identified Small Hydro Pilot Projects (three)	0	110	990	0	1,100
3. Identified Solar & Wind Pilot Projects (Five)	0	310	0	0	310
4. Future Solar & Wind Pilot Projects	0	88	89	124	301
5. Identified Biomass Pilot Projects (One)	0	22	0	0	22
6. Future Biomass Pilot Projects	0	70	80	100	250
7. Small Projects Funds	0	0	0	0	0
8. Evaluations	0	0	0	0	0

* - disbursed

17

TABLE 4:
"FINANCIAL PLAN FOR OBLIGATION OF PROJECT FUNDS"
U.S. CONTRIBUTION ($000)

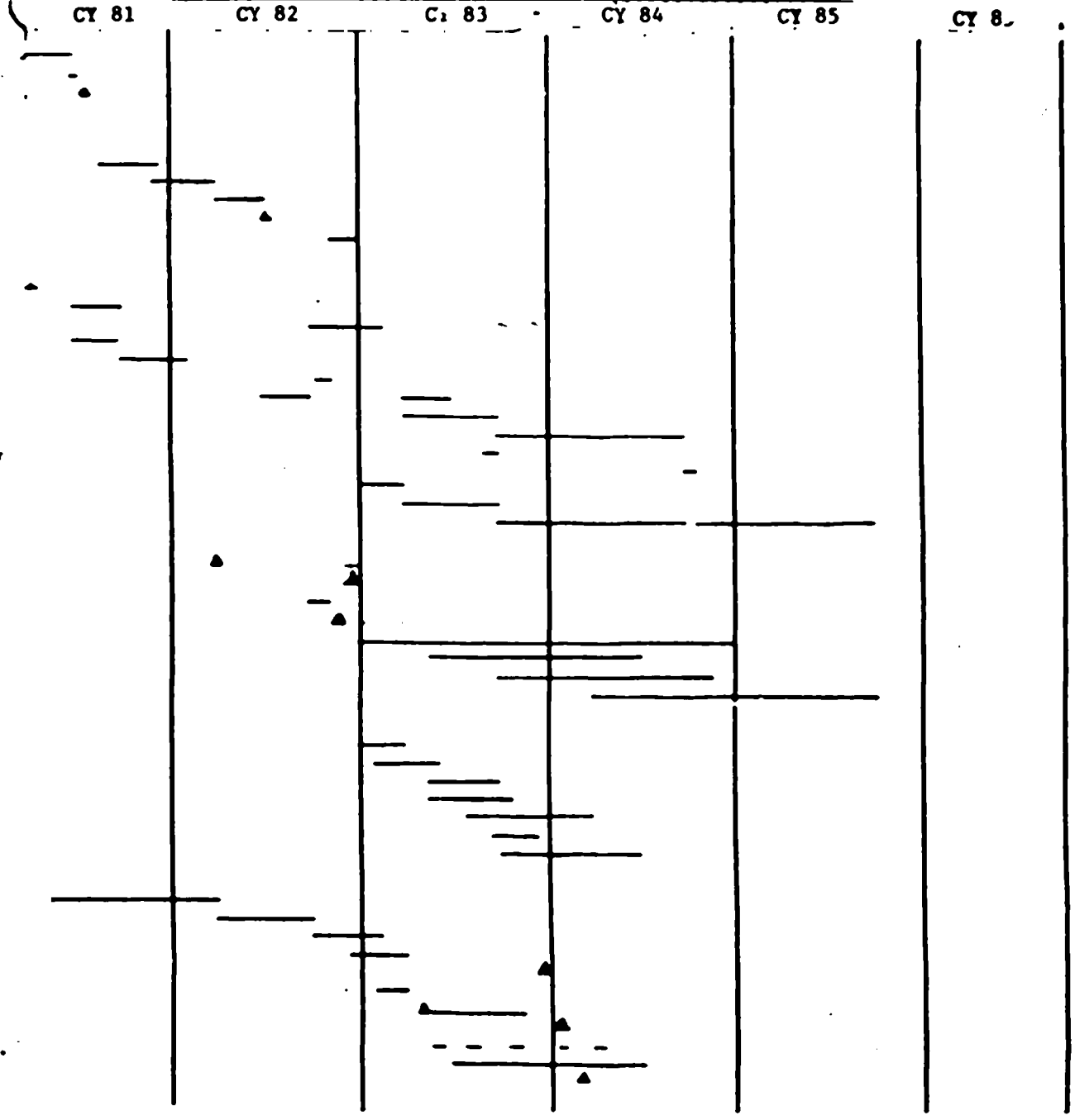
FISCAL YEARS (October 1 - September 30)

	'82*	'83	'84	'85	TOTAL
TOTAL A.I.D.	661	1,789	3,769	2,982	9,200
1. Center for Renewable Energy Developm.	(661)	(1,076)	(2,423)	(2,512)	(6,671)
a) Preparatory Studies/training (USAID)	611	0	0	0	611
b) Priority Equipment (USAID)	50	56	0	0	106
c) Technical Assistance (Contractor)	0	977	1,109	1,186	3,271
d) Lab. Materials (Contractor)1)	0	6	996	1,000	2,002
e) Training (Contractor)	0	37	318	326	681
f) Design & Construction	-	-	-	-	-
g) Land	-	-	-	-	-
h) Furnishings	-	-	-	-	-
i) Maintenance and Utilities	-	-	-	-	-
j) Staff Costs	-	-	-	-	-
k) International Travel	-	-	-	-	-
2. Identified Small Hydro Pilot Projects (three)	0	110	990	0	1,100
3. Identified Solar & Wind Pilot Projects (Five)	0	310	0	0	310
4. Future Solar & Wind Pilot Projects	0	110	120	130	360
5. Identified Biomass Pilot Projects (One)	0	22	0	0	22
6. Future Biomass Pilot Projects	0	30	115	215	360
7. Small Projects Funds	0	125	110	110	345
8. Evaluations	0	6	11	15	32

* - disbursed

1) - Forwarding expenses included

ACTION SCHEDULE - RENEWABLE ENERGY DEVELOPMENT PROJECT



I. Preparation of PP Amendment - Phase II

- Preparation of PP
- AID/W review and approval
- Pending negotiation with CDM. Signing

II. Long-Term Technical Assistance for CDER

- Prequalification of U.S. firms
- Preparation of RFP. Review by AID/W
- Preparation and submittal of responses
- CDM and AID review of proposals. Selection
- Negotiation and signing of contract
- Mobilization of contractor's staff

III. Training Activities

- MEM selects initial nucleus of 5 CDER engineers
- Preparation of action plan and training prog.
- Procurement and delivery of training equipment
- Training in Morocco of 5 CDER engineers
- Training in U.S. of 5 CDER engineers
- CDER staff another work on Nat. En. Plng.
- MEM recruits second group CDER staff
- Training in Morocco second group CDER staff
- TRaining in U.S. second group CDER staff
- Observation tour in U.S. of CDER Director
- Observation tour in U.S. of CDER Deputy Director
- MEM recruits CDER staff for academic training
- English language training for above
- Academic training in U.S. for above

IV. Center for Renewable Energy Development

- Contract for U.S. architectural firm
- Contract for Moroccan architect
- Preliminary and final design. Specifications
- IFB for construction of Center. Contract
- Construction of Center
- Preparation of Center equipment specifications
- Preparation and issuance of procurement docs.
- Delivery of equipment

V. Solar and Wind Applications

- Review of CT Main Report
- Selection of pilot projects
- Preparation of final design & specifications
- Preparation & issuance of procurement docs.
- Delivery of equipment
- Training of Moroccan technicians in U.S.
- Construction & installation of equipment

VI. Small Hydro Pilot Installations

- Preliminary design & socioeconomic studies
- Implementation arrangements
- Preparation of final design & specifications
- Issuance of procurement documents
- Delivery of equipment
- Preparation & issuance of IFBs for construct.
- Award of contracts and construction
- Erection of equipment
- Supervision of construct. & erection by [illegible]
- Installation of power distribution lines & [illegible].
- Startup of installations

ANNEX No. 1 - ACTION SCHEDULE

PROJECT PAPER CORE

UNCLASSIFIED

FILE

U.S. INTERNATIONAL DEVELOPMENT COOPERATION AGENCY

AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

PROJECT PAPER

MOROCCO

RENEWABLE ENERGY DEVELOPMENT II

PROJECT = 608-0159

GRANT

1981

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

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

2. DOCUMENT CODE

3. COUNTRY/ENTITY: MOROCCO

4. DOCUMENT REVISION NUMBER: 1

5. PROJECT NUMBER (7 digits): 608 - 0159

6. BUREAU/OFFICE: SYMBOL NE, CODE 03

7. PROJECT TITLE (Maximum 40 characters): Renewable Energy Development, II

8. ESTIMATED FY OF PROJECT COMPLETION: FY 86

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 80; B. QUARTER 3; C. FINAL FY 86

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	600		600	6700		6700
(GRANT)	600		600	6700		6700
(LOAN)						
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY		420	420		5550	5550
OTHER DONOR(S)						
TOTALS	600	420	1020	6700	5550	12250

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	C. 1ST FY 80 E. GRANT	C. 1ST FY 80 F. LOAN	H. 2ND FY 81 G. GRANT	H. 2ND FY 81 H. LOAN	I. 3RD FY 82 I. GRANT	I. 3RD FY 82 J. LOAN
(1) ST	740	280		600					
(2) DI	740	280				1494		1500	
(3)									
(4)									
TOTALS						1494		1500	

A. APPROPRIATION	N. 4TH FY 83 O. GRANT	N. 4TH FY 83 P. LOAN	O. 5TH FY 84 Q. GRANT	O. 5TH FY 84 R. LOAN	LIFE OF PROJECT S. GRANT	LIFE OF PROJECT T. LOAN
(1) FN	1500		1606		6700	
(2)						
(3)						
(4)						
TOTALS	1500		1606		6700	

12. IN-DEPTH EVALUATION SCHEDULED: 02 83

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. BUDGETING OFFICE CLEARANCE

SIGNATURE

TITLE: Director, USAID/Morocco

DATE SIGNED: 04 23 81

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: 05 06 81

AID 1330-4 (9-76)

RENEWABLE ENERGY DEVELOPMENT PROJECT PAPER

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Andres Acedo	Program Office
Jack Sleeper	Office of Agriculture

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Harold S. Fleming	Director, USAID
George Corinaldi	Education Advisor

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Mike Hanz	NE/PD/ENGR
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W. Antoinette Ford	Assistant Administrator, NE

M O R O C C O

RENEWABLE ENERGY DEVELOPMENT (Project 608-0159)

Project Paper Amendment

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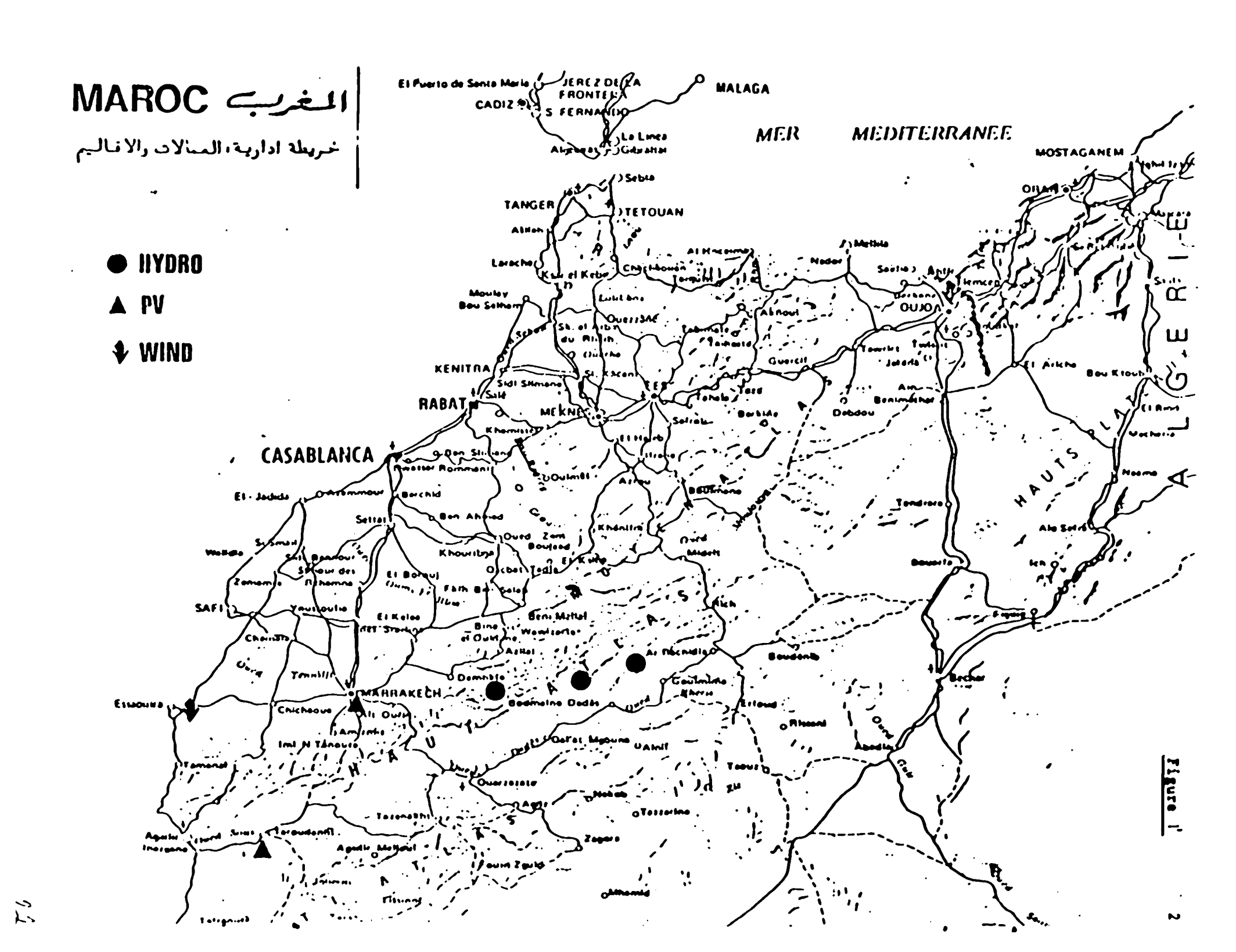

MAROC المغرب
خريطة ادارية، العمالات والاقاليم
HYDRO
PV
WIND
MER MEDITERRANEE
MALAGA
CADIZ
TANGER
TETOUAN
KENITRA
RABAT
CASABLANCA
MEKNES
FES
OUJDA
MOSTAGANEM
SAFI
MARRAKECH
HAUTS PLATEAUX
ALGERIE

Figure 1

ABBREVIATIONS

. CDER	Center for Renewable Energy Development (Centre de Developpement des Energies Renouvelables)
. CTM	Charles T. Main International
. DOE	Department of Energy
. DH	Moroccan Dirhams
. DS/EY	Development Support Bureau, Office of Energy
. DSI	Development Sciences Incorporated
. FAA	Foreign Assistance Act of 1961, as amended
. FY	Fiscal Year
. GOM	Government of Morocco
. GSA	General Services Administration
. GSAI	GSA International
. ha	hectares
. IBRD	International Bank for Reconstruction and Development
. IQC	Indefinite Quantity Contract
. MEM	Ministry of Energy and Mines
. MI	Ministry of Interior
. Min Ag.	Ministry of Agriculture and Agrarian Reform
. NASA	National Aeronautics and Space Agency
. NRECA	National Rural Electrical Cooperative Association
. ONE	Office National de l'Electricité
. PASA	Participation Agency Service Agreement
. pm	person-month
. PP	Project Paper
. PV	Photovoltaic

Abbreviations (Contd.)

- RFP — Request for Proposals
- RSSA — Reimbursable Support Services Agreement
- SERI — Solar Energy Research Institute, Golden, Colorado
- TA — Technical Assistance

CURRENCY EQUIVALENTS

(As of April 15, 1981)

Currency Unit	=	Dirhams (DH)
DH 1	=	U.S. $ 0.208
DH 4.8	=	U.S. $ 1.00

MEASURES

1 kilometer	=	0.62 mile (mi)
1 cubic meter	=	35.315 cubic feet (ft^3)
1 barrel (bbl)	=	42 gallons (USgal) 0.159 cubic meter.
1 kilovolt (kv)	=	1,000 Volts (V)
Medium Voltage	=	In Morocco: 22-KV, 8.5-KV & 5.5-KV.
Low Voltage	=	In Morocco: 380/220-V.
1 Kilowatt (KW)	=	1,000 Watts (10^3W)
1 megawatt	=	1,000-KW (10^6W = 10^3 KW)
1 kilowatthour (kWh)	=	1,000 Watthours (10^3 Wh) 860.4 Kilocalories (kca)
1 megawatthour (MWh)	=	1,000 Kilowatthours
1 Gigawatthour (GWh)	=	1,000,000 Kilowatthours
1 kilovolt amperes(kVa)	=	1,000 Volt amperes (10^3VA)
1 Megavolt ampere (MVA)	=	1,000 kilovolt amperes
1 kilocalories (kcal)	=	1,163 Watthours
1 kilogram coal equivalent (Kgce)	=	7.10^3 kcal
1 hectare (ha)	=	2.47 acres
1 cubic meter (m^3)	=	264 gallons
1 gallon	=	.0038 cubic meters

MOROCCO RENEWABLE ENERGY DEVELOPMENT PROJECT PAPER AMENDMENT

I. SUMMARY AND RECOMMENDATIONS

A. Costs

The project total costs are as follows :

	Phase I[1] FY-80	Phase II FY 81-84	TOTAL
. AID Grant	$ 600,000	$ 6,100,000	$ 6,700,000
. GOM Budget[2]	420,000	5,130,000	5.550,000
TOTAL	$1,020,000	$11,230,000	$ 12,250,000

1. Authorized February 20, 1980.

2. In U.S. $ equivalent at US $1 equals 4.80 Moroccan Dirhams.

Grantee	Kingdom of Morocco
Principal Agency	Ministry of Energy and Mines (MEM)
Phase I Grant Amount	US $ 600,000
Phase II Grant Amendment	US $ 6,100,000 (of which US $1,500,000 in FY 81)

B. Project Purpose

Assist the Ministry of Energy and Mines to create a Center for Renewable Energy Development with the professional staff and facilities to carry out a wide range of applied research and pilot activities, studies and analyses to identify the most effective ways to exploit Morocco's renewable energy potential and develop programs to encourage its efficient use throughout the country.

C. Summary Description

The Center for Renewable Energy Development will be built by the Moroccan Government and equipped by A.I.D. Its staff will be trained and guided by resident and short-term AID-financed contract technical assistance advisors. Participant training will be provided in the United States and third countries.

The construction of the Center building, itself a model of energy-efficient design, will begin in early 1982 and is scheduled for completion in late 1983. Well before then, as its action program gets underway, the Center will become a strong, flexible institution designed to shape and be guided by Morocco's evolving energy needs. An assessment of the country's current and future energy requirements and resources now being financed by A.I.D. will yield results in 1982 which will assist the Center in defining targets for renewable energy use and helping shape GOM renewable energy policy. The Center is expected to play a catalytic role in expanding the use of renewable energy resources in the nation's economy as a substitute for imported fossil fuels.

Initial Center activities include pilot projects demonstrating four renewable energy technologies:

— Small decentralized hydroelectric generation;

— Direct use of solar energy, mainly photovoltaic cells and solar thermal collectors for productive use in rural areas;

— Use of wind for electricity generation and water pumping;

— Biomass conversion, beginning with improved charcoal production.

Initially, three 40-250 kilowatt small hydro units will be installed at sites in the High Atlas Mountains starting in mid-1982. They will be monitored for technical, social and economic replicability elsewhere. Two 40 kilowatt windmill units will pump water for irrigation and drinking on farms. Beginning in late 1981, small-scale photovoltaic units will pump water for drinking and irrigation and provide power for refrigeration in remote health dispensaries.

Several pilot projects in biomass conversion - including improved charcoal production, biogas generation and combustion of urban waste - are planned for initiation in 1982.

The project is designed for institution building and effective transfer of U.S. technology. Equipment for the Center and pilot projects totalling $2,455,000 will consist mainly of off-the-shelf items.

Peace Corps volunteers will assist in the implementation of selected pilot projects, particularly small-scale farm and village-sized activities financed through a Small Project Fund (See page 26), guided by the long-term contract technical assistance coordinator.

Project preparation began with an initial AID survey team which examined Morocco's energy development potential in the summer of 1978. A second A.I.D.-financed team carried out a feasibility study during the summer of 1979, which resulted in approval of a Project Paper for Phase I February 20, 1980. The present Project Paper Amendment describes Phase II activities. It amplifies, modifies and refines the material presented in Phase I Project Paper.

The Project reflects a GOM initiative with USAID. USAID provided project development assistance through teams from Charles T. Main International, Development Sciences Incorporated, GSA International and locally-contracted surveys and social analysis. Much of the substance of this amendment, including annexes, includes or reflects material developed by these teams. Further specific attribution is not hereafter made.

D. Project Implementation

GOM responsibility for management of this project rests with the Office of Energy Resources Development of the Directorate of Energy of the Ministry of Energy and Mines. The Center for Renewable Energy Development reports to this office. The research, development and evaluation activities to be carried out under this project will be managed by CDER.

The design and construction of CDER buildings and facilities will be carried out by private firms under contract to the MEM. The construction, installation and maintenance of the small hydro pilot and the larger solar and wind pilot projects will be carried out by the Office National de l'Electricité (ONE).

Coordination with other GOM agencies, such as the Ministry of Interior, the Ministry of Agriculture and Agrarian Reform and their local subsidiary agencies will be the responsibility of CDER with MEM support when necessary.

E. Beneficiaries

As an institution-building project to help the Moroccan Government develop the capability to exploit its renewable energy resources

more effectively, this project's most important benefits are long-run and indirect.

The CDER's most immediate beneficiaries are the 30 members of its staff who will be trained to assume major responsibilities in renewable energy development.

The pilot projects' most immediate beneficiaries are about 6,000 rural dwellers who will use energy produced by the small hydro, solar, wind and biomass pilot projects to be set up during the project's four year life.

The longer-term beneficiaries will be the 200,000 - 300,000/rural population of the 200 sites where productive small hydro generation units may be installed, the several hundred thousand people who may benefit from similar replication of solar, wind and biomass pilot activities, and, in the end, the entire population of Morocco who will benefit from the economic advantages of the more efficient use of the country's available energy.

F. Statutory Criteria

All statutory criteria have been met. Congressional notification has been made.

G. Country Team Views

USAID and the American Embassy in Morocco support this grant as consistent with U.S. policy objectives in Morocco.

H. Fund Availability

Funds for Phase I of this Project were obligated in April 1980. FY 1981 funds of $ 1.5 million for Phase II have been allocated to the USAID.

I. Analysis

The analysis in this Amendment concludes that the entire project is technically, financially and socially feasible and that planning is sufficiently developed for implementation of Phase II to begin. All significant issues have been identified and will be dealt with as outlined in Section V (Issues).

J. Waiver

A waiver will be requested to permit

inclusion of a price element in the proposals for executing the long-term technical assistance financed under the Project. See Section III.B.4. (Technical Assistance).

K. Recommendation

That this Project Paper Amendment be approved and that the level of AID-appropriated funding approved for this project over its five year life be increased from $ 600,000 to a new total of $ 6,700,000.

II. BACKGROUND

A. General

Morocco is a middle income country with a $14 billion gross domestic product in 1979-1980. Its present 21 million population is increasing at an annual rate of over three percent. Over the long term, Morocco has considerable resources on which to base steady economic growth, including phosphates and other minerals, potential for higher agricultural productivity, and substantial existing infrastructure.

The high cost of energy is a major problem for the Moroccan economy and a major reason for recently increased imports expenditures. Morocco is heavily dependent upon imported fuels. It must include constantly increasing petroleum prices in its economic calculations. To confront the energy problem the Government plans a program of energy conservation and domestic resource development: coal, petroleum exploration, shale oil deposits, hydro-electric power and renewable energy. The Government has recently intensified offshore and onshore oil and gas exploration via joint ventures with foreign firms. Morocco's increasingly serious search for new energy resources offers potential investment opportunities in oil prospecting, shale oil exploitation, uranium extraction, and solar energy.

The Ministry of Energy and Mines (MEM) is responsible for overall development planning, pricing, and investments in the energy sector. It has administrative control over a number of key public enterprises in the energy sector including the Office of National de l'Electricite (ONE), responsible for most electric power generation and transmission; the Bureau de Recherche et Participation Miniere (BRPM), which manages oil, gas and uranium exploration; the newly-created Office National des Recherches et de l'Exploitation des Hydrocarbures (ONAREXH), charged with the exploitation of Morocco's extensive oil shale deposits; and - most important for the proposed project - the Centre de Developpement des Energies Renouvelables (CDER), whose legal existence was formally approved by the GOM Council of Ministers in May 1981.

During 1978, the Government of Morocco designated a research facility site and set aside funds for a research program to increase use of renewable energy in Morocco. A consultant team sponsored by A.I.D. visited Morocco and assisted the Government to plan the Center and to identify pilot research activities. The resulting December 1978 report recommended an organization plan for the renewable energy center and concluded that small hydro sites in the Atlas Mountains should be investigated with a view to identifying suitable sites for feasibility studies, final design, and construction. Further preliminary survey and project identification work was carried out in 1979 which led to identification of this proposed renewable energy development project in Morocco (See DSI June 1979 report in Bibliography, Annex 20).

In the energy sector, the Government has itself concluded that the rural electrification program deserves major emphasis and that development of renewable resources may offer the best hope for a way to extend the benefits of power to the rural population and to agricultural production. This proposed renewable energy project is in accord with USAID/Rabat's basic program strategy on Morocco. It reinforces the policies and programs of the MEM in the rural electrification subsector.

This project represents a unique and timely marriage of Morocco's long-term development goals and A.I.D.'s program objectives in Morocco, coupled with the universal need to address higher and increasing energy costs. The proposed series of studies, training and technical assistance should launch the GOM renewable energy program on a sound economic and technical basis, utilizing U.S. technology to the maximum, and adapting that which is found to be practical to the environment of Morocco.

B. GOM Energy Sector Objectives

The energy demands of the monetized Moroccan economy are met mainly by petroleum products (82 per cent), coal (8 per cent) and hydro-electric power (9 per cent). The energy deficit, therefore, is mainly an oil deficit. Virtually all oil is imported. The volume of Moroccan oil imports has increased at 8-10 percent annually during recent years, and are now running at an annual rate of over $1 billion. Faced with this financial hemorrhage, Morocco must experiment with several other energy sources, looking toward the year 2000. It is thus important that Morocco not only assure itself of a reliable source of oil but also explore every possible domestic energy resource so as to reduce its dependence on external suppliers.

The period 1978-1979 was a turning point in energy policy. Increased interest in energy, including renewable energy, was stimulated, in part, by the realization that the cost of imported petroleum might soon exceed revenues from phosphate exports and that known domestic supplies of coal, gas, oil and wood, at present rates of utilization, will disappear in less than a generation. There are, to be sure, indications that Morocco probably has significantly larger deposits of coal and may even discover an oil field along with its other presumed mineral wealth. But proving the point takes time, effort and, above all, money.

The Ministry of Energy and Mines has begun to put in motion a national energy policy which is likely to affect every aspects of the Moroccan economy during the next few years. The 1978-1980 Three Year Plan emphasized the need to reduce Morocco's dependence on imported oil. This orientation will be pursued with greater vigor and determination in the 1981-1985 Five Year Plan period. The Plan involves programs which will (1) intensify oil and gas exploration, (2) develop Morocco's very large oil shale deposits, (3) accelerate rural electrification, particularly with small and medium scale

hydroelectric generation, (4) extract uranium from phosphates and introduce nuclear energy, (5) intensify exploration and production of coal, lignite and uranium, (6) develop renewable energy, particularly solar energy and biomass, and (7) encourage energy conservation.

Morocco is counting heavily on exploiting its oil shale resources and, at this point, may well actually apply retorting technology to commercial ends before the U.S. does. Whether these resources can be developed economically remains to be determined. The GOM therefore wishes to explore and develop the full economic potential of other energy resources, including renewable energy.

The GOM has already taken steps to explore the potential of renewable energies, including activities under Phase I of this Project. Small hyd- s particularly attractive to the GOM (and to the USAID) because of its potential for contributing to the development of remote, poor areas in the context of the GOM's policy of reducing regional disparities in services. We would propose to play a role in directing Moroccan energy sources into channels which will be relatively more decentralized and available to broad segments of the rural population.

C. Other Energy Assistance to Morocco

The World Bank is a major contributor to GOM energy efforts, having lent nearly $200 million between 1974 and 1980 to Morocco for electric power generation, transmission and rural electrification and a further $65 million in 1981 for oil exploration and oil shale development. The Bank is now cooperating with the GOM to carry out a 15-year rural electrification program which will include a major expansion of hydroelectric generation capacity, through large scale hydro power and small dam development. At present, electricity provides a quarter of total energy supply and generation is rising at 10 percent per year. About 64 per cent of production is thermal, generated from coal and oil, and 36 per cent is hydroelectric. With greater use of hydro and development of oil shale potential, dependence on imported oil should be reduced. The Bank has indicated interest in financing an expansion of small hydro generation facilities if the AID-financed pilot projects yield encouraging results.

Morocco is following with interest activities in Europe, especially France, involving various forms of renewable energy. There is increasing evidence of interest on the part of private sector firms in France, Italy and Germany in equipment sales, local manufacture and pilot projects in small hydro, wind, solar and biomass development in Morocco, but lack of financing has inhibited significant action so far. A major French agreement recently signed with Morocco for cooperation over a broad range of industrial and mining activities envisions cooperation in energy development - but so far no funds have been committed.

The UNDP has installed a few demonstration solar flat plate collectors for water heating and UNICEF in financing a small program for the repair of windmills, of which there are many in Morocco which were installed in 1950s for mechanical water pumping.

AID has financed a pilot installation at an agricultural school near Rabat (through an OPG to the Catholic Relief Services) which includes solar flat plate collectors ans a solar parabolic oven designed by a French technical assistance group (CEFOSAT). The equipment is being installed by two young French volunteer engineers as part of a training program for Moroccan farm boys at the CIDERA school.

It is envisioned that the Peace Corps will play a role in the proposed Renewable Energy Development Project by guiding and encouraging small, grass-roots projects financed by the Small Project Fund described in Section III.B.7. An AID-financed project for Integrated Forestry Development proposed for FY 1982-1986 implementation will contribute to the expansion of biomass production, complementing the biomass conversion element of this Project.

The GOM has asked for U.S. assistance in planning and management of conventional as well as renewable energy. Beginning in 1981, AID is assisting the MEM to develop a national energy planning capacity, provide technical assistance for planning the development of oil shale, and finance training in energy technology management across the board. Together with the anticipated involvement of American private firms, and coordinated with World Bank activities, these programs are likely to have a major influence on Morocco's energy future and therefore on its economic development.

The GOM has budgeted a total of $31.8 million for renewable energy activities in the 1981-1985 Five Year Plan. During that period the GOM proposes the following program allocations.

	$000
Center for Renewable Energy Development	9,400
Solar Energy Development	5,000
Wind Energy Development	400
Small Hydro Development	16,000
Biomass Development	1,000
	31,800

Of these funds, the GOM has so far allocated $5,550,000 to the proposed Renewable Energy Development project. A summary financial plan for the project by component and category is shown on the following page and in Annex 1, Table 9.

III. PROJECT DESCRIPTION AND IMPLEMENTATION

A. Phase I and Phase II Activities

The project consists of two phases:

Phase I, financed with FY 1980 funds, began in June 1980 and includes:

1. A feasibility and preliminary design study for the Center for Renewable Energy Development and related pilot projects for small hydro, solar and wind powered pumping units (June-October 1980).

2. Survey, socioeconomic study and preliminary engineering design of the small hydro generation pilot projects (Dec.1980-May 1981).

3. Initiation of a work and training program in Morocco for the Center for Renewable Energy Development (begun April 1981).

4. Design of a training program in the United States for staff of the Center for Renewable Energy Development (January 1981).

5. Beginning of final design for the Center for Renewable Energy Development (June-August 1981).

Phase II, to begin in July 1981 after approval of this Project Paper Amendment and obligation of FY 1981 funds will include:

1. Additional training in Morocco and the United States for Moroccan professionals assigned to the Center for Renewable Energy Development.

2. Completion of final design, detailed specifications and bidding documents for the Center for Renewable Energy Development and related pilot projects for small hydro, wind and solar power generation.

3. Equipping the Center for Renewable Energy Development and related pilot projects.

4. Provision of U.S. resident, long-term technical assistance and short-term advisory services to support training, management and research activities as part of the institutional development of the Center and its program.

The Ministry of Energy and Mines budgeted $420,000 in FY 1980 for renewable energy development and acquired a site in Marrakech for the Center for Renewable Energy Development. A director and a deputy director were appointed to guide the project and legislation for the legal establishment of the Center was approved by the Conseil du Gouvernement. An initial staff of five engineers was recruited for the Center in late 1980 and an additional $ 830,000 was budgeted for renewable energy development in FY 1981.

During June-October 1980, Charles T. Main International, Inc. carried out feasibility and preliminary design studies for the Center for Renewable Energy Development, 3 small hydro pilot projects and 5 solar or wind-powered water pumping pilot projects. After these studies were reviewed by AID and the Moroccan Ministry of Energy and Mines, certain changes and revisions were made which are reflected in this Project Paper Amendment. Preliminary engineering design and preparation of equipment and construction specifications have been completed for the Center for Renewable Energy Development and the 3 small hydro pilot projects. Revised recommendations for solar and wind-powered pilot projects have been submitted and are contained in this Amendment. An initial action program of training and data-gathering has already begun at the Center, carried out by a skeleton Moroccan staff with U.S. guidance.

The Ministry of Energy and Mines has invited proposals from Moroccan architects to work with an American architectural firm on the final design of the Center later this year. The MEM plans to let contracts for construction of the small hydro units in late 1981, for the Center in March 1982, and for the solar and wind-powered pilot projects as soon thereafter as practicable.

Phase II of this project can begin upon approval of this Amendment and obligation of FY 1981 funds. Phase II will finance a 2-person technical assistance team and short-term consultants to guide the development of the Center for Renewable Energy Development; further participants training in the United States and third countries for Center staff; and equipment for the Center and the related pilot projects.

B. The Center for Renewable Energy Development

1. Objectives

The Center for Renewable Energy Development (CDER) represents a significant step forward in Morocco's efforts to reduce its dependence on imported fuels, and to make maximum use of the country's renewable resources for the production of usable energy, while at the same time preserving these resources from environmental degradation.

The objectives of the Center for Renewable Energy Development are to :

— Characterize the quantity and quality of Morocco's renewable energy resources;

— Identify and develop renewable energy technologies best suited to Morocco;

— Establish an objective performance measurement system for renewable energy techniques and equipment;

— Train a cadre of engineers, scientists and managers in the application and administration of renewable energy technology;

— Develop a Moroccan institutional capability to manage and coordinate renewable energy research activities that are applicable and relevant to Moroccan economic and social development;

— Integrate renewable energy techniques into Moroccan national sector policy and planning.

It has been suggested that at best renewable energy can substitute for only 8-15 percent of LDC energy needs to the year 2000 (See Palmedo, in bibliography). This estimate is in line with the MEM's plans for Morocco which call for 5 percent utilization of renewable energy excluding hydropower (MEM, Energies Renouvelables, See bibliography). That percentage could be considerably higher depending upon the relative speed of application of renewable energy and Morocco's oil shale, phosphate/uranium and limited petroleum alternatives.

The objective of the CDER, rather than to do pure research in the renewable energy field (although that is not excluded) is to provide technically competent monitoring of such research elsewhere and accelerate the adoption of favorable technologies by improving their performance, testing alternative designs and making them socially acceptable through demonstration. Where technical and economic analyses indicate that renewable energy applications will be financially preferable in 10 years or less, the time to begin the testing and demonstration of such technologies is now, if premature investments or inappropriate choice or scale of technologies are to be avoided.

AID is financing a national assessment of Morocco's current and future energy resources and requirements, which in 1982 will yield results which will assist the Center in defining targets for renewable energy use. Under the guidance of a U.S. contractor, a nucleus of Center staff is already taking part in the assessment and beginning to develop an ability to apply modern analytical techniques to the energy sector. The Center program will build upon the assessment in providing a basis for setting priorities and defining programs in renewable energy development and, as a center for applied technology and research, to explore ways to make optimum use of available renewable energy technologies.

The Center will have several important responsibilities:

1. Develop knowledge about Moroccan natural resources which can be used to produce energy.

2. Assess the applicability of renewable energy technologies for Morocco, and adapt these technologies so that they can serve Moroccan development.

3. Plan for the introduction of renewable energy into Moroccan development through demonstration and pilot projects, analyzing the social and economic effects, and recommending adjustments in technology application necessary to ensure success.

4. Disseminate information on renewable energy technologies and their applications to the Moroccan scientific, commercial, governmental and public sectors.

5. Conduct testing of renewable energy devices, and notify the Moroccan commercial and industrial sectors as to their performance; assist Moroccan business to establish standards of performance.

6. Assist government ministries with the planning and implementation of renewable energy projects on a large scale, providing data, and analytical and managerial skills to such ministries.

2. Organization

To carry out these responsibilities, the CDER will have its own facility, and a professional staff of some thirty professional and twenty support staff.

The Center will direct its activities toward the application of renewable energy technologies, rather than carrying out basic research in the technologies themselves. Basic research will be the province of Moroccan educational institutions, particularly Mohammed V University. The nation wide implementation of renewable energy will be the responsibility of governmental organizations where large-scale investments are required (e.g., small hydro, biomass plantations), and very possibly the industrial and commercial sectors where investments may be smaller, or divisible into manageable parts.

The CDER thus will occupy a middle position between basic research and nationwide acceptance of renewable energy, and its functions have been planned to enable it to meet the requirements that this implies. Its professional staff will be trained in resource assessment and associated technologies and will be able to work effectively with university personnel; they will also have a command of the planning and analytical functions which will enable them to advise ministries on renewable energy use on a regional or nationwide scale.

It is important that the full range of expertise developed at the Center be available to participate in interdisciplinary, task-oriented approaches to energy problem-solving. Under the guidance of the U.S. technical assistance contractor the staff of CDER will be structured to facilitate the use of the Center's resources to expand the application of renewable energy resources for rural/agricultural purposes, commercial purposes and fossil fuel displacement. The organizational structure of CDER will therefore retain a degree of flexibility and adaptability to be delineated more precisely as the Center's functions evolve under the guidance of the U.S. technical assistance contractor.

The Center will be organized and staffed around five basic functions:

- Administration and Support Services
- Technology Development
- Information
- Planning and Analysis
- Applications

In Annex 13 is a detailed functional description of the CDER staff positions.

ORGANIZATION OF THE CENTER FOR RENEWABLE ENERGY DEVELOPMENT

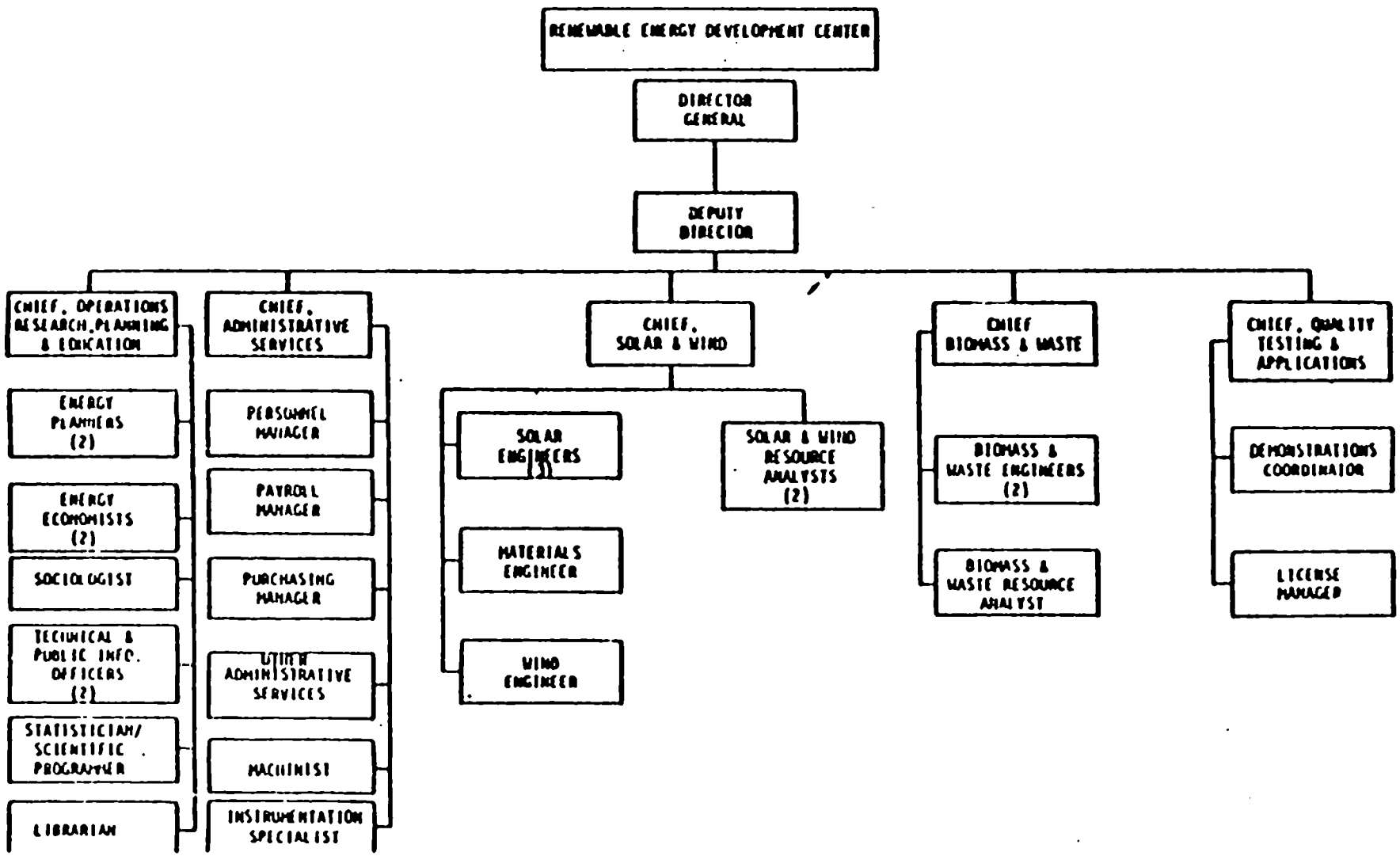


Figure 2

40X

3. Training

A major purpose of the A.I.D. assistance program is the development of an institutional capability to introduce renewable energy into the Moroccan economy. When the building for the Center is completed in late 1983, a fully functioning institution should be in place to take advantage of the facilities. The design of the facilities implies a program of some breadth in the renewable energy field, covering a broad range of resources and technologies. Furthermore, it is expected that an evolution of concerns and growth of capacity will take place as needs and events clarify the future investments appropriate to Moroccan energy supply and demand patterns. It is anticipated that the staff will grow from an initial few (7 in May 1981) to increasing numbers (30 in 5 years) and from a narrow range of technical expertise to a broader set of skills to accomodate expanding demands. Consequently the recruitment, training, and evolution of personnel requirements are designed to meet projected needs over the next few years. A total of 12 academic trainees and 80 person-months of short-term training will be financed during the life of the project.

a. Short-Term Program and Training in Morocco

It is important that both program and building construction proceed in parallel so that the sequence of events does not inhibit progress. The short-term activities in Phase I are therefore designed to interrelate and reinforce each other.

One must distinguish between the physical construction of the Center, which will not be completed until late 1983 according to present schedule, and the implementation of the Center's action plan which has already begun. A detailed action plan for initiating the Renewable Energy Development Center has been developed. It has two major components : On-the-job training in Morocco as the Center's program activities are initiated; and short-term training in the United States.

The first part of this program is now under way in Morocco for CDER's first five professional staff financed with Phase I funds under the direction of short-term U.S. experts under an Indefinite Quantity Contract.

The training program has been planned with four principal purposes in mind:

1. Maximize the exposure of CDER staff to renewable energy concepts and renewable energy trade-offs in a Moroccan context in order to give purpose and direction to their U.S. training;

2. Provide exposure to the technical vocabulary they will be using in the U.S.;

3. Introduce them to the concepts and methods of national assessment in the renewable energy field and to make a start on their contribution to the assessment which should continue and grow after their return from the U.S.;

4. Provide sufficient flexibility in scheduling that we can minimize lost time due to normal delays, interruptions, non-deliveries, or changed schedules encountered.

With these priorities in mind, training activities are being carried out during the period April-August 1981 in the following four areas:

1. Insolation and wind resource measurement;
2. Case studies of energy outpots in target industries with possible solar potential;
3. A survey of local availability of solar materials, conventional solar materials substitutes, and solar manufacturing processes;
4. Repair and installation of solar equipment for CDER in Marrakech.

b. Participant Training Outside Morocco

Training in the United States will begin with observation tours to renewable energy installations for the Director and Deputy Director of CDER in the summer and fall of 1981. The initial CDER staff of five engineers will attend a three month program in renewable energy technology at the University of Florida in the fall of 1981 and retur to Morocco to work with U.S. contract technical assistance advisors in early 1982.

Another 6 CDER staff members will be recruited and will begin training in early 1982 to be available for work in 1983 when the Center laboratories are expected to be operational.

During the life of the project, 12 Moroccans will be given Master's degree training in the United States in various aspects of renewable energy development. They will return to join the CDER staff. Designing and pursuing viable energy strategies requires a wide range of skills at various levels, in such areas as energy planning, project management, engineering, environmental analysis, economic and social science disciplines, energy equipment operation and maintenance, and other aspects of renewable energy development.

The project will also finance 20 person-months per year of short-term and in-service training for the staff of CDER and other groups working with CDER on renewable energy development.

Training and observation tours will also be arranged in other Third World countries where renewable energy progress is being made. waiver to permit participant training in Geographic Code 941 countries is included in the Project Authorization Amendment (Annex 8). Waivers will be sought on a case by case basis for observation training in Europe when plans are more precisely defined.

It is important that Moroccan staff be recruited and trained rapidly enough to effectively decrease the CDER's dependence on the U.S. technical assistance contractor staff well before the end of the project. To this end, a condition precedent to disbursement of funds for the Center will specify that the MEM develop a plan for the recruitment, training and assignment to the CDER of Moroccan staff.

Training in Morocco, the United States and elsewhere will be designed and managed by the U.S. long-term technical assistance contractor.

4. Technical Assistance

The Center's action plan will be carried out with the help of a team of American technicians under contract to the GOM.

The technical assistance to be financed by this project will consist of the services of two long-term resident, French-speaking renewable energy experts and 25 person-months per year of short-term consultants who will assist the director of CDER to plan the structure, staffing, research capability and administrative management for the CDER; formulate a five-year renewable energy research and development program, including sub-project activities, methodologies, timetables and budget estimates; and formulate and carry out professional training program.

The two person team will consist of team leader with a background in energy planning and management, and an engineer with expertise in renewable energy development. Additional special skills required for carrying out the CDER program will be provided by consultants who will serve for periods up to 6 months. The long term technical assistance contractor will also be responsible for (1) managing participant training in the United States and elsewhere; and (2) arranging for the procurement of most project commodities.

A Prequalification Notice was published in the Commerce Business Daily January 12, 1981 and the MEM prequalified 6 firms in early April. Requests for Technical Proposals will be issued in July 1981 to qualified firms upon approval of this PP and an host country contract will be signed with the MEM in December 1981 (See Implementation Plan, Annex 3).

A waiver will be sought to permit inclusion of a price element in proposals for the long-term technical assistance contract.

Moroccan law requires that proposals for contracts with the Government of Morocco contain a price element. In addition to causing legal problems, the absence of such an element would undermine AID's overall host country contracting philosophy, as outlined in Policy Determination 68.

AA/NE has recently approved the inclusion of price in technical services proposals for the Range Management Improvement (608-0143) project, among others, essentially for the reasons described above.

Contract staff are scheduled to arrive for duty in Morocco in February 1982. Construction of the Center's facilities will begin in March 1982, and the Moroccan nucleus CDER staff of five will return from the United States to work with the U.S. contract staff. In early 1982, a second cycle of CDER staff will depart for a 6-month training program in the United States. By then, selection should be under way, with the participation of the contract staff, for candidates for U.S. academic training to begin in September 1982.

The U.S. contract staff will be responsible for procurement of all equipment for the Center and related pilot projects except that which must be ordered well in advance of the contractor team's arrival in Morocco to avoid unacceptable and unnecessary project implementation delays. (Equipment shown in Annex 5 as having procurement priority 1). To this end USAID will order approximately $100,000 of equipment and materials for the Center to enable the U.S. contract to function effectively during the first 6 months after their arrival. All other equipment for the Center will be procured by the U.S. contractor beginning in 1982.

The U.S. contract staff will have arrived by March 1982 and will participate in the procurement and installation of the solar and wind equipment and arrange for CDER monitoring and evaluation of the pilot activities. They will work closely with CDER and MEM to insure that appropriate maintenance and surveillance provisions are made, and to develop further cooperative working relationships with other arms of the GOM which will have been established during the course of 1981 by MEM, CDER, and operational agencies of the Ministries of Agriculture and Interior.

Within three months of their arrival in Morocco, the contract team will have reviewed the project's progress and have developed, in close coordination with the Director of CDER, a detailed action plan for the remainder of 1982 and a preliminary action plan for the remainder of their contract period (1982-1984). It is likely that, as the CDER evolves and Moroccan staff play an increasing role in its operations, the role of the U.S. contract staff will also change. For this reason, long-term and short-term contractor staff needs will be reexamined after two years as part of the project evaluation. Revisions in the contract requirements may be made at that time.

An important element of the contractor's initial activities will be to develop a series of recommendations for action in the field of biomass. The AID/USDA Bioenergy Team report (Biomass for Energy in Morocco, August 1980) made a number of recommendations for MEM action which are summarized in Section III E-2. The MEM has, however, not yet decided on a program to explore biomass possibilities for Morocco, nor has staff so far been allocated to do so. Funding has been earmarked within this project for a biomass program based on certain of the Bioenergy Team's preliminary recommendations subject to further detailed reviews by the technical assistance contractor. This figure is, needless to say, illustrative, but indicates that biomass exploitation is intended to be an important part of the Center's activities. Action in this area will be coordinated with biomass production activities carried out under the proposed Integrated Forestry Development Project (608-0165) scheduled to begin in collaboration with the GOM Ministry of Agriculture's Forest Service.

5. The Center's Physical Facilities

The Renewable Energy Development Center is to be housed in facilities which will be built in Marrakech next to the School of Mines. The structure will be carefully designed as a model of energy-sensitive architecture, incorporating principles of solar design and energy-efficient use of local materials. It will serve as an example for emulation by Moroccan architects and builders in government and in the private sector. At the same time, its laboratory facilities will provide Morocco with an adaptable and flexible instrument for pursuing the development of the country's renewable energy resources.

The form of the building has been designed following the functions described above. It will include laboratory facilities which will permit the Center staff to carry out a broad range of research and development activities:

- For technology testing and development of solar thermal, photovoltaic and wind systems, a fluid system laboratory, an air system laboratory, an electrical laboratory and a materials laboratory.

- For technology testing and development of biomass and waste utilization, a biocombustion laboratory and a biochemical laboratory.

The laboratories will be supported by a machine shop and an instrument shop.

The Center will provide facilities for publication, training and education activities as well as a library for acquisition and maintenance of current information on renewable energy activities. The data processing needs of the Center will not require a computer. Its computation needs will be handled by hand and desk-top calculators adequate to the task.

On-site housing for senior staff members will be designed by the same Moroccan-American architectural team which produces the Center's final designed. They will be financed and constructed by the GOM.

Under Phase I of this project, Charles T. Main produced a feasibility and preliminary design for the Center during the summer of 1980. The GOM has made it clear that this Center is to be a model of energy efficient design, to incorporate a variety of passive and active uses of solar energy, energy conservation and use of local materials so as to inspire Moroccan architects and planners both in the private sector and in the Ministry of Housing and Regional Development to apply these methods and practices nationwide. The main feasibility study and preliminary design did, indeed, incorporate certain passive and active solar design features:

Passive Design

- Optimize natural lighting through layout,
- Optimize cooling through a well insulated wall and roof system,

- Natural ... circulation,
- Building orientation.

Active Solar Design

- Solar thermal hot water heating and cooling,
- Solar electric (photovoltaic) power for irrigation pumping for the Center grounds, energency lighting, battery charging and laboratory experimentation,
- Automatic control of artificial lighting.

AID and GOM reviewed the Main design and concluded that a different approach to design was required if the Center were truly to conserve energy, use local materials and construction techniques, incorporate traditional Moroccan design concepts and exemplify appropriate building in Morocco's solar environment.

An American architectural firm with considerable experience in energy efficient design in the Middle East has been asked to redesign the Center with these factors in mind. This firm will work closely with the Moroccan architect selected by the MEM to produce the Center's final design and supervise its construction. The American team will work initially in Morocco for a month in June 1981, and then in Houston where the Moroccan architect will participate actively in the preparation of design plans. Costs of the American firm's services are financed centrally by the AID Office of Energy. The Moroccan architect will be contracted and financed by the MEM. Construction will be carried out under MEM financing by a Moroccan contractor and supervised by the Moroccan architect.

The Ministry of Energy and Mines will finance the costs of land acquisition, design, construction and facilities (summarized in Table I B) estimated at $2,720,000. AID will finance solar collection devices for the buildings, laboratory equipment and a research library at a total estimated cost of $1,195,000 (Table 1 A). Laboratory equipment is itemized in Annex 5. It is likely that the redesign of the Center may increase the cost of its construction somewhat. The cost of the AID-financed items, however, will not change.

6. The Site

The designated site adjacent to the School of Mines in Marrakech was evaluated by the Charles T. Main team as to adequacy for the various activities of the Center: wind, solar, biomass; ownership; availability of utilities; accessibility; drainage; sociological and environmental compatibility.

Main concluded that the designated site is adequate for the construction and operation of the proposed facility. This conclusion is substantiated by the brief description of each of the above items' evaluation in Annex 15.

7. The Small Project Fund

An important part of the Center's action program will be to engage the interest and energy of a broad range of individuals and organizations, both private and public, in renewable energy development activities. This leverage will be particularly essential in view of the modest size of CDER staff. It will be particularly relevant in connection with encouraging the widespread use of truly micro installations equipment and practices which can be applied on individual farms, in individual households and in small industry. To support activities of this kind a Small Project Fund will be established. This fund will be administered by CDER under USAID guidance and with USAID support in its initial years. The Fund will provide small grants and finance small contracts ranging from $500 to $20,000 which will support the development of small pilot projects, innovative approaches, applied research, production and market studies and diffusion of information on renewable energy methods and practices. Grants will be made by a CDER Project Selection Committee which will include at least one representative from the U.S. contractor staff. It is expected that as the Center's capacity is strengthened over time the Moroccan staff will play an increasing role in the decision-making process. These proposals will be judged on the basis of selection criteria developed by the Center with assistance from the U.S. contractor and approved by USAID. Selection criteria will be based on economic, financial and technical feasibility and social and environmental impact. The project should be likely to yield results which:

(1) can be replicated in Morocco and are responsive to Moroccan economic and social needs,
(2) can increase the utilization of a renewable energy resource, and
(3) hold the potential for being further developed and spread by the private sector.

The project should have a potentially favorable cost-benefit ratio and employ a level of technology which is feasible in Morocco. These guidelines are included in the Project Agreement (See Section 4.4 in Annex 7). Annex 14 provides further guidelines from which the selection criteria are to be developed.

The Peace Corps is ready and willing to play a key role in helping develop and carry out community level pilot projects of this type. A few volunteers have already been trained in small scale renewable energy technologies in the United States. Working with local groups, they have built and experimented with a prototype solar flat plate collector for hot water at a village school, and a biogas digestor at a government-run farm.

Lack of resources however sharply limits the activities of this kind which can be undertaken. The Peace Corps has an Associate Director for Appropriate Technology who is prepared to work with CDER and USAID to develop an expanded program of small-scale, low cost, village-level pilot activities which could be carried out with help from Peace Corps volunteers and modest AID financing. The Ministry of Energy and Mines has encouraged such program and has expressed considerable interest in the few initiatives which have so far been undertaken. There are one or two others: USAID has financed a pilot project involving a solar

oven and solar hot water heaters at a small agricultural school near Rabat - under the CIDERA Rural Development OPG (608-0158) administered by Catholic Relief Services - where two young French engineers with a background in solar energy are giving hands-on training to rural youths in the construction and use of these renewable energy devices. The UNDP two years ago installed an array of solar flat place collectors for hot water heating at a Ministry of Health dispensary near Rabat. To be maximally useful, small pilot activities of this kind should be planned, coordinated, monitored, evaluated and publicized by a central responsible authority like CDER. The Small Project Fund is designed to accomplish this end. See Annex 14 for a description of its operation. A total of $320,000 will be reserved for the Small Project Fund during the life of the project.

USAID will provide initial funding for the Small Project Fund of $20,000 so that certain selected activities can begin under CDER auspices, in 1982. The CDER will submit quarterly reports to USAID on the activities and awards of the Small Project Fund. Subsequent replenishment of the Fund will be subject to annual evaluation of its operations.

8. The Pilot Project Fund

A. Purpose, Function and Procedure

Wind and solar pilot project activities will be an important part of the CDER program. Although initial pilot project activities have been developed and are outlined in Section III D, it is clear that more adaptive research needs to take place to discover cost-effective ways of exploiting Morocco's solar and wind energy potential. Pilot and demonstration activities are an essential element of this process. A needs assessment now being carried out under the AID-financed Energy Policy and Planning project (see page 67) will highlight potential areas for large impact.

The same is true for biomass activities. As stated in Section III E-2, a AID/USDA biomass team recommended a variety of ways in which Morocco can move to explore prospects for making more energy effective use of its biomass resources. The team recommended certain pilot activities in these areas for immediate and medium-term implementation. Sites will be chosen and detailed feasibility studies carried out to permit beginning pilot activities in early 1982 under the CDER technical assistance contractor. The Pilot Project Fund will be used to finance pilot activities identified by CDER during the life of the project. It is distinguished from the Small Project Fund in that (1) it will finance activities monitored or managed directly by CDER, and which have their origin in feasibility studies carried out or commissioned by CDER, and (2) it is not limited as to the size of cost of pilot activities to be financed, as is the Small Project Fund. Initial projects to be financed under the Pilot Project Fund are described below. Center staff with assistance from U.S. contractors will prepare the necessary feasibility and design documentation for these and subsequent pilot activities to be financed under the Pilot Project Fund.

A joint CDER Moroccan-American committee will be established for that review of proposed pilot projects in the various forms of renewable energy which CDER will test. The committee, on which USAID will be represented, will review proposals against USAID-approved criteria to ensure technical and economic feasibility, proper design, replicability, and consistency with CDER objectives. To the extent possible, pilot activities will be clustered and developed as part of integrated programs which will be approved by the CDER Director and, when AID funds are required, by the USAID Director. The general guidelines from which selection criteria for the Pilot Project Fund as well as the Small Project Fund are to be developed are included in the Project Agreement (See Section 4.4 in Annex 7). The committee will provide for appropriate monitoring and evaluation of all pilot projects and the dissemination of their results.

As conditions precedent to the disbursement of funds for each pilot project for solar, wind, biomass or other forms of renewable energy the Government of Morocco, acting through CDER, will be required to prepare a plan of action acceptable to USAID which :

1. Assigns responsibility for construction of pilot facilities;

2. Provides for financing of this construction;

3. Assigns responsibility for maintenance of pilot facilities and describes how it is to be done;

4. Identifies who will benefit from the pilot project and what the costs will be for them;

5. Clearly describes the responsibilities of whatever governmental or private entities are actively involved in implementing the pilot project.

B. Initial Biomass Pilot Program

A total of $30,000 of FY 1981 funds will be allocated to the Pilot Project Fund. All of this amount will be used for a pilot program in improved charcoal production, considered by the AID/USDA biomass team to have moderate to high near-term potential. An initial feasibility study will be carried out in June 1981 by a U.S. biomass expert provided under an Indefinite Quantity Contract (See Section III E.3).

Sites will be selected and a program developed based on design studies to be undertaken by CDER in collaboration with the Ministry of Agriculture's Forest Service and financed under the Pilot Project Fund.

Equipment will be procured in early 1982, when the charcoal production pilot program will be implemented as part of the CDER program under the guidance of the long-term technical assistance team. The program will be expanded in the following year using FY 1982 funds as shown in Table 1.C.

C. Second Stage Solar Pilot Project

As noted in Section III.E.5 (Further Solar and Wind Pilot Projects), the possibilities of solar energy utilization in Morocco are clearly not limited to the small photovoltaic pumps and refrigerators to be financed in FY 1981.

A team from the Solar Energy Research Institute (SERI) will make a preliminary study later in 1981 and specific pilot technologies and sites for pilot activities will be examined as an early activity of the long-term technical assistance team. One project to be considered

is described below. It was recommended initially by the Charles T. Main team but requires further examination of its economic aspects. If it is determined to hold potential for replicability, this project, or a variant thereof, will be financed under the Pilot Project Fund from FY 1982 funds (See Table 1.C.).

The pilot project site is located at Rabt Tehtani, in Oujda Province, near the Algerian border, about 80 kilometers south of the provincial capital of Oujda. The site provides potable water for domestic and livestock purposes to nomadic families in the area. The number of people using the site varies from 500 to 1,000 and livestock varies from 15,000 to 20,000 sheep and goats. About 75 per cent of the rural population in Oujda Province are nomadic and Rabt Tehtani is typical of the general conditions.

The proposed application is for potable water pumping. The renewable energy pumping system has been designed to provide a pilot project which is both reliable and modular. Conditions at Rabt Tehtani permit the use of both solar and wind generation to generate electricity directly to storage. The hybrid wind and photovoltaic system is placed on a ridge near the wells. This type of siting allows maximum advantage to be taken of the wind and solar conditions and provides flexibility to tap a number of wells without requiring costly relocation.

The Rabt Tehtani site offers both excellent wind and solar potential, characteristics which are common to much of Morocco. When wind speed is insufficient, batteries provide power to the water pump. The batteries are charged by the photovoltaic system and by wind turbine energy in excess of pumping requirements. Monitoring of (1) the hybrid system's performance, (2) the coincidence of wind and solar energy availability, and (3) the use for pumping of wind, solar and battery stored energy will provide reliable field data upon which replication of hybrid systems at future sites can be based.

A 10 kilowatt wind turbine and a 1 kilowatt photovoltaic hybrid system is proposed and will supply power for a 3.4 horsepower water pump motor. Energy storage is provided by a 400 ampere hour battery bank and the existing 40 cubic meter water tank. With proper management, the water and electric energy stored are adequate to meet projected needs for two days, under adverse conditions. Tables ID-IE describe equipment, load forecast and operation of the proposed hybrid solar and wind pumping system.

The project is not expected to place an inequitable financial burden on users. Under the current proposed plan for development, the provincial government is expected to provide both technical support and meet any operating costs. The proposed installation is not expected to take any valuable agricultural or grazing land out of production nor it is expected to interfere with present water use or grazing patterns. Full community support of the project is anticipated.

FINANCIAL PLAN - CENTER FOR RENEWABLE ENERGY DEVELOPMENT - AID FINANCING ($000) TABLE 1A

Fiscal Years	80	81		82		83		84		85		86		LOP
	Obl.	Obl.	Exp.	Obl.	Exp.	Obl.	Exp.	Obl.	Exp.	Obl.	Exp.	Obl.	Exp.	Obl.
1. Total AID	540	680	560	1500	850	1700	2010	1400	1450		850		100	5820
2. Preparatory Studies	465		465											465
a. Feasibility and Preliminary Design (CTM-Completed June/Nov. 80)	435		435											435
b. Initial Center Work Plan (DSI completed Nov. 80/Jan. 81)	30		30											30
3. Technical Assistance		300		325	355	515	545	735	590		385			1875
a. 2 resident advisors		200		200	220	205	245	335	260		215			940
b. 2 p M/Yr short term consultants		100		125	135	310	300	400	330		170			935
4. Training	60	180	60	280	185	400	300	365	300		340		100	1285
a. In-country training for Center staff (DSI) (Apr.-July 81)	45		45											45
b. 12 Academic (M.S.) Trainees		100		200	100	250	200	260	170		240		100	810
c. 20 p M/Yr short term training	15	80	15	80	85	150	100	105	130		100			630
5. Equipment & Materials	15	150	35	595	180	435	820		160					1195
a. Laboratory & Demonstration Equipment	15	140	35	545	150	365	750		130					1065
b. Library Acquisition		10		50	30	70	70		30					130
6. Other		50		300	130	350	350	300	400		120			1000
a. Small Project Fund (see Section III.B.7)		20		100	30	100	100	100	150		40			320
b. Pilot Project Fund (see Section III.B.8)		30		200	100	200	250	200	200		80			630
c. Project Evaluation (see Section VI)						50			50					50

NOTE : See Annex 1 for financial tables for the total project.

FINANCIAL PLAN - CENTER FOR RENEWABLE ENERGY DEVELOPMENT - GOM FINANCING ($000) TABLE 1B

	Fiscal Years							
	80	81	82	83	84	85	86	LOP
1. Total GOM	420	830	860	1095	465	460	470	4600
2. Center design and Construction	220	790	700	710				2420
3. Land acquisition	200							200
4. Furnishings of Center				75	25			100
5. Maintenance and Utilities				20	50			70
6. Salaries and staff related costs		30	60	100	130	150	160	630
7. Participant travel		10	10	10	10	10	10	60
8. Other			90	180	250	300	300	1120
a. Small Project Fund (see Section III.B.7)			40	80	80	100	100	400
b. Pilot Project Fund (see Section III.B.8)			50	100	150	200	200	700
c. Project Evaluation (see Section VI)					20			20

Table 1C

Pilot Project Fund - Initial Funding (Dollars)

		FY 1981	FY 1982
1.	Initial Biomass Pilot Program	30,000	
	a. Pilot Project Design Studies	5,000	
	b. 5 portable metal kilns for charcoal production (at $ 2,000 each)	10,000	
	c. 1 Missouri kiln for charcoal production (at $ 15,000)	15,000	
2.	Biomass Program Expansion		100,000
	a. Pilot project feasibility and design studies		5,000
	b. 5 portable metal kilns for charcoal production (at $ 2,000 each)		10,000
	c. 4 Missouri kilns for charcoal production (at $ 15,000 each)		60,000
	d. 5 wood burning stoves (at $ 2,000 each)		10,000
	e. 10 biogas digesters to produce methane-rich fuel gas from small family-run farms (at $ 1,500 each)		15,000
3.	Second Stage Solar Pilot Project Program		100,000
	Rabt Tehtani project (Oujda Province)		
	a. Final design		5,000
	b. Imported Equipment		70,000
	c. Imported monitoring instruments		15,000
	d. Local costs		10,000
4.	Total Initial Biomass and Solar Costs	30,000	200,000

C. Small Decentralized Hydro Power.

1. Background.

The quantity of energy generated by small hydroelectric installations in Morocco is minimal. In 1977, of 1,374 billion kWh produced by hydroelectric plants, only 45 million kWh, or 3 per cent, was produced by small hydroelectric installations under 1 megawatt capacity.
While all significant large scale centralized hydro sites have been or are being developed, small hydro holds considerable potential in Morocco.

In late 1978 following the visit of an AID financed team to investigate renewable energy development prospects in Morocco, the MEM instructed the Office National de l'Electricité (ONE) to examine the possibility of developing micro-hydro plants in areas of the country not likely to be reached in the medium term by the national electrical system. An AID small hydro specialist estimated in 1979 that nearly 200 sites existed at which decentralized hydro generators could produce electricity at least 9 months of the year, (See DSI, Renewable Energy and Morocco Development, 1979). During the summer of 1979 ONE conducted a preliminary site survey to identify 20 sites worthy of further investigation as pilot project sites. The sites were located in the High Atlas, the Middle Atlas and the Rif Mountains. ONE ranked the sites considering the size of population to be served by the facility ; the importance of the community ; the relative magnitude of construction costs, given the likely dimensions and magnitude of intake structures, basins and distribution lines ; water availability, head and power potential ; difficulty of construction, and the feasibility of providing electricity to the site from the existing grid as judged by the site's distance from the existing grid and the characteristics of the terrain to be crossed.

A Charles T Main small hydro team visited the 10 most promising sites in July-August 1980 to examine their characteristics. Data were collected through field visits, review of existing documents, and meetings with various GOM agencies. Field investigations considered the basic design and construction requirements, transmission line requirements and water requirements. Socioeconomic and demand forecast studies were carried out by means of field visits to candidate sites, interviews with various officials and others familiar with local conditions, the examination of existing documents in Rabat and Casablanca (ONE Headquarters), and a brief review of relevant published literature.

2. Socioeconomic Site Selection Considerations.

A set of broad socioeconomic criteria were developed for ranking sites according to their potential to make use of electricity to stimulate local economic development, and according to their suitability for research and demonstration and future replicability.

The socioeconomic conditions judged to be important preconditions to meeting the project goals were :

1. Wealth and Interest :

There must be sufficient wealth and interest in the community to enable users to pay for electricity and to make the small capital investments in electrical tools or machinery for use in agricultural processing and/or small-scale commercial or industrial applications.

2. Accessibility :

There must be evidence of access to modern a opposed to traditional technology and a positive attitude towards technological innovation. There should be sufficiently reliable year-round access to the site to permit research and monitoring of community response to electrification and maintenance of the facility.

3. Resource base :

A sufficient resource base should be available to provide opportunities to allow for processing of goods or for applications in other productive areas (i.e. tourism) using electric power.

4. Marketing channels :

Marketing channels through which new products could be sold should be present.

5. Settlement pattern :

The settlement pattern should be sufficiently nucleated to make the extension of electricity practical.

6. Regional importance :

The community should be regionally important serving as a government and market center. The government infrastructure can help initiate economic development applications of electricity and can help provide the foundation for project monitoring and research.

In the mountain valley areas considered for small hydro development, a productive base already exists which the introduction of electricity could stimulate. The configuration of these new uses cannot be precisely forecast, but the kinds of activities that may occur are generally known. These include use of refrigeration to store meat, milk, butter, potatoes, fresh fruits and vegetables, as well as soft drinks prior to sale ; electric saws, lathes, drills and sanders to fabricate wooden furniture and for other woodworking ; arc welding and grinding wheels to repair agricultural implements and tools, and to fabricate simple ironwork ; and a variety of electric motors to power flour milling facilities, fan drying or ventilation of produce, butter churning, milk pasteurizing, cheese making, nut cracking, wool spinning, weaving and looming, potable water pumping, meat slicing and wheat threshing.

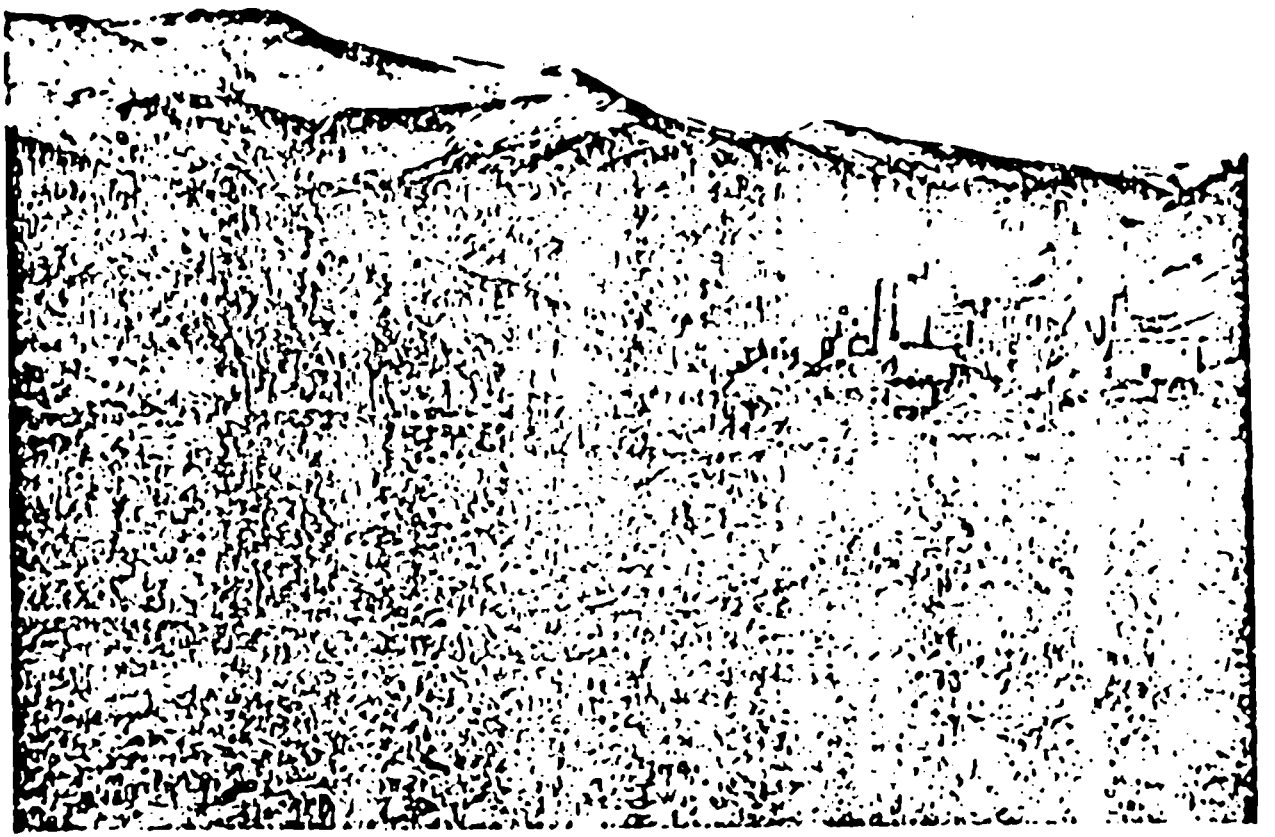
3. Economic and Financial Considerations.

a - First Higher Cost Approach. From the 10 sites visited by the Main team, 4 were selected as the most promising : Tabant-Ait Imi and Tillouguit (Azilal Province) on the north slope of the High Atlas Mountains and Msemrir (Ouarzazate Province) and Arhbalou-n-Kerdouss (Errachidia Province) on the south slope of the High Atlas.(See Fig. 1). The MEM wishes to locate each pilot site in a separate province, and Tillouguit was therefore dropped in favor of the more economically promising Tabant-Ait Imi.

The economic and financial soundness of each of the microhydro projects were evaluated by the Charles T main team with respect to :

1. Least cost comparison : does the micro-hydro installation constitute the least cost solution in terms of discounted, life-cycle investment and operating costs ?
2. Financial soundness : are expected revenues from the sale of electricity sufficient to amortize investment, including an adequate return on investment, and to cover operation and maintenance costs ?
3. Economic return : do the project's net economic benefits provide an internal rate of return comparable to what might be expected for other infrastructure investments in Morocco ?

To determine whether the micro-hydro plants should be compared to the grid extension or diesel generation, the cost of these two latter alternatives were compared. The grid is so distant for all three sites selected (48-55 km as the crow flies) that the capital costs of subtransmission line construction approached those for the micro hydro plants. Implementation of Morocco's IBRD-financed rural electrification program over the next 15 years will not bring the grid any closer to these 3 sites. If the distance is factored upward by 25 % to reflect variations in terrain, the transmission line costs exceed those for the hydro plants. Thus for these sites, diesel generation was selected as the basis for comparison with hydro.
In this comparison, reliability is an important factor in which small hydro enjoys a significant advantage. In a ONE/World Bank Survey of 187 villages served by free standing diesel generators, the quality of electricity supply was found to be poor and unreliable with one third of the units in poor condition and the rest overloaded and deteriorating rapidly. Small hydro units are generally far freer of repair and maintenance problems and the usable life commonly extends to 20-30 years.



1. Near Tabant Ait Imi, a small hydro site in the fertile Bou Guemez Valley of the High Atlas Moutains

2. The Tabant souk, one of the larger markets in the Bou Guemez Valley

b - Revised Lower Cost Approach. Upon review, Charles T Main designs for the pilot hydro application were seen to be very conservativa. The units were found to be large and contained components which could be eliminated, downsized or replaced with more economical and readily available substitutes. It was therefore decided to engage another firm with substantial experience in the microhydro field (less than 500 kilowatts) to reevaluate the applications and prepare designs and cost estimates for three selected sites. Site surveys were carried out in December 1980 with the help of a Moroccan survey team and the participation of the Moroccan Office National de l'Electricité. The U.S. engineering firm recommended smaller-scale off-the-shelf power generation units designed to require more modest civil works than Charles T Main had proposed andcosting approximately one-fifth as much as the earlier estimates (See Table 2 and Annex 17).

Of the three recommended sites, Main calculations for Msemrir indicated a negative rate of return for economic and financial calculations, with diesel being the preferred rate of return, below the opportunity cost of capital. Financially, it would not cover full cost using Main's recommended installation. Arhbalou was also found to be sub-marginal financially. Its economic IRR was positive but again less than the opportunity cost of capital.

However, the U.S. AID recommended installations dramatically reduce the costs and at a greater rate than the number of beneficiaries, with the result that cost recovery is enhanced.

c - Beneficiary Demand Forecast. To develop a forecast of electricity demand, the Main team estimated different types of end-uses : (1) residences, (2) public lighting, (3) government administration, and (4) commerce and agro-industry. Projections of residential demand were based upon estimates of population growth, the proportion of total households to be connected over the 15 year forecast period, and average projected electric energy usage per connected household over time. Street lighting requirements were forecast on the basis of the length of village roads, rate of installation and use. Government offices and households of government officials were projected to make immediate use of electricity. From this high initial level of consumption, government administration requirements were assumed to increase at a conservative rate of growth. Government administration was deemed to comprise, on the average, a dispensary, a primary school, housing for 2 government officials, a mosque and koranic school, and 8 separate office units. Commercial and agro-industry loads were projected by examining availability, usage patterns, and opportunities for use of refrigeration for small scale commercial applications, electric hand tools for repair shop and artisanal manufacturing operations, and electric motors for various commercial, pumping, artisanal and agricultural processing functions. A saturation level for each kind of appliance was projected for five year intervals.

Demand forecasts are necessarily imprecise. "The demand for power is not always immediately evident because micro hydroelectric systems generally bring electrical power for the first time" (1).
Thus other energy sources likely to be replaced by cheaper or more convenient electricity must be estimated first and then increased by estimates of new usage. The latter is difficult to forecast, especially in Morocco where no studies exist of what actually happens when a village is electrified (2). For this reason a hydroelectric program is normally introduced in two stages. "Pilot installations are used to assess load patterns and growth, installed capital costs, and running costs in addition to testing hardware" (3).
The three proposed micro hydro installations follow this pattern.

The Main report based demand forecasts on existing village activities and projected growth with standard and reasonable assumptions tied to the three principal benefits of electrification — cash savings resulting from substitution from diverted or new usage, and convenience, the latter being the most difficult to forecast. By substitution less costly installations than those originally suggested, the cost side of the Main calculations have been considerably reduced, resulting in lower cost per KW and lower cost per beneficiary while retaining the demand estimations but for a reduced population of beneficiaries.
In the two cases where U.S. AID final recommendations match the Main recommendations the lower cost units will produce less electricity resulting in earlier demand saturation. The Main report found that for these two sites, micro hydro even with the higher cost installations first envisioned, had lower life of project discounted costs than the alternatives of grid extension or diesel generation. Once the initial investment is made, hydroelectric power is one of the few energy sources whose future costs decrease in real terms (4)

In the case of Msemrir, the lower cost installations finally recommended resulted in a more favorable projected return for a pilot site which met other demonstration and dispersion criteria. If a scale of financial viability exists, the three sites selected would doubtless be among the best but not necessarily the three best.

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(1) "Community Load Determination, Survey and System Planning", by R. Holland, R. Armstrong, Evans, K. Marshall, P. 60 on Small Hydro Electric Powerplants (Proceedings of meetings in Ecuador, 1980) NRECA and AID.

(2) CDER will commission studies of the villages electrified by the small hydro pilot projects as part of its evaluation program.

(3) op. cit.

(4) "Economic and Financial Feasibility Study Methodologies", D.C. Avslan and M. Henwood, P. 101 in Small Hydroelectric Powerplants.

This is appropriate for a pilot project where experience, demonstration and replicability are the issues.

Cost recovery projections for small hydro are reassuring. Electricity tariffs have been increased several times in recent years. The increases reflect : 1/ rising fuel costs, 2/ an end to cross subsidies by smaller users for industrial and municipal purchasers and 3/ a general GOM policy, backed by the World Bank and IMF, to eliminate subsidies. The World Bank Rural Electrification project forecasts cost recovery for a program extending grid electricity to 360,000 inhabitants of 220 villages based on standard tariffs and profits from connection charges.

The average cost per rural connection in 1979 was found to be 4,750 dirhams (about $ 1000), excluding import duties and taxes which brought the cost to DH 5600. House wiring cost about DH 900 but charges averaged DH 1200. Average cost of delivery to a low voltage customer in 1977 was DH .259/kwh while the tariff was DH .459. Tariffs increased DH .63/kwh in 1979 and DH .685/kwh in 1980 reflecting increased fuel costs, which may be taken as a proxy for consumer willingness to pay. Since the proposed hydro installations were found to be cheaper than grid or diesel alternatives, there is every reason to believe that a tariff set at about DH .68/kwh adjusted for inflation, would be paid and would cover operating costs and most if not all capital costs.

On the socioeconomic side, thetime constraint of four months imposed by the terms of Charles T Main's Indefinite Quantity Contract did not allow careful socioeconomic examination of the tentatively selected sites. U.S. AID therefore contracted with Dr. Abdellah Hammoudi, a Moroccan sociologist on the faculty of the Institut National Agronomique et Vétérinaire Hassan II, to investigate the social and economic aspects of the sites.

It is clear from investigations so far that 1/ conflicts over land do not exist because the pilot sites will be on government owned land ; 2/ possible conflicts over water between irrigation and electrical generation needs can be avoided through proper design and location of the hydro installations ; and 3/ there is strong enthusiasm for the small hydro units among the populations of the villages which will benefit. Plans for construction of the facilities and distribution of the electrical power generated will be carefully reviewed with local authorities and representatives of the beneficiary villages to make sure that the projects are well understood and enjoy firm local support.

Annex 17 provides more details on the three individual villages where pilot installations are to be placed. The pilot units will provide a total beneficiary population of about 3,300 people with an average of 330 installed kilowatts.

The overall construction and installation cost of the units will be about $240 per person.

The eventual beneficiaries of these pilot projects will be the estimated 200,000 population of 200 sites in Morocco where small hydro-units may later be installed.

4. Implementation.

In the light of the technical and socioeconomic reports and recommendations of the Ministry of Energy and Mines, Ministry of Interior and ONE will agree on specific operational responsibilities for financing, installation, maintenance and management of the pilot units. A plan of action satisfactory to U.S. AID will be a condition precedent to procurement of any equipment for the pilot sites.

Construction of civil works will be carried out by Moroccan firms under contract to ONE. Small provincial contractors and local labor from the villages concerned will be used to the extent practical to maximize local employment. Equipment installation will be supervised by the U.S. design engineer. ONE will construct power distribution lines and facilities. Start up for the first unit is scheduled for August 1982, with the other to follow shortly thereafter.
Total cost for all 3 units is estimated at $790,000, $475,000 in foreign exchange and $315,000 in local costs. (See Table 3 for cost details).

Competence and familiarity with small hydo installation design is a highly specialized field. For the sake of efficiency, to avoid expensive delays in appropriate design and execution, it is anticipated that NRECA will provide final engineering design, preparation of specifications, supervision of construction and installation and start-up of equipment. The selected small sydro sites are in remote High Atlas mountain valleys accessible with difficulty if at all during the winter. To permit arrival and installation of the small hydro equipment during the 1982 construction season, it is essential that procurement be initiated no later than October 1981, well before the arrival of the U.S. technical assistance contractor assigned to CDER. USAID will therefore procure the small hydro equipment directly.

