

FIFTH ANNUAL WORK PLAN
(JULY, 1987 THROUGH JUNE, 1988)

SUDAN RENEWABLE ENERGY PROJECT

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I. INTRODUCTION

A. General

This is the Fifth Annual Work Plan (July, 1987 through June, 1988) prepared by the Sudan Renewable Energy Project (SREP), which is implemented by the Energy Research Council (ERC) of the National Council for Research. The SREP (now designated as SREP I to differentiate it from the authorized follow-on project, SREP II) was originally scheduled for completion on November 30, 1986 as stated in the Fourth Year Work Plan. SREP I has been extended to June 30, 1987 and USAID/Sudan authorized dollar funding for SREP II in March, 1987 and presently plans to begin implementation as soon as possible after completion of SREP I. In addition, the Government of Sudan's Ministry of Finance and Economic Planning and the National Council for Research have agreed with USAID/Sudan to earmark local currency funds in the amount of LS 1,165,000 to implement the SREP's Fifth Annual Work Plan which is presented herein. SREP II extends the current project for an additional two years.

The Fifth Year Work Plan will cover the transition period between the two separate dollar funded US technical assistance contracts. Originally, USAID contemplated that the technical assistance contract for SREP II would begin in the first half of 1987; it is now planned for the latter part of 1987 or early 1988. This Fifth Year Work Plan therefore addresses the dollar funded components of SREP II only generally, as specific US contractor activities will need to be reviewed and approved by USAID upon contractor mobilization in Sudan. In the meantime, however, RERI will continue implementation of all local currency Project Account funded activities in the five priority technology project areas and the active Grants program as described and scheduled in this document.

The five priority technology areas included in this Fifth Annual Work Plan are:

- o Fuelwood/Forestry, to include Mechanized Farming & Charcoal Production
- o Charcoal Stoves
- o Briquetting
- o Water Pumping

Some water pumping study project activities were organized and implemented during the Fourth Annual Work Plan period. However, because of the importance of water to all aspects of Sudanese life, water pumping will become a significant or major activity of SREP II. Photovoltaic applications will be discontinued as one of the high priority technology areas and will become part of the water pumping project. As discussed in the Fourth Annual Work Plan, if the water pumping project of SREP II can achieve its intended goals, it could serve as a model for replication to other areas in Africa.

B. U.S. Evacuation from Sudan

As discussed in the Fourth Annual Work Plan the American staff of SREP I (Georgia Tech's Chief of Party, Don Peterson, and five American Peace Corps Volunteers (PCV's) were evacuated from Sudan in April, 1986. During their evacuation to the United States, SREP I activities in Sudan were continued under the direction and leadership of Dr. El Tayeb Idris Eisa (SREP Coordinator) and Gaafar El Faki (SREP Assistant Coordinator).

Don Peterson and three of the PCV's continued work on SREP I activities at Georgia Tech in Atlanta. A conceptual design for a charcoal briquetter was drawn up and documented, and the Charcoal Stove Book was completed and published in July, 1986. A short-term (two weeks) general marketing training course was also conducted in Atlanta for 6 staff members of RERI/SREP I, and 3 individuals from the National Energy Administration. There was no participation in SREP I by the PCV's beyond publication of the Charcoal Stove Book.

Don Peterson returned to Sudan in mid-September, 1986 to resume his duties as Georgia Tech's Chief of Party. He left Sudan in late January, 1987 to become the Peace Corps Director in Asuncion, Paraguay.

The evacuation order for American personnel was lifted October 15, 1986 and USAID personnel returned to Khartoum. Some continuity between SREP I and USAID was lost during the evacuation from April to October, 1986. However, the USAID SREP I Project Officer, with inputs from the ERC/SREP staff, during his absence from Sudan was able to prepare the required documentation to secure dollar funding authorization for SREP II.

The early departure of Don Peterson as the Georgia Tech Chief of Party made it necessary for the Georgia Tech Project Director (William Larson) in Atlanta to fulfill Georgia Tech's contractual obligations from Atlanta. He made short-term visits to SREP I in March/April, 1987 and in May/June, 1987. The first visit was to assist in preparing the Fifth Annual Work Plan and the second visit will be to terminate Georgia Tech's contract and to prepare the final report for SREP I.

II. FOURTH YEAR IMPLEMENTATION (JULY, 1986 THROUGH JUNE, 1987)

A. Institutional Development

1. Organizational Structure

The Sudan Renewable Energy Project (SREP) is a project jointly sponsored by the Government of Sudan and the United States Agency for International Development Mission in Sudan (USAID/Sudan). The Energy Research Council is the counterpart organization for the Georgia Institute of Technology (GIT), the technical assistance contractor for SREP I (October, 1982 through June, 1987). The Director of the ERC is the designated Coordinator of the SREP for the Government of Sudan and the direct counterpart to GIT's Chief of Party (COP). The COP is responsible for implementing the technical assistance contract in Sudan. The Coordinator and COP report to the ERC Board through the ERC Technical Committee which oversees general program policy and direction.

The ERC/SREP cooperates with other government organizations as well as with private sector entities which are involved in renewable energy activities in Sudan. For example, the SREP has developed good working relationships with the Forest Administration, the Forest Research Center, the National Energy Administration, the National Water Corporation and the National Electricity Corporation. SREP has also cooperated with the UN's Food and Agriculture Organization (FAO) and with private voluntary organizations such as PLAN/Sudan and CARE in carrying out activities under the priority technology areas mentioned above.

2. Staffing and Technical Assistance

a. RERI/SREP Personnel Much of the manpower to implement the SREP comes from the ERC's Renewable Energy Research Institute (RERI). Other staff personnel are seconded from Sudanese Government agencies and are also retained as consultants under personal services contracts with ERC. At the end of the Fourth Year of implementation SREP I had a working staff of 45 government employees and 8 consultants.

b. Technical Assistance Contractor Personnel During the early part of the Fourth Year of implementation, the GIT Chief of Party, Don Peterson, and the five Peace Corps Volunteers (PCV's) were in evacuation status in the U.S. From mid-September, 1986 through June, 1987, Don Peterson and Bill Larson (acting COP) carried out the TA contractor responsibilities as described under I.B. above. Also, as described in I. B. above, the PCV's participation in SREP I ceased, for all practical purposes, at the end of the Third Year of Implementation. The ERC was well satisfied with the PCV's involvement in SREP I and has requested Peace Corps involvement for SREP II. Peace Corps involvement in SREP II will require the active encouragement and brokering of USAID/Sudan and early agreement by the Peace Corps in Washington to select and train PCV's prior to the mobilization of the SREP II technical assistance contractor.

C. Overseas Consultants Travel restrictions imposed by the U.S. evacuation previously described, as well as insufficient dollar funds remaining in the TA contract