5. Administrative Feasibility.

ONE is a semi-public organization under the direction of the MEM, and is responsible for the installation and maintenance of all electrical generation equipment in the country. It is an organization of excellent technical and administrative quality. ONE will be responsible for the management and execution of the small hydro pilot projects. ONE engineers carried out the initial 1979 study which

recommended 20 potential sites for the pilot projects, and ONE engineers participated in the survey and mapping of the 3 selected sites. ONE will arrange for the construction and installation of the generation and distribution facilities. ONE is experienced at local contracting and plans to contract for these activities. ONE will receive funds from the MEM for all local costs of construction, installation and maintenance of the small hydro installations, and will provide technical staff for maintenance and repair of the small hydro installations.

Day to day operation of the units and collection of charges for the electricity will be the responsibility of local village government authorities which are under the authority of the Ministry of Interior, among the most efficient ministries in the government. Local groups in the3 areas concerned are experienced in the cooperative management of irrigation facilities for the equitable allocation of water. The generation and distribution of electricity will be handled in the same way, with a local person being trained by ONE to assume the role of guardian/technician for normal maintenance and minor repair. Local village government has the authority to collect taxes, to administer regional development funds allocated by the Ministry of Interior and from the local sale of village - owned forest products.

There is thus sufficient local practical and administrative capability for the effective management of the small hydro pilot facilities.

The CDER will be actively involved in monitoring and evaluation of the small hydro pilot projects. It will coordinate with ONE in gathering and analyzing data on pilot project performance, demand and utilization of power generated and studies directed to the expanded use of small hydro generation in follow on programs.

Table 2

Small Hydro Pilot Projects — Characteristics and Cost estimates

	Tabant	Msemrir	Arhbalou	TOTAL
Head (feet)	100	15-17	60-70	
Flow (cubic feet/sec.)	8	35	10-18	
Size (KW)	100 (2 50 KW units)	40	120-250	
Turbine type	Pelton	Francis	Pelton	
Cost of equipment (Dollars) (including shipping & insurance)	67,000	22,000	386,000	475,000
Cost of Civil Works (Dollars)	155,000	100,000	60,000	315,000
Total cost (Dollars)	222,000	122,000	446,000	790,000
Dollars/KW	2,220	3,050	1,784 - 3,717	

TABLE 3 A

Financial Plan - Small Hydro Pilot Projects - AID Financing ($000)

	FISCAL YEARS														LOP
	80		81		82		83		84		85		86		Obligations
	Obl.	Exp.	Obl.	Exp.	Obl.	Exp.	Obl.	Exp.	Obl.	Exp.	Obl	Exp.	Obl	Exp.	
1. Total AID	20		560	55		525									580
2. Preparatory Studies	20		35	55		475									55
a. Feasibility and preliminary design (CTM - completed June-Nov. 80)	1/														
b. Site survey and mapping (Boghdadi- completed Dec. 80)	5			5											5
c. Socioeconomic study - (Hammoudi - completed Dec. 80 - May 81)	15			15											15
d. Final engineering design and specification			35	35											35
3. Equipment for 3 pilot sites			475			475									475
4. Supervision of equipment installation and start-up			50			50									50

1/ Shown under CDER Financial Plan (Table 1)

TABLE 3 B

Financial Plan - Small Hydro Pilot Projects - GOM Financing ($000)

	80		81		82		83		84		85		86		LOP Total
1. Total GOM					815		11		12		13		14		865
2. Construction of 3 hydro sites civil work					315										315
3. Electric Distribution systems					378										378
4. Access Roads					112										112
5. Maintenance and repair					10		11		12		13		14		60

D. Solar and Wind Power Pilot Projects.

1. Background.

Morocco presents considerable potential for the widespread exploitation of solar and wind energy. The solar regime in Morocco is excellent, particularly inland. The average solar radiation in Morocco is estimated to be above the minimum level used by the U.S. Department of Energy (430 Langleys/day or 157,000 Langleys/year) as a criteria for selecting sites for solar demonstration projects. In Marrakech where solar radiation measurements have been made the annual average levels are 488 Langleys/day, 13 per cent above the DOE criteria. (see page 52).

Wind in a number of areas in Morocco, particularly along the coasts, is sufficiently high in velocity and duration to permit both direct mechanical pumping and electrification. Wind data from long term meteorological records for several sites show average velocities for numerous sites in Morocco of speeds rated as excellent for wind powered water pumping and, in several of these locations, wind powered electrification.

2. The Evolving Economics of Sun and Wind.

The selection of water pumping as a primary application for solar and wind pilot projects is based on several factors. The most important are existing demand and directly productive use.

End uses of pumped water include :

A. Potable water
B. Livestock watering
C. Irrigation

U.S. AID is currently developing a rural portable water project, Douar Water Systems (608-0167). An estimated 10% of installations are suitable for wind powered pumping where water table depth is not too great, wind speeds average 12 mph and villages are not on the electric grid. Under these circumstances wind power is an economically viable alternative to diesel pumps at present(1). The principal problem to be overcome is that of maintenance which bedevilled existing Aeromotor windmills installed in Morocco during the 1960s.

The economics of solar and wind energy must be approached with caution, however. A recent analysis, DSI, the Economic Costs of Renewable Energy, (See bibliography, Annex 20) found that photovoltaic (PV) pumping would be more economic than diesel/gasoline internal combustion (IC) pumping for farmers or society in the late 1980s. In general

(1) DSI "The Economic Costs of Renewable Energy". The same report indicates that PV pumping could be economic before the end of the 1980's but the planning cycle, based on experience, should begin now.

for pumping applications, the smaller the job the more suitable renewable energy became. The projection of future relative economic advantage of PV over IC pumping was relatively independent of fuel price projections since fuel is a relatively small proportion of system cost. Rather, the rate of technology development and application and assumptions about future PV modules and balance of system (BOS) costs were critical to the analysis.

The same principal applies to livestock watering, a principal application of windmills in Morocco as on the Great Plains in the United States. Large remote potential grazing areas, especially in the wind swept northeast plateau, are reduced in productivity because of insufficient stock watering possibilities.

Irrigation for crop production is a directly productive use where demand is demonstrated and expanding. Morocco has about 500,000 hectares under irrigation by private farmers within large government managed perimeters controlled by dams. An additional 150,000 hectares, approximately, often within or adjacent to the perimeters, are irrigated by private farmers. Such land may also be group managed but is privately financed(1). The preferred mode of irrigation is by electric pump where grid electricity is available. However this method is heavily constrained by limited extension of low voltage grids (2). In some areas, traditional gravity flow and lifting devices are used but this is rare, given their low output and the surface water or water table characteristics required. The most common pumping technology is by free standing or tractor driven diesel pumps. This technology spreads year by year, impelled by economic returns and drought risk for dry farming, wherever farmers can amass sufficient resources to pay for the equipment. It is estimated that there are about 20,000 diesel pumps in operation and that pumps and acreage will expand by about 10% per year during the 80's. Experience and demonstration of wind and solar pumping projects needs to begin now if substantial substitution for diesel power is to begin before the end of the decade. In addition to lower financial costs to farmers. such substitution offers economic, foreign exchange and employment benefits in oil imports foregone and opportunities for local manufacture of some components.

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(1) Credit for pump irrigation is available from a government-backed credit authority.

(2) Cost factors have inhibited provision of low voltage power for the rural areas traversed by high voltage lines.

3. Site Selection Considerations.

This project will test the use of wind-powered electric water pumping at two pilot sites ; photovoltaic-powered water pumping by five small, portable units; and five photovoltaic-powered refrigeration units for medical purposes. The two wind powered pumping units will be installed at the sites described below. The portable photovoltaic pumping units will be installed as pilot demonstrations at 1/ the Center for Renewable Energy Development in Marrakech ; 2/ an experimental and demonstration farm in Agadir province and 3/ on other farms to be selected in consultation with the Ministry of Agriculture. The refrigeration units will be installed in remote public health dispensaries to be selected in consultation with the Ministry of Health.

Site selection criteria for wind and solar powered pumping were based largely on the availability of on-site technical assistance. Site attributes were investigated both in the field and, when possible, through examination of meteorological wind speed and direction data, as well as agricultural, hydrological and electric grid data.

The following criteria were adopted :

1. Meteorological suitability - To ensure sufficient solar radiation wind.

2. Typicality - To maximize possibilities for replication to a variety of other sites.

3. Socioeconomic conditions - No problems concerning ownership, rights and water use ; the proposed application should not be disruptive nor result in any dislocation of the users or surrounding population ; the local community should be able to participate in managing the new technology ; on site support should be adequate to insure proper monitoring and management ; and the local community should be willing to participate in the project and recognize potential benefits.

4. Accessibility/Distribution - Sites should be sufficiently accessible so that the CDER can monitor performance, acceptability and impact ; and so that maintenance and repair can be carried out effectively. Sites should also be distributed regionally to provide a variety of conditions to test applicability.

5. Systems considered - Water pumping renewable energy systems analyzed included d.c. and a.c. electrical energy production by solar photovoltaic modules, wind turbine generators and solar thermal Rankine cycle power plants. Wind mechanical systems do not represent a new technology - some 200 such systems are in operation in Morocco - and their demonstration for water pumping was considered unnecessary. Sites were selected and differing technologies, equipment and applications were chosen so that the CDER would have monitoring records from a range of pilot projects available for evaluation. Future decisions as to replication can then be based on a review of the field testing of a variety of renewable energy and pumping configurations.

6. Economic and cost analysis - Preliminary 20-year life cycle cost analyses were conducted for each of the recommended sites except the CDER site itself. All future costs were accounted for and the present worth of renewable energy systems were compared to equivalent diesel alternatives. The use of life cycle cost analysis permits an equitable comparison of a low capital investment but fuel intensive diesel plant with that of a high capital but no fuel cost solar or wind power plant over the life of the systems.

7. Sociological Review - The sociological review of the proposed water pumping sites included field visits to sites, meetings with government officials and others familiar with local conditions, and a review of relevant documents and literature. There was an opportunity to visit most of the sites considered as potential locations for renewable energy water pumping technologies. In the course of these visits, informal interviews were held with local officials and residents.

Information was gathered about present water use, rights, pumping practices and priorities ; beneficiaries and how they might benefit (irrigation of agricultural land, time saving in transporting water for domestic and livestock purposes, etc...) ; general economic patterns and income (e.g., pastoralism, agriculture, small commercial operations) ; demographic characteristics of the local population (e.g., total population/household size, age/sex, migration patterns) ; receptivity towards the proposed project ; present or future areas of conflict that might follow as a result of the project ; existing infrastructure to manage the proposed technology ; and general experience and predispositions of the population regarding technological innovation.

8. Environmental review - Each site investigation considered possible impacts on the environment and evaluated whether the proposed action would result in any significant environmental harm.

4. Wind Power Pilot Project Sites.

Using the above criteria, the Charles T. Main study suggested the installation of wind powered water pumping systems at two sites :

SITE	APPLICATION	TECHNOLOGICAL SYSTEM
1. Oujda (Oujda Province)	Water pumping for human and animal water supply	48 Kw wind electric pump
2. Sidi Boumouar (Essaouira Province)	Irrigation or potable water supply	40 Kw wind electric pump

The economic viability of the third site - a hybrid of wind and photo-voltaics - requires further analysis before a decision to proceed. However it is proposed, based on Main's findings, to install the first two wind electric pumping units described below.

A. PK 8 Route d'Ahfir, Oujda Province

A 40 kw wind electric generator is to be installed for potable water pumping at a site 8 km north of Oujda, a provincial capital in the north-eastern part of the country. The well at the site now provides water for human and animal consumption, serving 1,400 people who live on 4 livestock farms in the vicinity and 500-600 nomads who move through the area regularly. The total animal population (sheep, goats, cattle and mules) relying on the well is 20,000-25,000. There is no electricity. The present system for obtaining and distributing water includes two diesel engine driven pumps, four concrete storage tanks and an underground pipe distribution network. Families collect water from the four storage tanks and cart it for domestic use. The pumps are operated and maintained by the provincial office of the Ministry of Agriculture and a resident technician is in charge of their operation. The water distributions network is maintained by the provincial government. The well is 62 meters deep.

The proposed project for establishing a wind pumping facility for potable water is sociologically sound. The project will not place a financial burden on the users. All costs will be met by the provincial government. The institutional infrastructure necessary to operate, maintain and administer the proposed facility is already in place. The present resident technician will be trained to perform basic operations and to recognize and report any abnormalities to the CDER.

Applications such as the one proposed for water pumping can be expected to be widely disseminated throughout the area in the future. Potable water is generally obtained from hand-drawn wells which often are several kilometers from home. In addition to representing a substantial expenditure of human time, a substantial amount of human energy is spent in securing water. The local population and the provincial authorities, including the Governor, have expressed a keen desire for the installation of the pilot project, which is perceived to be more reliable and less costly than the diesel installation.

B. Sidi Bounouar, Essaouira Province

The proposed site is on a cooperative farm 30 miles northeast of Essaouira, a provincial capital on the Atlantic coast. A wind electric generator is to be installed for pumping water. There is excellent wind potential at this site and sufficient power can be produced to meet potable water pumping needs and much of the existing need for electrification of cooperative members' homes. If well tests demonstrate adequate capacity to meet planned irrigation needs, a 40 kw wind generator will be installed to produce potable water, electricity and irrigation water pumping.

The farming cooperative of Sidi Bounouar has 450 hectares of land and 20 families for a total of 156 people. The general economic picture of Sidi Bounouar compares favorable with other small farmers in the area. The existing institutional infrastructure of the cooperative includes a cooperative administrative committee and a resident technical advisor to supervise crop planning and management and general assistance. The committee and technician also supervise water use.

The project is not expected to place an inequitable financial burden on users. Interest in the project is high among all cooperative members and governmental officials. The proposed installation will not take any agricultural land and no problems are anticipated in local acceptance of the project.

The Sidi Bounouar site is fully supported by the Governor of Essaouira Province and is now under the supervision of the provincial office of the Ministry of Agriculture.

The cooperative has already petitioned the Provincial Agricultural Development Service of Essaouira for a diesel irrigation water pumping installation. Under the planned arrangement, the government would assume all administrative and technical costs and would assign a government mechanic to operate the facility. The cooperative would assume all costs for equipment, parts and maintenance, and fuel. Installing a wind electric generator instead of a diesel unit will provide an excellent opportunity to demonstrate the appropriateness of renewable energy systems for agriculture and potable water and, at the same time, eliminate the need for additional government expense of assigning a full-time resident technician to operate the diesel engine.

Sidi Bounouar should be an excellent test case for replicability. The local setting is representattive of much of the rural coastal plan where water pumping is required for potable and agricultural applications.

Cost estimates and technical information for both of these wind powered pumping units are given in Table 4 and Annex 16.

C. Action Plan

The Center for Renewable Energy Development, with assistance as may be required from U.S. contractors, will develop final design and specifications for equipment and civil works for the two sites described above, based on Main's feasibility studies and preliminary designs. In cooperation with other appropriate GOM agencies, CDER will develop detailed plans for implemention, management and monitoring of the two pilot projects. The U.S. technical assistance contractor assigned to CDER will procure equipment for delivery by September 1982. Moroccan technicians responsible for installation and maintenance of equipment will undergo training in Morocco and will participate in the construction and installation of equipment in early 1982, guided by U.S. supplier representatives and U.S. contract technical assistance staff who will arrive at CDER in early 1982. Peace Corps volunteers will assist in training, installation and subsequent monitoring of pilot projects.

5. PHOTOVOLTAIC-POWERED PILOT PROJECTS

The use of photovoltaic power in agriculture at this time can include the following applications:

1. Pumping

   a. Low lift pumps for irrigation expansion
   b. Cattle watering
   c. Household uses

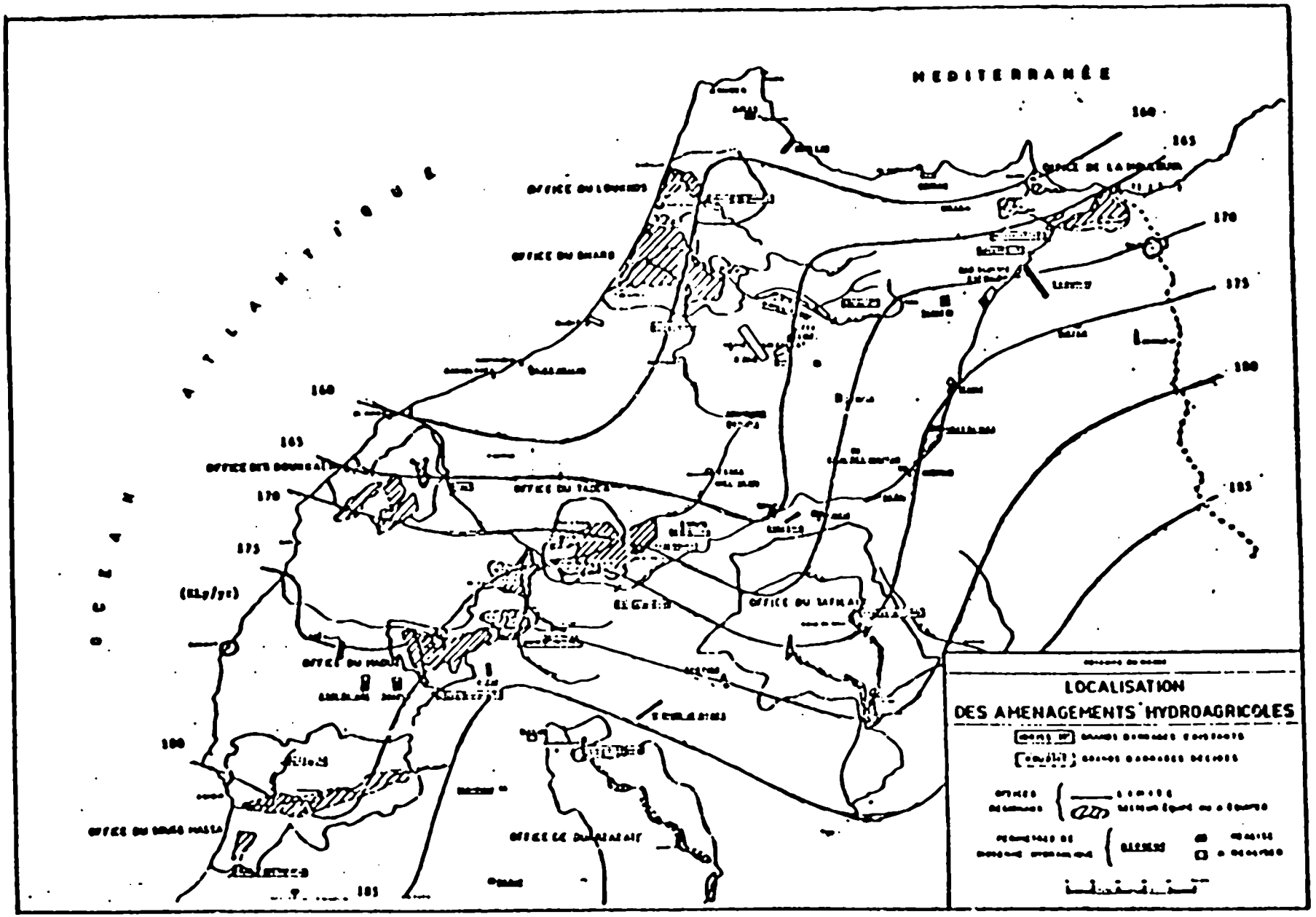
2. Centralized battery charging (for small power needs)

3. Refrigeration

   a. Individual health facilities, small stores, restaurants and household use
   b. Centralized crop storage, fish preservation

4. Standalone power systems

There are many other potential uses of electricity for motors, grain milling, etc.; however adequately demonstrated technology systems are not available nor are widespread needs for these demonstrated in Morocco.



SOLAR RADIATION INTENSITY LINES (ISOHELS) FOR MOROCCO

Appropriate applications in economic terms are defined by the specifics of the application; size, site, use, performance expectations, etc., must all be considered before an application is "appropriate."

If water demand is large at certain times and minimal at other times as is the case with certain crops; if water demand is constant irrespective of the weather or season; or if water demand extends beyond daylight hours, photovoltaic pumping is either inappropriate or storage (of electricity or water) is necessary. To find the set of conditions in which photovoltaic pumping is appropriate, both agricultural and technological specialists must work together. At this time in the development of photovoltaic powered irrigation systems, there is no a priori appropriate system; rather there are only appropriate combinations of circumstances and system components. In selecting and designing applications, it is necessary to be sure that the combination of use and technology will be appropriate.

Photovoltaic-powered pumping units will be installed at the following sites:

Center for Renewable Energy Development, Marrakech

Excellent solar radition in Marrakech make this an ideal site for a photovoltaic-power system. A 5 kw photovoltaic module mounted on the Center's roof will permit pumping of either of the Center's two wells or charging of the Center's batteries. The water pumped will meet someof the needs for potable, landscape

garden and construction uses. This system can also be used for many research and teaching applications.

Crafa (Agadir Province) and other sites

The Crafa site is located on an experimental and demonstration farm near Taroundant in Agadir Province, about 80 km in from the Atlantic coast in a rich agricultural area. The farm area is 68 hectares. However, within the area served by the demonstration farm, there are about 800 farm families (about 8,000 people) working 7,300 hectares of irrigated land. A planned extension of the irrigation system will bring an additional 20,000 hectares of land under irrigation and involve an additional 15,000 families. The Crafa program brings groups of farmers to the facility for instruction in new technologies for crop production and farm management.

Farmers receive water from the government system of canals and either use gravity or diesel pumps to deliver water to their fields. Occasionally, some electric pumping is done. Farmers are increasingly concerned with rising costs of pumping. According to Crafa officials, the diesel costs are becoming increasingly prohibitive and there will be a growing demand for alternative energy sources.

Main's study recommended irrigation water pumping using a 15 kw solar photovoltaic system to irrigate 5 hectares of land together with a system to provide heat for an on site greenhouse. However, they pointed out that small, independent farmers cannot realistically be expected to set aside a portion of their land experimenting with a solar application given that the value of irrigated land is DH 50,000 ($12,500) per hectare locally. It is also unlikely that a farmer could be persuaded or should be persuaded to make the $200,000 investment required by Main's recommended array.

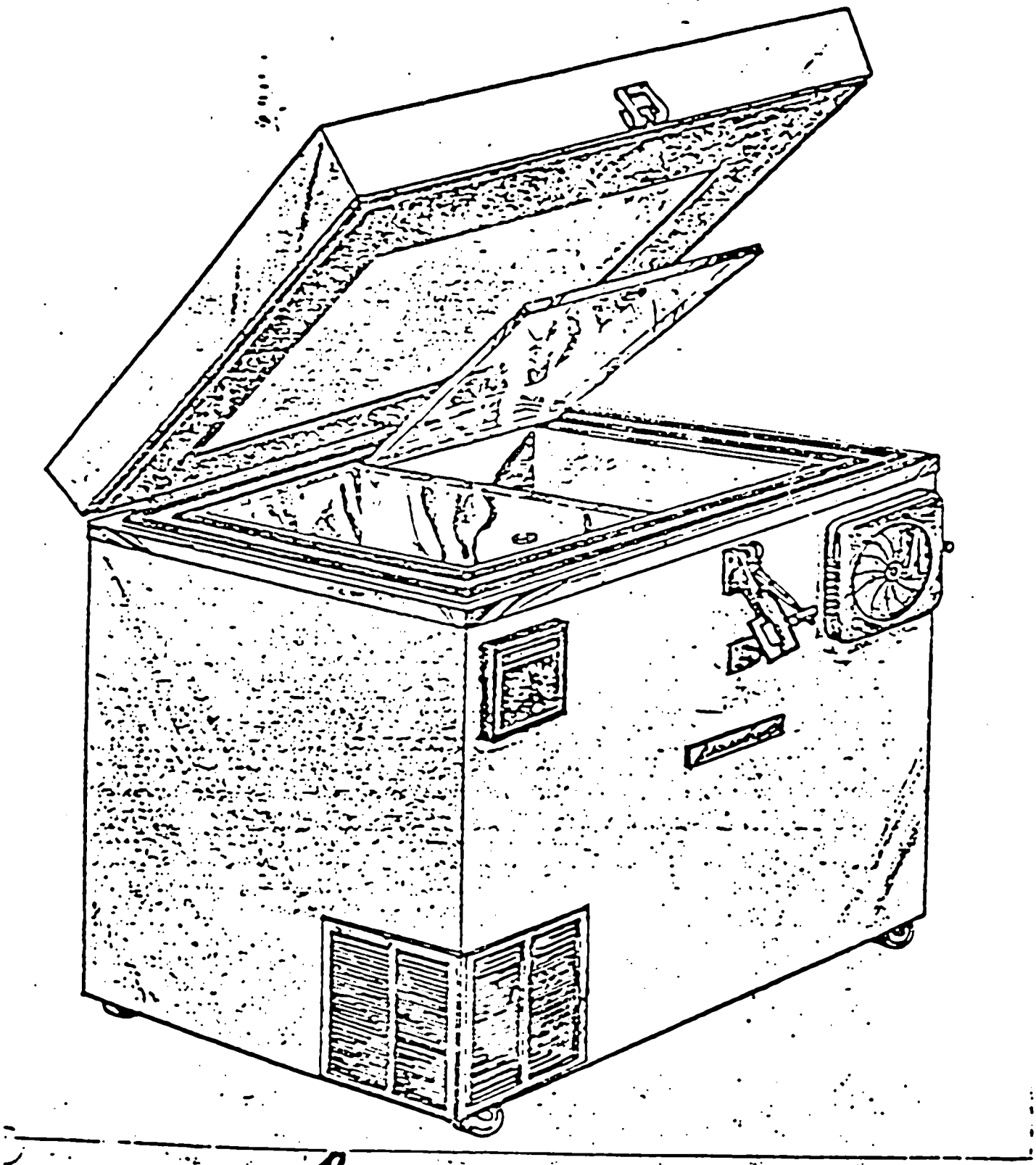
If a 15 kw solar photovoltaic pumping system is beyond the reach of small and medium scale producers and uneconomic even for large scale producers, it would seem to be an inappropriate application of photovoltaic technology, and should not be considered even for a pilot project. Smaller scale applications of photovoltaic modules have a much greater potential for economic use, and the powering of low-lift portable pumps is one of these. Although the cost per installed watt is the same as for larger installations, portable 250-500 watt pumping units costing $6,000 have real application for extending irrigated areas by raising water from canal to field and from lower fields to higher fields rather than for raising water from the depths of a well. Pumping units of this type have been developed as off the shelf items and are in use in a number of irrigated areas in the Middle East and Asia (See Annex 18). It is proposed to install 5 of these units at the

Crafa demonstration site and other locations to be selected in areas already under irrigation. The Crafa 5 hectare parcel is typical of farm sizes in the irrigated southern plains of Morocco where many small farmers obtain irrigation water from government operated canals. The Sidi Bounouar wind generation site on the other hand is typical of irrigation systems managed jointly by independent farmers. Thus, the two sites provide an opportunity to test renewable energy technologies for two different irrigation systems (individual and group)

Photovoltaic-powered refrigeration units are another viable rural use of solar energy. Small volume units requiring little electric power have been designed for use in remote health stations without access to an electrical grid. One type which will be considered for use is illustrated on the following page. Capacity is about 100 liters. Cost, about half for the refrigerator unit and half for photovoltaic modules, is about $6,000. The Ministry of Health will monitor the use of five pilot units in remote medical facilities. NASA-Lewis Research Center and the U.S. Communicable Disease Center (CDC) have an on-going A.I.D.-financed program to locate PV powered refrigeration units in health facilities around the world. This program is meant to introduce this technology in developing countries where it can be useful and to begin to encourage its application. Morocco meets the criteria used by NASA and CDC to site units. The five PV pilot refrigeration units will be procured by the U.S. technical assistance contractor in early 1982 based on NASA specifications so that they will arrive in Morocco and be ready for installation later that year.

6. Further Solar and Wind Pilot Projects

The possibilities of solar energy utilization in Morocco are clearly not limited to small photovoltaic pumps and refrigerators. Other possibilities for technically and economically viable uses of photovoltaics and other forms of solar energy will be explored by the Center for Renewable Energy Development with the assistance of U.S. specialists. A team provided by the Solar Energy Research Institute (SERI) has been asked to make a preliminary study later in 1981 and design a national solar and wind measurement program, a prerequisite for further action in this area. Specific technologies and sites for pilot activities will be examined as an early activity of the long-term technical assistance team scheduled to begin work at CDER in early 1982.



ADLER-BARBOUR DCM-12SM
SOLAR PHOTO-VOLTAIC POWERED REFRIGERATOR-FREEZER

In addition to the projects listed in Table 4, additional wind and solar pilot and demonstration activities will be developed during the life of the project for funding under the Pilot Project Fund, described in Section IIIB8. A total of $300,000 is reserved for wind and solar activities during the life of the project, beginning with $100,000 in FY 1982.

Table 4

Wind and Solar Projects - Characteristics and Cost Estimates

A. Wind

1. Location: PK 8, Route d'Ahfir, Oujda Province
   Type: 40 Kilowatt wind powered pumping unit for Portable Water
   Cost: Equipment: $72,600 (AID)
   Civil Works: $12,225 (GOM)
   Total $84,825

2. Location: Sidi Bounouar, Essaouira Province
   Type: 40 Kilowatt wind powered electric pumping unit for Potable and Irrigation Water
   Cost: Equipment: $98,370 (AID)
   Civil Works: $ 58,650 (GOM)
   Total $157,020
   Total Wind Pilot Projects $241.845

B. Solar

1. Location: Crafa Experimental Farm, Agadir Province and other photovoltaic demonstration sites to be selected
   Type: Pumping of irrigation and potable water 5 portable photovoltaic-powered pumps x $6,000 each $30,000 (see annex 18) 5 photovoltaic-powered refrigertors for medical purposes x $6,000 each $30,000
   Total $60,000 Solar Pilot Projects (AID)

Total costs of wind and solar pilot projects listed above $301,845 of which A.I.D.-financed equipment $230,970

TABLE 5 A

Financial Plan - Wind and Solar Pilot Projects - ($ 000) - AID Financing ($000)

	80		81		82		83		84		85		86		LOP
	Obl.	Exp	Obl	Exp	Obl	Exp	Obl	Exp	Obl	Exp	Obl	Exp	Obl	Exp	Obligation
1. Total AID	20		260	190		90									280
2. Preparation Studies	20		30	50											50
a. Feasibility and preliminary design (CTM - June - Nov. 80)	1/														
b. Final design and specifications	20		2/ 30	50											
3. Equipment			230	140		90									230
a. 2 wind pumping units			170	100		70									
b. 5 PV portable pumps			30	20		10									
c. 5 PV refrigeration units			30	20		10									
4. Wind and solar pilot projects to the identified and financed under pilot projects Fund (non-add)					(100)	(70)	(100)	(100)	(100)	(90)		(40)			(300) 1/
a. Feasibility studies					15	10	10	15	10	10					35
b. Equipment					85	60	90	85	90	80		40			265

1/ Shown under CDER Financial Plan - Table 1

2/ For preparation of center equipment specifications.

TABLE 5 B

Financial Plan - Wind and Solar Pilot Projects - GOM Financing ($000)

	FISCAL YEARS							
	80	81	82	83	84	85	86	LOP
1. Total GOM			72	3	3	3	4	85
2. Construction of 2 wind power sites-civilworks			70					70
3. Operation and Maintenance			2	3	3	3	4	15
4. Wind and solar pilot projects to be identified and financed under the Pilot Project Fund (non-add) (See Section III B.8.)			(25)	(50)	(75)	(100)	(100)	(350) 1/

1/ Shown under CDER Financial Plan - Table 1

E. Biomass Conversion Pilot Projects

I. Background

Today more than 50% of the total energy consumed by many of the developing nations is supplied by their bio-resources. In Morocco a very large measure of energy is thought to come from biomass and animal waste.

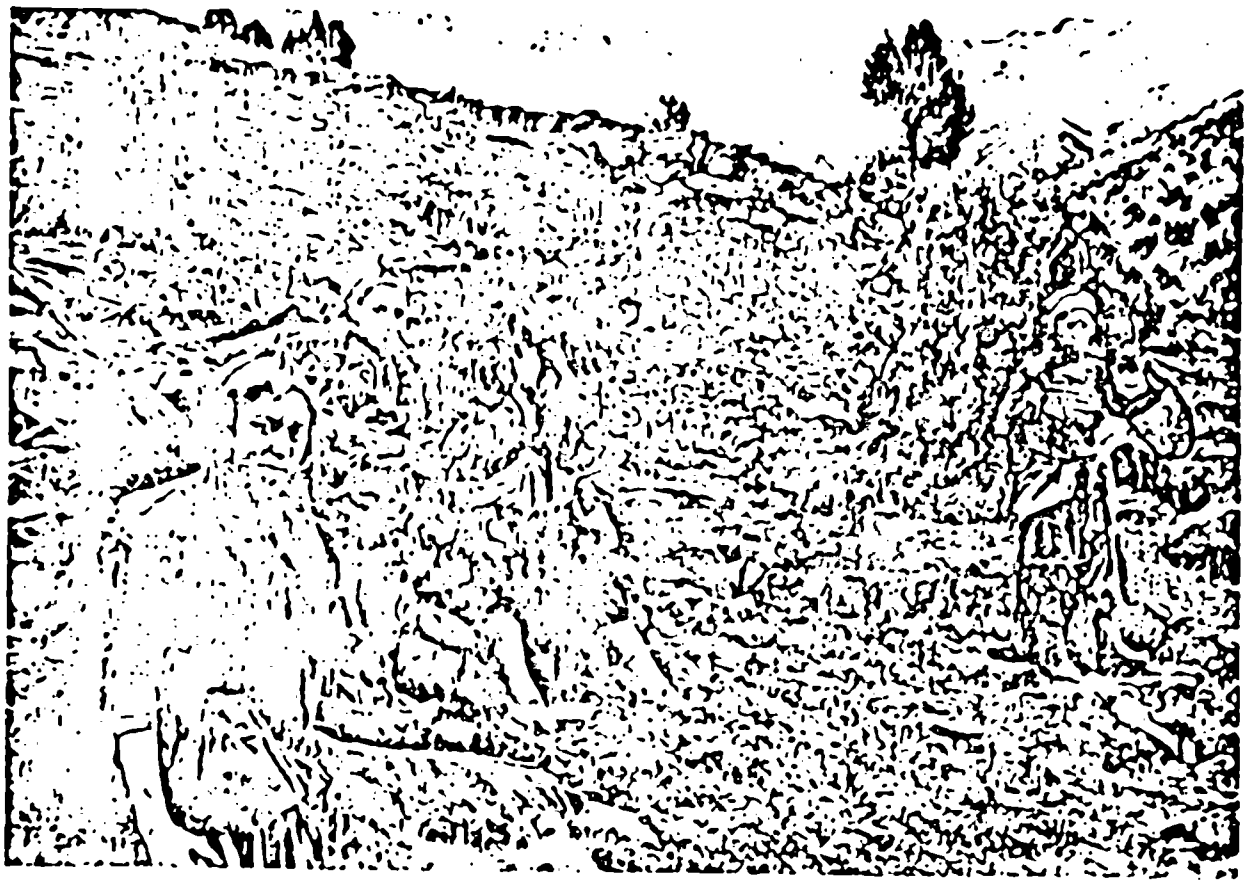
This supply of energy principally goes to Morocco's rural and poor urban population and is used primarily for domestic purposes. i.e cooking and hot water. In addition, some of this energy is used for small-scale industries such as tanning, soap making and food processing.

As in most developing countries, Morocco has not yet measured the availability of biomass nor studied seriously its potential uses as an energy source. Wood and other vegetation is currently used as a biomass energy source. However, it is consumed at a rate that far exceeds its normal replacement capacity.

Despite reforestation efforts, Morocco is losing at least 30,000 hectares of already scarce forest resources per year. Its forests are insufficient to meet the country's needs for wood fiber and household energy. Annual recorded production of firewood averages about a million cubic meters per year. About 60 per cent of this is converted into charcoal. Prices for charcoal have increased almost twice as rapidly as the average cost of living.

An AID/USDA biomass study team visited Morocco in July-August 1980 to advise the GOM and USAID on biomass needs in facility design of the proposed Renewable Energy Development Center, to recommend the range of biomass conversion technologies feasible in Morocco and to indicate biomass pilot projects which might be carried out by the GOM.

The team found that, while animal waste and municipal solid waste offered certain opportunities for biomass exploration, the greatest opportunity for energy from biomass lay in the use of woody material from plantation growth and residue. The team proposed a technical assistance project to increase the present area of



4. Women gathering wood in the High Atlas Mountains. Wood for cooking and heating is becoming increasingly scarce.

plantations by 300,00 hectares in 10 years. The biomass from 300,000 hectares would fuel, for example, at least 6 power plants of 25 megawatts capacity and make a significant contribution to the energy balance in Morocco by reducing the import of petroleum by nearly 10 per cent. USAID has proposed an Integrated Forestry Development project (608-0165) for FY 1982-1986 funding based on these recommendations.

The forestry project will closely complement the Renewable Energy Development project's biomass conversion activities by expanding wood production for energy uses.

Growing evidence worldwide indicates a strong positive correlation between household energy prices and deforestation in developing countries. The proposed forestry project will help offset rising charcoal prices and will directly affect the success of the biomass components of the Renewable Energy Development project. The biomass component of this project will seek to apply new techniques of converting woody biomass to energy in the Moroccan context. Of particular interest to the GOM is new and currently available village-level charcoal conversion technology. Present Moroccan conversion techniques are primitive and result in wasted wood fiber (wood is burned in mud retorts). The new technology to be applied will preserve small scale village characteristics but greatly reduce these losses. The net result is greater charcoal production from the same amount of wood, and should ease pressure on forest resources.

With respect to the conversion of biomass for energy, the team identified a number of tested conversion technologies which showed promise for implementation or adaptation in the next 10 years under Moroccan conditions, and produced a list of potential biomass conversion projects. Possible applications range widely in scale and cost from woodburning stoves for household use $2000 to anaerobic digestion facilities for the city of Marrakech. ($1,500,000)

2. Feasible Development Projects

The following list indicates feasible development projects for biomass conversion in Morocco, covering a range of scale, complexity and cost. Local conditions will have to govern the choice of projects to implement.

POTENTIAL BIOMASS CONVERSION PROJECTS

Combustion:

Woodburning stoves
- Moderate/high near-term potential
- Cost of $2000
- Requires 3 dry metric tons/year (dmt/yr) wood
  - 1 hectare tree plantation.

With respect to the conversion of biomass for energy, the team identified a number of tested conversion technologies which showed promise for implementation or adaptation in the next 10 years under Moroccan conditions.

High Potential

- Stationary internal combustion engines retrofitted with air-blown gasifiers (irrigation pumping, electric power production)

- Portable metal kilns for charcoal making.

Moderate to High Potential

- Stoves for heating and cooking.

- Retrofitting existing oil-fired industrial boilers with air-blown gasifiers.

- Retrofitting vehicles with gasifiers.

- Densification of agricultural residues, sawdust, charcoal dust, etc...

- Missouri kilns for charcoal making.

Moderate Potential

- Methane fermentation of animal wastes and low lignin content vegetable or plant wastes.

- Mass burning of biomass and wastes to produce steam ; in shop fabricated boilers with grates or shop fabricated furnace with waste heat boiler.
  Moderate near-term potential
  Cost $300,000
  Requires 2800 dmt/yr wood
  875 hectares tree plantation

- Field erected fluidized bed burners with waste heat boilers, producing steam, using olive pits, nut shells, waste wood.
  Moderate near-term potential
  Cost $1,000,000
  Requires about 9100 dmt/yr biomass from processing plant waste with high moisture content.

- Biomass derived char/fuel oil slurry in an oil fired boiler
  Moderate near-term potential
  Cost $1,000,000 to 2,000,000
  Requires about 16,000 dmt/yr wood
  5,000 hectares tree plantation

Gasification

- Air-blown gasifiers to produce fuel gas for diesel electric generators in rural areas.
  High near-term potential
  Cost $600,000 to $900,000 (250 Kw engine)
  Requires 875 hectares tree plantation

- Air-blown gasifiers on vehicles or trailers
  Moderate/high near-term potential
  Cost $5,000 - $10,000 (300 hp engine)
  Requires 164 dmt/yr wood
  51 hectares tree plantation.

- Air-blown gasifiers to fuel existing oil fired industrial boilers
  Moderate/high near-term potential
  Cost $250,000
  Requires 4030 dmt/yr wood
  125 hectares tree plantation

Anaerobic Digestion

- Digester to produce methane rich fuel gas from shredded municipal solid waste
  Moderate/high near-term potential
  Cost about $1,500,000
  Requires 9000 dmt/yr solid waste from Marrakech or same size city

- Digester to produce methane rich fuel gas from large farm or feedlot
  Moderate near-term potential
  Cost varies from $25,000 to $100,000
  Requires 80 dmt/yr manure from 100 cattle

- Digester to produce methane rich fuel gas from small family run farms
  Moderate near-term potential
  Cost highly variable, up to $2000
  Requires 8 dmt/yr manure from 10 cattle

Pyrolysis

- Portable metal kilns for charcoal production
  High near-term potential
  Cost less than $2000
  Requires 288 dmt/yr wood
  90 hectares tree plantation

- Missouri kiln for charcoal production
  Moderate/high near-term potential
  Cost $10,000 to $15,000
  Requires 1248 dmt/yr wood
  390 hectares tree plantation

TABLE 6

FINANCIAL PLAN - BIOMASS CONVERSION PILOT PROJECTS
A.I.D. FINANCING[A] ($ 000)

	FISCAL YEARS														
	80		81		82		83		84		85		86		LOP
	Obl.	Exp.	Obl.	Exp.	Obl.	Exp.	Obl.	Exp.	Obl.	Exp.	Obl.	Exp.	Obl.	Exp.	Obligation
1. TOTAL A.I.D.	20			20											20
a. Feasibility & Design Studies	20			20											20
b. Biomass pilot projects to be identified & financed under the Pilot Project Fund (non-add)			(30)		(100)	(80)	(100)	(120)	(100)	(100)		(50)			(330)
a. Feasibility Studies			5		15	10	10	20	10	20					40
b. Equipment			25		85	70	90	100	90	80		50			290

A GOM financing for biomass conversion activities will be provided through the Pilot Project Fund (See Section III.B.8) for which a life of project GOM contribution of $700,000 is shown in Table 1 B (Financial Plan - CDER-GOM Financing). About half of this amount will be tentatively reserved for biomass activities.

Densification

Densification equipment to produce fuel pellets or briquettes from agricultural residues, sawdust, charcoal dust, or crops like alfa

Moderate near-term potential
Cost up to $2,000,000
Requires $12,500 dmt/yr residue

Clearly further study will be required to help the MEM establish an order of priorities for pilot activities in biomass conversion. The Center for Renewable Energy Development will take a leading long-run role in moving ahead on the biomass front, using the expertise of the technical assistance contract team to be assigned there. In 1982 the contract team will develop a plan of action for biomass activities to be carried out under the aegis of the Center in cooperation with the Ministries of Agriculture and Interior. Plans are likely to include small-scale, village level applications of biomass technology, better charcoal-making methods efficient Lorena-type stoves, biogas digesters, some of which may be carried out with the participation of Peace Corps volunteers with support from the Small Projects Fund.

3. Next Steps and Funding

The USDA team underlined the urgency of beginning activities on the biomass front and recommended pilot projects which could be undertaken without delay, particularly in small-scale charcoal production. A biomass expert provided under an Indefinite Quantity Contract in June 1981 will develop specific proposals for pilot activities in charcoal production based on the USDA report and further investigations in Morocco in June 1981. These recommendations will provide a basis for early action by CDER and the long-term technical assistance contract team beginning in early 1982.

To finance equipment and related costs required for early pilot and other biomass activities to be developed subsequently, $30,000 will be reserved under the Pilot Project Fund in FY 1981 and a total of $330,000 during the life of the project. See Section III B.8. for a description of initial pilot projects to be financed

IV. ADMINISTRATIVE FEASIBILITY

A. Moroccan Government Capability

The Ministry of Energy and Mines is responsible for the overall coordination of this project.

GOM responsability for development and management of this project rests with the Office of Energy Resources Development of the

Directorate of Energy of the Ministry of Energy and Mines. The Center for Renewable Energy Development reports to this office.

As project implementation gets underway, operational authority will be increasingly delegated to CDER as the operating capacity of CDER is strengthened by increased staff. Coordinating and action authority will be delegated increasingly to CDER for all aspects of the project. Contracting authority will remain with the Ministry of Energy and Mines. Thus the MEM will contract for the architectural design and the construction ofthe CDER buildings, but the research and development activities of the CDER will be carried out by CDER staff directly.

The individual nominated to direct the Center for Renewable Energy Development has successfully managed sugar refinery construction projects and will receive training in renewable energy technologies by attending schools and visiting renewable energy facilities in the United States and elsewhere. Based on the foregoing, we have concluded that the MEM has the experience and requisite administrative capability to execute this project.

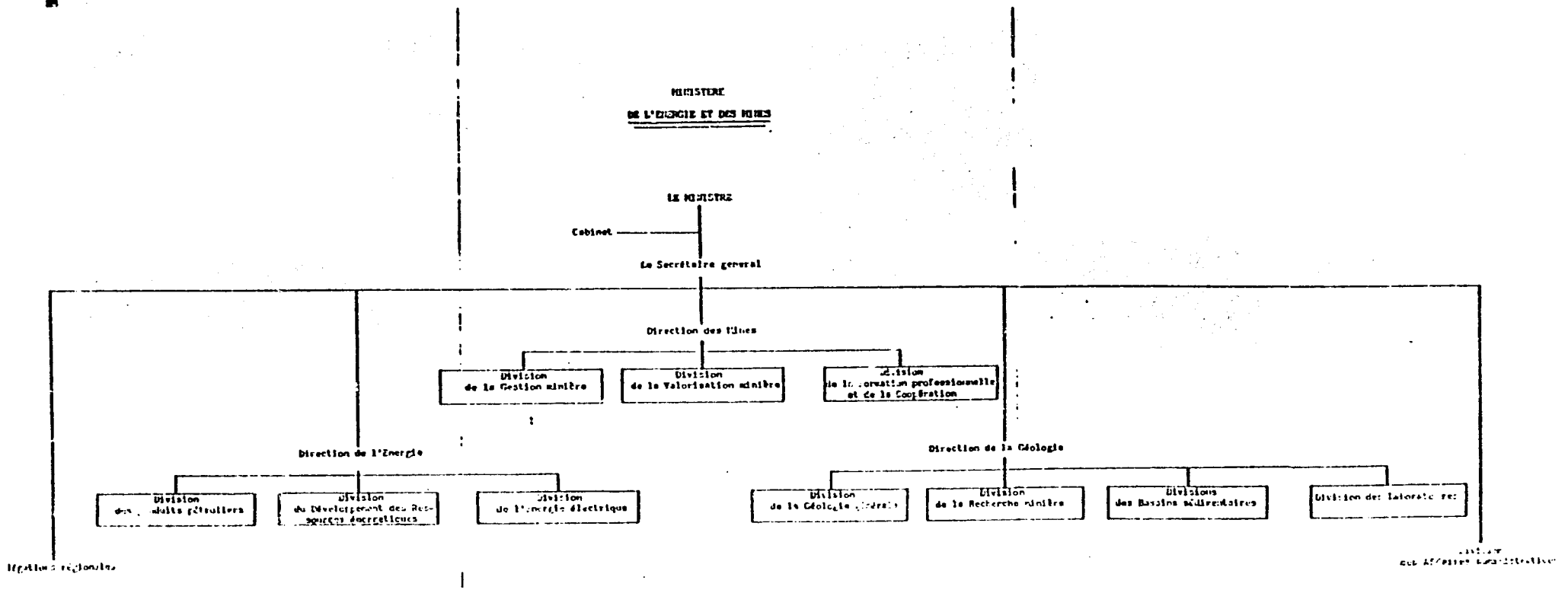
The construction, installation and maintenance of the small hydro pilot projects, and the larger solar and wind pilot projects will be the responsibility of the Office National de l'Electricité (ONE) - a semi public agency which reports to the Ministry of Energy and Mines.

Implementation of the small hydro, solar, wind and biomass pilot activities will be coordinated by CDER with the Ministry of Interior, as may be required.

Provincial governors and village authorities are under the direction of the Ministry of Interior. The Water and Forest Service is under the direction of the Ministry of Agriculture and Agrarian Reform. Clear delineation of responsibilities is a condition precedent for implementation of all pilot projects (See Annex 7).

U.S. AID is in direct contact with CDER and MEM on all matters relating to this project. On matters relating to the pilot projects, CDER and U.S.AID are in direct touch with provincial governors, their staffs, local authorities and the target population. In the case of small hydro sites, for example, public meetings were held during the visit to the 3 selected sites of the survey mapping team and of the U.S. AID contract sociologist, at which the details of the proposed pilot projects were thoroughly discussed. The same approach will be used when additional sites are selected for solar and biomass pilot activities. Thus, participation on all levels is achieved in a way which will insure effective and responsive project execution.

Like ONE, the Center for Renewable Energy Development is a subsidiary of the MEM. Until it is legally established, its staff are employees of the MEM. Legal establishment requires a texte d'Institution and a décret loi to be approved by 1/ the Conseil du Gouvernement, chaired by the Prime Minister — done September


MINISTERE
DE L'ENERGIE ET DES MINES
LE MINISTRE
Cabinet
Le Secrétaire général
Direction des Mines
Division de la Gestion minière
Division de la Valorisation minière
Division de la Formation professionnelle et de la Coopération
Direction de l'Energie
Division des Hydrocarbures pétroliers
Division du Développement des Ressources énergétiques
Division de l'énergie électrique
Direction de la Géologie
Division de la Géologie générale
Division de la Recherche minière
Divisions des Bassins sédimentaires
Division des Laboratoires
Affaires régionales
Affaires administratives

V99

24, 1980; 2/ the Conseil des Ministres, chaired by His Majesty Hassan II - done May 20, 1981; and 3/ the Parliament - expected by late 1981. With formal legal establishment, CDER will acquire its own budget and the capacity to offer substantial recruitment incentives to attract top quality Moroccan staff, thus adding substantially to its institutional capacity.

B. AID Capability

Given the uncertainties and evolving nature of renewable energy activities, this project must by its very nature be designed to permit flexibility and adaptation. Given the high priority which both AID and the GOM accord to rapid, effective action to exploit renewable energy resources, we have deliberately tried to design this project with a view to reduce delays, telescope actions and yield useful results at the earliest possible dates. Phase I has therefore been carried out by means of a combination of IQCs, centrally funded assistance from AID/W staff and local contracts, all coordinated by the U.S. AID Program Office. Our experience to date has shown that this approach is indeed effective - the diversity of specialities and talents required for the various aspects of project development and the first stages of implementation can best be orchestrated by U.S. AID with timely, competent backstopping from the appropriate AID/W offices. The IQC's available through DS/EY and NE/TECH will further be used to provide a range of services following the schedule outlined in the Implementation Plan (Annex 3) before the arrival of the long-term technical assistance contract staff. Beginning in Spring 1982, the contract staff will reside in Marrakech, and will arrange for specialized consultant services for further project elaboration. USAID will assume a largely expediting and monitoring role. In the meantime, however, U.S. AID will describe scopes of work, request IQC services, procure essential equipment and arrange training so as to maintain project momentum.

AID's energy portfolio in Morocco has expanded during 1981 so that it now includes three major elements:

1. Renewable Energy Development (608-0159)

2. Energy Policy and Planning (936-5703)

Under this centrally-funded project a U.S. contractor is carrying out a national energy assessment which will yield, by early 1982, data and analysis on which CDER will draw in shaping its program. Beginning in FY 1982, the Energy Planning Assistance II project (936-5728 will provide continuing U.S. participation with the MEM in energy planning and policy formation and will ensure effective coordination and interlinkage with CDER activities.

3. Conventional Energy Technical Assistance (936-5724)

Under a Memorandum of Understanding with the GOM to be signed in July 1981, this centrally-funded project will provide technical assistance to the MEM in conventional energy, primarily oil shale development. It will be complemented by centrally-funded Training in Conventional Energy (936-9997) to strenghten Moroccan staff and institutional capability in the MEM and its dependent public enterprises concerned with oil shale and fossil fuels.

Certain of the activities carried out under each of the projects will have implications for the others. Energy planning, conventional energy development and renewable energy development are all interrelated, and continuing coordination will be essential. To ensure effective interlinkage, the resident coordinators for these projects will participate on a steering committee, chaired by the U.S. AID energy project manager, who will oversee and coordinate all AID energy activities in Morocco.

U.S. AID project management has so far been carried out by the Program Officer with the assistance of one local Foreign Service National, the Program Specialist/Chief Procurement Officer. The Program Officer will depart from Post late June 1981, and be succeeded immediately by a General Development Officer who will assume certain multi-sector project management responsibilities, including the energy portfolio. The Program Specialist/Chief Procurement Officer will continue to be actively involved in this project and will monitor all AID-financed equipment procurement.

The Regional Legal Advisor and the Regional Engineer will participate in various aspects of project implementation such as contract negotiation and review later in 1981.

V. ISSUES

A. GOM Funding for CDER & the Pilot Projects

The GOM has budgeted $1,250,000 (DH 6,000,000) for renewable energy activities in 1981.* Most of this will be carried over for expenditure in 1982, as shown in Table 10 B, Annex 1. In FY 1981, however, the CDER staff have had initial difficulties in securing the release of funds required for initial activities and staff training. Clearly, arrangements must be made for the timely release of funds as the project moves into the implementation stage and contracting begins for the design and construction of the Center, the construction and installation of pilot projects, etc. The MEM has assured USAID that they are most desirous of disbursing funds as rapidly as possible for the development of the CDER.

To make sure that GOM funds are made available as needed for effective execution of the project, conditions precedent to disbursement of U.S. funds have been included on this point in the Grant Agreement (Annex 7 Sections A.3, B.2 and C.2)

B. GOM Staffing for CDER

The MEM has found it difficult so far to recruit staff for the CDER, partly because the CDER has not yet been formally constituted as a legal entity and cannot therefore offer its staff the salary levels and incentives necessary to attract sufficient high quality candidates for staff positions. The Center cannot function effectively unless this problem is dealt with. The legislative process is underway, the Director and Deputy Director of the CDER have been formally appointed to their positions by King Hassan II. The MEM has assured USAID that formal establishment of the CDER is expected before the end of 1981, and that a vigorous recruiting campaign will begin immediately thereafter.

A condition precedent to disbursement of funds requires action on the legislative process to establish the CDER and the Grant Agreement commits the GOM to provide sufficient staff for the Center, following a phased recruitment and training plan.

C. Local Participation in Decisions on Small Hydro and Other Pilot Projects

The Hammoudi report states that, although a high degree of enthusiasm for the small hydro pilot projects exists among the local population where they are to be installed, there is concern at one site (Arhbalou-n-Kerdouss) that water needs for generation might conflict with water needs for irrigation. Clearly, no pilot project should be installed unless it if fully accepted by the indigenous population. The small hydro installation is being designed so that it will not conflict with irrigation needs. Before construction begins at the site, the proposed pilot installation design will be thoroughly reviewed with the local

*This includes a carryover of $420,000 (DH 2,000,000)

authorities and with the beneficiary population so that the advantages, disadvantages, water and land requirements, and the extent of local responsibilities for the installation can be fully aired. The pilot unit will not be installed without full local acceptance.

Conditions precedent to disbursement of funds are included in the Grant Agreement requiring a plan of action for all pilot projects setting forth local responsibilities, who will benefit from the installations, and the projects' acceptability to the local population. (Annex 7, Sections B.1 and C.1).

D. Responsibilities for Construction, Repair and Maintenance of Small Hydro and Other Pilot Projects

For pilot projects to function effectively and fulfill their objectives, clear arrangements must be made for assigning responsibilities for the planning, financing and execution of construction, repair and maintenance of the facilities to be tested. In the case of small hydro, an Interministerial Committee for Rural Electrification met in early 1981 to review these matters, but, as with many interministerial enterprises, no tangible results were forthcoming. The MEM has indicated that their intention is to provide the Office National de l'Electricité with budgeted funds for the capital costs of the small hydro installations, that ONE would be responsible for major repairs, and the local communities for normal maintenance. Formal assignment of authority and responsibilities in these matters has not yet been made. Further discussion among the MEM, ONE, local authorities and USAID will be required to work out detailed operational arrangements. Similar arrangements will be required for the effective functioning of each pilot project, no matter how small. Conditions precedent for disbursement of funds addressing these points have been included in the Grant Agreement (Annex 7, Sections B.1, B.2, C.1 and C.2).

VI. EVALUATION PLAN

The growth of the Center for Renewable Energy Development will be an evolutionary process which should be the subject of frequent reexamination and correction. During implementation, adjustments and refinements at the input/output level will be achieved through routine project monitoring (on a frequent and regular basis) of contractor performance, expenditures, and CDER activities and developments as a viable, on-going institution. This monitoring of project progress throughout the implementation stage will be carried out in conjunction and consultation with the CDER staff and the Ministry of Energy and Mines.

As the project progresses, a more purpose level evaluation of CDER institutionalization and performance will be undertaken. Such an evaluation would assess the CDER's ability to initiate, implement and analyze studies of Moroccan renewable energy resources and needs and to translate the results of those studies into workable pilot projects capable of eventual expansion to the broader national scene.

The first evaluation should take place two years after the U.S. technical assistance team begins working at the Center. Subjects for evaluation include :

1. The extent to which the objectives of the project are being accomplished.
2. The progress toward the institutionalization of CDER (its staff, program and facilities).
3. The evolving role of the contractor, so as to determine possible changes in the requirements for long-term resident advisors as well as short-term consultants.

4. The functioning and achievements of the Pilot Project Fund and the Small Project Fund.

5. The effectiveness of the pilot projects, their monitoring by CDER and the results and impact achieved, particularly with regard to prospects for replication.

6. Identification of necessary corrections or changes in the project's implementation or objectives.

This first objective evaluation will take place a few months after the Center's new physical facilities are completed. Its results will be used to reorder priorities of activities carried out so far by the Center's staff and develop a new program for the Center and related activities, adjusting their evolving role for maximum contribution to Morocco's exploitation of its renewable energy resources.

The evaluation team should include both Moroccan and American members. Among them there should be:

1. A person with a background in energy technology;

2. An energy economist;

3. A sociologist

4. An energy policy expert

5. An individual with past experience in the evaluation of comparable projects.

A total of $50,000 is provided for project evaluation in FY 1983 (See Table 1A, Section 6c).

A further evaluation of purpose-to-goal level achievements will take place toward the end of the life of project. This evaluation will focus on the institutionalization of the CDER — on how productively the returning trainees are employed at the Center, on how well the various outputs work together to create an on-going Center, on how successful the Center is in establishing replicable, cost-effective pilot projects. The scope and method of this evaluation will be developed and refined by USAID in collaboration with CDER.

PROJECT PAPER AMENDMENT

Renewable Energy Development (608-0159)

Annexes 1 - 20

USAID/Morocco
April 23, 1981

ANNEXES

1. Financial Tables
   Table 8. - Cost Summary, Phase I
   Table 9. - Financial Plan, Total Project By Project Component and Category of Assistance
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3. Implementation Plan
4. Contractors and Sources of Services
5. Procurement Plan and Center for Renewable Energy Development Equipment List.
6. a. Mission Director's Determination to Waive Host Country Contracting.
   b. Mission Director's Section 611 (e) Certification
7. Covenants and Conditions Precedent
8. Project Authorization Amendment and AA/NE Action Memorandum
9. Draft Project Agreement Amendment
10. Initial Environmental Examination
11. Logical Framework
12. Statutory Criteria
13. Organization of the Center for Renewable Energy Development
14. Small Projects Fund, Features and Criteria
15. Site Evaluation of the Center
16. Cost Estimates and Technical Information on Wind Power Pumping Sites
17. Site Descriptions - Small Hydro

    Part I - Tabant
    Part 2 - Msemrir
    Part 3 - Arhbalou-n-Kerdouss
18. Portable Photovoltaic Pumping Unit (Description and Picture)
19. Morocco: Economic and Social Data
20. Congressional Notification and PP NEAC Cable
21. Bibliography

ANNEX 1

FINANCIAL TABLES

Table 8

COST SUMMARY, PHASE I

		Costs ($000)
1.	Feasibility and Preliminary Design Studies	435
	Center for Renewable Energy Development Small hydro pilot projects Solar and wind pilot projects	
	Charles T. Main International June - October 1980 (completed)	
2.	Center for Renewable Energy Development	105
	a. Design of Center's initial training and work plan Development Sciences Inc. November 1980 - January 1981 (completed)	30
	b. Training program in Morocco for Center staff Development Sciences Inc. April - July 1981	45
	c. Equipment for training program in Morocco 2 portable, self-powered meteorological stations, USAID procurement	15
	d. Participant training in the United States	15
3.	Small Hydro Pilot Projects	20
	a. Site survey and mapping Boghdadi Surveyors - December 1980 (completed)	5
	b. Socio-economic survey - Hammoudi - December 1980 - May 1981 (completed)	15
4.	Solar and Wind Pilot Projects	20
	Final design and specifications	20
5.	Biomass Conversion Pilot Projects	20
	Feasibility and design studies	20
	TOTAL PHASE I	600

10a

FINANCIAL PLAN - OBLIGATION BY PROJECT COMPONENT AND CATEGORY OF ASSISTANCE

(in thousands of Dollars)

	A.I.D.-Financed					Total	Total	Total
	Preparatory Studies	Technical Assistance	Training	Equipment	Other	A.I.D.	COM	Life of Project
Center for Renewable Energy Development	465	1,875	1,285	1,195	370 1/	5,190	3,900 2/	9,090
Small Hydro Pilot Projects	55	50	-	475		580	865	1,445
Solar & Wind Pilot Projects	50	35	-	495		580	435	1,015
Biomass Pilot Projects	20	40	-	290		350	350	700
Total	590	2,000	1,285	2,455	370	6,700	5,550	12,250

1/ Includes $50,000 for Project Evaluation and $320,000 for the Small Project Fund.
Excludes $630,000 (A.I.D. contribution) for Pilot Project Fund (shown on Table 1A) which is shown here under preparatory studies and equipment for Solar and Wind ($300,000) and Biomass Pilot Projects ($330,000).

2/ Excludes $700,000 (COM contribution) for Pilot Project Fund (shown on Table 1 B) which is shown here under Solar and Wind ($350,000) and Biomass Pilot Projects ($350,000).

FINANCIAL PLAN - TOTAL PROJECT BY COMPONENT AND FISCAL YEAR

ANNEX I - TABLE 10 A

AID FINANCING ($000)

FISCAL YEARS

	80		81		82		83		84		85		86		L O P
	OBL.	EXP.	OBL.	EXP.	OBL.	EXP.	OBL.	EXP.	OBL.	EXP.	OBL.	EXP.	OBL.	EXP.	OBLIGATION
1. Total AID	600		1500	825	1500	1465	1700	2010	1400	1450		850		100	6700
2. Center for Renewable Energy Development	540		680	560	1500	850	1700	2010	1400	1450		850		100	5820
3. Small Hydro Pilot Projects	20		560	55		525									580
4. Solar and Wind Pilot Projects	20		260	190		90									280
Solar/Wind Pilot Projects Fund Allocation (non-add)					(100)	(90)	(100)	(130)	(100)	(100)		(30)			(300)
5. Biomass Pilot Projects	20			20											20
Biomass Pilot Projects Fund Allocation (non-add)			(30)		(100)	(80)	(100)	(120)	(100)	(100)		(60)			(330)

FINANCIAL PLAN - TOTAL PROJECT BY COMPONENT AND FISCAL YEAR

GOM FINANCING ($000)

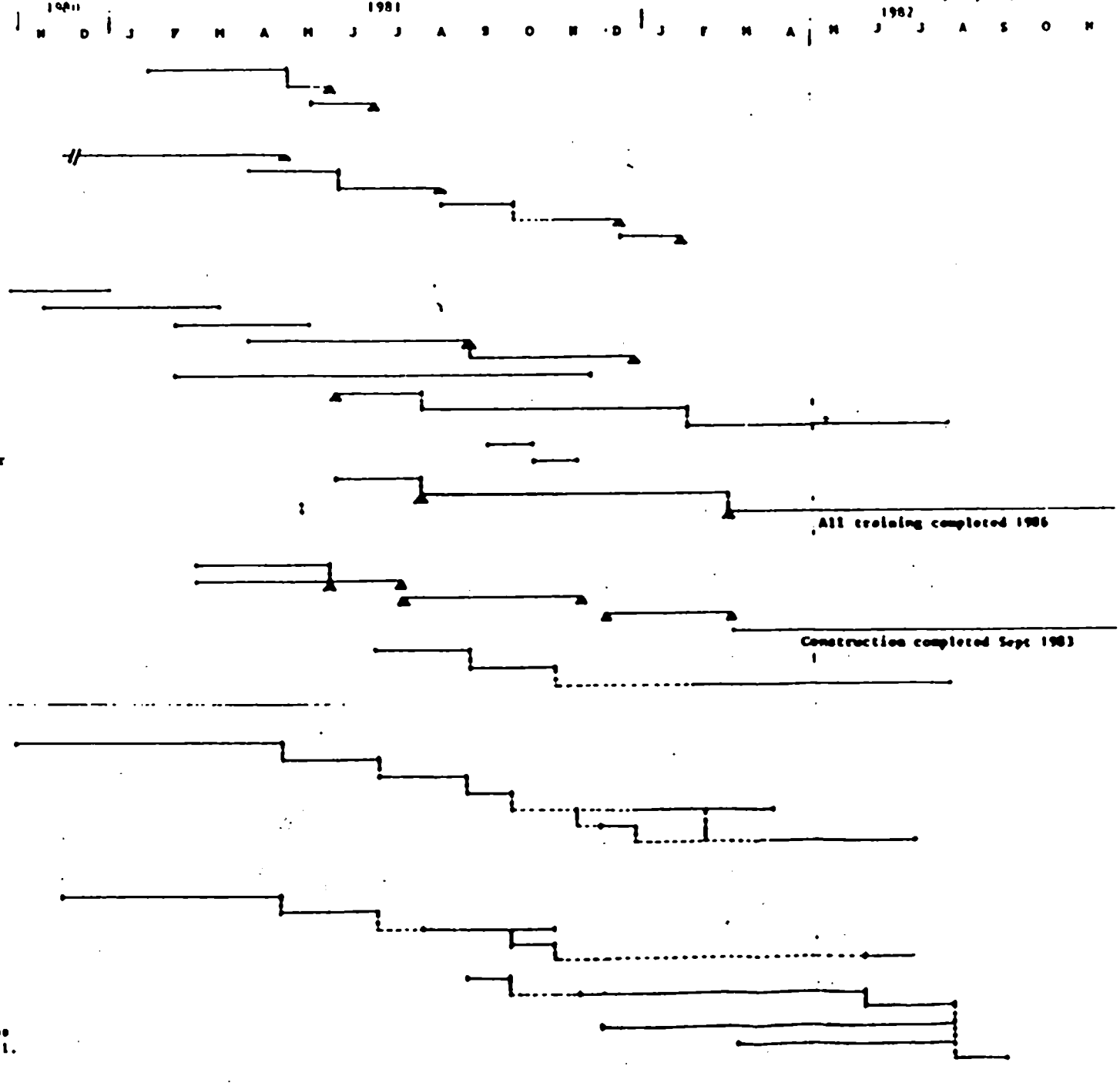
	FISCAL YEARS							
	80	81	82	83	84	85	86	L O P
1. Total GOM	420	830	1947	1109	480	476	488	5550
2. Center for Renewable Energy Development	420	830	1860	1095	465	460	470	4600
3. Small Hydro Pilot Projects			815	11	12	13	14	865
4. Solar & Wind Pilot Projects			72	3	3	3	4	85 (350)*
5. Biomass Pilot Projects								(350)*

*Additional pilot projects in solar, wind and biomass will be identified and financed under the Pilot Project Fund for which $700,000 of GOM funds are shown in CDER Financial Plan - Table 1.B.

Annex 2

Action Schedule, a graph of
Implementation Plan (Annex 3)

ACTIVITY SCHEDULE - RENEWABLE ENERGY DEVELOPMENT PROJECT (608-0159)



ANNEX 3

RENEWABLE ENERGY DEVELOPMENT (0159)

IMPLEMENTATION PLAN

I. Preparation of Project Paper Amendment (Phase II)

Sept. 3 (80)	USDA biomass report completed in draft.
Oct. 6	DS/EY submits final report to USAID
Oct. 10	Draft report translated and transmitted to MEM.
Oct. 31	CTMain final report submitted to USAID.
Dec. 20	DSI draft report of Center action plan submitted (TI).
Jan. 26 (81)	DSI report on Center training and US training submitted (T1 & T2)
Feb-Apr.	USAID prepares PP, and Project Agreement, reviews with MEM, and approves.
Apr. 30	GSA International hydro redesign report and cost estimates submitted.
May 1	PP submitted to AID/W for review.
June 4	NEAC review and approval of PP.
June 15-30	Congressional Notification and waiting period (15 days).
July 15-30	USAID negociates ProAg with GOM.
Aug. 1	ProAg signed.

II. Contracting for Long-Term Technical Assistance for Center (Host Country Contract)

1.	Oct. 1 (80)	Prequalification Notice and Questionnaire drafted by USAID and submitted to AID/W.
2.	Nov. 24	AID/W revised Prequalification Statement; USAID and MEM approved statement.
3.	Dec. 15-22	AID/W processed notice.
4.	Jan. 12 (81)	Notice published in Commerce Business Daily.
5.	Feb. 15	Deadline for submission of statements.
6.	Apr. 4	MEM selects short list of contractors (7 weeks).
7.	June 15	MEM advises contractors of their retention or exclusion.

RFP Notification Process

8.	June (81)	USAID drafts RFP;
9.	July	RFP reviewed in AID/W; RFP translated into French and reviewed with MEM.
10.	Aug. 1	RFP sent to preselected contractors.
11.	Sept. 25	Contractor proposals mailed to MEM, copies to AID/W for transmittal to USAID.
12.	Oct. 15	Bid deadline (70-day period).
13.	Oct. 15 - Nov. 15	GOM reviews proposals, rates and selects contractor. USAID reviews proposals separately (4 weeks).
14.	Nov. 20	AID/W and USAID approve selected firm.

Contract Approval Process

15.	Nov. 30	Selected contractor sends representative to Rabat to negociate contract with GOM.
16.	Dec. 15	GOM approves contract.
17.	Dec. 20	Contract signed. USAID approves contract.
18.	Jan. 10 (82)	Letter of Commitment issued.
19.	Feb. 1	Contractor staff arrives in Morocco.

III. Training Activities

1.	Oct. 31 (80)	CTMain final report submitted to USAID. Report transmitted to MEM Nov. 4.
2.	Nov-Dec.	MEM selects initial nucleus of 5 staff members for Center and they begin English language training.
3.	Nov. 17-25	DSI develops initial action plan for Center under IQC.
4.	Dec. 20	Draft report of initial action plan (dated Nov. 28) submitted to USAID. Transmitted to MEM for review and approval Dec. 31.
5.	Jan. 26 (81)	DSI final report on action plan and training in U.S. submitted to USAID.
6.	Feb. 17	USAID begins equipment procurement - 2 small, self-powered meteorological stations for use initial CDER action plan. (3 mos. delivery time). Equipment to be delivered May 10.
7.	Feb. 20-28	DSI works out final details of training program with CDER and MEM.
8.	Mar. 15	MEM concurs in action program for training at Center.
9.	Apr. 1 - Sept. 1	Assignment of the 5 CDER employees to begin 5 month training program in Rabat and Marrakech under DSI supervision.
10.	Apr-May (81)	CDER staff nucleus to begin solar and wind resources evaluation. One U.S. expert for 1 week (Apr. 1-8) to help select sites for meteo stations.(May 10)2 meteo stations equipment delivered. One U.S. expert (May 10-30) 3/4 time to help assemble and install stations, (1 at CDER, 1 at MEM/Rabat) and initiate monitoring program.
11.	Apr-Nov.	1 CDER staff member to work with E31/DSI energy assessment team - 8 mos - on National Energy Planning Program.
12.	June	Recruit and begin English training for a second cycle of CDER staff to be sent for 6 mos. of U.S. training beginning Feb.-Mar. 82. NOTE : U.S. academic training program for additional CDER staff to be developed by long-term technical assistance contractor. However, if training is to begin Jan. 82 (staff to arrive in Morocco Jan. 82), then candidates should be recruited and begin English training by June 1981.

13.	Sept-Oct.	Observation tour in U.S. for CDER Director (Ms. Fakihani) (1 month).
14.	Sept-Dec.	Training program in U.S. for 5 CDER staff (4 mos.)
15.	Oct-Nov.	Observation tour in U.S. for CDER Deputy Director, Mr. Mzabi (1 month).

IV. Final Design and Construction of Center for Renewable Energy Development

1.	Oct. 31 (80)	CTMain final report submitted to USAID. Report transmitted to MEM Nov. 4.
2.	Dec (80) - Feb. (81)	Critical review of CTMain report by MEM and AID.
3.	Mar-May	DS/EY arrange for U.S. architectural firm to assist with energy efficient redesign of Center. MEM prequalifies and selects Moroccan design architect.
4.	June 1	MEM negotiates contract with Moroccan architect for final design, preparation of construction specs and construction supervision of Center.
5.	June 15	MEM signs contract with Moroccan architect.
6.	June 15- Oct. 15	Final design and cost estimates for Center by Moroccan architect in cooperation with U.S. architectural firm provided under DOE/SERI RSSA (Central Funding).
7.	July 1- Sept. 1	Priority equipment procurement preparation. Under PASA services, DOE/SERI will prepare detailed specs and list of equipment for priority procurement(Priority 1 on CTMain list). For all other equipment, SERI will write detailed specs, including any installation, servicing and training to be required from suppliers. All other equipment for CDER to be procured by U.S. technical assistance contractor.
8.	Sept. 1 (81) Nov. 1	USAID to prepare procurement documents and place orders for critical items only.
9.	Oct. 15- Nov. 15	MEM receive final design for Center.
10.	Dec. 1	MEM issues IFB for Moroccan construction contractor based on final design.
11.	Mar. 1 (82)	MEM signs construction contract. Supervision by Moroccan architect and U.S. architectural firm with oversight by AID Regional Engineer.
12.	Mar. 1 (82)- Sept. (83)	Construction (18 mos.).

V. Solar and Wind Applications

1. Oct. 31 (80) CTM solar and wind report submitted to USAID. Reviewed by USAID.

2. Feb. 6 (81) CTMain solar and wind report (revised version) in English received by USAID Feb. 1. French version mailed Feb. 5. Transmitted both to MEM Feb. 26.

3. March AID and MEM review CTMain report.

4. April DS/EY reviews CTMain report with assistance of SERI.

5. Sept. SERI to send team to Morocco to design National Solar and Wind Measurement program and recommend plan of action for pilot activities.

6. Oct.-Nov. AID and MEM to agree on plan of action. MEM and other GOM authorities and USAID to agree on responsibilities for initial construction, installation, operation, maintenance and monitoring.

7. Mar.-Apr. (82) Final design, specs and cost estimates preparation by U.S. contractor at CDER.

8. April TA contractor to procure equipment for additional solar and wind pilot projects. Issue IFBs - assume 6 mos. delivery time.

9. Sept. Equipment arrives. Moroccan technicians from responsible GOM implementing agencies (CDER and others) receive on-the-job training for installation and maintenance.

10. Oct.-Nov. U.S. technical assistance contractor supervises construction and installation with possible support from U.S. suppliers.

11. Dec. (82) Pilot units installed. CDER begins monitoring and evaluation of pilot units.

VI. Small Hydro Pilot Installations

1. Oct. 31 (80)	CTMain final report in English submitted to AID. Report translated and transmitted to MEM Jan. 8 (81).
2. November	Reviewed by USAID.
3. Nov. 25-Dec. 13	NRECA small hydro expert and Moroccan surveyor team (Boghdadi - USAID contract) survey 3 pilot sites, produce maps, photos and stake out location of critical elements. Sites: Tabant Msemrir Arhbalou-n-Kerdouss
4. Nov. (80)-May (81)	A. Hammoudi, Moroccan sociologist, (USAID contract) studies social and economic feasibility of sites.
5. May 20	NRECA expert completes preliminary engineering design and cost estimates.
6. June	Preliminary engineering design and social/economic feasibility studies reviewed by AID and MEM.
7. June-July	MEM/ONE/Min. Interior/local authorities and USAID agree on implementation arrangements including; land acquisition (where required), resolution of possible conflicts between use of water for irrigation and generation, responsibilities for financing and initial installation of generating units, distribution facilities and access roads, maintenance of units, power rates, collection, related development activities and uses of electricity.
8. July	AID contracts with NRECA for final engineering design, specifications, supervision of construction, equipment installation and start-up.
9. July-Oct.	NRECA completes engineering design and prepares construction and equipment specs for 3 sites. Sends specs and engineering design drawings for 1st site to MEM and USAID as soon as completed.
10. Oct. 1-June (82)	USAID procures equipment - turbines, generators, controls, etc. for 3 sites. Eight-month delivery time - equipment arrives June.
11. Oct. 1 (81)	ONE invite bids for civil construction contracts (1 for each site), including erection of equipment and access roads. ONE installs power distribution system.

12. Nov. 15 (81)	COM awards contract for 1st site construction.
13. Dec. 1- June 1 (82)	Construction (6 mos.)
14. June 1- Aug. 1	Completion of construction and erection of equipment (2 mos.)
15. Dec. 1 (81) Aug. 1 (82)	Supervision by U.S. firm of construction and equipment erection (periodic site visits during 8 mo. period).
16. Mar. 1- Aug. 1	ONE installs power distribution lines and facilities (5 mos.).
17. Aug. 1- Sept. 2 (82)	Start up supervised by U.S. small hydro engineer and ONE.

ANNEX 4

CONTRACTORS AND SOURCES OF SERVICES

Services	Period	Cost ($)
General		
Feasibility studies preliminary designs for Center for Renewable Energy Development, Small Hydro Pilot sub-projects and Solar and Wind Pumping sub-pilot projects.	June-October 1980 (completed)	435.000
. Indefinite Quantity Contract with Charles T. Main International.		
Center for Renewable Energy Development		
1. Preparation of initial work plan for Center and participant training program for Center staff.	November 1980 January 1981 (completed)	30,000
. Indefinite Quantity Contract with Development Sciences Incorporated.		
2. Implementation of initial in-country training program for Center staff.	April-August 1981 (underway)	45,000
. Indefinite Quantity Contract with Development Sciences Incorporated.		
3. Architectural team to assist with final design.	June 15-Oct.15 1981	(150,000) (Central funding)
. RSSA with DOE/SERI.		
4. Preparation of detailed specifications for Center laboratory equipment.	July-Sept. 1981	30,000
. PASA with DOE/SERI.		
5. Long-term technical assistance for Center.	January 1982 - December 1985	1,875,000
. Host-Country Contract with a U.S. Firm.		
Small Hydro Pilot Sub-Projects		
1. Small hydro site survey and mapping	Dec. 1980 (completed)	5,000
. Direct AID contract with A. Boghdadi, Moroccan Surveyor.		

Services	Period	Cost ($)
2. Small hydro socio-economic study	December 1980-April 1981 (underway)	15,000
. Direct AID contract with A. Hammoudi, Moroccan sociologist.		
3. Small hydro preliminary engineering design	Feb-Apr. 1981 (completed)	(15,000) (Central Funding)
. NRECA.		
4. Preparation of final engineering design, detailed equipment and construction and supervision of equipment erection and start-up.	July-Sept. 1981 Feb.-June 1982	35,000 50,000
. Host Country Contract with a U.S. firm.		
Solar and Wind Powered Pilot Sub-Projects		
Preparation of final design and detailed specifications.	July-Sept. 1981	20,000
. PASA with DOE/SERI.		
Biomass Conversion Pilot Projects		
AID/USDA Bioenergy Team	August 1980	(Central Funding)
. RSSA with USDA.		
Feasibility and design studies.	May-June 1981	20,000
. Indefinite Quantity Contract.		
TOTAL CONTRACT SERVICES		$ 2,560,000—
(Excluding Central Funding)		—

Annex 5

Equipment Procurement Plan

Equipment will be procured for the project components shown below. AID procurement will be carried out directly by USAID only for (1) the small hydro pilot projects in order to permit arrival and installation of equipment in the summer of 1982, thus avoiding the loss of one construction season; and (2) equipment and materials determined by USAID to be critical for timely and efficient project implementation through June 1982.

After arrival of the long term technical assistance contract team at the Center for Renewable Energy Development in early 1982, the contractor will handle all procurement for the Center and related pilot projects directly-- approximately $1,900,000 of laboratory equipment and other commodities -- using standard U.S. government procurement procedures.

The Ministry of Energy and Mines will arrange for Moroccan customs clearance, pay custom duties and arrange for inland transport to the sites where it will be used.

Equipment and Mode of Procurement	Procurement Period	Cost (in Dollars)
1. Center for Renewable Energy Development		
a. Equipment for initial in-country work plan (2 portable self-powered meteorological measuring stations) (Completed)	Feb. -May 1981	15,000
. Direct AID procurement based on specifications prepared by DSI.		
b. Laboratory equipment, library acquisition and solar collection devices	July 1981-Sept. 1983	1,180,000
Procurement to be phased over construction period to insure arrival when required. For details see Charles T. Main equipment list pages 5-3ff of this annex. The CDER technical assistance contractor will manage all procurement except as noted above.		
2. Small Hydro Pilot Projects		
Turbines, generators and related equipment.	Oct. 1981-June 1982	475,000
. Direct AID procurement based on detailed specifications prepared by NRECA.		

Equipment and Mode of Procurement	Procurement Period	Cost (in Dollars)
3. Solar and Wind Powered Pilot Projects		
a. Photovoltaic-powered portable pumps and refrigerators.	Mar. June 1982	60,000
. Procurement by TA contractor based on detailed specifications provided by DS/EY.		
b. Equipment for wind powered units	Mar.-Aug. 1982	170,000
. Procurement by TA contractor based on detailed specifications prepared by DOE/SERI.		
c. Equipment for wind and solar pilot projects to be identified and financed under Pilot Projects Fund.	April 1982-April 1985.	265,000
. Procurement by TA Contractor.		
4. Biomass Conversion Pilot Projects		
a. Equipment for initial pilot projects identified by IQC Contract consultant	Mar.-Aug. 1982	25,000
. Procurement by TA contractor.		
b. Equipment for subsequent pilot projects to be identified by long term technical assistance Contractor and financed under Pilot Projects Fund.	April 1982-April 1985.	265,000
. Procurement by TA Contractor.		
TOTAL EQUIPMENT COST:		$2,455,000 -

7.4 Preliminary Equipment List

In the interval before purchasing actually begins, this list should be considered flexible enough to allow both additions and deletions: additions as thought goes into the initial form of the program; deletions as new instruments which combine functions become available.

This preliminary list contains those equipments which are essential for the laboratory regardless of any particular program, but when specific programs are planned, they will probably require additional equipment.

This preliminary list does not "give the Center full capacity to carry out adaptive, applied research in every type of renewable energy equipment and technology." Some, such as photovoltaic synchronous satellites, the power tower or ocean thermal energy conversion are excluded for obvious reasons. Some, perhaps not so obvious, are excluded in the interests of fiscal responsibility and the desire to avoid a "wish list." They involve personal judgments and are obviously subject to review.

Brand names or model numbers, when given do not necessarily imply the acquisition of that particular model or brand. Rather, they provide a convenient way of indicating a size, a level of quality, or a range of specifications for the preparation of bids prior to procurement. At the time of bidding all electrical equipment shall be specified in terms of the Moroccan power grid (50 cycle, 220 volt, single phase or three phase as required).

Prices listed are for the summer of 1980 and are given in U.S. dollars. We recommend that for budgetary planning purposes an annual inflation rate of 15 percent be applied to these figures.

We also recommend that procurement of these items be phased to match the training, building construction, and program development timetable. Three different procurement periods have been identified by appropriate coding.

1) Items marked with a (1) should be ordered so as to arrive in Marrakesh before September 1981. The "nucleus" of the four engineers and an energy planner referred to in Section 1.3.4 will have completed their training at that time and will need to address themselves immediately to the acquisition of resource data and the assembly of apparatus which has special demonstration value. They will oversee the erection of the instrumentation tower and the installation of the solar and meteorological recording equipment. They will also be involved in the installation of recording and sensing equipment into relay racks which will fit into the van or 4 x 4 truck so that data acquisition can begin in other parts of the country. They will also assemble monitoring equipment for evaluating the performance of the solar panels already owned by the Center in order to develop familiarity with test procedures prior to the installation of new equipment in the air and water systems laboratories.

2) The bulk of the equipment list is coded (2). These items should have a procurement schedule calculated to achieve delivery immediately after the Center is completed. These items are largely "general purpose". They are essential for the operation of the Center; and nothing would be gained by waiting until a later date to order them since their prices are not expected to fall.

3) Acquisition of items coded (3) should be deferred until the Center is staffed, all trainees have returned from the U.S., and the consultants have made their contributions. These items are the most sophisticated in the list. Their need is predicated on an anticipated rate of progress in developemnt of the program, and the opinions of the consultants should weigh heavily in the decisions to purchase.

			procurement priority
(a)	General		
10	Typewriters (French Keyboard)	$ 8,000	2
1	Word processor	18,200	3
2	Copiers	3,000	2
17	Hand calculators		
	11 H/P 41c @ 300	3,300	1
	5 H/P 38c @ 150	800	
	1 H/P 92 @ 500	500	
1	Desk top calculator Digital Equipment MINC-11	11,000	2
2	Microfiche readers, WSI Mini Cat TN	600	2
2	Microfilm readers, Xerox 350	1,200	2
1	Microform Reader/Copier, Minolta RP405	3,400	2
1	Interactive terminal for data base interrogation (library)	1,200	3
		$51,200	
(b)	Vehicles		
1	4 x 4 1 tonne truck	$10,000	2
1	3/4 tonne panel truck	9,000	1
1	compact auto	6,000	2
1	1-1/2 tonne fork lift (battery powered)	11,000	1
		$36,000	
(c)	Machine Shop		
1	Bridgeport vertical milling machine (3.3 m bed) with grinding & indexing attachments (metric)	$ 9,000	2
1	engine lathe with attachments (metric) (20 cm swing, 1.65 m bed)	6,000	2

1 drill press (2 cm chuck) and attachments, Powermatic 1200	15,000	2
1 band saw (1 m throat) DoAll Metalmaster	3,500	2
1 power hack saw, Kalamazoo Model 310	2,000	2
1 metal forming brake (1.3 m) DiAcro	800	2
1 sheet metal shear (1.3 m) DiAcro	800	2
2 bench grinders, Delta	400	2
1 portable A-frame and hoist	1,000	2
1 Heliarc welder, Miller, Model 320A/3P	12,000	2
1 oxygen-acetylene welder	200	1
1 heat treating oven 4000 watts	600	2
1 thermocouple welder, Rocky Mountain Orthodontics 506A	600	2
1 belt sander, Delta	500	2
1 20 cm table saw, Craftsman	400	2
1 band saw (wood)(30 cm throat), Craftsman	200	2
1 jointer (2 cm), Craftsman	300	2
1 fume hood (2 m)	1,000	2
1 anodizer (2m x 2m x 1m)	4,500	3
1 plating tank and controls (2m x 2m x 1m)	3,600	3
1 paint spray booth (3m minimum)	1,200	2
miscellaneous power and hand tools (drills, routers, reamers, end mills, gauges, micrometers, surface plate, dial indicators, etc.)	10,000	2
	$73,600	

(d) Stockroom

Initial stocking: electronics components, glassware supplies, plumbing fittings, (ells, tees, valves, gauges) electrical fittings (breakers, switches, relays, etc.), metal stocks (rod, bars, tubes, sheets), chemical supplies	$25,000	2

(e) Instrument Shop (Standards and Test Equipment)

1 potentiometer and ancillary equipment - Leeds & Northrup Type K-5	$ 6,000	2
1 Voltage calibrator General Radio 1822	3,500	2
1 impedance bridge Hewlett Packard 4260A	1,600	2
1 frequency meter H/P 5314A	500	2

2 platinum resistance thermometers L & N 8160	1,200	2
1 ice-point thermocouple calibrator, Omega TRC	700	2
1 Angstrom pyrheliometer, Eppley	4,800	3
1 Datapulse Mod 101 pulse generator	900	2
1 RMS voltmeter H/P 3403C	3,000	2
1 logic troubleshooting Kit H/P 5011 T	800	2
1 curve tracer Tektronix 576	6,500	2
1 storage oscilloscope + cart Tektronix 5111	1,700	2
1 oscilloscope + cart Tektronix 5110	900	2
1 dual beam oscilloscope Tektronix 5112	1,600	2
1 X-Y recorder H/P 7004 B	3,300	2
Precision resistance, capacitance and inductance standards	4,000	2
1 Mueller Bridge	3,000	2
Set of 12 plug-ins for Tektronix 5000 series oscilloscopes	3,600	2
	$47,600	

(f) Air-Water-Materials and Electrical Laboratory Equipment

Equipment for panel truck: 2 Pyranometers, Pyrheliometer, Strip chart recorders, Mountings	$ 9,200	1
Battery bank for electrical lab 40 heavyduty (80-100 amp-hr.) (installed on site by staff)	4,000	2
Meters, converters and switch gear for battery bank (installed on site by staff)	6,000	2
Test stands for collector test mounting (fabricated & installed by staff) materials	4,000	2
Solar hardware for permanent installation at the Center (experimental use only)		
Wind 5KW	8,000	1
Photovoltaic 5KW (based on projected price of $2/peak watt)	10,000	2
Flat plate collectors (10 M^2) (installation by Center staff)	4,000	2
6 ice-point reference junction and amplifier Omn. Amp 2B	12,000	2

4	digital thermocouple meters Omega 175	800	1
4	digital thermocouple meters Omega 2170	1,600	2
4	digital multimeters, Fluke 8024A	800	1
4	digital microvolmeters 3-Keithley 177	1,200	2
	1 H/P 3465A	600	
3	signal generators Tektronix TM 504	700	2
12	plug-ins for TM504	7,200	2
10	DC Laboratory power supplies Lambda LP412A	3,000	2
4	oscilloscopes, Tektronix 5110 + plug-ins (16)	4,700	2
4	X-Y recorders H/P 7015B	4,800	2
8	strip chart recorders, dual channel H/P7100	28,000	two 1 six 2
8	data loggers, H/P 41 series	16,000	two 1 six 2
4	process controllers L & N 400 series	10,000	2
	Flow meters		
	1 hot-wire	3,000	2
	16 rotameters	8,000	2
	4 positive displacement	3,200	2
	4 turbine	2,000	2
	1 Doppler	2,000	2
	4 Venturi	2,000	2
1	steel tower for instruments (40 ft.)	2,500	1
	1 recording anemometer	1,200	1
	1 recording humidity meter	1,500	1
	1 recording barometer	1,000	1
	1 recording temperature meter	1,000	1
10	pyranometers, Eppley	12,000	2
2	pyrheliometers (Eppley NIP) plus mounts	6,000	2
10	cassette recording modules for the radiometers above LiCor LI-1776	1,500	two 1 eight 2
2	Campbell Scientific CR-27 microloggers	4,000	2
1	paint tester (ASTM specs)	1,500	2
1	Spectrophotometer (H/P or Perkins Elmer)	8,000	2
1	Monochrometer, (UV through IR) Gaertner	4,000	2
1	optical bench, Oriel	2,000	2
1	reflectometer	2,500	2
1	microscope, Bausch & Lomb	1,200	2
1	metallographic microscope Bausch & Lomb	1,200	2

1 precision balance, Beckman	1,200	2
1 pan balance, Mettler	400	2
1 scanning electron microscope	100,000	3
1 vapor deposition vacuum system for anti reflecting coating work (Varian 3118)	40,000	2
6 equipment consoles (assembled by Center staff)	4,000	2
Start-up supplies (lab tools, small hardware, meters, variacs, lab jacks, parts cabinets, guages, etc.)	15,000	2
	$368,500	

(g) Bio Combustion Laboratory

1 Mechanical Convection Oven, Blue M.	$ 900	(g) Bio Combustion Lab and (h) Bio-chemical lab are procurement priority 2.
1 Vacuum drying oven, VWR Scientific	700	
1 Vacuum pump for above, Welch Duo Seal	800	
2 Muffle Furnaces, Thermolyne 1630	1,300	
1 25 Tonne Laboratory Press with 6.5 cm Test Cylinder (for pelletizing), Carver C.	1,200	
1 Two Jar - Two Tier Jar, Mill and accessories (for particle size reduction)	1,400	
1 11 kg Top Loading Balance, Mettler P11N/SW	4,500	
1 1.2 kg Top Loading Balance, Mettler P 1210	2,700	
1 Electronic Analytical Balance Mettler AC88	3,600	
1 Particle Size Analyzer consisting of:		
Alpine Air-Jet Sieve A-200	3,500	
Micro Mesh Sieve Adapter Kit	400	
320 mm Fine Filter Attachment	1,400	
Alpine High Efficiency Cyclone GAZ-125	1,600	
Ultrasonic Screen Cleaner Sonorex RK106	700	
Complete Set of Stainless Steel Screens (Mesh 10-425 + 5-35 micron)	5,000	
1 Calorimeter System consisting of:		
Adiabatic Oxygen Bomb Calorimeter, Parr 1241	3,600	
Master Control unit for above, Parr 1680	4,800	
Additional Oxygen Bombs (2), Parr 1108	1,300	
Water Heater, Parr 1541	300	
Water Cooler, Parr 1551	600	
Oxygen Regulator, Parr 1825	200	

Ignition Unit, Parr 2901	100
Wet Test Meter, Precision 63126	1,100
1 3 Zone Tube Furnace 1100°c (15cm x 60 cm), Lindburg 55773	1,500
1 Gas Chromatograph - Refinery Gas Analyzer (Carle Instruments Series S)	8,000
Accessories:	
Regulators (2), Varifio	400
Compound Pressure Guage, Heise CMM 8.5	1,000
Tubing and Valves, Swagelok	1,000
Vacuum Pump, Welch Duo Seal 1308-01	800
Miscellaneous Small Parts (glassware, laboratory hardware, special purpose tools, gas cylinders, chart paper, etc.)	7,500
	$61,900

(h) Bio Chemical Laboratory

1 Chemical Oxygen Demand Apparatus (Oceanography International)	$ 1,400
1 Kjeldahl Nitrogen Determination Apparatus (6 unit)(Labcone)	4,400
1 Turbidimeter (Integrating Sphere) HF Instruments - CCST-3000	4,500
1 Gas Chromatograph, H/P 5840A	10,000
including:	
Dual Nitrogen Phosphorus Detector, OPT 218	5,000
FID Jets (2) and Flow Controller, OPT 037/040	300
Glass Capillary Inlet System, OPT 035	2,200
Gas Regulators, Variflo	400
Syringes, Hamilton 700	200
1 Low Temperature BOD Cabinet, Precision 815	2,000
1 Analytical Set (water action) for alkalinity, chloride, ammonia, turbidity determinations (Bausch & Lomb)	1,300
1 Mechanical Convection Oven, Blue M.	900
1 Vacuum Drying Oven VWR Scientific	700
1 Vacuum Pump for above (Welch Duoseal 13CB-01	800
2 Muffle Furnaces, Thermolyne PA160	1,300
2 Wet Test Meter, Precision Scientific 63115	2,200
1 Explosion Proof Refrigerator, Lab-Line 3359	1,100

1	Centrifuge IEC/Damon 8196 including:	3,500
	8 place rotor for 50 ml tubes	700
	4 place rotor for 250 ml tubes	700
1	11kg Top Loading Balance, Mettler P11N/SW	4,500
1	1.2 kg Top Loading Balance, Mettler P1210	2,700
1	Electronic Analytical Balance, Mettler AC88	3,600
1	Microwave Oven	400
1	Incubator	1,500
1	Autoclave 1m x 1.3m x 2m, Aminco	7,000
1	Microscope, Bausch & Lomb	2,000
1	Coulter Counter	4,000
3	14 liter Fermenters	1,500
1	Floor Mounted Top Loading Centrifuge	6,000
1	Floor Mounted Flask Shaker	4,000
Miscellaneous Small Parts (glassware, laboratory hardware, gas cylinders, etc.)		12,500
		$93,300

$757.100

at 3.74 dirhams per dollar = 2,832,000 d

	($000)
Development laboratory equipment	
Purchase cost	757,000
Shipping	65,000
Installation	10,000
Contingency (10%)	83,000
TOTAL	915,000
Solar collection devices	150,000
Total equipment	1,065,000

ANNEX 6

MISSION DIRECTOR'S DETERMINATION TO WAIVE HOST COUNTRY CONTRACTING

For Phase II of this Renewable Energy Development Project, we have carefully reviewed the factors affecting the procurement of commodities and technical assistance. Consistent with our determination of December 14, 1979 (Annex I to Phase I Project Paper), we have determined that the host country has the capacity to contract for the technical assistance element of the Project. Nevertheless, in order to (i) prepare certain pilot project designs and equipment specifications and (ii) deliver commodities in country when the technical assistance team arrives so as to maintain the momentum of the Project, I have decided to waive the presumption in favor of host country contracting, as described in Policy Determination 68, with certain respect to (i) services to be obtained under IQC and RSSA and (ii) commodities required for the project. I have also taken into consideration the fact that the Ministry of Energy and Mines has limited experience with international contracting.

Harold S. Fleming
Director

4/23/81
Date

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

I, Harold S. Fleming, Director, the principal officer of the Agency for International Development in Morocco, having taken into account, among other things, the maintenance and utilization of projects in Morocco previously financed or assisted by the United States, do hereby certify that in my judgment Morocco has both the financial and human resources capabilities to effectively maintain and utilize the project, which consists of, inter alia: (a) the Center for the Development of Renewable Energy and (b) pilot activities in biomass, small hydroelectric, solar and wind energies. This judgment is based upon considerations discussed in the Project Paper to which this certification is attached.

Harold S. Fleming
Director

4/23/81
Date

Annex 7 Revised

Covenants and Conditions Precedent

The project consists of several separate components which may proceed at different speeds of implementation. Conditions precedent to disbursement of funds for all purposes except training will therefore be linked (except for the condition set forth in Section 4.1 below) to specific project elements as stated in the following text, which is numbered as it appears in the draft Project Amendment (Annex 9 Revised).

Section 4.1 Specimen Signatures

Prior to any disbursement of funds or to the issuance of any documents pursuant to which funds may be disbursed under the Project Agreement, the Government of Morocco will, except as the Parties may other agree in writing, furnish to AID, in form and substance satisfactory to AID, a statement of the names of the persons holding or acting in the office of the Grantee specified in Section 8.2, and of any additional representatives, together with a specimen signature of each person specified in such a statement.

Section 4.2 The Center for Renewable Energy Development (CDER)

a. Prior to the first disbursement of funds, or the issuance of documentation pursuant to which funds may be disbursed under the Project Agreement to finance commodities or technical assistance for the CDER, the Government of Morocco shall provide to AID evidence, in form and substance acceptable to AID, that:

1. Establishment of the CDER has been officially approved by both the Conseil du Gouvernment and the Conseil des Ministres; and

2. Any and all land required for the CDER has been acquired by the Government of Morocco and will be made available for the Project; and

3. A staffing plan, acceptable to AID, which indicates a time-phased sequence for recruitment and training, has been prepared; and

4. Funds required to staff, operate and maintain the CDER have been budgeted and will be made available by the Government of Morocco on a timely basis.

b. Prior to any disbursement of funds, or the issuance of documentation pursuant to which funds may be disbursed under the Project Agreement to finance commodities or technical assistance for the CDER on or after July 1, 1982, the Government of Morocco shall provide to AID evidence, in form and substance acceptable to AID, that the CDER has been officially established and/or ratified by act of Parliament and constitutes a legally recognized de jure entity under the laws of the Kingdom of Morocco.

Section 4.3:

Pilot Projects

a. Pilot Projects for Small Hydroelectric Power Generation

Prior to any disbursement of funds or to the issuance of any documents pursuant to which funds may be disbursed under the Project Agreement to finance pilot projects for small hydroelectric power generation, the Government of Morocco shall provide to A.I.D. in form and substance satisfactory to A.I.D.:

1. Evidence that designation has been made of:

   (a) The organizations responsible for the construction of the pilot generating plants, related canals, distribution systems, access roads and other civil works; and

   (b) The organizations responsible for maintenance of pilot facilities.

2. Evidence of a developed plan of action which includes:

   (a) A description of the responsibilities and authorities for each organization designated above, together with a statement of how these organizations will perform their responsibilities; and

   (b) Identification of the beneficiaries of the pilot projects, and establishment of the governing criteria for the rate structure which will encourage maximum productive use of available electricity.

3. Evidence that the funds necessary to finance the dirham costs required for the construction, operation and maintenance of the pilot projects as set forth in the plan of action have been budgeted by the Government and/or the local authorities and will be available for project implementation on a timely basis.

4. Evidence that the land required for the pilot projects and related facilities (canals, including inter alia access roads, and distribution systems) is available for the projects.

b. Pilot Projects for Solar, Wind, Biomass and Other Forms of Renewable Energy

Prior to any disbursement of funds or to the issuance of any documents pursuant to which funds may be disbursed under the Project Agreement to finance pilot projects for solar, wind, biomass or other forms of renewable energy, the Government of Morocco shall provide to A.I.D. in form and substance satisfactory to A.I.D.:

1. Evidence that designation has been made of:

   (a) The organizations responsible for the construction of the pilot facilities;

   (b) The organizations responsible for the maintenance of the pilot facilities.

2. Evidence of a developed plan of action which includes:

   (a) A description of the responsibilities and authorities for each organization designated above, together with a statement of how these organizations will perform their responsibilities; and

   (b) Identification of the beneficiaries of the pilot projects, the work which they will undertake and the costs which they will incur in connection with the pilot projects; and

   (c) A description of the responsibilities of whatever governmental or private entities will participate actively in the implementation of the pilot projects.

3. Evidence that the funds necessary to finance the dirham costs required for the construction, operation and maintenance of the pilot projects as set forth in the plan of action have been budgeted and will be available on a timely basis.

4. Evidence that land and related facilities required for the pilot projects is available.

Section 4.4:

Pilot Project Fund and Small Project fund

Prior to any disbursement of funds or to the issuance of any documents pursuant to which funds may be disbursed under the Project Agreement to finance activities under the Pilot Project Fund or the Small Project Fund, the Government of Morocco shall, furnish to A.I.D., in form and substance acceptable to it, evidence of the selection criteria to be employed for the projects, the administrative arrangements and procedures by ehich project selection will be made, and the accounting arrangements which will be used for financing the projects.

Article 5: Special Covenant

Section 5.1:

Project Evaluation

The Government of Morocco shall agree to cooperate with USAID in carrying out a program of periodic evaluation of the degree to which this project has attained its planned objectives. The pilot and demonstration activities will be evaluated with a view toward assessing their impact and the prospects for future replication of the technologies tested.

August 6, 1981

ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR, NE

From: NE/TECH, Lewis P. Reade LPReade

Subject: Authorization of Renewable Energy Development Project (0159) for Morocco

Problem: Your authorization is requested for the Morocco Renewable Energy Development Project (608-1059). The grant for Life of Project Funding is $6,700,000.

Discussion: Your approval is requested for authorization of Phase II of the Renewable Energy Development project (608-0159) in Morocco. A Project Paper for Phase I of this project was authorized February 20, 1980 for $600,000 of FY 1980 funding under the Selected Development Activities (Sec. 106) account.

Feasibility studies and preliminary design activities were carried out under Phase I during 1980-1981, resulting in the present Project Paper Amendment which amplifies, modifies and refines the material previously presented in the Phase I Project Paper. Life of project funding is requested in the amount of $6,700,000 to finance the establishment of a Center for Renewable Energy Development (CDER) in Marrakech, training of its staff and development of its action program by a U.S. technical assistance contractor, and implementation of related pilot projects to test exploitation of small hydro, solar, wind and biomass energy resources. The project is designed for institution building and effective transfer of U.S. technology. Equipment for the Center and pilot projects totalling $2,455,000 will consist mainly of off-the-shelf items. Peace Corps volunteers will assist in the implementation of selected pilot projects, particularly small-scale farm and village-sized activities financed through a Small Project Fund.

The Moroccan Ministry of Energy and Mines will finance $5,550,000, equivalent to 45 percent of the $12,250,000 life of project cost. During the 1981-1985 Five Year Plan, the GOM plans $31.8 million for renewable energy development activities.

The Project Review Committee met May 28, 1981 and the Near East Advisory Committee reviewed the project June 4, 1981. The project was approved subject to the reservations set forth below. The Project Paper Amendment has in consequence been revised as noted.

1. USAID project management interventions should be simplified and reduced, particularly as regards the administration of the Pilot Project Fund and the Small Project Fund and in the Procurement of commodities.

a. To simplify and reduce USAID involvement in project implementation:
--Projects financed under the Pilot Project Fund will be approved by the USAID Director, but will to the extent possible be clustered and developed as part of integrated programs.
--Grants under the Small Project Fund will be made by a Project

Selection Committee on which the U.S. technical assistance contractor, resident at the Center for Renewable Energy Development, will be represented. The center will submit quarterly reports to USAID on the activities and awards of the Small Project Fund.

b. To lighten USAID's burden, most commodity procurement will be handled by the U.S. technical assistance contractor, whose field staff is to arrive in Morocco in February 1982. However, to ensure that contract staff have certain essential materials to work with upon their arrival, two exception will be permitted: --(1) USAID will procure equipment for the small hydro pilot projects amounting to approximately $475,000 in order to permit its arrival and installation in the summer of 1982, thus avoiding the loss of one construction season; and (2) USAID will procure equipment and materials amounting to approximately $100,000, determined by USAID to be critical for timely and efficient project implementation during the first six months of the contractor's residence in Morocco. These consist primarily of items required to initiate a solar and wind measurement program, a prerequisite for further action on solar and wind energy activities. (See Annex 5 pages 5-3 through 5-7 for items marked procurement priority 1).

As specifications and procurement documents will be prepared in both cases by outside staff (NRECA for the small hydro and SERI for CDER equipment) USAID's workload will be reduced to easily manageable dimensions.

2. Guidelines should be provided to the U.S. technical assistance contractor and to CDER from which to develop selection criteria for activities financed under the Small Project Fund and the Pilot Project Fund.

The Project Agreement (Section 4.4) now contains guidelines from which project selection criteria for both funds are to be developed. See also Section III.B.7 and 8 of the Project Paper which discuss the two Funds.

3. U.S. technical assistance contract staff will at first consist of two experts(a planning person and a technical person) resident at CDER and supplemented by short-term specialized consultants. The precise needs for the contract staff may evolve as CDER develops, and consequently, the contractor's role should be permitted to change over time.

The evaluation Plan (Section VI) provides for an examination of the evolving role of the contractor, so as to determine possible changes in the requirements for long-term resident advisors as well as short term consultants.

4. The Ministry of Energy and Mines should be encouraged to move vigorously to recruit and train staff for the Center.

The Project Agreement (Annex 9) preamble confirms the GOM's intention to develop and strengthen the institutional and staff capacity of CDER as rapidly and effectively as possible. The Project Agreement provides in a condition precedent (Section 4.2a.3) that the GOM will prepare a staffing plan indicating a time-phased sequence for recruitment and training.

5. A waiver is requested to permit inclusion of costs in proposals for the long-term technical assistance contract.

Moroccan law requires that proposals for contracts with the Government of Morocco contain cost estimates. Despite discussions by USAID personnel and the RLA with the GOM concerning the Agency requirement for the exclusion of estimated budgets in technical proposals for host country contracts (Handbook II, Chapter 1,2,3), the Government of Morocco has taken a firm position that proposing firms must submit estimated budgets as part of their technical proposals and that such information will be taken into account during the selection process. GOM procurement laws, which the RLA has reviewed, provide for selection of a firm performing professional services to be made both on the basis of cost as well as technical considerations.

You have the authority to grant this exception per Delegation of Authority No. 38 and consistent with Section 2.3 of Handbook II, Chapter 1.

AA/NE has recently approved the inclusion of price in technical services proposals for the Range Management Improvement project (608-0145), among others, essentially for the reasons described.

The attached Project Authorization Amendment No.1 provides for inclusion of a cost proposal.

6. Arrangements should be made to strengthen coordination among the multiple energy activites.

The legal establishment of CDER by the Parliament will considerably strengthen CDER's authority and capability to coordinate renewable energy development activities with the Moroccan Government and in the private sector. The Council of Ministries, chaired by King Hassan II, approved the establishment of CDER in May 1980. Parliamentary approval is a condition precedent to disbursement of funds after July 1, 1982. (See Section IV A and Annex 7 of the PP.)

Coordination of CDER activities with other AID-financed activities in Energy Policy and Planning and Conventional Energy Technical Assistance will be ensured by the resident team leaders for these projects constituting a steering committee, chaired by the USAID energy project manager, who will oversee and coordinate all AID energy activities in Morocco. (See Section IV B of the PP.)

The NEAC concluded that the entire project is technically, financially and socially feasible and that planning is sufficiently developed for implementation of Phase II to begin. All significant issues have been identified and dealt with as described above and in Section V of the Project Paper. All statutory criteria have been met, and Congressional notification has expired. There are no current human rights issues under Section 116 of the Foreign Assistance Act which would preclude provision of this assistance to Morocco.

FY 1981 Funds of $1,494,000 for Phase II of this project have been allotted to USAID/Rabat.

Recommendation: That you indicate your approval of this Project Paper Amendment by signing the attached Project Authorization Amendment.

Clearance:
NE/TECH/HRST, Barry Heyman
NE/PD, Selig A. Taubenblatt
NE/NENA/TM, James R. Phippard
GC/NE, Judd Kessler
NE/DP, Bradshaw Langmaid
DAA/NE, Alfred D, White Alfred D. White
Drafted by:NE/TECH/HRST, George Self:7/16/81:Ext. 28164

ASSISTANT
ADMINISTRATOR

AMENDMENT

TO

PROJECT AUTHORIZATION

Name of Country: Morocco **Name of Project:** Renewable Energy Development

Number of Project: 608-0159

1. Pursuant to Section 106 of the Foreign Assistance Act of 1961, as amended (FAA), the Renewable Energy Development Project for Morocco was approved by the Assistant Administrator, Bureau for Near East, on February 20, 1980, for total authorized funding of $600,000. That authorization, pursuant to Section 103 of the FAA, is hereby amended by adding $6,100,000 in grant funds over a five-year period from the date of this authorization amendment for total authorized project funding of Six Million Seven Hundred Thousand United States Dollars ($6,700,000) subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange costs for the Project.

2. The Project Authorization is further amended by substituting the following provisions for corresponding numbered paragraphs thereof:

Paragraph 2: "The Project consists of the development of a program for the exploitation of energy resources, particularly renewable resources, in Morocco. Such program includes commodities and technical assistance for the Center for Renewable Energy Development (CDER) and other commodities and technical assistance for renewable experiments in Morocco."

Paragraph 3.a: "Goods and services, except for ocean shipping, financed by A.I.D. under the Project, shall have their source and origin in the United States or Morocco, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States."

3. The Project Authorization is further amended by adding the following conditions precedent to disbursement of funds authorized by this amendment:

A. Specimen Signatures

Prior to any disbursement of funds or to the issuance of any documents pursuant to which funds may be disbursed

under the Project Agreement, the Government of Morocco will, except as the Parties may other agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D., a statement of the names of the persons holding or acting in the office of the Grantee specified in Section 8.2, and of any additional representatives, together with a specimen signature of each person specified in such statement.

B. The Center for Renewable Energy Development (CDER)

a. Prior to the first disbursement of funds, or the issuance of documentation pursuant to which funds may be disbursed under the Project Agreement to finance commodities or technical assistance for the CDER, the Government of Morocco shall provide to A.I.D. evidence, in form and substance acceptable to A.I.D., that:

1. Establishment of the CDER has been officially approved by both the Conseil du Gouverment and the Couseil des Ministres; and

2. Any and all land required for the CDER has been acquired by the Government of Morocco and will be made available for the Project: and

3. A staffing plan, acceptable tc A.I.D., which indicates a time-phased sequence for recruitment and training, has been prepared; and

4. Funds required to staff, operate and maintain the CDER have been budgeted and will be made available by the Government of Morocco on a timely basis.

b. Prior to any disbursement of funds, or the issuance of documentation pursuant to which funds may be disbursed under the Project Agreement to finance commodities or technical assistance for the CDER on or after July 1, 1982, the Government of Morocco shall provide to A.I.D. evidence, in form and substance acceptable to A.I.D., that the CDER has been officially established and/or ratified by act of Parliament and constitutes a legally recognized de jure entity under the laws of the Kingdom of Morocco.

C. Pilot Projects

a. Pilot Projects for Small Hydroelectric Power Generation

Prior to any disbursement of funds or to the issuance of any documents pursuant to which funds may be disbursed under the Project Agreement to finance pilot projects for small hydroelectric power generation, the Government of Morocco shall provide to A.I.D. in form and substance satisfactory to A.I.D.:

1. Evidence that designation has been made of:

   (a) The organizations responsible for the construction of the pilot generating plants, related canals, distribution systems, access roads and other civil works; and

   (b) The organizations responsible for maintenance of pilot facilities.

2. Evidence of a developed plan of action which includes:

   (a) A description of the responsibilities and authorities for each organization designated above, together with a statement of how these organizations will perform their responsibilities; and

   (b) Identification of the beneficiaries of the pilot projects, and establishment of the governing criteria for the rate structure which will encourage maximum productive use of available electricity.

3. Evidence that the funds necessary to finance the dirham costs required for the construction, operation and maintenance of the pilot projects as set forth in the plan of action have been budgeted by the Government and/or the local authorities and will be available for project implementation on a timely basis.

4. Evidence that the land required for the pilot projects and related facilities (canals, including inter alia access roads, and distribution systems) is available for the projects.

b. <u>Pilot Projects for Solar, Wind, Biomass and Other Forms of Renewable Energy</u>

Prior to any disbursement of funds or to the issuance of any documents pursuant to which funds may be disbursed under the Project Agreement to finance pilot projects for solar, wind, biomass or other forms of renewable energy, the Government of Morocco shall provide to A.I.D. in form and substance satisfactory to A.I.D.:

1. Evidence that designation has been made of:

   (a) The organizations responsible for the construction of the pilot facilities;

   (b) The organizations responsible for the maintenance of the pilot facilities.

2. Evidence of a developed plan of action which includes:

   (a) A description of the responsibilities and authorities for each organization designated above, together with a statement of how these organizations will perform their responsibilities; and

   (b) Identification of the beneficiaries of the pilot projects, the work which they will undertake and the costs which they will incur in connection with the pilot projects; and

   (c) A description of the responsibilities of whatever governmental or private entities will participate actively in the implementation of the pilot projects.

3. Evidence that the funds necessary to finance the dirham costs required for the construction, operation and maintenance of the pilot projects as set forth in the plan of action have been budgeted and will be available on a timely basis.

4. Evidence that land and related facilities required for the pilot projects is available.

D. Pilot Project Fund and Small Project fund

Prior to any disbursement of funds or to the issuance of any documents pursuant to which funds may be disbursed under the Project Agreement to finance activities under the Pilot Project Fund or the Small Project Fund, the Government of Morocco shall, furnish to A.I.D., in form and substance acceptable to it, evidence of the selection criteria to be employed for the projects, the administrative arrangements and procedures by which project selection will be made, and the accounting arrangements which will be used for financing the projects.

4. The Project Authorization is further amended by adding the following special covenant:

Project Evaluation

The Government of Morocco shall agree to cooperate with USAID in carrying out a program of periodic evaluation of the degree to which this project has attained its planned objectives. The pilot and demonstration activities will be evaluated with a view toward assessing their impact and the prospects for future replication of the technologies tested

5. Section 612(b) Determination

I hereby determine in accordance with Section 612(b) of the Foreign Assistance Act of 1961, as amended: (1) the expenditure of United States Dollars for the procurement of goods and services in Morocco, as authorized above, is required to fulfill the purposes of this Project; (2) the purpose of this Project cannot be met effectively through the expenditure of United States-owned local currencies for such procurement; and (3) the administrative official approving local cost vouchers may use this determination as the basis for this certification as required by Section 612(b) of the Act.

6. Cost Proposal

Pursuant to A.I.D. Delegation of Authority No. 38 and consistent with Section 2.3 of Handbook 11, Chapter 1, I hereby authorize an exception to the contracting policy expressed in Handbook 11, Chapter 1, Section 2.3, to permit the inclusion of a price element in proposals for host country contracts for executing the long-term assistance financed under the Project.

Except as hereby amended, the authorization cited above remains in full force and effect.

Alfred DeWitz for

W. Antoinette Ford
Assistant Administrator
Bureau for Near East

AUG 13 1981
Date

Annex 9

Project Agreement Amendment (Draft)

First Amendment Dated_____ to the Project Grant Agreement dated April 22, 1980

("The Agreement")

Between

The Kingdom of Morocco, acting through the Ministry of Energy and Mines (Grantee")

And

The United States of America, acting through the Agency for International Development ("A.I.D.")

WHEREAS, A.I.D. is agreeable to providing an additional increment of funding for the Project and

WHEREAS, the parties confirm their mutual commitment to the project described in Section 2.1 which has been initiated in Phase I and is to be expanded in Phase II and

WHEREAS, the Grantee confirms its intention to develop and strengthen the institutional and staff capacity of the Center for Renewable Energy Development as rapidly and effectively as possible; and

WHEREAS, A.I.D. financing in the amount of $6,700,000 is planned over the life of the project, subject to funds being made available by the Congress, and the mutual agreement of the Parties to proceed,

NOW THEREFORE, the Parties hereto agree as follows:

I. Article 2 is amended by adding Section 2.3 as follows:

Section 2.3 - Incremental Nature of the Project

a. AID's contribution to the Project will be provided in increments, the initial one being made available in accordance with Section 3.I of this Agreement. Subsequent increments will be subject to availability of funds to AID for this purpose, and to the mutual agreement of the Parties, at the time of

each subsequent increment, to proceed.

b. Within the overall Project Assistance Completion date stated in this Agreement, AID, based upon consultation with the Grantee, may specify in Project Implementation Letters appropriate time periods for the utilization of funds granted by AID under an individual increment of assistance.

2. Section 3.I - The Grant is amended to read as follows:

To assist the Grantee to meet the costs of carrying out the Project, AID, pursuant to the Foreign Assistance Act of 1961, as amended, agrees to grant the Grantee under the Terms of this Agreement not to exceed Two million one hundred thousand United States dollars ($2,100,00) ("Grant"). The Grant may be used to finance foreign exchange costs as defined in Section 6.I and local currency costs, as defined in Section 6.2, of goods and services required for the Project.

3. Section 3.3 - Project Assistance Completion Date is amended by deleting "September 30, 1980" and substituting "September 30, 1986" in lieu thereof.

4. Article 4 - Conditions Precedent to Disbursement - is amended by adding Sections 4.2, 4.3 and 4.4 as follows:

Section 4.2 <u>The Center for Renewable Energy Development (CDER)</u>

a. Prior to the first disbursement of funds, or the issuance of documentation pursuant to which funds may be disbursed under the Project Agreement to finance commodities or technical assistance for the CDER, the Government of Morocco shall provide to AID evidence, in form and substance acceptable to AID, that:

1. Establishment of the CDER has been officially approved by both the Conseil du Gouvernment and the Conseil des Ministres; and

2. Any and all land required for the CDER has been acquired by the Government of Morocco and will be made available for the Project; and

3. A staffing plan acceptable to AID, which indicates a time-phased sequence for recruitment and training, has been prepared; and

4. Funds required to staff, operate and maintain the CDER have been budgeted and will be made available by the Government of Morocco on a timely basis.

b. Prior to any disbursement of funds, or the issuance of documentation pursuant to which funds may be disbursed under the Project Agreement to finance commodities or technical assistance for the CDER on or after July 1, 1982, the Government of Morocco shall provide to AID evidence, in form and substance acceptable to AID, that the CDER has been officially established and/or ratified by act of Parliament and constitutes a legally recognized de jure entity under the laws of the Kingdom of Morocco.

Section 4.3 Pilot Projects

a. Pilot Projects for Small Hydroelectric Power Generation

Prior to any disbursement of funds or to the issuance of any documents pursuant to which funds may be disbursed under the Project Agreement to finance pilot projects for small hydroelectric power generation, the Government of Morocco shall provide to AID in form and substance satisfactory to AID:

1. A plan of action that:

   (a) Designates the organizations responsible for the construction of the pilot generating plants, related canals, distribution systems, access roads and other civil works; and describes clearly their responsibilities within this project; and

   (b) Designates the organizations responsible for maintenance of pilot facilities, describes how it is to be done, and describes clearly their responsibilities within this project; and

   (c) Identifies the beneficiaries of the pilot projects and establishes the governing criteria for the rate structure which will encourage maximum productive use of available electricity.

2. Evidence that the funds necessary to finance the dirham costs required for the construction, operation and maintenance of the pilot projects as set forth in the plan of action have been budgeted by the Government and/or the local authorities and will be available for project implementation on a timely basis.

3. Evidence that the land required for the pilot projects and related facilities (canals, access roads, distribution systems, etc.) is available for the projects.

b. Pilot Projects for Solar Wind, Biomass and Other Forms of Renewable Energy

Prior to any disbursement of funds or to the issuance of any documents pursuant to which funds may be disbursed under the Project Agreement to finance pilot projects for solar, wind, biomass or other forms of renewable energy, the Government of Morocco shall provide to AID in form and substance satisfactory to AID:

1. A plan of action that:

   a. Designates the organizations responsible for the construction of the pilot facilities and describes clearly their responsibilities within this project; and

   b. Designates the organizations responsible for the maintenance of the pilot facilities describes how it is to be done, and describes clearly their responsibilities within this project; and

   c. Identifies the beneficiaries of the pilot projects, the work which they will undertake and the costs which they will incur in connection with the pilot projects; and

   d. Describes clearly the responsibilities of whatever governmental or private entities will participate actively in the implementation of the pilot projects.

2. Evidence that the funds necessary to finance the dirham costs required for the construction, operation and maintenance of the pilot projects as set forth in the plan of action have been budgeted and will be available on a timely basis.

3. Evidence that land and related facilities required for the pilot projects is available.

Section 4.4 Pilot Project Fund and Small Project Fund

Prior to any disbursement of funds or to the issuance of any documents pursuant to which funds may be disbursed under the Project Agreement to finance activities under the Pilot Project Fund or the Small Project Fund the Government of Morocco shal except as the parties may otherwise agree in writing, furnish to AID, in addition to the applicable items set forth in Section 4.3 evidence in form and acceptable to AID, of the selection criteria to be employed for the projects, the administrative arrangements and procedures by which project selection will be made, and the accounting arrangements which will be used for financing the projects.

Selection criteria will be based on economic, financial and technical feasibility and social and environmental impact.

5. Sections 4.2 - Notification - is renumbered Section 4.5

6. Section 4.3 - Terminal Date for Conditions Precedent - is renumbered Section 4.6 and amended as follows

If the conditions specified in Sections 4.1 through 4.5 have not been met within 90 days from the date of this Amendment, or such later date as A.I.D. may agree to in writing, A.I.D., at its option, may terminate this Agreement by written notice to the Grantee.

7. Article 6: Foreign Exchange Costs is amended by changing its title from "Foreign Costs" to "Procurement Source" to reade as follows:

ARTICLE 6: Procurement Source

Section 6.1: Foreign Exchange Costs

Disbursement pursuant to Section 7.1 will be used exclusively to finance the costs of goods and services required for the Project having their source and origin in the United States and Selected Free World Countries (Codes 000 and 941 of the A.I.D. Geographic Code Book as in effect at the time orders are placed or contracts entered into for such goods and services ("Foreign Exchange Costs")), except as A.I.D. may otherwise agree in writing, and except as provided in the Project Grant Standard Provisions Annex, Section C.1 (b) with respect to marine insurance. Ocean Transportation costs will be financed under the Grant only on vessels under flag registry of the United States or Morocco, except as A.I.D. may otherwise agree in writing. If A.I.D. determines either that there are no vessels under flag registry of Morocco generally available for ocean transportation or that Morocco has no access to U.S. flag service, A.I.D. in a Project Implementation Letter may agree to finance under the Grant ocean transportation costs on vessels flag registry of any country included in A.I.D. Geographic Code Book 941.

Section 6.2: Local Currency Costs

Disbursement pursuant to Section 7.2 will be used exclusively to finance the cost of goods and services required for the Project having their source and, except as A.I.D. may otherwise agree in

writing, their origin in Morocco ("Local Currency Costs").

8. Article 7: Disbursement is amended by renumbering Section 7.2 - Other Forms of Disbursement as Section 7.3 and inserting a new Section 7.2 - as follows:

Section 7.2 - Disbursement of Local Currency Costs

a. After satisfaction of conditions precedent, the Grantee may obtain disbursements of funds under the Grant for Local Currency Costs required for the Project in accordance with the terms of this Agreement, by submitting to AID, with necessary supporting documentation as prescribed in Project Implementation Letters, request to finance such costs.

b. The local currency needed for such disbursement may be obtained by AID from local currency already owned by the United States Government. The United States dollar equivalent of the local currency made available hereunder will be the amount of United States dollars required by I.D. to obtain the local currency.

9. Article 7 is further amended by adding Section 7.4 - Rate of Exchange which reads as follow:

Except as may be specifically provided under Section 7.2, if funds provided under the Grant are introduced into Morocco by A.I.D. or any public or private agency for purposed of carrying out obligations of A.I.D. hereunder, the Grantee will make such arrangements as may be necessary so that such funds may be converted into cur-

rency of Morocco at the highest rate of exchange which, at the time the conversion is made, is not unlawful in Morocco.

10. Section 5.1 - Project Evaluation - is amended as follows:

The Government of Morocco shall, in addition, covenant to cooperate with U.S.A.I.D. in carrying out a program of periodic evaluation of the degree to which this project has attained its planned objectives. The pilot and demonstration activities will be evaluated with a view to assessing their impact and the prospects for future replication of the technologies tested.

INITIAL ENVIRONMENTAL EXAMINATION

Projected Location:	Morocco
Project Title:	Renewable Energy Development II
Funding:	FY 80 through FY 84. Life of Project Funding by USAID is US$6,700,000
Life of Project:	Four Years
IEE Prepared by:	J. A. Sleeper, Environmental Officer, USAID/Rabat
Date:	April 20, 1981

Environmental Action Recommended: The proposed project will not have an adverse effect upon the environment. Therefore, a Negative Determination is recommended, with the proviso that certain considerations be incorporated into final project design and implementation (see para C5). As described in this annex and throughout the narrative of this PP, the proposed project is essentially a research project under which pilot demonstrations of small scale hydro power, wind and solar power and biomass conversion will be set up.

Concurrence:

Harold S. Fleming
Director

4/23/81
Date

A. Description of Project

Under the proposed project, a Center for Renewable Energy Development will be constructed and run in Marrakech by the Ministry of Energy and Mines. AID will provide technical assistance, participant training and commodities to assist the Center in developing a pilot research and demonstration program for commercially viable uses of renewable energy. Pilot projects will be undertaken in small scale hydro power systems (3 pilot sites); wind powered pumping of potable and irrigation water (2 sites). biomass conversion; solar powered pumping of potable irrigation water; and other applications of solar energy.

B. Center for Renewable Energy Development

Under the proposed project, the actual facility to house the Center for Renewable Energy Development will be constructed, as well as support buildings, site support areas (eg. solar arrays) and personnel housing. The Center and support housing will be located on 4.68 hectares of relatively level land with available water, electric power, transportation and municipal sewer services. Property ownership of the site is currently being transferred from the Ministry of Islamic Affairs to the Ministry of Energy and Mines.

Minimum negative environmental impact by the proposed Center is foreseen. There will be no direct economic or residential dislocation or disruption due to construction or subsequent operations.

No significant effects are anticipated for the small business and local people now found immediately adjacent to the site. It is expected that some residents will derive direct and long term economic benefits from the Center through employment during construction and operation. The Center will generate new employment opportunities for service personnel.

No high noise level experimental equipment will be used in the laboratories. The total number of Center employees will be modest (50-100 maximum at some future date) and will not create any local traffic problems. The architectural style of the Center's villas is in keeping with Moroccan tradition, and is expected to blend in with the nearby campus of the School of Mines and other adjacent buildings. The building to house the Center will be a model of energy-efficient design.

C. Small Scale Pilot Hydro Power Generation Systems

1. Introduction. Field visits were made to ten prospective sites (villages) in rural Morocco where the installation of small scale hydro systems is feasible. Sites were ranked according to the following criteria: hydrology; locations for intake structures, penstocks, storage reservoirs (if any), powerhouses, and other civil works; available head; water availability, adequacy and reliability; engineering and cost considerations; geographic distribution (to meet pilot demonstration objectives); socioeconomic

conditions; and the potential for significant environmental impact. The three villages ranked the highest and consequently chosen for pilot systems were: 1) Msemrir (200 households), located in Quarzazate Province on the southern slope of the central High Atlas along the Assin-Imedrhas River; 2) Tabant-Ait-Imi (182 households), located in Azilal Province on the northern slope of the central High Atlas along the Bou-Wgammez River; and 3) Arhbalou-n-Kerdouss (178 households) located in Errachidia Province on the southern slope of the central High Atlas.

The economies of all three villages are based to varying degrees upon a mixture of semi-pastoralist herding of sheep and goats and rainfed cereal cultivation, supplemented by intensive irrigated vegetable production with some doubled-cropped grains and forages. There is no indication that an inequitable financial burden will be placed upon users of the proposed pilot systems in any of the three villages. Local economies have been judged sufficient to both absorb the costs of electrification and support modest investments in electrical applications which should contribute to broadening the local economic base. In all three villages, social attitudes towards the proposed pilot systems are quite favorable. The present system of irrigation management by mayor's office (caidat) functions well in all three villages and is a good indication of local abilities to organize and manage effectively. Operation, maintenance and technical expertise will be provided by the ONE (National Office of Electrification).

The site at Msemrir will improve and upgrade an existing diversion structure currently used for irrigation from the Assin-Imedrhas River to a produce approximately 125 KW of power. At the Tabant-Ait-Imi and Arhbalou sites, spring sources adjacent to the villages already used for irrigation will be developed to provide 100 and 120-250 KW respectively.

The proposed sites will not require relocation of any housing or other existing structures and is not expected to have a y negative impact on downstream users below the systems. Erosion control measures during construction will be used in all areas of ground disturbance and should minimize the degree of soil loss. These measures may include scheduling construction during the dry seasons, seeding or revegetation mulching, avoidance of excessive slopes and terracing. To date, there is no evidence of critical habitat, rare or endangered species occuring within the vicinity of the Msemrir site. Visual contrast of the proposed development with the surrounding environment can be mitigated through use of construction design and materials most compatible with the are.

2. Msemrir. The major environmental impacts at Msemrir will occur as a consequence of construction of a small reservoir and powerhouse, and improvement of an existing access road and diversion channel from the Assin-Imedrhas River. Proposed civil works are comprised of existing stone masonry diversion structure; an intake; a power channel; structures for irrigation water on the power channel; a storage reservoir; a steel penstock; and powerhouse.

Access to the site for construction purposes will probably be via an existing jeep trail on the opposite bank. This trail can be widened and upgraded with a minimum of disturbance and without taking any irrigated or other agricultural land. There should be no serious problems in crossing the river which appears to have a solid bed of small rock. No necessity is foreseen for any bridge construction or filling in of the river bed to make a temporary crossing.

Improvement of the power channel and construction of reservoir and powerhouse is expected to take a small amount of irrigated land. However, careful planning should keep land taking to a minimum.

Construction activities adjacent to the river required for the canal and diversion structure may periodically introduce some sediment to the stream. This disturbance can be kept to a minimum through use of soil stabilization practices (avoidance of excessive slopes, seeding, mulching, dry season construction) along the power canal.

It is not anticipated that improvement of the diversion structure will significantly affect the stream habitat of any fish. Some vegetation will be cleared for both construction and improved access. Coupled with grading activity, the potential for soil erosion is increased. Again, these impacts can be minimized through soil stabilization efforts.

3. Tabant-Ait Imi. The proposed water source for power generation is a spring which discharges into a small tributary above the village of Ait Imi. Design of the system consists of : a reinforced concrete and stone masonry intake structure near the mouth of the spring ; a power channel consisting of an underground concrete pipeline ; structures along the power channel to meet existing irrigation water demand ; a storage reservoir, a penstock, a powerhouse and tailrace.

Access to the spring source will require the construction of approximately 1 Km of new road. Through development of a sensitive road alignment and design, impacts to adjacent land use (agriculture, grazing, sparsely-settled housing) and indigenous vegetation cover will be minimal with the exception of the actual land taking required for the road. Some noise and dust may also result during construction of the road and in transporting materials. Construction of the canal, reservoir and powerhouse will also require a -

minimal amount of land taking. Impacts to existing land use will again be kept to a minimum through sensitive setting and construction practices.

Provision for release of irrigation waters in the design of the power canal will mitigate any conflict with existing irrigation practices. During construction of the intake structure, some sediment may be introduced to the spring flow. This will be a short term effect which should have minimal impact on downstream users.

4. Arhbalou-N-Kerdouss. The spring to be developed is located about 75 m from the existing dirt road at Arhbalou village. Under the project the following civil works will be constructed : reinforced concrete intake structure near the mouth of the spring ; an open channel with stone masonry along approximately one third of its length ; a storage tank ; a steel penstock ; a powerhouse ; and a tailrace channel.

Access to the spring for construction purposes will require a temporary roadway, which should be aligned to take no or very little irrigated land. The suggested route for the road begins before approaching the village and arches toward the spring, thus avoiding irrigated land. Some noise and dust may also result during construction of the road and in transporting materials.

The planned intake structure will not have any large scale impact on vegetation except for some shrubs now scattered around the mouth of the spring. These shrubs should be easily re-established.
Widening the present canal from the intake will take a small amount of irrigated land, but careful planning should avoid unnecessary destruction of valuable land. Construction of the rest of the canal structures, storage tank, powerhouse and tailrace will also require a minimal amount of land taking. However, this land is not used for agricultural or residential purposes.

5. Summary of Impacts of Small Scale Hydro.

	Village			
Impact Areas	Msemrir	Tabant	Arhbalou	
Land Cleaning	N	L	L	(NOTE: See footnote
Altered use of water	L	L	L	page 10-9 for
Sediment	L	L	L	explanation of
Aquatic life	M	L	L	abbreviations)

6. Recommendations for Project Design and Implementation. When weighed against the benefits of project development, the reasonably foreseeable environmental effects of the three pilot small-scale hydro-power systems are minimal. However, it is recommended that the following courses of action be taken during project design and implementation :

a) Prior to final design and start of any construction, actual current meter measurements of spring discharges/stream flow

should be made monthly at each of the 3 sites.

b) Prior to final design and start of any construction, measurements must be also made of the quantity of water used in irrigation in order to make accurate estimates of power generation month-by-month, and to ensure that water requirements for power generation do not conflict with those for irrigation.

c) During implementation, the potential for conflict over priorities for water use in irrigation vs. power must be carefully monitored.

NOTE : Section C above, is based upon analyses found in the following documents :

A. HAMMOUDI - Micro Power Plants : Report on Arhbalou-N-Kerdouss and Msemrir.
C. T. MAIN, Inc., - Small Pilot Hydro Power Generation System. Renewable Energy Development Project, Morocco, 1980.
D. ZOELLNER - "Environmental Assessment of Small Scale Hydropower", Small Hydroelectric Powerplants, National Rural Electric Cooperative Association, 1980.

D. Solar and Wind Pumps

Under the proposed project, new solar and wind powered technologies for use in irrigation or potable water pumping will be demonstrated in a pilot program. Three sites with different pumping technologies have been recommended :

Site	Application	Technology System
Oujda	Water pumping for human and animal water supply	40 Kw wind electric pump
Sidi Bounouar (Essaouira)	Irrigation and potable water supply	40 Kw wind electric pump
Marrakech (Renewable Energy Center)	Water supply	5 Kw photovoltaic electric pump

These pilot demonstrations will provide hands-on performance data for solar and wind powered technologies in Morocco. Because of the very small size of this pilot program, little significant effect upon the environment is foreseen.

The solar powered refrigerators for health centers will emit no fumes, vapors or noises. They will not be dangerous or environmentally damaging. The PV power system will be totally enclosed, away from human contact and has no environmentally damaging emissions. Electric shocks can be received if the PV panels are improperly handled, however, they will be shielded such that contact with current carrying components cannot be accidentally made. The PV modules contain extremely small amounts of hazardous materials, however there is no chance that these can be released to the environment or that living organisms can be affected by them.

The batteries for electricity storage contain sulphuric acid, however they are in every way similar to automobile batteries except that they are much more strongly constructed. Because those coming in contact with the batteries can be instructed as to the possible dangers and because the population is already familiar with batteries, the potential for environmental damage is extremely small.

E. Biomass Conversion

Several pilot research activities involving biomass conversion (improved charcoal production, more efficient stoves, biogas digestors and other pilot activities to be defined) are planned under the project. Because of the pilot nature of these research activities, none can be expected to have detrimental effect upon the environment with the following possible exceptions.

The GOM is very interested in developing new technologies for village-level charcoal conversion. Present techniques of charcoal production are primitive and result in wasted wood fiber (wood is burned in mud retorts). The new technology to be developed under the proposed project will preserve the small-scale characteristics, but greatly reduce these losses. Should this technology become widely adopted, the net result would be greater charcoal production from the same amount of wood, thereby easing pressure on forest resources.

It must be recognized that the opposite effect -- increased cutting for charcoal production -- could conceivably occur with widespread adoption of the new technology. This danger is great because both the demand for household energy and imported natural gas prices are continually rising. Charcoal and butane/propane are the two major sources of household energy in the country and are relatively substitutable. Unit prices for retail charcoal have increased by almost 90 per cent (twice as rapidly as the cost of living) from 1971 to 1979, but retail prices of natural gas have more than doubled over the same period, in part because a larger percentage of total gas consumption is imported (72 per cent in 1978). Thus, the improved charcoal conversion technology could accelerate wood cutting by lowering the price of charcoal relative to gas and by removing the currently existing convertion constraint.

However, USAID judges that the new technology is not likely to contribute to deforestation for the following reasons. USAID is currently developing a $US 6 million project with the GOM Forest Service to streamline their reforestation effort. Furthermore, the record of the Forest Service for protecting reforested areas has generally been very good. Finally, the discovery of new deposits of natural gas in commercial quantities in Essaouira Province promises to enable Morocco to become less dependent on expensive imported gas.

IMPACT IDENTIFICATION AND EVALUATION FORM

Impact Areas and Sub-Areas*	Impact Identification & Evaluation**
A. Land Use	
1. Changing the character of the land through:	
a. Increasing the population	N
b. Extracting natural resources	N
c. Land clearing	L
d. Changing soil character	N
2. Altering natural defenses	N
3. Foreclosing important use	L
4. Jeopardizing man or his works	N
5. Other factors	None

Impact Areas and Sub-Areas (Cont.) *	Impact Identification and Evaluation **
B. Water Quality	
1. Physical state of water	L
2. Chemical and biological states	N
3. Ecological balance	L
4. Other factors	None

* See explanatory notes for this form

** Use the following symbols: N - No environmental impact
L - Little environmental impact
M - Moderate environmental impact
H - High environmental impact
U - Unknown environmental impact

C. ATMOSPHERE

1. Air additives	N
2. Air pollution	N
3. Noise pollution	N
4. Other factors	None

D. NATURAL RESOURCES

1. Diversion, altered use of water (irrigation)	L
2. Irreversible, inefficient commitments	N
3. Other factors	None

E. CULTURAL

1. Altering physical symbols	N
2. Dilution of cultural traditions	N
3. Other factors	None

F. SOCIO-ECONOMIC

1. Changes in economic employment patterns	N
2. Changes in population	N
3. Changes in cultural patterns	N
4. Other factors	None

G. HEALTH

1. Changing a natural environment	N
2. Eliminating an ecosystem element	N
3. Other factors - Small quantities of Fertilizers and plant protection materials	N

H. GENERAL

1. International impacts	N
2. Controversial impacts	N
3. Larger program impacts	N
4. Other factors	None

I. OTHER POSSIBLE IMPACTS (not listed above)

_____	None

UNITED STATES GOVERNMENT

memorandum

DATE: May 29,1981

REPLY TO ATTN OF: NE/PD/PDS, Stephen F. Lintner, SFL
Bureau Environmental Coordinator

SUBJECT: MOROCCO - Renewable Energy Development II - Project Paper (608-0150) - Environmental Clearance

TO: NE/TECH/HRST, George Self,
Project Chairperson

I have reviewed the proposed project and concur with the recommendation of the Mission that it be given a "Negative Determination" in compliance with the requirements of 22 CFR 216, "A.I.D. Environmental Procedures".

cc: GC/NE, B. Janigan
AID/Rabat, J. Sleeper, Mission Environmental Officer
AID/Tunis, S. Carlson, Regional Legal Adviser

OPTIONAL FORM NO. 10
(REV. 1-80)
GSA FPMR (41 CFR) 101-11.6
5010-114
U.S. Government Printing Office: 1980—341-525/6192

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project: From FY 80 to FY 86
Total U.S. Funding $6,200,000
Date Prepared: April 22, 1981

Project Title & Number: Renewable Energy Development (608-0139)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: Reduce Morocco's dependence on imported fuels by making maximum use of the country's renewable resources for the production of usable energy while at the same time preserving these resources from environmental degradation.	Measures of Goal Achievement: -- Reduction of Morocco's petroleum imports during the period through 1990 -- Increased use of Morocco's renewable energy resources during the period through 1990	Existing national data	Assumptions for achieving goal targets: That GOM national policy will be able to affect oil consumption
Project Purpose: Create a Center for Renewable Energy Development (CDER) with the professional staff and facilities to carry out a wide range of applied research and pilot activities to identify how best to exploit Morocco's renewable energy potential and encourage its efficient use.	Conditions that will indicate purpose has been achieved: End of project status: -- CDER built by end 1983 with trained staff and a Moroccan institutional capability to manage renewable energy research. -- CDER making an active contribution to development of GOM renewable programs and policies.	Assessment of CDER facilities, staff capability, activities and impact by expert evaluation team	Assumptions for achieving purpose: That results of CDER activities will be used by GOM for policy and program formation in the energy sector
Outputs: — One CDER with staff, buildings and laboratory equipment actively engaged in an effective program to integrate renewable energy techniques into sector policy and planning. -- A pilot project program in small hydroelectric generation, wind and solar energy and biomass.	Magnitude of Outputs: -- 1 CDER with trained staff and laboratory facilities -- 3 small hydro pilot projects -- 2 wind powered pump water pumping pilot projects -- Photovoltaic pilot projects - 5 portable pumps, 5 refrigerators and others to be determined	Direct observation	Assumptions for achieving outputs: That GOM will budget sufficient funds and logistical backstopping for CDER and the related pilot projects.
Inputs: -- 2 U.S. resident advisors -- 100 person-months short term consultants -- Participant training in Morocco and the U.S. (12 degree candidates, 80 person-months short term) -- Feasibility studies, engineering and architectural design and imported equipment for the Center and related pilot projects	Implementation Target (Type and Quantity): CDER programs to: -- Characterize quantity and quality of renewable energy resources -- Identify and develop renewable energy technologies -- Establish performance measurement system for renewable energy techniques and equipment -- Train a cadre of engineers, scientists and managers in application and administration of renewable energy technology	Assessment of CDER facilities staff capability activities and impact by expert evaluation team	Assumptions for providing inputs: That GOM will provide sufficient staff for CDER to carry out its planned program

Annex 12, Revised

Statutory Checklist

SC(1) - COUNTRY CHECKLIST

GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

1. FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights? — N/A

2. FAA Sec. 481. Has it been determined that the government of recipient country has failed to take adequate steps to prevent narcotics drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the United States unlawfully? — N/A

3. FAA Sec. 620(b). If assistance is to a government, has the Secretary of State determined that it is not controlled by the International Communist movement? — N/A

4. FAA Sec. 620(c). If assistance is to government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government? — N/A

5. FAA Sec. 620(e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities? — N/A

A.

6. FAA Sec. 620(a), 620(f); FY 79 App. Act, Sec. 108, 114 and 506. Is recipient country a Communist country? Will assistance be provided to the Socialist Republic of Vietnam, Cambodia, Laos, Cuba, Uganda, Mozambique, or Angola? N/A

7. FAA Sec. 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression? N/A

8. FAA Sec. 620 (j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property? N/A

9. FAA Sec. 620(l). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason? N/A

10. FAA Sec. 620(o); Fishermen's Protective Act of 1967, as amended, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters: N/A

a. Has any deduction required by the Fishermen's Protective Act been made?

b. Has complete denial of assistance been considered by AID Administrator?

11. FAA Sec. 620; FY 79 App. Act, Sec. 603. (a) Is the government of the recipient country in default for more than 6 months on interest or principal of any AID loan to the country? (b) Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds? N/A

12. FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget which is for military expenditures, the amount of foreign exchange spent on military equipment and the N/A

A.12.

amount spent for the purchase of sophisticated weapons systems? (An affirmative answer may refer to the record of the annual "Taking Into Consideration" memo: "Yes, as reported in annual report on implementation of Sec. 620(s)." This report is prepared at time of approval by the Administrator of the Operational Year Budget and can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)

13. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption? **N/A**

14. FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget? **N/A**

15. FAA Sec. 620A, FY 79 App Act, Sec. 607. Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism? **N/A**

16. FAA Sec. 666. Does the country object, on basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. there to carry out economic development program under FAA? **N/A**

17. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? Has it detonated a nuclear device after August 3, 1977, although not a "nuclear-weapon State" under the nonproliferation treaty? **N/A**

B. FUNDING CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria

a. FAA Sec. 102(b)(4). Have criteria been established and taken into account to assess commitment progress of country in effectively involving the poor in development, on such indexes as: (1) increase in agricultural productivity through small-farm labor intensive agriculture, (2) reduced infant mortality, (3) control of population growth, (4) equality of income distribution, (5) reduction of unemployment, and (6) increased literacy? **YES**

8.1.

b. FAA Sec. 104(d)(1). If appropriate, is this development (including Sahel) activity designed to build motivation for smaller families through modification of economic and social conditions supportive of the desire for large families in programs such as education in and out of school, nutrition, disease control, maternal and child health services, agricultural production, rural development, and assistance to urban poor? N/A

2. Economic Support Fund Country Criteria

a. FAA Sec. 502B. Has the country engaged in a consistent pattern of gross violations of internationally recognized human rights? This section not applicable

b. FAA Sec. 533(b). Will assistance under the Southern Africa program be provided to Mozambique, Angola, Tanzania, or Zambia? If so, has President determined (and reported to the Congress) that such assistance will further U.S. foreign policy interests?

c. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?

d. FY 79 App. Act, Sec. 113. Will assistance be provided for the purpose of aiding directly the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights?

e. FAA Sec. 620B. Will security supporting assistance be furnished to Argentina after September 30, 1978?

5C(2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable generally to projects with FAA funds and project criteria applicable to individual fund sources: Development Assistance (with a subcategory for criteria applicable only to loans); and Economic Support Fund.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE?
HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?

A. GENERAL CRITERIA FOR PROJECT

1. FY 79 App. Act Unnumbered, FAA Sec. 653 (b); Sec. 634A. (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)? — YES

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? — YES

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? — Legislation officially establishing the Center for Renewable Energy Development (CDER) is a condition precedent to disbursement of funds in the Project Agreement.

4. FAA Sec. 611(b); FY 79 App. Act 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? — N/A

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 and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project? — N/A

6. FAA Sec. 209. 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. — NO

A.

7. FAA Sec. 601(a). 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.

Project has the potential to improve technical efficiency of industry, agriculture and commerce by increasing availability of energy resources.

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).

U.S. firm will supply services under project.

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.

Host country to make required in-kind contribution.

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

Morocco is a near-excess country; no local currency expenditures are to be financed.

11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?

Yes

12. FY 79 App. Act Sec. 603. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar, or competing commodity?

N/A

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b); 111; 113; 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 and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained

One purpose of project is to make energy available to rural areas with an equitable distribution to include rural poor.

B.1.a.

basis, using the appropriate U.S. institutions; (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; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph 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;

Project components will assist GOM develop renewable technologies for irrigation, rural electrification for cottage industries, and increased resource availability and efficiency.

(2) [104] for population planning under sec. 104(b) or health under sec. 104(c); if so, extent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning for the poorest people, with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics and health posts, commercial distribution systems and other modes of community research.

N/A

(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;

N/A

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

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

Project specifically directed at items described in (i)

(ii) to help alleviate energy problems;

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

(iv) reconstruction after natural or manmade disaster;

B.1.b.(4).

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

(vi) 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.

c. [107] Is appropriate effort placed on use of appropriate technology?

d. FAA Sec. 110(a). Will the recipient country 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)?

The Host Country will provide at least 25% of costs for entire project.

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

NO

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 civil education and training in skills required for effective participation in governmental and political processes essential to self-government.

Project seeks to improve energy research and application abilities of country people.

g. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase or productive capacities and self-sustaining economic growth?

YES

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, including reasonableness of repayment prospects.

N/A

b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?

N/A

B.

3. Project Criteria Solely for Economic Support Fund

a. FAA Sec. 531(a). Will this assistance support promote economic or political stability? To the extent possible, does it reflect the policy directions of section 102? N/A

b. FAA Sec. 533. Will assistance under this chapter be used for military, or paramilitary activities? N/A

STANDARD ITEM CHECKLIST

A. Procurement

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of goods and services financed?	YES
2. FAA Sec. 604(a). Will all commodity procurement financed be from the U.S. except as otherwise determined by the President or under delegation from him?	YES
3. FAA Sec. 604(d). If the cooperating country discriminates against U.S. marine insurance companies, will agreement require that marine insurance be placed in the United States on commodities financed?	YES
4. FAA Sec. 604(e). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity?	Not Financed
5. FAA Sec. 608(a). Will U.S. Government excess personal property be utilized wherever practicable in lieu of the procurement of new items?	NO
6. FAA Sec. 603. (a) Compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S.-flag commercial vessels to the extent that such vessels are available at fair and reasonable rates.	N/A
7. FAA Sec. 621. If technical assistance is financed, will such assistance be furnished to the fullest extent practicable as goods and professional and other services from private enterprise on a contract basis? If the	YES

A.7.

facilities of other Federal agencies will be utilized, are they paritcularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?

8. International Air Transport. Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will provision be made that U.S.-flag carriers will be utilized to the extent such service is available? — YES

9. FY 79 App. Act Sec. 105. Does the contract for procurement contain a provision authorizing the termination of such contract for the convenience of the United States? — YES

B. Construction

1. FAA Sec. 601(d). If a capital (e.g., construction) project, are engineering and professional services of U.S. firms and their affiliates to be used to the maximum extent consistent with the national interest? — YES, The construction design financed.

2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable? — Not financed.

3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the United States not exceed $100 million? — N/A

C. Other Restrictions

1. FAA Sec. 122 (a). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter? — N/A

2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights? — N/A

3. FAA Sec. 620(h). Do arrangements preclude promoting or assisting the foreign aid projects or activities of Communist-bloc countries, contrary to the best interests of the United States? — YES

4. FAA Sec. 636(i). Is financing not permitted to be used, without waiver, for purchase, long-term lease, or exchange of motor vehicle manufactured outside the United States, or guaranty of such transaction? — YES

5. Will arrangements preclude use of financing:

a. FAA Sec. 104(f). To pay for performance of abortions or to motivate or coerce persons to practice abortions, to pay for performance of involuntary sterilization, or to coerce or provide financial incentive to any person to undergo sterilization? **YES**

b. FAA Sec. 620(g). To compensate owners for expropriated nationalized property? **YES**

c. FAA Sec. 660. To finance police training or other law enforcement assistance, except for narcotics programs? **YES**

d. FAA Sec. 662. For CIA activities? **YES**

e. FY 79 App. Act Sec. 104. To pay pensions, etc., for military personnel? **YES**

f. FY 79 App. Act Sec. 106. To pay U.N. assessments? **YES**

g. FY 79 App. Act Sec. 107. To carry out provisions of FAA sections 251(d) and 251(h)? (Transfer of FAA funds to multilateral organizations for lending.) **YES**

h. FY 79 App. Act Sec. 112. To finance the export of nuclear equipment, fuel, or technology or to train foreign nations in nuclear fields? **YES**

i. FY 79 App. Act Sec. 601. To be used for publicity or propaganda purposes within United States not authorized by the Congress? **YES**

ANNEX 13

Organization of the Center for Renewable Energy Development

Senior Management

The Director General is responsible both for the overall direction and administration of the Center, and also for representing the Center in its relations with the Ministry of Mining and Energy, other Ministries, the business community and other Moroccan institutions, and foreign energy institutions. He is supported in these functions by the Deputy Director. The Deputy Director is responsible for the internal management of the Center, including support services in the form of the machine shop and instrumentation laboratory. He is also in charge of all professional aspects of the Center which are not technology-centered: education, energy planning, economic and social research, information, data acquisition and analysis, and the library. In addition, his responsibilities include all technology-related activities: demonstration projects, applications research, resource assessment, and quality testing and commercialization.

These two persons constitute the senior administration of the Center. It is apparent, however, that additional management is necessary to cover the wide span of activities to be undertaken. For this reason, five middle management positions have been designated: Chiefs for Operations Research, Planning and Education; Administrative Services; Solar and Wind; Biomass and Waste; and Quality Testing and Applications. Four of these middle management positions are staffed with professionals who will receive training either in Morocco or abroad; the fifth (Chief, Administrative Services) will be an experienced administrator who should not require special training. The responsibilities of each of the four professional sub-areas are reviewed below.

Operations Research, Planning & Education

1. The Chief, Operations Research, Planning and Education will be both a manager and a professional in the field of Operations Research.

Managerial duties will fall mostly in the area of budget preparation and reporting to senior management. Professionally, this person will be an operations research analyst, who will analyze problems of renewable energy systems.
solutio

2. The Energy Planners will collect, organize and analyze data on the roles of renewable energy in Moroccan development. These planners will act as resource experts for Ministry planners, and will be particularly valuable as intermediaries between local and regional authorities, and the central government. They will obtain data on energy consumption patterns in various sectors of the Moroccan economy: industry, commerce, transportation, households and agriculture.

3. The Energy Economists will work closely with the planners, in that they will determine the economic impacts of renewable energy projects on development. They will also perform analysis of costs and benefits of large-scale projects, thus aiding in the investment decision process, whether by the Government of Morocco or by international development agencies.

4. The Sociologist will work to determine how renewable energy can be introduced most successfully, given cultural and familial patterns of group behavior in both rural and urban areas. The involvement of the sociologist in all project decisions is necessary so as to lessen the chances for unforeseen adverse effects on the lives of Moroccan citizens.

5. The Technical and Public Information Officers will have two basic responsibilities. One will be to organize, write and publish technical information as developed by the Center, so as to serve the Moroccan and international scientific, technical and development communities. The second will be to provide needed information to the Moroccan public on renewable energy, in a form in which it can be readily understood.

6. The position of Statistician/Scientific Programmer combines the functions of the formerly designated Engineering and Scientific Programmer, and Applied Energy Statistician. This person will perform statistical analyses and write statistical reports on energy resources and use, and will be able to operate a small desk-top computer for the solution of engineering, management and other problems.

7. The Librarian will be responsible for the acquisition of library materials in a variety of formats: films, microfiches, unpublished reports, journals, books, and so forth. He or she will organize the published works of the Center, and maintain the library as a service to the other professional staff. This person will see to it that the Center maintains information-sharing links with other libraries, universities, and research centers throughout the world.

Solar and Wind

1. The Chief, Solar and Wind will have responsibility for resource assessment, technology development, and technology applications in these two areas. He or she will have a staff of seven professionals working with the Energy Planners, Economists and Sociologist; he or she will plan and execute renewable energy demonstration projects in ways that best fit development patterns. This person will supervise the work of specialists in the section: solar engineers, a wind engineer, a materials engineer, and resource analysts. Where large-scale introduction of technologies are planned, he or she will work directly with other Ministries (or will designate other staff members to do so) on technical problems.

2. The Solar Engineers will work to adapt solar thermal and photovoltaic technologies to Moroccan climatic, environmental and development conditions. They will also adapt passive solar technologies in such areas as building design, working with Moroccan architects and industrialists. They w devise special approaches to renewable energy suitable to Morocco, and will write papers on their accomplishments. Some of their time will be spent in the field on the implementation of pilot projects. At least one person will be responsible as well for liaison in the small hydro area.

3. The Wind Engineer will perform similar functions with respect to wind technology, in the areas of mechanical energy and electricity generation.

4. The Materials Engineer will investigate the effect of Moroccan soil, climatic and environmental conditions on materials used in renewable energy devices. He or she will be concerned with developing new combinations of materials, or adapting construction methods of such devices, so as to increase reliability and energy output. This person will work both in a materials testing laboratory, and in the field.

5. The Solar and Wind Resource Analysts will initially spend much time in gathering data on solar and wind resources of the country. In the case of wind, this will require the establishment of long-term measurement procedures. Charts, graphs, computer printouts and other displays of information will be produced to serve the needs of other Center personnel as well as the larger Moroccan community. These persons will be especially valuable in planning for the sizing of installations whether village-wide, region-wide, or for a single farm or building.

Biomass and Waste

1. The Chief, Biomass and Waste, will have responsibilities similar to those of his Solar and Wind counterpart; resource assessment, technology development, and technology applications. The technologies under this section include combustion systems, biogas, biochemistry, and integration of biomass-fueled energy systems with other systems. He or she will have a staff of three professionals.

2. The Biomass and Waste Engineers will develop systems for urban and agricultural wastes, utilizing either boilers or biogas generators for the production of energy. They will also develop novel combustion systems which may be integrated with wind installations; one of these persons at least will therefore have some liaison responsibilities in this area.

3. The Biomass and Waste Resource Analyst will be responsible for measuring the caloric content of various prospective fuels, determining their present availability, and at what cost they are available, and planning for their increased production, such as through biomass plantations. He or she will thus work both in the laboratory and in the field, and will write and publish reports on all forms of biofuels, including urban wastes.

Quality Testing and Applications

1. The Chief, Quality Testing and Applications is responsible for the management of the efforts of the Center which contribute to the widespread acceptance and use of renewable energy devices, through the Moroccan industrial and commercial sectors. He or she will also coordinate the testing of devices at the Center, and will notify standards for tests, and performance characteristics to the commercial sector.

2. The Demonstration Coordinator coordinates the testing of devices outside the laboratory, under field conditions. This person arranges for construction and instrumentation at the testing site.

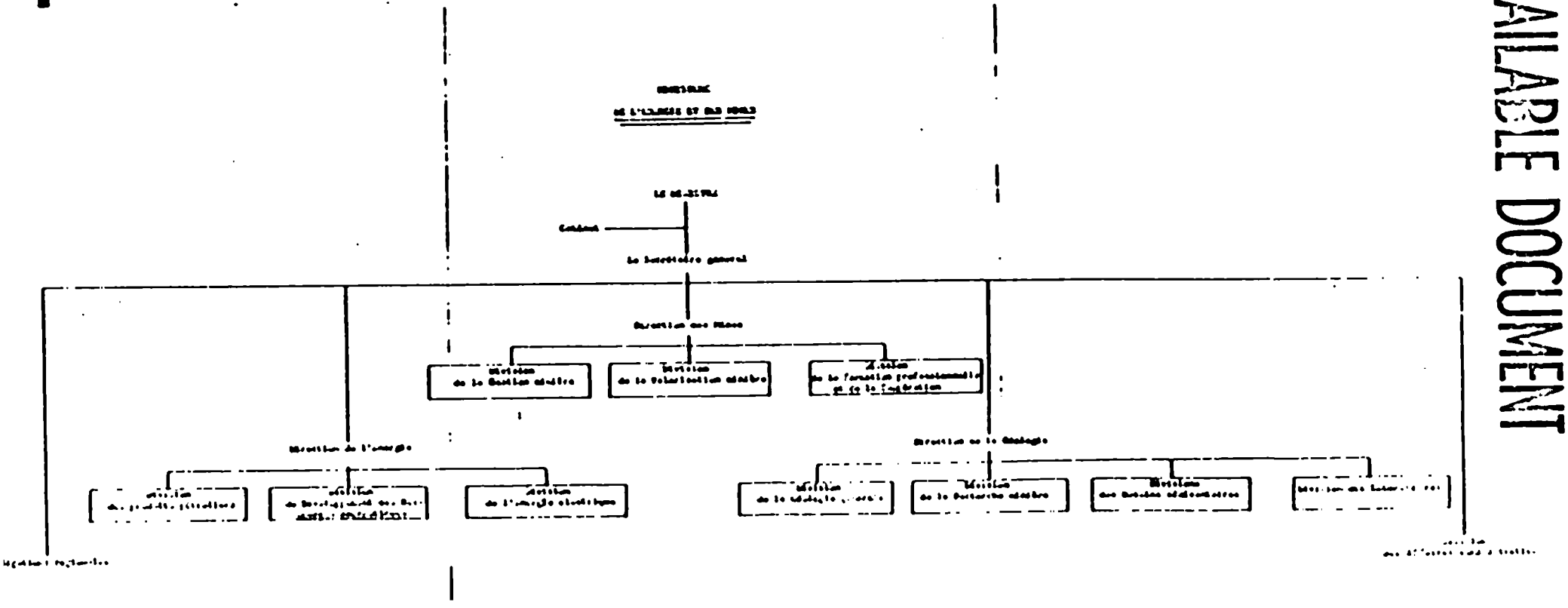
3. The Licensing Manager prepares for the Ministry's granting of licenses, seals of approval, or other documentation which relate to the standards for the manufacture and sale of renewable energy devices in Morocco.

The above constitutes the present staffing plans for the CDER.

The Center will not commence operations with all the above personnel in place. Difficulties of recruitment, differing lengths of training time, and priorities set by the Government of Morocco will determine the composition of the staff actually present at the commencement of operations. This is by no means a flaw in the development of the Center, as there will inevitably be a

startup period of many months, during which time professionals will be establishing their operations, getting acquainted with equipment, and beginning to contact persons in universities, government departments, and the various economic sectors with which they will be working. It is likewise possible that experience may eventually dictate an expansion of the Center, or changes in its constitution. This will become clearer over the first five years of operation. The professional staff outlined above, however, should be able to adapt successfully to any changes which are presently foreseeable.

BEST AVAILABLE DOCUMENT



ANNEX 14

Small Projects Fund, Features and Criteria

The Small Projects Fund follows the model of the United States Department of Energy Small Grants Program for Appropriate Technology in Energy, the United States National Science Foundation Grant Program for Scientific Research and Development of Appropriate Technologies, and AID Renewable Energy Development project funding criteria. It is anticipated that Peace Corps volunteers will be actively involved in developing and helping carry out some of the projects financed through the Fund. The Fund will be managed by CDER, guided by the technical assistance contractor and USAID. It will have the following features:

- -- Formal solicitation of grant applications
- -- Requests for proposals
- -- Broad distribution of the solicitations through newspaper announcements and mailings to potential respondents
- -- Initial review of applications by CDER energy experts and U.S. contract technical assistance staff advisors
- -- Circulation of applications to experts to elicit their comments and recommendations for funding
- -- Final selection of awards in a Merit Review by CDER and AID-financed experts
- -- Awards paid in quarterly advances
- -- Quarterly progress reports
- -- Final payment upon receipt of a final report
- -- Renewal of grants and contracts upon justification and successful completion of the first endeavor proposed
- -- Grant levels of $500 to $20,000 to individuals, businesses, government agencies, private voluntary organizations, and non-profit institutions.

All projects proposed must have clearly stated goals which can be and are expected to be achieved within a specified time period. These goals should be responsive to locally felt needs and able to be understood, accepted and implemented with a minimum of outside assistance.

In addition to the selection guidelines stated in Section III B.7 certain criteria will be set up for the offerors or initiators who apply for support from the Small Projects Fund:

- -- The project proposed must be compatible with GOM energy development priorities and the objectives of the Renewable Energy Development project
- -- The project staff must include at least as many Moroccan citizens as foreign residents

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- Offerors must demonstrate that the project meets an expressed need of some portion of the Moroccan poor population. The expression of the need, the scope of the problem and the potential supportive acceptance of the project by the intended beneficiary population must be documented.
- The offeror must document a financial or in-kind commitment which is commensurate with the scope of the project and the amount of the request. One form of documentation would be prior commitment of funds and/or personnel for the same or similar project.
- The offeror must have the capacity to keep records and accounts or include in the application a request for funds to have such records kept by a person responsible to the offeror so as to be able to show where, how and for what purpose project funds were disbursed, as a component of the quarterly and final reports.

Small Projects Fund Grant Program

The general areas and types of endeavors to be supported by the Small Projects Fund Grant Program will include:

Concept Development

Awards will be made for the development of an idea, concept or investigative finding which may be applied to the design of a particular renewable energy or energy-saving technology, of an end-users' training program or of a method to promote and disseminate renewable energy or energy-saving technologies among the Moroccan population.

Research and Development

Research and development projects will normally be limited to the applied research necessary to adapt a particular technology to the Moroccan environment, or to produce prototypes, or to acquire the knowledge necessary as a component of production, dissemination or training. Support will be available for the experimental construction or manufacture of prototypes with Moroccan raw materials, restricting the component of imported materials to 20 percent of the total value of the raw materials when existing plans, blueprints or earlier generations of the device have been developed by the initiator. Awards will be made to test a newly developed or newly adapted technology under operating conditions to demonstrate that its application is technically, economically and environmentally feasible; that the renewable energy or energy-saving technology is acceptable to the Moroccan rural population and meets a definite need of this beneficiary population.

Production and Market Studies

Projects may be proposed by private entrepreneurs attempting to produce and to market renewable energy or energy-saving technologies for the consumer market. Normally, these would be limited to market surveys, the refining of the production processes or product design and the purchase of necessary capital equipment. The prospects for commercial success should be high and the potential multiplier effect should be apparent. Priority will be given to organizations with the capacity to develop into commercially

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viable enterprises and to projects that create jobs, generate income, in cash or kind, or substantially reduce the cost of an item to the consumer or which can be self-sustaining. Private entrepreneurs will be required to demonstrate that conventional bank loans are not available for the project proposed; in some case, private entrepreneurs can apply to the Small Projects Fund for the technical assistance required to prepare successful loan applications for renewable energy production and marketing related projects.

Information Techniques

Innovative ways of promoting renewable energy and energy conservation will be supported through pilot projects in single communities, through special training programs for end-users, radio broadcasts, slide shows, and the preparation, printing and distribution of manuals and brochures for selected target groups. The Fund will promote the use of pilot projects to diffuse a new renewable energy or energy-saving technology into specific rural communities and to study the process and any impediments to acceptance on the part of the beneficiary population.

The transfer of renewable energy and energy-saving technology to technicians and extension agents in Morocco will be supported, especially through the preparation, printing and distribution of newsletters or circulars outlining an appropriate technology; and through conferences and workshops on specific applications of renewable energy and energy-saving technology which bring together selected target groups from several different locations and institutions in Morocco.

ANNEX 15

Site Evaluation - Center for Renewable Energy Development

A. The following paragraphs summarize evaluation criteria used to select the site proposed for the Center.

1. Adequate for the Center's activities - Sufficient property is available for the Center, support buildings, site support areas including solar arrays, and villas. In addition, the Center has a certain amount of expansion capability for future growth. The site is relatively level and open and has excellent sun exposure. Wind exposure is relatively good, but with some wind screening effect from palm tree clusters of generally less than 15 meters in height. The proposed type of usage of the site (Development Center and Support Housing), is compatible with the proposed development plan for that area.

2. Site Ownership - The property ownership is in the process of being transferred from the Ministry of Religion to the Ministry of Mines. The total property consists of 4.68 hectares, of which a parcel of 1.00 hectares immediately adjacent to the School of Mines will be reserved for the school, thus leaving a parcel of 3.68 hectares for the Center.

3. Utilities Availability - Ample electric power, water, municipal sewer service and telephone service are now available for the Center.

4. Accessibility - The selected site is located directly adjacent to Route No. 7, a principal highway connecting Marrakech and Casablanca on the outskirts of Marrakech. It thus affords proximity to a nearby population center from which to draw staff. Marrakech hotels would provide temporary housing for visitors.

5. Drainage - The site has gentle slopes and will be graded during construction to be free-draining.

6. Other Location Considerations - The site is well situated in respect to the academic community by being located immediately adjacent to the School of Mines and also being located in an area of rapidly developing housing for academic and other professional people.

Minimum impact by the proposed Center is foreseen. There will be no direct economic or residential dislocation or disruption due to construction or subsequent operations.

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No direct negative impacts are anticipated for the small business and local people now found immediately adjacent to the site. It is expected that some residents will derive direct and long term economic benefits from the Center through employment during construction and operation. The Center will generate new employment opportunities for service personnel.

The proposed Center is expected to have a broadly positive impact for the planned urban subdivision to be constructed nearby. No high noise level experimental equipment will be used in the laboratories. The total number of Center employees will be modest (50-100) and will not create any local traffic problems. The architectural style of the Center's villas is in keeping with Moroccan tradition and is expected to blend in with the campus of the School of Mines and the buildings of the subdivision.

The Center will probably be perceived as a complementing institution to the School of Mines. Aesthetically, the Center will be a dramatic improvement in the present appearance of the site.

No recognizable significant adverse environmental effects are projected as a result of the Center's construction, operation or maintenance.

B. SUPPLEMENTAL 20 HECTARE SITE

Consideration has been given to the acquisition and use of a 20 hectare site located approximately 20 km west of Marrakech. Its greatest usefulness would appear to be a satellite area for any pilot projects which MEM and CDER might plan, but which would be too large to be located at the CDER site, for example: a small power tower, a gasanol pilot plant, a biomass cultivation test plot or a solar powered irrigation system. The site is 10-12 km beyond the industrial park area on the western side of the city and is in a sparsely occupied farming area. The site is owned by the Ministry of Finance. If the site is approved as the experimental parcel for the CDER, the Ministry of Finance has agreed to transfer ownership of the 20 hectare to MEM. The 20 hectare parcel is now rented to a local farmer for rainfall agriculture. There are no people living on the site itself. The proposed development of the site will take the 20 hectare of farmland out of use. The farmer presently renting this land will have to look for alternate hectarage. This is not expected to present a hardship as there are considerable amounts of farmland available in the general area. It is not anticipated that any negative disruptions or dislocations will be experienced by adjacent occupants as a consequence of the project. The proposed development should result in new employment opportunities for some local residents.

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The proposed development for the 20 hectare site is considered to be socially sound. The site consists of cleared land used for minimal grazing of livestock and subsistence farming. The AID/USDA Bioenergy Team Report, Biomass For Energy in Morocco, August 1980, (see bibliography) recommends the acquisition of this site for biomass test plantings and also for possible large scale pilot testing of a variety of chemical processes. The sociological and environmental assessments indicate that this site is acceptable for large scale biomass resource development, and the wind and solar development.

TECHNICAL INFORMATION

WIND POWER PUMPING SITES

1. Center for Renewable Energy Development, Marrakech. 16-1

2. Sidi Bounouar, Essaouira Province. 16-3

3. PK 8 Route d'Ahfir, Oujda Province. 16-7

4. Rabt Tehtani, Oujda Province 16-11

Hybrid wind power/photovoltaic pumping site for possible future consideration for funding under the Pilot Project Fund

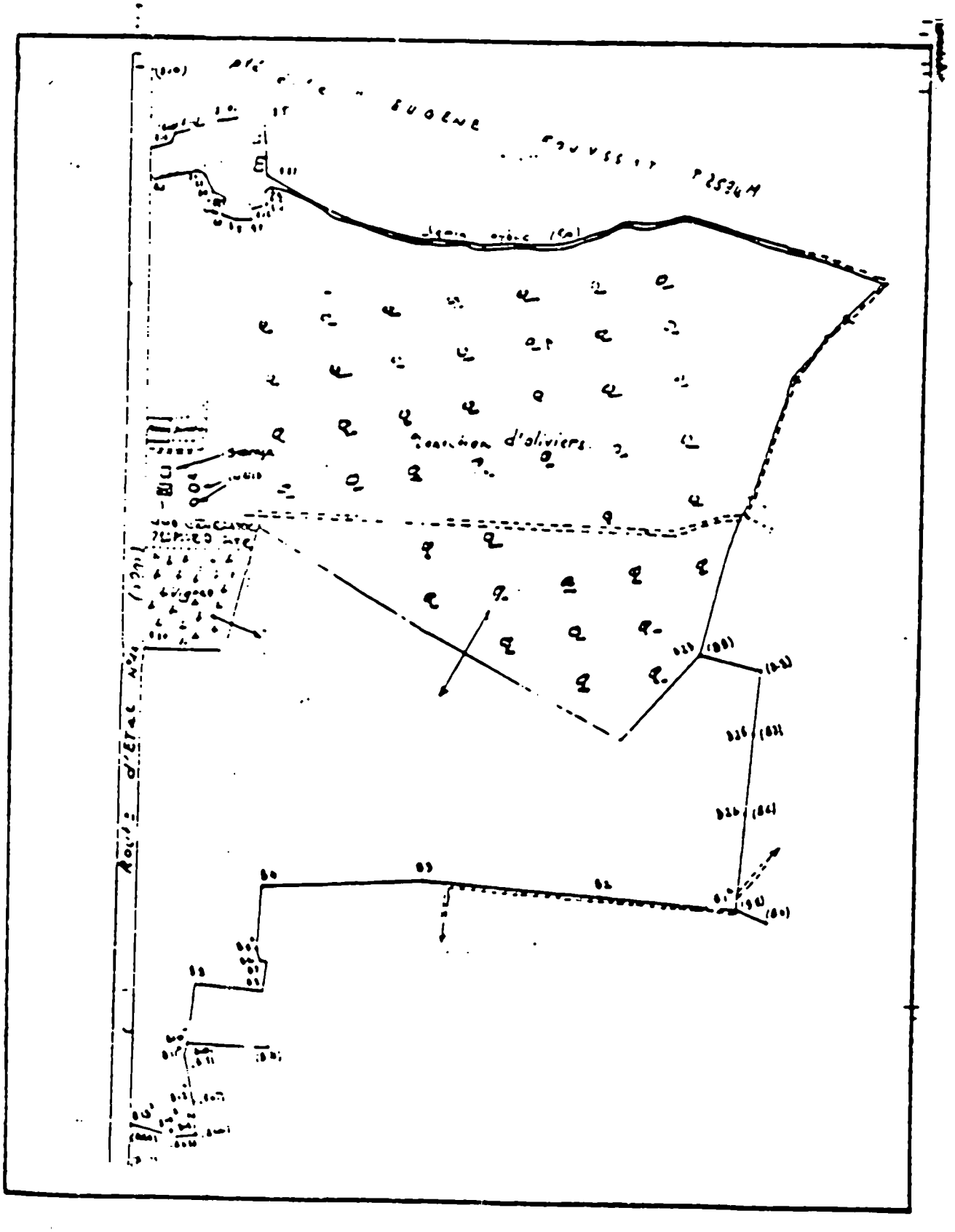
EQUIPMENT
FOR
RENEWABLE ENERGY CENTER

EQUIPMENT	DESCRIPTION	CAPACITY
Photovoltaic	125 volts d.c.	5 kW
Batteries	Common batteries used in the Center	
Water Pump	Total head = 30 meters Discharge = 1 liter per sec	1 hp 0.75 kW
Pump Motor	125 volt d.c. permanent magnet motor	1 kW

OPERATION SEQUENCE FOR RENEWABLE ENERGY CENTER

EQUIPMENT	MODE OF OPERATION
Assumptions	1. The photovoltaic is a source of energy for the renewable energy center. The output terminals will be connected to 125 volt d.c. main bus bar. 2. A bank of 125 volt d.c. batteries will be connected to the d.c. bus bar. 3. The water pump is a load connected to a 125 volt d.c. bus bar. 4. The entire electric system in the Center is considered a central system.
Photovoltaic	The output will directly feed onto the d.c. bus bar for direct utilization or storage. The energy output should be continuously recorded.
Water Pump	With small capacity, it can be operated at any time. The time of operation and the energy used should be recorded.

FARM LAYOUT SIDI BOUNOUAR



CHARACTERISTICS AND CAPACITY OF EQUIPMENT FOR IRRIGATION PUMPING AT SIDI BOUNOUAR SITE

ITEM	DESCRIPTION	CAPACITY
Wind Turbine Generator	40 kW wind generator at 9 m/sec Cut in speed of 3.5 m/sec Cut out speed of 18 m/sec	40 kW peak 18.3 kW average nearby site
Batteries	125 Volts 62 cells 2.1 Volts per cell in series	500 Ampere Hours
Water Pump	Total head 45 meters Discharge 11.6 liters per sec	15 hp (11 kW)
Pump Motor	125 Volt d.c. permanent magnet	20 hp (15 kW)
Panelboard	125 Volts, 50 Amperes	
Storage Tank* for Irrigation Water	Elevation of the bottom of the tank is 10 meters above well outlet	600 m^3

NOTE:* = Existing 200 m^3 water storage tank is sufficient to store potable water for 8 days, including 20% loss allowed for evaporation.

LOAD FORECAST: SIDI BOUNOUAR

IRRIGATION, POTABLE WATER AND ELECTRICITY

ITEM	CONDITIONS		CAPACITY REQUIRED (KW)
Water Pump	Total Head	45 meters	
	Pumping Rate =	11.6 liters per sec	Pump = 15 hp Motor = 15 kW
Lighting	20 houses, 4-20 watt fluorescent lamps per house	80 watts each	Total Load 1.6 kW
Auxiliary Power	One blender	1.0 kW	Total Load
	Battery charging	1.0 kW	2.2 kW
	Lighting	0.2 kW	

NOTE: (1) Existing 200 m^3 water storage tank is adequate to store water for 8 days, including 20% loss allowed for evaporation.

(2) A 600 m^3 water storage tank is proposed to store water for irrigation.

SYSTEM OPERATION FOR IRRIGATION PUMPING AT SIDI BOUNOUAR SITE

EQUIPMENT	MODE OF OPERATION
Wind Turbine Generator	Automatically starts or stops at cut in or cut out wind speeds.
Water Pump	The water pump is operated manually by a pump control switch. The switch can only be closed for operation when the wind speed exceeds 6 meters per second and the water level of the storage tanks are below preset level.
Storage Tank (Potable Water)	Existing 200 m^3 water storage tank should always be maintained at high level. The water can never be used for irrigation.
Storage Tank (Irrigation)	The tank should be filled up before the irrigation starts.
Lighting	5 hours per day. When necessary, the operating time or the number of lamps used should be reduced.
Batteries	The batteries will not supply loads when its specific gravity is below preset value. The specific gravity can be read from an indicator installed at pilot cell.
Auxiliary Power	Auxiliary power can be used when the water pump is not in operation and the batteries are in fully charged condition (indicated by specific gravity).

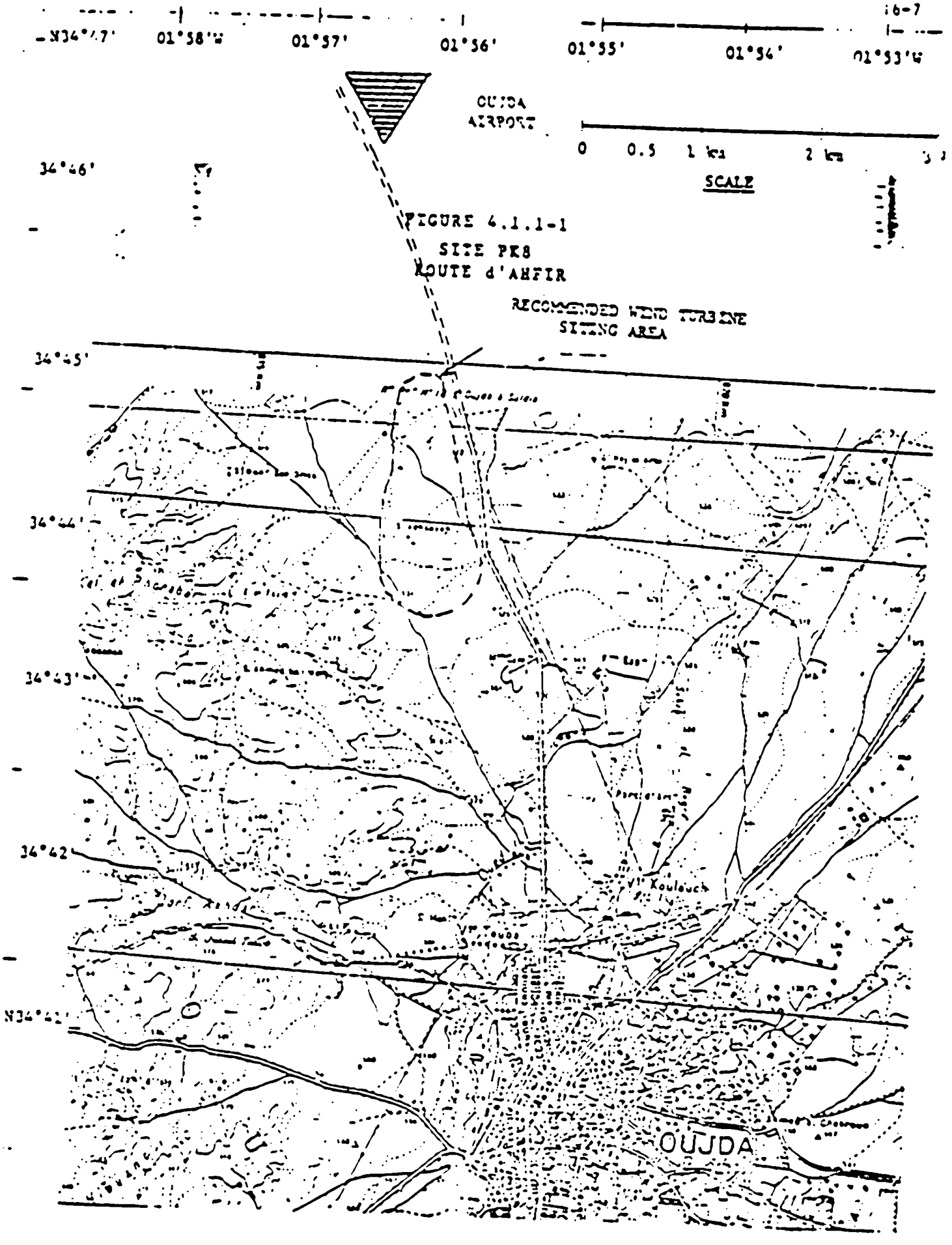


FIGURE 4.1.1-1
SITE PK8
ROUTE d'AHFIR

RECOMMENDED WIND TURBINE
SITING AREA

LIST OF EQUIPMENT FOR POTABLE WATER AT PK-8 ROUTE d'AHFIR SITE

EQUIPMENT	TECHNICAL INFORMATION	CAPACITY
Wind-Turbine Generator	40 kW wind generator at 9 m/sec Cut in speed of 4.5 m/sec Cut out speed at 17.5 m/sec 3-phase, 208 Volt, 50 Hertz synchronous generator	40 kW peak 13.97 kW Average at Site
Water Pump (Lift)	Total head = 80 meters Discharge = 5 liters per sec	10.8 hp (8 kW)
Pump Motor (Lift)	3-phase, 50 Hertz, 208 Volt Wound rotor motor Variable speed, Variable output	13.5 hp (10 kW)
Pump - (Distribution)	Total head = 30 meters Discharge = 5 liters per sec	4 hp (3 kW)
Pump Motor (Distribution)	3-phase, 208 Volt, 50 Hertz Squirrel cage motor	5 hp (4 kW)

LOAD FORECAST FOR POTABLE WATER AT PK-8 ROUTE d'AHFIR SITE

ITEMS	DESCRIPTION
Present Requirement	5 liters per sec - discharge, 12 hours operation $216 m^3$/day
Water Storage	4 - tanks 100 m^3 each Total 400 m^3 with 15% evaporation loss Total capacity (net) 340 m^3 Good for 1.6 days (normal use) 2.0 days (emergency conditions)
Pumping Capacity	With adequate wind power supply, 24 hours operation. Daily pumping capacity at discharge rate 5 liters per sec = 432 m^3/day. Daily operation - supplies daily use and 50% of storage

OPERATION FOR POTABLE WATER SYSTEM AT PK 8 ROUTE d'AHFIR SITE

EQUIPMENT	METHOD OF OPERATION
Wind Turbine Generator	Automatically starts or stops at cut in or cut out wind speeds.
Lifting Pumps	With the automatic control device provided, the motor can be operated as long as the wind turbine generator is in operation. The motor is variable speed and regulates pump output according to the output of the wind generator.
Distribution Pumps	The motor is a regular 3-phase type with a special starting device to minimize the starting current. Manually controlled. It can be connected to the system when the wind speed exceeds 6.0 meters per second. If it is necessary to operate at a lower wind speed, the motor can only be operated when the lifting pump is shut down.

LIST OF EQUIPMENT FOR RABT TEHTAN:: SITE AT OUJDA

ITEM	TECHNICAL INFORMATION	CAPACITY
Wind Turbine Generator	10 kW wind generator at 9.1 m/sec Cut in speed of 2.7 m/sec Cut out speed of 23 m/sec	10 kW peak 3.1 kW average at nearby site
Photovoltaic	125 Volts (Batteries are commonly installed)	1 kW
Batteries	62 cells, 2.1 Volts per cell in series	400 Ampere Hours
Pump	Head = 50 meters Discharge = 2 liters per sec	2.7 hp (2.0 kW)
Pump Motor	125 Volt d.c. permanent magnet	3.4 hp (2.5 kW)
Lighting	For pump house use 2 - 40 watt lights	80 watts

LOAD FORECAST FOR RABT TEHTANI SITE AT OUJDA

TIME FRAME	LOAD
Present Condition	• 8 hours per day operation • Discharge = 2 liters per sec • Total water consumed = 57.6 m^3/day Storage tank 40 m^3
Future Load	• Normal Conditions • Total Water Consumption 7.2 m^3/hour 57.6 m^3/day • Calm wind day and cloudy day. • Total water consumption 40 m^3 (Limited by the capacity of storage tank) • Total Power Load Normal conditions Water pumped 57.6 + 40 = 97.6 m^3/day Electric Power consumed 34 kWh/day • Calm wind day or cloudy day. Water pumped - 40 m^3 Energy consumed = 14 kWh/day

ANNEX 17

Site Descriptions - Small Hydro

Part 1 : Tabant-Ait Imi

Description : Tabant-Ait Imi is in the Bou Guemez valley on the northern slope of the central High Atlas, at an altitude of 1860 meters and about 74 km south of the provincial capital of Azilal. The rich, well-watered valley supports widespread and intensive agriculture which provides the basic ingredients for a very prosperous local economy combining agriculture with the regionally more traditional pastoralism. The valley is four hours'drive by dirt road from Azilal, over a pass closed by snows at least for two months each year. The total population of the Ait Bou Guemez valley is about 10,000 spread among 25 villages and hamlets. Tabant-Ait Imi consists of 3 separate hamlets in 182 households totalling 1,117 people. It is the primary administrative center of the valley. The caid's office is located there, as well as a primary school, a souk, a post and telephone office, a dispensary and a local office of the Forest Service.

About 3,000 ha of land are irrigated in the valley by irrigation canals gravity fed from hillside springs and the river. Principal irrigated crops are potatoes and forage and corn for animal feed. Potatoes are raised as a commercial crop and sold during harvest. Walnuts and apples are another important source of cash income. The souk at Tabant is the principal market valley and one of the most important souks in the central High Atlas.

Animal and human power are used for agricultural and pastoral tasks. Water power is used for cereals grinding in small mills. There are no diesel installations and few motor vehicles in the area. Domestic uses of energy include those typical for the Atlas. Wood and charcoal are used mainly for cooking and heating. Butagas is used for lighting and cooking, and candles and kerosene are used for lighting. There is no electricity now being generated in the valley and there are no reports of any past attempts to generate electricity.

Two 50 kilowatt electric generation units will be installed at an estimated total cost of $ 222,000 ($ 67,000 for equipment and $ 155,000 for civil works.)

Water : The rivers in the vicinity of the site are spring fed. The proposed water source for power generation is a spring which discharges into a small tributary above the village of Ait Imi. There is sufficient water for power generation the year round.

Socio economic Factors : The project to electrify Tabant-Ait Imi is considered sociologically acceptable. No negative impacts are foreseen as a consequence of the project. There is no indication that an inequitable financial burden will be placed upon the users of the project.

The local economy is sufficient to absorb the costs of electrification and even support modest investments in electrical applications which should expand the economic base.

Cmain found that Tabant Ait Imi offered a combination socio-economic and ecological conditions which make it an attractive site for the small-hydro electrification project. The valley as a whole has a solid economic base which includes cash income. There is high interest and strong support for the project among a broad cross-section of area residents, government officials and local leaders. There is considerable movement in and out of the valley making it accessible and open to innovative outside influences which could lead to commercial as well as domestic applications of electricity. Agricultural extension agents make regular visits to the valley and merchants from urban areas regularly come to purchase potatoes. The road to Azilal provides fairly reliable access for 10 months of the year. There should thus be few obstacles to carrying out studies to monitor the effects of electrification and to necessary repairs and maintenance operations for the physical plant and transmission lines. Tabant will serve an important role as a demonstration project having potential replicability within the valley and in broadly similar settings in other remote areas. Tabant is typical of at least 6 other possible sites for small hydro installations in the Ait Bou Guemez valley and many more sharing a similar economic and cultural base and depending on spring water sources through the High Atlas and Middle Atlas Mountains. Tabant's resource base offers a range of economic possibilities that might be realized through the use of electricity. Development possibilities are foreseen especially for the agricultural sector and a modest tourist industry.

Possibilities for agricultural applications include potato storage, cereal grain processing and irrigation water pumping. Small scale commercial applications are expected to occur based on existing resources and needs. Refrigeration for meat is an immediate application. A repair shop with an arc welder and power tools for woodworking operations, including furniture making are further applications. A small tourist industry might be developed to take advantage of the lush valley setting in summer and skiing in winter.

The provincial government intends to carry out an integrated development program including road construction, agricultural and forestry activities and tourism development all of which will benefit from the introduction of electricity. The program is now being reviewed for inclusion in the 1981-85 Five Year Plan.

Present GCM plans call for the generating and transmission facilities, once installed, to be under the supervision of the Ministry of Interior through local authorities. A trained technician from ONE will be permanently resident at the site and responsibilities will also include collecting customer revenues. ONE will provide any additional special technical assistance as needed. Institutional arrangements planned for operating, maintaining and administering the facility are the responsability of the local collectivity - the caid'office. The local community will not be required to provide the

technical expertise necessary and no difficulties are foreseen in adapting to the planned institutional structure.

A local extension office of the Ministry of Agriculture will be established at Tabant in 1981. This office will be able to provide advice in introducing new and improved production techniques and agricultural processing. Improved water and land management techniques and the expansion of irrigation through electrically operated pumps can help expand and improve agricultural production and thus contribute to the broader economic base of the valley.

Electricity will improve the health of the community through provision of refrigeration, sterilization, lighting and hot water to the health care clinic. It will also provide a small amount of power for commercial and small scale business activities ; power for a grist mill, lighting for shops and refrigeration for foods. The improvement in education through lighting, TV and radio will also be felt. Lastly a higher standard of personal confort and more recreation activities will be promoted. The broad range of potential benefits and the positive local view toward electricity indicates that there is strong community interest in the project and a willingness to participate.

When weighed against anticipated benefits of project development, the reasonably foreseeable environment impacts are not considered cause of significant environmental harm.

Part 2 : Msemrir

Description : At an altitude of 2000 m., Msemrir is on the southern slope of the Central High Atlas Mountains in Ouarzazate Province. It consists of villages totalling 200 households with 1.200 inhabitants. Msemrir is a commune center, includes a primary school, a dispensary, a commune court, an office of the Forest Service and a souk. Electricity is now being generated by a diesel engine from 6 pm to 11 pm to light the administrative center, streets and 50 private houses. The diesel generator is not reliable and has an history of breakdowns every 2 to 3 months.

The local economy reflects the long standing prominence of traditional pastoralism and the growing importance of agriculture and contributions from migrants. Intensive irrigated agriculture is practised. The amount of land now under irrigation is estimated as 200 hectares for Msemrir center and 150 hectares for the commune. Local officials estimate that there are an additional 50 hectares in Msemrir center and 200-400 ha in the commune overall which could be brought under irrigation with pumping. Agricultural production consists of wheat, barley, walnuts, potatoes and apples.

Present energy sources include electricity as well as the traditional human and animal power. When available, electricity is used for home, administrative and domestic lighting and for television and radios. Domestic uses of energy are typical. Wood and charcoal are used primarily for cooking and heating, butagas for lighting and cooking, and candles and kerosene for lighting. There are 5 diesel powered grist mills in the commune ; two of these are in the center of Msemrir, and all are privately owned. At least one householder in the commune has installed his own small gasoline engine to pump well water for domestic, animal and irrigation purposes.

Water :Water availability could present a problem if the river were the only source. During the summer dry season river flow is reduced substantially. CTMain suggested that possibly improved water management techniques in conjunction with pumping could make more efficient use of what river water is available and that several springs in the general area might also be used for irrigation water pumping. The smaller hydro installation recommended by Grower, however, places less demand on available water than does the installation recommended by CTM, and a USAID engineering review concluded that with proper design power can be provided reliably throughout the year without conflicting with other water uses.

The land to be used for the unit and the canals is collective land under State control, and questions of expropriation or compensation do not therefore arise. There is an abondance of water in relation to crop demands. The project will not in any way interfere with irrigation.

Socioeconomic Factors : Msemrir offers a combination of socioeconomic conditions which should make it a good pilot site for the research, demonstration and replicability and economic development goals for the

small hydro program. Investments in commercial or industrial applications for electricity are expected to accompany the project. Msemrir has an economic base which includes cash income and a portion of this is expected to be available for investment.

There is a high interest and strong support for the project among area residents, government officials and local leaders. Msemrir is now served by a small diesel generator which, when working, meets only a fraction of the potential load. The demand for additional power is clear. The 1981-85 development plans for the area proposed by the provincial government include several commercial and industrial projects which would add to the load. Symbols of locally available capital to make commercial investments are visible in new house construction and reflect the remittances of migrants. There are also reports that migrants have significant amounts of capital to invest in new business once elctricity becomes more available.

The fairly good condition of the road allows for relatively easy year round access.

The resource base at Msemrir offers good options for development, especially when considered in conjunction with government proposals included in the 1981-85 Five Year Plan. Opportunities are foreseen for agricultural and pastoral applications of electricity and in a range of small scale commercial and service industries, including tourism.

Present marketing channels include the local souk and souks at nearby major towns along the main highway.

The settlement pattern at Msemrir makes electrification very practicable. All 5 douars are compact settlements and within a 1 to 1,5 km radius of each other and the site for the proposed power plant.

Electricity will improve the health of the community through provision of refrigeration, sterilization, lighting and hot water to the health care clinic. It will also provide a small amount of power for commercial and small scale business activities ; power for a grist mill, lighting for shops and refrigeration for foods. The improvement in education through lighting, TV and radio will also be felt. Lastly a higher standard of personal comfort and more recreation activities will be promoted. The broad range of potential ben fits and the positive local view toward electricity indicates that there is strong community interest in the project and a willingness to participate.

Various agencies of the GOM plan to undertake development activities in the Msemrir area, particularly in agriculture and small agriculture-related industry. Efforts will be made to coordinate these activities for optimum use of available electricity through the local and provincial authorities. The Ministry of Agriculture plans to establish an extension center in Msemrir later in 1981. Its major responsabilities will be irrigation pumping and expanding and improving agricultural production and livestock management practices. The potential impact

of this type of technical assistance can be considerable. Irrigation pumping can have a major role in improving water management on land now irrigated and in expanding the land under intensive cultivation.

Emigrant workers - those who have left the area to work in urban areas in Morocco and Europe and repatriate their earnings - are a likely source of cash for investments, market outlets, business management skills and technological innovation. Efforts will be made to encourage their active participation in the development of the area.

Present plans call for the generating and transmission facilities to be under the supervision of the Ministry of the Interior. A ONE trained technician will be permanently resident at the site and responsabilities will probably also include collecting customer revenues. ONE will provide any additional special technical assistance as needed.

Institutional arrangements planned for operating, maintaining and administering the facility already have their basic foundation in the caid's office. The local community will not be required to provide the technical expertise needed and no difficulties are foreseen in adapting to the planned institutional structure.

The proposed project will not require relocation of any housing or other existing structures and is not expected to have any negative impact on downstream users of water. When weighud against anticipated benefits of project development, the reasonably forseeable impacts are not considered to cause any significant environmental harm.

Part 3 : Arhbalou-n-Kerdouss

Description : Arhbalou-n-Kerdouss is at an altitude of 1600 m. on the southern slope of the central High Atlas Mountains in Errachidia Province. The site is 51 km and about 2 hours by dirt road from the main highway and is accessible throughout most of the year. It consists of 3 settlements about 3/4 Km apart in a short broad upland valley. The population is about 1,000 people in 178 households.

Arhbalou is the commune center and the seat of a newly established caid's office. Public services include a primary school, a post and telegraph office, a dispensary, administrative-center, and a newly built agricultural extension center. This center will provide agricultural advisory services to local farmers and may assume some of the responsability of regulating the delivery of irrigation water. Potable water is obtained from wells and from the spring feeding the irrigation system. There is no local souk and no electricity. The local economy is based on pastoralism and agriculture, with support from remittances from emigrants.

Rain fed cereal culture is practiced as well as intensive irrigated agriculture. Principal crops are corn, barley, alfa and vegetables. Little wheat is raised. An estimated 186 hectares of commune land are now irrigated and 40 hectares more, could be irrigated. The size of irrigated holdings varies considerably by family, but an average holding of 1/2 ha per family is probably accurate. Cash income is derived from the sale of livestock and some of its by-products (raw wool, hides) and remittances from family members who have emigrated.

Patterns of energy sources and use are typical. Wood and charcoal are used for cooking and heating, butagas for cooking and lighting and candles and kerosene for lighting. There are 7 privately owned diesel grist mills for grinding barley and corn in the commune. There is no local use of hydropower.

A generation capacity of 250 kilowatts will be installed at a total cost of $ 446,000 ($ 386,000 for equipemnt and $ 60,000 for civil works).

Socioeconomic Factors : Arhbalou-n-Kerdouss offers a combination of socio-economic conditions which should make it a good pilot site for the research, demonstration and replicability and economic development goals of the small hydro program. Investments in commercial or industrial applications for electricity are expected to accompany the project. Arhbalou-n-Kerdouss has an economic base which includes cash income and a portion of this is expected to be available for investment. Local interest and support are strong and

the project is seen as providing the only viable possibility for electrification within the near future. Potential uses for the power foreseen by local officials include the usual lighting and recreational applications (TV and radio), and the commercial applications of irrigation water pumping corn and barley grinding, lighting for local shops, and possibly fig drying and olive oil pressing plants. In addition, it is reported that a summer camp for children will be established in the valley by the government.

Access to modern technology is primarily via migration and visits to larger towns and cities by local residents. Migration is an important source of exposure to modern technology and helps chape local attitudes toward technological innovation. The newly constructed agricultural extension center will also be an important avenue of access to innovation when it begins operations.

Access to the site for project monitoring, demonstration and maintenance and operations purposes should not present any major difficulties.

The existing agricultural and resource base offers some possibilities for small applications of electricity which would help to broaden the local economic base. Other small scale application are seen for local service businesses such as welding and vehicle repair.

Marketing channels for Arhbalou-n-Kerdouss now exist with the nearby large towns and good roads provide access to provincial capitals and the large commercial centers.

Water : The spring which will provide the source of water for the hydro facility is also the source for the extensive irrigation system serving the three valley communities. Engineering plans call for placement of the powerhouse at the foot of the slope below Arhbalou-n-Kerdouss village.

There are no detailed hydrologic data for the site. However, preliminary estimates suggest that there could be occasions when the power plant might not be able to generate power 24 hours per day if water is required for Arhbalou.

Power reductions would be only occasional and are not seen as serious enough to jeopardize capital investments in electrical applications.

The present water calendar management system seems to be functioning well and is an indication of the local abilities to organize and manage effectively.

A socioeconomic study of Arhbalou-n-Kerdouss in December 1980 recommended that water use for electricity generation be carefully planned so as not to interfere with its use for irrigation, particularly in the summer; and that the local authorities review with the population the project plans to assure them that installation of the pilot unit will not conflict with irrigation.

The small hydro installation will not only not conflict with irrigation needs, but will help satisfy them. The unit as designed will provide for using a portion of the electricity generated to pump part of the water which has passed through the turbine back up to top of the irrigation network for re-use. This will allow irrigation of a larger area than has so far been possible with simple gravity irrigation.

Questions of responsability for financing, installation, management, repair and maintenance of the small hydro facilities appropriate GOM authorities : (Ministry of Interior, are now being reviewed by the/Ministry of Energy and Mines and the Office National de l'Electricité). Clear assignment of responsabilities for these matters and a firm commitment to carry them out will be conditions precedent for AID procurement of any small hydro equipment for this project.

Before construction begins at the site, the proposed pilot installation design will be reviewed with the local authorities and beneficiary population at a public meeting so that the advantages, disadvantages, water and land requirements, and the extent of local responsabilities for the installation can be fully aired. The pilot unit will not be installed without full local acceptance.

Present plans reportedly call for the generating and transmission facilities to be under the supervision of the Ministry of the Interior. an ONE trained technician will be permanently resident at the site and their responsabilities will probably also include collecting customer revenues. ONE is supposed to provide any qdditional special technical assistance as needed.

The institutional arrangements planned for operating, maintaining and administering the facility already have their basic foundat' 1 present with the caid's office. The local community will not be required to provide the technical expertise necessary and no difficulties are foreseen in adapting the planned institutional structure.

Widening the present canal from the intake will take a small amount of irrigated land, but careful planning should avoid unnecessary destruction of valuable land. Construction of the rest of the canal structures, storage tank, powerhouse and tailrace will also require a minimal amount of land taking. However, this land is not used for agricultural or residential purposes. The project is not expected to disturb any present housing.

To date, there is no evidence of critical habitat, rare or endangered species occurring within the vicinity of the Arhbalou-n-Kerdouss site. The Ministry of Water and Forests will provide comment in this area once the precise location and the extent of development are known.

When weighed against anticipated benefits of project development, the reasonably foreseeable impacts are not considered cause of significant environmental harm.

ANNEX 18

PORTABLE PHOTOVOLTAIC PUMPS

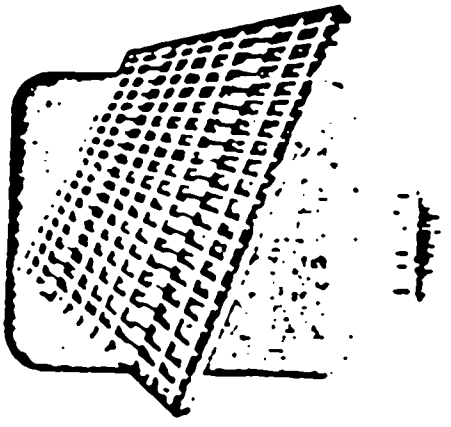
The attached description is provided by one of a number of firms manufacturing portable photovoltaic pumps. It produces a 250 watt unit which pumps 40 gallons per minute at 15 feet - enough to yield 60-80 cubic meters per day and irrigate 1-4 hectares, depending on the crop, soil and climate. The cost, now at about $6000, is projected to drop significantly during the next five years.

Generating electricity directly from sunlight

A new day is dawning in which electricity will be as abundant as sunshine. Sunlight striking photovoltaic (p.v.) cells causes current to flow and power to be generated.

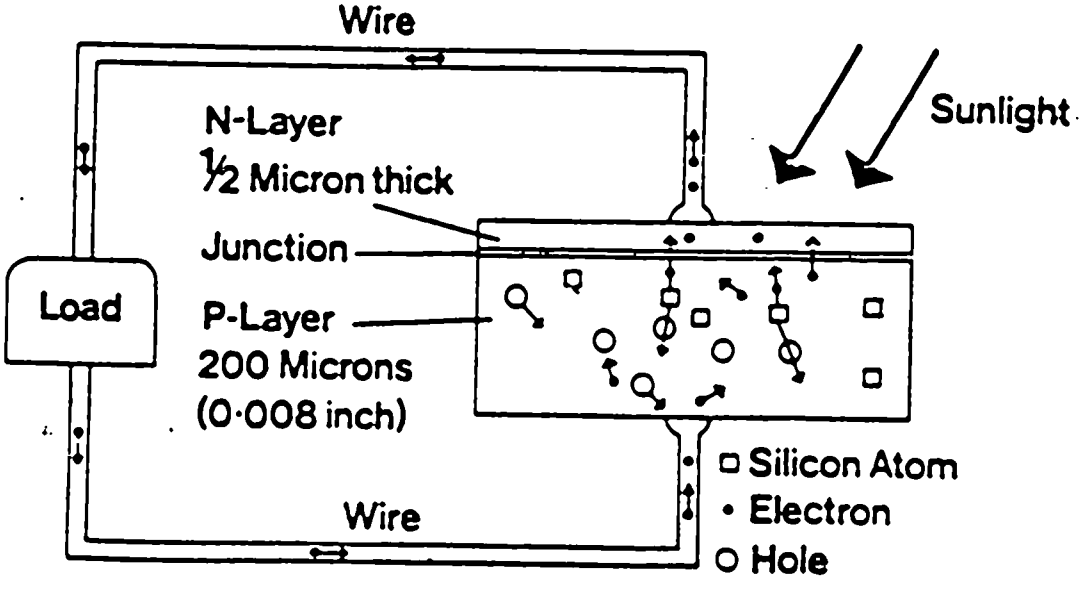
Photovoltaic systems differ from other forms of power generation in that the efficiency does not depend on system size. Because there are no "efficiencies of scale" in photovoltaics, this has become the most suitable source for small, widely distributed, power requirements.

This new approach to power generation has, in the past, been expensive. Through careful market analysis and imaginative engineering Solar Electric International has identified and developed applications that are economic now.



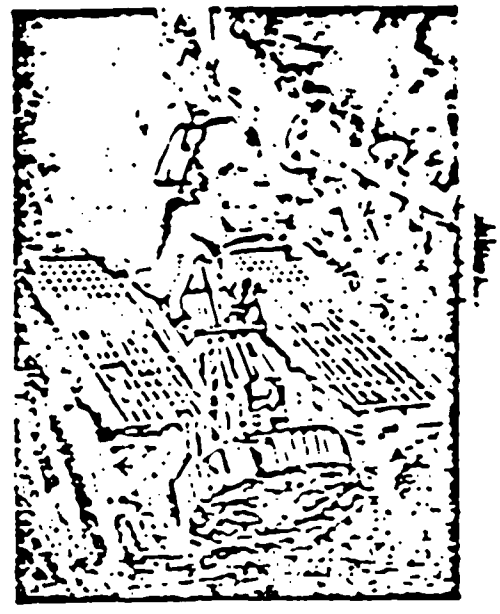
How does a solar cell work?

The basic concept is simple. A solar cell is made of two very thin layers of semiconductor material normally silicon. These are mixed with other materials to give one layer a negative electrical bias (n-bias, an excess of electrons), and the other layer a positive bias (p-bias, a deficiency of electrons). Terminals of an external circuit are attached to the front and back of the cell. Sunlight reaches the junction between the two layers in the form of photons of energy and knocks electrons across the junction. This leads to a current which can be drawn through the external circuit to return to the other side of the junction. If a load, such as a d.c. electrical motor, or a light bulb is placed in the circuit, it will be operated by the current. Thus sunlight is directly converted into electricity. This should not be confused with a thermal process, and no heat transfer is involved.



Photovoltaic power applications

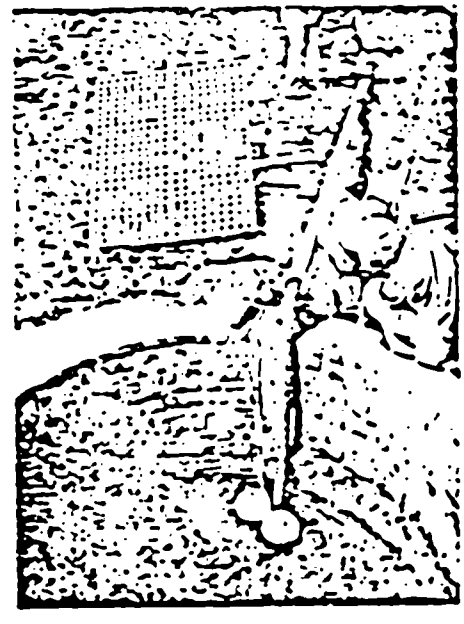
Past



Solar electric power systems were developed in the early 1960's to provide on-board electrical power for satellites and spacecraft. In outer space, they have functioned superbly, far from any possibility of maintenance, year after year.

In the early 1970's photovoltaics started to "come down to earth". As lower cost manufacturing techniques were developed, a small number of applications were recognized as being the first of man's earthly needs which could be economically served by solar energy. These applications, typified by microwave repeater stations and offshore navigational buoys, were all at remote locations requiring strictly limited quantities of energy.

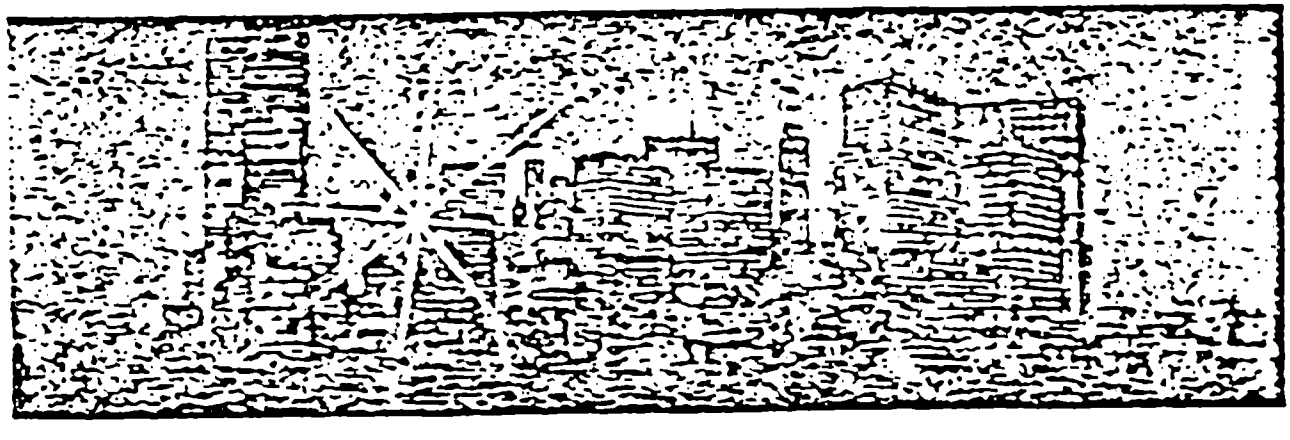
Present



As fossil fuel costs continue to rise and photovoltaic costs to fall, solar electric power is rapidly becoming economic for a far wider range of applications. Amongst the most promising of these are water pumping systems, remote lighting and power packs for the needs of non-electrified villages. Solar Electric International has available, or under development, a considerable number of devices ranging from micro-irrigation systems and battery chargers, through refrigerators and educational TV sets, to handheld agricultural implements such as crop sprayers and weeders.

Future

In the future, as the costs continue to decrease, the use of photovoltaics will become justified for large-scale electrical generation. However, for the 1980's, the guiding principle of solar electricity will continue to be "Small is Sensible"!



Solar Electric International

- ★ World leader in photovoltaic powered water pumping technology
- ★ Unmatched capacity in photovoltaic system design and engineering
- ★ Wide experience in international development and installations

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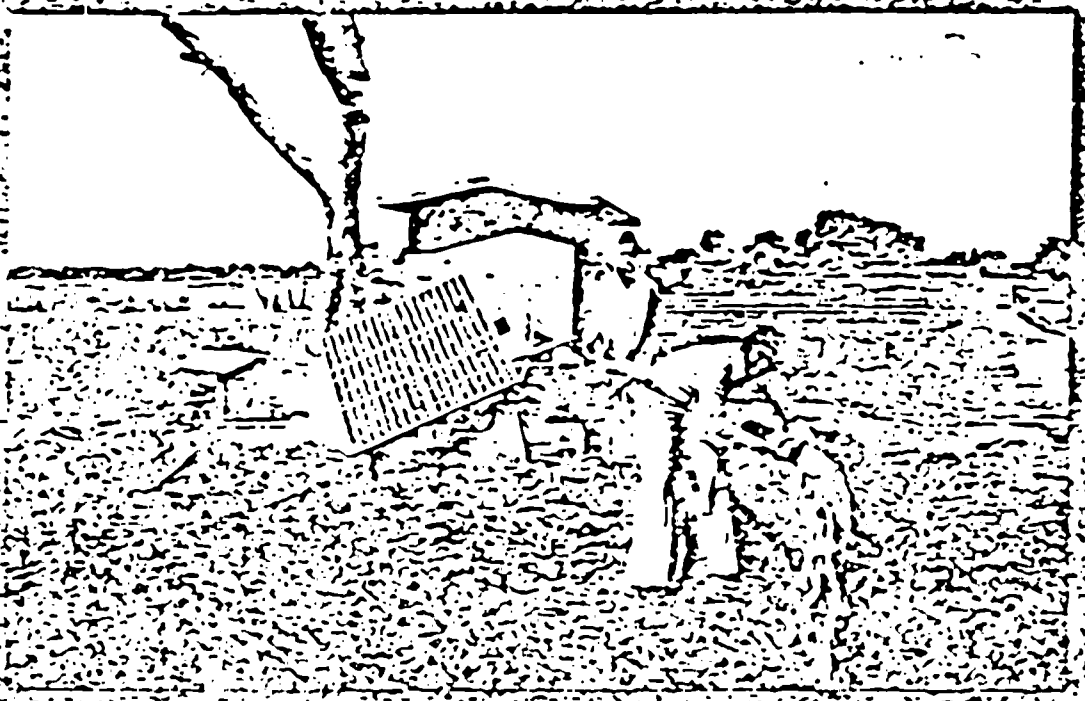

IN TECHNOLOGY SIMPLICITY IS

Solar Electric International

SEI-250 Portable Sun Pump

CONCEPT

Over 50 million of the world's poorest farm families exist on less than 50 million hectares (125 million acres) in the fertile alluvial valleys, deltas and coastal plains of the Third World. Most of these areas experience extended dry seasons during which cropping is impossible without irrigation, but adequate irrigation is frequently either unavailable or beyond the financial means of a small farmer.

The SEI-250 Sun Pump is a solar-powered water pumping system which can dramatically alter the irrigation options open to these farmers. The unit has been specifically designed to supply irrigation water to farms of 1 to 4 ha., depending on lift and cropping pattern, where conventional methods are inappropriate or becoming prohibitively expensive.

DESCRIPTION

The lightweight, portable Sun Pump is a self-contained system comprising a 250-watt photovoltaic array, a pumpset, a Maximum Power Controller (MPC) and a mounting frame. The entire unit can be easily moved from house to field or from one water source to another; its simple operation and low maintenance make it particularly well suited for use in rural areas and in other places not served by an electric grid. The MPC is an electronic device which matches the pumpset load to the power available from the solar array under varying conditions of insolation (sunshine). This raises the efficiency and maximizes the yield of the system, ensures good start-up capability and, within a broad range, varies the speed of the pump to maximize output when either insolation or lift conditions diverge from the base values for which the equipment was designed.

The Sun Pump available today is optimized to yield 2.5 liters/second at a lift of 4.5 meters (40 gpm at 15 ft.). Solar Electric International pumps with larger yields and lower/higher lifts are being developed and will be available in the near future.

OPERATION AND MAINTENANCE

The SEI-250 Sun Pump is quiet, safe and simple to operate. The user merely places it in the proper south-facing direction in the morning, lowers the pumpset and switches the unit on. If he does not intend to move the Sun Pump daily he leaves the switch on; the unit will automatically turn on and off as the sun rises and sets.

Routine maintenance involves occasional water rinsing to remove any accumulated dust or dirt. The array should have a trouble-free lifetime of 15 years, while the pumpset should last 7 - 8 years.

FEATURES AND SPECIFICATIONS

ARRAY

Rugged, high-reliability, easily maintained
Outer surface protected by tempered glass which provides high transmittance
Peak power 250 Watts*
Open circuit voltage 125 Volts*
Short circuit current 2.5 Amps*

FRAME

Sturdy frame supports the array, allows proper orientation to the sun and facilitates transportation of unit

PUMPSET

Submersible, high efficiency variable voltage/variable speed
Nominal operation 3000 RPM at 60 Volts DC
Brushless permanent magnet design eliminates need to unseal motor for periodic maintenance
Vertical axis single-stage centrifugal pump close-coupled to motor
High impact plastic impeller and casing
Integral flotation device
Optimized for high-flow, low-head canal and open well conditions

MAXIMUM POWER CONTROLLER

Safe operation to 325 Watts
Output limits 5 Amps, 5 Volts
Electronically matches pumpset load to available array power under all conditions, using pulsewidth modulated downconverter with integrated circuit logic

PERFORMANCE

Head / Discharge*	Meters			Feet		
	2	4	6	6	12	18
Liters/sec	3.5	2.75	1.5			
M^3/hr	12.6	9.9	5.4			
US Gal/min				60	48	26
Acre-in/hr				14	11	.06

* Under typical field conditions (95 mw/cm² insolation, 30°C ambient temperature)

SOLAR ELECTRIC INTERNATIONAL

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SOLAR ELECTRIC INTERNATIONAL

SCHEDULE OF CURRENT AND INDICATIVE FUTURE PRICES* FOR SEI SUN PUMPS

SEI-250	Year					
	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
No. of Units	(U.S. Dollars)					
1-10	$5,250	$3,950	$2,650	$2,150	$1,650	$1,250
11-20	4,750	3,600	2,650	2,150	1,650	1,250
21-50	4,250	3,250	2,650	2,150	1,650	1,250
51-100	3,750	3,000	2,500	2,150	1,650	1,250
101-200	3,450	2,750	2,300	1,900	1,650	1,250
201-500		2,650	2,200	1,825	1,450	1,125
501-1000			2,150	1,750	1,300	1,025
1001-2000				1,650	1,275	950
2001-5000					1,250	925
5001-10,000						900

SEI-500						
1-10	$7,000	$5,500	$4,000	$3,000	$2,350	$1,850
11-20	6,500	5,100	4,000	3,000	2,350	1,850
21-50	6,000	4,750	4,000	3,000	2,350	1,850
51-100	5,500	4,500	3,750	3,000	2,350	1,850
101-200	5,200	4,250	3,550	2,775	2,350	1,850
201-500		4,150	3,450	2,700	2,150	1,725
501-1000			3,400	2,625	2,000	1,625
1001-2000				2,550	1,900	1,550
2001-5000					1,850	1,500
5001-10,000						1,475

*1980 $ ex-factory

April, 1980

ANNEX 19

MOROCCO: ECONOMICAL AND SOCIAL DATA

U.S. OVERSEAS LOANS AND GRANTS – OBLIGATIONS AND LOAN AUTHORIZATIONS
(U.S. Fiscal Years – Millions of Dollars)

COUNTRY MOROCCO

PROGRAM	FOREIGN ASSISTANCE ACT PERIOD					TOTAL LOANS AND GRANTS 1946-70	REPAYMENTS AND INTEREST 1946-70	TOTAL LESS REPAYMENTS AND INTEREST 1946-70
	1966	TQ	1967	1968	1969			
I. ECONOMIC ASSISTANCE – TOTAL	65.1	4.0	24.0	30.2	27.2	980.2	290.2	690.0
Loans	24.0	-	4.4	8.0	9.7	515.7	290.2	225.0
Grants	40.2	4.0	18.6	27.4	17.5	465.9	-	465.0
A. AID and Predecessor Agencies	30.3	0.5	2.1	16.0	4.1	391.9	213.4	178.5
Loans	13.0	-	-	-	-	341.5	213.4	128.1
Grants	1.3	0.5	2.1	16.0	4.1	50.4	-	50.4
(Economic Support Fund)	-	-	-	-	-	71.1		
B. Food for Peace (P.L. 480)	49.3	2.0	23.1	24.5	20.9	568.9	76.8	490.1
Loans	11.0	-	4.4	8.8	9.7	173.7	76.8	96.9
Grants	37.2	2.0	15.1	15.7	11.2	393.2	-	393.2
Total Title I Sales Agreements	11.0	-	8.1	8.8	9.7	173.7	76.8	96.9
Repayment in U.S. Dollar Loans	11.0	-	8.1	8.8	9.7	122.5	42.7	79.8
Payment in Foreign Currency, Retained for Country Use	-	-	-	-	-	51.2	34.1	17.1
Title II Food Grants	37.2	2.0	15.1	15.7	11.2	393.2	-	393.2
Grants Based Under Section 32 World Food Program	4.7	-	-	-	-	145.5	-	145.5
Voluntary Relief Agencies	36.5	2.0	15.1	15.7	11.2	267.7	-	267.7
C. Other Economic Assistance	1.6	2.7	1.6	1.7	2.2	21.6	-	21.6
Loans	-	-	-	-	-	-	-	-
Grants	1.6	2.7	1.6	1.7	2.2	21.6	-	21.6
Peace Corps	1.6	2.7	1.6	1.7	2.2	21.6	-	21.6
Other	-	-	-	-	-	-	-	-
II. MILITARY ASSISTANCE – TOTAL	36.9	0.2	30.0	44.2	46.1	290.3	94.9	195.4
Credits or Loans	13.8	-	30.0	43.0	45.0	234.4	94.9	139.5
Grants	4.9	0.2	0.6	1.2	1.1	55.9	-	55.9
A. MAP Grants	-	0.2	-	-	-	29.6	-	29.6
B. Credit Financing FMS								
C. Military Assistance Service Funded (MASF) Grants	30.0	-	30.0	43.0	45.0	234.4	94.9	139.5
D. Transfers from Excess Stocks	4.9	-	0.1	1.2	1.1	14.4	-	14.4
E. Other Grants	-	-	-	-	-	11.9	-	11.9
	-	-	-	-	-	-	-	-
III. TOTAL ECONOMIC AND MILITARY ASSISTANCE	70.3	4.2	57.0	80.4	73.3	1270.5	385.1	885.4
Loans	34.7	-	39.4	51.0	54.7	749.6	385.1	364.5
Grants	21.2	4.2	19.6	29.4	18.6	520.9	-	520.9
Other U.S. Government Loans and Grants	5.3	0.4	24.1	-	7.0	178.2	155.6	22.6
A. Export-Import Bank Loans	31.0	-	11.1	-	7.0	88.8	55.6	33.2
B. All Other Loans	43.1	0.4	13.0	-	-	89.4	100.0	10.6-

* Less than $500,000

TQ – Transitional Quarter (7/1/76 – 9/30/76)

ECONOMIC PROGRAMS OF ALL DONORS
(Millions of Dollars)

A. ASSISTANCE FROM INTERNATIONAL AGENCIES – COMMITMENTS

	FY 1969	FY 1970	FY 1971	FY 1966-70
TOTAL	96.0	430.4	193.5	1633.9
IBRD	81.1	407.0	166.0	1421.9
IFC	1.2	13.2	16.5	44.4
IDA	0.0	0.0	0.0	50.0
IDB	0.0	0.0	0.0	0.0
ADB	0.0	0.0	0.0	0.0
AFDB	9.0	0.0	0.0	26.0
UNDP	6.7	9.9	5.0	51.9
OTHER-UN	0.0	2.3	4.0	13.3
EEC	0.0	0.0	24.0	26.0

B. BILATERAL OFFICIAL DEVELOPMENT ASSISTANCE

1. DAC COUNTRIES (Net Disbursements)

Donor	FY 1969	FY 1970	FY 1966-70
TOTAL	194.5	195.4	1494.1
U.S.	27.0	26.0	319.0
FRANCE	106.0	98.2	729.2
GERMANY	38.7	49.4	268.1
BELGIUM	14.3	15.6	77.6
CANADA	4.6	1.5	40.7
ITALY	1.8	2.1	31.7
OTHER	1.3	2.6	7.8

2. OPEC COUNTRIES (Net Disbursements)

	FY 1969	FY 1970	FY 1966-70
TOTAL	34.3	20.5	289.9

C. LOANS AND GRANTS EXTENDED BY COMMUNIST COUNTRIES

	FY 1969	FY 1970	FY 1966-70
TOTAL	2,089	-	2,320
USSR	2,000	-	2,100
EASTERN EUROPE	89	-	170
CHINA	-	-	55

ECONOMIC AND SOCIAL DATA

COUNTRY: MOROCCO

BASIC DATA

TOTAL POPULATION.. (THOUSANDS, MID 1980) 19,954

PER CAPITA GNP..... (DOLLARS, 1978) 670

AVERAGE ANNUAL PER CAPITA REAL GNP GROWTH RATE.. (1960-78) 2.5%

AVERAGE ANNUAL RATE OF INFLATION (1960-70) 2.2% (1970-78) 7.1%

NATIONAL INCOME RECEIVED BY LOW 20% OF POPULATION.. (1970) 4.0%

LIFE EXPECTANCY AT BIRTH, IN YEARS
(1978) TOTAL 55.4 MALE 53.8 FEMALE 57.0
(1968) TOTAL 50.4 MALE 49.0 FEMALE 51.8

ADULT LITERACY RATE (1971) TOTAL 21% MALE 34% FEMALE 10%
(1960) TOTAL 14% MALE 22% FEMALE 6%

AGRICULTURE

AVERAGE ANNUAL PER CAPITA AGRICULTURAL PRODUCTION GROWTH RATE (1970-1979) -2.8%

AGRICULTURAL PRODUCTION AS % OF GDP..... (1978) 18%

POPULATION DENSITY / SQ MI OF AGRICULTURAL LAND (1980) 255

LAND OWNED: (1973) BY TOP 10% 49.0% BY LOWEST 10% 1.0%

MAJOR CROPS:				ARABLE LAND	YEAR
SUBSISTENCE:	WHEAT	BARLEY		51%	(1979)
CASH:	WHEAT	ORANGES	SUGAR BEETS	29%	(1979)

MAJOR AGRICULTURAL EXPORTS: (1979) ORANGES TOMATOES

MAJOR AGRICULTURAL IMPORTS: (1979) WHEAT VEG. OIL SUGAR

PROPORTION OF LABOR FORCE IN AGRICULTURE..... (1978) 53%

CENTRAL GOVERNMENT FINANCES

TOTAL DOMESTIC REVENUES (% MILLIONS, U.S.)
(1976) 1,997 (77) 2,580 (78) 2,806

TOTAL EXPENDITURES (% MILLIONS, U.S.)
(1976) 3,867 (77) 4,692 (78) 4,092

DEFICIT(-) OR SURPLUS (% MILLIONS, U.S.)
(1976) -1,870 (77) -2,104 (78) -1,286

DEFENSE EXPENDITURES.
AS % OF TOTAL EXPENDITURES.. (1976) 8.5% (77) 9.9% (78) 11.5%
AS % OF GNP..... (1976) 3.2% (77) 4.0% (78) 3.7%

OFFICIAL INTERNATIONAL RESERVES, GROSS HOLDINGS END OF PERIOD.
(%MILLIONS, U.S.) (1977) 531 (78) 649 (79) 590
EQUIVALENT TO 2.[illegible] MONTHS OF IMPORTS (1979)

FOREIGN TRADE

MAJOR EXPORTS... (1978) PHOSPHATES

EXPORTS TO U.S.
(% MILLIONS, US, FOB) (1977) 25 (1978) 43 (1979) 43
AS % OF TOTAL EXPORTS (1977) 2% (1978) 3% (1979) 2%

MAJOR IMPORTS... (1978) MACHINERY FOODSTUFFS OIL PRODUCTS

IMPORTS FROM U.S.
(% MILLIONS, US, CIF) (1977) 202 (1978) 249 (1979) 242
AS % OF TOTAL IMPORTS (1977) 6% (1978) 8% (1979) 7%

TRADE BALANCE (% MILLIONS, U.S.) (1977) -1,097 (78) -1,462 (79) -1,609

MAIN TRADING PARTNERS: FRANCE SPAIN ITALY

EXTERNAL PUBLIC DEBT AS % OF GNP (1978) 40.1%

SERVICE PAYMENTS ON EXTERNAL PUBLIC DEBT.
(% MILLIONS, U.S.)..... (1978) 548
AS % OF EXPORT EARNINGS (DEBT SERVICE RATIO).... (1978) 10.7%

SOCIAL DATA

POPULATION GROWTH RATE.....(1969-79) 2.9%

POPULATION IN URBAN AREAS..... (1969) 32% (1976) 38%

TOTAL BIRTHS PER 1,000 POPULATION..... (1979) 45

MARRIED WOMEN AGED 15-44 YRS. USING CONTRACEPTION... (1976) 7%

POPULATION (1978) IN AGE GROUP:
(0-14YRS) 46.5% (15-64YRS) 50.1% (65+ YRS) 3.4%

INFANT DEATHS DURING FIRST YEAR OF LIFE / 1000 INFANTS (1972) 133

PEOPLE PER PHYSICIAN..... (1976) 11,101

MAJOR CAUSES OF
DISEASE (1975): MEASLES EYE DISEASES
DEATH.. (1975): MEASLES RESPIRATORY GASTROINTESTINAL

PER CAPITA CALORIE SUPPLY AS A % OF REQUIREMENTS.... (1977) 105%

POPULATION WITH REASONABLE ACCESS TO SAFE WATER SUPPLY (1975) 55%

TOTAL SCHOOL ENROLLMENT AS % OF POPULATION IN AGE GROUP:
PRIMARY..... (1977) TOTAL 66.0% MALE 86.0% FEMALE 50.0%
SECONDARY..... (1975) TOTAL 17.0% MALE 21.0% FEMALE 12.0%
POST SECONDARY .. (1977) TOTAL 4.2% MALE [illegible] FEMALE 1.9%

ENERGY PRODUCTION AS % OF CONSUMPTION..... (1978) 19%

AGENCY FOR INTERNATIONAL DEVELOPMENT

ADVICE OF PROGRAM CHANGE

Country : Morocco

Project Title : Renewable Energy Development

Project Number : 608-0159

Data Base Reference : Near East Programs, p. 41

Appropriation Category : Agriculture, Rural Development and Nutrition

Life-of-Project Funding : $6,700,000

Intended FY 1981 Obligation : $1,500,000

This is to advise that AID plans to obligate $1,500,000 in FY 1981, Agriculture, Rural Development and Nutrition (ARDN) grant funds for this project as shown in the Data Base, rather than $1,300,000 in Selected Development Activities (SDA) funds as shown in the FY 1981 Congressional Presentation. In addition, the planned life-of-project cost is now $ 6,700,000, $1,700,000 higher than the $5,000,000 shown in the FY 81 CP and Data Base.

As a result of an Agency decision made after the preparation of the FY 81 CP increasingly to fund energy activities from ARDN funds when the activities were aimed at rural areas, hereinafter all funding for this project will be from Section 103. The planned funding increases for FY 1981 and for the life-of-project are based on feasibility studies and final project design cost estimates which were not completed when the Data Base was prepared.

Attachment: Revised Activity Data Sheet

The attached notifications were sent to the Hill on July 7, 1981. Obligation may be incurred on July 22, 1981.

PROGRAM: MOROCCO

ACTIVITY DATA SHEET

TITLE: Renewable Energy Development	FUNDING SOURCE: (1) Agriculture, Rural Dev. & Nutrition (2) Selected Development Activities	PROPOSED OBLIGATION (In thousands of dollars) FY 81 1,500	LIFE OF PROJECT (Auth.) 6,700
NUMBER 608-0159; GRANT [X] LOAN [ ]; NEW [ ]; CONTINUING [X]	PRIOR REFERENCE: Advice of Program Change dated 1/29/80	INITIAL OBLIGATION FY 80	ESTIMATED FINAL OBLIGATION FY 84; ESTIMATED COMPLETION DATE OF PROJECT FY 86

Purpose: To create and institutionalize an applied research and demonstration capability in renewable energy development which will contribute to national energy policy and planning.

Background: Morocco is one of a number of countries whose economic development is threatened by increasing energy costs. A.I.D. energy teams visited Morocco in 1978 and 1979 to analyze the Moroccan energy situation and examine opportunities for renewable energy activities. The teams recommended that a Center for Renewable Energy Development be established under the aegis of the Ministry of Energy and Mines (MEM).

Project Description: The project began early in 1980 with further survey and design work. Now that feasibility studies have been completed, technical assistance will be provided to (1) develop the Center, (2) train Moroccan staff in Morocco, the United States and third countries; and (3) design and carry out a renewable energy research and development program under Center sponsorship. A.I.D. will also finance the procurement of U.S. source technical and scientific equipment for the Center and for the pilot projects and demonstration projects.

Relation of Project to A.I.D. Country Strategy: One of the major elements of A.I.D.'s strategy in Morocco is to assist the Government of Morocco to integrate renewable energy development into national energy planning, and make renewable sources available to groups lacking access to conventional energy.

Beneficiaries: The immediate beneficiaries of the project will be Center staff receiving training, and the target groups of the pilot projects selected. Over time this project will help reduce dependence on high-cost fossil fuels, permit the continued expansion of energy supply essential to economic growth and help improve the quality of rural life by increasing agricultural productivity and agro-employment opportunities, and reducing environmental destruction.

Host Country and Other Donors: The Government of Morocco is providing staff and land and will construct facilities for the Center for Renewable Energy Development in Marrakech as well as for the pilot and demonstration projects. Estimated Government of Morocco contributions will exceed $5,000,000 during the life of project. No other donors are directly associated with this project.

Major Outputs	All Years
Center for Renewable Energy Development established	1
Small remote hydroelectric generation pilot projects established	3
Solar, wind and biomass pilot projects installed and functioning	10
Moroccan staff trained for Center	80

A.I.D. - Financed Inputs	($ thousands) Life of Project
Personnel (long-term 8 p.y.)	940
(short term 100 p.m.)	1,060
Training (long-term 24 p.y.)	810
(short-term 120 p.m.)	475
Commodities (such as laboratory and hydro-power generation equipment, small photo-voltaic pumping and refrigeration units, and wind-powered-electric pumping units)	2,455
Small projects fund	320
Other costs (preparatory studies, evaluation, etc.)	640
TOTAL	6,700

U.S. FINANCING (In thousands of dollars)

	Obligations	Expenditures	Unliquidated
Through September 30, 1979	--	--	-
Estimated Fiscal Year 1980	600	1	
Estimated through September 30, 1980	600	1	599
		Future Year Obligations	Estimated Total Cost
Proposed Fiscal Year 1981	1,500	4,600	6,700

PRINCIPAL CONTRACTORS OR AGENCIES

To Be Selected

BEST AVAILABLE DOCUMENT

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Department of State

OUTGOING TELEGRAM 20-3

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ORIGIN AID-35

ORIGIN OFFICE: NETC-04
INFO NEPD-04 AANE-01 NEDP-02 CH6-01 NENA-03 PPCE-01 PDPR-01
PPPB-03 GC-01 PPEA-01 GCFL-01 GCNE-01 STA-10 IDCA-01
PPIA-01 FM-02 AADS-01 C-01 CMGT-02 CNE-02 CPP-01 CPS-02
CSE-02 CTR-02 DSEY-01 CH8-01 DOE-01 OPIC-10 /064 A4 823

INFO OCT-00 /035 R

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E.O. 12065: N/A

TAGS:

SUBJECT: PP FOR MOROCCO RENEWABLE ENERGY DEVELOPMENT II (608-0159)

1. THE NEAC REVIEWED AND APPROVED SUBJECT PP ON JUNE 4, 1981. THE COMMITTEE WAS PLEASED WITH THE OVERALL CLARITY OF THE PP AND COMMENDS THE MISSION ON AN EXCELLENT PROJECT PAPER.

2. THE NEAC OVERALL PERCEPTION IS THAT THE PROJECT REQUIRES A LARGE NUMBER OF SEPARATE AND LABOR INTENSIVE MISSION ACTIONS WHICH WILL UNDOUBTEDLY INCREASE MISSION'S AND AID/W WORKLOAD. THE COMMITTEE RECOMMENDS THAT THE PROJECT DESIGN BE REVIEWED WITH THE GOAL OF DECREASING THE NUMBER OF DIRECT MISSION INTERVENTIONS. SOME OF THE SUGGESTIONS AND RECOMMENDATIONS WHICH FOLLOW ARE ATTEMPTS TO ACHIEVE THIS GOAL.

3. IN THE PILOT PROJECT FUND, SUB-ALLOCATION OF FUNDS SHOULD HAVE MISSION DIRECTOR'S APPROVAL. THESE PROJECTS SHOULD, HOWEVER, BE PACKAGED BY APPLICATIONS OR TECHNOLOGIES IN ORDER TO ASSURE THAT THEY ARE REASONABLY INTEGRATED AND COORDINATED, AND TO REDUCE THE NUMBER OF MISSION REVIEWS TO A MINIMUM.

4. IN THE SMALL PROJECT FUND THE MISSION SHOULD NOT BECOME INVOLVED IN INDIVIDUAL FUNDING DECISIONS. SELECTION OF PROJECTS SHOULD BE GOM RESPONSIBILITY WITH ACTIVE ROLE FOR US CONTRACTOR RATHER THAN THE PASSIVE ROLE ENVISIONED BY THE SUGGESTION THAT THE US CONTRACTOR BE GIVEN VETO POWER OVER PROPOSALS. ROLE PLAYED BY US CONTRACTOR WOULD DIMINISH AS CDER CAPABILITY GROWS. THE GOM IN CONSULTATION WITH THE CONTRACTOR SHOULD BE REQUIRED TO PROVIDE THE MISSION WITH A QUARTERLY REPORT ON PROJECT

STATE 164500 7073 001634 AID9691

FUNDING AND PROGRESS ON THE ACTIVITIES UNDER THE SMALL PROJECT FUND. CRITERIA FOR USE OF FUNDS SHOULD BE MUTUALLY AGREED UPON AND MISSION SUPERVISION EXERCISED BY REGULAR, NOT LESS THAN QUARTERLY, POST APPROVAL REVIEW OF FUNDING DECISIONS WITH RIGHTS TO DISASSOCIATE US FUNDS FROM ANY ACTIVITY NOT CONSISTENT WITH AGREED CRITERIA.

5. SELECTION CRITERIA GUIDELINES NEED TO BE DEVELOPED FOR BOTH PROJECT FUNDS, BUT PARTICULARLY FOR THE SMALL PROJECT FUND AS ITS USES ARE RELATIVELY LESS DEFINED IN PP. THE US CONTRACTOR WITH ASSISTANCE FROM CDER STAFF SHOULD DEVELOP THE CRITERIA ALONG WITH THE ADMINISTRATIVE PROCEDURES FOR MANAGING THE FUNDS. GENERAL GUIDELINES FOR DEVELOPMENT OF THESE CRITERIA SHOULD BE PROVIDED IN AN ANNEX OF THE PP. THESE GUIDELINES SHOULD BE BASED ON THE NORMAL AID PROJECT CRITERIA INVOLVING ECONOMIC, SOCIAL, ADMINISTRATIVE, TECHNICAL, AND BUDGETARY FEASIBILITY AS WELL AS ADEQUACY OF A DATA COLLECTION SYSTEM TO INSURE ANTICIPATED RESULTS. A CP SHOULD BE ADDED REQUIRING MISSION'S CONCURRENCE IN THE CONTRACTOR/CDER DEVELOPMENT CRITERIA AND PROCEDURES.

6. IN ACCORDANCE WITH GENERAL GUIDELINES, PARA 2 ABOVE, THE US CONTRACTOR SHOULD BE RESPONSIBLE FOR ALL PROJECT COMMODITY PROCUREMENT EXCEPT IN THOSE CRITICAL CASES WHERE EQUIPMENT DELAYS WILL SIGNIFICANTLY EFFECT THE IMPLEMENTATION AND OVERALL SUCCESS OF THE SUB-PROJECT. THE COMMITTEE IS IN AGREEMENT WITH THE MISSION ON THEIR PROCUREMENT OF THE SMALL HYDRO EQUIPMENT AND OTHER CENTER EQUIPMENT AND MATERIALS REQUIRED WITHIN THE FIRST SIX MONTHS OF THE CONTRACTOR'S ARRIVAL. DECISIONS ON OTHER EARLY PROCUREMENT SHOULD BE MADE ON A CASE BY CASE BASIS IN LIGHT OF THE URGENCY OF NEED AND MISSION PROCUREMENT OFFICE WORKLOAD.

7. ANOTHER NEAC CONCERN WAS THE FLEXIBILITY OF THE CONTRACT AND ALLOCATION OF GRANT FUNDS BETWEEN THE VARIOUS PROJECT COMPONENTS. THE NEAC SUGGESTS MISSION KEEP AS MUCH FLEXIBILITY AS POSSIBLE DURING IMPLEMENTATION. THEREFORE, THE NEAC RECOMMENDS THAT THE INITIAL TA CONTRACT BE LIMITED TO TWO YEARS AND THAT FUTURE TA NEEDS BE ASSESSED AS CONDITIONS EVOLVE. THE PROJECT DESIGN SHOULD ALSO ALLOW FOR FUNDING SHIFTS BETWEEN PROJECT COMPONENTS IF AND AS NECESSARY.

8. ADDITIONAL ITEMS THAT REQUIRE ELABORATION AND DEVELOPMENT FOR THE FINAL DRAFT OF THE PP ARE:

A. THE COMMODITY PROCUREMENT SCHEDULE ANNEX NEEDS TO BE EXPANDED WITH DETAILS ON EACH COMPONENT OF THE PROJECT GIVEN NEAC RECOMMENDATIONS, PARA 6.

B. THE STATUTORY CHECKLIST, ANNEX 12, NEEDS TO BE UPDATED SINCE AT PRESENT IT IS AN ADDITION TO THE PHASE 1 PP AND THE CHECKLIST HAS CHANGED SINCE THE PHASE 1 CHECKLIST WAS DEVELOPED.

C. THE EVALUATION PLAN (PAGES 71-72) NEEDS TO BE EXPANDED AND DEVELOPED FURTHER. THERE IS SOME CONFUSION IN THE PLAN BETWEEN MEASURING PURPOSE LEVEL ACHIEVEMENT (I.E. ESTABLISHMENT OF AN EFFICIENT AND RELEVANT CENTER) AND MEASURING MOROCCAN ENERGY NEEDS AND DEVELOPMENT. IT IS ALSO NOT CLEAR IF THE CENTER EVALUATION WILL INCLUDE AN EVALUATION OF PILOT PROJECT ACTIVITIES. CONCLUSION OF NEAC WAS THAT EVALUATION SHOULD FOCUS ON INSTITUTIONAL CAPACITY ISSUES.

D. THE PP NEEDS A SUMMARY FUNDING TABLE IN THE PROJECT DESCRIPTION WHICH SHOWS THE VARIOUS SUB-PROJECTS, THEIR

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FUNDING COMPONENTS, AND WHETHER AID OR GOM-FUNDED.

E. THE MISSION SHOULD DELETE THE GENERAL WAIVER FOR EUROPEAN OBSERVATION VISITS AND USE A CASE BY CASE WAIVER. THE BLANKET WAIVER MAY ENCOURAGE RENEWABLE ENERGY VISITS TO EUROPE, RATHER THAN TO U.S.

F. AN ANNEX NEEDS TO BE INCLUDED FOR THE TWO PROJECT FUNDS' CRITERIA GUIDELINES SUGGESTED, PARA 5 ABOVE.

G. AN ADDITIONAL CP SHOULD BE ADDED FOR MISSION'S CONCURRENCE ON THE SMALL PROJECT FUND AND THE PILOT PROJECT FUND SELECTION CRITERIA AND ADMINISTRATIVE PROCEDURES DEVELOPED BY THE CENTER WITH ASSISTANCE FROM US CONTRACTOR.

H. CONSIDERATION SHOULD BE GIVEN TO CREATING AN ADMINISTRATIVE MECHANISM WITHIN THE CENTER TO FOCUS ON TECHNOLOGY APPLICATIONS. THIS GROUP WOULD CONSIST OF ENERGY SPECIALIST RESPONSIBLE FOR CONSERVATION AND VARIOUS SECTOR APPLICATIONS SUCH AS RURAL AND AGRICULTURAL, INDUSTRIAL,

COMMERCIAL/INSTITUTIONAL, AND DOMESTIC. ONCE SECTOR ENERGY PROBLEMS HAVE BEEN IDENTIFIED, THIS APPLICATIONS GROUP WOULD WORK WITH THE TECHNOLOGY SPECIALIST IN PROJECT DESIGN AND DEVELOPMENT. THIS SUGGESTION REFLECTS CONCERN THAT THE CDER AS PRESENTLY CONFIGURED DOES NOT HAVE A PLAN FOR A MULTI-DISCIPLINARY APPROACH TO DETERMINING APPROPRIATE TECHNOLOGIES GIVEN A SPECIFIC PROBLEM. THIS GROUP SHOULD BE CREATED WITHIN THE PROPOSED STAFFING;LEVEL OF CDER.

I. PP, P. 20, INDICATES EARLY TRAINING WILL BE SHORT-TERM TECHNICAL TRAINING FOR ENGINEERS. LONG-TERM TRAINING PLAN, P. 20-21, INDICATES THAT ALTHOUGH ACADEMIC PROGRAMS MAY INCLUDE EXPOSURE TO NON-TECHNICAL SUBJECTS, ALL PARTICIPANTS WILL BE ENROLLED FOR MS DEGREES. NEAC CONSIDERED IT ESSENTIAL THAT BOTH EARLY SHORT-TERM AND LONG-TERM ACADEMIC TRAINING PLANS AND SCHEDULE PROVIDE CENTER WITH A BALANCED MIX OF PROFESSIONAL SKILLS, NOT SIMPLE - HIGHLY TECHNICAL EXPERTISE. WHAT IS THE TRAINING PLAN FOR

NON-TECHNICAL STAFF SHOWN, P. 19, FIGURE 2, AS PART OF OPERATIONS RESEARCH AND PLANNING UNIT?

J. THE NEAC ALSO SUGGESTED CP REQUIRING THE CENTER TO DEVELOP A TIME PHASED RECRUITMENT AND STAFFING PLAN WHICH WOULD ENCOURAGE THE CDER TO INCREASE ITS STAFFING ASAP AND TO PROGRESSIVELY TAKE ON MORE RESPONSIBILITY FOR THE IMPLEMENTATION OF THIS PROJECT. ONE APPROACH IS TO ENCOURAGE MORE ON THE JOB TRAINING (PROVIDED, IN PART, BY US CONTRACTOR) FOR CDER STAFF INSTEAD OF THE TREND TO EMPLOY PERSONNEL ONLY AFTER COMPLETION OF A TRAINING PROGRAM. SUGGEST THAT TRAINING OF STAFF BE CARRIED OUT AS EARLY AS FEASIBLE IN ORDER TO HAVE CDER ASSUME MAJOR RESPONSIBILITY FOR PROJECT PRIOR TO TIME PROJECTED IN PP.

9. AID/W WITH PARTICIPATION AND CONCURRENCE OF MARK WARD USAID/RABAT, IS;REVISING PP TO RESPOND TO ALL OF THE ABOVE POINTS. CN IS IN PROCESS. UPON USAID CABLE CONCURRENCE ON PP CHANGES AND EXPIRATION OF CN WAITING PERIOD, REVISED PP WILL BE PRESENTED TO AA/NE FOR AUTHORIZATION. STOESSEL

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AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

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9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 79; B. QUARTER 4 (Enter 1, 2, 3, or 4); C. FINAL FY 83

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

A. FUNDING SOURCE	FIRST FY 79 B. FX	C. L/C	D. TOTAL	LIFE OF PROJECT E. FX	F. L/C	G. TOTAL
AID APPROPRIATED TOTAL	1200			5000		5000
GRANT	1200			5000		5000
LOAN						
OTHER U.S. 1						
OTHER U.S. 2						
HOST COUNTRY						
OTHER DONOR(S)						
TOTALS	1200			5000		5000

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	D. LOAN	E. 1ST FY 79 F. GRANT	G. LOAN	H. 2ND FY 80 I. GRANT	J. LOAN	K. 3RD FY 81 L. GRANT	M. LOAN
(1) ST	740	878		1200		2211		1589	
(2)									
(3)									
(4)									
TOTALS				1200		2211		1589	

A. APPROPRIATION	N. 4TH FY 82 O. GRANT	P. LOAN	Q. 5TH FY 83 R. GRANT	S. LOAN	LIFE OF PROJECT T. GRANT	U. LOAN
(1)					5000	
(2)						
(3)						
(4)						
TOTALS					5000	

12. IN-DEPTH EVALUATION SCHEDULED: MM 04 YY 82

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: [signature]

TITLE: Harold S. Fleming
Mission Director

DATE SIGNED: MM DD YY

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

AID 1330-4 (3-78)

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PROJECT COMMITTEE

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ADVISORY COMMITTEE

Harold S. Fleming, Mission Director, Chairperson
James Smith, Human Resources Development Officer

PROJECT OVERVIEW

The five-year project involves the creation of a Renewable Energy Center for Morocco in which the host country's commitment to the development of renewable and alternative energy sources will be focussed. Under the aegis of the Ministry of Energy and Mines, the Center will conduct applied research, planning, staff development, technology demonstration and other activities in renewable energy in cooperation with other Moroccan institutions and departments responsible for various development activities. In its first years, the Center will have a staff of some 30 professionals and in addition will train and use the services of technical personnel from the cooperating institutions noted above. The Moroccan Government will furnish land and a building for the Center in the city of Marrakech and will assume responsibility for associated local costs of demonstration projects. AID will finance the training of 19 professional persons in the United States and will provide laboratory and other equipment for the Center and for various technology demonstration projects. Additionally, AID will support one full time resident consultant to work with the Director of Energy * and his staff on the design and management of the Center and will provide short term consultants for the purpose of training Moroccans in renewable energy technologies and to assist in the three technology demonstration sub-activities: small decentralized hydroelectric power generation, biomass (wood), and solar, thermal and photovoltaic.

Estimated costs for the first three years will be $3,411 000, in the form of a grant, to be implemented through a host country contract.** Project costs for years four and five will be determined in year two.

The project will be centered on promulgating renewable energy in rural areas, and it will also contribute to the reduction of Morocco's dependency on imported fuel, now running at 80 percent of total energy consumption.

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* - In Ministry of Energy and Mines.

** - Technical assistance portion only.

Morocco

Almeria
Málaga
Cádiz
Algeciras
GIBRALTAR
United Kingdom
Mediterranean Sea
Oran
Ceuta
(Tangier) Tanger
Tetouan
Al Hoceima
Melilla
Nador
Sidi bel Abbes
Atlantic
Ocean
Larache
Oujda
Souk el Arba du Rharb
Kenitra
Salé
Rabat
Meknès
Fes (Fez)
Mohammedia
Casablanca
Azemmour
El Jadida
Berrechid
Settat
Oued Zem
Kasba Tadla
Beni Mellal
Safi
Essaouira
Agadir
Taroudant
Ouarzazate
Zagora
Bechar
Berguent
Ifni

I. PROJECT SUMMARY

A. Purpose

The purpose of this project is to create a Renewable Energy Center that will carry out studies and demonstrations of renewable energy resources that will contribute to the formation of a national energy plan.

The Center will assist the Government of Morocco to conserve and exploit more effectively its renewable energy resources. Among its initial activities will be studies and demonstrations in the use of solar energy, biomass and decentralized hydroelectric generation.

B. Background

Morocco is one of a number of countries whose economic expansion, rural development and employment creation are threatened by the looming energy crisis. Current energy demand is met by coal (eight percent), hydroelectric power (12 percent) and petroleum (80 percent). Virtually all petroleum is imported. In 1978, imported petroleum amounted to 5.5 million tons. Forty percent of this comes from the Soviet Union and is bartered for citrus fruit.* The Soviet Union is reducing its exports of petroleum each year and Morocco must therefore purchase the shortfall from her other suppliers--Iraq, Kuwait and Saudi Arabia--at ever-increasing prices.

The consumption of energy in Morocco is expected to rise by a minimum of 10 percent per year. A considerable part of this expansion is planned for villages in rural areas: six percent of all Moroccan villages (foyers ruraux) were electrified in 1973, and a target of 12 percent has been set for 1982.**

For its energy expansion program, Morocco is counting heavily on exploiting its shale oil resources. Nuclear power is also being seriously considered. The Office Nationale d Electricite has estimated the following to be the energy needs and sources to the end of the century:***

Year	Need (MW x 10^9)	Source
1990	12	Hydro (4) Coal (1) Petroleum (7)
2000	31	Hydro (4) Coal (1) Shale Oil (10) Petroleum & Nuclear (15)

* These data from U.S. Embassy (oral communication).

** Office Nationale de l'Electricite (oral communication).

*** Ibid.

These projections may not be realized. Whether shale oil can be developed economically in Morocco remains to be determined; the same is true for nuclear energy. Furthermore these sources are not suitable as decentralized energy systems, and so cannot bring energy to poor rural areas as a component of development without prohibitively high transmission costs.

An AID energy team visited Morocco in late 1978 to make a preliminary analysis of the Moroccan energy situation. It concluded that there were opportunities for the introduction of renewable energy into Morocco, and recommended that a Renewable Energy Center be established. There is a growing and serious interest in renewable energy within the Ministry of Energy and Mines as well as in other quarters of the GOM. This interest is stimulated in part by the realization that, from 1980, the cost of imported petroleum will exceed revenues from all mining activities, including phosphates. In 1978, importation of petroleum rose to 20 percent of all imports.*

C. Administration of the Project

The Ministry of Energy and Mines will be the Moroccan Government agency responsible for the project. Figure 1 shows the proposed relationships of the Center and its two subprojects to other GOM entities. During the first year of the project, an American expert under contract to the GOM Ministry of Energy and Mines** will assist in managing the initial phase of development, spending up to nine man-months in the United States and Morocco for this purpose. In the second and third years of the project, a full-time renewable energy management expert under contract to the GOM Ministry of Energy and Mines*** will be resident at the Center in Marrakech.

D. Interministerial Coordination

While the Ministry of Energy and Mines appears to have considerable power, including special mandates from the Palace, in moving the country toward energy independence, the project's success will depend on the cooperation and resource inputs of several different ministries and semi autonomous organizations. In fact, the project's administrative arrangements and their workability provide some of the most difficult challenges of the project. The Center can play a key role in this regard, by focusing attention of various government personnel on problems and getting the problems solved. The ability of the Center to play this managerial, coordinative role will be assured through the existence of an interministerial Board of Directors ("Conseil d'Administration").

It is planned that overall management of demonstration projects and research will be provided by Center staff. One exception to this is the small hydro activity, where the management will be assumed by the Office Nationale de l'Electricite (ONE). The Center's small hydro project manager will be concerned with the integration of hydro and biomass-fueled generation of electricity, and activity planned for the fourth year.

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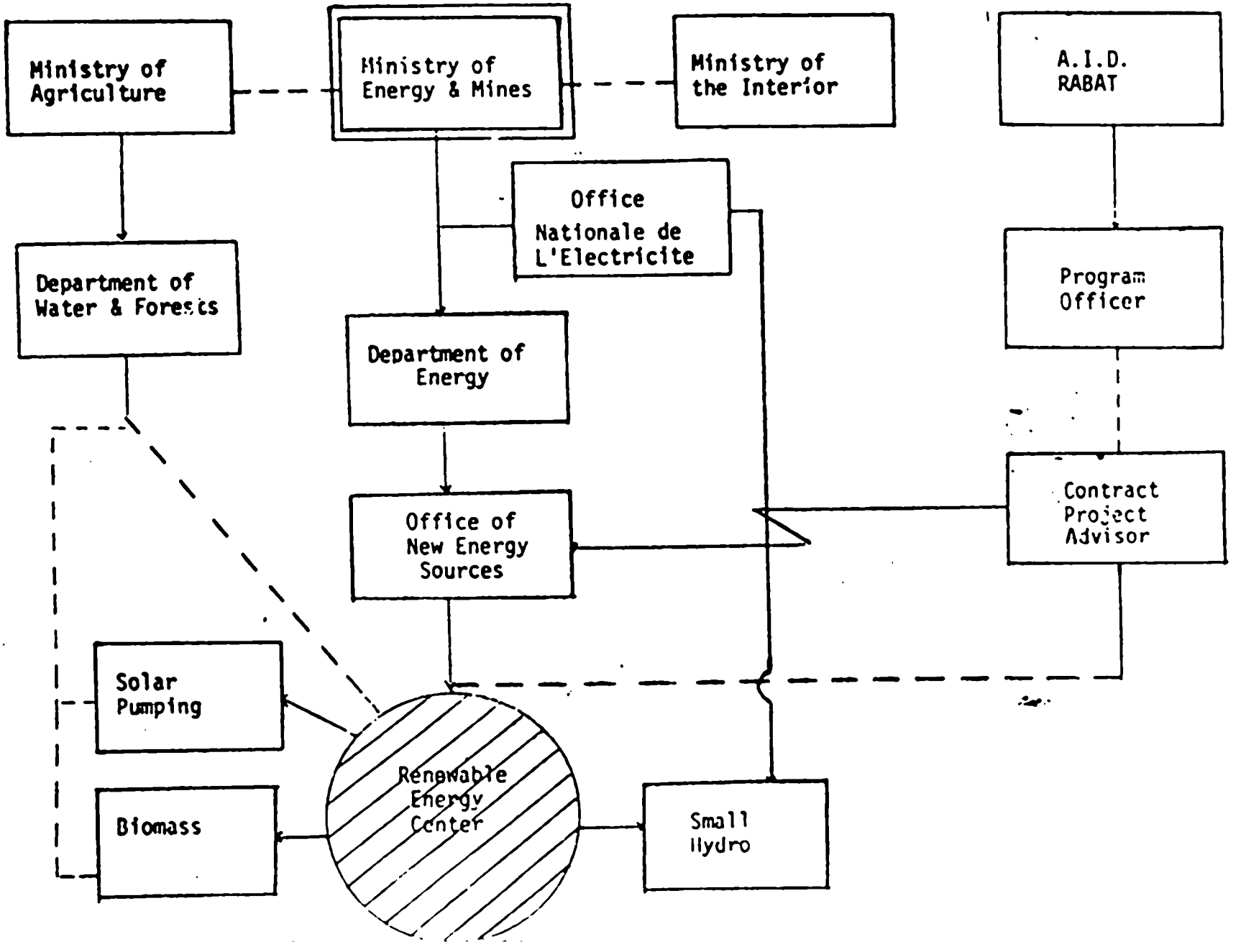
* Data from Note de Presentation du Projet de Loi Portant Creation du Centre National des Energies Renouvelables, Ministry of Energy and Mines, 1979.

** AID financed host country contract

*** Also AID financed.

Figure 1

Project Relationships



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Demonstration projects will have to be partially staffed by the interested ministry, e.g. Agriculture's Office of Water and Forests for biomass. The Ministry of Interior is concerned with site selection as an integral part of the rural development program. The organizing of such support will be a principal task of the Center's Director and individual project managers. All demonstration projects will have to have milestones for measuring progress, and permitting design alterations where necessary.

There are possibilities of sizeable loan programs at the conclusion of the biomass and small hydro activities and this may provide the necessary motivation for all parties concerned to make these activities successful.

E. Relation to Other United States Government Activities

There are several relationships to on-going USAID projects which it would be possible to develop, though at this time it is not possible to predict the degree of mutual support which could emerge.

In biomass, it is possible to build cooperation between the Center's applications researchers and the researchers at the Institut Agronomique et Veterinaire Hassan II, particularly as regards soils. (Higher Agricultural Education Project 0134) Likewise, it may be possible to rely on strengths created in the Ministry of Agriculture for dryland research. (Dryland Agriculture Applied Research Project 0136) Experience gained in the Nonformal Education for Women project (0139) may prove useful in the later stages of the Energy Development project when entrepreneurship and job creation based on energy availability are being considered. Finally, potable water supply (Rural Potable Water Project 0150) is a possible use for photovoltaic-powered pumping. (Where water tables are high enough, such pumping may prove competitive with diesel-powered pumping.)

It will be the responsibility of the project director to encourage productive linkage and coordination with other on-going development activities financed by AID, other donors and the GOM, and to share with them any insights or information which may be useful to them.

II. PROJECT BACKGROUND AND DESCRIPTION

A. Background

Underlying this proposed project are two basic ideas. The first is that it is essential for Morocco to begin taking steps to lessen its dependence on imported fossil fuel. The second is that development of renewable decentralized energy sources not only can lead to greater energy independence but also permits energy to play a much larger role in rural development than may have been envisaged heretofore. It is therefore felt that the Government of Morocco should acquire a familiarity with a range of renewable energy technologies and their possible applications, and should plan for the eventual introduction of these technologies so as to replace wherever possible imported petroleum.

The Government of Morocco and USAID believe that the most efficient way to acquire such knowledge, and to conduct such planning, is to establish a new institution, under the aegis of the Ministry of Energy and Mines. For

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the purpose of this paper, this institution is called the Renewable Energy Center, although it has been informally indicated by the GOM that research on all energy sources may eventually be included in the Center. The program to establish the Center will be evolutionary, and will require from four to five years in the development stage. The Center eventually will enable the Moroccan government to plan for the systematic introduction of new energy sources, the applications for which it will develop. The Center will initiate and coordinate the activity of several research groups, as well as conduct training and demonstration projects having long-term national significance for rural development.

Initially, the project will provide training for a group of Moroccans, to provide staff support to the Ministry of Energy and Mines. During the first year of the project, land for a building to house the Center will be acquired in Marrakech by the Ministry; design and construction will be begun. A director will be selected. In addition to staff training, during the first year information gathering and some planning activities will be carried on; the Moroccan government has stated that the activities of the Center will not depend on the completion of a building in Marrakech but will commence under the aegis of the Ministry of Energy and Mines' Director of Energy and his staff. Finally, initial phases of particular activities in biomass* research and utilization, small-scale hydroelectric generation at selected sites, and testing of various solar devices already purchased by the government will be begun. By 1981, it is expected that sufficient data will have been gathered to indicate priority applications of solar pumping. By 1982, the Center will have been constructed and staffed with qualified professionals in a number of technologies and other functions; biomass, small decentralized hydro, and solar systems will be storing or producing energy for rural consumers.

The material in the Appendices amplifies the planned activities in sufficient detail as to permit further evaluation. Appendix A describes the manpower organization, utilization and training for the Center. Appendix B surveys small hydro potential and indicates the immediate and long-term opportunities to be exploited. Appendix C presents the biomass activity, its overall justification in terms of national potential, and the research and operations planned. Appendix D provides a resume of data needs and sources which will facilitate future project design and economic evaluation. For each of the two energy activities, a summary is taken from appendix materials and is briefly presented elsewhere in this paper.

B. <u>The Role of the Implementing Agency</u>

The Ministry of Energy and Mines (MEM) was established in 1977 as a result of the Moroccan Government's recognition of the necessity for effective energy management under conditions of increasing world scarcity. The Ministry's senior staff is composed of relatively young people whose

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* As used in this paper, the term "biomass" refers to the utilization of wood from trees grown on plantations to produce various forms of energy. "Biomass" in general may include all energy drawn from organic materials, using several technologies, and the Center will undoubtedly experiment with these at some point.

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training, competence and drive is substantially better than the average in comparison with most of the GOM ministries with which AID has worked. As in most countries the Ministry is feeling its way in the field of renewable energy, but it has been authorized by King Hassan II, whose confidence the Minister enjoys, to conceive, plan and carry out policies and programs which will affect Morocco's energy consumption patterns profoundly during the years ahead. The Ministry is aware of the limits of their knowledge and skill in this new and changing field, and for that reason is most receptive to ideas and suggestions from foreign experts. The recent AID energy team, for example, found that the Ministry welcomed their views and recommendations regarding the draft legislation for the future Renewable Energy Center.

The Ministry will inevitably affect the policies and programs of a number of other ministries and government organizations. This will require the resourceful use of its currently delegated authority as well as a continuing process of diplomacy, education and negotiation in order to secure the cooperation of those government (as well as private) bodies whose active cooperation and participation will be necessary for an effective energy management program. The Ministry of Energy and Mines has already made considerable progress along these lines in its operational coordination with a number of other agencies. They work closely, for example with the Office National de l'Electricite (ONE), responsible for all of Morocco's electricity generation. ONE is participating actively in the initial studies to lay the groundwork for pilot activities in decentralized hydro-electric generation and will continue to work closely with the Ministry of Energy and Mines in this area. ONE has cooperated effectively with the World Bank in developing electrical distribution grids under several Bank loans, and the Bank will be an active partner in the overall program for expansion of decentralized hydro installations for rural development.

Rural development in Morocco is of profound interest to the Ministry of Interior, which employs all provincial governors, rural security and administrative forces. The Grand Programme des Petits Projets (GPPP) which the GOM and the World Bank are evolving as an important nation-wide rural development effort, will be administered primarily by the Ministry of Interior. The Ministry of Interior has already expressed interest in greater efforts to provide potable water to the poorer and more remote villages (particularly in the High Atlas Mountains and directly south thereof), in the exploitation of small hydroelectric generating possibilities for villages inaccessible to the high-tension grids, and in the possible uses of solar energy for small-scale rural activities likely to be applicable in the poorer rural areas. The early interest of the Ministry of Interior in exploring alternative energy sources indicates that their continuing cooperation is likely. The participation of Interior will lend powerful assistance to the integration of alternative energy development into GOM rural development activities. It is essential, of course, that the new energy made available from small hydro installations, solar energy, biomass and other sources be exploited and used in other GOM programs. The Ministry of Interior can be expected to play a dynamic coordinating role in this area.

The draft legislation authorizing the Renewable Energy Center provides for a coordinating committee to guide it. Several key ministries will be represented on this committee: Interior, Agriculture, Finance and

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Plan (Secretariat d'Etat au Plan et au Developpement Regional). Their participation will ensure that the GOM central planning and financial authorities as well as the provincial political authorities will be appropriately involved. The Ministry of Energy and Mines is now exploring ways to institutionalize their influence on the policy, program and operational levels of alternative energy development in Morocco. The Renewable Energy Center will play a key role in bringing this influence to bear and providing the operating ministries of the GOM with the information and guidance which can be applied to their programs. As it is strengthened by the AID-financed contract staff and training provided under this project, the proposed Center will develop the capacity to exercise its coordinating and informing role more effectively. It will be able to provide a significant part of the inputs required for a national energy plan, and to mobilize the foreign and domestic resources required for the execution of effective alternative energy programs. The Ministry of Energy and Mines and within it the Renewable Energy Center cannot control all aspects of energy utilization in Morocco, and it is not appropriate that they should. It is clear, however, that the Ministry as now constituted is able to play an important role in publicizing, coordinating and influencing energy use, and that this capacity will increase as the Ministry acquires the competence which this project is designed to supply. The Center will be designed with the flexibility and the breadth of mandates to permit it to make an impact upon all energy use not just renewable energy use. The Center will perform an important training function, exposing officials of a variety of ministries and organizations to usable energy-related knowledge in their fields, thus building a constituency for change throughout the government. The process will be an evolutionary one, as it is in the United States and elsewhere, spurred by the accelerating energy problem which oil-poor Morocco faces. The Renewable Energy Center will play a leading role in shaping Morocco's response.

C. The Renewable Energy Center

The project is expected to play a seminal role, in that a number of future projects may be expected to grow out of it (e.g., a major biomass effort; installation of hydroelectric generation at a large number of suitable sites, etc.). These projects will be candidates for future funding for other international donors, as well as AID. First, however, we give a brief description of the five priority functions for the Center, as delineated by the Ministry of Energy and Mines. The GOM has selected certain priority functions for the Center. These are: (1) Management and Coordination; (2) Planning and Analysis; (3) Technological Research and Development; (4) Training; and (5) Quality Assurance. These are briefly discussed here.

1. Management and Coordination

The Center will work from a technological basis provided by research at Mohammed V University and by basic knowledge gathered from other domestic and international sources. It will productively adapt and develop technology so that it can be applied effectively. Thus, on the one hand the Center will receive and verify information; on the other side and as a result of its work, it will inform the GOM of the role renewable energy can play in the national energy plan; it would also inform the private

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sector of opportunities in the marketplace. To accomplish these ends, the Center would carry out a number of related actions which constitute a managerial, coordinative role. At one level, this would eliminate duplication of effort and a lack of shared information. The GOM cited to the AID energy team the example of solar energy as a technology whose introduction ought to be free to the maximum extent of waste of limited resources, and dangers of early failures. Thus, the Center will provide an information clearinghouse service, and might seek some control over funding of development projects with a high energy component, especially where funding is provided by international agencies. At another level, the successful introduction of energy into rural development will require the support of other ministries and departments in the demonstration projects. The Center should serve as the coordinator of such participation.

2. Planning and Analysis

Planning and analysis are important functions, for they both guide research priorities, and indicate to the Ministry of Energy and Mines when and how various types of energy can be reliably introduced for national consumption. They will also result in the production of much information about the energy hardware market, thus informing the private sector of investment opportunities. The kinds of information to be produced are found in Appendix D.

It is envisaged that the Center would provide a significant part of inputs required for a national energy plan. This will mean that the expertise of Center planners--shown on the organization charts in Appendix A as "Planning and Analysis Engineers"--will go beyond technical knowhow and will encompass an understanding of the uses of decentralized renewable energy in development. As has been discussed with the Ministry of Energy and Mines, it is not absolutely necessary that these planners be engineers, provided that their background permits absorption of sufficient technical understanding so as to permit them to make informed decisions, and to work effectively with engineers and scientists who will be trained in the United States. The planners will also have to be able to work with, and in a sense to manage, the participation of personnel from other ministries in early project planning efforts. For example, it is planned to evaluate the uses of solar powered devices in agriculture during the first year of the project. One or more planning persons will work with personnel of the Ministry of Agriculture to acquire the data and to plan for activities in year two.

Once demonstration activities are well underway, they will be managed by technical personnel within the Center. However, the results of these activities will have to be measured. Obstacles will have to be analyzed, so as to devise means of overcoming them in a regional or nationwide effort. The Planning and Analysis Engineers will perform these tasks as well.

3. Technology R&D

The Center would advance technology on its own initiative, three specific initial activities (biomass, hydro and solar) being listed

below. In addition, as the technologies mature in other areas, and as the needs are established by planning and analysis, other technologies will go through development phases at the Center.

4. Training

The Center's first training activities will provide four Ministry staff persons with a rapid familiarization in basic energy planning issues and renewable energy technologies, as they apply specifically to Morocco. This first effort includes attending an intensive energy planning course in the United States and on-the-job training workshops conducted by American experts in Morocco. Later, 19 persons are slated for training in the United States, many of whom will study for a Master's degree. These people will return to form the permanent staff of the Center.

Additional training will occur in Morocco in a variety of areas, such that a minimum of 31 persons will have been participants in formal job training, technical as well as managerial. In addition, a number of persons will have attended courses on an informal basis (e.g., forestry personnel will be invited to join a biomass workshop), and will thus receive attention in specialized areas of application of renewable energy.

5. Quality Assurance

Early failures in Morocco have led to the need for an activity which would test and provide government-certified performance data on equipment. This is one of the roles chosen by the Ministry of Energy and Mines for the Center; equipment and training would be provided to assist in developing testing procedures and public information programs.

These priority functions will permit the systematic and timely introduction of renewable energy technologies to Morocco. The Center will work through Moroccan government agencies which can implement technologies (e.g., the Office National de l'Electricite for small hydro) and will support them through experience gained in its laboratories and on its demonstration projects. Where several Moroccan agencies are involved, the Center can provide a coordinative function. Results of research conducted by the Center can be fed directly to the Ministry of Energy and Mines, which can establish appropriate policies based on newly gained technological understanding.

It is expected that a list of worthwhile projects arranged according to priority will be developed over time. Using sources of information necessary to evaluate such projects as outlined in Appendix D, analysis can be done by Center planners. However, it is not necessary to await the development of the Center's planning capability to begin to move on two demonstration projects in renewable energy. There is considerable energy potential of social and economic value in both biomass and small decentralized hydro generation. Immediate steps for application are recommended while additional research for later expansion is underway. Furthermore, it is recommended that solar pumping be begun in the second year of the project, based on data gathered by Center staff during the first year. All three of these activities are outlined below.

D. The Biomass Activity

This activity within the Center is concerned with energy from wood. As such, it will involve three separate areas. First training and research will be carried on to determine the best sorts of trees for rapid biomass production in Morocco. Second, both existing and newly developed species of trees will be planted in various densities and in various sorts of soils to achieve the best per-hectare production. Third, end uses for wood will be developed at the village or regional level, e.g., charcoal, steam generation of electricity, etc. To carry out these activities, the Center will have laboratory and test planting facilities in Marrakech. Village tree plantations will be planted (initially, three plantations of 2500 ha. are proposed), which will require extension of the Center's activities into the village economic life, as well as considerable organization for planting and caring for the plantation. Since trees will require a three year growing period before they can be harvested, it will be possible to begin using this biomass for energy generation during the life of this five-year project. Concurrent with the tree-growing period, a study will be undertaken of the most appropriate combustion technology for the mass of product, and a budget is reserved for three boilers which would use wood in different ways. One would produce electricity; one would serve as a dry-season back-up for small hydro; and one would produce mechanical energy. It is important for this equipment to be available before the end of the three-year growing period, as experience can be gained using wood from other sources for test runs.

The technical details of the production system are found in Appendix C, but the national theoretical potential based solely on available land is estimated to be equal to current consumption of petroleum, or 4.5 million tons (34 million barrels) annually. Using conservative wood growth estimates based on past experiments in Morocco, and projecting these numbers based on recommended densities, it is possible to "grow" the equivalent of 10 barrels of oil per year per hectare.* Morocco has 4 million hectares of Class 4 and** (in addition to the 7 million hectares already in forest for other uses). While it is not clear that all available Class 4 land could be dedicated to energy use, even a fraction of it would provide sufficient energy in combustible form (65 percent efficient or higher if dried) so that a contribution could be made to satisfy village firewood, charcoal, and electricity demands on a large scale.

A realistic projection for the development of the biomass potential must take into account many factors, such as managerial capability, availability of labor, means for integrating biomass into the economy, and so forth. A major effort would require a vast expansion of the Department of Water and Forests in the Ministry of Agriculture. A

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* Class 4 land cannot be used for agriculture, but it can sustain the densities needed to produce energy.

** Current cost projections for this solution bring it under world prices of oil and projected costs of exploiting oil shale domestically.

decision to make such an effort would not come before at least five years from the start of the project (at that, it would probably be a decision to make a regional effort). At such a time, it would be realistic to plan for planting half a million hectares over a seven-year period, as well as establishment of energy generation and distribution facilities.

Of course, no single source of energy meets all requirements and research will go on at the Center to find the best applications, amounts and places for exploiting biomass in the years ahead.

E. The Small Decentralized Hydroelectric Generation Activity

The second major technological activity involves the assessment and demonstration of small decentralized hydro generation. The AID program begins with a plan to demonstrate three applications in the High Atlas. The technical assessment of the three demonstration sites has been completed; their recommendations have been made under the criteria of year-round availability of water for power, existence of population centers, distance from existing or planned distribution networks, only minor dams or civil works, irrigation benefits, potential for integration with other renewable sources, and economic costs per kilowatt.

A survey in the summer of 1979 by the Office National de l'Electricite will indicate additional sites for more detailed consideration. By October 1 it will offer 20 potential sites from which the ten best technologically will be selected with the assistance of an American expert, and the final three selected for demonstration funding under this project. The selection process will involve the GOM agencies agreed upon by the World Bank and the GOM in previous negotiations, thus avoiding possible conflicts due to different criteria.

These sites for demonstration will serve to train personnel and will demonstrate the utility of small hydro for possible replication under a major loan program which could be developed for bilateral or multilateral loan financing in 1981. If the demonstration program, including visits to the United States, satisfies the GOM, then a major effort involving long-term financing and coordination with the current World Bank 15-year rural electrification program will be considered.

Based on the present estimates of rainfall and topography, coordinated with results from gauging stations, population estimates, and electrification plans, it is estimated that there is a development potential for small hydro of approximately 33 megawatts at approximately 100 sites which would meet Moroccan and AID social and economic criteria for development.* There is a potential for almost that amount again at two large sites, which would require high costs for dams. The average cost per KW of the 100 sites is between $2000 and $3000 installed capacity.

For a typical 330 kilowatt small hydro site with four kilometers of subtransmission lines to the load center, the following capital cost

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* Moroccan criteria remain to be investigated more fully during the selection process.

factors would apply: approximately $2000-$3000 per kilowatt for installed generation capacity and $5000 per kilometer of installed sub-transmission line. The total capital cost for this station comes to $895,000 or approximately $2600 per kilowatt. For nine months of operation, the total possible electricity generated would be 2.2 million kilowatt hours. If annual O&M costs are ten percent of the capital or approximately $10,000 per year and the amortization period is 15 years, the annual cost would be approximately $70,000 per year or about $0.03 per kwh. Even if the station operated at 30 percent of the maximum capacity, the kwh cost would only be $0.10. Operating costs for diesel based isolated energy systems in Panama of similar sizes show actual O&M costs ranging from $0.20 to $0.60 per kwh.* This high cost does not include spare parts or amortization and is due to the high inefficiency associated with operating diesel generators at less than their design load. Other data prepared by AID in a description of a proposed Photovoltaic Development and Support Program** shows that for a typical small community isolated diesel electrification systems employing a three kva generator and operating at 50 percent capacity electricity would cost $0.95 per kwh.

Therefore, for remote locations with some hydro capacity, generation of hydro power is very competitive with diesel. On a separate project-by-project basis where a given load center can be supplied by either extending a grid or developing a small hydro project, the small hydro seems also to be less expensive. The costs for extending a major transmission line long distances and stepping the voltage down for use at a load center are significantly greater than supplying power from close-by hydro sources through short voltage lines.

The site construction work will be done by ONE and coordinated with other energy projects planned or under consideration at the Center, for example, biomass. Where small hydro is seasonal and year-round service is desired, the use of biomass with a reliable steam generator linked to the hydro's generator can provide a service which can be competitive with centralized power. This combination of energy sources will be among the projects for future consideration and development at the Center. A nine hectare biomass plantation could accommodate the need for a 35 kw plant that might be without water for four months.

As renewable energy forms become more and more familiar, such combinations to overcome problems of intermittency will improve the quality of service.

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* Gerencia de Sistemas Aislados -- Gastos de Operacion de Plantas -- 1978, Instituto de Recursos Hidraulicos y Electrification, Republic de Panama.

** Photovoltaic Development and Support Program, Project Paper DS/EY, March 1979, AID.

F. A Solar Energy Use Program

The exploitation of solar energy in Morocco can have a significant impact on the government's attempts to supplement traditional energy forms with alternative energy resources. The available solar energy reaching the ground at Marrakech, for example, varies over the year from 260 (December) to 680 (July) cal/cm^2/day (Langleys). The average for the year is 474 cal/cm^2/day. There are also on the average 8.6 hours of sunlight per day.* These values are very high and theoretically there is a maximum of 5.5 kw hours of electricity per day per M^2 of surface area. Thus, if the available solar energy could be converted to electricity at 100 percent efficiency, a peak megawatt could be generated for each 200 M^2 of surface area. This type of efficiency is not possible today; even with space age and highly efficient photovoltaic conversion technology, only 10 percent of this is achievable. However, because the solar energy profile for Morocco is so ideal for exploitation, uses of solar energy should be examined, technologies developed and applications provided.

In order to begin this long-term solar energy development and exploitation at the Renewable Energy Center, a program of study, research and demonstration should be initiated. This program should begin with a study to define the appropriate geographic and economic development situations in the country for solar energy applications. This study will require a minimum of 8 months to complete and should match appropriate solar technologies with social and economic development programs. Additionally, this study should identify country-specific priorities for monitoring research, technology assembly and manufacturing and specific sites for demonstrations. It is expected that this study will set the course for the solar energy related work of the Renewable Energy Center. It is anticipated that the study will be prepared under the direction of a consultant working with Moroccan personnel.

A preliminary evaluation by GOM/AID personnel has identified solar thermal irrigation and water supply applications as a potentially important area of work for the Center. Solar pumping technologies are currently undergoing substantial adaptation and innovation and these improvements are to the point where specific technology/application matches are economically competitive with other pumping schemes. Because of the in-country need for economically competitive alternatives to diesel-driven pumps and the expected increase in dispersed agricultural irrigation**, one of the first technology demonstrations should be solar pumping. As a first step in introducing and applying technology to irrigation and water supply, small state of the art thermal solar, photovoltaic and wind-driven pumping systems should be purchased and installed at sites on or near the Center. This program of technology introduction will require approximately $200,000 during the second year of the project

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* Data taken from the October 1977 Rapport du Groupe Energie, Energies Nouvelles (preparation du Plan de Developpement Economique et Social - 1978-1982), Ministere de l'Energie et des Mines.

** Ibid.

and should result in at least one system each using the above-mentioned three solar processes to be operating at agricultural sites in Morocco by the end of the second year. It is possible that additional different technologies will also be identified as appropriate for immediate application. If this occurs, either a different mix of technologies can be purchased for the same budget or the solar project budget can be increased. The total solar program of the Center from studies through technology replication will amount to approximately $250,000 for the first three years of operation.

The full project for Morocco encompasses the creation of an institution, training of professionals to work within it, information to assist in making further decisions necessary to introducing renewable energy to Morocco, and two applications of national, social, economic and energy significance.

The Center provides a means for Morocco to expand its capacity to manage energy systems. AID is well placed to give the Center a necessary impetus and focus on renewable energy; the Moroccan government has recognized that this effort is a necessary beginning to a solution of its energy future and may expand its concept to include all energy sources.

III. SOCIAL SOUNDNESS

A. Analysis

The Moroccan social and political structures does not pose major obstacles to introducing renewable energy technologies such as those proposed under this project. Moroccan farmers along the coastal plains are well familiar with wind-powered pumping systems, although many such systems were abandoned in the 1950s when diesel-powered motors and/or gravity irrigation were deemed more practical. Solar energy for hot water heating was introduced on a limited scale some 20 years ago, and there is currently wide interest in this technology among government planners and the science and technology community. Most Moroccans in the rural sector are aware of the large hydroelectric dams which dot the mountains and valleys and the pace and benefits of rural electrification which now reaches most main towns.

Although all the long-range implications of the technologies introduced in this project may not be evident, Moroccan officials and villagers at the proposed small hydro power sites, for example, appear quite receptive to the planned demonstrations. Since much of the rural population already derives household fuel from brush and forests (with increasing difficulty in many of the mountainous and semi-arid zones), controlled wood lots under intensive cultivation should be readily accepted as providing a direct and comprehensible benefit. With the introduction of solar pumping, the demonstration will largely substitute this energy form for human, animal and, in some cases, fossil fuel energy. Except for the question of maintenance and need for back-up systems using conventional energy, the benefits should be readily apparent to the small farmer.

Therefore, while we are reasonably assured of the acceptability of these technologies, an important aspect of the project is to determine

how these technologies are used by the rural population and what socio-economic changes in the environment result as a consequence of this technology.

In developing renewable energy applications, the Renewable Energy Center at Marrakech will be looking at socio-economic implications. Personnel from the Center, or contracted by the Center, will conduct socio-economic feasibility studies on the three sites selected for small decentralized hydro demonstrations. This sort of groundwork is often overlooked with unfortunate long-run repercussions. The range of issues for social analysis is extensive and includes:

1. Current village energy services and their application to special activities;

2. New demands for conventional energy which may be created by renewable energy demonstrations;*

3. The long-run and probably deteriorating supply/demand relationships for wood, brush, and dung as village fuel sources;

4. Technical performance of devices, including problems of maintenance and delivery to a dispersed population;

5. Cultural congruence and associated behavioral changes;

6. Costs relative to existing and alternative technologies which could inhibit future applications.

Again, while the purpose of the demonstration projects is to test both the technological and socio-economic viability of renewable energy, some preliminary observations may be made. It is clear that demonstration projects should be sited with great care to assure selection of target villages where the impact of new energy sources will be strong and beneficial. In discussions with the Ministry of Interior, criteria were used that assumed selection would be made among villages where additional development funds were slated as part of a Moroccan effort to create village centers as productive alternatives to the urban areas.

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* For example, the project does not provide for motive power, e.g., for land preparation or farm-to-market movement of produce, both of which are dependent on human and animal effort or petroleum-powered engines.

With regard to project congruence with existing practices, it may be noted that many isolated mountain villages in Morocco are already familiar with small water power technology. Thus, it is unlikely that the SDH technology will be rejected for societal reasons. At one projected demonstration site, there is a 12 KW SDH system operating off a spring. The power generated is only sufficient to light the village chief's house for a few hours each evening. It is pooposed to replace this inefficient spring-powered unit with a larger unit which will provide electrical power for all the inhabitants of the village

For biomass demonstrations, there are several non-technical issues critical to the successful demonstration of the tree plantations project. Most center on the management of the tree plantations.

Although the land to be used is all Class 4 land, land not suitable for agriculture, ownership may be shared. The land may be individually, collectively or government owned. In putting together a 2500 hectare demonstration site, land ownership may be an important issue to be resolved by the government and villagers affected.

Villagers will have to be mobilized to help establish the tree plantations and to maintain them during the three-year growing period. There will be certain periods of high labor demand such as during initial plantings and at harvest time. It will be important that the villagers feel they have a stake in the tree plantations; otherwise, they may be reluctant to contribute their services (even though they may be paid). While labor requirements do not appear to be very great, optimal planting of the biomass plantations may occur roughly at the same time most other crops are planted.

Clearly, the tree plantations proposed in this project involve a number of important social and economic issues. As part of the pilot applications of this activity, analysis will be required of technical and behavioral questions.

Problems of social soundness may well surface in the specific application of new renewable energy sources at specific sites. Indeed, the social and economic feasibility studies developed by the Center are designed to reduce these problems. But, as the following section on benefits notes, the overall project is socially sound and desirable.

B. Benefits

The project and its associated activities should result in a number of desirable economic benefits within the context of the AID human needs objectives. These benefits arise first from the introduction of new energy sources to villages which previously lacked them. Secondly, they arise from the replacement of human and animal effort in critical peak labor demand activities such as threshing. In addition, there are benefits, such as reducing dependency on imported energy, which are national in scope, and which cut across the lines of economic classes.

With reference to the disadvantaged rural population, economic benefits arise at the village level in the following ways. First, the production of biomass should directly provide fuel for cooking and heating fires of the rural poor, either through burning of wood, or of charcoal made from the wood. Biomass plantations should provide some employment for villagers (planting, care and harvesting). The eventual production of electrical and mechanical power, through equipment to be purchased under the project, will provide an opportunity for additional employment, provided such power is carefully integrated into a scheme for the stimulation of small enterprises in the village.

Solar pumping, too, can provide economic benefits to the rural poor, through the introduction of new cash crops made possible by irrigation, for example. Again, the technology must be applied as part of a well-thought-out agricultural development effort. It is possible that new credit mechanisms will have to be developed in the context of the demonstration projects, so that truly poor rural people who nevertheless have some land can gain access to the new technology. Small hydro power can have beneficial effects on mountain population centers, such as market towns, through better food storage and processing facilities, lighting, school and dispensary electrification, provision of power for small-scale repair and construction shops and access to communications.

Villages condemned to darkness in the evening are limited in the time available for educational, entertainment or productive activities. Evidence in the Philippines indicates that lack of lighting is a contributing factor to high birth rates. Complete reliance on wood, brush, dung or straw is not only physically burdensome to the women and children involved in the increasingly long trek to gather it, but also results in further soil degradation. Sheet and gully erosion increase and organic nutrients are removed. In the absence of energy-using pumping systems (whether driven by diesel, solar, wind, human, or animal means) village water supply is often confined to human or animal haulage from surface sources. The resulting supply is inadequate in both quantity and quality for drinking, cooking, clothes washing and bathing with resultant sanitation and health problems. In short, the greater the reliance on traditional energy, the more likely it is that

village residents have a low physical quality of life, few employment alternatives and little potential for improvement.

In addition to impacts at the village level, there are national implications arising from the successful completion of demonstration projects. The substitution of renewable energy sources for expensive imported petroleum frees scarce foreign exchange and domestic resources for other purposes. Substantial reduction of fossil fuel used to generate electricity from a nationwide grid can be obtained by tying in a number of decentralized hydro stations to the grid. This can be done by running central generating plants at less than top capacity, and using hydro power to meet demand peaks. For such a purpose the hydro stations would have to be sized larger than required for rural village or town uses; but the additional cost of increased generating capacity at a small hydro site is relatively modest.

In the biomass area, one of Morocco's current natural resource problems is the deforestation which is taking place at a net rate of about 15000 hectares per year (the government plants approximately 25,000 and 40,000 are cut from mature growth). A beneficial impact of the biomass plantations can be expected to be a preservation of existing forests, the reduction of upstream erosion and downstream siltation of reservoirs. To achieve these ends plantations must be substituted successfully as sources of supply for the current wood market (it is not known at present how much deforestation is due to individual, non-market related taking).

If a village demonstration program is deemed successful, it should be adopted on a much larger scale, and may be able to be extended to urban areas, providing energy for both domestic and certain industrial uses.

Other Center activities will have economic impacts as well. During the first start-up period when the training program is developing an understanding of basic potential for the introduction of renewable energy, market studies will emerge. Only one half of the irrigable land is now developed in Morocco, and water pumping analysis is slated for determining solar pumping possibilities for the rest. Other markets for renewable energy will be discovered (e.g., hot water) and results should stimulate activity in the private sector. Quality assurance efforts by the Center should help avoid the market potential being damaged by faulty devices.

The primary social significance of the Center's work is that village poor will be given opportunities for advancement through the addition of energy to their productive potential. By relating electricity generation to the other development activities slated to be introduced into communes by the GOM, village economic life should be stimulated and the tide toward large cities may be slowed. In the

context of an articulated policy by the GOM to improve village life decentralized energy is the technological analogue to retaining rural populations. The AID program can be one element which will assist the GOM to carry this policy forward.

In the long run, the demonstration of the value of renewable energy for the rural population will have national implications for urban population who potentially will be better served both through the reduction of overcrowding and through the results of the countryside "growing" energy for the city

The technological impact is both specific and general. Most specifically, the technological work of the Center will result in quality assurance of performance of solar equipment; the introduction, adaptation, and advancement of specific solar devices; and the bringing of agronomic technology to forestry production methods. More broadly the end use analysis at the Center can result in different consumer devices being produced to apply new energy forms to traditional uses. From the training included in the project effort, there also will be produced scientifically trained engineers with technological skills for application in the production of energy and its applications. The initial exposure of these young engineers to the village targets will provide the basis for them to develop technologies in service of the rural population. Technological development in many developing countries has most often been for the modern, urban sector. Renewable energy technology in the format introduced by the Government of Morocco and AID, has a chance of changing that focus.

IV. ACTIVITY RESULTS

The activities and milestones are developed in detail in the project implementation chart. In general, the result of the effort in Morocco over a five-year period will be a group of more than 19 well-trained renewable energy experts to work for the introduction of renewable energy. This represents a doubling of existing personnel at the headquarters of the new ministry charged with a national energy management mission.

This group will work together to coordinate and develop efforts that advance application of renewable energy. Two main activities in biomass and small hydro will begin immediately to be followed in one year by a water pumping program

The biomass activity will involve a test plantation of 20 hectares, where various specific investigations will be carried out as detailed in Appendix C. There will also be three demonstration plantations, which will eventually amount to 2500 hectares each (only one-third of each plantation will be planted each year because of the

planned harvesting pattern). Equipment to use the energy potential of the plantations will be ordered in the third year of the project; generation of 2000 kw will be an eventual output at one site (Year 4), and 250 boiler horsepower will be provided at a second site, for a possible combination of electricity generation and mechanical energy. At the third site a linking of decentralized hydro and biomass will be planned, probably about 50 kw. for steady generation of electrical power during period of dry stream beds.

The decentralized hydroelectric generation activity will involve three sites, each generating 200 kw on a year-round basis. One will be on the North side of the High Atlas, and two on the drier South side.

Solar pumping activities will be investigated during the first year, and implemented during the second and third years. The amount reserved for equipment would permit application of solar energy to six to ten locations, depending on several factors. At present it is thought that one or two applications ought to be for village drinking water, and the others for agricultural uses. What actually happens will depend on research during Year 1.

During the development of these activities, more substantiation for additional projects will be undertaken. Based on the additional analysis a long-range program can be developed at the Center.

Thus, people, plans, and projects all emerge from the effort. The project scopes include initial studies, demonstration efforts and plans for major scale introduction into the national and rural economy. The management supervision role of the Center should facilitate integration of activities among the ministries so that renewable energy takes its most reasonable place in the economic future of the country.

V. FINANCIAL PLAN

The costs identified in this project paper for each sub-project are based on current analysis of projected expenditures. Much of the energy Center's work program will be developed in the first year. Thus it is not possible to give detailed estimates now for each of the Center's proposed activities. For example, $250,000 is planned for Year 2 Center budget to purchase solar pumping equipment. The exact number of solar pumping demonstrations and the cost of each individual demonstration will be determined by the solar pumping demonstration plan to be prepared in Year 1. We have included $40,000 under Technical Services in Year 1 to cover the cost of social analyses in order to provide as accurate a picture as possible of the socio-economic impact on rural populations of renewable energy applications. While the general magnitude of resources can be determined now the specific allocation must await the detailed plan envisaged for Project Year 1.

The recommended United States financial contribution to this project over three years is $3.411 million. This amount covers the foreign exchange cost of three categories: technical services ($1,420,000); participant training ($320,000) and equipment ($1,230,000). Inflation and contingency factors account for the remainder ($441,000).

GOM contributions, although difficult to calculate in detail at this stage, are substantial. The GOM will construct and staff a Renewable Energy Center. Construction costs are estimated at a minimum of $500,000 (exclusive of land acquisition costs). By the end of Project Year 4, the Center will have a staff of 26 professional and additional administrative personnel. Annual salary costs will be over $700,000. The hydropower and bioresource demonstration projects will require substantial GOM outlays for labor support services and construction. These outlays will dwarf the United States contribution, especially when the GOM begins replicating the demonstration projects. The three decentralized hydropower demonstrations will require a GOM outlay of roughly $400,000 for civil engineering. United States costs for the demonstrations are estimated at $450,000.

The GOM realizes that the development of renewable energy resources tends not to be capital intensive. Indeed, the majority of project costs will be local, not foreign exchange. However, while the GOM share of the project will be high, the potential for saving Moroccan earned foreign exchange is also high. Each barrel of oil equivalent produced by renewable energy will save the GOM the foreign exchange equivalent of a barrel of oil. Additional costing will have to be done to determine how much the GOM will contribute financially to the project. A conservative estimate is that the GOM will contribute $2 for each dollar of United States assistance

Table I shows planned United States expenditures by sub-projects and by project year. Table II is a summary of total cost estimates by project year.

Table I

PLANNED EXPENDITURES BY SUB-PROJECT & PROJECT YEAR (US $ 000s)

	PY 1 US/HC	PY 2 US/HC	PY 3 US/HC	Total US/HC
A. Renewable Energy Center*				
1. Equipment	50 500	500 10	30	580
2. Training	42	152	90	284
3. Technical Services	280	110	160	550
4. Inflation (10 percent)	37	76	28	141
5. Contingency (5 percent)	19	38	14	71
	428	876	322	1626
B. Biomass Project				
1. Equipment		100	200	300
2. Technical Services	40	20	50	110
3. Inflation (10 percent)	4	12	25	41
4. Contingency (5 percent)	2	6	13	21
	46	138	288	472
C. Decentralized Hydropower				
1. Equipment	350 400			350
2. Training	36			36
3. Technical Services	560 65	200 35		760 100
4. Inflation (10 percent)	91	20		111
5. Contingency (5 percent)	46	10		56
Sub-total	1083	230		1313
Project year sub-totals	1557	1244	610	
PROJECT TOTAL	3411			

* Costs for Center include Solar study and demonstrations.

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Table II

SUMMARY OF COST ESTIMATES BY PROJECT YEAR (US $ 000s)

A. AID Inputs	PY 1	PY 2	PY 3	Totals
1. Technical Services	840	330	250	1420
2. Training	78	152	90	320
3. Equipment	400	600	230	1230
4. Inflation (10 percent)	128	108	57	293
5. Contingency (5 percent)	65	54	29	148
	1511	1244	656	3411

B. GOM Inputs

The GOM will provide the building for the Renewable Energy Center (estimated at $500,000 not including cost of land), and professional and administrative staff of the Center (26 professionals by the end of Year 4), all civil engineering costs for the small hydro demonstrations (estimated at $400,000), and all personnel for the hydro study; land, labor, seedlings, and maintenance for the biomass plantations.

Table II:

ANTICIPATED USE OF CONSULTANTS

Year	Type	Duration (P/M)
1	Project Advisor	9
	Decentralized Hydro Expert	3
	Biomass Expert	3
	Solar Thermal/Photovoltaic	8
2.	Project Advisor	24 (resident)
	Decentralized Hydro Expert	2
	Biomass Expert	2
	Solar Thermal/Photovoltaic Expert	2
	Development Advisor/s*	4
3.	Technical Consultants **	10

* Will include small business consultants; possibly rural sociologist or economist. These persons will work both at ministry and local levels to implement development projects, particularly those involving small hydro.

** No specific designations are given: these will depend on program development at the Center

VI. IMPLEMENTATION SCHEDULE

The technical assistance portion of this project will be implemented through the vehicle of a host country contract. DS/EY and NE/TECH will assist the Mission in preparing the necessary technical RFP so that ideally a contract award can be made four months after the signing of a Project Agreement and sometime during December 1979. Various entities of the Ministry of Energy and Mines have had substantial contract experience in the areas of petroleum exploration large hydroelectric installations, etc., and thus contract management capability is strong. It is thought that most U.S. origin equipment required for this project can be procured on a more cost effective basis through USAID/M. That is technical specifications will be prepared by the Technical Assistance Contractor in collaboration with the Ministry of Energy and Mines, and channelled through the AID procurement system for competitive awards. In order to have core trained staff available as early as possible during the life of the project, certain participant training activity will commence before the signing of the project agreement, e.g., via USAID/M's Development Training and Management Improvement Project (0149) and various centrally-funded projects, host country candidates have been recruited to participate in diverse short-term and long-term training programs in the renewable energy sector. Future training activities will be covered by this project.

Figure 1 shows the planned schedule of implementation for the first three years of the project and associated activities. Shown are start-up activities development of the Center, and small hydro, biomass and solar pumping. It is realized that certain dates are approximate, and that there will probably be some slippages. Nevertheless, certain dates are regarded as key milestones. These are set forth below. The implementation schedule for the fourth and fifth years of the project will be developed during years one and two.

Figure 1

1. Start-Up	
Summer 1979	Recruitment of four engineers
September 1979	Two engineers to Brookhaven
January 1980	In-Morocco training of staff
March 1980	Biomass research and village selection begin
2. Center	
September-December 1979	Renewable Energy Center Law
September-December 1979	Director appointed
September-December 1979	Site identification and acquisition starts
April 1980	Director commences project planning
September 1980	Building started
September 1981	Building occupied
3. Small Hydro	
September 1979	O.N.E. completes study of 20 sites
October 1979	Sites selected and design begins
December 1979	Major site study begins
April 1980	Construction begins -- 3 sites
November 1980	Three sites operational
4. Biomass	
February 1980	Center research design and lab design
March 1980	Equipment specified
June 1980	Experimental plantings at Center location
September 1980	Two biomass scientists to United States for graduate study
5. Solar Pumping	
April 1980	Solar pumping study begins
October 1980	Solar equipment ordered
January 1981	Solar site work begins
May 1981	Solar pumping begins

Figure 2

IMPLEMENTATION SCHEDULE

1979

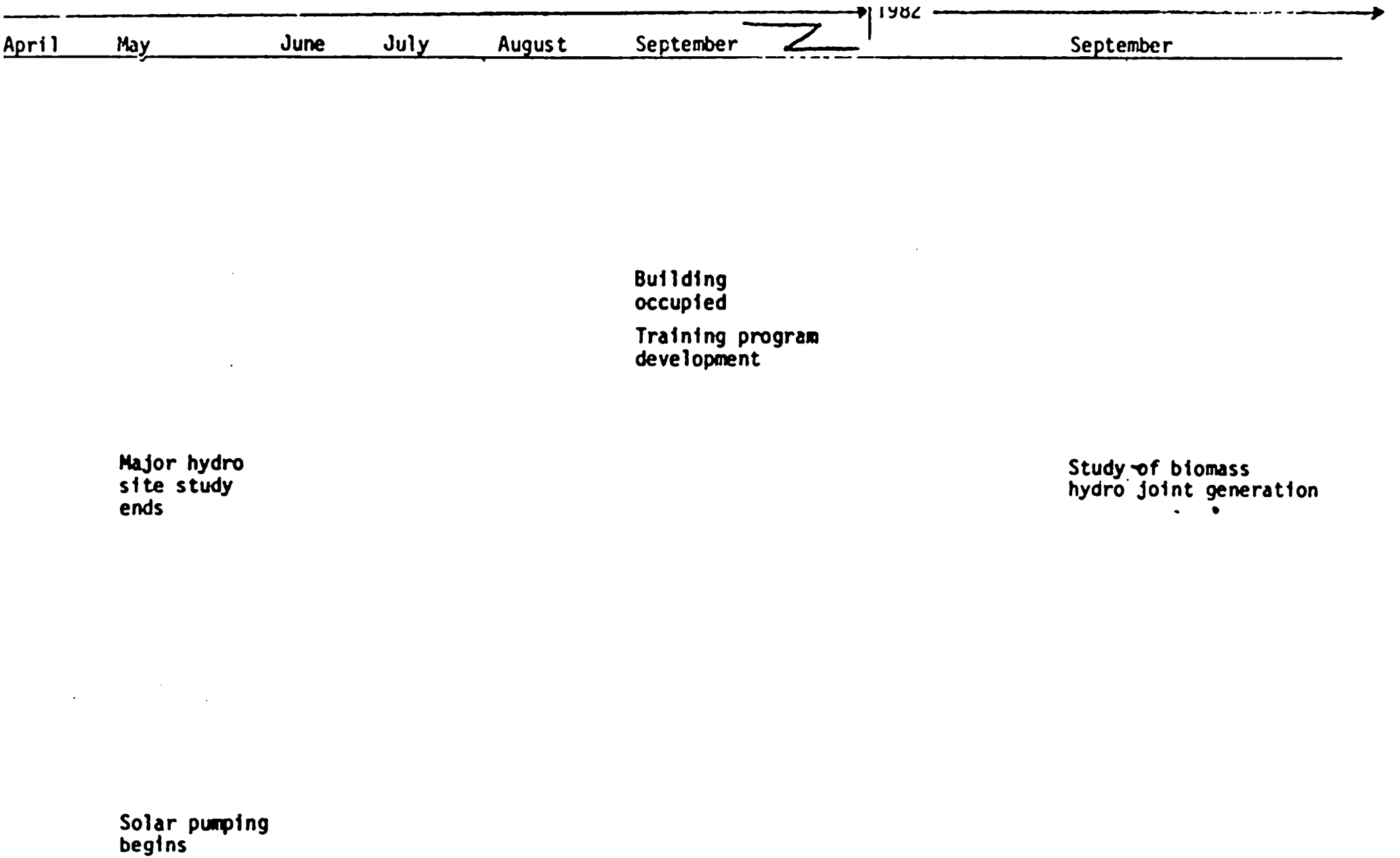
Activities	Summer	September	October	November	December
Start-up	Recruitment of 4 engineers (Ministry of Energy & Mines)	2 engineers to Brookhaven (total: 3 months)			
Center		Law passed	Director appointed Site acquisition commences	Review of national energy planning and development	
Small Hydro	Study of 20 sites -- O. N. E. -- U.S.-Moroccan approval - 3 sites		Consultant to Morocco Select & prepare design for seven sites Equipment order for 3 sites		Major study (18 months) of 200 sites
Biomass					
Solar Pumping					

1980-

January	February	March	April	May	June
Energy planning and applications seminar	Biomass workshop	Biomass research 2 engineers to Brookhaven	Small hydro workshop	Site visits	Brookhaven reports - review (2 weeks) 2 solar engineers to United States
			Project planning (Solar, Biomass)		
Moroccan hydro engineers in United States (2 months)					
	Center research design Lab equipment specified	Villages selection	Management Planning Site Acquisition begins		Experimental plantings (20 hectares)
			Solar pumping study commenced		

Figure 2 (continued)

Activities	1980 July	August	September	October	November	December	1981 January
Start-up			Solar engineers return				
Center			Building commences				
Small Hydro			Site work ends on three sites	Hookups of three sites	Electricity generation - three sites		
Biomass	Management planning		2 biomass scientists to United States (18 month study	Site work begins on three sites			
Solar Pumping			Complete study	Solar equipment ordered			Solar site work begin


1982
April
May
June
July
August
September
September
Building occupied
Training program development
Major hydro site study ends
Study of biomass hydro joint generation
Solar pumping begins

VII. EVALUATION PLAN

A. Renewable Energy Center and Activities, Years 1 and 2

The success of the Renewable Energy Center depends on the degree to which each of the functions contributes to the introduction of renewable energy into both the planning and development of the country's energy system. The Director of Energy has indicated to the team his desire to see an integration of renewable energy into the planning process. Thus, one of the factors to be evaluated on a yearly basis is how well this is being accomplished. In the first year, the acquisition and organization of data, and the preparation of reports for the Director concerning discrete technologies should be undertaken. Funds have been included in the budget for the undertaking (in Year 1) of social analysis aimed at gathering and evaluating the necessary data (see Section V - Financial Plan). The first evaluation will describe these activities and the reception by the Ministry.

In the second year, overseas training will have begun for a number of engineers, and biomass, small hydro and solar pumping projects will have begun. Evaluation of this year's activities should include the interest and participation of the ministries concerned with development. Thus, the full cooperation of the Ministry of Agriculture will be required to commence solar pumping demonstrations. In biomass, the successful acquisition of land and the mobilization of rural workforces for planting will be required, and for the first time, cooperation will be required at the local level. Problems encountered will have to be carefully evaluated and solutions found if biomass is to attain its potential in Morocco. In small hydro, the Office Nationale d'Electricite will largely be responsible for the installation of units at the selected sites. Evaluation will be made by the Center staff and a foreign consultant of the success of the operating installations in meeting design specifications.

B. Biomass

Evaluation as a separate activity (apart from the Center) will be important during the third year of the project. In biomass there are many uncertainties and potential problems, of both scientific and organizational natures. Knowledge of soil adaptability and growth rates are based thus far on somewhat limited geographic evidence -- nine years experience with an experimental planting, plus information gathered in conversations with foresters and officials of Eaux et Forets. By the end of the third year of the project, some preliminary conclusions will be able to be drawn about the suitability of some eucalyptus species to adapt to close planting; this assumes that test plantings can begin at the beginning of the year. There will as yet not have been time to test other species, or to have performed any genetic work in a laboratory.

Scientific evaluation will thus be limited: however, the managerial and technical questions relative to development of a wood energy system will have to be addressed during the third year, inasmuch as preparations will be made to move to demonstrations of mechanical and electrical energy generation from wood during Year 4. The organization of transportation of biomass, the setting up of end uses (e.g., small industries -- an idea mentioned enthusiastically by Ministry of Energy personnel), and the means taken to avoid social disruption, all will require much thought and planning. Evaluation of the biomass activity will consider this, as it is as important as the scientific aspects for the future of this form of energy.

C. Small Hydro

In small hydro, it is hoped to have operating demonstration sites by the end of 1980: at the same time the study of about 200 sites will be proceeding. In the third year, comparisons can be made between small hydro generation and a village where diesel electricity is now provided: a village with no electricity: and a village where a very small (10 kw) old hydro unit is providing power to two or three buildings only. Patterns of development of electric use should be able to be measured from the first weeks of operation over a period of twelve to eighteen months. The Office Nationale d'Electricite maintains that development will follow the introduction of electricity. The Director of the Renewable Energy Center will, through his small hydro engineer, not only follow operations of the hydro activity, but will actively plan for those additional activities necessary for full use of hydro energy in development (again, small manufacturing and service industries area possibility: also tying in hydro with biomass-fueled generation during dry periods). In approximately April 1982, an in-depth evaluation will be held to examine overall progress of the project.

VIII. OTHER DONOR ACTIVITIES

The UNDP sent a mission to Morocco in April 1979 to investigate whether Morocco would be willing and able to participate in a regional program involving applications of renewable energy. The mission concluded that the Renewable Energy Center would probably be nominated by the GOM as the responsible organization for such an enterprise. UNDP has a small ($10m^2$) solar heating installation in a small town south of Rabat. It has no present plans to work in the renewable energy area within Morocco.

The World Bank plans to have a major project to extend the electrical distribution system in Morocco. This will take place over the next fifteen to twenty years. It is possible that financing for a major decentralized hydroelectric effort may be sought from the Bank, following successful demonstration of the technology by the Renewable Energy Center.

Though French companies are attempting to develop exports of solar thermal collectors to Morocco, there is no French government program in this area within the country. (Some engineers are studying basic science relative to solar at French universities.) There is no known involvement of the German government, or of the African Development Bank.

AID 1020-28 (1-72)

PROJECT DE
LOGICAL F

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS
Program or Sector Goal: The broader objective to which this project contributes: Expand the uses of renewable energy in rural development	Measures of Goal Achievement: Substantial increase in plans for and applications of renewable energy in rural development projects. Ministry's budgets include renewable energy activities
Project Purpose: The purpose of this project is to create a Renewable Energy Center for Morocco to carry out studies and demonstrations that will contribute to formation of a national energy plan.	Conditions that will indicate purpose has been achieved: End of project status. - Physical establishment of a Center - Research and demonstration projects operating. - Center functioning in all departments - Center's studies being included in national energy plan
Outputs: Trained personnel at Center and in Ministries. Renewable energy studies. Renewable energy projects and reports. Renewable Energy Center. Quality assurance program	Magnitude of Outputs: Trained personnel (Center only) 19 Trained personnel in ministries 12 Renewable energy studies 5 Renewable energy projects and reports 3 Renewable Energy Center building and lab equipment 1
Inputs: Technical services Equipment Training Moroccan Ministry of Energy Personnel " Land and Buildings	Implementation Target (Type and Quantity) _____) _____) $5,000,000 _____) 59 person/months As necessary " "

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:N SUMMARY
.MEWORK

Life of Project:
From FY _____ to FY _____
Total U. S. Funding _____
Date Prepared: _____

MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
evelopment plans and budgets of various inistries and reports of the Ministry f Energy.	Assumptions for achieving goal targets: - Ministries include renewable energy resources in rural development plans - New energy generated is used to stimulate new enterprises at village level - - GOM makes careful selection of village demonstration sites where impact of energy will be strongest
GOM project reports. Contractor project report. AID Mission reports.	Assumptions for achieving purpose: Enough trainable personnel can be recruited. Large amounts of land for biomass will be provided by GOM Moroccan electricity utility will aggressively pursue activities in connection with small hydro site identification and development.
'raining reports .nergy study reports of Ministry of Energy. :ield visits to sites; reports. :ield visit to building.	Assumptions for achieving outputs: Ministries will release personnel part time for training in Morocco, full time for overseas training. Center staff will be able to work independently after field briefings by experts. Ministries of Agriculture Interior, Housing and Plan will cooperate in projects. Moroccan government will finance construction and land costs.
'ouchers :opies of subcontracts :eports	Assumptions for providing inputs: AID can contract for services required. Government of Morocco is willing to provide required land to construct building, and to assume responsibility for all dirham costs.

APPENDIX A

ORGANIZATION AND TRAINING

I. Organization

The organization plan for the Renewable Energy Center is designed to fit its evolutionary character, and also to take into account the time required to form qualified staff, in a country where there is a chronic shortage of technical specialists in all fields. The investigations carried out by team members concerning the availability of personnel have influenced their recommendations as to the progressive development of the Center. Though engineers with excellent training are available to the Center, none has had other than casual exposure to renewable energy technology. The training program described below is designed to build upon undergraduate training of engineers in such fields as hydraulics and electricity. This will require time.

Figure 1 shows the organization of the Center as it is expected to be during Years 1 and 2. In the team's view, the early nomination of a Director is not critical: direction can come from Ministry staff. until a Director is selected. It is, however, critical to identify the four planning engineers, who will perform the initial work of gathering and analyzing data. and planning for the introduction of renewable energy as a substitute or new source. The Ministry has indicated that it will not be difficult to assign four young engineers to the planning function as early as June or July, 1979. In fact, it is already considering specific persons for at least two of these positions.

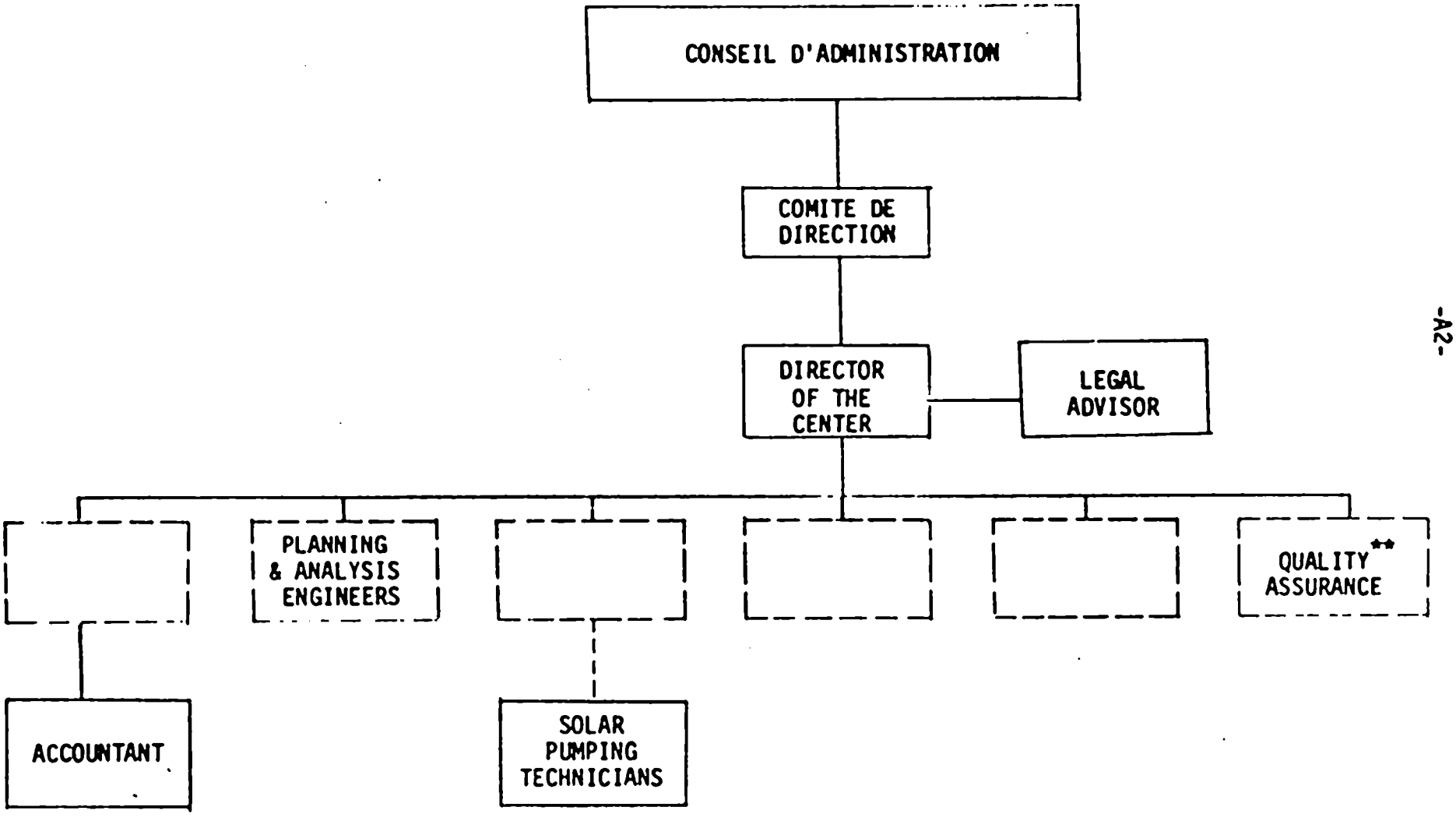
The Ministry has also planned to have a legal advisor who would work with Ministry technical personnel or the Director when he is nominated, to draft legislation, arrange for the acquisition of land, and so forth. Toward the end of the first year, two Ministry personnel will receive training in solar pumping in the United States, so as to be able to work at designated sites during Year 2.

During Year 2 it is likely that some Quality Assurance work will be performed, on renewable energy equipment already in the country. A Quality Assurance engineer will not yet have been trained. but initial work can be begun by the Planning and Analysis engineers in cooperation with Faculty of Science professors.

During the first two years of the Center's existence, and while the process of acquisition of land, constructing and equipping of buildings is continuing, Center staff will be recruited and trained according to the schedule set forth in Fig. 2. At this point it is appropriate to note that although they do not appear on the organization plan of the Center until Year 4, the training of several of the technical

Figure 1

Renewable Energy Center Organization*
Year 1/2



* Technical and professional personnel only shown on charts.

** Functions may initially be performed by planning and analysis engineers.

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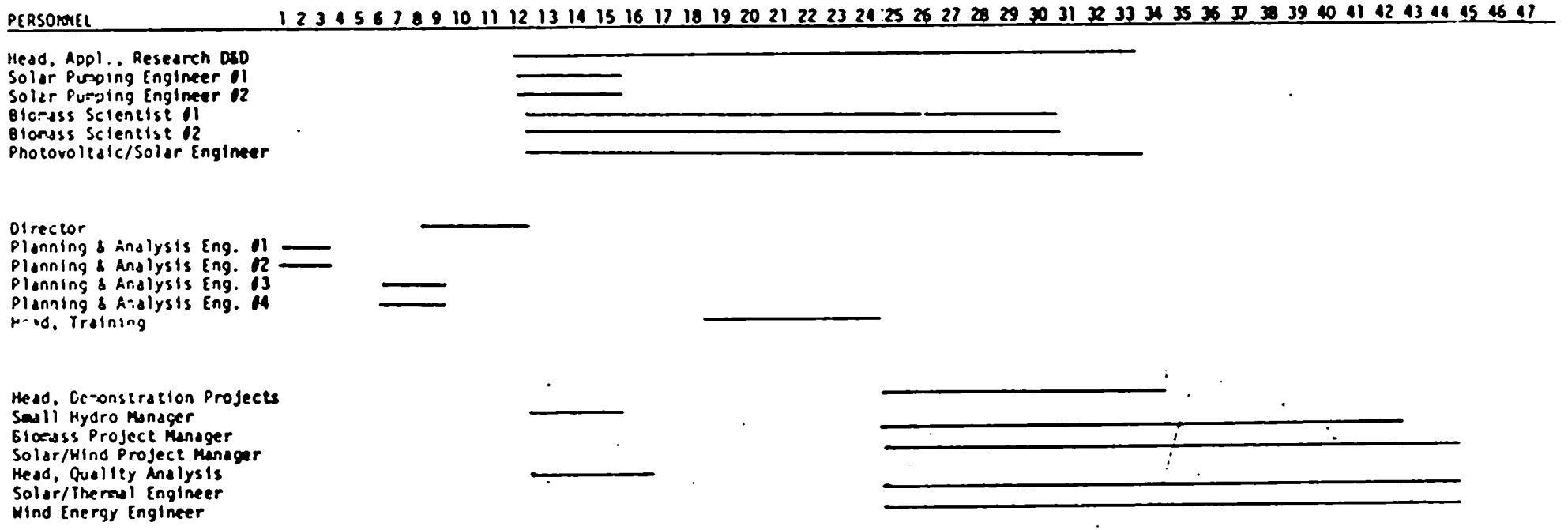
Overseas Training

Figure 2

SCHEDULE FOR OVERSEAS PROFESSIONAL TRAINING



personnel begins during Years 1-3, or the period covered by this project paper. It is essential to realize that flexibility is required when planning so far ahead for a new institution. During the first several months of the project the new directions the Center will take, and its linkages with other governmental bodies will emerge much more clearly. It would be wise to review the organizational planning toward the end of the first year in the light of experience gained. It is thus possible, for example, that the Small Hydro Projects Manager may, in fact, be located in the Office Nationale de l'Electricite (O.N.E.). Though adjustments may be made, however, the team is confident that the general organizational lines and, in particular, the training for technical personnel, is appropriate to the purposes and goals of the Center.

Figure 3 shows the Center as it is expected to evolve in Year 3. An economist trained to analyze energy tradeoffs, and costs and benefits of energy systems, will provide information to the Head of Energy Planning and Analysis. Each of the planning and analysis engineers will by now have had training overseas in energy policy analysis, as well as in-Morocco training in renewable energy technologies, data analysis, and project planning. One of these engineers should be appointed to be Head of the department, which will be one of five eventual departments in the Center. A systems analyst/statistician should join the department in Year 3; in addition to organizing and working on data acquired or developed by the Center, this person will have the specific task of planning for a major biomass project.

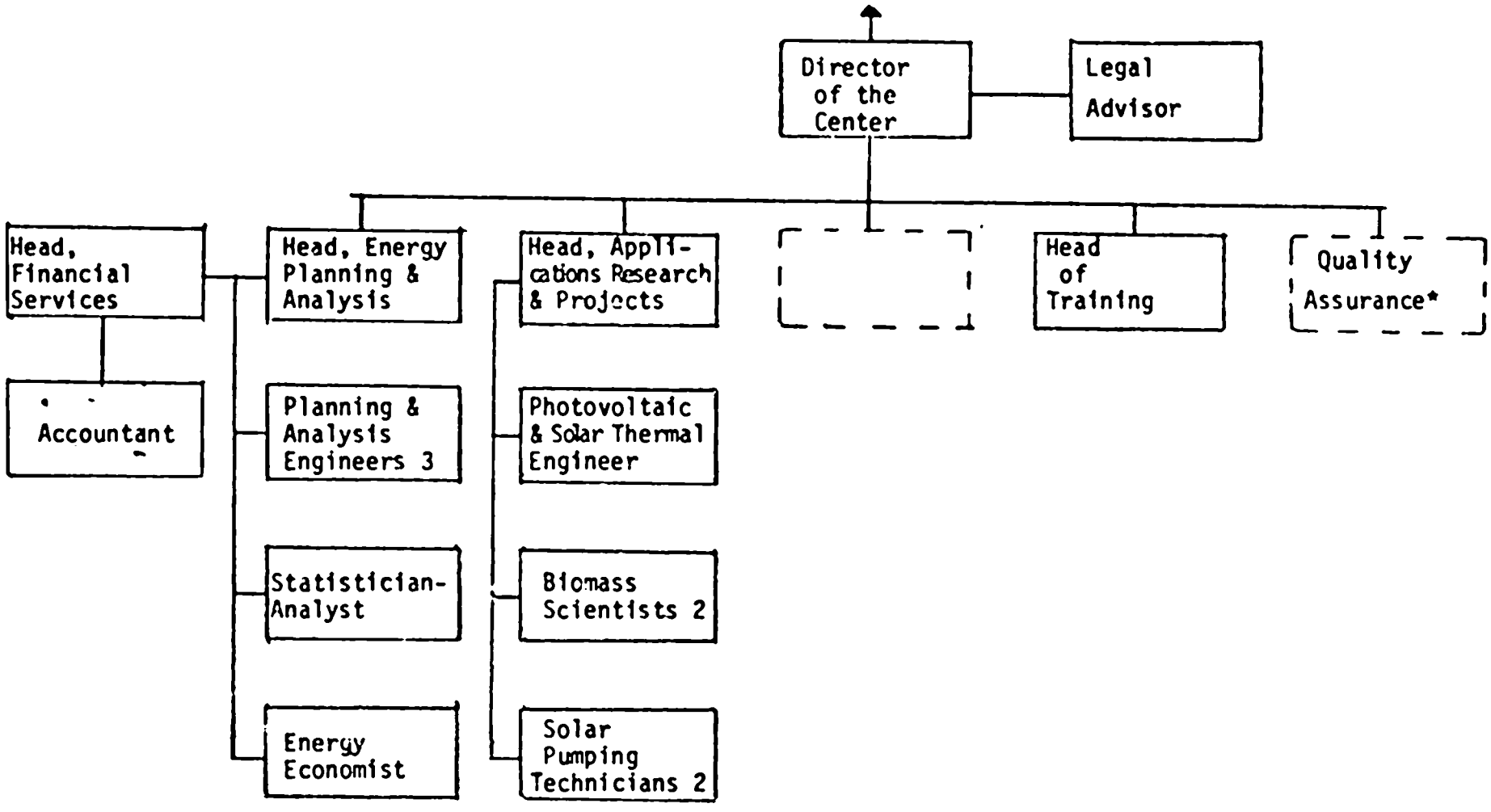
A Department of Applications Research, Development and Demonstrations (ARDD) is also established during Year 3. It is concerned with all activities needed to apply renewable energy technologies to new energy needs, or as substitute sources. All six initial members of this department will have extensive training abroad; major emphasis is given to small hydro, biomass and solar pumping, to correspond to the three projects which are planned in these technologies. Small hydro personnel will be located in with O.N.E., which already has some experience and one installation, and which will be responsible for installing and maintaining small hydro plants. Biomass personnel will be located at the Center and will work with Eaux et Forets, which would have a significant role in a major biomass effort. The photovoltaic solar thermal engineer will work part-time on problems of quality assurance.

Year 3 also sees the creation of a training department. Activities to be pursued by this department are more fully described in the section on training. It is presently anticipated that the Head of Training will organize training efforts for both Center staff, for other government officials, and for the general public. To do this he will utilize the resources available within the Center as well as at various faculties, such as the Ecole Mohammedia d'Ingenieurs, or the Faculte des Sciences at Universite Mohammed V.

Figure 3

RENEWABLE ENERGY CENTER ORGANIZATION

YEAR 3



* Functions may be initially performed by Planning & Analysis Engineers

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Although the project paper covers only the first three years' effort, a projection has been made of the Center's organization in Year 4. This is shown on Figure 4. Year 4 sees the Center with all five of its projected divisions established. A new Department of Quality Assurance is added, while the former department of ARDD has split into two departments -- Research, and Demonstration Projects.

The Department of Quality Assurance will be able to establish performance standards and test renewable energy devices against them. It will also be able to provide guidance to local business men on materials suitable for manufacture of such devices. In this way it will provide a link between university and Center research and development, and the Moroccan business community. It is expected that this will result in some employment creation, both in urban (manufacture) and rural areas (assembly, maintenance).

The Department of Research will continue to carry out research and development; in Year 4 it should enter into close relationship with the Faculty of Science in Rabat. This faculty will at this time have some 30 new faculty members who will have returned from overseas doctoral level training in basic science related to renewable energies. The team feels that Year 4 is an appropriate time to split off a separate department in charge of creating and evaluating demonstration projects. At present it is not possible to estimate with accuracy how large this department would be: at least four project managers (each of whom would manage more than one project) are envisaged. The solar project manager would integrate solar thermal, photovoltaic, and wind energy in rural projects. Project managers would, in addition to any technical staff they might have for their projects, be able to call on personnel from the research department as available and required: they could also request the participation of Ministry and Faculty staff. This new department is the point of contact between the Center and widespread application of renewable energy technologies.

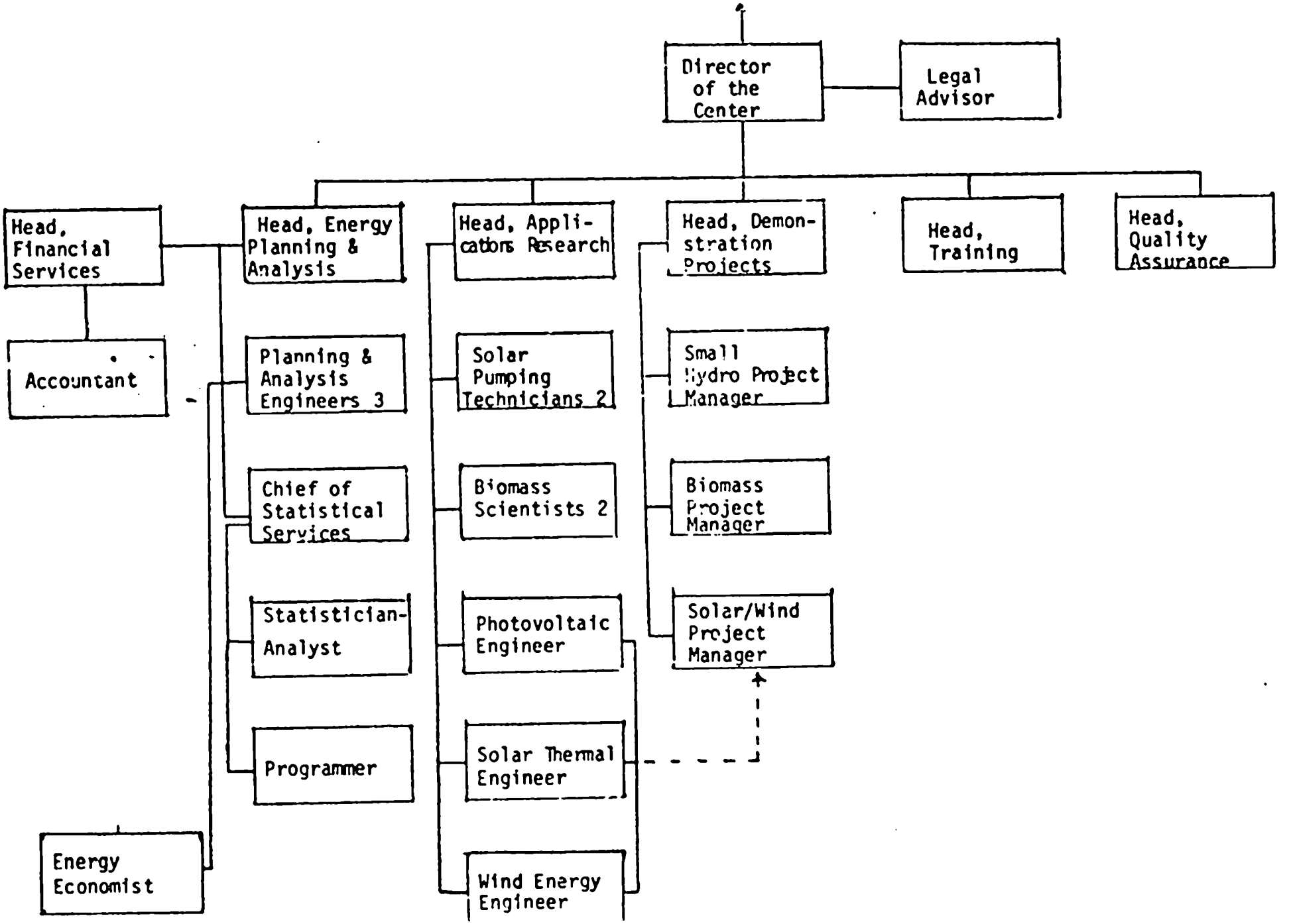
II. Training

A. Training of Center Staff -- General

The project calls for the training overseas of a total of 19 professional members of the Center's staff, for a total of 105 man-months. Table 1 lists all professional staff planned for Years 1 through 4, and indicates the number of months of overseas training, and the month this training starts, for each trainee.

The background of trainees will generally be in engineering, with the exception of the biomass scientist, who should have received training in biology or botany. Engineering graduates are usually hired by ministries upon graduation: the Ministry of Energy and Mines makes offers to graduates in June and July. Because of the time required to

RENEWABLE ENERGY CENTER ORGANIZATION
YEAR 4



DEVELOPMENT SCIENCES INC.

Table I

RENEWABLE ENERGY CENTER PROFESSIONAL PERSONNEL

YEARS 1-4

	Overseas Training M/M	Start Month
Begin Work Year 1/2		
Director	4	9
Legal Advisor	-	-
Planning & Analysis Engineer #1	3	1
Planning & Analysis Engineer #2	3	1
Planning & Analysis Engineer #3	3	7
Planning & Analysis Engineer #4	3	7
Head, Financial Services	-	-
Accountant	-	-
Solar Pumping Engineer #1	3	13
Solar Pumping Engineer #2	3	13
Year 3		
Energy Economist	-	-
Statistician/Analyst	-	-
Head, Applications Research	21	13
Biomass Scientist #1	18	13
Biomass Scientist #2	18	13
Photovoltaic/Solar Thermal Engineer	21	13
Head, Training	6	19

Table I (cont'd)

	Overseas Training M/M	Start Month
Year 3 (cont'd)		
Head, Quality Analysis	5	12
Small Hydro Projects Manager	3	13
Year 4		
Chief, Statistical Services	-	-
Programmer	-	-
Solar Thermal Engineer	21	25
Wind Energy Engineer	21	25
Head, Demonstration Projects	12	25
Small Hydro Projects Manager	3	13
Biomass Project Manager	18	25
Solar/Wind Project Manager	21	25

arrange admission into an American university, it is unlikely that trainees seeking Master's degrees will be able to begin training until at least January of 1980; and if a particular program requires a fall semester start, trainees would only begin in September of 1980. Assuming that the project has an official "start date" of September 1 (the date that energy management training begins at Stony Brook), two persons would begin training on that date (Planning and Analysis Engineers); two more would go to Stony Brook in Month 7 (March 1980) and seven more would begin training in September 1980 (four in Master's programs, three in short-term programs). Planning thus should begin for these programs at an early date after the project paper is approved and an accord signed.

Moroccan Sources of Trainees

In general, it is anticipated that the Ministry of Energy and Mines will not be able to spare existing personnel for overseas training, at least for more than three months. Thus, trainees will be young graduates of Moroccan institutions, of which three may be expected to furnish most or all.

1. Ecole Mohammedia d'Ingenieurs. Located in Rabat, this school prepares engineers over a five-year course of study. Admissions are limited to applicants having a secondary school training in mathematics or science. Students obtain education in mathematics, computer science, physics, and chemistry during a two-year general education; then they proceed to specialize in one of four areas: mineral engineering, civil engineering, electrical engineering, or mechanical engineering. Of special interest to the Center will be those graduates who have, within their specialization, chosen options in hydraulics, hydrogeology, civil engineering, heat engineering and motors, and electrotechnics.

2. Ecole Nationale de l'Industrie Minerale. Located also in Rabat, this school trains engineers in four years. A two-year basic program is offered, as in the Ecole Mohammedia, in mathematics, computer programming, chemistry, etc. Thermodynamics is also taught. Because the school was originally created to serve the mining industry, the specializations available to date are in geology, mining, and mineral treatment. New options are being added at a rate of one per year, however, and beginning in 1979, metallurgy, chemical engineering (1980) and electromechanics (1981) will be offered. Applicants must have mathematics or science backgrounds.

3. Faculty of Sciences, Mohammed V University. Also in Rabat, the Faculty offers three "cycles" of two years each: in the first cycle leading to a Certificat Universitaire d'Etudes Scientifiques, training is given in math, physics, physical chemistry, biology and geology. Trainees for the Renewable Energy Center, however, would have completed the second "cycle", and would have the "License" in mathematics, physical chemistry, or natural sciences. At present, only the last

option would fit the plans for the Center: the two biomass scientists would be biologists. The Faculte has many young faculty members now abroad, studying for doctorates which will result in three or four years in an institution able to conduct much basic research into such areas as photovoltaic cells.

Training Plans

1. Director. Background: Good English; graduate engineer; experience in energy planning or management (at least two years).

Training Program: Four months overseas of a special program incorporating energy management: visits to renewable energy laboratories, factories manufacturing small hydro turbines, wind machines, solar devices; visits to renewable energy project sites, Department of Energy Offices.

2. Planning and Analysis Engineers. Background: Good English; graduate engineer.

Training Program: Three months overseas of a special program incorporating energy planning and management, and visits similar to Director's. In Morocco, total of six months training by foreign renewable energy technology experts, plus supervised planning activities, all during Year 1.

3. Head, Applications Research. Background: Good English; graduate engineer; work experience (at least two years), preferably involving management responsibilities.

Training Program: Twenty-one months of overseas training in a renewable energy technology (solar thermal/photovoltaic recommended) plus practical work experience on one or more applications of renewable energy.

4. Solar Pumping Engineers. Background: Good English, graduate engineers.

Training Program: Three months overseas of a special program. Manufacturing of solar and wind devices, visits to sites, and exposure to installation methods and problems through talks with engineers and site managers. In Morocco, several months of on-the-job training during installation of solar demonstration projects, under the supervision of an American expert.

5. Biomass Scientists. Background: Good English, graduates in biology or botany (License or Doctorat level). (Note: agronomic training does not satisfy prerequisite.)

Training Program: Eighteen-month Master's level course in an American University, such as Texas A&M, including practical work on biomass projects.

6. Photovoltaic/Solar Engineer. Background: Good English, graduate engineer. Interest in solar.

Training Program: Twenty-one months Master's program in American university, including both photovoltaics and solar thermal, and project in one or both areas.

7. Head of Training. Background: Good English: graduate engineer.

Training Program: Six months overseas in a special program, including exposure to renewable energy technologies, energy audit methods, and energy-related education in elementary through high schools (through the Department of Energy's Office of Education). The program should also involve visits to sites where renewable energy is being installed: these visits should point up requirements for technicians, their training, etc.

8. Solar Thermal Engineer. Background: same as Photovoltaic/Solar Engineer.

Training Program: Twenty-one month Master's program in an American University in solar thermal technology: visits to manufacturers of solar collectors, and to sites.

9. Wind Energy Engineer. Background: Good English: graduate engineer. (It would be feasible to recruit a graduate of the Ecole Hassania des Travaux Publics et des Communications, in Casablanca. (See note.)

Training Program: A 21-month program in an American University, which could lead either to an undergraduate degree in engineering (for graduate of Ecole Hassania) or a graduate degree. Considerable training in design and construction of wind machines, as well as project experience.

10. Head, Demonstration Projects. Background: Good English: graduate engineer.

Training Program: Project Management in an American school for 12 months (Arthur D. Little has an accredited 12-month Master of Science in Management program).

11. Small Hydro Projects Manager. Background: Good English: graduate engineer.

Note: The Ecole Hassania graduates Ingenieurs d'Application after a three-year program. One year of basic sciences is given, after which specialization in Electricity or Civil Engineering is possible.

Training Program: Three months overseas of a special program similar to that of the small hydro engineers, but with one or more short courses in aspects of project management (e.g.. those offered by American Management Association). Visits to sites should include some exposure to relations of small hydro units to grids and utilities.

12. Biomass Project Manager. Background: Good English: graduate in biology or botany.

Training Program: Similar to biomass scientists but includes short course/s in project management, PERT/CPS, and computers.

13. Solar/Wind Project Manager. Background: Good English: graduate engineer.

Training Program: Twenty-one months in an American university, preferably a combined Master's level program including project management and solar and wind technologies. Alternatively, a one-year management course (e.g., ADL School) followed by nine months of training in solar and wind technologies at a school of engineering.

14. Head, Quality Analysis. Background: Good English: graduate engineer: ideally some manufacturing experience.

Training Program: A five month special program which will include production quality control (short course - one week), and manufacturing, testing and application of photovoltaic, solar thermal, and wind devices and machines. Visit to Bureau of Standards, and testing laboratories: participation in one or more tests. Visits to sites where renewable energy has been operating for some time.

B. Training Programs at the Center

The Center will be able to offer training related to renewable energy in a number of forms. The organization of such training will be the responsibility of the Head of Training. Though it is not possible to state specifically which training activities will be offered at the Center it is possible to state their general type. There are five general types of energy-related training which might be part of the Center:

1. Energy Policy. The team has noted that while there is some awareness of renewable energy, and of energy questions generally in various ministries, much more could be done to stimulate thinking on the role of renewable energy in development. The concept of substitution of energy from traditional sources by wind, solar, biomass and small hydro has yet to be widely understood.

2. Energy Project Management. Renewable energy projects will require management skills if they are to be generalized eventually in all areas of Morocco where this makes technological and economic sense. Biomass requires the coordination of a variety of services in order to work; likewise, village-level renewable energy projects in pumping, heating, irrigation, and lighting may require local capacities to manage planting and harvesting (for example) in non-traditional ways. The Center should be prepared to train managers of such projects, using the skills and experience of Center staff, and also drawing on all other appropriate sources within the country.

3. Technical Training. The introduction of renewable energy sources requires not only engineers, but also technicians who are capable of installing, monitoring, maintaining and repairing solar, wind, and small hydro devices. Working in cooperation with the Office de la Formation Professionelle et de la Promotion du Travail, the Center can arrange for technical training, using its own or other facilities. Site-specific training may be required for the installation of technologies in remote sites; to accomplish this, the Center's Head of Training would arrange for short courses to be given at or near such sites. Ideally, it would not be long before one or more Centres de Formation would offer training in solar thermal assembly, installation, and maintenance.

4. Public Education. The introduction of an awareness of the importance of energy, its conservation, and its sources has become of great interest in the United States. As the Center develops, consideration should be given to what forms of energy-related education are appropriate for Morocco's citizens in general. Such education could take the form of chapters in school texts, films, publications, village meetings, and so forth.

5. Renewable Energy Engineering and Science. It is likely that the sorts of knowledge developed at the Center should be used to train renewable energy experts, and thus to lessen dependence on foreign institutions and consultants. The Head of Training should, therefore, investigate all means of integrating the Center's learning with the programs of Moroccan engineering and science faculties. The team's conversations with various Moroccan officials have convinced it that such integration is feasible and desirable.

APPENDIX B

DECENTRALIZED HYDRO ACTIVITY

1. Methodology

It was decided to take the approach that AID/MOROCCO should go ahead with three (3) or more demo sites as a first step. Regions in the Atlas and Rif Mountains were selected where conditions are favorable for hydro production. Specifically the best technical locations for one or more sites north of the Atlas and one or more sites south of the Atlas were chosen. The Rif Mountain was ruled for the demonstration unit for technical reasons as there is less rainfall in that region in the summer.

In addition, C.N.E. has decided to assign to the small hydro assessment team personnel from the:

1) Transmission and Distribution Division.
2) The equipment and Facilities Division.

Twenty sites will be chosen for analysis and seven additional sites will be jointly-qualified from a technical standpoint with GSA before October 1, 1979. Thus, a total of ten sites would be ready for ordering equipment if they were all approved by AID and the interministerial group by October 1, 1979.

A rational site selection criteria was developed which will identify those sites which have the greatest potential for a successful project. The technical selection criteria is given below.

Technical Site Selection Criteria

1. Year around water.
2. Market, use or need for power.
3. No network power available to site area.
4. Non-dam, low water supply costs.
5. Possible secondary use of water (irrigation, small-scale industry or other).
6. Power cost/kW equal to or less than diesel.
7. Possible combination use:

   a) hydro plus diesel (diesel during low water).
   b) hydro plus biomass/steam (Biomass during low water).

   For each site the following also must be determined.

   a) Economic Feasibility
   b) Social Soundness
   c) Technical Feasibility
   d) Administrative Feasibility
   e) Environmental Concern

The final selection of sites is to be made by a joint-committee of: O.N.E., Ministry of Energy, Ministry of Interior plus AID.

2. Selected Sites

A. Aït Arbi (200 kW)

A site in the Haut Atlas on a typical river where a "non-dam" or "high head" approach was selected for investigation. The site was deemed to be technically feasible and under present planning, the 2,000 people there will not have electricity for another 15 years. Table 1 presents costs necessary to develop this site.

B. Msemrir (200 kW)

Another area offering hydroelectric potential, but without any electricity planned in the foreseeable future, is on the south side of the Haut Atlas at Msemrir on the Dades River. A diesel generator supplies small amounts of power twice daily but this is expensive, too small, and requires frequent maintenance. A site was found where, using a canal and a hydro unit, up to 200 kW of power can be produced. See Table 2 for cost estimates of this site.

C. Tilaugguit (200 kW)

A second area in the Dades Valley is Aït Arbi, where a large spring emerges from the mountainside about 35 meters above the Dades River surface. Two small villages are nearby and about 200 kW could be recovered for perhaps 6 months/year with lesser amounts available at other times. See Table 3 for cost estimates of this site.

3. Economic Feasibility

To determine the economic feasibility of any hydro-site, many aspects related to the specific site must be known or determined. The following factors must be considered:

1) Geographic Maps: the geography of the site must be known before other factors can be analysed.

2) Precipitation Maps: These maps are needed to choose areas in which hydro-power could exist. Without year round rainfall, there is not water year round.

3) Run-off Data: Gauging stations are set up along most rivers to measure flows throughout the year. Using these date "control" or comparison, flows can be estimated for similar-sized drainage basins within similar areas of the

precipitation map, even though no gauging station may exist at the chosen river-site.

4) Existing Power Grid and Projected Expansions: Generally it would not be economic to install a hydro-station of small size in an area of network service. Hydro is cost effective against diesel plants, but in small sizes it cannot compete with central fossil fuel stations, as long as that fuel remains available and is reasonably priced. Therefore, economics will dictate that hydro is most cost effective in areas not likely to be served in the near future.

5) Population to be Served: The hydro-plant does not noticeably penalize its users when demand varies with time as is the case with diesel and thermal power plants. Energy costs are zero with hydro and, therefore, efficiency loss at part load is not an economic factor. However, the capital costs still have to be reckoned with. Therefore, there must be user demand for the power generated. Without a network to absorb excess power, the hydroplant size must recognise at least a near-term future projection of population needs and power sales.

(6) When the five (5) foregoing factors have been identified there will be several sites where hydro can be cost-effective. A comparison with a diesel power plant is revealing when both capital and direct energy cost are compared on usable life of equipment (neglecting expensive diesel maintenance) and with capital and direct energy costs reduced to cents/kwh (Dh/kwh). The calculations are given in Table 4. In Morocco, diesel kw-11.8¢/kwh. Public power at rural site = 11.0¢/kwh, and small decentralized hydro is 7.0¢/kwh.

(7) Summary of Economic Feasibility: One conclusion can be drawn and another inferred.

a) When the five (5) site selection criteria are favorable, small decentralized hydro is cost-effective in rural areas against both diesel-powered systems and future extensions of long network lines into areas of small demand.

b) The inferred conclusion is that capital dollars may be spent justifiably in creating power supplies to meet rural demand whenever any incremental increase in GNP is obtained without the cash flow and balance-of-payment problems that would result from increasing the GNP a similar amount with foreign-source energy.

4. Social Soundness

The History of projects in other developing countries indicates that in Morocco too, some of the early advantages of rural power will include hospitals, irrigation systems, local small industries and improved communications. Certainly, in a country such as Morocco, great increases in yields per hectare will result from irrigation. It should also be recognized that use of

irrigation water from wells will bring other hectares into production that are now too dry to support agriculture. These factors will absorb increasing numbers of rural workers, and with increased standards of living in rural areas, rural people will not flock to urban centers and form slums such as are already building up around Rabat and Casablanca.

The build-up in agricultural development due to small decentralized hydro power, will increase Morocco's exports of food products and, at the same time, lessen Morocco's dependence on foreign oil.

5. Technical Feasibility

Selection of all sites included analysis of rainfall patterns, basin area drainage and run-off, as measured by gauging stations located within regions of investigation. Selection of the Dades River Valley in the Draa Basin was indicated by calculations based on minimum flow readings recorded at Msemrir and Ait Moutade. Average annual flows were about $4m^3$/sec with minimum about $.5m^3$/sec for the driest month and $.238m^3$/sec for the one driest day in the year at Ait Moutada.

At Msemrir, data was intermittent, but flows were higher at this upstream location due to downstream losses of irrigation, evaporation and percolation. Based on minimum flow of $.5m^3$/sec (17cf/sec) we would have 1 kw per foot of net turbine head at the lower location. With 50 feet of head this would be 50 kw installed with a capability of 438,000 kwh/year. At Msemrir, minimum flows could generate slightly more. At 11¢/kwh, if 500,000 kwh/year were sold, this would be $55,000/year power savings for this community which now gets about 262,000 kwh/year from a diesel electric plant. If the system is properly installed the operating and maintenance costs are negligable. (About the same as a 50 kw irrigation pump.)*

The technology of SDH power is about 50/50 art and science. The science part is over 100 years old. Therefore, the technical feasibility at a given location becomes extremely site-sensitive. Water supply designs must assure not only quantity but also quality (cleanliness) of the water; at least insofar as sand and larger particulate matter is concerned. This is especially true when run-of-stream operation is attempted without a dam. It could be technically unfeasible to install a plant in an area of adequate water flow and head <u>if</u> space did not permit use of a stilling pond, off-set from the main channel, from which "settled" water could be supplied to the turbine. In such a case (narrow rocky valley or gorge), a dam would have to be built to protect the turbine from sand, gravel, etc., and the high water supply cost could render a small plant non cost-effective. Normally, we like to see the water supply system equal to (or less than) the capital cost of the turbine-generator-control system.

The remote site selected at Tilougguit on the Ahancal River was selected

* The station should be sized for average flow or about 200 kw.

from several because flows were more than needed at all times of the year; because space existed for a properly designed water supply system and head of 11 meters (35 feet) could be obtained. The plant concept would be a 200 kw turbine with great load variation capability supplying power to a remote rural and semi-agricultural community of about 2,000 people. A tiny spring-fed hydraulic turbine is now able to give about 10 to 15 kw there, but none is available to the town's residents. It snows at this location in winter and space heating could be a welcome addition to lighting during nights in the non-irrigation season, if tariffs were structure to permit this. This excellent site would be more cost-effective if small cottage-type industries permitted greater future recovery of hydro potential at this site.

Capital costs are given in the Appendix, but we have estimated about $2100/kw installed (U.S.). If the town were able to absorb initially even half of the $1,750,000 kwh/year this would still yield about $100,000 per year cash flow at 11¢/kwh. Even at half capacity, the power value would equal the estimated plant cost in a little over 4 years. This site is technically feasible and superior to a diesel plant. In any case, the technical feasibility is excellent.

6. Administrative Feasibility

Small decentralized hydro requires no more administration (from an operating viewpoint) than a remotely located pump in an irrigation system. It is recommended that new thinking be developed in the area of administration of tariffs in decentralized hydro locations. In any location where power is generated with zero energy cost, a different method of accounting could be used which would recognize the capital-intensive cost of this power. However, the engineering and maintenance strength of an organization such as ONE must still be available at the site.

It is recommended that ONE create a small "core" group concerned with creation, operation and administration of SDH. Philosophy such as that used in U.S.A. in 1934 (Rural Electrification Administration) could be employed. Financing plans could be based on lender-approved studies of SDH feasibility in any given river basin. Phase I (initial valley SDH development) would have to recognize growth patterns which always develop with adequate power availability at reasonable cost. Phase II (total hydro potential development) would be aimed at reduction of Moroccan dependence on foreign energy sources.

The feasibility of administering SDH development has been illustrated in the U.S.A., and is being illustrated by IHRE in Panama. Perhaps the least known, but greatest, success is in China where 50,000 SDH units were claimed by the Chinese to be in operation.

7. Environmental Concern

Small decentralized hydro is a non-consumptive water use and turbines

thus have the same affect on the water as a potable or irrigation water pump. No large dams or impoundments are used to heat and de-aerate the water. There is a small positive impact in that "stilling" ponds remove some salt from the flowing water.

Proper design of water supply systems at the site is extremely important. These types of installations are designed for a minimum stream flow to be taken by a short canal into a stilling basin adjacent to the main stream. The stilling basin is the water source for the water supply system to the turbine. Increases in the stream flow simply flow on past the short canal entrance to the "stilling" basin and are re-joined with the turbine water down stream of the power plant. Fish do not migrate during the minimum water flow season and at all other times excess water flows normally in the main stream, thus there is no adverse environmental concern with respect to a SDH installation on a mountain stream, or an irrigation system.

8. Estimated Project Budget (1979) (1000's U.S. $)

	U.S.	GOM
A. Demonstration Sites		
Technical Services(1)	60	65
Equipment(2)	350	400
Training	36	10
B. SDH Study		
Technical Services(3)	700	200
Inflation (10%)	111	68
Contingency (5%)	56	34
	1313	777

Notes:

(1) Complete general arrangement and detail drawings, equipment lists and descriptions, geologic and hydrologic analysis, economic analysis, procurement and construction supervision for three sites.

(2) Turbine-generator, electrical and mechanical equipment, power house, dam if required, civil works.

(3) Outline and foundation drawings, equipment description, bill of materials and rate structure for 100 sites.

TABLE 1

Calculations of AÏt Arbi, 200 kW (High Head)

1.	Flow at $1M^3$/sec.	= 34 CFS.		
2.	Head at 35 Meters	= 105 Ft. Net Head		
3.	Penstock 6" PVC	= 300 Ft x $15/ft	$ 4,500	or 18,000 dh.
4.	Pelton Turbine	= High Speed Unit	32,600	or 130,000 dh.
5.	Linkage & Governor	= Woodward or equal	2,400	
6.	A.C. Generator	= Enclosed, S.E.	20,400	
7.	Governor Deflector	= Nozzle Control	3,600	
8.	Fabricated Baseplate	= W/c Foundation Blts ...	2,800	
9.	Control Panel	= Cabinet-Type	3,400	
10.	Electrical Equipment	= Brkrs, Gauges etc.....	8,400	
11.	Engineering (GSA)	= Combining Package	11,375	
12.	Engineered Package	= U.S. Funds	$89,475	or 357,900 dh.
13.	Installation Labor	= 600 M-days at $20	12,000	or 48,000 dh.
14.	Installation Mtrls.	= 22 Yrd Concrete & re-bar	2,970	or 11,880 dh.
15.	Supporting Steel	= 2 tons at $.75/	3,000	or 12,000 dh.
	Power House	= 150 Ft^2 at $40/F ?.....	6,000	or 24,000 dh.
17.	TOTAL FUNDS U.S. PACKAGE		$ 89,475	
18.	TOTAL FUNDS MOROCCAN PORTION			95,880 dh.

19. U.S. Package is $447/KW

20. Total installed package is $576/KW plus ONE in-house engineering.

TABLE II

Calculations of Msemrir, 200 kW (Low Head)

1.	Design 3.5 M^3/sec.	= 120 CFS.		
2.	Head 10 Meters	= 30 Ft. Net Head		
3.	Penstock (& canal)	= 1950 feet canal +		
	600 Meters	60 Ft. Penstock		
	Penstock Cost w/c gate	=	$ 2,000	or 8,000 dh.
	Drainage under canal	=	2,000	or 8,000 dh.
	Stilling Basin	=	800	or 3,200 dh.
	Tailrace Excavation	=	6,000	or 24,000 dh.
	Power House	=	8,000	or 32,000 dh.
4.	Control Panel	=	$ 4,000	or 16,000 dh.
5.	Turbine & Generator	=	$120,000	
6.	Engineering (GSA)	=	$ 18,000	
7.	Installation Labor	=	12,000	or 48,000 dh.
8.	Installation Material	=	6,000	or 24,000 dh.
9.	Support Steel	=	3,000	or 12,000 dh.

10. TOTAL FUNDS U.S. PACKAGE = ...$144,000

11. TOTAL FUNDS MOROCCAN PORTION = ... 451,000 dh.

12. U.S. Package is 720/KW

13. Total installed package is $1284/KW plus ONE in-house engineering (small)

TABLE III

Calculations of Tilougguit, 200 kW

1. Flow (design) 3.5 M^3/sec. = 120 CFS.
2. Head Gross 11 Meters = 30 Ft. Net Head
3. Penstock (and canal)

200 ft. open ditch with Concrete Sides	$ 10,000 or	40,000 dh.
1100 ft. dia x 180 degree pre-cast canal	127,770 or	511,080 dh.
300 Support Piers, native stone & concrete	30,000 or	120,000 dh.
Canal Labor 400 Man Days at $20/day	8,000 or	32,000 dh.

4. Power House 15' x 20' Materials ..... 8,000 or 32,000 dh.

   Labor ..... 6,000 or 24,000 dh.

   Turbine Foundation M&L ..... 8,000 or 32,000 dh.

5. Engineering at ONE ..... 20,000 dh.

   Engineering at USA) ..... ≈12,000

6. Head Gate ..... ≈ 6,000
7. Penstock ..... ≈12,000
8. Inlet Valve (Butterfly) 48" Diameter ..... ≈ 7,500
9. Turbine Leffel Samson or equal 3.50 H.P. 80,000
10. Generator S.E. 50 cycle synchronons 200KW 20,000
11. Misc. Steel - 2 tons 3,000
12. TOTAL FUNDS U.S. PACKAGE .....≈$140,500
13. TOTAL FUNDS MOROCCAN PORTION ....$202,770 (U.S.) .....=(811,080 dh.)
14. Equipment Package is $703/KW.
15. Installed Cost (remote area) is $1716/KW.

MAPS AND COMPUTATIONS

1. Map of Morocco with Rif and Haut Atlas defined.
2. Map showing rainfall patterns.
3. Existing power grid down to 22 KW. (See ONE book).
4. Location of Tilougguit, Msemrir and Ait Arbi on Maps.
5. Calculations of Diesel vs SDH power costs.
6. Calculation of total SDH potential and costs. (Assume 315 kw average and 100 units.)
7. SDH in conjunction with solar or biomass.

TABLE IV

CALCULATIONS OF DIESEL vs SDH POWER COSTS

1. Diesel at 100% load averages 34% thermal eff. = $\frac{2545}{.34}$ = 7484 Btu/H.P./Hr.

2. Ratio of Kwh to H.P./Hr = 746, so it is 10,034 Btu/Kwh at coupling.

3. Average small generator eff.(self-excited) is 90% so we need 11,150 Btu/Kwh.

4. Average diesel fuel is 140,000 Btu/gal so we need .0796 gals/Kwh.

5. At remote locations in Morocco diesel fuel is $1.20/gal, or 9.6¢/Kwh.

6. Neglect operating & maintenance costs and recover capital in 10 years.

   300 Kwh diesel is about 90,000 installed.
   300 Kwh SDH is about 360,000 installed.

7. 10 yrs. at maximum of 70,000 hrs x 300 = 21,000,000 Kwh = 1/2¢/Cap.Ret.

   10 yrs at 10% is .25¢ interest. Total Capital Cost = .75¢/Kwh. diesel.

8. $360,000 ÷ 21,000,000 = 1.7¢ + .9¢ = 2.6¢ Capital Cost/SDH.

9. Fuel + Capital Cost
   A. Diesel 9.6 + .75 = 10.35¢/Kwh.
   B. SDH 0.0 + 2.6 = 2.60¢/Kwh.

HYDRO

MOROCCO HYDRO-POTENTIAL

From precipitation charts showing 200 to 1000 mm of rainfall annually and;

From elevation plots showing this rainfall to contact terrain at average elevations of 1900 meters and;

From gauging stations whose readings indicate approximately 60% run-off down to 1000 meter levels; we have a basis for calculations as follows:

Locations in Rif and Haut Atlas with flows above 3 cubic meters/sec and heads of 10 meters or more, number approximately 150 on 43 streams and tributaries.

Power = 34.3 x $3M^3$ x 30 ft(net) x .7 ÷ 113 = 183 KW low flow.
= 300 KW at $5M^3$/sec.

Size units for 315 KW x 150 units x 8700 hrs = 411,080,000 Kwh/yr.

Using $1300/KW installed is $61,425,000 Capital Cost.

(foreign exchange is about 50%) = $30,712,500 without engr. costs.

Power value at 8¢/Kwh & 80% load factor is $32,886,400/year.

Note: 1977 hydropower in Morocco was 1,365,137,000 Kwh;
the SDH would increase this by 30%.

AID team has decided that a biomass boiler must be priced with and without SDH use. GSA has been asked to estimate:

1. Pick a 50 KW delivered at crank shaft.

2. 70 H.P. at 2545 theor. BTU/HP = 178,150 T BTU/Hr.

3. A.S.R. (non-condensing) 1184 -1150 = 34 BTU/ x .7 = 24.

4. 24 BTU/ recovered and 178,150 needed = 7,423 /Hr steam.

5. Boiler design (raw water) (80 psig) (320°F) (wood fired) (injector) (7500 /Hr).

6. Boiler price (base 7050 x 1.30 = 9165) (2750 wood-fired 30%)
   850 (injector) 1200 (piping) Total $13,965

   Est. $14,000 Est. Dry wt.=1200

7. Pick Clark CMA-2 Frame 100 HP at $6000.

8. Pick Ajax Steam Cylo. at 600 r.p.m. (2) 8" at $5,000 = $10,000.

9. Est. combination Engr. chg. one unit + combining labor $2000 + $1200 + $3000 = $6200.

   F.O.B. Corry, Pa., or Olean, N.Y. $22,200 + cplg. at $600.

   Estimated shipping weight = 2200

Engineering Package Total on fab. steel base with quick-dis. cplg. = $22,800.

TOTAL PACKAGE $36,800 Shipping Weight 3400

DELIVERY 8 Months

Add about $8,000 for generator, voltage regulator, gauges, panel.

APPENDIX C

BIOMASS ACTIVITY

INTRODUCTION

The use of biomass for fuel is an established practice in Morocco. In fact it is a cause of some of the deforestation now occurring at a rate of 40,000 hectares per year. Twenty-five thousand hectares are planted each year placing the country in a deficit situation. Examination of the biomass requires, then, a look at the present forestation efforts, existing systems, research, residues, and semi-arid lands. Then suggestions will be made as to future action.

With reforestation at a rate of 25,000 hectares per year the nation will continue to decline in net forested areas. Two actions will reverse that trend. The first may require a considerable effort to develop funds for reforestation. There are four million hectares of class four land. Such land is poor agricultural soil, but is deemed sufficient for growing trees. Species selection should be made to optimize the available soil, topography and climate. The expertise is present to make these recommendations. Second, the planting should be done in such a way as to insure fuel wood very early in the rotation, providing an economic return or reducing the deforestation associated with fuel stick removal.

Presently, plantations are established on a 3 m x 3 m spacing. Such spacing produces crop trees with little maintenance. The small amount of maintenance is primarily done by grazing animals for the foliage of eucalyptus are not preferred food. Since the forests provide a large portion of the grazing land, changes in planting practices requires recognition of the possible displacement of grazing opportunities. Present practice also seems to place little emphasis on the selection of seed source for the production of nursery stock. This is particularly noticeable in the Canary Island pine plantations. One suspects it is also true of other species. To sum up present practices would be to say the nation is in a deficit reforestation situation, competant forest scientists are present and that a biomass program would aid the country by: 1) providing an alternate fuel to fossil fuels, 2) developing a market for products from intensive forest practices and 3) reversing the deforestation now occurring.

As stated earlier the 3m x 3m spacing presently used in the eucalyptus planted for pulpwood and charcoal requires years before the site is fully occupied. This existing system provides harvested material each decade through six rotations. The first one from planted stems, the next five from coppice. The plantation is then dug up and the land lies fallow. Such a system requires 1100 trees per hectare. Growth maximizes during the fourth rotation, then declines slightly. Presently, no fertilization nor interplanting with legumes, is practiced. This system does show a considerable depth of knowledge toward plantation management that is readily transferred to the intensive energy forest.

Research into intensive forestry has been initiated. Spacing studies begun in 1972 have yielded interesting results as shown in Table 1.

TABLE 1

VOLUMES OBTAINED FROM VARIOUS SPACINGS & HARVESTING SCHEMES
(m^3/ha)

Spacing	Harvesting: 3 rotation of 2 yrs.	2 rotation of 3 yrs.	1 rotation of 6 yrs.
0.5 x 0.5 m	24.4	56.0	54.8
0.75 x 0.75 m	16.4	54.9	61.1
1.0 x 1.0 m	10.6	25.9	49.3
1.5 x 1.5 m	7.7	23.1	37.4
1.5 x 3.0 m	7.7	16.2	25.1
3.0 x 3.0 m	4.1	10.2	13.4

Notice the low yield from the 3 x 3 spacing, the present practice. Also the 0.5 x 0.5 meter spacing has completely utilized the site and yield is declining. There are many other conclusions to be drawn from this experiment, but are the property of the researchers since the study has yet to be published. The site was very poor, sandy, and droughty. Yields could increase with fertilization and perhaps drip irrigation.

Projections from such data are risky, yet a base is established. The experiment indicates forest sites are not fully exploited at the 3 x 3 m spacing presently used. A biomass plantation is developed to provide a quantity of wood for long periods of time. Such plantations, if planted on a 0.75 x 0.75 m spacing could yield firewood as a thinning crop. The products of such plantations can be other than firewood by removing every other row or some thinning scheme. Presently the Department of Water and Forests is planting 25,000 hectares per year at the 3.0 x 3.0 m spacing. If this spacing were changed to 0.75 x 0.75 m approximately four times the mass would be produced. If the average density of the wood were 0.5 kilos per cubic meter then harvests at six years (61.1 cubic meters) or two harvests, one at 3 years and one at 6 years after establishment (54.9 cubic meter), then 30.5 or 27.4 metric tons would be harvested. If the material were bone dry (density is bone dry mass/green volume) and had a 9,000 Btu/lb (4,450 cal/kg) then at least 536 million Btu's or 121 million calories would be developed each rotation. A gallon of fuel oil contains 140,000 Btu's (35,280 calories) thus the equivalent of about 3600 gallons of fuel would be produced or 14 barrels of oil per hectare per year. If the four million hectares of class four land were planted and the crop had positive economic and net energy budgets, the projected and energy equals existing oil imports.

Agricultural and forest residues are biomass. Two types of residue seem available: Corn stover and baggage. All other residues are utilized for feed, bedding and soil amendments. Manure is nor generally available since most animals graze, few are penned. This small size of the herds (over seventy percent of the herds contain two to five animals) also suggest biogas is a site specific enterprise.

Additional studies for the arid lands would include investigations into several desert plants. Guayule is a species which upon harvesting may yield up to 10 percent natural rubber. Jojoba beans produce an oil not unlike sperm oil. The oil has utility as a lubricant for it maintains a viscosity at high temperatures. It also is suited for cosmetic base. Perhaps these and other plants should be tested to utilize the one million hectares in "halpha".

The establishment of biomass plantations is a viable energy alternative and a project should be developed to expedite the establishment of such plantations.

Using the above as introduction the following is a plan to accomplish a program of action in three areas: 1) research, 2) training, 3) extension of results to field demonstrations.

Research Topics

The research associated with energy plantations can be conducted within the proposed center boundaries of responsibility. Each research area has a companion training component. Research demonstration should be conducted in 1) genetics of adapted or indigenous species with an emphasis on increased mass per hectare per rotation. 2) Species should be chosen for mass, coppice ability, seedling survival, freedom from pathogens or insects, form, etc. 3) Silviculture techniques on site preparation, fertilizer, irrigation, thinning schemes, etc. must be demonstrated. 4) Provenances for selected species and genotypes are to be conducted in several selected areas of the country to assure survival and growth. 5) Conversion efficiencies are to be studied including direct burning by dutch oven or inclined grate, pyrolysis, charcoal conversion, etc. 6) The replacement or compliment of fossil fuels with biomass must be analyzed as a system from growth to conversion. 7) The economic and net energy budget must be determined for the country and for selected specific sites.

Training Suggestions

Each of the above items has a training requirement. Genetics of forest trees is a specific skill requiring graduate work. A program of pragmatic studies leading to a Masters of Agriculture or other such degree, i.e. Master of Forestry. Such a degree program is available at Texas A&M and other U.S. schools. Silviculture, species and provenance work should be conducted by graduate foresters with additional training by in-country visits by U.S. personnel. Conversion efficiency studies could be conducted by graduate engineers with a knowledge of combustion parameters Suppliers of such equipment could be utilized to conduct such training. Systems analysts can be developed from biometrists through a program of studies at U.S. Universities. Economists should be available.

An additional cadre of training people are necessary to effect the biomass plantations. Plant pathologists, entomologists and harvesting experts are needed. Such disciplines should be college educated, preferably with graduate degrees. A second level of persons trained in tree nursery practices, plantation maintenance, mechanics, etc. are needed to produce, plant and care for the seedings and plantations. Requirements in land, seeds and people to produce sufficient seedlings are considerable. If a 0.75 x 0.75 m spacing, rather than 3.0 x 3.0 m is chosen 17,000 additional seedlings will be needed per hectare. Failures at each phase of the establishment can be very costly. The investment in trained people becomes a necessity to insure against such failures.

Demonstrations

There are several scenarios to be projected for biomass. The establishment and use of plantations, the coupling of plantations with low head hydro and a development of energy schemes using emerging technology will be proposed as three of the more obvious routes demonstrations in biomass can take. Each demonstration provides a research and a training function as well as hard numbers on the economic and energy budgets. Such numbers can be used to prioritize energy plantation sites.

The establishment of plantations requires investment in land (other than food producing land), seedlings, plantings and people. If we assume land is available costs are associated with establishment and harvesting of the plantations:

TABLE 2

PLANTATION COSTS

	Spacing	
Plantation Costs/ha	3 x 3 m (dirhams)	0.75 x 0.75 m* (dirhams)
Mountain	2,375	8,110
Medium Slope	2,230	7,965
Mechanical	2,170	7,905
Clear Cut	1,700	7,435

* an additional 16,300 seedlings @ 0.3 dirham/seedling + 65 mandays @ 13 dirhams/day.

Harvesting Costs (dirhams)/ha.		
Mountains	150	175
Medium	125	150
Level	80	100

Collection on site, transport and hammermilling costs were not established. These costs must be determined to complete the total economic budget. It is suggested several sites be chosen to demonstrate the energy plantation concept, run provenance tests and determine the net energy relationships.

The major site for demonstrations is at Marrakech. Here a center is planned with 20 hectares available for buildings and test plantations. A major research plan must be established for this site. Three components are suggested: Species provenances, site management and spacing. Data to be obtained are mass per unit area per year, survival and site depletion among others. Laboratories associated with this site are listed in the appendix and in the PP.

Costs for the establishment of the plantations at the Marrakech site must be closely monitored. Trained crews should do the planting, seedling must be similar to those now outplanted and costs for land preparation are to be controlled. Several tests can be run by the research forestry group. A factorial similar to that reported earlier in which spacing vs. irrigation vs. fertilization can be run with each species. A second major experiment would examine harvesting. Thinning schemes for conifers should also be examined.

The factorial experiment would examine 3 levels of spacing: 0.75 x 0.75 m, 1.5 x 1.5 m and 3 x 3 m. Three levels of irrigation during the growing period 0, twice natural rain fall and four times natural rainfall and three levels of complete fertilization 0, one ton per hectare, four tons per hectare, If one-half hectare plots were used, thirteen and one-half hectares will be needed. The remaining area around the center may be used to demonstrate a thinning operation where the initial spacing is 0.75 x 0.75 m and trees are removed from every other row at three year or six year intervals. The second thinning would be in columns perpendicular to the initially thinned rows, so that spacing after six years or twelve years would be 1.5 x 1.5 m. A second round of thinning would result in crop trees 3 x 3 m apart. Such a scheme would be used with those species that do not coppice. A control must be planted at both 0.75 x 0.75 m and 3 x 3 m to show stagnation at the small spacing and presumably lower total at conventional spacings.

These plantations or others should be coupled with the low head hydro demonstrations. The wood produced would provide a backup source of energy and a source of fuel wood for the community. The low head hydro may have items in the year when insufficient water is present. A steam engine could be coupled with the hydro generator to provide the needed standby energy. A boiler for such low pressure system could be associated with a small furnace fueled with wood. This system adds cost to the low head hydro but assures year-round operation. Such a forest could be a community effort with early production of fuel sticks and a charcoaling operation.

A third demonstration combines the development of low Btu gas with charcoal production to provide heat for steam or drying and charcoal for consumption. Charcoal is a commodity. The increased heat content per unit mass also may improve char as a supplemental fuel for distant existing power plants. Existing methods of charring are without control and manual charring as practiced for centuries can be replaced by portable kilns, or similar charring devices. Newer charring systems produce pyrolytic oils, low Btu gas and char. The development and demonstration of these units in Morocco could be a function of the center.

The following systems costs for the electric generation are taken from data obtained in the last few months (February to May 1979) and require site specific studies be made.

Values prove difficult to obtain. Electric generation costs have been quoted as "1500 KW steam-turbine generator set at approximately $700,000; the price of a 5000 KW similar set at approximately $1,000,000. These prices include the turbine, its governing system, the electrical generator and its exciter". Another quote for a 2000 KW turbine generator was $ 650,000.

Costs of a generator main breaker and associated protective relay ranges from $40,000 to $50,000. A step down transformer is $10,000. A low voltage control center for controlling stationary motors for boiler feed, circulating water pumps, force and induced draft fans for the boiler and furnace would be $15,000.

Fuel handling systems range from $310,000 to $500,000 depending on maximum tonnage requirements. A boiler for a 750 KW facility is quoted at $705,000, one for a 2000 KW unit is $1,150,000. Auxiliaries would cost from $85,000 to $133,000 for these two units.

None of the above costs include transportation nor labor.

If a demonstration electric generation capacity of 2000 KW were assumed the generation costs without labor or freight would be expected to be $3,250,000. If we assume the wood is burned at 50 percent moisture it will produce 8.4 million Btu's accounting for firing efficiencies (bone dry wood would produce 13.8 million Btu's). The 50 percent wood can develop 8600 pounds of steam per hour or 250 boiler horsepower. Rounding everything off, a ton of wood per hour would produce sufficient heat to fire this unit. In Morocco the intensive forest produces 350 cubic feet of wood per hectare per year. If the average specific gravity is 0.5 then each hectare produces about five tons per hectare per year. This is a bone dry ton. At 50 percent moisture content wood each hectare produces ten short tons per year. Wood from each hectare could run this plant for ten hours. If a 8670 hour year is anticipated (100% capacity) then 876 hectares need to be harvested per year. On a three year rotation a 2500 hectare forest is needed. Each of these assumptions must be validated in Morocco.

Laboratory, Greenhouses, Lathouse and Headhouse Costs.

Laboratory (9 x 10 m)

Soil & Plant Nutrient Analysis

Equipment Needs:

Atomic Absorption Spectrophotmer	$21,000
Photometer & Accessories	10,000
P'h Meter	1,000
Still	8,000
Balances	3,500
Kleldahl	3,800
Glassware & Laboratory Tools	4,200
Chemicals	5,000
SUB-TOTAL	$56,500

Laboratory (9 x 10 m)

Combustion and General:

Calorimeter	$ 7,200
Chromatograph - gas & Accessories	7,500
Combustion Retort (Constructed)	8,500
Fluid Bed Reactor (Constructed)	10,000
Glassware	8,000
Chemicals	5,000
SUB-TOTAL	$46,200

Greenhouse 10 x 15 m	
Still, Benches, Controls Cooling System	$ 35,000
Lathhouse 10 x 15 m	$ 10,000
Headhouse 6 x 10 m	
Benches, water, cabinets	$ 15,000
TOTAL BIOMASS UNITS	$162,700

APPENDIX D

PLANNING FOR THE INTRODUCTION OF RENEWABLE ENERGY IN MOROCCO

NOTE

During its visit to Morocco the AID energy team often referred to data needed to introduce renewable energy to the country. The Governement of Morocco requested the team to prepare a list of such data, in order to give it a sense of the amount and scope to be handled by the Center.

Appendix D, drafted in Morocco and reviewed with the GOM, contains this material.

Morocco is not a producer of fossil fuels, and it must import 80 percent of energy to satisfy its needs. The situation becomes bleaker if one considers the growth rate of 10 percent in local consumption of energy and the trend of worldwide increase of oil prices. This fact was not neglected by the GOM which, in its three-year plan, envisions the development of renewable sources of energy by creating a center for energy research and planning. Among its several functions, an important place is given to creating information which facilitates the choice of alternative technologies to fulfill energy needs among end uses compatible with the natural potential of Moroccan resources.

Data are needed for each step of the decision process. Figure 1 shows a simplified model of dependence of energy planning steps on data sources. A comment on this model is in order before a list of data and data sources are mentioned for Morocco's planning process.

An assumption is made that there exists a national development plan in which a national energy policy is one of the objectives. The renewable energy policy is determined by the possible end uses of renewable sources, and it, in turn, dictates the magnitude of action to be undertaken in order to achieve the plan objective. For instance, the energy policy might be set forth in the national plan to use water pumping by renewable energy for irrigation of a certain number of hectares. In other examples, energy needs can be expressed in terms of number of villages to be electrified, number of buildings to be heated, or number of hospitals to be served. The Center can provide the required analysis to substantiate policy directives.

Once the energy needs by end use are determined, the assessment of technological applications for using the country's resources will be accomplished at the Center. The process leads to the choice of the best technology among available technologies. The candidacy of technologies is examined under technological and economic constraints, present and future. As an example, the rural electrification of a location (a village or a small town) can be achieved by small-scale hydro, by biomass, or by wind turbine. The resources of the location are analyzed for each competing technology. In small-scale hydro, the data on river systems of the location, and gauge readings on contour maps are analysed along with the costs of capital and operation to bring electricity to the location. For biomass, the data on forest land, on agricultural residues, on livestock manures are analyzed along with the costs of capital and operation to bring electricity to the location. For biomass, the data on forest land, on agricultural residues, on livestock manures are analyzed along with the costs of harvesting, collection, transportation and storing of biomass, the costs of conversion, the costs of capital and the costs of distribution of electricity to the location. The speed of wind, the regularity of the wind and the size of turbine are gathered for windmills; the capital costs and the operation costs are also determined. The best technology is chosen from the above considerations. This best technology is cost effective for introduction in the location under study.

The best technology must also provide benefits to the community and thus to the nation. These benefits include the economic benefits due to the increase of production and of income and the social benefits due to the improvement of comfort, health, nutrition, etc. The benefits must outweigh the costs, including the costs of installing and operating the technology and the social costs which may arise from the loss of amenities or the increase of externalities such as pollution, price increase. Data sources for the analysis of these impacts are to be found in different surveys and studies on Morocco.

The technological feasibility which has led to the choice of a best technology adapted to the natural resources of the country and the analysis of social, economic and political impacts of the technology indicate to the government new directions for further development of renewable energy applications in the country. The government can be aware of the implications of using a technology adapted to the resource potential of a particular location in order to achieve an end use. The information permits the government to issue new energy guidelines with the expectation of fulfilling a desired objective; thus, the new objective to be achieved will be taken up in the next national development plan, or in the amendment of the present national development plan, or in special energy guidelines put out by the government for a concerned agency to follow.

The list which follows is divided into two parts The first part indicates to the renewable energy planner the kinds of information which are needed for each step of planning. The second part shows some of the sources of information about Morocco that can be found there and that can be used to investigate the resource potential of Morocco for a particular renewable energy technology. The list is not exhaustive; it serves to illustrate possibilities so that the Center's training and analysis capability can be designed to plan for the introduction of renewable energy in Morocco.

PART I. INFORMATION NEEDED FOR EACH STEP OF PLANNING

A. Information on End Uses

The Center will consider all the possible end uses that the technologies of renewable energy can furnish. The ones that are consistent with the energy policy or are considered as priorities by the Center or a certain ministry are taken for analysis. Major end uses of renewable energy which are known to have applications on a small-scale basis at present development stage, are as follows:

1. Water Pumping

   - Irrigation
   - Livestock and other agricultural needs
   - Saline water in saltworks
   - Household or collective uses
   - Institutional uses (hospitals, schools...)

2. Heat Applications

- Crop drying
- Drying of Wood, pulp, paper
- Dehydration of foods
- Curing of concrete blocks
- Space heating (livestock shelters, greenhouses, schools..)
- Water heating
- Spcae cooling (greenhouses, schools, hospitals)
- Production of slat by evaporation of seawater

3. Mechanical and Electrical Applications

- Powering agricultural tasks (grinding corn, throshing..)
- Powering industrial tasks
- Powering domestic applicances and machinery

4. Lighting

5. Home Cooking

6. Communications

II - INFORMATION ON TECHNOLOGICAL APPLICATIONS

Several technologies give rise to the same end use. The list below mentions only the technologies that are suggested as adapted to Morocco at its present stage of development. The best technology is said to be "best" if it is supported by the resource potential of the site where it is applied and if it is cost effective (least cost among competing technologies to achieve a same energy amount of end use.) Many end uses can be satisfied indirectly by technologies through electrification. Even though electrification is not considered as end use, it is mentioned in the list to show the technologies that produce electricity which in turn is used to meet end use.

1. Electrification

- Small-Scale hydro
- Biomass
- Photovoltaic
- Wind turbine
- Geothermal

2. Water Pumping

- Electricity from first set of processes
- Windmill

3. Heat Application

- Electricity from first set of processes
- Biomass
- Geothermal
- Solar thermal

4. Lighting

- Electricity from first set of processes
- Biomass

5. Home Cooking

- Electricity from first set of processes
- Biomass

6. Mechanical Works

- Electricity from first set of processes
- Wingmill
- Waterwheel

III INFORMATION ON RESOURCES OF THE COUNTRY

The application of a particular technology depends upon the resource potentials of Morocco. The Center will analyze the types of data listed below for selection of sites. Without careful analysis, the performance of a particular technology may be reduced or interrupted due to physical constraints of the site.

1. Small-scale Hydro

- Drought (occurence, frequency, by area)
- River system and gauge reading for each river
- Slope
- Earthquake
- Soil type
- Rainfall
- Snowfall
- Competing uses of water
- Electrical network

2. Biomass

- Land available for forests
- Soil type
- Varieties of woods giving high yield in Moroccan condition
- Concentration of crop residues(location and quantity)
- Concentration of livestock residues (location and quantity
- Concentration of wood residues (location and quantity)

3. Solar Thermal and Photovoltaic

- Intensity of insolation
- Duration of insolation
- Frequency of damaging winds, rain, hail

4. Wind Energy

- Velocity of wind
- Regularity of wind
- Direction of wind

5. Geothermal Energy

- Location of hot spring of deep hot rock
- Depth of hot spring of hot rock
- Temperature and pressure of water
- Mineral contents of hot water

IV. INFORMATION ON COSTS OF INSTALLED TECHNOLOGIES

A particular technology is chosen not only because it is technologically feasible at a site, but also because it is cost effective. Among the alternative technologies to produce a same end use, the Center will choose the one that has the lowest cost for the same output. The costs below are to be completed by adding costs of distribution.

1. Costs of small-scale hydro

- Construction of site
- Generator
- Attachments (penstock, fittings, valves, draft tube...)
- Transmission
- Maintenance

2. Costs of Biomass (Wood)

- Land to grow forests
- Plantation (soil preparation, plantation, maintenance...)
- Harvest
- Transportation of wood to boiler
- Boiler
- Boiler installation
- Operation
- Maintenance
- Transmission or cost of fuel transportation pipe

3. Costs of Photovoltaic

- Land site
- Equipment (module, batteries, power conditioning)
- Construction of structure
- Transportation
- Maintenance

4. Costs of Wind

- Structure
- Equipment and attachments
- Maintenance)
- Drilling) for water pumping
- Pumping)
- Pipeline or duct)
- Generator/batteries) for electricity
- Transmission)

5. Costs of Geothermal

- Drilling)
- Generator) for electricity
- Transmission) for heating
- Pipes)

V INFORMATION FOR ANALYZING IMPACTS

Socio-economic data will be analyzed by the Center ot estimate the impacts of the introduced tec-nology on the site. The technology should provide economic and social benefits to the site, so that the quality of life of the people is enhanced with the introduction of technology, Improvement is measured by the difference of the socio-economic status of the site before and after the introduction. Thus a survey should be undertaken for baseline data with the introduction of technology.

The impacts of a technology can be direct or indirect through a multiplier effect; some can be readily measured or observed and some cannot. Some variables listed below are impacts of technology readily measurable.

I. Agricultural Uses

(a) Direct Effects

1. Increased yield
2. New crops
3. Market and selling activity of new products
4. New land under cultivation
5. Improved food preservation in markets/farms.

(b) Indirect Effects

1. Higher farm family income/New spending patterns
2. Decisions to remain in rural area
3. Hiring of unemployed/landless labor
4. Non-farm related business growth in area
5. Decline in spoilage and waste.

II. Health Uses

(a) Direct Effects

1. Establishment of new or improved health services
2. Decrease in infant mortality
3. Availability of uncontamined water supply
4. Reduction in incidence of disease.

(b) Indirect Effects

1. Longer life span
2. Increased opportunity of rural labor
3. Family planning activities.

III. Industry Uses

(a) Direct Effects

1. Growth of energy-consuming industries
2. Non-farm employment growth
3. General industrial growth.

(b) Indirect Effects

1. Growth in village or town incomes
2. Improved transportation to other towns
3. Increased development assistance from ministries
4. Decisions to remain in area (rather than migrate to cities).

IV. Communications Uses

(a) Direct Effects

1. New communication channels for development information (radio, TV, local phone, printing press, etc.)

(b) Indirect Effects

1. New types of education
2. Increase in village assemblies, etc. (due to improved lighting).

V. Forestry Uses

(a) Direct Effects

1. Reduction in taking of wood from forests
2. Introduction of heating to homes (e.g. using charcoal in stoves with ventilation)
3. Employment for unskilled labor.

(b) Indirect Effects

1. Recureration of land from semi-desert
2. Increase in fauna
3. Flood reduction
4. Soil improvement

VI. Domestic Uses

(a) Direct Effects

1. Increase in household amenities
2. Changes in construction (e.g. windows)

(b) Indirect Effects

1. Decision to remain in rural area
2. Changes in household activities (e.g. addition of studying, crafts).

PART II. DATA SOURCES

The list of documents given in the following pages is the result of a search during the Team's mission. The documents are separated into two groups. The first set contains selected data sources that the Center can use immediately for the analysis of the resource potentials of Morocco for each type of technology in renewable energy - the second group includes data sources that the Center can use for investigating the socio-economic impacts of a technology at the site.

The titles of documents are given in the list. However, some documents were known to exist, but were not actually inspected by the Team. In that case, an esterisk(*) is placed on the sources of data.

I. DATA SOURCES FOR ANALYZING RESOURCE POTENTIALS

1. Small-Scale Hydroelectric Generation

A. Folders available from O.N.E. (Office National d'Electricité)

a. Géomorphologie (géologie, seismologie)

- (Map) Les Grandes Unités Structurales Géogrphiques et Géologiques
- (Map) Cartes Structurale et Hydrogéologique
- (Map) Zones de Seismicité

b. Climatologie

- (Map) Postes Pluviométriques et Isophyètes Moyennes Annuelles
- (Map) Caractéristiques Schématiques du Manteau de Neige Haut Atlas Central
- (Graph) Climagramme Pluviométrique du Coefficient
- (Map) Cartes de Valeurs du Quotient Pluviothermique d'Emberges
- (Map) Cartes des Pluies (total annuel des précipitations atmosphériques - 1933-63)
- (Map) Nombre de Jours de Précipitations Atmosphériques (1925-49)
- (Map) Carte des Zones Caractérisées par le Mois où le Nombre de Jours de Précipitations est Maximum
- (Map) Intensité Moyenne Diurne des Précipitations Atmosphériques
- (Map) Pluviométrie (intensité de la variabilité)
- (Map) Variabilité dans l'éspace de l'Isophyète 300mm
- (Map) Vitresse des Vents

c. Hydrographie et hydrologie

- (Table) Caractéristiques Principales et Crues Caractéristiques
- (Graph) Débits Moyens Mensuels
- (Graph) Débits Moyens Annuels

d. Réseau électrique

- (Map) Réseau Electrique à Haute Tension

e. L'équipement agro-énergétique

- (Map) Inventaire des Aménagements Hydro-électriques
- (Map) Equipment d'Irrigation

f. Rapport Annuel 1977

B. Publications Available from Direction de l'Hydraulique

a. Annuaire Hydrologique 1970-1973

b. Annuaire Hydrologique 1973-1974
1974-1975

c. Ressources en Eau au Maroc

- Tome I - Domaines du Rif et du Maroc Oriental
- Tome II - Domaines plaines et Bassins atlasiques
- Tome III - Domaines atlasiques et sud-atlasiques
- Annexe - cartes

2. Biomass

A. Available from the centre de recherche agronomique

a. Map of land classification (*)

b. Planting/harvesting calendars of different crops (*)

c. Areas and production of different crops (*)

B. Available from the direction des Eaux et Forêts

a. Le Maroc Forestier

b. Rapport Annuel d'Activité

C. Available from Division de Statistique agricole

a. Areas and production of crops (*)

b. Statistiques Agricoles

3. Photovoltaic

A. Available from the Service de la Météorologie Nationale

a. Détermination de l'Irradiation Solaire Globale au Maroc

b. (Map) Rayonnement Global Annuel en Kc/cm2

c. (Map) Stations permanentes mesuran.

- Rayonnement Global
- La Durée d'Insolation
- La Vitesse et la Direction du Vent

d. Data on insolation by station (*)

4. Wind Energy

A. Available from the Service de la Météorologie Nationale

a. Data on velocity and direction of wind (*)

b. (Map) see I. 3. A. c.

5. Geothermal

A. Available from O.N.E. (See I. 1. A. c.)

B. Available from Thermalisme

Data on location and depth of hot springs (*)

II. DATA SOURCES FOR ESTIMATING SOCIO-ECONOMIC IMPACTS

1. Available from Direction de la Statistique

   - Recensement Général de la Population et de l'Habitat de 1971 (in several volumes)
   - Enquête de la Consommation de 1970-71 (in several volumes)
   - Annuaire Statistique du Maroc (annual)
   - La Situation Economique du Maroc (annual)
   - Le Maroc en Chiffre (annual)
   - Indice du Coût de la Vie (monthly)
   - Bulletin Mensuel de Statistiques (monthly)
   - Etude des Structures
   - Enquête sur le Commerce Intérieur (1963)
   - Enquête à Objectifs Multiples (1961-63)
   - L'Industrie, l'Energie et les Mines (1964, 65, 66)

2. Available from Ministry of Agriculture

   - Data on areas and production of crops (*)
   - Statistiques Agricoles
   - Grandés Périmètres d'Irrigation
   - L'Elevage au Maroc
   - Plan Laitier
   - Bilan des Etudes et des Réalisations dans les Terrains de Parcours

3. Available from Ministry of Health

   - Health Statistics (*)
   - Enquête sur la Continuation des Méthodes Contraceptives (1972)

4. Available from Banque du Maroc

   - Etude et Statistique (monthly)

5. Available from Ministry of Social Affairs

   - Annuaire Statistique du Travail

6. Available from Ministry of Interior

   - Etude d'Identification de Projets (Potential and diagnostic study on 11 provinces)

7. Available from some provinces (Agadir, Meknes, El Kelaa, Khemisset)

   - Bulletin Economique et Social (semestrial)

8. Available from the World Bank

   - Le Développement Economique du Maroc

APPENDIX E

INITIAL ENVIRONMENTAL EXAMINATION

INITIAL ENVIRONMENTAL EXAMINATION

Project Location: Morocco

Project Title: Renewable Energy Development

Funding: FY 79 - $1,200,000

Life of Project: $5,000,000

IEE Prepared by: Eric Melby
AID/W - DS/EY
Date: 30 July 1979

Environmental Action Recommended: Negative determination

Concurrence: Harold S. Fleming
Mission Director
Date:

I. Examination of Nature Scope and Magnitude of Environmental Impact

A. Description of Project

There are two central components to the project: (a) institution building and training and (b) demonstrations of renewable energy technologies. As the first is environmentally neutral, only the second component will be discussed here.

The renewable energy technologies to be demonstrated are small, decentralized hydro (SDH), biomass and solar. Each technology will be discussed separately.

1. Small, Decentralized Hydro

The project will demonstrate SDH technology at three sites in the High Atlas mountains. Although the GOM has not yet made a final decision on the sites, they are expected to be located at Tillougguit, Msemrir and Ait Arbi. Site selection included analysis of rainfall patterns, basin area drainage and run-off as measured by gauging stations located near each of the sites. Each site is estimated to produce 200 KW of power. The demonstrations are designed to have minimal adverse environmental impact. SDH is a non-consumptive water use. No large dams or impoundments are used to heat and de-aerate the water. There is a small positive effect as stilling ponds remove some silt and debris from the flowing water.

Proper design of the water supply system at the site is important. SDH installations are designed for minimum stream flow to be taken by a short canal into a stilling basin adjacent to the main stream. The stilling basin is the water source for the turbine. Thus, the flow of the stream is not disturbed. Increases in the stream flow simply move past the short canal entrance. The stream flow meets the exit water from the turbine downstream from the power plant.

Movement of fish should not be adversely affected with a properly designed SDH plant. Fish normally do not migrate during the minimum water flow season. At other times, excess water flows in the main stream, permitting fish to by-pass the canal entrance to the stilling pond.

With proper design, there are no adverse environmental effects with small, decentralized hydro installations. Their operation is pollution-free and quiet compared to decentralized diesel systems.

2. Biomass

The biomass activities center on research on tree growth and cultivation of trees for energy production. Although it is not known what percentage of tree clearing is for energy production, Morocco currently loses 40,000 hectares of trees annually. Reforestation replaces 20,000 for a net loss of 20,000 hectares.

There will be four demonstration tree plantations: a 20 hectare research site in Marrakech and three 2500 hectare demonstration sites at

locations yet to be chosen. The land to be used for these plantings is Class 4 land, land not suitable for agriculture. The biomass activities in this project should entail minimal, if any, adverse environmental effects. Water requirements are minimal as the species to be planted--eucalyptus--requires additional water only during the planting phase.

If the demonstration activities are successful and Morocco decides to replicate tree plantations on a wider scale, certain environmental concerns will have to be examined. Large-scale cultivation might intrude on agricultural land and poor cultivation practices could deplete the soil. However, since there are over four million hectares of Class 4 land in Morocco, land particularly suited to arid land tree cultivation, use of agricultural land should not be needed.

The objective of growing tree plantations is to produce wood for domestic cooking and heating and wood for decentralized generation of electricity and mechanical power. These applications will be tested in Years 4 and 5 of the project. Utilization of the biomass will have to be managed properly to assure that particulates from wood combustion do not form.

It is expected that the biomass plantations will have overall beneficial environmental effects. These effects include the preservation of existing forests (to the extent that biomass plantations are substituted as sources in the fuel wood market) and prevention of further soil erosion as presently denuded lands are planted with fast-growing tree species.

3. Solar

Solar energy activities under this project will be identified during the first year's solar planning phase. Demonstration activities are planned in water pumping for potable and irrigation use. Potential adverse effects would include a lowering of the water table. As this concern will be an integral part of planning and site selection, no adverse environmental effect is anticipated.

II. Recommendation for Environmental Action

A negative determination is recommended.

IMPACT IDENTIFICATION AND EVALUATION FORM

Impact Areas and Sub-Areas*	Impact Identification and Evaluation**
A. Land Use	
1. Changing the character of the land through:	
a. Increasing the population	N
b. Extracting natural resources	N
c. Land clearing	N
d. Changing soil character	L
2. Altering natural defenses	N
3. Forecasting important use	N
4. Jeopardizing man or his works	N
5. Other factors	None
B. Water Quality	
1. Physical state of water	N
2. Chemical and biological states	N
3. Ecological balance	N
4. Other factors	None
C. Atmosphere	
1. Air additives	L
2. Air Pollution	L
3. Noise pollution	N
4. Other factors	None

* See Explanatory Notes for this form.

** Use the following symbols: N - No environmental impact.
L - Little environmental impact
M - Moderate environmental impact
H - High environmental impact
U - Unknown environmental impact

D. Natural Resources	
1. Diversion, altered use of water (irrigation)	L
2. Irreversible, inefficient commitments	N
3. Other factors	None
E. Cultural	
1. Altering physical symbols	N
2. Dilution of cultural traditions	N
3. Other factors	None
F. Socio-Economic	
1. Changes in economic employment patterns	L
2. Changes in population	N
3. Changes in cultural patterns	N
4. Other factors	None
G. Health	
1. Changing a natural environment	N
2. Eliminating an ecosystem element	N
3. Other factors - small quantities of fertilizers and plant protection materials	N
H. General	
1. International impacts	N
2. Controversial impacts	N
3. Larger program impacts	N
4. Other factors	None
I. Other Possible Impacts (not listed above)	None

APPENDIX F

PROJECT CHECKLIST FOR STATUTORY REQUIREMENTS
(See AID Handbook 3, App. 5C-2)

Note: Both Country Checklist and Standard Item Checklist are updated and may be found in Annex 4 of Project Paper 608-0154, Social and Economic Research.

A. General Criteria

1. a. The Appropriation Committees will be notified in accordance with normal agency procedures.

   b. Yes.

2. a. Yes.

   b. Yes.

3. Legislation is required to establish the Renewable Energy Center. Apart from the fact of its very high priority in the Ministry of Energy and Mines, there will be a Condition Precedent to disbursement under the Grant Agreement stipulating that the legislation must be passed.

4. NA.

5. NA.

6. NA.

7. By stimulating rural uses of renewable energy resources, the project is expected to improve the technical efficiency of agro-industry and to foster private initiative.

8. A private American contractor will provide technical assistance. American equipment will be purchased.

9. The project agreement will so provide.

10. Morocco is not an excess currency country.

11. Yes.

12. NA.

B. Funding Criteria

1. a. (a) The project focusses on appropriate rural applications of renewable energy resources and will attempt to enlist wide participation of rural village populations.

   (b) NA.

   (c) The project will support the self-help efforts of rural communities by applying appropriate technology to local development acticity.

   (d) NA.

   (e) NA.

b. (106) The project has great potential in the long run for alleviating the energy problem by developing domestic alternatives to importation of petroleum.

c. Yes.

d. Yes.

e. NA.

f. The project meets a direct need of rural Morocco--cheap energy. Research and development of renewable energy will tax the country's available talent in this area, and considerable U.S. training is envisaged.

g. Yes.

2. NA.

3. NA.

UNCLASSIFIED

U.S. INTERNATIONAL DEVELOPMENT COOPERATION AGENCY

AGENCY FOR INTERNATIONAL DEVELOPMENT

WASHINGTON, D.C. 20523

PROJECT PAPER

MOROCCO: Renewable Energy 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: Morocco

4. DOCUMENT REVISION NUMBER:

5. PROJECT NUMBER (7 digits): 608-0159

6. BUREAU/OFFICE: A. SYMBOL: NE; B. CODE: 03

7. PROJECT TITLE (Maximum 40 characters): Renewable Energy Development, Phase I

8. ESTIMATED FY OF PROJECT COMPLETION: FY 84

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 80; B. QUARTER 3 (Enter 1, 2, 3, or 4); C. FINAL FY 80

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)	(600)	( )	(600)	( )	( )	(600)
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY						*
OTHER DONOR(S)						
TOTALS	600		600			600

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 80 F. GRANT	E. 1ST FY 80 G. LOAN	H. 2ND FY ___ I. GRANT	H. 2ND FY ___ J. LOAN	K. 3RD FY ___ L. GRANT	K. 3RD FY ___ M. LOAN
(1) ST	740	878		600					
(2)									
(3)									
(4)									
TOTALS				600					

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)					600	
(2)						
(3)						
(4)						
TOTALS						

12. IN-DEPTH EVALUATION SCHEDULED: MM 04, YY 82

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)

*host country contribution exceeding 25% of total project cost will be made during second phase of project.

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: Eric Griffel

TITLE: Acting Director, USAID/Morocco

DATE SIGNED: MM 12, DD 14, YY 79

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM 12, DD 24, YY 79

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NON-TECHNICAL ABBREVIATIONS

A.I.D.	Agency for International Development
CIER	Commission Interministérielle de l'Electrification Rurale
DH	Moroccan Dirhams
DSI	Development Sciences, Inc.
FAA	Foreign Assistance Act of 1961, as amended
FY	Fiscal Year
ha	hectares
IBRD	International Bank for Reconstruction and Development
GOM	Government of Morocco
MEM	Ministry of Energy and Mines
MI	Ministry of Interior
Min Ag	Ministry of Agriculture
OIT	Office of International Training, A.I.D.
ONE	Office National de l'Electricité
PP	Project Paper
SUNY	State University of New York
USAID/Rabat	The A.I.D. Mission in Rabat
U.S.	United States
USSR	Soviet Russia
NE/TECH	Near East Bureau, Office of Technical Assistance
DS/EY	Development Support Bureau, Office of Energy
PACD	Project Assistance Completion Date
NEAC	Near East (Bureau) Advisory Committee

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CURRENCY EQUIVALENTS

Currency Unit	=	Dirham (DH)
DH 1	=	U.S. $ 0.27
DH 3.7	=	U.S. $ 1.00

MEASURES AND TECHNICAL ABBREVIATIONS

1 kilometer (km)	=	0.62 mile (mi)
1 cubic meter (m^3)	=	35.315 cubic feet (ft^3)
1 barrel (bbl)	=	42 gallons (USgal) 0.159 cubic meter
1 kilovolt (kV)	=	1,000 Volts (V)
Medium Voltage	=	In Morocco: 22-kV, 8.5-kV and 5.5-kV
Low Voltage	=	In Morocco: 380 220-V
1 kilowatt (kW	=	1,000 Watts (10^3W)
1 megawatt	=	1,000-kW (10^6W = 10^3kW)
1 kilowatthour (kWh)	=	1,000 Watthours (10^3Wh) 860.4 kilocalories (kca
1 megawatthour (MWh)	=	1,000 Kilowatthours
1 Gigawatthour (GWh)	=	1,000,000 kilowatthours
1 kilovolt ampere (kVA)	=	1,000 Volt amperes (10^3VA)
1 Megavolt ampere (MVA)	=	1,000 kilovolt amperes
1 kilocalorie (kcal)	=	1.163 Watthours
1 kilogram coal equivalent (kgce)	=	7.10^3 kcal
Per year	=	/a
1 hectare (ha)	=	2.47 acres
1 cubic meter (m^3)	=	264 gallons
1 gallon	=	.0038 cubic meters

MOROCCO: RENEWABLE ENERGY DEVELOPMENT

SUMMARY

Grantee: Kingdom of Morocco

Principal Agency: Ministry of Energy and Mines (MEM)

Phase I Grant Amount: U.S. $600,000

Phase II Estimated Grant Amendments: U.S. $4.4 million

Project Purpose: Finance the design and development of an experimental renewable energy program and research institution in Morocco in accordance with Section 106, FAA.

Project Description: The project will be executed in two phases. Phase I will provide for the necessary feasibility and preliminary design studies for infrastructure activities, training and technical assistance while Phase II will include construction and longer term institution building activities. The provision of early training and short term technical advisors during Phase I will permit an early start on [illegible] the functional responsibilities and manpower requirements of the Moroccan renewable energy center, and should facilitate expeditious implementation of Phase II.

Specifically, Phase I of the project consists of (1) development of a training plan and participant training in the U.S. for the initial Moroccan professional cadre for the renewable energy research institution; (2) the services of a French-speaking U.S. engineer to provide coordinating assistance to the Ministry of Energy and Mines (MEM) in the execution of Phase I activities; (3) feasibility and preliminary design studies for three small, remote, hydro electric power generation plants in the Moroccan mountains, a renewable energy laboratory and research center at Marrakech, and several wind and sun-powered irrigation pumping stations; (4) short term U.S. technical advisory services.

Phase II, of the project will consist of: (1) additional training in the U.S. and Morocco for Moroccan professionals assigned to the new renewable energy research institution, (2) constructing and equipping the three small, remote hydro-electric power plants, the wind and sun-powered irrigation pumping stations, and the renewable energy laboratory and research center at Marrakech that were subjected to design and feasibility studies during Phase I; (3) both short and long-term U.S. technical advice and assistance for the development of Morocco's institutional capacity to sustain a program of renewable energy appropriate to that country's needs, and (5) initiation of new training, management and research activities which are expected to be identified during the execution of the project and in the course of the development of the new institution.

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Project Implementation: The Director of Energy, MEM, will execute the project along two parallel lines. Phase I feasibility and preliminary design studies will be carried out via A.I.D. work orders to a technically specialized U.S. engineering firm. A French-speaking U.S. general engineer will assist the MEM to coordinate Phase I activities. While the studies are in progress, the MEM will begin competitive procurement for all U.S. services required to execute Phase II of the project. That contract should be executed in mid-1980 after studies are completed and after obligation of the initial FY-80 increment of Phase II funds. Thereafter, the U.S. firm contracted by the MEM will assist the MEM to carry out Phase II of the project, including overall coordination, final designs for construction elements, equipment procurement, training, and short-term advisory services.

Statutory Criteria: All statutory criteria have been met. Congressional notification has been made.

Country Team Views: The Mission and the American Embassy in Rabat support this grant as consistent with U.S. policy objectives in Morocco.

Grant Application: The Kingdom of Morocco has requested this grant. See Annex A, Grant Application.

Fund Availability: Funds for this proposed grant have been made available by transfer of $ 600,000 from the FY-80 $ 1.3 million Regional Energy Development account to the FY-80 Morocco bilateral program.

Recommendation: Authorize a $ 600,000 grant to the Kingdom of Morocco for the Phase I activities described above. That will be the first phase of an anticipated 5 year, $5 million project. (See Annexes B and C, Draft Grant Authorization and Agreement.)

I. BACKGROUND

1.01 Morocco is a middle income country with a $ 14 billion gross domestic product in 1978. Its present 20 million population is increasing at an annual rate of over three percent. It faces declining agricultural productivity per capita, dependence on foreign capital, and the economic drain attributed to the conflict with the Polisario in the Western Sahara. (See Annex D for details of the Moroccan economy). Over the long term, Morocco has considerable resources on which to base steady economic growth, including phosphates and other minerals, potential for higher agricultural productivity, and substantial existing infrastructure.

1.02 The high cost of energy is a major problem for the Moroccan economy and a major reason for recently increased imports expenditures. Morocco is heavily dependent upon imported fuels. It must include constantly increasing petroleum prices in its economic calculations. Energy consumption in Morocco has annually increased seven per cent for the last ten years. Although energy accounted for only 6.5 percent of Morocco's imports in 1973, it amounted to about 14 percent in 1978. Expenditures for petroleum imports are expected to exceed receipts from phosphate exports during 1979. (See Annex F for details of Morocco's balance of payments.) To confront the energy problem, the Government has eliminated subsidies on kerosene and diesel oil. (See Annex G for retail prices of petroleum products in Morocco.) It plans a program of energy conservation and domestic resource development: coal, petroleum exploration, shale oil deposits, hydroelectric power and renewable energy. The Government has recently intensified offshore and onshore oil and gas exploration via joint ventures with foreign firms. Morocco's increasingly serious search for new energy resources offers potential investment opportunities in oil prospecting, shale oil exploitation, uranium extraction, and solar energy.

1.03 Morocco has multiple domestic energy resources. Domestic oil production has declined to about 450 barrels per day, versus a daily demand for 50,000 barrels. In 1978, Morocco imported 3.7 million tons of petroleum and related energy products from Iraq, the USSR, Saudi Arabia and Loweit. Gas reserves are expected to last 32 more years at the current 82-million-cubic meters-per-year rate of consumption, principally by the fertilizer industry. Coal is Morocco's principal fossil fuel resource. Probable resources are 36 million tons. Current production, 700,000 tons per year, is primarily used for power generation. The Government plans to increase production to a million tons per year during the next three years. Thus, coal and gas could be consumed within 40 years. Oil shale deposits of about 24 billion tons exist at Timahdite and Tarfaya. The Occidental Petroleum Company is determining appropriate technology for its extraction. Current plans call for a daily output

of 50,000 barrels by 1985. The Government is negotiating with a Romanian and West German consortium for construction of four shale oil-fired 200-MW generating plants. Morocco's hydroelectric resources are principally in the Moulouya, Sebou and Oum R'bia river basins. They annually yield about 1470 GWh. The 1980-1990 development program is expected to add another 1400GWh. Morocco's 50-billion-ton phosphate reserves are estimated to have a 150 to 200-gram-per-ton uranium content. Extraction is uneconomic with present technology. Commercially exploitable uranium deposits have not yet been discovered in Morocco. Firewood and charcoal are important sources of fuel for home heating and cooking in Morocco. Deforestation is occuring at and annual rate of 40,000 hectares; only 25,000 hectares are annually replanted with trees.

1.04 Morocco has a significant solar energy potential that could be developed to meet part of the country's demand for energy. The Government has become seriously interested in long-term development of Morocco's renewable energy potential to complement conventional sources of electric power. Renewable energy is a concept "whose time has come". Renewable energy is non-depletable, capable of regeneration; its sources cannot be exhausted. All sources of renewable energy are related to the energy of the sun. For that reason, literature on this subject frequently interchanges the terms "renewable" and "solar". There are four fundamental sources of renewable energy: in (1) photosynthesis, plants store solar energy which provides nutrients for human and animal power, for energy released by combustion, and for generation of methane gas from organic wastes; (2) falling water is made renewable by the sun's evaporation of water at sea level which is then deposited by rainfall on mountains and high plateaus; (3) wind is created by variations in the intensity and effects of the sun's heat on various portions of the earth's surface; (4) direct solar energy from the sun's rays may be converted to heat or electric power. Ocean tides and geothermal heat are other sources of non-depletable energy.

1.05 The Ministry of Energy and Mines (MEM) is responsible for overall development planning, pricing, and investments in the energy sector. It manages oil, gas, and uranium exploration and has administrative control over the Office National de l'Electricité (ONE), the public enterprise responsible for most electric power generation and transmission. The Ministry of the Interior (MI) supervises the 13 public enterprises responsible for distribution of water and electricity to urban centers. MI's representative heads the Commission Inter-

ministérielle de l'Electrification Rurale (CIER), i.e. the village electrification program which is implemented by ONE. The Ministry of Agriculture's Department of Waters and Forests is responsible for tree plantations. Fragmentation of control over the energy sector hinders the coordination of investment planning and financing, particularly for urban power distribution and rural electrification.

1.06 ONE generates about 91 percent of Morocco's electric power. Captive plants, generally linked to industrial enterprises, produce another eight percent. About one percent is generated by small, isolated diesel generators. At the end of 1978 ONE's installed capacity was 1063 MW of which 396 MW (37 percent) was hydro and 667 MW (63 percent) was thermal. In 1978, total generation was 3,970 GWh. Peak demand was 765 MW. About 60 percent of ONE's production of electric power is sold to large industrial customers and to the public enterprises for urban distribution. The remaining 40 percent is distributed to provincial cities and rural areas connected to its grid. For transmission, the 225 KW subtransmission network transports energy to the distribution system at 22 KV.

1.07 In 1978, only 6 percent of Morocco's rural people had access to electricity, compared to 60 percent of the country's eight million city dwellers. Lack of infrastructure and services in extensive areas of the countryside, e.g., water, electricity, roads, etc., is considered a primary cause of the continuing migration which aggravates the country's urban poverty problem. Rural electrification, combined with other Government programs for rural development is expected to stem the exodus from rural areas by improving basic infrastructural services and by improving employment opportunities in agro-industry.

1.08 In 1977, the Government, meaning in this instance, CIER, MI, and ONE, formulated the first national rural electrification program for the electrification of 500 villages. French consultants financed by the IBRD developed the program. The main criterion was that villages designated for electrification would maximize expected benefits to the rural population at the lowest feasible cost to the Moroccan economy. This has evolved into Morocco's current three-phase, 15-year, rural electrification program. The program has two principal objectives: (1) increase access to electricity for Morocco's 11.3 million rural people; (2) increase agricultural productivity. Part of this program is the IBRD Village Electrification Project, a rural distribution scheme that will construct 1250 km of 22-KV subtransmission lines, 995 km of 380/220 volt distribution lines, 45 MVA of 22/0.4-KV transformer capacity, and street lighting. It will extend grid power to about 220 villages in 16 rural provinces and will provide electricity

to about 360,000 rural people. ONE will execute the project. Estimated rate of economic return on the $85 million investment is 6 to 8 percent.

1.09 During 1978, the Government of Morocco designated a research facility site and set aside funds for a research program to increase use of renewable energy in Morocco. A consultant team sponsored by A.I.D. visited Morocco and assisted the Government to plan the center and to identify pilot research activities. The resulting December 1978 reports concluded that small hydro sites in the Atlas Mountains should be investigated with a view to identifying suitable sites for feasibility studies, final design, and construction. The team recommended an organization plan for the renewable energy center. Further preliminary survey and project identification work was carried out in 1979 which led to identification of this proposed renewable energy development project in Morocco. (See DSI's June 1979 report).

1.10 In the energy sector, the Government has itself concluded that the rural electrification program deserves major emphasis and that development of renewable resources may offer the best hope for a way to extend the benefits of cheap power to the rural population and to agricultural production. This proposed renewable energy project is in accord with USAID/Rabat's basic program strategy on Morocco. It reinforces the policies and programs of the MEM in the rural electrification subsector.

1.11 The MEM has expressed and demonstrated serious interest in this proposed project. This Ministry is responsible for moving the country towards greater energy independence. It has agreed to appoint a Director for the new renewable energy research center, and to nominate the 30 professionals required to staff the new center. The Government has agreed to provide all the land required for the new center, and the small hydro, solar, and wind-powered test sites. The Government has further agreed to provide all the initial dirham costs for the project and to budget for and to provide for the subsequent costs of operating and maintaining the facilities that will be created by the project. See Annex A, Grant Application for details. The Government is anxious to begin the

the development and utilization of renewable energy technology and to test the performance in Morocco of U.S. renewable energy equipment.

1.12 This project represents a unique and timely marriage of Morocco's long-term development goals and A.I.D.'s program objectives for Morocco, coupled with the universal need to address higher and increasing energy costs. The proposed series of studies, training, and technical assistance should launch the GOM renewable energy program on a sound economic and technical basis, utilizing U.S. technology to the maximum, and adapting that which is found to be practical to the unique environment of Morocco.

II. PROJECT DESCRIPTION

2.01 The purpose of this project is to create a new renewable energy institution in the Ministry of Energy and Mines that will have the professional staff and laboratory equipment to carry out a wide range of applied, adaptive, field trials concerning the design, performance, installation and maintenance of renewable energy equipment and techniques, and will be capable of disseminating knowledge concerning renewable energy technology and applications throughout the Government. The project constitutes the first part of a long term effort by the Government of Morocco to develop and utilize the country's renewable energy resources and thereby to increase production and improve living standards, particularly in remote rural areas, decrease dependence on imported fuel, and conserve domestic sources of depletable fuel.

2.02 A.I.D. intends to sponsor a number of inputs for this purpose, including long-term and short-term technical assistance, training, laboratory equipment for the renewable energy testing facility, pilot demonstrations of small, remote hydroelectric power plants, and wind and sun-powered water pumping stations. A.I.D.'s grants for this project will be based upon Section 106 of the Foreign Assistance Act, which authorizes assistance for "programs to help developing countries alleviate their energy problems by increasing their production and conservation of energy, through such means as research and development of suitable energy sources and conservation methods, collection and analysis of information concerning countries' potential supplies of and needs for energy, and pilot projects to test new methods of production or conservation of energy".

2.03 The program to establish the new research center will be evolutionary and is expected to require four or five years to achieve the following objectives:

- identify and develop renewable energy technology best suited to Morocco;
- establish an objective performance measurement system for renewable energy techniques and equipment;
- train a cadre of engineers, scientists and managers in the application and administration of renewable energy technology;
- develop a Moroccan institutional capability to manage and coordinate renewable energy research activities that are applicable and relevant to Moroccan economic and social development;
- integrate renewable energy techniques into Moroccan national energy sector policy and planning.

2.04 The project will be executed in two phases. Phase I of the project consists of:(1) development of a training plan and participant training in the U.S. for the initial Moroccan professional cadre for the renewable energy research institution; (2) the services of a French-speaking U.S. engineer to provide coordinating assistance to the Ministry of Energy and Mines (MEM) in the execution of Phase I; (3) feasibility and preliminary design studies for the infrastructure and physical facilities components of the project; (4) short-term U.S. technical advisors. Phase II of the project will consist of: (1) additional training in the U.S. and Morocco for Moroccan professionals assigned to the new renewable energy research institution; (2) preparation of final designs, equipment specifications, bidding documents for infrastructure activities; (3) equipping the renewable energy research center facility; (4) execution of the pilot renewable energy test projects that were subjected to design and feasibility studies during Phase I and found to be feasible; (5) U.S. resident, long-term, technical advice and assistance for the development of Morocco's renewable energy; (6) short-term advisory services for initiation of new training, management, and research activities which are expected to be identified during the execution of the new institution.

Training

2.05 For Phase I training, four Moroccan professionals from the Ministry of Energy and Mines (MEM) will be sent to the U.S. for familiarization with basic energy planning issues and training in renewable energy technology applicable to Morocco. The director of the new center will also be sent to the U.S. for similar training. English language training may also be necessary. The total amount of training to be carried out during Phase I is estimated at 16 man-months: four man-months for the research center director and three man-months for each of four planning and analysis engineers. These trainees will be sent to one of several U.S. institutions specializing in energy research and management. The training program will incorporate: energy management; visits to renewable energy laboratories and to facilities that make small hydro turbines, windmills, and solar devices; visits to renewable energy project sites and to offices of the U.S. Department of Energy. Upon return to Morocco, the four professionals will form the cadre of the new renewable energy research center. They will perform the initial acquisition and analysis of data, and plan ways to introduce renewable energy technology in Morocco.

2.06 During Phase II of the project, an additional 14 Moroccans will receive training in the U.S. The total amount of training to be carried out during Phase II is 89 man-months. Five of the trainees will receive short-term training in renewable energy; nine will receive long-term training that will, in most cases, lead to masters degrees. English language training may also be necessary. Upon their phased return to Morocco, these graduates will be posted to the research, planning and analysis, and demonstration projects staffs of the renewable energy center. See Annex J for detailed project training plan.

2.07 Technical Advisory Services. During Phase I a French-speaking, U.S., resident advisor will assist the MEM to coordinate the studies, training and technical assistance. Phase II technical assistance will consist of the services of a resident U.S. renewable energy expert who will assist the Director of Energy of the MEM to plan the structure, staffing, research capability, and administrative, management, and intra-governmental coordinating mechanisms for the renewable energy center. He will assist the MEM with the formulation of a five-year renewable energy research program, including sub-project activities, methodologies, timetables and budget estimates. He will assist the MEM with the formulation of professional training programs and with the screening and selection of Moroccan participant trainees. In addition, Phases I and II will fund approximately 20 man-mont of short-term advisory services in such categories as remote hydro, biomass combustion and utilization, fuelwood silviculture, solar energy, and rural sociology. These sort-term consultants will be brought to Morocco from time-to-time to assist the Director of Energy, MEM, the director of the renewable energy research center, and the U.S. resident advisor with various technical aspects of the research program and its pilot demonstration subprojects.

2.08 Research Laboratory and Facility. The Government has selected three possible sites near Marrakech for the renewable energy research center laboratory and facility where the new institution will be located and where applied research and testing of renewable energy technology will be carried out. The feasibility study and preliminary design to be financed by the Phase I grant will

recommend a site, determine specific requirements for laboratory and other equipment for the center, and plan the architectural configuration of the facility to incorporate utilization of the latest and most cost effective U.S. renewable energy technology for the facility's heating, lighting, cooling, and water and sewerage requirements. The facility will also be designed to incorporate U.S. - source laboratory and testing equipment, as recommended by the consultant, which will be financed by A.I.D. during Phase II of the project. Laboratory equipment recommendations will include equipment for testing locally available biomass such as wood, dung, garbage, etc. for power generation by combustion and via methane gas. It will also include equipment for testing Moroccan utilization and adaptation of solar thermal heat and power, solar photovoltaic power, wind power, and small, remote hydroelectric power. The GOM will finance the local cost elements of actual construction of the center.

2.09 Pilot Demonstrations, General. Phase I will finance the execution of two feasibility and preliminary design studies in addition to that for the renewable energy research laboratory and facility at Marrakech: (1) for three small (100 to 900 KW) hydro electric power generation and distribution facilities in the Moroccan mountains; (2) for irrigation pumping stations powered by wind or sun. Pilot renewable energy activities are intended to:

-- familiarize the Moroccan energy bureaucracy (MI, CIER, MEM, ONE, Min Ag, etc.) with the range and potential application of renewable energy technology;

-- provide an early and credible institutional and administrative function for the new renewable energy research center;

-- provide a training and institutional development vehicle for the Moroccan professionals assigned to the new research center;

-- provide useful information concerning the cost, feasibility, performance, administration, maintenance, sociological effects, etc. of actual applications and performance tests of various renewable energy technologies and equipment in rural Morocco;

-- provide cheaper, useful sources of electric power for agricultural and industrial production applications and home lighting at the rural sites where the several renewable energy pilot research activities will be carried out.

2.10 Small Hydro Demonstrations. In small, remote villages or farmsteads small populations and relative isolation tend to make extension of generated grid power uneconomic. Demand for power may have resulted in the acquisition and operation of small diesel generators that consume imported fuel oil inefficiently. Where abundant stream

water exists year-round, small-scale, environmentally benign, mechanical and electrical hydro power systems may offer an economically viable alternative. Under the terms of the U.S. National Energy Act, a small hydro plant has a 15 MW capacity. In New York State, officials define it as having a 1.5 MW capacity, that is, enough to power a small paper manufacturing plant. Micro-hydro systems generally have power outputs less than 0.1 MW, that is, enough to power a small village of about 100 homes and associated productive requirements. Soaring oil costs, controversy about nuclear plants and concern about emissions from coal-burning plants are causing New York and New England to look to small hydro plants as supplemental sources of energy for private homes and small industry.

2.11 There are 187 remote villages in Morocco that use small diesel generators and rudimentary distribution networks for house lighting and irrigation pumping. These installations are financed by MI from its budget for municipal equipment. Daily operation is insured by local authorities. Maintenance is provided by ONE. The quality of service is poor and unreliable. A third of the isolated diesel generators are in poor condition. The rest are overloaded and deteriorating quickly. The IBRD Village Electrification Project will connect 30 of these remote villages to the national grid. This substitution will result in savings to the economy because ONE's grid power is generated from coal, fuel oil, and hydro and therefore has an average lower economic cost than the opportunity cost of imported fuel oil. The mountainous regions of Morocco may have a rainfall pattern that would justify expansion of investments in small remote hydroelectric power generation facilities. Mean annual rainfall is about 25 to 50 inches in the Moroccan mountains and is "periodic"; i.e., north and west of the mountains rain occurs during each season except the summer; south and east of the mountains rain occurs only in winter. Future development of large hydro sites is constrained in Morocco by short rainy seasons and increasing use of water for irrigation. The need to allocate water between power generation and irrigation has prompted Government-commissioned studies and master plans for each of the river basins.

2.12 The 1979 DSI Report estimated that small hydro plants in these mountains would cost about $ 2600 per kilowatt not including back-up diesel generation for dry seasons, should that prove necessary.

The Office National de l'Electricité (ONE), assisted by the IBRD, is completing feasibility studies and preliminary designs for a 1984-1990 hydro development program, and this development program will include small, remote hydro stations in the Atlas and Rif Mountains. The project proposed in this paper will finance the foreign exchange cost of construction of three, small, remote hydro stations that will test high and low head techniques. ("High head" means roughly 50 feet or more; "low head" means below 50 feet.) The preliminary surveys for this project conducted by DSI identified three potential sites in the Atlas Mountains for hydro power installations. Each was expected to have a 200 KW (0.2 MW) output, that is, enough power simultaneously to light 2000 100-watt light bulbs. The feasibility study to be financed by the Phase I grant will focus first on the technical and economic feasibility of small hydro power plants at those or other sites to be designated by the GOM with the advice of the consultant. According to the National Center for Appropriate Technology, a consultant contracted by the U.S. Department of Energy, there is a head and flow rate below which there is currently no economic advantage of trying to obtain hydro electric power. For practical purposes in micro-scale hydroelectric systems, any head less than ten feet is probably going to be uneconomical to develop. Similarly, ten gallons per minute can be considered the lower limit to the flow rate. However, ten gallons per minute at 100 feet of head will give about 100 watts of useful power - enough to light a single 100-watt bulb continuously. A flow rate of 100 gallons per minute at 10 feet of head will also deliver about 100 watts of useful power. Accordingly, the study consultant will first determine, for each proposed hydro site, the average head and flow rate for each month of the year, for normal, wet, and dry years. If this data is technically and economically positive, the consultant will examine how the resulting power output would be used by the local populations at the three sites, prepare preliminary generation plant and distribution system designs and cost estimates, and examine economic, sociological, financial, and environmental feasibility considerations. The bottom line of the study will be recommendations, based on all factors, as to wheter or not small hydro power is technically feasible and economically viable for testing and demonstration at those locations, or whether alternative or supplementary sources of power; e.g., solar, ONE grid, diesel, or biomass might be appropriate. For those sites where the consultant's recommendations are positive, Phase II of this project will finance final design and the foreign exchange costs of construction.

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Irrigation Pumping Demonstrations

2.13 Two factors combine to make Morocco an ideal testing ground for the development of solar and wind energy to power irrigation pumps: (1) favorable geographic and climate conditions; (2) genuine need for viable, low-cost technology to replace inefficient diesel pumps in areas remote from grid power. Morocco lies in the same latitude as San Diego County and has the same 20 to 40 percent mean annual cloudiness In October 1979, San Diego County enacted a first-in-the-U.S. requirement for solar water heaters on new residential buildings not served by natural gas. The law will affect about 10,000 living units in the first year alone. There are two principal ways to utilize the direct rays of the sun. (1) Flat plate solar collectors utilize an insulated box covered with glass and painted black on the inside to trap the heat of the sun's rays. The heat is then used directly to heat water, operate a pump, power refrigeration, dry fish, etc. Use of this solar thermal technology to heat water for cooking is wide-spread in Japan, Israel and Australia. (2) Photovoltaic or solar cells were first used in space craft to generate electricity from the direct rays of the sun. The semiconductors are usually made of wafer thin slices of silicon covered with, or imbedded in, glass. The action of the sun on these cells creates a continuous electric charge which is collected and carried off by wires to batteries. Average sunlight conditions in Morocco will produce 5.5 KWh of electricity per day for each square meter of a photovoltaic cell. Wind power can be harnessed for direct mechanical energy; e.g., to grind grain or to pump water. Windmills can also generate electric power. The spiraling cost of oil has created interest in wind power. Wind technology on land is feasible where mean wind velocity is at least six miles (9.7 km) per hour. Morocco's coastal regions have a mean wind velocity that justifies research and development of this renewable energy source. Indeed, windmills were used in farms on coastal regions of Morocco until they were replaced by diesel engines in the early 1950's.

2.14 The Government's rural electrification program aims to increase agricultural productivity by making electric power available for irrigation pumping schemes to expand the total cultivated area, to improve yields in areas currently being irrigated unefficiently, and to reduce the economic cost of energy used for irrigation pumping by substituting ONE's centrally generated electricity for the diesel oil currently being used in small isolated generators. An increase in dispersed agricultural irrigation is anticipated, that is, an increase in irrigation pumping remote from grid power but less and less economic when carried out with remote diesel pumps

This situation provides the ideal testing ground for solar and, in coastal regions, wind technology. This project will sponsor a series of irrigation pumping stations powered by the sun or the wind. For these agricultural irrigation pumping stations, preliminary site designations or investigations have not yet been made. Accordingly, the Phase I U.S. study consultant will be expected to work closely with officials of the MI, MEM, and possibly the Min Ag, to identify appropriate sites for the tests, to define the mix of renewable energy sources, and to recommend an appropriate number of test stations. Some of the sites should be in coastal areas to test windmill applications. Some should be tests of solar thermal technology. At least one should be a test of solar photovoltaic technology, despite its present high investment cost. After sites and techniques have been firmly designated for the project by the GOM, the consultant will prepare requisite system preliminary designs and cost estimates, appraise technical, economic, financial, sociological, and environmental aspects of each site, and make appropriate recommendations for execution of the tests.

Biomass Research

2.15 Biomass utilization and production offers a fertile field for adaptive research in Morocco, but the issues surrounding a viable project are considerably more complex than those pertaining to hydro, solar, and wind power. Use of organic matter to produce energy takes three principal forms: (1) biogasification; (2) direct combustion; (3) synthetic oil or alcohol production and combustion. Biogasification, generation of methane gas from organic wastes such as human and animal excreta, and garbage, can be used directly for cooking and lighting or as fuel for electric power generation. This technology is particularly reliable where livestock are abundant. One cow can generate enough methane to produce four kwh of electricity per day. Subsequent use of animal residues for fertilizer is not degraded by their prior use for gas production. Sewage treatment is a prime area for energy saving in the U.S. A purification plant in Wilton, Maine, gets 25 percent of its power from solar panels and will soon become completely energy self-sufficient by drawing the rest of the power it needs from the heat and methane gas that are produced by decomposing sludge. Research would probably identify suitable methane gas applications in Morocco. Wood, garbage, cornstalks, leaves, pinecones, and other kinds of biomass can be burned to generate electricity. In heavily wooded Vermont the Burlington Electric Company has kept electric power rates down by burning woods chips -

(at $ 12.50 per ton) instead of coal at about $ 112 per ton, in two generators. Burlington residents recently approved a bond issue to build a 50 MW wood-burning generator that will be the largest in the world. Some U.S. cities are selling their combustible trash to utilities which burn it to supplement coal. Roughly 30,000 of Milwaukee's 250,000 homes get their power from garbage, sorted at a $4.2 million plant that produces six times more energy than it uses. Ames, Iowa, burns garbage to generate electricity for its 63,000 customers. In energy-short Japan, research is being conducted in the use of the eucalyptus trees and aosango cactus to produce gasoline substitutes. High technology sugar cane production with direct conversion from cane to alcohol is also being developed. Part of Japan's domestic fuel requirements are planned to be met by Southeast Asian cultivation of eucalyptus, aosango, and sugar cane because those nations receive more sunlight annually and because large-scale agriculture is not possible in heavily populated Japan. Present state-of-the-art indicates that eucalyptus oil will produce synthetic gasoline at $ 1.75 per gallon versus the $ 2.50 per gallon that ordinary gasoline costs in Tokyo.

2.16 In Morocco, wood is a principal fuel for home heating and cooking. There are seven million hectares of managed forests, primarily in eucalyptus, used for pulpwood and charcoal. There are four million hectares of Class 4 land which are unsuitable for agriculture but which may be suitable for grazing or fuelwood production. Present managed forests are used for wood production and grazing. The trees are spaced three meters apart; the animals do not like to forage upon eucalyptus leaves. Various measures such as increased use of fertilizer, drip irrigation, closer spacing of trees, use of different tree species, and more frequent harvesting might be introduced to increase fuelwood production further to satisfy domestic demand for fuelwood and charcoal and, possibly, to generate electric power. According to the 1979 DSI Report, such changes in planting practices would displace present grazing opportunities. Phase I feasibility study of a fuelwood tree plantation is not contemplated for this project but could be added during Phase II if it is believed appropriate.

2.17 The Moroccan Department of Waters and Forests, Ministry of Agriculture, has been conducting research in intensive forestry practices since 1972, and considerable data is available. While this project may not focus explicitly on the area, a fertile field of inquiry into biomass utilization and production remains appropriate for the new renewable energy research center. Research may include:
(1) substitutes for fuelwood and charcoal for home heating and cooking; e.g., corn stover, bagasse, manure, and solar energy;
(2) various methods of combustion and utilization of biomass;
(3) total system

cost and economics of biomass production and utilization, including transportation costs and alternative land use economics; (4) optimum silviculture techniques for fuelwood plantations, including species, site preparation, fertilizer, irrigation, thinning, harvesting, etc.; (5) alcohol, synthetic gasoline and oil, rubber production, etc. from such plants as eucalyptus, guayule, jojoba, and aosango; (6) optimum combustion and conversion equipment for utilization in Morocco. As the project progresses, when initial efforts will have produced a sound basis for judgments, and if suitable land in the Marrakech vicinity becomes fully available, it may be appropriate for the center to sponsor small, pilot, experimental fuelwood plantations. Short-term U.S. consultants could be financed by the project during Phase II to assist with research, project definition, design and feasibility if it is deemed appropriate.

Cost Estimates

2.18 The cost of Phase I of the project has been estimated to be U.S. $ 600,000 as shown in Figure 1. The Moroccan contribution for Phase I of the project is limited to local salaries, office rent, logistic support and other in-kind contributions. GOM contributions to be made during Phase II will include land for the center and the demonstration projects, local salaries, and all local construction costs and will amount to at least 25 percent of the combined Phase I and II total cost.

Figure 1

Phase I Project Cost Estimate

Item	U.S. $
1. Training five MEM professionals in the U.S., 16 man-months	50,000
2. Feasibility study and preliminary design, three small hydro systems, eight man-months	100,000
3. Feasibility study and preliminary design, research laboratory and facility at Marrakech, nine man-months	110,000
4. Feasibility study and preliminary design, wind or sun-powered irrigation pumping stations, nine man-months	110,000
5. U.S. short-term advisory services, 12.5 man-months	150,000
6. Contingency for price escalation	35,000
7. Contingency for unplanned costs	45,000
8. Phase I Total	$ 600,000

2.19 Order-of-magnitude costing for the increments of Phase II of the project is available from the preliminary surveys performed by DSI during 1979. They indicate that Phase II may cost about U.S. $ 3.0 million plus Moroccan DH 6.0 million, or a total cost the equivalent of U.S. $ 4.5 million. A more precise Phase II cost estimate is expected to stem from the Phase I consultant's preliminary designs that will be specific to project sites.

2.20 Appraisal of the technical, economic, financial, environmental, and sociological soundness of each proposed subproject will be a product of consultant feasibility studies and will be summarized in a short Phase II project paper. A subproject will be considered technically sound if: all pertinent technical aspects have been included in the analysis and each is positive; preliminary designs conform to accepted engineering standards and practices; estimated investment and operating costs, discounted over 20 years, are as low as other alternatives that would produce the same result. A subproject will be considered financially sound if resulting revenues would be sufficient to amortize the investment, cover fixed charges, maintenance, administration, and operating costs, and provide an adequate return on the investment. A subproject will be considered economically sound if the economic internal rate of return is adequate and at least as high as would be the case for other technically feasible alternatives. A subproject will be considered sociologically acceptable if: inequitable financial burdens will not be placed upon users; user communities will be able to provide or adapt to the new institutions required to operate and maintain a facility to be placed in their midst: the local community will be sufficiently involved in the design and development of the subproject to assure its willingness to participate. A subproject will be considered environmentally acceptable if all pertinent and reasonably foreseeable effects of the project on the human environment have been included in the analysis and either: no adverse environmental effects are projected; or, those that have been identified are considered when weighed against the anticipated benefits of the project, to be acceptable; or, a way to ameliorate a foreseen environmental impact has been devised and its cost has been included in the project design.

III. PROJECT IMPLEMENTATION

3.01 Implementing Activity. The Director of Energy, Ministry of Energy and Mines (MEM) will be responsible for execution of the project. The Ministry of Energy and Mines (MEM) was established in 1977 as a result of the Government's recognition of the need for effective energy management. It consists of a secretariat and four principal departments: (1) Energy, (2) Mining Exploration, (3) Mines, (4) Research and Mining Participation. The Energy Department is further organized into three divisions: (1) petroleum products; (2) electric power; (3) development of energy resources. The Department is staffed with professionally qualified engineers. It has recently carried out projects for expansion of the Samir oil refinery, underground gas storage, construction of hydraulic generators at Oued El Makhazine, El Massira, and Takerkoust, construction of steam turbines at Kenitra and Mohammedia, and construction of gas generators at Agadir, Tanger, and Tetouan. The individual nominated to direct the new renewable energy research center has successfully managed sugar refinery construction projects. Based on all the foregoing, we have concluded that the MEM has the experience and requisite administrative capability to execute this project.

3.03 Basic Plan for Implementation. The Phase I project will be implemented along two parallel lines. Phase I feasibility and preliminary design studies will be executed via work orders to a technically specialized firm that now has a standing contract with A.I.D. The firm will be given an additional requirement to furnish a French-speaking general engineer to assist the MEM to coordinate the Phase II studies, training, and short-term advisors. While the studies are in progress the MEM will advertize in the U.S. and begin to pre-qualify U.S. firms to furnish all U.S. services required by the MEM to execute Phase II, including long-term resident advisory services, preparation of final construction, designs, preparation of equipment specifications and bidding documents, coordination of the training program, procurement and coordination of short-term technical advisory services, procurement of local construction services, and procurement of U.S.-source equipment. The final RFP for those services should be issued during Phase I permitting Phase II contract execution by the MEM with the selected U.S. firm soon after obligation of the initial increment of the Phase II grant. Thereafter, A.I.D.-financed Phase II project increments will be entirely coordinated and executed by the MEM, and the Phase II U.S. contractor.

3.03 For implementation of Phase I participant training in the U.S., the Director of Energy, MEM, will nominate candidates in accordance with a training plan to be developed in coordination with the Phase I consultant firm. They will be screened by USAID/Rabat and processed by the U.S. resident technical advisor to the MEM. Phase II participants will be screened and administered by the MEM with the administrative assistance of the contracted Phase II consultant.

3.04 For the renewable energy research center laboratory and facility near Marrakech, the feasibility study and preliminary design consultant to be financed by this Phase I grant will assist the MEM to select a suitable site, plan the architectural configuration of the facility, and recommend specific renewable energy laboratory and testing equipment for it. For this essentially architectural design activity, the U.S. consultant is expected to provide leadership and the input of expert knowledge concerning renewable energy building design and laboratory equipment.

Participation of Moroccan architects is, however, required to insure that the facility design incorporates the use of materials, construction standards and techniques, and design considerations that are appropriate for Morocco. Moroccan architects will be contracted by the GOM to assist the U.S. consultant with this Phase I task. A Moroccan sociologist will also be appointed to assist the consultant with the necessary sociological assessment. The consultant will provide U.S. consultant services in specialized aspects of renewable energy as required.

3.05 The Phase I study of small hydro demonstration projects requires the services of an electric power engineer with specialized experience in small hydro installations. The selected contractor specializes electric power tasks and has experience in small and micro-hydro installations in New England. One of its engineers participated in the recent DSI survey of this project. A work order to this firm for services to carry out this study is contemplated. The ONE will contribute engineers to assist the consultant with the peculiarly Moroccan aspects of this study. A Moroccan sociologist will be provided by the GOM to assist with the necessary sociological inquiries.

3.06 Phase I feasibility and preliminary design study of the sun and wind-powered irrigation pumping stations requires the service of a consultant expert in irrigation hydraulics assisted by engineers expert in wind and solar energy equipment and technology. After appropriate pumping station sites have been selected, the consultant will insure that hydraulic arrangements for pumping and distributing irrigation water at each site are satisfactory. Examination of ground water hydrology will be necessary if ground water, rather than canal water, will be used. Thereafter, solar or wind energy factors will be evaluated and pumping systems designed. The MEM will furnish Moroccan engineers and a Moroccan sociologist to assist the U.S. consultant.

3.07 As described above, A.I.D. direct contracting is contemplated for Phase I study and advisory services. This is primarily because each component of required services is too small to justify the trouble, expense, and time that alternative issuance of international r.f. p.'s in the U.S. by the MEM would require.

Use of an A.I.D. standing ("requirements" or "indefinite quantity") contract is appropriate. It's use will save considerable time. See Annex I for the Mission Director's determination to waive host country contracting for these services.

3.08 Goods and services to be financed by these proposed A.I.D. grants will have their source and origin in the United States. Phase II host country contracting for the Phase II overall services and advisory contract, and for the Phase II procurement of U.S.-source equipment, will be carried out in accordance with Moroccan procurement regulations and A.I.D. Handbook 11. A.I.D. direct letter of commitment financing is contemplated for Phase II contracts.

3.09 Grant funds for Phase I will be provided by transfer from the Regional Energy Development account to the FY-80 Morocco bilateral program. Congress was notified during FY-79 of the intention to obligate up to $ 1.3 million for this project. Congressional notification is required for this proposal Phase I $ 600,000 FY-80 grant. Fairly rapid Phase I disbursement is foreseen. Phase I PACD should be established about eight months after agreement execution, and a terminal disbursement date six months from that date would provide ample time for any delayed payments. These dates will be revised by amendment of the grant in mid-1980 to finance the first Phase II increment.

3.10 Phase I of this project will take about eight months to execute. An estimated implementation schedule for Phase I is shown in Figure 2 below. See Annex K for a bar chart showing the implementation plan for Phases I and II.

Figure 2

Phase I Project Implementation Schedule

1.	PP approval by NEAC	January, 1980
2.	Congressional notification	January, 1980
3.	Grant authorization	February, 1980
4.	Phase I grant agreement	February, 1980
5.	A.I.D. work orders for study consultancies and short-term coordinator	February, 1980
6.	MEM nomination of Phase I participant trainees	February, 1980
7.	Participant training begins	March, 1980

8.	Feasibility and preliminary design studies for renewable energy institute, hydro power plants, and wind or sun-powered irrigation pumping stations	March-June, 1980
9.	U.S. Resident short-term coordinator's services begin	March, 1980
10.	A.I.D. , MEM review of consultant feasibility study reports for three capital activities	July, 1980
11.	Phase II PP drafting	July-August
12.	Phase II grant agreement amendment	August 1980

IV. COVENANTS AND CONDITIONS PRECEDENT

4.01 The following covenants have been accepted by the GOM during informal negotiations and will be included in the Grant Agreement:

— to cooperate with A.I.D. in project evaluations;

— to establish a renewable energy research center in the MEM;

— to designate the land for the research center and for the Phase I studies;

— to provide necessary logistic support and assign suitable counterpart personnel for the Phase I studies.

See Annex C, Draft Phase I Grant Agreement, for further details.

4.02 As a condition of securing a Phase II grant, it is contemplated that the GOM will be required to agree to the following. This list is not exhaustive and will be adjusted in the Phase II PP.

— to pass legislation to establish a renewable energy research institution within the Ministry of Energy and Mines;

— to budget for, and to provide, on a timely basis, all the funds required to operate and to maintain the new renewable energy research facility;

— to budget for, and to provide, on a timely basis, all the funds required to finance the local currency costs of the project;

— to participate with A.I.D. from time to time in the evaluation of the degree to which this project has attained its planned objectives;

— to consult with A.I.D. frequently concerning the execution of the project and concerning problems that may arise that affect the time implementation of the project;

— to make available on an appropriate and timely basis all the land including rights of way and water rights, required to carry out the project;

— to operate, maintain, and administer, in accordance with the best standard practices, all the facilities and infrastructure that may be created by this project, throughout the useful life of such infrastructure.

4.03 As a condition of securing disbursement of Phase I grant proceeds, the Kingdom of Morocco will be required to provide in form and substance satisfactory to A.I.D. the names and specimen signatures of the person or persons authorized to represent the Grantee in all matters pertaining to this grant.

4.04 It is contemplated that the following conditions to disbursement will be regarded to implement Phase II;

— evidence that funds to finance the estimated local currency costs of the project have been budgeted for and are avaliable for disbursement;

-- evidence that the legislative process to establish a renewable energy research facility within the Ministry of Energy and Mines has been initiated with indication that the process will be completed not later than one year from the date of execution of the initial Phase II grant obligation;

-- evidence that all the land required for the project has been acquired by the Government and is available for the project;

-- evidence that a well-qualified director for the new renewable energy research facility has been appointed.

V. EVALUATION PLAN

5.01 The objectively verifiable indicators of the degree to which Phase I of the project has achieved its purposes are listed below. USAID/Rabat and the MEM expect to review and evaluate these points together in the course of preparing a PP for the Phase II grant.

(1) A clear conceptualization of the long-term institutional development objectives of the renewable energy institution including functions and responsibilities and long term manpower requirements.

(2) A feasibility and preliminary design study for the renewable energy laboratory and research facility at Marrakech, with reasonably firm foreign exchange and local currency cost estimates, adequate to justify authorization of construction funds and final design, preparation of equipment specifications, and issuance of bidding documents;

(3) Progress towards the acquisition of the long-term services of a well qualified U.S. renewable energy expert to provide advisory services to the MEM for the development of Morocco's renewable energy program;

(4) a feasibility and preliminary design study for three micro-hydro power generation and distribution facilities in the Atlas adequate to provide the basis for a definitive judgement as to whether or not funds for construction of the three facilities should be authorized;

(5) a feasibility and preliminary design study for irrigation pumping stations, with reasonably firm foreign exchange and local currency cost estimates, adequate to justify authorization of construction funds, preparation of specifications, and issuance of bidding documents;

(6) coordinated sociological inputs into the various feasibility studies;

(7) five Moroccan professional employees of the MEM trained in the U.S. in renewable energy technology, and returned to Morocco to form the cadre of the new renewable energy research center.

5.02 The objectively verificable indication of the degree to which Phase II of the project has achieved its purpose will be a renewable energy research institution, in the MEM complete with a trained and functioning staff, an ongoing research and demonstration program, requisite facilities and equipment, and some degree of influence upon GOM energy sector planning and budgeting. A.I.D. and the MEM will provide for joint evaluation of this indicator approximately four years from the date of execution of the initial grant agreement.

ANNEX A

GRANT APPLICATION

Rabat,..... (date invisible,
circa March 1978)

Kingdom of Morocco

Ministry of State
in charge of Foreign Affairs
and Cooperation

No. D.C.E.C.I./M.A.E.

To: Embassy of the United States
of America in Rabat

1/2283

The Ministry of State in charge of Foreign Affairs and Cooperation presents its compliments to the Embassy of the United States of America in Rabat and has the honor to inform the Embassy that during the course of a meeting held on 4 March 1978, at the Ministry of Energy and Mines, A.I.D. officials informed us that pursuant to American Congressional action, the aforementioned organization grants financial assistance to various Middle Eastern and North African countries to promote the use of renewable energy resources (solar, geothermal and wind).

In this connection, the Ministry has the honor to inform the Embassy that Morocco has identified the following projects that precisely conform to A.I.D.'s description:

- construction of a National Institute for Solar Energy;
- construction of a few pilot facilities using this type of energy;
- possibilities of developing the SEBKHATS located southeast of Tarfaya.

Brief description of these projects are annexed.

The Ministry of State in charge of Foreign Affairs and Cooperation would be grateful if the Embassy of the United States of America in Rabat would intervene with A.I.D. in Washington before the closing date of 31 March 1978, so that these projects may be granted financial aid within the context of the aforementioned funding and avails itself of this opportunity to renew its assurances of its highest consideration.

Seal: Kingdom of Morocco,
Ministry of Foreign Affairs

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D.C. 20523

ASSISTANT
ADMINISTRATOR

PROJECT AUTHORIZATION

Name of Project: Renewable Energy Development

Name of Country: Morocco

Number of Project: 608-0159

1. Pursuant to Part I, Chapter I, Section 106 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Renewable Energy Development Project for the Kingdom of Morocco involving planned obligations of not to exceed six hundred thousand United States dollars ($600,000) in grant funds over a one-year period from date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange costs for the Project.

2. The Project consists of the development of a program for the exploitation of energy resources particularly renewable resources, in Morocco. It is anticipated that the scope of the Project will be expanded during a second phase activity.

3. The Project Agreement which may be negotiated and executed by the officer(s) to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority shall be subject to the following essential terms and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate:

a. Source and Origin of Goods and Services

Goods and services financed by A.I.D. under the Project shall have their source and origin in the United States, except as A.I.D. may otherwise agree in writing.

b. Morocco Shall Covenant:

i) to establish a renewable energy institution;

ii) to designate the land for the research center and for the pilot project studies; and

iii) to assign suitable counterpart personnel for A.I.D. advisers and to provide necessary logistic support to carry out required feasibility studies.

Alfred D. White
Acting Assistant Administrator
Bureau for Near East

Feb 20, 1980
Date

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ANNEX C

A.I.D. Project Number: 608-0159

PROJECT GRANT AGREEMENT

BETWEEN

THE KINGDOM OF MOROCCO

AND

THE UNITED STATES OF AMERICA,

FOR

RENEWABLE ENERGY DEVELOPMENT (PHASE I)

Projet de l'A.I.D. Numero: 608-0159

ACCORD DE DON

ENTRE

LE ROYAUME DU MAROC

ET

LES ETATS-UNIS D'AMERIQUE

POUR LE DEVELOPPEMENT

ENERGIES RENOUVELABLES (PHASE I)

Project Grant Agreement

Dated

Between

The Kingdom of Morocco, acting through the Ministry of Energy and Mines ("Grantee").

and

The United States of America, acting through the Agency for International Development ("A.I.D."),

together referred to as the "Parties".

WHEREAS, the Project described in Article 2 is the first phase of a planned two-phase activity; and WHEREAS the second phase is subject to funds being made available by the Congress, the successful implementation of the first phase and the mutual agreement of the Parties to proceed.

NOW THEREFORE, the Parties hereto agree as follows:

ARTICLE 1 : The Agreement

The purpose of this Agreement is to set out the understandings of the Parties with respect to the undertaking by the Grantee of the Project described below, and with respect to the financing of the Project by the Parties.

ARTICLE 2 : The Project

The Project, which is further described in Annex 1, will consist of the development of a program for the exploitation of renewable resources in Morocco.

Annex 1, attached, amplifies the above definition of the Project. Within the limits of the above definition of the Project, elements of the amplified description stated in Annex 1 may be changed by written agreement of the authorized representatives of the Parties named in Section 8.2, without formal amendment of this Agreement.

ARTICLE 3 : Financing

Section 3.1 - The Grant

To assist the Grantee to meet the costs of carrying out the Project, A.I.D., pursuant to the Foreign Assistance Act of 1961, as amended, agrees to grant the Grantee under the terms of this Agreement not to exceed Six Hundred Thousand United States Dollars (US $600,000) (the "Grant").

The Grant may be used to finance Foreign Exchange Costs, as defined in Article 6, of goods and services required for the Project.

Section 3.2 - Grantee Resources for the Project

(a) The Grantee agrees to provide or cause to be provided for the Project, all funds, in addition to the Grant, and all other resources required to carry out the Project effectively and in a timely manner.

(b) The Grantee agrees to provide not less than 25 percent of the cost of the entire program, including costs borne on an "in kind" basis.

Section 3.3 - Project Assistance Completion Date

(a) The Phase I Project Assistance Completion Date (PACD), which is September 30, 1980, or such other date as the Parties may agree to in writing, is the date by which the Parties estimate that all services financed under the Grant will have been performed and all goods financed under the Grant will have been furnished for the Project as contemplated in this Agreement.

(b) Except as A.I.D. may otherwise agree in writing, A.I.D. will not issue or approve documentation which would authorize disbursement of the Grant for services performed subsequent to the PACD or for goods furnished for the Project, as contemplated in this Agreement, subsequent to the PACD.

(c) Requests for disbursement, accompanied by necessary supporting documentation prescribed in Project Implementation Letters are to be received by A.I.D. or any bank described in Section 7.1 no later than nine (9) months following the PACD, or such other period as A.I.D. agrees to in writing. After such period, A.I.D., giving notice in writing to the Grantee, may at any time or times reduce the amount of the Grant by all or any part thereof for which requests for disbursement, accompanied by necessary supporting documentation prescribed in Project Implementation Letters, were not received before the expiration of said period.

ARTICLE 4 : Conditions Precedent to Disbursement

Section 4.1 - Disbursement

Prior to disbursement under the Grant, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, the Grantee will, except as the Parties may otherwise agree in writing, furnish to A.I.D., in

form and substance satisfactory to A.I.D. a statement of the name of the persons holding or acting in the office of the Grantee specified in Section 8.2, and of any additional representatives, together with a specimen signature of each person specified in such a statement.

Section 4.2 - Notification

When A.I.D. has determined that the condition precedent specified in Section 4.1 has been met, it will promplty notify the Grantee.

Section 4.3 - Terminal Date for Condition Precedent

If the condition specified in Section 4.1 has not been met within 30 days from the date of this Agreement, or such later date as A.I.D. may agree to in writing, A.I.D., at its, option, may terminate this Agreement by written notice to the Grantee.

ARTICLE 5 : Special Covenants

Section 5.1 - Project Evaluation

The Grantee agrees to cooperate from time to time with A.I.D. in the evaluation of Phase I. Such evaluations will examine, among other things, the extent to which Phase I has achieved its objectives.

Section 5.2 - Center for the Development of Renewable Energy

The Grantee agrees to:

(a) Create a Center for the Development of Renewable Energy in Marrakech; and

(b) Designate the land where the center will be located.

Section 5.3 - Additional Covenants

The Grantee further agrees to:

(a) Designate and make available on an appropriate and timely basis the land and rights related thereto required to carry out the Phase I studies; and

(b) Provide all necessary logistic support including sociologist and suitable counterpart personnel to carry out the Phase I activities on a timely and efficient basis.

ARTICLE 6 : Foreign Exchange Costs

Except as A.I.D. may otherwise agree to in writing, disbursements pursuant to Section 7.1 will be used exclusively to finance the costs of goods and services required for the Project having their source and origin in the United States (Code 000 of the A.I.D. Geographic Code Book as in effect at the time orders are placed or contracts entered into for such goods or services) ("Foreign Exchange Costs"). With respect to marine insurance, Section C.1(b) of Annex 2, Project Grant Standard Provisions, will apply.

ARTICLE 7 : Disbursement

Section 7.1 - Disbursement for Foreign Exchange Costs

A. After satisfaction of conditions precedent stipulated in Section 4.1, the Grantee may obtain disbursements of funds under the Grant for the Foreign Exchange Costs of goods or services required for the Project in accordance with the terms of this Agreement, by such of the following methods as may be mutually agreed upon:

1. By submitting to A.I.D., with necessary supporting documentation as prescribed in Project Implementations Letters, (a) requests for

reimbursement for such goods or services or (b) requests for A.I.D. to procure commodities or services on Grantee's behalf for the Project; or,

2. By requesting A.I.D. to issue Letters of Commitment for specific amounts (a) to one or more U.S. banks, satisfactory to A.I.D., committing A.I.D. to reimburse such bank or banks for payments made by them to contractors or suppliers, under letters of credit or otherwise, for such goods or services, or (b) directly to one or more contractors or suppliers committing A.I.D. to pay such contractors or suppliers for such goods or services.

B. Banking charges incurred by the Grantee in connection with letters of commitment and letters of credit will befinanced under the Grant unless the Grantee instructs A.I.D. to the contrary. Such other charges as the Parties may agree to may also be financed under the Grant.

Section 7.2 - Other Forms of Disbursement

Disbursements of the Grant may also be made through such other means as the parties may agree to in writing.

Section 7.3 - Date of Disbursement

Disbursements of the Grant by A.I.D. will be deemed to occur on the date on which A.I.D. makes a disbursement to the Grantee or to its designee or to a bank, contractor or supplier pursuant to a Letter of Commitment, contract or purchase order.

ARTICLE 8 : Miscellaneous

Section 8.1 - Communications

Any notice, request, document or other communication submitted by either Party to the other under this Agreement will be in writing or by telegram or cable, normally in the French language, and will be deemed duly given or sent when delivered to such Party at the following addresses:

To the Grantee:

Mail address:

Ministere de l'Energies et des Mines
Direction de l'Energie
Projet Developpement des Energies Renouvelables
Rabat, Maroc

To A.I.D.:

Mail address: United States A.I.D. Mission to Morocco
137, Avenue Allal Ben Abdallah
Rabat, Maroc

Other addresses may be substituted for the above upon the giving of notice.

Section 8.2 - Representatives

For all purposes relevant to this Agreement, the Grantee will be represented by the individual holding or acting in the office of Minister of Energy and Mines, and A.I.D. will be represented by the individual holding or acting in the office of Mission Director, each of whom, by written notice, may designate additional representatives for all purposes other than exercising the power under Section 2.1 to revise elements of the amplified description in Annex 1. The names of the representatives of the Grantee, with specimen signatures, will be provided to A.I.D., which may accept as duly authorized any instrument signed by such representatives in implementation of this Agreement, until receipt of written notice of revocation of their authority.

Section 8.3 - Standard Provisions Annex

A "Project Grant Standard Provisions Annex" (Annex 2) is attached to and forms part of this Agreement.

Section 8.4 - Language of Agreement

This Agreement is prepared in both the English and French Languages. In the event of ambiguity or conflict between the two versions, the English version will control.

IN WITNESS WHEREOF, the Kingdom of Morocco and the United States of America, each acting through its duly authorized representatives, have caused this Agreement to be signed in their names and delivered on the day and year first above written.

UNITED STATES OF AMERICA	KINGDOM OF MOROCCO
By : _____	By : _____
TITLE : _____	TITLE : _____

36a X

AMPLIFIED PROJECT DESCRIPTION

A. PROGRAM GOALS

The goals of the two-phased activity are to:

1. Develop a Moroccan capability to manage and coordinate applied research of the use of renewable energy for the economic and social development of Morocco;

2. Adapt renewable energy technology to Moroccan needs and circumstances;

3. Create a quality assurance program which will permit Morocco to judge the performance of technologies against standards;

4. Develop a capability in the integration of renewable energy forms into national energy policy and planning; and

5. Train a cadre of engineers, scientists and managers in the application of renewable energy technologies at demonstration sites and eventually on a national scale.

To help achieve these goals, A.I.D. will assist the Grantee to establish a Renewable Energy Development Center, and to carry out demonstration pilot projects.

B. PROJECT IMPLEMENTATION

1. Summary

An evolutionary program for research and application of renewable energy is visualized starting with the creation of a Center for the Development of Renewable Energy. Through the center, the Moroccan Government will be able to plan for the systematic introduction of new energy sources to relieve its reliance on imported fossil fuels, and to develop renewable energy

alternatives not now available for application to the economic and social development of Morocco, in particular in rural areas. The Center will initiate and coordinate the activity of several research groups as well as conduct specialized training for its staff and several demonstration projects having long-term national significance for the development of the country. During Phase I a group of Moroccans will start their training to provide immediate staff support to the Ministry of Energy and Mines, responsible for creating the Center. Feasibility and preliminary design studies will be conducted for the Center at Marrakech (laboratory facilities etc.), three small hydroelectric facilities, and small wind and solar-powered irrigation pumping stations. Short term consultants will be brought to Morocco for various activities. Contracting for long-term Phase II services will begin.

C. IMPLEMENTATION SCHEDULE

During early 1980, short-term training for five Moroccan professionals in the United States and feasibility and preliminary design studies for the Center facilities, small hydro plants, and wind and sun-powered irrigation pumping stations will be carried out. Short-term consultants will assist the Ministry of Energy and Mines to execute Phase I. Contracting for Phase II services will begin in the first half of 1980. In the second half of 1980, final designs, equipment specifications, and bidding documents for construction and equipment should be prepared and issued. Construction of facilities and erection of equipment should begin in 1981.

Long-term training planned for Phase II will be prepared during the first quarter of 1980; applied research will start in 1980 and continue through out Phase II; technical assistance will be provided during Phases I and II; so that institution-building and organization will go forward concurrently with the construction of facilities and demonstration projects. Details will be amplified by implementation letters to be issued by USAID/Rabat.

D. FINANCIAL PLAN FOR PHASE I

The financing of Phase I is estimated as follows:

Training	$50,000
Studies	320,000
Advisors	150,000
Price Contingency	35,000
Contingency for unforseen events	45,000
	$600,000

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ATTACHMENT 3B. HONDURAS ECONOMIC DEVELOPMENT DATA

ANNEX 1
Page [illegible]

	Estimate 1967	1972	1976	1977	1978	Projected 1/ 1979	1980	1981	1982	1983	1984	Annual Growth Rate 1972-77	1977-81	1981-84	Percent of GNP 1977	1984
A. NATIONAL ACCOUNTS (IN MILLIONS, 1960 PESOS)																
1. GROSS DOMESTIC PRODUCT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2. TERMS OF TRADE ADJUSTMENT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3. GROSS DOMESTIC INCOME	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4. IMPORTS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5. EXPORTS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6. EXPORTS, TT ADJUSTMENT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7. RESOURCE BAL. TT ADJUSTMENT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8. TOTAL CONSUMPTION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9. PRIVATE CONSUMPTION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10. GOVERNMENT CONSUMPTION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11. GROSS FIXED INVESTMENT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12. CHANGE IN STOCKS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13. DOMESTIC SAVINGS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14. NATIONAL SAVINGS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15. GROSS DOMESTIC PRODUCT (IN MILLION CURRENT PESOS)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16. GROSS NATIONAL PRODUCT (IN MILLION CURRENT PESOS)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B. SECTOR OUTPUT	(Percent of GNP at Current Prices)															
1. AGRICULTURE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2. MINING	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3. MANUFACTURING, CONSTR.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4. OTHER SERVICES	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C. PRICES																
1. EXPORT PRICE INDEX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2. IMPORT PRICE INDEX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3. TERMS OF TRADE INDEX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4. GROSS DOMESTIC PROD. PER OCCUPATION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5. EXCHANGE RATE(IN PER $)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D. SELECTED INDICATORS	1967 TT	1972 TT	1977 TT	1981 TT												
1. ICOR	[illegible]	[illegible]	[illegible]	[illegible]												
2. IMPORT ELASTICITY/GDP	[illegible]	[illegible]	[illegible]	[illegible]												
3. AVERAGE NATIONAL SAVING RATE	[illegible]	[illegible]	[illegible]	[illegible]												
4. MARGINAL NATIONAL SAVING RATE	[illegible]	[illegible]	[illegible]	[illegible]												
5. INFRASTRUCTURE	[illegible]	[illegible]	[illegible]	[illegible]												
6. INVESTMENT/GDP	[illegible]	[illegible]	[illegible]	[illegible]												
7. RESOURCE GAP/GDP	[illegible]	[illegible]	[illegible]	[illegible]												
E. LABOR FORCE 1/	1970 TT	1972 TT	Annual Rate													
1. AGRICULTURE	[illegible]	[illegible]	[illegible]													
2. INDUSTRY	[illegible]	[illegible]	[illegible]													
3. SERVICES	[illegible]	[illegible]	[illegible]													
4. GOVERNMENT	[illegible]	[illegible]	[illegible]													
5. TOTAL EMPLOYMENT	[illegible]	[illegible]	[illegible]													
6. TOTAL LABOR FORCE	[illegible]	[illegible]	[illegible]													
7. UNEMPLOYED, UNDEREMPLOYED 1/	[illegible]	[illegible]	[illegible]													
F. CENTRAL GOVERNMENT FINANCES	1967	1972	1976	1977	Projection 2/											
1. CURRENT REVENUES	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]											
IDCA PROFIT TRANSFERS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]											
2. CURRENT EXPENDITURES 1/	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]											
3. CURRENT SURPLUS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]											
4. INVESTMENT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]											
5. FISCAL INTERFERENCE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]											

1/ [illegible]
2/ Including balance and capital transfers
3/ [illegible] and data provided by Planning Secretariat for 1977
4/ [illegible]
5/ [illegible]

March 30, 1979
[illegible]

TABLE 1A
MOROCCO - SOCIAL INDICATORS DATA SHEET

	MOROCCO			REFERENCE GROUPS (ADJUSTED AVERAGES) 1/ - MOST RECENT ESTIMATE -		
LAND AREA (THOUSAND SQ. KM.) TOTAL 459.0 1/; AGRICULTURAL 137.8	1960 2/	1970 2/	MOST RECENT ESTIMATE 3/	SAME GEOGRAPHIC REGION 4/	SAME INCOME GROUP 5/	WEST NORTHERN INCOME GROUP 6/
GNP PER CAPITA (US$)	290.0	290.0	370.0	1438.3	[illegible]	867.2
ENERGY CONSUMPTION PER CAPITA (KILOGRAMS OF COAL EQUIVALENT)	168.0	180.0	274.0	816.7	251.7	379.3
POPULATION AND VITAL STATISTICS						
TOTAL POPULATION, MID-YEAR (MILLIONS)	11.6	16.8	17.7	.	.	.
URBAN POPULATION (PERCENT OF TOTAL)	29.3	32.2	39.5	43.8	36.2	46.2
POPULATION DENSITY						
PER SQ. KM.	26.0	33.0	39.0 7/	33.2	42.7	50.8
PER SQ. KM. AGRICULTURAL LAND	81.0	74.0	112.0	112.4	93.0	93.3
POPULATION AGE STRUCTURE (PERCENT)						
0-14 YRS.	44.3	46.4	45.8	44.0	44.9	42.9
15-64 YRS.	51.7	51.1	51.6	50.6	52.8	53.3
65 YRS. AND ABOVE	4.0	2.5	2.6	3.3	3.0	3.3
POPULATION GROWTH RATE (PERCENT)						
TOTAL	2.6	2.4	2.4	2.9	2.7	2.3
URBAN	6.6	4.0	4.8	5.0	8.8	4.7
CRUDE BIRTH RATE (PER THOUSAND)	50.4	49.2	44.5	43.0	42.2	37.8
CRUDE DEATH RATE (PER THOUSAND)	24.2	18.5	13.4	13.7	12.4	10.8
GROSS REPRODUCTION RATE	3.4 8/	3.4	3.3	3.4	3.2	2.5
FAMILY PLANNING						
ACCEPTORS, ANNUAL (THOUSANDS)	..	23.1	68.0	.	.	.
USERS (PERCENT OF MARRIED WOMEN)	..	3.0	5.4	14.7	14.2	20.3
FOOD AND NUTRITION						
INDEX OF FOOD PRODUCTION PER CAPITA (1969-1001)	118.7	100.0	86.0	107.1	106.3	107.3
PER CAPITA SUPPLY OF CALORIES (PERCENT OF REQUIREMENTS)	90.0	102.0	108.0	99.2	99.5	105.3
PROTEINS (GRAMS PER DAY)	43.0	64.0	70.3	63.6	56.8	63.0
OF WHICH ANIMAL AND PULSE	..	14.0 9/	13.6	16.4	17.5	21.7
CHILD AGES 1-4 MORTALITY RATE	..	..	..	..	7.5	6.0
HEALTH						
LIFE EXPECTANCY AT BIRTH (YEARS)	45.4	50.4	53.0	53.7	53.3	57.2
INFANT MORTALITY RATE (PER THOUSAND)	149.0 10/	..	138.0	77.7	82.5	53.9
ACCESS TO SAFE WATER (PERCENT OF POPULATION)						
TOTAL	..	31.0	..	39.1	31.1	56.8
URBAN	..	92.0	..	83.9	68.5	79.0
RURAL	..	28.0	..	38.0	28.2	31.8
ACCESS TO EXCRETA DISPOSAL (PERCENT OF POPULATION)						
TOTAL	..	29.0	..	44.3	37.5	30.9
URBAN	..	73.0	..	94.3	69.3	43.4
RURAL	..	4.0	..	27.7	25.4	[illegible]
POPULATION PER PHYSICIAN	9700.0 11/	12830.0	12600.0	4271.6	9339.2	2706.8
POPULATION PER NURSING PERSON	..	2820.0	1300.0	2077.4	2762.5	1462.0
POPULATION PER HOSPITAL BED						
TOTAL	680.0	660.0	710.0	580.2	786.3	493.9
URBAN	..	460.0	..	310.0	278.4	329.4
RURAL	..	2980.0	..	..	1358.4	2947.9
ADMISSIONS PER HOSPITAL BED	..	13.5	16.5	22.0	19.2	22.1
HOUSING						
AVERAGE SIZE OF HOUSEHOLD						
TOTAL	4.8	5.3	..	5.4	..	5.2
URBAN	4.3	4.9	..	..	..	5.0
RURAL	5.1	5.8	..	..	..	5.4
AVERAGE NUMBER OF PERSONS PER ROOM						
TOTAL	2.2	2.4	..	..	..	2.0
URBAN	2.1	2.1	..	1.8	2.3	1.5
RURAL	2.3	2.6	..	..	..	2.7
ACCESS TO ELECTRICITY (PERCENT OF DWELLINGS)						
TOTAL	18.0 12/	..	..	60.3	29.3	54.1
URBAN	85.0 12/	58.0	55.0	..	..	87.8
RURAL	11.0 12/	..	.	12.2	10.3	36.2

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TABLE 3A
MOROCCO - SOCIAL INDICATORS DATA SHEET

	MOROCCO			REFERENCE GROUPS (ADJUSTED AVERAGES /a - MOST RECENT ESTIMATE)		
	1960 /b	1970 /b	MOST RECENT ESTIMATE /b	SAME GEOGRAPHIC REGION /c	SAME INCOME GROUP /d	NEXT HIGHER INCOME GROUP /e
EDUCATION						
ADJUSTED ENROLLMENT RATIOS						
PRIMARY: TOTAL	47.0	52.0	65.0	80.5	75.7	99.8
FEMALE	27.0	37.0	47.0	61.8	67.9	93.3
SECONDARY: TOTAL	5.0	13.0	17.0	23.6	17.7	33.8
FEMALE	2.0	7.0	12.3	18.2	12.9	29.8
VOCATIONAL (PERCENT OF SECONDARY)	..	2.0	3.0	6.7	7.4	12.8
PUPIL-TEACHER RATIO						
PRIMARY	43.0	34.0	40.0	31.5	34.3	34.9
SECONDARY	..	20.0	22.0	22.3	23.5	22.2
ADULT LITERACY RATE (PERCENT)	17.0	21.0	28.0	50.1	63.7	71.8
CONSUMPTION						
PASSENGER CARS PER THOUSAND POPULATION	11.0	15.0	18.0	14.5	7.2	12.4
RADIO RECEIVERS PER THOUSAND POPULATION	46.0	60.0	77.0	125.8	71.1	104.5
TV RECEIVERS PER THOUSAND POPULATION	0.4	11.0	23.0	34.5	14.1	28.1
NEWSPAPER ("DAILY GENERAL INTEREST") CIRCULATION PER THOUSAND POPULATION	27.0	16.0	14.0	17.4	16.3	45.2
CINEMA ANNUAL ATTENDANCE PER CAPITA	2.0	..	1.6	1.6	1.6	4.6
EMPLOYMENT						
TOTAL LABOR FORCE (THOUSANDS)	3250.0	3980.0	4930.0	.	.	.
FEMALE (PERCENT)	10.6	15.2	19.0	9.3	28.0	25.7
AGRICULTURE (PERCENT)	56.4	48.9	42.5	42.0	54.1	46.2
INDUSTRY (PERCENT)	11.3	14.9	18.1	..	..	..
PARTICIPATION RATE (PERCENT)						
TOTAL	28.0	26.3	27.0	26.9	37.8	33.8
MALE	50.1	44.5	44.6	46.6	50.3	48.1
FEMALE	5.9	8.0	10.3	5.3	20.9	17.3
ECONOMIC DEPENDENCY RATIO	2.0	1.9	1.8	1.9	1.3	1.4
INCOME DISTRIBUTION						
PERCENT OF PRIVATE INCOME RECEIVED BY						
HIGHEST 5 PERCENT OF HOUSEHOLDS	18.0 /k	20.0 /k	..	..	19.5	23.6
HIGHEST 10 PERCENT OF HOUSEHOLDS	43.3 /k	49.0 /k	..	..	48.9	52.3
LOWEST 20 PERCENT OF HOUSEHOLDS	7.0 /k	4.0 /k	..	..	5.9	4.3
LOWEST 40 PERCENT OF HOUSEHOLDS	18.0 /k	12.0 /k	..	..	15.7	13.1
POVERTY TARGET GROUPS						
ESTIMATED ABSOLUTE POVERTY INCOME LEVEL (US$ PER CAPITA)						
URBAN	107.0	157.0	288.0	..	155.9	191.9
RURAL	66.0	101.0	174.0	142.0	97.9	193.1
ESTIMATED RELATIVE POVERTY INCOME LEVEL (US$ PER CAPITA)						
URBAN	..	..	189.0	236.1	143.7	319.8
RURAL	..	..	..	144.7	87.3	197.7
ESTIMATED POPULATION BELOW POVERTY INCOME LEVEL (PERCENT)						
URBAN	59.0	39.0	34.0	21.5	22.9	19.8
RURAL	49.0	43.0	45.0	37.4	36.7	35.1

.. Not available
. Not applicable.

NOTES

/a The adjusted group averages for each indicator are population-weighted geometric means, excluding the extreme values of the indicator and the most populated country in each group. Coverage of countries among the indicators depends on availability of data and is not uniform.

/b Unless otherwise noted, data for 1960 refer to any year between 1959 and 1961; for 1970, between 1969 and 1971; and for Most Recent Estimate, between 1973 and 1977.

/c North Africa & Middle East; /d Lower Middle Income ($251-550 per capita, 1976); /e Intermediate Middle Income ($551-1135 per capita, 1976); /f Including Moroccan provinces in Western Sahara; /g Excludes Moroccan provinces in W. Sahara; /h 1962; /i Av. 1964-66; /j Brick building only; /k Consumption expenditures of households.

September, 1978

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DEFINITIONS OF SOCIAL INDICATORS

Note: The adjusted group averages for each indicator are population-weighted geometric means, excluding the extreme values of the indicator and the most populated country in each group. Coverage of countries among the indicators depends on availability of data and is not uniform. Due to lack of data, group averages for Capital Surplus Oil Exporters and indicators of access to water and excreta disposal, housing, income distribution and poverty are simple population-weighted geometric means without the exclusion of extreme values.

LAND AREA (thousand sq. km)
- Total - Total surface area comprising land area and inland waters.
- Agricultural - Most recent estimate of agricultural area used temporarily or permanently for crops, pastures, market and kitchen gardens or to lie fallow.

GNP PER CAPITA (US$) - GNP per capita estimates at current market prices, calculated by same conversion method as World Bank Atlas (1975-77 basis); 1960, 1970, and 1977 data.

ENERGY CONSUMPTION PER CAPITA - Annual consumption of commercial energy (coal and lignite, petroleum, natural gas and hydro-, nuclear and geothermal electricity) in kilograms of coal equivalent per capita.

POPULATION AND VITAL STATISTICS
- Total population, mid-year (millions) - As of July 1; if not available, average of two end-year estimates; 1960, 1970, and 1977 data.
- Urban population (percent of total) - Ratio of urban to total population; different definitions of urban areas may affect comparability of data among countries.
- Population density
  - Per sq. km. - Mid-year population per square kilometer (100 hectares) of total area.
  - Per sq. km. agriculture land - Computed as above for agricultural land only.
- Population age structure (percent) - Children (0-14 years), working-age (15-64 years), and retired (65 years and over) as percentages of mid-year population.
- Population growth rate (percent) - total, and urban - Compound annual growth rates of total and urban mid-year populations for 1950-60, 1960-70, and 1970-75.
- Crude birth rate (per thousand) - Annual live births per thousand of mid-year population; ten-year arithmetic averages ending in 1960 and 1970 and five-year average ending in 1975 for most recent estimate.
- Crude death rate (per thousand) - Annual deaths per thousand of mid-year population; ten-year arithmetic averages ending in 1960 and 1970 and five-year average ending in 1975 for most recent estimate.
- Gross reproduction rate - Average number of daughters a woman will bear in her normal reproductive period if she experiences present age-specific fertility rates; usually five-year averages ending in 1960, 1970, and 1975.
- Family planning - acceptors, annual (thousands) - Annual number of acceptors of birth-control devices under auspices of national family planning program.
- Family planning - users (percent of married women) - Percentage of married women of child-bearing age (15-44 years) who use birth-control devices to all married women in same age group.

FOOD AND NUTRITION
- Index of food production per capita (1970=100) - Index number of per capita annual production of all food commodities.
- Per capita supply of calories (percent of requirements) - Computed from energy equivalent of net food supplies available in country per capita per day. Available supplies comprise domestic production, imports less exports, and changes in stock. Net supplies exclude animal feed, seeds, quantities used in food processing, and losses in distribution. Requirements were estimated by FAO based on physiological needs for normal activity and health considering environmental temperature, body weights, age and sex distributions of population, and allowing 10 percent for waste at household level.
- Per capita supply of protein (grams per day) - Protein content of per capita net supply of food per day. Net supply of food is defined as above. Requirements for all countries established by USDA provide for a minimum allowance of 60 grams of total protein per day and 20 grams of animal and pulse protein, of which 10 grams should be animal protein. These standards are lower than those of 75 grams of total protein and 23 grams of animal protein as an average for the world, proposed by FAO in the Third World Food Survey.
- Per capita protein supply from animal and pulse - Protein supply of food derived from animals and pulses in grams per day.
- Child (ages 1-4) mortality rate (per thousand) - Annual deaths per thousand in age group 1-4 years, to children in this age group.

HEALTH
- Life expectancy at birth (years) - Average number of years of life remaining at birth; usually five-year averages ending in 1960, 1970, and 1975.
- Infant mortality rate (per thousand) - Annual deaths of infants under one year of age per thousand live births.
- Access to safe water (percent of population) - total, urban, and rural - Number of people (total, urban, and rural) with reasonable access to safe water supply (includes treated surface waters or untreated but uncontaminated water such as that from protected boreholes, springs, and sanitary wells) as percentages of their respective populations. In an urban area a public fountain or standpost located not more than 200 meters from a house may be considered as being within reasonable access of that house. In rural areas reasonable access would imply that the housewife or members of the household do not have to spend a disproportionate part of the day in fetching the family's water needs.
- Access to excreta disposal (percent of population) - total, urban, and rural - Number of people (total, urban, and rural) served by excreta disposal as percentages of their respective populations. Excreta disposal may include the collection and disposal, with or without treatment, of human excreta and waste-water by water-borne systems or the use of pit privies and similar installations.
- Population per physician - Population divided by number of practicing physicians qualified from a medical school at university level.
- Population per nursing person - Population divided by number of practicing male and female graduate nurses, practical nurses, and assistant nurses.
- Population per hospital bed - total, urban, and rural - Population (total, urban, and rural) divided by their respective number of hospital beds available in public and private general and specialized hospitals and rehabilitation centers. Hospitals are establishments permanently staffed by at least one physician. Establishments providing principally custodial care are not included. Rural hospitals, however, include health and medical centers not permanently staffed by a physician (but by a medical assistant, nurse, midwife, etc.) which offer in-patient accommodation and provide a limited range of medical facilities.
- Admissions per hospital bed - Total number of admissions to or discharges from hospitals divided by the number of beds.

HOUSING
- Average size of household (persons per household) - total, urban, and rural - A household consists of a group of individuals who share living quarters and their main meals. A boarder or lodger may or may not be included in the household for statistical purposes. Statistical definitions of household vary.
- Average number of persons per room - total, urban, and rural - Average number of persons per room in all, urban, and rural occupied conventional dwellings, respectively. Dwellings exclude non-permanent structures and unoccupied parts.
- Access to electricity (percent of dwellings) - total, urban, and rural - Conventional dwellings with electricity in living quarters as percentage of total, urban, and rural dwellings respectively.

EDUCATION
- Adjusted enrollment ratios
  - Primary school - total, and female - Total and female enrollment of all ages at the primary level as percentages of respectively primary school-age populations; normally includes children aged 6-11 years but adjusted for different lengths of primary education; for countries with universal education enrollment may exceed 100 percent since some pupils are below or above the official school age.
  - Secondary school - total, and female - Computed as above; secondary education requires at least four years of approved primary instruction; provides general vocational, or teacher training instructions for pupils usually of 12 to 17 years of age; correspondence courses are generally excluded.
- Vocational enrollment (percent of secondary) - Vocational institutions include technical, industrial, or other programs which operate independently or as departments of secondary institutions.
- Pupil-teacher ratio - primary, and secondary - Total students enrolled in primary and secondary levels divided by numbers of teachers in the corresponding levels.
- Adult literacy rate (percent) - Literate adults (able to read and write) as a percentage of total adult population aged 15 years and over.

CONSUMPTION
- Passenger cars (per thousand population) - Passenger cars comprise motor cars seating less than eight persons; excludes ambulances, hearses and military vehicles.
- Radio receivers (per thousand population) - All types of receivers for radio broadcasts to general public per thousand of population; excludes unlicensed receivers in countries and in years when registration of radio sets was in effect; data for recent years may not be comparable since most countries abolished licensing.
- TV receivers (per thousand population) - TV receivers for broadcast to general public per thousand population; excludes unlicensed TV receivers in countries and in years when registration of TV sets was in effect.
- Newspaper circulation (per thousand population) - Shows the average circulation of "daily general interest newspaper," defined as a periodical publication devoted primarily to recording general news. It is considered to be "daily" if it appears at least four times a week.
- Cinema annual attendance per capita per year - Based on the number of tickets sold during the year, including admissions to drive-in cinemas and mobile units.

EMPLOYMENT
- Total labor force (thousands) - Economically active persons, including armed forces and unemployed but excluding housewives, students, etc. Definitions in various countries are not comparable.
- Female (percent) - Female labor force as percentage of total labor force.
- Agriculture (percent) - Labor force in farming, forestry, hunting and fishing as percentage of total labor force.
- Industry (percent) - Labor force in mining, construction, manufacturing and electricity, water and gas as percentage of total labor force.
- Participation rate (percent) - total, male, and female - Total, male, and female labor force as percentages of their respective populations. These are ILO's adjusted participation rates reflecting age-sex structure of the population, and long time trend.
- Economic dependency ratio - Ratio of population under 15 and 65 and over to the labor force in age group of 15-64 years.

INCOME DISTRIBUTION
- Percentage of private income (both in cash and kind) received by richest 5 percent, richest 20 percent, poorest 20 percent, and poorest 40 percent of households.

POVERTY TARGET GROUPS
- Estimated absolute poverty income level (US$ per capita) - urban and rural - Absolute poverty income level is that income level below which a minimal nutritionally adequate diet plus essential non-food requirements is not affordable.
- Estimated relative poverty income level (US$ per capita) - urban and rural - Relative poverty income level is that income level less than one-third per capita personal income of the country.
- Estimated population below poverty income level (percent) - urban and rural - Percent of population (urban and rural) who are either "absolute poor" or "relative poor" whichever is greater.

Economic and Social Data Division
Economic Analysis and Projections Department

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ANNEX F
Page 5 of 6

ATTACHMENT 4A. BALANCE OF PAYMENTS AND EXTERNAL ASSISTANCE
(MILLIONS OF US DOLLARS) (CURRENT MARKET PRICES)

	Actuals					Projected 1/						
	1967	1972	1973	1977	1978	1979	1980	1981	1982	1983	1984	1985
A. SUMMARY OF BALANCE OF PAYMENTS	.	.	.	.	.	.	.	.	.	.	.	.
1. EXPORTS, FOB	555.3	969.3	1717.3	1866.3	2265.3	2783.3	3310.3	3926.3	4542.3	5337.3	6130.3	6950.3
2. IMPORTS, FOB	623.3	976.3	3519.3	4126.3	3959.3	3634.3	4045.3	4524.3	5125.3	5863.3	6613.3	7400.3
3. RESOURCE BALANCE	-68.3	-27.3	-1802.3	-2259.3	-1714.3	-849.3	-735.3	-598.3	-583.3	-526.3	-483.3	-453.3
4. NET FACTOR SERVICES	-17.3	37.3	378.3	379.3	416.3	367.0	355.3	371.3	416.3	457.3	500.3	531.3
4.1. NET INTEREST PAYMENTS	-17.3	-29.3	-57.3	-129.3	-187.3	-236.3	-299.3	-319.3	-325.3	-326.3	-447.3	-722.3
4.2. NET INVESTMENT INCOME	-2.3	-28.3	-4.3	-19.3	-34.3	-48.3	-119.3	-125.3	-132.3	-154.3	-175.3	-192.3
4.3. WORKERS REMITTANCES	41.0	139.3	367.3	509.3	741.3	751.3	844.3	866.3	921.3	989.3	1013.3	1053.3
4.4. OTHER (NET)	52.3	16.3	73.3	52.3	46.3	56.3	58.3	59.3	56.3	53.3	53.3	53.3
5. CURRENT TRANSFERS(NET)	13.0	42.3	69.4	52.3	48.3	48.3	52.3	55.3	58.3	63.3	63.3	116.3
6. CURRENT ACCOUNT BALANCE	-92.3	55.3	-1355.3	-1827.3	-1259.3	-1436.3	-1322.3	-1152.3	-1041.3	-1026.3	-1136.3	-1009.3
7. PRIVATE DIRECT INVESTMENT (NET)	9.3	26.3	38.4	53.3	53.3	76.3	77.0	85.3	93.3	102.3	153.3	241.3
8. PUBLIC M.L.T. LOANS	.	.	.	.	.	.	.	.	.	.	.	.
8.1. DISBURSEMENTS	88.3	111.3	734.3	1273.3	792.3	823.3	866.3	933.3	962.3	1049.3	[illegible]	[illegible]
8.2. REPAYMENTS	29.3	78.3	68.3	185.3	296.3	426.3	452.3	489.3	493.3	456.3	[illegible]	[illegible]
8.3. NET DISBURSEMENTS	59.3	33.3	666.3	1108.3	496.3	397.3	414.3	444.3	49.3	233.3	[illegible]	385.3
9. SHORT TERM CAPITAL (NET)	-18.3	-32.3	29.3	68.3	-5.3	.	.	.	.	.	.	.
10. NET USE OF IMF RESOURCES	0	12.3	195.3	.	36.3	78.3	8.3	91.3	14.3	11.3	.	.
11. CAPITAL N.E.I. 2/	32.3	95.3	559.3	579.3	438.3	.	.	.	.	.	.	.
12. CHANGE IN RESERVES	-19.3	-79.3	-116.3	-41.3	34.3	37.3	-41.3	16.3	49.3	-298.3	-268.3	342.3
13. LEVEL OF RESERVES	.	.	.	.	.	.	.	.	.	.	.	.
13.1. GROSS	21.3	237.3	491.3	532.3	569.3	463.3	526.3	510.3	599.3	897.3	1876.3	1583.3
13.2. MONTHS IMPORTS	0.9	2.9	2.3	1.3	1.5	1.5	1.6	1.5	1.5	1.8	1.9	2.3
14. GRANT & LOAN COMMITMENTS	.	.	.	.	.	.	.	.	.	.	.	.
15. OFFICIAL GRANTS	25.3	17.3	15.3	18.3	.	.	.	.	.	.	.	.
16. TOTAL PUBLIC M.L.T. LOANS	88.3	179.3	969.3	1938.3	1366.3	.	.	.	.	.	.	.
16.1. IBRD/IDA	8.3	97.3	158.3	166.3	133.3	.	.	.	.	.	.	.
16.2. OTHER MULTL INSTITUTIONS	0	3	4.3	19.3	17.3	.	.	.	.	.	.	.
16.3. GOVERNMENTS	80.3	63.3	144.3	653.3	220.3	.	.	.	.	.	.	.
16.4. SUPPLIERS CREDITS	0	16.3	8.3	163.3	9.3	.	.	.	.	.	.	.
16.5. COMMERCIAL BANKS	0	3.3	463.3	936.3	965.3	.	.	.	.	.	.	.
17. MEMO ITEMS	.	.	.	.	.	.	.	.	.	.	.	.
1. GRANT ELEMENT(%)	.	30.3	13.9	11.2	6.9	.	.	.	.	.	.	.
2. AVERAGE INTEREST(%)	.	9.3	7.2	7.5	7.5	.	.	.	.	.	.	.
3. AVERAGE MATURITY(YEARS)	.	22.3	11.7	18.1	7.5	.	.	.	.	.	.	.

1/ Including special military import programs which are tentatively estimated by the mission at $390 million in 1976 and $530 million in 1977.

March 30, 1979
USAID CP 11c

2/ Including grants.

3/ Projections are being revised by the Basic Economic Mission.

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ATTACHMENT 4B. EXTERNAL DEBT CREDITWORTHINESS

	Actuals					Projected 1/						
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
A. MEDIUM & LONG TERM DEBT (MILLIONS OF US DOLLARS)	•	•	•	•	•	•	•	•	•	•	•	•
1. TOTAL DOD AT YEAR'S END	•	919.3	2282.3	3869.3	5967.3	6897.3	5171.3	5316.3	5363.3	5546.3	6896.3	11296.3
2. INCLUDING UNDISBURSED	•	1187.3	3211.8	5676.3	6125.3	7466.3	7530.3	7525.3	[illegible]	7394.3	9386.3	9745.3
3. DEBT SERVICE	46.8	101.3	146.3	234.8	481.3	642.3	942.3	1150.3	1216.3	1.01.3	1392.3	2976.3
3.1. OF WHICH INTEREST	17.8	34.8	57.8	129.8	187.3	236.3	290.3	319.3	325.3	324.3	447.3	722.3
B. DEBT BURDEN	•	•	•	•	•	•	•	•	•	•	•	•
1. DEBT SERVICE/EXPORTS OF G & NFS	8.3	10.7	8.1	12.5	21.4	26.2	28.7	28.7	27.3	22.6	15.8	15.5
2. DEBT SERVICE/EXPORTS & WORKERS REMIT	7.7	9..	8.1	9.5	16.3	19.7	23.8	24.2	22.1	18.7	13.1	13.4
3. DEBT SERVICE/GDP	1.5	2.1	1.5	2.2	3.8	5.8	6.3	6.8	6.7	5.8	4.2	6.8
C. TERMS	•	•	•	•	•	•	•	•	•	•	•	•
1. INTEREST/PRIVATE TERM DOD	•	3.9	2.8	5.6	5.3	5.9	5.9	6.3	6.4	6.2	5.6	7.8
2. DEBT SERVICE/PRIVATE TERM DOD	•	11.6	8.1	10.2	13.6	16.6	18.6	21.2	23.1	21.6	15.7	25.3
D. DEPENDENCY RATIOS	•	•	•	•	•	•	•	•	•	•	•	•
1. GROSS DISBURSEMENTS/IMPORTS	18.1	12.8	28.8	38.8	28.8	22.7	23.9	20.7	18.5	18.5	21.2	8.6
2. NET DISBURSEMENTS/IMPORTS	6.7	2.2	18.8	28.3	12.5	6.2	3.3	-0.3	-5.8	-2.3	0.3	-0.8
3. NET DISB./GROSS DISB	47.7	17.9	68.5	91.7	62.8	18.6	1.2	-28.8	-31.8	-18.7	39.2	-18.9
E. EXPOSURE RATIOS	•	•	•	•	•	•	•	•	•	•	•	•
1. BANK DISB./TOTAL DISB.	•	21.8	8.7	5.6	11.1	•	•	•	•	•	•	•
2. BANK GROUP DOD/TOTAL DOD	•	18.9	12.6	16.8	11.2	•	•	•	•	•	•	•
3. BANK GROUP DEBT SER./TOTAL DEBT SER.	•	18.5	25.8	17.9	9.5	•	•	•	•	•	•	•
F. EXTERNAL DEBT(DISBURSED ONLY) (MILLIONS OF US $)	•	•	•	•	•	•	•	•	•	•	•	•
			Outstanding Dec 31,77									
1. IBRD	•	•	816.3	14.3	•	•	•	•	•	•	•	•
2. IDA	•	•	30.8	1.3	•	•	•	•	•	•	•	•
3. OTHER INTL ORGAN.	•	•	67.8	1.2	•	•	•	•	•	•	•	•
4. GOVERNMENTS	•	•	1190.3	38.3	•	•	•	•	•	•	•	•
5. SUPPLIER CREDITS	•	•	376.8	9.5	•	•	•	•	•	•	•	•
6. FINANCIAL INSTITUTIONS	•	•	1888.3	47.6	•	•	•	•	•	•	•	•
7. OTHER	•	•	17.8	1.4	•	•	•	•	•	•	•	•
8. TOTAL OUTSTANDING - DISBURSED	•	•	3967.3	100.8	•	•	•	•	•	•	•	•
9. TOTAL OUTSTANDING	•	•	6125.3	154.6	•	•	•	•	•	•	•	•
G. DEBT PROFILE	•	•	•	•	•	•	•	•	•	•	•	•
1. Total debt service 1978/82/Total DOD and 1977 = 1.14												

1/ Projections are being revised by the Bank Economic Mission.

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Enclosure
Rabat A- 55

Retail Prices, Duty and Taxes on Petroleum Products as of July 1, 1979

Post Location	Exchange Rate	Petroleum Products	Retail Prices	Includes	
				Duty	Taxes
Morocco	US$1 = DH 3.90	Motor Gasoline			
		Regular	$2.57 US GAL.	N.A.**	64.55%
		Premium	$2.77 US GAL.	N.A.**	65.65%
Estimated Population: 19,000,000		Household kerosene	$1.21 US GAL.	N.A.**	45.00%
		Motor Lubricating Oil	$7.76*** US GAL.	12.50%	N.A.
		Distillate, Gas Oil and Diesel	$1.21 US GAL.	N.A.**	41.55%
		Bunker "C" Fuel Oil (Heavy Fuel Oil No. 2)*	$137.18 Metric Ton	N.A.**	16.66%

* Heavy fuel oil No. 2: Price listed is wholesale price, since there is no retail price.

** Most petroleum products are refined locally, and crude imported for this purpose is duty-free. A small part of Morocco's requirements for refined products are imported, and a duty of 10 percent ad valorem plus 8 percent special tax, are paid on such imports.

*** Motor lubricating oil: basic components imported and blended locally with insufficient national production in a wide variety of qualities. Retail prices vary from US$6 to US$9 per US GAL.

SOURCE: Ministry of Energy and Mines

AID 1020 28 (1-72)

Phase I Annex H

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Identification (Phase I)
Fund FY 80 to FY 84
Total US Funding
Date Prepared Oct. 08, 1979

Project Title & Number: Morocco: Renewable Energy Development, 608-0159

I. NARRATIVE SUMMARY	II. OBJECTIVELY VERIFIABLE INDICATORS	III. MEANS OF VERIFICATION	IV. IMPORTANT ASSUMPTIONS
A. Program or Sector Goal: The broader objective to which this project contributes: (Phase I and II) Develop and utilize Morocco's renewable energy resources and thereby increase production and improve living standards, particularly in remote rural areas, decrease dependence on imported fuel, and conserve domestic reserves of depletable fuel.	Measures of Goal Achievement: (Phase I and II) Incorporation of renewable energy, at about 10 percent of total energy, in all national energy sector plans and forecasts; inclusion of renewable energy as a line item in the budget of each major ministry of the Government.	(Phase I and II) -Energy sector planning documents -Ministry of Energy and Mines reports -Annual budgets of each ministry	Assumptions for achieving goal targets: (Phase I and II) That the government will utilize local or outside to provide a sound basis for an investment program in renewable energy in transition, particularly in rural areas, remote from conventionally generated grid power.
B. Project Purpose: (Phase I and II) Create a renewable energy laboratory and research institution within the Ministry of Energy and Mines and a renewable energy research and demonstration program	Conditions that will indicate purpose has been achieved: End of project status. (Phase I) 1. Feasibility study reports for the renewable energy facility and for three companion test and demonstration subprojects in hand at MEM 2. Preliminary designs and cost estimates for the four facility increments in hand at MEM 3. Functions & objectives o renewable energy inst. are formulated.	Phase I -Examination of consultant reports -Examination of MEM training reports -Visits to the MEM	Assumptions for achieving purpose: (Phase I) (See at Block IV. C. below)
C. Outputs (Phase I) 1. Feasibility studies and preliminary designs for A. research laboratory and center; B. 3 micro hydro generation and distribution facilities; D. irrigation wind or non-powered pumping stations. 2. Five Moroccan professionals trained in renewable energy in the U.S.	~~Magnitude of Outputs~~ renewable energy advisor at work with the MEM Five Moroccan professionals trained in the U.S. in renewable energy and at work in the new R.E.C., MEM. A Phase II grant PP in hand at USAID/Rabat.	N.A.	Assumptions for achieving outputs: (Phase I) 1. Consultants will quickly and diligently carry out their assigned scopes of work. 2. Appropriate sites for studies will be provided in a timely fashion by the GOM
D. Inputs. (Phase I) 1. consultant studies, 20 MM 2. advisory services to MEM, 4 MM 3. Participant training of MEM professionals, 16 MM	Implementation Target (Type and Quantity) N.A.	N.A.	Assumptions for providing inputs: (Phase I) 1. A.I.D. direct recruitment and contracting for consultants will be approved. 2. Qualified U.S. consultants will be available on a timely basis. 3. Qualified Moroccan consultants will be provided by the MEM or contracted for 4. Moroccan professional trainees will be identified by the MEM

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ANNEX H

H-1

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UNITED STATES OF AMERICA

AGENCY FOR INTERNATIONAL DEVELOPMENT

RABAT, MOROCCO

United States Address:
Rabat (ID)
Department of State
Washington, D.C. 20520

العنوان المحلي :
137، شارع علال بن عبد الله
صندوق البريد 120
الرباط - المغرب
الهاتف : 303-61

Adresse locale:
137, Avenue Allal Ben Abdallah
B.P. 120
Rabat, Maroc
Téléphone: 303-61

MISSION DIRECTOR'S DETERMINATION TO

WAIVE HOST COUNTRY CONTRACTING

USAID/Rabat

December 14, 1979

For Phase I of this Renewable Energy Development Project, No. 608-0159, we have carefully reviewed the factors affecting procurement of consultants for study and advisory services. Each of the three feasibility and design studies is distinctively different from each other in technical content and in kind of professional expertise required. Time is of the essence. Each of the elements of consultant services is too small to justify the trouble, expense and time that issuance of international r.f. p's in the U.S. by the MEM would require. Use of work orders to three indefinite quantity or requirements contractors already contracted by A.I.D. is considered the most appropriate way to bring on the three different kinds of consultancies required. For these reasons, I have determined that Policy Determination 68, the presumption in favor of host country contracting, should be waived for the technical study and advisory services required to carry out Phase I of this project. Competitive host country contracting by the MEM for a blanket Phase II services contract is, however, appropriate.

Eric Griffel
Acting Director

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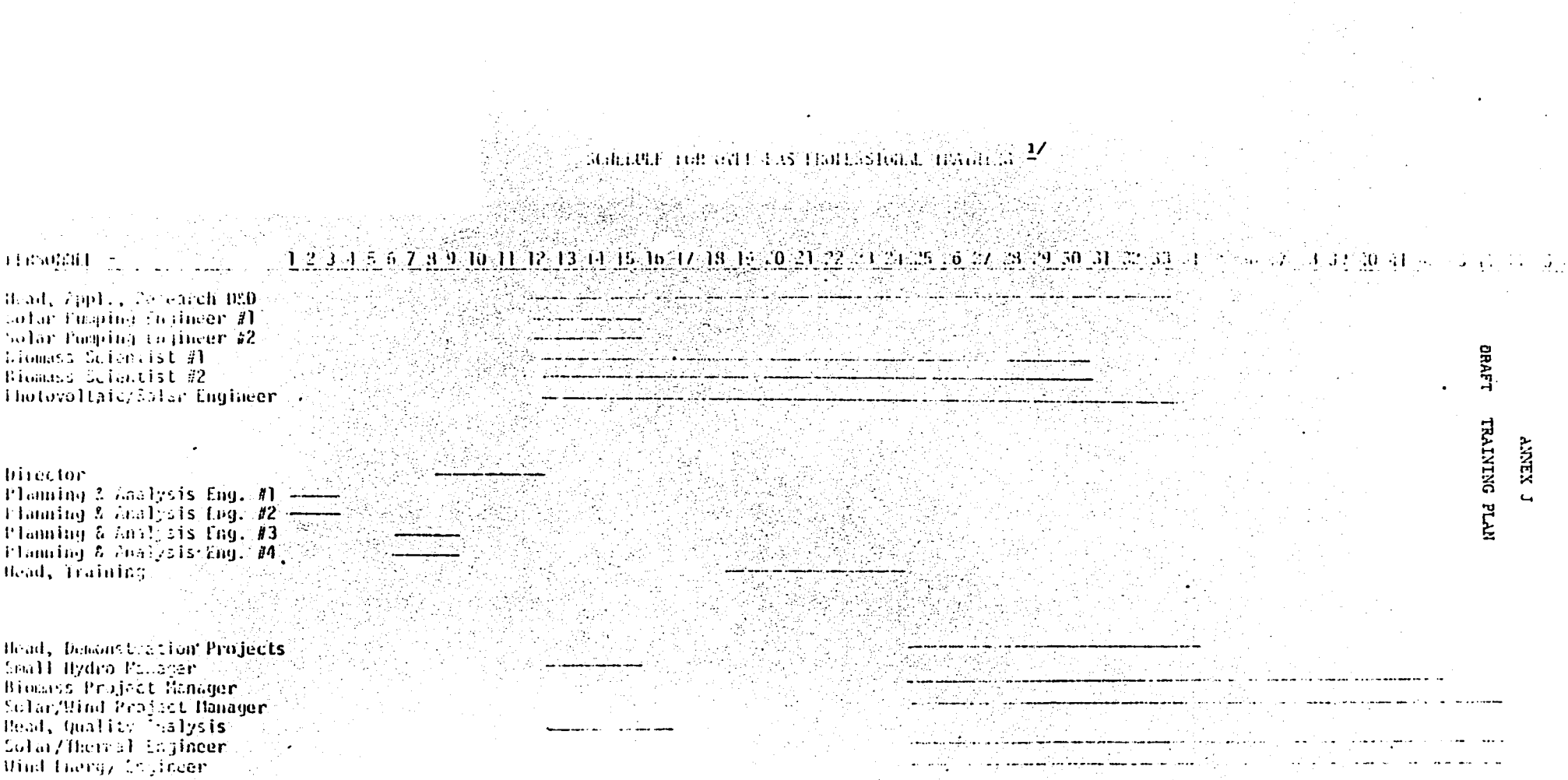
SCHEDULE FOR OFF-SITE PROFESSIONAL TRAINING [1/]



1/ This suggested plan was proposed in the DSI report of July 1979. Final training plan will incorporate more broadly based training in economics, management and social sciences fields related to energy.

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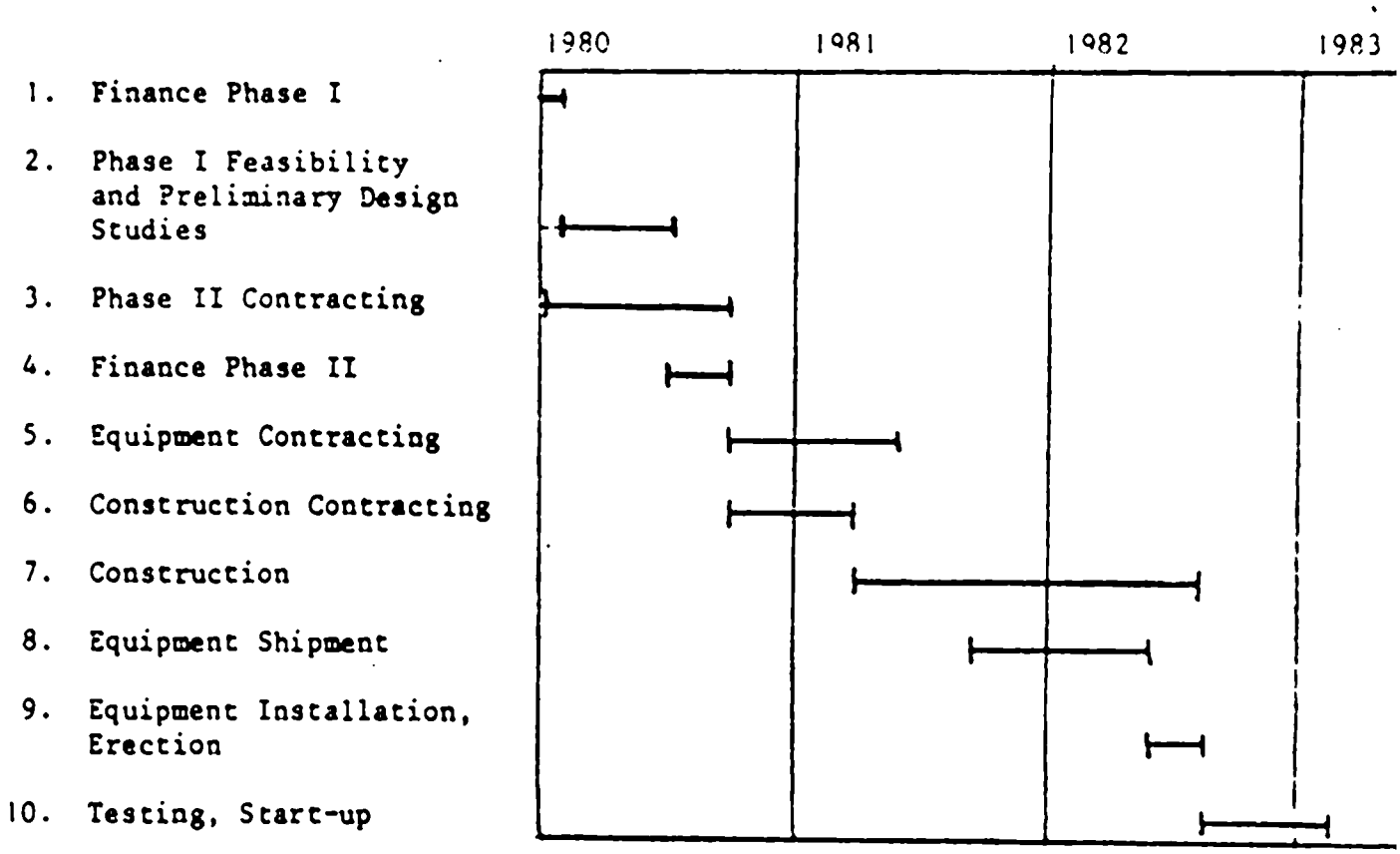
PHASE I - PHASE II

FACILITIES IMPLEMENTATION PLAN



PROJECT CHECKLIST

A. GENERAL CRITERIA FOR PROJECT

1. FY 79 App. Act Unnumbered; FAA Sec. 634A; Sec. 653(b). (a) Describe how authorizing andappropriations Committees 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)?	Advise of program change consistent with usual procedures. Yes.
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?	Yes.
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?	Not required.
4. FAA Sec. 611(b); FY 79 App. Act 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., contruction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	Not applicable.
6. FAA Sec. 209. 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.	No.

7. FAA Sec. 601(a). 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.	Project has the potential to improve technical efficiency of industry, agriculture and commerce by increasing availability of energy resources.
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).	U.S. firms will supply services under project.
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.	Country to make required in-kind contributions.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	Morocco is near-excess country; no local currency expenditures being financed
11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes.
12. FY 79 App. Act Sec. [608]. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?	Not applicable.

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B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b); 111; 113; 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 and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions: (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; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

One purpose of project is to make energy available to rural areas.

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

Section 106.

(1) [103] for agriculture, rural development or nutrition; if so (a) extent to which activity is specifically designed to increase productivity and income of rural poor; [103A] if for agricultural research, full acount shall be taken of the needs of small farmers, and extensive use of field testing to adapt basic research to local conditions shall be made; (b) extent to which assistance is used in coordination with programs carried out under Sec. 104 to help improve nutrition of the people of developing countries through encouragement of increased production of crops with greater nutritional value, improvement of planning, research, and education with respect to nutrition, particularly with reference to improvement and expanded use of indigenously produced foodstuffs; and the undertaking of pilot or demonstration programs explicitly addressing the problem of malnutrition of poor and vulnerable people; and (c) extent to which

activity increases national food security by improving food policies and management and by strengthening national food reserves, with particular concern for the needs of the poor, through measures encouraging domestic production, building national food reserves, expanding available storage facilities, reducing post harvest food losses, and improving food distribution.

(2) [104] for population planning under Sec. 104(b) or health under Sec. 104(c); if so, (a) extent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning for the poorest people, with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics and health posts, commercial distribution systems and other modes of community research.

(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; and (b) extent to which assistance provides advanced education and training of people in developing countries in such disciplines as are required for planning and implementation of public and private development activities.

(4) [106] for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is: (i) (a) concerned with data collection and analysis, the training of skilled personnel, research on and development of suitable energy sources, and pilot projects to test new methods of energy production; and (b) facilitative of geological and geophysical survey work to locate potential oil, natural gas, and coal reserves and to encourage exploration for potential oil, natural gas, and coal reserves.

Project specifically directed at items described in (i)(a).

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

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

(iv) reconstruction after natural or manmade disaster;

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

(vi) 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.

c. [107] is appropriate effort placed on use of appropriate technology? (relatively smaller, cost-saving, labor using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor.)

d. FAA Sec. 110(a). Will the recipient country 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)?

Country will provide at least 25% of costs for entire project.

e. 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.

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 civil education and training in skills required for effective participation in governmental processes essential to self-government.

Project seeks to improve energy research and application abilities of country's people.

g. FAA Sec. 122(b). 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?

Yes.

STANDARD ITEM CHECKLIST

A. Procurement

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed?	Yes.
2. FAA Sec. 604(a). Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him?	Yes.
3. FAA Sec. 604(d). If the cooperating country discriminates against U.S. marine insurance companies, will commodities be insured in the United States against marine risk with a company or companies authorized to do a marine insurance business in the U.S.?	No commodities financed.
4. FAA Sec. 604(e). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity?	Not financed
5. FAA Sec. 608(a). Compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S.-flag commercial vessels to the extent that such vessels are available at fair and reasonable rates.	Yes.
6. FAA Sec. 621. If technical assistance is financed, to the fullest extent practicable will such assistance, goods and professional and other services from private enterprise, be furnished on a contract basis? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?	Yes. Not utilized.

X

7. International Air Transport. Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will provision be made that U.S.-flag carriers will be utilized to the extent such service is available? — Yes.

8. FY 79 App. Act Sec. [105]. Does the contract for procurement contain a provision authorizing the termination of such contract for the convenience of the United States? — Yes.

B. Construction

1. FAA Sec. 601(d). If a capital (e.g., construction) project, are engineering and professional services of U.S. firms and their affiliates to be used to the maximum extent consistent with the national interest? — Yes for the construction design financed.

2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable? — Not financed.

3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million? — Not applicable.

C. Other Restrictions

1. FAA Sec. 122(b). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter? — Not applicable.

2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights? — Not applicable

3. FAA Sec. 620(h). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interest of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries? — Yes.

4. FAA Sec. 636(i). Is financing not permitted to be used, without waiver, for purchase, sale, longterm lease, exchange or guaranty of motor vehicles manufactured outside the U.S.? **Yes.**

5. Will arrangements preclude use of financing:

a. FAA Sec. 104(f). To pay for performance of abortions as a method of family planning or to motivate or coerce persons to practice abortions; to pay for performance of involuntary sterilization as a method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization? **Yes.**

b. FAA Sec. 620(g). To compensate owners for expropriated nationalized property? **Yes.**

c. FAA Sec. 660. To provide training or advice or provide any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? **Yes.**

d. FAA Sec. 662. For CIA activities? **Yes.**

e. FY 79 App. Act Sec. /104/. To pay pensions, etc., for military personnel? **Yes.**

f. FY 79 App. Act Sec. /106/. To pay U.N. assessments? **Yes.**

g. FY 79 App. Act Sec. /107/. To carry out provisions of FAA section 209(d) (Transfer of FAA funds to multilateral organizations for lending.) **Yes.**

h. FY 79 App. Act Sec. /112/. To finance the export of nuclear equipment, fuel, or technology or to train foreign nationals in nuclear fields? **Yes.**

i. FY 79 App. Act. Sec. /601/. To be used for publicity or propaganda purposes within U.S. not authorized by Congress? **Yes.**

COUNTRY CHECKLIST

A. GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

1. FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy?	No.
If not, has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights?	No.
2. FAA Sec. 481. Has it been determined that the government of the recipient country has failed to take adequate steps to prevent narcotics drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully?	No.
3. FAA Sec. 620(b). If assistance is to a government, has the Secretary of State determined that it is not dominated or controlled by the international Communist movement?	Yes.
4. FAA Sec. 620(c). If assistance is to the government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) the debt is not denied or contested by such government?	No.
5. FAA Sec. 620(e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?	No, although there is a matter pending in this area concerning the nationalizatio of land (less than $1 million
6. FAA Sec. 620(a), 620(f), 620D; FY 80 App. Act. Sec. (511, 512, and 513.) Is recipient country a Communist country?	No.
Will assistance be provided to Angola, Cambodia, Cuba, Laos or Vietnam?	No.
Will assistance be provided to Afghanistan or Mozambique without a waiver?	No.

7. FAA Sec. 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or agression? — No.

8. FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property? — No.

9. FAA Sec. 620(l). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason? — No.

10. FAA Sec. 620(o); Fishermen's Protective Act of 1967, as amended, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters, — No.

a. has any deduction required by the Fishermen's Protective Act been made?

b. has complete denial of assistance been considered by AID Administrator?

11. FAA Sec. 620; FY 80 App. Act Sec. (518.)
(a) Is the government of the recipient country in default for more than six months on interest or principal of any AID loan to the country? — No.
(b) Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds? — No.

12. FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget which is for military expenditures, the amount of foreign exchange spent on military equipment and the amount spent for the purchase of sophisticated weapons systems? (An affirmative answer may refer to the record of the annual "Taking Into Consideration" memo: "Yes, taken into account by the Administrator at time of approval of Agency OYB." This approval by the Administrator of the Operational Year Budget can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.) — Not applicable.

13. FAA Sec. 620(t). Has the country served diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption? — No.

14. FAA Sec. 620(u). That is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget? — Current, except for small delinquency in peacekeeping account. 620(u) is met.

15. FAA Sec. 620A, FY 79 App. Act, Sec. (607) Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism? — No.
Has the country granted sanctuary from prosecution to any individual or group which has committed a war crime? — No.

16. FAA Sec, 666. Does the country object, on basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. there to carry out economic development program under FAA? — No.

17. FAA Sec. 669, 670. Has the country, after August 3, 1799, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? Has it detonated a neclear device after August 3, 1977, although not a "nuclear-weapon State" under the nonproliferation treaty? — No.

B. FUNDING SOURCE CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria.

a. FAA Sec. 102(b)(4). Have criteria been established and taken into account to assess commitment progress of country in effectively involving the poor in development, on such indexes as: (1) increase in agricultural productivity through small-farm labor intensive agriculture, (2) reduced infant mortality, (3) control of population growth, (4) equality of income distribution, (5) reduction of unemployment, and (6) increased literacy. — Yes.

b. FAA Sec. 104(d)(1); IDC Act of 1979. If appropriate, is this development (including Sahel) activity designed to build motivation for smaller families through modification of economic and social conditions supportive of the desire for large families in programs such as education in and out of school, nutrition, disease control, maternal and child health services, agricultural production, rural development, assistance to urban poor and through community-based development programs which give recognition to people motivated to limit the size of their families? not appropriate

Draft No. 1

NE/PD:JWilliams:PC

October 19, 1979

UNCLASSIFIED

U.S. INTERNATIONAL DEVELOPMENT COOPERATION AGENCY

AGENCY FOR INTERNATIONAL DEVELOPMENT

WASHINGTON, D.C. 20523

PROJECT PAPER

MOROCCO: Renewable Energy Development

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

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

PP

2. DOCUMENT CODE: 3

COUNTRY ENTITY: Morocco

4. DOCUMENT REVISION NUMBER:

PROJECT NUMBER (7 digits): 608-0159

6. BUREAU OFFICE: A. SYMBOL: NE; B. CODE: 03

7. PROJECT TITLE (Maximum 40 characters): Renewable Energy Development, Phase I

ESTIMATED FY OF PROJECT COMPLETION: FY 80

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 80; B. QUARTER 1 (Enter 1, 2, 3, or 4); C. FINAL FY 80

10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 - DH 3.9

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
ID APPROPRIATED TOTAL						
(GRANT)	(347)	( )	(347)	( )	( )	(347)
(LOAN)	( )	( )	( )	( )	( )	( )
THER U.S. 1.						
THER U.S. 2.						
OST COUNTRY						
THER DONOR(S)						
TOTALS	347		347			347

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 80 F. GRANT	E. 1ST FY 80 G. LOAN	H. 2ND FY ___ I. GRANT	H. 2ND FY ___ J. LOAN	K. 3RD FY ___ L. GRANT	K. 3RD FY ___ M. LOAN
1) ST	740	878		347					
2)									
3)									
4)									
TOTALS				347					

A. APPROPRIATION	N. 4TH FY ___ O. GRANT	N. 4TH FY ___ P. LOAN	O. 5TH FY ___ R. GRANT	O. 5TH FY ___ S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
1)					347	
2)						
3)						
4)						
TOTALS						

12. IN-DEPTH EVALUATION SCHEDULED: MM YY

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: Harold S. Fleming

TITLE: Director, USAID/Morocco

DATE SIGNED: MM DD YY

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

AID 1330-4 (3-78)

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NON-TECHNICAL ABBREVIATIONS

A.I.D.	Agency for International Development
CIER	Commission Interministerille de l'Electrifaction Rural
DH	Moroccan dirhams
DSI	Development Sciences, Inc.
FAA	Foreign Assistance Act of 1961, as amended
FY	Fiscal Year
GOM	Government of Morocco
ha	hectares
IBRD	International Bank for Reconstruction and Development
MEM	Ministry of Energy and Mines
MI	Ministry of the Interior
Min Ag	Ministry of Agriculture
OIT	Office of International Training, A.I.D.
ONE	Office National de l'Electricite
PP	Project Paper
USAID/Rabat	The A.I.D. Mission in Rabat
U.S.	United States
USSR	Soviet Russia

(September 1978)

Currency Unit	=	Dirham (DH)
DH1	=	Centimes (ctm) 100
DH1	=	US$0.25
DH 4.00	=	US$1.00
DH 1,000	=	US$250.0
DH 1,000,000 (MDH1)	=	US$250,000 (MUS$0.250)

MEASURES AND TECHNICAL ABBREVIATIONS

1 kilometer (km)	=	0.62 mile (mi)
1 cubic meter (m^3)	=	35.315 cubic feet (ft^3)
1 barrel (bbl)	=	42 gallons (USgal) 0.159 cubic meter
1 kilovolt (kV)	=	1,000 Volts (V)
Medium voltage (MV)	=	In Morocco: 22-kV, 8.5-kV and 5.5-kV
Low voltage (LV)	=	In Morocco: 380/220-V
1 kilowatt (kW)	=	1,000 Watts (10^3W)
1 Megawatt (MW)	=	1,000-kW (10^6W = 10^3kW)
1 kilowatthour (kWh)	=	1,000 Watthours (10^3Wh) 860.4 kilocalories (kcal)
1 Megawatthour (MWh)	=	1,000 Kilowatthours
1 Gigawatthour (GWh)	=	1,000,000 kilowatthours
1 kilovolt ampere (kVA)	=	1,000 Volt amperes (10^3VA)
1 Megavolt ampere (MVA)	=	1,000 kilovolt amperes
1 kilocalorie (kcal)	=	1.163 Watthours
1 kilogram coal equivalent (kgce)	=	7.10^3 kcal
Per year	=	/a
1 hectare (ha)	=	2.47 acres

3-1

SUMMARY

Grantee: Kingdom of Morocco

Beneficiary: Ministry of Energy and Mines (MEM)

Grant Amount: U.S. $347,000

Moroccan Contribution: U.S. $_____ equivalent

Total Phase I Cost: U.S. $_____ and equivalent

Project Purpose: Finance the design and development of an experimental renewable energy program and research institution in Morocco in accordance with Section 106, FAA.

Project Description: Four preliminary design and feasibility studies of facilities will be carried out: (1) a renewable energy research laboratory and facility near Marrakesh: (2) three 0.2 MW hydroelectric power generation facilities at Ait Arbi, Msemrir, and Tilaugguit; (3) three biomass tree plantations (2500 ha);(4) ten irrigation pumping stations utilizing solar energy or wind power. The services of a U.S. renewable energy expert will be provided to the MEM for a two-year period. Renewable energy training will be provided at U.S. institutions for five Moroccan professionals. the new renewable.

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Project Implementation: Participant trainees will be screened and processed by the MEM, USAID/Rabat and OIT. Study and advisory services will be contracted directly by AID/Washington in accordance with justification in this PP. The MEM will oversee the conduct of studies. It will be assisted by the contracted, resident U.S. renewable energy expert upon his arrival in Morocco. Studies are expected to provide the basis of a follow-on, second phase, grant amendment in early 1980.

Statutory Criteria: All statutory criteria have been met. Congress was notified during FY-79 and no further notification is required at this time.

Country Team Views: The mission and the American Embassy in Rabat support this grant as consistent with U.S. policy objectives in Morocco.

Grant Application: The Kingdom of Morocco has requested this grant. See Annex A, Grant Application.

Fund Availability: Funds for this proposed grant have been made available by transfer from the Regional Energy Development account to the FY-80 Morocco bilateral program.

Recommendation: Authorize a $347,000 grant to the Kingdom of Morocco to develop this renewable energy project. See Annex B, Draft Grant Authorization, ~~and Annex C, Draft Grant Authorization,~~ and Annex C, Draft Grant Agreement.

I. PROJECT BACKGROUND

1.01 Morocco is a middle income country with a $12.2 billion gross domestic product. Its 17 million population is increasing at an annual rate of over 3 percent. It faces declining agricultural productivity per capita, dependence on foreign capital, and the economic drain attributed to the conflict with the Polisario in the Western Sahara. (See Annex D for details of the Moroccan economy.)

1.02 Over the longer term, Morocco has considerable resources on which to base economic growth. This includes phosphates and other minerals, potential for higher agricultural productivity and substantial existing infrastructure. By 1982, Morocco can hope to resume steady and balanced economic growth based upon improved phosphate prices, exploitation of oil shale, and expanded agricultural production. Morocco's increasingly serious search for new energy resources offers potential investment opportunities in oil prospecting, shale oil exploitation, solar energy, and uranium extraction.

1.03 The high cost of energy is a major problem for the Moroccan economy and a major reason for recently increased import expenditures. Morocco is 80 percent dependent on imported fuels. It must include constantly increasing petroleum prices in its economic calculations. Although energy accounted for only 4.8 percent of Morocco's imports in 1973, it now amounts to about 25 percent. Expenditures for petroleum imports are expected to exceed receipts from phosphate exports during 1979. See Annex F for details of Morocco's balance of payments.

1.04 Energy consumption in Morocco has annually increased 7 percent for the last ten years. In 1978, Morocco imported 35 million tons of petroleum from the USSR, Iraq, Kuwait, and Saudi Arabia. Domestic oil production has declined to about 450 barrels per day, versus a daily demand for 50,000 barrels. Gas reserves are expected to last 32 more years at the current 82-million-cubic meters-per-year rate of consumption, principally by the fertilizer industry.

1.05 To confront the energy problem, the Government has eliminated subsidies on kerosene and diesel oil. (See Annex G for retail prices of petroleum products in Morocco.)

It plans a program of energy conservation and domestic resource development: coal, petroleum exploration, shale oil deposits, hydroelectric power and renewable energy. The Government has recently intensified offshore and onshore oil and gas exploration via joint ventures with foreign firms.

1.06 Coal is Morocco's principal fossil fuel resource. Probable resources are 36 million tons. Current production, 700,000 tons per year, is primarily used for power generation. The Government plans to increase production to a million tons per year during the next three years.

1.07 Oil shale deposits of about 24 billion tons exist at Timhadite and Tarfaya. The Occidental Petroleum Company is determining appropriate technology for its extraction. Current plans call for a daily output of 50,000 barrels by 1985. The Government is negotiating with a Romanian and West German consortium for construction of four shale oil-fired 200-MW generating plants.

1.08 Morocco's hydroelectric resources are principally in the Moulouya, Sebou and Oum R'bia river basins. They annually

yield about 1470 GWH. The 1980-1990 development program is expected to add another 1400 GWH. Future development of hydro sites is constrained by short rainy seasons and increasing use of water for irrigation. The need to allocate water between power generation and irrigation has prompted Government-commissioned studies and master plans for each of the river basins. The Office Nationale d'Électricité (ONE), assisted by the IBRD, is completing feasibility studies and preliminary designs for a 1984-1990 hydro development program.

1.09 Morocco's 50-billion-ton phosphate reserves are estimated to have a 150 to 200-gram-per-ton uranium content. Extraction is uneconomic with present technology. Commercially exploitable uranium deposits have not yet been discovered in Morocco.

1.10 Firewood and charcoal are important sources of fuel for home heating and cooking in Morocco. Deforestation is consequently occuring at an annual rate of 40,000 hectares; only 25,000 hectares are annually replanted with trees.

1.11 Morocco has a significant solar energy potential that could be developed to meet part of the country's demand for energy

1.12 The Ministry of Energy and Mines (MEM) is responsible for overall development planning, pricing, and investments in the energy sector. It manages oil, gas, and uranium exploration and has administrative control over the Office National d'Electricite (ONE) the public enterprise responsible for most electric power generation and transmission. The Ministry of the Interior (MI) supervises the 13 regies, the public enterprises responsible for distribution of water and electricity to urban centers. MI's representative heads the Commission Interministerielle de l'Electrification Rural (CIER), i.e., the village electrification program which is implemented by ONE. The Ministry of Agriculture's Department of Waters and Forests is responsible for tree plantations. Fragmentation of control over the energy sector hinders the coordination of investment planning and financing, particularly for urban power distribution and rural electrification.

1.13 ONE generates about 91 percent of Morocco's electric power. Captive plants, generally linked to industrial enterprises, produce another 8 percent. About one percent is generated by small, isolated diesel generators.

At the end of 1978 ONE's installed capacity was 1063 MW of which 396 MW (37 percent) was hydro and 667 MW (63 percent) was thermal. In 1978, total generation was 3,970 GWH. Peak demand was 765 MW. About 60 percent of ONE's production of electric power is sold to large industrial customers and to the regies for urban distribution. The remaining 40 percent is distributed to provincial cities and rural areas connected to its grid. For transmission, the 225-KV grid is progressively replacing the former 150 KV system. A 60 KV subtransmission network transports energy to the distribution system at 22 KV.

1.14 In 1977 the Government, meaning in this instance, CIER, MI, and ONE formulated the first national rural electrification program for the electrification of 500 villages. French consultants financed by the IBRD developed the program. The main criterion was that villages designated for electrification would maximize expected benefits to the rural population at the lowest feasible cost to the Moroccan economy. This has evolved into Morocco's current three-phase, 15-year, rural electrification program. The program has two principal objectives: (1) increase access to electricity for Morocco's 11.3 million rural people; (2) increase agricultural productivity.

1.15 In 1978, only 5.8 percent of Morocco's rural people had access to electricity, compared to 60 percent of the country's six million city dwellers. Lack of infrastructure and services in the countryside, e.g., water, electricity, roads, etc., is considered a primary cause of the continuing rural migration which aggravates the country's urban poverty problem. Rural electrification, combined with other Government programs for rural development, is expected to stem the exodus from rural areas by improving basic infrastructural services and by improving employment opportunities in agro-industry.

1.16 The rural electrification program aims to increase agricultural productivity by making electric power available for irrigation pumping schemes to expand the total cultivated area and to improve yields in areas currently being irrigated inefficiently. The program also aims to reduce the economic cost of energy used for irrigation pumping by substituting ONE's centrally generated electricity for the diesel oil currently being used in small isolated generators.

1.17 The IBRD Village Electrification Project is a rural distribution scheme that will construct 1250 km of 22-kv

subtransmission lines, 995 km of 380/220-volt distribution lines, 45 MVA of 22/0.4-kv transformer capacity, and street lighting. It will extend grid power to about 220 villages in 16 rural provinces. It will provide electricity to about 360,000 rural people. ONE will execute the project. The Government will put up $40.0 million as a condition of receiving a $42 million Bank loan. Estimated rate of economic return on the $85 million investment is 6 to 8 percent.

1.18 There are 187 remote villages that use small diesel generators and rudimentary distribution networks. These installations are financed by MI from its budget for municipal equipment. Daily operation is insured by local authorities. Maintenance is provided by ONE. The quality of service is poor and unreliable. A third of the isolated diesel generators are in poor condition. The rest are overloaded and deteriorating quickly. The Village Electriction Project will connect 30 of those 187 remote villages to the national grid. This sub-

stitution will result in savings to the economy because ONE's grid power is generated from coal, fuel oil, and hydro. It therefore has an average lower economic cost than the opportunity cost of diesel fuel extracted from imported oil. Connection to the grid will enable the inhabitants of these 30 villages to use electricity for house lighting and irrigation pumping.

II. PROJECT BACKGROUND

2.01 It is in the context described above of growing demand for electric power consumption, particularly on the part of the rural poor majority and for the agricultural sector, coupled with high and rising generation costs, that the Government has become seriously interested in long-term development of Morocco's renewable energy potential to complement conventional sources of electric power. Renewable energy is a concept "whose time has come".

2.02 What is "renewable energy"? Renewable energy is non-depletable, capable of regeneration; its sources cannot be exhausted. All sources of renewable energy are related to the energy of the sun. For that reason, literature on this subject frequently interchanges the terms "renewable" and "solar". There are four fundamental sources of renewable energy: In (1) photosynthesis, plants store solar energy which provides nutrients for human and animal power, for energy released by combustion, and for generation of methane gas from organic wastes; (2) Falling water is made renewable

by the sun's evaporation of water at sea level which is then deposited by rainfall on mountains and high plateaus; (3) Wind is created by variations in the intensity and effects of the sun's heat on various portions of the earth's surface; (4) Direct solar energy from the sun's rays may be converted to heat or electric power. The state of the art has advanced since the United Nations conference on renewable energy was held in Rome in 1961. There are six proven renewable energy technologies, although the feasibility of their application varies with geographical, climatic, and sociological circumstances.

2.03 There are two principal ways to utilize the direct rays of the sun. (1) Flat plate solar collectors utilize an insulated box covered with glass and painted black on the inside to trap the heat of the sun's rays. The heat is then used directly to heat water, operate a pump, power refrigeration, dry fish, etc. Use of this solar thermal technology to heat water for cooking is widespread in Japan, Israel and Australia. (2) Photovoltaic or solar cells are used in space craft to generate electricity from the

direct rays of the sun. These semiconductors are usually made of wafer thin slices of silicon covered with, or imbedded in, glass. The action of the sun on these cells creates a continuous electric charge which is collected and carried off by wires to batteries.

2.04 In October 1979 San Diego County enacted a first-in-the-U.S. requirement for solar water heaters on new residential buildings not served by natural gas. The law will affect about 10,000 living units in the first year alone. Morocco lies in about the same latitude as San Diego County, South Carolina, Georgia and northern Florida. Mean annual cloudiness is 20 to 40 percent, about the same as that of Southern California. Average sunlight conditions in Morocco will produce 5.5 kwh of electricity per day for each square meter of a photovoltaic cell. Although the recent IBRD study for village electrification in Morocco found the cost of solar equipment to be ~~too~~ high in relation to anticipated benefits, geographic considerations suggest that solar thermal and solar electric power technology offers the highest potential for research, development, and application in Morocco.

2.05 Biogasification, generation of methane gas from organic wastes such as human and animal excreta, and

garbage, can be used directly for cooking and lighting or as fuel for electric power generation. This technology is particularly reliable where livestock are abundant. (The dung from one cow can generate enough methane to produce four kwh of electricity per day). Subsequent use of animal residues for fertilizer is not degraded by their prior use for gas production. Sewage treatment is a prime area for energy saving in the U.S. A purification plant in Wilton, Maine, gets 25 percent of its power from solar panels, and will soon become completely energy self-sufficient by drawing the rest of the power it needs from the heat and methane gas that are produced by decomposing sludge. Research would proably identify suitable methane gas aplications in Morocco.

2.06 Small, decentralized hydro-power plants can provide direct mechanical power; e.g. for flour mills, or they can generate electricity. Under the terms of the U.S. National Energy Act, a small hydro plant has a 15 MW capacity. In New York State, officials define it as having a 1.5 MW capacity, that is, enough to power a small paper manufacturing plant. Micro-hydro systems generally have power outputs less than 0.1 MW, that is, enough to power an individual home, a farm, or a workshop. According to an inventory in that state, there

are about 300 practical sites for new or renovated hydro plants. Soaring oil costs, controversy about nuclear plants, and concern about emissions from coal-burning plants are causing New York and New England to look to small hydro plants as supplemental sources of energy for private homes and small industry. The mountainous regions of Morocco may have a rainfall pattern that would justify similar investments in small hydroelectric power generation facilities. Mean annual rainfall is about 25 to 50 inches in the Moroccan mountains and is "periodic"; i.e. north and west of the mountains rain occurs during each season except the summer; south and east of the mountains rain occurs only in winter. The 1979 DSI Report estimated that small hydro plants in these mountains would cost about $2600 per kilowatt not including back-up diesel generation for dry seasons.

2.07 Wind power can be harnessed for direct mechanical energy; e.g., to grind grain or to pump water. Small windmills can also be utilized to generate electric power. The spiraling cost of oil has created new interest in wind power for large commercial sailing ships. In West Germany, the United States, and Britain designers are actively seeking capital for construction of sailing ships that would do 14 knots and complete the Europe to Australia grain run in just

over a week longer than a motor ship. At current oil prices the voyage would cost owners a fifth less per ton of cargo. In many parts of Asia, the Pacific, the Caribbean, and the Middle East cargo and passenger carrying by sail vessels never died out; it remains a vital part of local transportation systems. Wind technology on land is feasible where mean wind velocity is at least six miles (3.7 km) per hour. Morocco's coastal regions have a mean wind velocity that would justify research and development of this renewable energy source. Indeed, windmills were used on farms in coastal regions of Morocco until they were replaced with diesel engines in the early 1950's.

2.08 Wood, garbage, cornstalks, leaves, pinecones, and other kinds of biomass can be burned to generate electricity. In heavily wooded Vermont the Burlington Electric Company has kept electric power rates down by burning wood chips - at $12.50 per ton - instead of coal in two generators. Burlington residents recently approved a bond issue to build a 50 MW wood-burning generator that will be the largest in the world. Some U.S. cities are selling their combustible trash to local utilities, which burn it to supplement coal. Roughly 30,000 of Milwaukee's 250,000 homes get their power from garbage, sorted at

a $4.2 million plant that produces six times more energy than it uses. Ames, Iowa, burns garbage to generate electricity for its 63,000 customers. In Morocco fuelwood production is considered to offer a relatively low potential for renewable energy development because the country is semi-arid and because wood plantations compete against food production for scarce productive land and fertilizer. Research is required to investigate optimum uses of wood, garbage, and other types of biomass for energy production, including possible ways to substitute ecologically cheaper kinds of domestic fuel for the wood and charcoal used for home heating and cooking in Morocco. Research is also required to develop optimum agricultural methods of tree production (silviculture), including species of tree, planting and harvesting techniques, and use of fertilizer.

2.09 During 1978 the Government of Morocco designated a research facility site and set aside funds for a research program to increase use of renewable energy in Morocco. A consultant team sponsored by A.I.D. visited Morocco and assisted the Government to plan the center and to identify pilot research activities. The resulting December 1978 report concluded that small hydro sites in the Atlas Mountains should be

investigated with a view to identifying suitable sites for feasibility studies, final design, and construction. The team recommended an organization plan for the renewable energy center. Further preliminary survey and project identification work was carried out in 1979 which led to identification of this proposed renewable energy development project in Morocco.

III. PROJECT DESCRIPTION

3.01 The project constitutes the first part of a long-term effort by the Government of Morocco to develop and utilize the country's renewable energy resources and thereby to increase production and improve living standards, particularly in remote rural areas, decrease dependence on imported fuel, and conserve domestic sources of depletable fuel. A.I.D.'s grants for this project will be based upon Section 106 of the Foreign Assistance Act, which authorizes assistance for "programs to help developing countries alleviate their energy problems by increasing their production and conservation of energy, through such means as research and development of suitable energy sources and conservative methods, collection and analysis of information concerning countries' potential supplies of and needs for energy, and pilot projects to test new methods of production or conservation of energy".

3.02 Within the context of the project goal described above, there are a number of relatively sophisticated project purposes and subpurposes. On the one hand, the project will assist the Moroccans to create a

new research and development institution and facility. At the same time, the project will sponsor a number of pilot renewable energy research activities. The program to establish the new research center will be evolutionary and is expected to require four or five years to achieve the following second tier of goals:

-- identify and develop renewable energy technology best suited to Morocco;

-- establish an objective performance measurement system for renewable energy techniques and equipment;

-- train a cadre of engineers, scientists and managers in the application and administration of renewable energy technology;

-- develop a Moroccan institutional capability to manage and coordinate renewable energy research activities that are applicable and relevant to Moroccan economic and social development;

-- integrate renewable energy techniques into Moroccan national energy sector policy and planning.

3.03 At yet a third tier of purposes, the pilot renewable energy activities that will be sponsored by the project are intended to:

-- familiarize the Moroccan energy bureaucracy (MI, CIER, MEM, CNE, Min Ag, etc.) with the range and potential application of renewable energy technology;

-- provide an early and credible institutional and bureaucratic function for the new renewable energy research center;

-- provide a training and institutional development vehicle for the Moroccan professionals assigned to the new research center;

-- provide useful information concerning the cost, feasibility, performance, administration, maintenance, sociological effects, etc, of actual applications and performance tests of various renewable energy technologies and equipment in rural Morocco;

-- provide cheap, useful sources of electric power for agricultural production applications and home lighting at the rural sites where the several renewable energy pilot research activities will be carried out.

3.04 The project will be financed in two phases. Phase I of the project consists of:(1) participant training in the U.S. for the initial Moroccan professional cadre

for the renewable energy research institution; (2) the services of a U.S. renewable energy expert to provide coordinating technical advice and assistance to the Ministry of Energy and Mines (MEM) in the development of the renewable energy research program and institution; (3) feasibility and preliminary design studies for the infrastructure and physical facilities components of the project.

3.05 For Phase I training, four Moroccan professionals from the Ministry of Energy and Mines (MEM) will be sent to the U.S. for familiarization with basic energy planning issues and training in renewable energy technology applicable to Morocco. The director of the new center will also be sent to the U.S. for similar training. The total amount of training to be carried out during Phase I is 16 man-months; four man-months for the research center director and three man-months for each of four planning and analysis engineers.

3.06 Phase I technical assistance will consist of the services of a U.S. renewable energy expert who will assist the Director of Energy of the MEM to plan the structure, staffing, research capability, and administrative, management and intra-governmental coordinating mechanisms for the renewable energy

research center. This advisor will also assist the MEM with the formulation of a five-year renewable energy research program, including subproject activities, methodologies, timetables and budget estimates. He will assist the MEM with the formulation of professional training programs and with the screening and selection of Moroccan participant trainees. The long-term primary advisor may from time-to-time be supplemented by the services of short-term U.S. consultants. The Phase I grant will fund this resident advisor's services for a two-year period.

3.07 Phase I will finance the execution of four preliminary design and feasibility studies: (1) for the renewable energy research laboratory and facility at Marrakesh; (2) for three micro (0.2 MW) hydro electric power generation and distribution facilities in the Atlas Mountains; (3) for ten irrigation ~~or potable water~~ pumping stations powered by the wind or the sun; (4) for three fuelwood tree plantations with a total 2500-hectare area.

3.08 The Government has selected a site near Marrakesh for the renewable energy research center laboratory and facility. The feasibility study and preliminary design to be financed by this Phase I grant will examine the

adequacy of the site, determine specific requirements for laboratory and other equipment for the center, and plan the architectural configuration of the facility to incorporate utilization of the latest and best U.S. renewable energy technology for the facility's heating, lighting, cooling, and water and sewerage requirements. The facility will also be designed to accomodate the U.S. -source laboratory and testing equipment, as recommended by the consultants, which is expected to be financed by A.I.D. during Phase II of this project. Laboratory equipment recommendations will specifically include equipment for testing locally available biomass such as wood, dung, garbage, etc. for power generation. For this essentially architectural design activity, U.S. consultants are expected to provide leadership and the input of expert knowledge concerning renewable energy building design and laboratory equipment. Participation of Moroccan architects is, however, required to insure that the facility design incorporates the use of materials, construction standards and techniques, and design considerations that are appropriate for Morocco.

3.09 The preliminary surveys for this project conducted by Development Sciences, Inc. identified three potential sites in the Atlas Mountains for hydro power installations: Ait Arbi on the northwest side of the mountains;

Msemrir on the southside of the mountains; Tilaïgguit on the south side of the mountains. Each was expected to have a 200 KW (0.2 MW) output, that is, enough power to simultaneously light 2000 100-watt light bulbs. Feasibility study to be financed by the Phase I grant will focus first on the technical and economic feasibility of small hydro power plants at those sites. According to the National Center for Approproate Technology, U.S. Department of Energy, there is a head and flow rate below which there is currently no economic advantage of trying to obtain hydro electric power. For practical purposes in micro-scale hydroelectric systems, any head less than ten feet is probably going to be uneconomical to develop. Similarly, ten gallons per minute can be considered the lower limit to the flow rate. However, ten gallons per minute at 100 feet of head will give about 100 watts of useful power - enough to light a single 100-watt bulb continuously. A flow rate of 100 gallons per minute at 10 feet of head will also deliver about 100 watts of useful power. Accordingly, the study consultant will first determine, for each proposed hydro site, the average head and flow rate for each momth of the year. If this data is technically and economically positive, the consultant will examine now the resulting power output will be used by the

local populations at the three sites, prepare preliminary generation plant and distribution system designs and cost estimates, and examine economic, sociological, financial, and environmental feasibility considerations. The bottom line of the studies will be recommendations, based on all factors, as to whether or not micro hydro power is feasible and appropriate for testing and demonstration at those locations, or whether some alternative source of power; e.g., solar, ONE grid, diesel, or biomass might be more appropriate.

3.10 For the ten irrigation ~~or potable water~~ pumping stations, no preliminary site designations or investigations have yet been made. Accordingly, the U.S. consultant will be expected at the outset to work closely with officials of the MI, MEM, and possibly the ~~Min Ag~~ Min Ag to identify appropriate sites for the ten tests. Two of the ten sites should be in coastal areas to test windmill applications. Four should be tests of solar thermal technology. Four should be tests of solar photovoltaic technology. After sites have been designated for the project by the GOM, the consultant will prepare requisite system designs and cost estimates; he will then appraise technical, economic, financial, sociological, and environmental aspects of each site and make appropriate recommendations for execution of the tests.

3.11 For the three fuelwood plantations, the consultant will initially assist officials of the Waters and Forests Department, Min. Ag., to identify suitable land for this purpose in the vicinity of Marrakesh. A 2500-hectare experiment is planned. This is essentially an agricultural activity. After appropriate sites have been identified and the land designed by the GOM for the project, the consultant will make all the soil, drainage, irrigation, etc. investigations normal to any agricultural activity. He will then recommend optimum tree species, sources of seedlings, manner of planting and harvesting, fertilizer, etc. This will result in a reasonably firm cost estimate and permit appraisal of technical, economic, financial, sociological, and environmental aspects of this subproject.

3.12 Phase II of the project will consist of: (1) additional training in the U.S. and Morocco for Moroccan professionals assigned to the new renewable energy research institution; (2) construction of the renewable energy research center facility; (3) construction and execution of the pilot renewable energy test projects that were subjected to design and feasibility studies during Phase I and found to be feasible; (4) continued U.S. technical advice and assistance for the development of Morocco's renewable energy; (5) initiation of new training, management, and research activities

which are expected to be identified during the execution of the project and in the course of the development of the new institution.

3.13 The cost of Phase I of the project has been estimated to be U.S. $347,000 and Moroccan DH_____, or a total cost the equivalent of U.S. $_____.

Figure 1

Phase I Project Cost Estimate

Item	US $	Moroccan Dirhams
1. Land		
a. Marrakesh research center, _____ hectares	—	?
b. 3 tree plantations, 2500 hectares total	—	?
c. 10 water pumping stations, approx. 5 hectares	—	?
d. 3 micro hydro generation plants, approx. 1.5 hectares	—	?

Figure 1 (con'd)

Item	U.S.$	Moroccan Dirhams
2. U.S. resident advisory services 2 man-years	$200,000	?
3. Training of Moroccans at U.S. institutions, 16 man-months	$37,000	?
4. Feasibility studies and preliminary designs		
a. Research center at Marrakesh 3 man-months	30,000	?
b. 3 fuelwood tree plantations, 1 man-month	10,000	?
c. 3 micro (0.2 MW) hydro plants 3 man-months	30,000	?
d. 10 wind or sun-powered water pumping stations, 3 man-months	30,000	?
5. Project direction and administration (GOM)		?
6. Contingency for price escalation (13 percent per year)	10,000	?
7. Phase I total cost	$347,000	?

3.14 Phase I of the project is expected to be financed as shown in Figure 2 below.

Figure 2

Phase I Financing Plan

Source	Percent	Amount (U.S. Dollars and U.S. Dollars Equivalent)
1. A.I.D. Grant	_____%	$347,000
2. Government of Morocco (MEM budget)	_____%	?
3. Government of Morocco (in-kind contributions, e.g. land)	_____%	?
4. Total	100%	$?

IV. PROJECT ANALYSIS

4.01 The purpose of this chapter is to provide a concise summary of mission and Government preliminary views concerning this project. More detailed technical, environmental, economic, financial, and sociological analysis and appraisal will be based upon the feasibility and design studies that will be financed by this grant, and they will be incorporated in a Phase II PP.

4.02 USAID/Rabat's program strategy is to concentrate limited U.S. bilateral aid resources on programs and projects that tend to shift the focus of Government resource allocation away from the urban and industrial sectors and towards the rural and agricultural sectors, particularly towards the least developed areas of Morocco and the rural poor majority. In the energy sector, the Government has itself concluded that the rural electrification program deserves major emphasis and that development of renewable energy resources may offer the best hope for a way to extend the benefits of cheap power to the rural population and to agricultural production. This proposed renewable energy project is thus an extension of USAID/Rabat's basic program strategy in Morocco. It reinforces the policies and programs of the MEM in the rural electrification subsector.

4.03 The MEM has expressed and demonstrated serious interest in this proposed project. This ministry appears to have considerable power, including a special mandate from the King, in moving the country toward greater energy independence. It has agreed to appoint a director for the new renewable energy research center at Marrakesh, to initiate the legislative process for the creation of the new research center, and to nominate the 30 professionals required to staff the new center. The Government has agreed to provide all the land required for the new center, the small hydro, solar, and wind-powered test sites, and the tree plantations; ~~and~~ land acquisitions are in process. The Government has further agreed to provide all the initial dirham costs for the project and to budget for and to provide for the subsequent costs of operating and maintaining the facilities that will be created by the project. See Annex A, Grant Application, for details. The Government is anxious to get started on the development and utilization of its renewable energy technology and to test the performance in Morocco of U.S. renewable energy equipment.

4.04 We have concluded that this project represents a unique and timely marriage of ~~the~~ Morocco's long-term development goals and A.I.D.'s program objectives for Morocco, ~~combined~~ coupled with the universal need to address higher and increasing energy costs. The proposed series of studies,

training and technical assistance should launch the GOM renewable energy program on a sound economic and technical basis, utilizing U.S. technology to the maximum, and adapting that which is found to be practical to the unique environment of Morocco.

V. PROJECT IMPLEMENTATION

5.01 The basic plan for implementation of this project is for the Ministry of Energy and Mines (MEM) to oversee the execution of feasibility and preliminary design studies with expert consultants contracted for by A.I.D. The MEM will be assisted in this function, and with the execution of the training elements of the project, by the resident renewable energy specialist contracted by A.I.D. The Office ~~of~~ National de l'Électricité (ONE) will participate actively in the study and design of the three micro hydro test facilities. The Department of Water and Forests, Ministry of Agriculture will participate actively in the study and design of three tree plantations. The ten solar and wind-powered water pumping tests will be carried out by the new Renewable Energy Center, in cooperation with the Ministry of the Interior, after it comes into being. Until it exists as an active institution, its functions will be performed by the Director of Energy, MEM. Contracting for the Phase II construction elements of the project will be carried out by the MEM.

5.02 The Ministry of Energy and Mines (MEM) was established in 1977 as a result of the Government's recognition of the

need for effective energy management. It consists of a secretariat and four principal departments: Energy, Mining Exploration, Mines, Research and Mining "Participations"

(to be consistent in Morocco)

Based on all the foregoing, we have concluded that the MEM has the experience and requisite implementation capability to oversee the execution of Phase I of this project

5.03 Phase I of this project will take about six months to execute. An estimated implementation schedule for Phase I is shown in Figure 3 below:

Figure 3

Phase I Implementation Schedule

1.	Phase I PP approval	Nov 1979
2.	Phase I grant agreement	Nov 1979
3.	AID direct recruitment of consultants for surveys and resident technical assistance	Dec 1979
4.	MEM nomination of participant trainees	Dec 1979
5.	Feasibility and preliminary design studies for renewable energy institute, tree plantations, hydro power plants, and wind or sun-powered pumping stations	Jan-Mar 1980
6.	Participant training in U.S.	Jan-Apr 1980
7.	U.S. resident technical advisory services begin	Feb 1980
8.	Phase II PP drafting	Mar 1980
9.	Phase II grant agreement amendment	Apr 1980

5.04 The four feasibility and design studies to be financed by the Phase I grant are distinctly different from each other in substantive content and in the kinds of technical expertise that will be required for each. The renewable energy research laboratory and facility primarily requires civil engineering and architectural expertise. The study of hydro power sites requires the services of an electrical engineer with specialized experience in micro hydro installations. The fuelwood plantation study requires the services of a fuelwood plantation silviculturist with arid-country experience. The sun and wind-powered water pumping study requires the services of engineers expert in irrigation hydraulics, windmill technology, solar thermal technology, and solar photo-voltaic technology. In addition, most studies will require auxiliary specialists in rural sociology, environmental appraisal, and economic and financial appraisal. A broad-guage, French speaking, renewable energy expert with overseas experience is required for the resident technical advisory services. Effective recruitment of the several different kinds of U.S. consultants can best be conducted in the U.S. with extensive use of the telephone to identify candidates, determine availability, and check references.

5.05 Different contracting modes may be appropriate for each of the different studies. For example, a personal services

contractor or an A.I.D. direct hire employee might be appropriate for the micro hydro study. A small architectural firm might be contracted for the design of the renewable energy center. Some studies might be suitable for a firm already contracted by A.I.D. on a requirements or indefinite quantity contract basis. A minority firm might be found to be suitable for one or more of the studies. Suitable A.I.D. requirements contracts are available for all consultant services other than the fuelwood plantation expert and the long-term resident advisor.

5.06 Time is of the essence. Each of the elements of consultant services required is relatively small and would hardly justify the trouble, expense, and time that international r. f. p.'s, that is, that host country contracting, would require. Accordingly, we believe A.I.D. direct recruitment and contracting for Phase I services is necessary and appropriate. See Annex I for the Mission Director's determination to that effect.

5.07 Grant funds will be provided by transfer from the Regional Energy Development account to the FY-80 Morocco bilateral program. Congress was notified during FY-79 of the then intention to obligate up to $1.3 million for this project. No new notification is required for this $347,000 FY-80 grant for the same purpose.

5.08 Fairly rapid disbursement is foreseen. Phase I PACD should be established about 30 months after agreement execution, and a terminal disbursement date six months from that date would provide ample time for any delayed payments. In any event, these dates are expected to be superceded by amendment of the grant to finance Phase II.

VI. COVENANTS AND CONDITIONS PRECEDENT

6.01 As a condition of securing this grant, the Kingdom of Morocco will be required to covenant as follows:

-- to pass legislation to establish a renewable energy research institution within the Ministry of Energy and Mines;

-- to budget for, and to provide, on a timely basis, all the funds required to operate and to maintain the new renewable energy research facility;

-- to budget for, and to provide, on a timely basis, all the funds required to finance the local currency costs of this project;

-- to participate with A.I.D. from time to time in the evaluation of the degree to which this project has attained its planned objectives;

-- to consult with A.I.D. frequently concerning the execution of the project and concerning problems that may arise that affect the timely implementation of the project;

-- to make available on an appropriate and timely basis all the land, including rights of way and water rights, required to carry out the project;

-- to operate, maintain, and administer, in accordance with the best standard practices, all the facilities and infrastructure that may be created by this project, throughout the useful life of such infrastructure. See Annex C, Draft Grant Agreement.

6.02 As a condition of securing initial disbursement of the grant proceeds, the Kingdom of Morocco will be required to provide in form and substance satisfactory to A.I.D.:

-- the names and specimen signatures of the person or persons authorized to represent the Grantee in all matters pertaining to this grant;

-- evidence that funds to finance the estimated local currency costs for Phase I of the project have been budgeted for and are available for disbursement;

-- evidence that the legislative process to establish a renewable energy research facility with the Ministry of Energy and Mines has been initiated;

-- evidence that all the land required for the project has been acquired by the Government and is available for the project;

-- evidence that a well-qualified director for the new renewable energy research facility has been appointed.

VII. EVALUATION PLAN

7.01 The objectively verifiable indicators of the degree to which this project has achieved its purposes are:

(1) a feasibility and preliminary design study for the renewable energy laboratory and research facility ~~of~~ at Marrakesh, with reasonably firm foreign exchange and local currency cost estimates, adequate to justify authorization of construction funds and final design, preparation of equipment specifications, and issuance of bidding documents;

(2) acquisition of the long-term services of a well qualified U.S. renewable energy expert to provide advisory services to the MEM for the development of Morocco's renewable energy program;

(3) a feasibility and preliminary design study for three micro hydro power generation and distribution facilities in the Atlas Mountains, adequate to provide the basis for a definitive judgement as to whether or not funds for construction of the three facilities should be authorized;

(4) a feasibility and preliminary design study for the 2500-hectare fuelwood tree plantations near Marrakesh, with reasonably firm cost estimates, adequate to justify authorization of construction funds, and commencment of land preparation and seedling procurement;

(5) a feasibility and preliminary design study for ten irrigation pumping stations, with reasonably firm foreign exchange and local currency cost estimates, adequate to justify authorization of construction funds, preparation of specifications, and issuance of bidding documents;

(6) five Moroccan professional employees of the MEM, trained in the U.S. in renewable energy technology, and returned to Morocco to form the cadre of the new renewable energy research center.

7.02 USAID/Rabat and the MEM expect to review and evaluate the above points together in the course of preparing a PP for the Phase II grant that is expected to be the ultimate objective of Phase I.

ATTACHMENT 3B. HONDURAS ECONOMIC DEVELOPMENT SHEET

	Actuals 1967	Actuals 1972	Actuals 1976	Actuals 1977	Actuals 1978	Projected 5/ 1979	Projected 5/ 1980	Projected 5/ 1981	Projected 5/ 1982	Projected 5/ 1987	Annual Growth Rate 1967-72	Annual Growth Rate 1972-77	Annual Growth Rate 1977-82	Annual Growth Rate 1982-87	Percent of GDP 1977
A. NATIONAL ACCOUNTS (ON MILLION, 1969 PRICES)															
1. GROSS DOMESTIC PRODUCT	15510,000	20400,000	27387,000	29028,000	30510,000	31427,000	33100,000	34859,000	36839,000	46843,000	5,600	7,300	6,000	6,300	100,000
2. TERMS OF TRADE ADJUSTMENT	95,000	-402,000	-407,000	-725,000	152,000	370,000	495,000	685,000	802,000	1106,000	-	-	-	-	2,500
3. GROSS DOMESTIC INCOME	15613,000	20006,000	26980,000	28303,000	30662,000	31797,000	33603,000	35544,000	37641,000	55947,000	5,100	7,200	5,000	6,300	97,500
4. IMPORTS	3237,000	3803,000	7220,000	6815,000	7170,000	7148,000	7465,000	7791,000	8276,000	13932,000	3,300	16,070	8,300	10,900	27,600
5. EXPORTS	-2743,000	-4676,000	-3928,000	-4351,000	-4639,000	-5107,000	-5625,000	-6180,000	-6639,000	-10265,000	7,900	1,300	9,500	9,100	19,000
6. EXPORTS, TT ADJUSTMENT	-2868,000	-3674,000	-3962,000	-4334,000	-4791,000	-5477,000	-6120,000	-6791,000	-7441,000	-11369,000	4,900	9,400	12,300	8,800	14,900
7. RESOURCE GAP, TT ADJUSTMENT	349,000	149,000	3499,000	4387,000	2379,000	1671,000	1345,000	1088,000	833,000	2563,000	-	-	-	-	19,100
8. TOTAL CONSUMPTION	14163,000	18620,000	23467,000	24352,000	25841,000	27439,000	28620,000	30107,000	31579,000	42357,000	4,900	6,200	5,200	6,000	83,900
9. PRIVATE CONSUMPTION	12230,000	15431,000	17466,000	18072,000	20901,000	22084,000	22489,000	23976,000	25103,000	32275,000	4,700	5,200	4,000	5,000	62,300
10. GOVERNMENT CONSUMPTION	1934,000	2507,000	6203,000	6280,000	4940,000	5355,000	5739,000	6131,000	6476,000	9082,000	6,200	19,300	6,000	7,000	21,600
11. GROSS FIXED INVESTMENT	1666,000	2441,000	4400,000	4280,000	6600,000	5800,000	5900,000	6000,000	6400,000	15500,000	4,200	27,700	-5,000	13,400	23,400
12. CHANGE IN STOCKS	-62,000	156,000	-597,000	-2000,000	600,000	229,000	429,000	438,000	495,000	653,000	-	-	-	-	6,900
13. DOMESTIC SAVINGS	1385,000	2866,000	3560,000	4676,000	4021,000	4358,000	4975,000	5637,000	6062,000	13890,000	11,900	14,500	4,000	17,500	16,100
14. NATIONAL SAVINGS	1224,000	2691,000	4540,000	5581,000	5849,000	5304,000	5651,000	6303,000	6377,000	14490,000	17,000	35,700	2,000	16,100	19,220
15. GROSS DOMESTIC PRODUCT (IN MILLION CURRENT PRICES)	3091,000	4037,000	9301,000	10397,000	12302,000	13410,000	14097,000	16562,000	18407,000	34931,000	9,010	16,060	10,400	13,700	
16. GROSS NATIONAL PRODUCT (IN MILLION CURRENT PRICES)	3034,000	4000,000	9349,000	10775,000	12600,000	13704,000	15253,000	16913,000	18885,000	35600,000	10,400	16,700	10,000	13,600	
B. SECTOR OUTPUT	(Shares of GDP at current prices)														
1. AGRICULTURE	21,700	21,600	19,500	16,300	18,300	17,300	17,400	17,600	17,000	16,600					
2. MINING	4,100	3,600	5,500	5,300	5,400	6,000	6,100	6,200	6,100	6,700					
3. ENERGY, MANUF., CONSTR.	24,400	24,500	24,700	27,900	28,300	28,400	29,200	29,900	29,900	35,100					
4. OTHER SERVICES	49,600	50,300	48,300	50,500	48,000	48,200	47,600	46,900	46,200	41,600					
C. PRICES															
1. EXPORT PRICE INDEX	1,002	1,044	1,932	1,932	2,210	2,453	2,655	2,896	3,114	4,002					
2. IMPORT PRICE INDEX	0,969	1,186	2,155	2,310	2,100	2,200	2,400	2,602	2,770	3,605					
3. TERMS OF TRADE INDEX	0,996	0,999	1,041	1,025	1,033	1,072	1,066	1,112	1,121	1,100					
4. GROSS DOMESTIC PRODUCT DEFLATOR	0,993	1,113	1,500	1,613	1,616	1,922	2,026	2,137	2,250	2,040					
5. EXCHANGE RATE(US PER $)	0,196	0,218	0,226	0,222	0,222	0,222	0,222	0,222	0,222	0					
D. SELECTED INDICATORS	1967-72	1972-77	1977-82	1982-87											
1. ICOR	2,950	3,140	3,700	2,750											
2. IMPORT ELASTICITY/GDP	1,130	2,910	6,100	1,300											
3. AVERAGE NATIONAL SAVING RATE	11,100	22,500	19,000	22,400											
4. MARGINAL NATIONAL SAVING RATE	21,500	37,000	11,000	42,200											
5. IMPORTS/GDP	20,100	23,600	25,100	24,000											
6. INVESTMENT/GDP	13,900	22,500	17,000	24,000											
7. RESOURCE GAP/GDP	2,100	7,600	7,200	2,900											
E. LABOR FORCE 1/	1971 1/	1977 1/	Growth Rate												
1. AGRICULTURE	1946,000	2100,000	1,000												
2. INDUSTRY	593,000	900,000	7,200												
3. SERVICES	429,000	610,000	7,300												
4. GOVERNMENT	266,000	360,000	5,200												
5. TOTAL EMPLOYMENT	3232,000	4170,000	2,500												
6. TOTAL LABOR FORCE	1375,000	4840,000	6,400												
7. ENLARGED UNEMPLOYED 4/	500,000	770,000	7,500												
F. GENERAL GOVERNMENT FINANCES	1967	1972	1976	1977	Projection 78										
1. CURRENT REVENUES (EXCL PROFIT TRANSFERS)	14,700	14,400	20,100	23,000	22,400										
2. CURRENT EXPENDITURES 1/	1,000	0	2,500	2,100	1,600										
3. CURRENT SURPLUS	13,500	14,700	17,600	19,000	18,000										
4. INVESTMENT	1,200	0,650	2,500	4,000	4,400										
5. FIXED INVESTMENT	6,900	5,100	9,600	22,000	11,400										
	6,000	8,500	9,600	18,200	5,700										

1/ Including debt services and subsidies
2/ Including defense and capital transfers
3/ 1971 census and 1976 to be provided by Planning Services for 1977
4/ Total [illegible] between 250,000 and 300,000
5/ [illegible] the Basic Economic Mission.

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ANNEX 2

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TABLE 3A
MOROCCO - SOCIAL INDICATORS DATA SHEET

	MOROCCO			REFERENCE GROUPS (ADJUSTED AVERAGES /a - MOST RECENT ESTIMATE)		
	1960 /b	1970 /b	MOST RECENT ESTIMATE /b	SAME GEOGRAPHIC REGION /c	SAME INCOME GROUP /d	NEXT HIGHER INCOME GROUP /e
LAND AREA (THOUSAND SQ. KM.)						
TOTAL 459.9 /f						
AGRICULTURAL 157.8						
GNP PER CAPITA (US$)	190.0	290.0	570.0	1438.5	432.3	867.2
ENERGY CONSUMPTION PER CAPITA (KILOGRAMS OF COAL EQUIVALENT)	148.0	180.0	274.0	816.7	251.7	578.3
POPULATION AND VITAL STATISTICS						
TOTAL POPULATION, MID-YEAR (MILLIONS)	11.6	14.8	17.7	.	.	.
URBAN POPULATION (PERCENT OF TOTAL)	29.3	32.2	39.5	45.8	24.2	46.2
POPULATION DENSITY						
PER SQ. KM.	26.0	33.0	39.0 /g	23.2	42.7	50.8
PER SQ. KM. AGRICULTURAL LAND	61.0	74.0	112.0	112.4	95.0	93.3
POPULATION AGE STRUCTURE (PERCENT)						
0-14 YRS.	44.3	46.4	45.8	46.0	44.9	42.9
15-64 YRS.	51.7	51.1	51.6	50.6	52.8	53.5
65 YRS. AND ABOVE	4.0	2.5	2.6	3.3	3.0	3.5
POPULATION GROWTH RATE (PERCENT)						
TOTAL	2.6	2.4	2.4	2.9	2.7	2.5
URBAN	6.4	4.0	4.8	5.0	8.8	4.7
CRUDE BIRTH RATE (PER THOUSAND)	50.4	49.2	44.5	45.0	42.2	37.8
CRUDE DEATH RATE (PER THOUSAND)	24.2	18.5	13.4	13.7	12.4	10.8
GROSS REPRODUCTION RATE	3.4 /h	3.4	3.3	3.4	3.2	2.5
FAMILY PLANNING						
ACCEPTORS, ANNUAL (THOUSANDS)	..	25.1	68.0	.	.	.
USERS (PERCENT OF MARRIED WOMEN)	..	3.0	5.4	14.7	14.2	20.0
FOOD AND NUTRITION						
INDEX OF FOOD PRODUCTION PER CAPITA (1970=100)	118.7	100.0	86.0	107.1	104.3	107.3
PER CAPITA SUPPLY OF						
CALORIES (PERCENT OF REQUIREMENTS)	90.0	102.0	108.0	99.2	99.5	105.3
PROTEINS (GRAMS PER DAY)	43.0	64.0	70.5	63.4	56.8	63.0
OF WHICH ANIMAL AND PULSE	..	14.0 /i	15.6	16.4	17.5	21.7
CHILD (AGES 1-4) MORTALITY RATE	..	..	..	..	7.5	8.0
HEALTH						
LIFE EXPECTANCY AT BIRTH (YEARS)	45.6	50.4	53.0	53.7	53.3	57.2
INFANT MORTALITY RATE (PER THOUSAND)	149.0 /h	..	130.0	77.7	82.5	53.9
ACCESS TO SAFE WATER (PERCENT OF POPULATION)						
TOTAL	..	51.0	..	59.1	31.1	56.8
URBAN	..	92.0	..	85.9	68.5	79.0
RURAL	..	28.0	..	38.0	18.2	31.8
ACCESS TO EXCRETA DISPOSAL (PERCENT OF POPULATION)						
TOTAL	..	29.0	..	64.3	37.5	30.9
URBAN	..	75.0	..	94.5	69.5	45.4
RURAL	..	4.0	..	27.7	25.4	16.1
POPULATION PER PHYSICIAN	9700.0 /h	12650.0	12400.0	4271.6	9359.2	2706.8
POPULATION PER NURSING PERSON	..	2820.0	1500.0	2077.4	2762.5	1462.0
POPULATION PER HOSPITAL BED						
TOTAL	680.0	660.0	710.0	580.2	786.5	493.3
URBAN	..	460.0	..	310.0	275.4	329.6
RURAL	..	2980.0	..	..	1358.4	2947.9
ADMISSIONS PER HOSPITAL BED	..	15.5	16.5	22.0	19.2	22.1
HOUSING						
AVERAGE SIZE OF HOUSEHOLD						
TOTAL	4.8	5.5	..	5.4	..	5.2
URBAN	4.2	4.9	..	..	..	5.0
RURAL	5.4	5.8	..	..	..	5.4
AVERAGE NUMBER OF PERSONS PER ROOM						
TOTAL	2.2	2.4	..	..	..	2.0
URBAN	2.1	2.1	..	1.8	2.3	1.5
RURAL	2.2	2.6	..	..	..	2.7
ACCESS TO ELECTRICITY (PERCENT OF DWELLINGS)						
TOTAL	25.3 /j	..	..	40.3	28.3	54.1
URBAN	85.4 /j	48.4	49.0	..	..	47.8

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TABLE 2A
MOROCCO - SOCIAL INDICATORS DATA SHEET

	MOROCCO			REFERENCE GROUPS (ADJUSTED AVERAGES) /a - MOST RECENT ESTIMATE		
	1960 /b	1970 /b	MOST RECENT ESTIMATE /b	SAME GEOGRAPHIC REGION /c	SAME INCOME GROUP /d	NEXT HIGHER INCOME GROUP /e
EDUCATION						
ADJUSTED ENROLLMENT RATIOS						
PRIMARY: TOTAL	47.0	52.0	63.0	80.9	75.0	99.8
FEMALE	27.0	37.0	47.0	61.8	67.9	93.3
SECONDARY: TOTAL	5.0	13.0	17.0	23.6	17.7	33.8
FEMALE	2.0	7.0	12.0	18.2	12.9	29.8
VOCATIONAL (PERCENT OF SECONDARY)	..	2.0	3.0	6.7	7.4	12.8
PUPIL-TEACHER RATIO						
PRIMARY	43.0	34.0	40.0	31.5	34.3	34.9
SECONDARY	..	20.0	22.0	22.3	23.5	22.2
ADULT LITERACY RATE (PERCENT)	17.0	21.0	28.0	50.1	63.7	71.8
CONSUMPTION						
PASSENGER CARS PER THOUSAND POPULATION	11.0	15.0	18.0	14.5	7.2	12.4
RADIO RECEIVERS PER THOUSAND POPULATION	46.0	60.0	77.0	125.8	71.1	104.5
TV RECEIVERS PER THOUSAND POPULATION	0.4	11.0	23.0	34.5	14.1	28.1
NEWSPAPER ("DAILY GENERAL INTEREST") CIRCULATION PER THOUSAND POPULATION	22.0	16.0	14.0	17.4	16.3	45.2
CINEMA ANNUAL ATTENDANCE PER CAPITA	2.0	..	1.6	1.6	1.6	4.6
EMPLOYMENT						
TOTAL LABOR FORCE (THOUSANDS)	3250.0	3980.0	4930.0	.	.	.
FEMALE (PERCENT)	10.6	13.2	19.0	9.3	28.0	25.7
AGRICULTURE (PERCENT)	56.4	49.9	42.5	42.0	54.1	46.2
INDUSTRY (PERCENT)	11.3	14.9	18.1	..	..	..
PARTICIPATION RATE (PERCENT)						
TOTAL	28.0	26.3	27.0	26.9	37.8	33.8
MALE	50.1	44.5	44.4	46.6	50.3	48.1
FEMALE	5.9	8.0	10.3	5.3	20.9	17.3
ECONOMIC DEPENDENCY RATIO	2.0	1.9	1.8	1.9	1.3	1.4
INCOME DISTRIBUTION						
PERCENT OF PRIVATE INCOME RECEIVED BY						
HIGHEST 5 PERCENT OF HOUSEHOLDS	18.0 /k	20.0 /k	..	..	19.5	23.6
HIGHEST 20 PERCENT OF HOUSEHOLDS	43.3 /k	49.0 /k	..	..	48.9	52.3
LOWEST 20 PERCENT OF HOUSEHOLDS	7.0 /k	4.0 /k	..	..	5.9	4.3
LOWEST 40 PERCENT OF HOUSEHOLDS	18.0 /k	12.0 /k	..	..	15.7	13.1
POVERTY TARGET GROUPS						
ESTIMATED ABSOLUTE POVERTY INCOME LEVEL (US$ PER CAPITA)						
URBAN	107.0	157.0	288.0	..	155.9	191.9
RURAL	66.0	101.0	174.0	142.0	97.9	193.1
ESTIMATED RELATIVE POVERTY INCOME LEVEL (US$ PER CAPITA)						
URBAN	..	..	189.0	236.1	143.7	319.8
RURAL	..	..	..	144.7	87.3	197.7
ESTIMATED POPULATION BELOW POVERTY INCOME LEVEL (PERCENT)						
URBAN	59.0	39.0	34.0	21.5	22.9	19.8
RURAL	49.0	45.0	45.0	37.4	26.7	35.1

.. Not available
. Not applicable.

NOTES

/a The adjusted group averages for each indicator are population-weighted geometric means, excluding the extreme values of the indicator and the most populated country in each group. Coverage of countries among the indicators depends on availability of data and is not uniform.

/b Unless otherwise noted, data for 1960 refer to any year between 1959 and 1961; for 1970, between 1969 and 1971; and for most recent estimate, between 1973 and 1977.

/c North Africa & Middle East; /d Lower Middle Income ($281-550 per capita, 1976); /e Intermediate Middle Income ($551-1135 per capita, 1976); /f Including Moroccan provinces in Western Sahara; /g Excluding Moroccan provinces in W. Sahara; /h 1962; /i Av. 1964-66; /j Brick building 20.7; /k Consumption expenditures of households.

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DEFINITIONS OF SOCIAL INDICATORS

Notes: The adjusted group averages for each indicator are population-weighted geometric means, [illegible] of the indicator and the most populated [illegible] in each group. Coverage of countries among the indicators depends on availability of data [illegible] to lack of data. group averages for Capital Surplus Oil Exporters and indicators of access to water and excreta disposal, [illegible] income distribution and poverty are simple population-weighted geometric means without the exclusion of extreme values.

LAND AREA (thousand sq. km)
Total - Total surface area comprising land area and inland waters.
Agricultural - [illegible] estimate of agricultural area used temporarily or permanently for crops, pastures, market and kitchen gardens or to lie fallow.

GNP PER CAPITA (US $) - GNP per capita estimates at current market prices, calculated by same conversion method as World Bank Atlas (1975-77 basis); 1960, 1970, and 1977 data.

ENERGY CONSUMPTION PER CAPITA - Annual consumption of commercial energy (coal and lignite, petroleum, natural gas and hydro-, nuclear and geothermal electricity) in kilograms of coal equivalent per capita.

POPULATION AND VITAL STATISTICS
Total population, mid-year (millions) - As of July 1; if not available, average of two end-year estimates; 1960, 1970, and 1977 data.
Urban population (percent of total) - Ratio of urban to total population; different definitions of urban areas may affect comparability of data among countries.
Population density
Per sq. km. - Mid-year population per square kilometer (100 hectares) of total area.
Per sq. km. agriculture land - Computed as above for agricultural land only.
Population age structure (percent) - Children (0-14 years), working-age (15-64 years), and retired (65 years and over) as percentages of mid-year population.
Population growth rate (percent) - total, and urban - Compound annual growth rates of total and urban mid-year populations for 1950-60, 1960-70, and 1970-75.
Crude birth rate (per thousand) - Annual live births per thousand of mid-year population; ten-year arithmetic averages ending in 1960 and 1970 and five-year average ending in 1975 for most recent estimate.
Crude death rate (per thousand) - Annual deaths per thousand of mid-year population; ten-year arithmetic averages ending in 1960 and 1970 and five-year average ending in 1975 for most recent estimate.
Gross reproduction rate - Average number of daughters a woman will bear in her normal reproductive period if she experiences present age-specific fertility rates; usually five-year averages ending in 1960, 1970, and 1975.
Family planning - acceptors, annual (thousands) - Annual number of acceptors of birth-control devices under auspices of national family planning program.
Family planning - users (percent of married women) - Percentage of married women of child-bearing age (15-44 years) who use birth-control devices to all married women in same age group.

FOOD AND NUTRITION
Index of food production per capita (1970=100) - Index number of per capita annual production of all food commodities.
Per capita supply of calories (percent of requirements) - Computed from energy equivalent of net food supplies available in country per capita per day. Available supplies comprise domestic production, imports less exports, and changes in stock. Net supplies exclude animal feed, seeds, quantities used in food processing, and losses in distribution. Requirements were estimated by FAO based on physiological needs for normal activity and health considering environmental temperature, body weights, age and sex distributions of population, and allowing 10 percent for waste at household level.
Per capita supply of protein (grams per day) - Protein content of per capita net supply of food per day. Net supply of food is defined as above. Requirements for all countries established by USDA provide for a minimum allowance of 60 grams of total protein per day and 20 grams of animal and pulse protein, of which 10 grams should be animal protein. These standards are lower than those of 75 grams of total protein and 23 grams of animal protein as an average for the world, proposed by FAO in the Third World Food Survey.
Per capita protein supply from animal and pulse - Protein supply of food derived from animals and pulses in grams per day.
Child (ages 1-4) mortality rate (per thousand) - Annual deaths per thousand in age group 1-4 years, to children in this age group.

HEALTH
Life expectancy at birth (years) - Average number of years of life remaining at birth; usually five-year averages ending in 1960, 1970, and 1975.
Infant mortality rate (per thousand) - Annual deaths of infants under one year of age per thousand live births.
Access to safe water (percent of population) - total, urban, and rural - Number of people (total, urban, and rural) with reasonable access to safe water supply (includes treated surface waters or untreated but uncontaminated water such as that from protected boreholes, springs, and sanitary wells) as percentages of their respective populations. In an urban area a public fountain or standpost located not more than 200 meters from a house may be considered as being within reasonable access of that house. In rural areas reasonable access would imply that the housewife or members of the household do not have to spend a disproportionate part of the day in fetching the family's water needs.
Access to excreta disposal (percent of population) - total, urban, and rural - Number of people (total, urban, and rural) served by excreta disposal as percentages of their respective populations. Excreta disposal may include the collection and disposal, with or without treatment, of human excreta and waste-water by water-borne systems or the use of pit privies and similar installations.
Population per physician - Population divided by number of practicing physicians qualified from a medical school at university level.
Population per nursing person - Population divided by number of practicing male and female graduate nurses, practical nurses, and [illegible]

Population per hospital bed - total, urban, and rural - Population (total, urban, and rural) divided by their respective number of hospital beds available in [illegible] hospitals and rehabilitation centers [illegible] at least one physician. [illegible] care are not included. [illegible] health and medical centers not permanently staffed by a physician [illegible] a medical assistant, [illegible] and provide a limited range of [illegible].
Admissions per hospital bed - Total number of admissions to or discharges from hospitals divided by the number of beds.

HOUSING
Average size of household (persons per household) - total, urban, and rural - A household consists of a group of individuals who share living quarters and their main meals. A boarder or lodger may or may not be included in the household for statistical purposes. Statistical definitions of household vary.
Average number of persons per room - total, urban, and rural - Average number of persons per room in all, urban, and rural occupied conventional dwellings, respectively. Dwellings exclude non-permanent structures and unoccupied parts.
Access to electricity (percent of dwellings) - total, urban, and rural - Conventional dwellings with electricity in living quarters as percentage of total, urban, and rural dwellings respectively.

EDUCATION
Adjusted enrollment ratios
Primary school - total, and female - Total and female enrollment of all ages at the primary level as percentages of respectively primary school-age populations; normally includes children aged 6-11 years but adjusted for different lengths of primary education; for countries with universal education enrollment may exceed 100 percent since some pupils are below or above the official school age.
Secondary school - total, and female - Computed as above; secondary education requires at least four years of approved primary instruction; provides general vocational, or teacher training instructions for pupils usually of 12 to 17 years of age; correspondence courses are generally excluded.
Vocational enrollment (percent of secondary) - Vocational institutions include technical, industrial, or other programs which operate independently or as departments of secondary institutions.
Pupil-teacher ratio - primary, and secondary - Total students enrolled in primary and secondary levels divided by numbers of teachers in the corresponding levels.
Adult literacy rate (percent) - Literate adults (able to read and write) as a percentage of total adult population aged 15 years and over.

CONSUMPTION
Passenger cars (per thousand population) - Passenger cars comprise motor cars seating less than eight persons; excludes ambulances, hearses and military vehicles.
Radio receivers (per thousand population) - All types of receivers for radio broadcasts to general public per thousand of population; excludes unlicensed receivers in countries and in years when registration of radio sets was in effect; data for recent years may not be comparable since most countries abolished licensing.
TV receivers (per thousand population) - TV receivers for broadcast to general public per thousand population; excludes unlicensed TV receivers in countries and in years when registration of TV sets was in effect.
Newspaper circulation (per thousand population) - Shows the average circulation of "daily general interest newspaper," defined as a periodical publication devoted primarily to recording general news. It is considered to be "daily" if it appears at least four times a week.
Cinema annual attendance per capita per year - Based on the number of tickets sold during the year, including admissions to drive-in cinemas and mobile units.

EMPLOYMENT
Total labor force (thousands) - Economically active persons, including armed forces and unemployed but excluding housewives, students, etc. Definitions in various countries are not comparable.
Female (percent) - Female labor force as percentage of total labor force.
Agriculture (percent) - Labor force in farming, forestry, hunting and fishing as percentage of total labor force.
Industry (percent) - Labor force in mining, construction, manufacturing and electricity, water and gas as percentage of total labor force.
Participation rate (percent) - total, male, and female - Total, male, and female labor force as percentages of their respective populations. These are ILO's adjusted participation rates reflecting age-sex structure of the population, and long time trend.
Economic dependency ratio - Ratio of population under 15 and 65 and over to the labor force in age group of 15-64 years.

INCOME DISTRIBUTION
Percentage of private income (both in cash and kind) received by richest 5 percent, richest 20 percent, poorest 20 percent, and poorest 40 percent of households.

POVERTY TARGET GROUPS
Estimated absolute poverty income level (US$ per capita) - urban and rural - Absolute poverty income level is that income level below which a minimal nutritionally adequate diet plus essential non-food requirements is not affordable.
Estimated relative poverty income level (US$ per capita) - urban and rural - Relative poverty income level is that income level less than one-third of average per capita personal income of the country.
Estimated population below poverty income level (percent) - urban and rural - Percent of population (urban and rural) who are either "absolute poor" or "relative poor" whichever is greater.

ATTACHMENT 4A, BALANCE OF PAYMENTS AND EXTERNAL ASSISTANCE
(MILLIONS OF US DOLLARS; CURRENT MARKET PRICES)

	Actuals					Projected 3/						
	1967	1972	1976	1977	1978	1979	1980	1981	1982	1983	1987	1992
A. SUMMARY OF BALANCE OF PAYMENTS	*	*	*	*	*	*	*	*	*	*	*	*
1. EXPORTS, INCL. NFS	555.0	949.0	1717.0	1/1868.0	1/2240.0	2783.0	3310.0	3924.0	4592.0	5337.0	9306.0	19059.0
2. IMPORTS, EXCL. NFS	623.0	976.0	3519.0	4126.0	3954.0	3632.0	4045.0	4502.0	5105.0	5883.0	11403.0	18642.0
3. RESOURCE BALANCE	-68.0	-27.0	-1802.0	-2258.0	-1714.0	-849.0	-729.0	-578.0	-513.0	-546.0	-2097.0	-583.0
4. NET FACTOR SERVICES	-47.0	37.0	378.0	379.0	416.0	367.0	355.0	371.0	414.0	457.0	866.0	931.0
4.1. NET INTEREST PAYMENTS	-17.0	-29.0	-57.0	-129.0	-187.0	-236.0	-290.0	-319.0	-325.0	-324.0	-447.0	-722.0
4.2. NET INVESTMENT INCOME	- 2.0	-28.0	-42.0	- 29.0	-54.0	-98.0	-109.0	-120.0	-132.0	-154.0	-150.0	-150.0
4.3. WORKER'S REMITTANCES	41.0	139.0	547.0	589.0	741.0	751.0	804.0	860.0	921.0	985.0	1313.0	1853.0
4.4. OTHER (NET)	-52.0	-16.0	-70.0	-52.0	-84.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0
5. CURRENT TRANSFERS(NET)	13.0	42.0	69.0	52.0	48.0	48.0	52.0	55.0	58.0	63.0	83.0	116.0
6. CURRENT ACCOUNT BALANCE	-92.0	55.0	-1355.0	-1827.0	-1250.0	-434.0	-322.0	-152.0	-41.0	-26.0	-1348.0	464.0
7. PRIVATE DIRECT INVESTMENT (NET)	9.0	24.0	38.0	53.0	53.0	70.0	77.0	85.0	93.0	102.0	150.0	241.0
8. PUBLIC M & LT LOANS	*	*	*	*	*	*	*	*	*	*	*	*
8.1. DISBURSEMENTS	88.0	111.0	732.0	1273.0	792.0	823.0	966.0	933.0	942.0	1089.0	2411.0	1569.0
8.2. REPAYMENTS	-29.0	-78.0	-84.0	-105.0	294.0	-426.0	-652.0	-789.0	-893.0	-856.0	-945.0	-1954.0
8.3. NET DISBURSEMENTS	59.0	33.0	648.0	1168.0	498.0	397.0	314.0	144.0	49.0	233.0	1466.0	-385.0
9. SHORT TERM CAPITAL (NET)	-16.0	-32.0	29.0	68.0	-5.0	*	*	*	*	*	*	*
10. NET USE OF IMF RESOURCES	0	12.0	195.0	*	34.0	70.0	8.0	91.0	12.0	11.0	*	*
11. CAPITAL N.E.I. 2/	-32.0	95.0	559.0	579.0	-38.0	*	*	*	*	*	*	*
12. CHANGE IN RESERVES	-19.0	-75.0	-114.0	-41.0	32.0	37.0	-61.0	14.0	-89.0	-298.0	-268.0	-320.0
13. LEVEL OF RESERVES	*	*	*	*	*	*	*	*	*	*	*	*
13.1. AMOUNT	21.0	237.0	491.0	532.0	500.0	463.0	524.0	510.0	599.0	897.0	1876.0	3083.0
13.2. MONTH'S IMPORTS	0.4	2.9	2.0	1.8	1.5	1.5	1.6	1.5	1.5	1.8	1.9	2.0
B. GRANT & LOAN COMMITMENTS	*	*	*	*	*	*	*	*	*	*	*	*
1. OFFICIAL GRANTS	25.0	17.0	15.0	10.0	*	*	*	*	*	*	*	*
2. TOTAL PUBLIC M & LT LOANS	88.0	179.0	969.0	1930.0	1344.0	*	*	*	*	*	*	*
2.1. IBRD/IDA	8.0	97.0	150.0	166.0	133.0	*	*	*	*	*	*	*
2.2. OTHER INT'L INSTITUTIONS	0	0	4.0	10.0	17.0	*	*	*	*	*	*	*
2.3. GOVERNMENTS	80.0	63.0	144.0	653.0	220.0	*	*	*	*	*	*	*
2.4. SUPPLIER'S CREDITS	0	16.0	8.0	163.0	9.0	*	*	*	*	*	*	*
2.5. COMMERCIAL BANKS	0	3.0	603.0	936.0	965.0	*	*	*	*	*	*	*
C. MEMO ITEMS	*	*	*	*	*	*	*	*	*	*	*	*
1. GRANT ELEMENT(%)	*	30.6	13.9	11.2	6.9	*	*	*	*	*	*	*
2. AVERAGE INTEREST(%)	*	5.3	7.2	7.5	7.5	*	*	*	*	*	*	*
3. AVERAGE MATURITY(YEARS)	*	22.3	11.7	10.1	7.5	*	*	*	*	*	*	*

1/ Including special military import payments which are tentatively estimated by the mission at $590 million in 1976 and $530 million in 1977.

2/ Including grants.

3/ Projections are being revised by the Basic Economic Mission.

March 26, 1979
EMENA CT IIc

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Enclosure
Rabat A- 55

Retail Prices, Duty and Taxes on Petroleum Products as of July 1, 1979

Post Location	Exchange Rate	Petroleum Products	Retail Prices	Includes Duty	Includes Taxes
Morocco	US$1 = DH 3.90	Motor Gasoline			
		Regular	$2.57 US GAL.	N.A.**	64.55%
		Premium	$2.77 US GAL.	N.A.**	65.65%
Estimated Population:		Household kerosene	$1.21 US GAL.	N.A.**	45.00%
		Motor Lubricating Oil	$7.76*** US GAL.	12.50%	N.A.
19,000,000		Distillate, Gas Oil and Diesel	$1.21 US GAL.	N.A.**	41.55%
		Bunker "C" Fuel Oil (Heavy Fuel Oil No. 2)*	$137.18 Metric Ton	N.A.**	16.66%

* Heavy fuel oil No. 2: Price listed is wholesale price, since there is no retail price.

** Most petroleum products are refined locally, and crude imported for this purpose is duty-free. A small part of Morocco's requirements for refined products are imported, and a duty of 10 percent ad valorem plus 8 percent special tax, are paid on such imports.

*** Motor lubricating oil: basic components imported and blended locally with insufficient national production in a wide variety of qualities. Retail prices vary from US$6 to US$9 per US GAL.

SOURCE: Ministry of Energy and Mines

AID 1020-28 (1-77)

Phase I Annex H

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Title of Project (Phase I)
From FY 80 to FY 80
Total U.S. Funding
Date Prepared 01 10 1979

Project Title & Number: Morocco: Renewable Energy Development, 608-0159

I NARRATIVE SUMMARY	II OBJECTIVELY VERIFIABLE INDICATORS	III MEANS OF VERIFICATION	IV IMPORTANT ASSUMPTIONS
A. Program or Sector Goal: The broader objective to which this project contributes: (Phase I and II) Develop and utilize Morocco's renewable energy resources and thereby increase production and improve living standards, particularly in remote rural areas, decrease dependence on imported fuel, and conserve domestic sources of deplotable fuel.	Measures of Goal Achievement: (Phase I and II) Incorporation of renewable energy, at about 10 percent of total energy, in all national energy sector plans and forecasts; inclusion of renewable energy as a line item in the budget of each major ministry of the Government.	(Phase I and II) -Energy sector planning documents -Ministry of Energy and Mines reports -Annual budgets of each ministry	Assumptions for achieving goal targets: (Phases I and II) That the Government will utilize test results to provide a sound basis for an investment program in renewable energy infrastructure, particularly in rural areas remote from conventionally generated grid power.
B. Project Purpose: (Phases I and II) Create a renewable energy laboratory and research institution within the Ministry of Energy and Mines and a renewable energy research and demonstration program	Conditions that will indicate purpose has been achieved: End of project status. (Phase I) 1. Feasibility study reports for the renewable energy facility and for three companion test and demonstration subprojects in hand at MEM 2. Preliminary designs and cost estimates for the four facility increments in hand at MEM	Phase I -Examination of consultant reports -Examination of MEM training reports -Visits to the MEM	Assumptions for achieving purpose: (Phase I) (Same as Block IV. C. below)
C. Outputs (Phase I) 1. Feasibility studies and preliminary designs for A. research laboratory and center; B. 3 micro hydro generation and distribution facilities; C. 2500 hectares of fuelwood tree plantations; D. 10 irrigation wind or sun-powered pumping stations. 2. Five Moroccan professionals trained in renewable energy in the U.S. 3. One resident U.S. energy advisor contracted for 2 years.	Magnitude of Outputs 3. Resident renewable energy advisor at work with the MEM 4. Five Moroccan professionals trained in the U.S. in renewable energy and at work in the new R.E.C., MEM. 5. A Phase II grant PP in hand at USAID/Rabat.	N.A.	Assumption for achieving outputs: (Phase I) 1. Consultants will quickly and diligently carry out their assigned scopes of work. 2. Appropriate sites for studies will be provided in a timely fashion by the GOM
D. Inputs (Phase I) 1. Four consultant studies, 10 MM 2. Resident advisory services, 6 MEM, 24 MM 3. Participant training of MEM professionals, 16 MM	Implementation Target (Type and Quantity) N.A.	N.A.	Assumption for providing inputs: (Phase I) 1. A.I.D. direct recruitment and contracting for consultants will be approved. 2. Qualified U.S. consultants will be available on a timely basis. 3. Qualified Moroccan consultants will be provided by the MEM or contracted for 4. Moroccan professional trainees will be identified by the MEM

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MISSION DIRECTOR'S DETERMINATION TO

WAIVE HOST COUNTRY CONTRACTING

USAID/Rabat

November 1979

For the first phase of this Renewable Energy Development Project, No. 608-0159, we have carefully reviewed the factors affecting recruitment of consultants for study and advisory services. Each of the four feasibility and design studies is distinctively different from each other in substantive content and in kind of technical expertise required. Effective recruitment of the several different kinds of U.S. consultants can best be conducted in the U.S. with extensive use of the telephone to identify candidates, determine availability, and check references.

Time is of the essence. Each of the elements of consultant services is too small to justify the trouble, expense and time that international r. f. p's would require.

Different sources and contracting modes; e.g., personal services contract, A.I.D. direct hire, indefinite quantity contractor, requirements contractor, small architectural firm, or university contract, may be most appropriate for the different kinds of consultancies required.

For these reasons, I have determined that Policy Determination 68, the presumption in favor of host country contracting, should be waived for the technical study and advisory services required to carry out this project.

/s/

Harold S. Fleming

Director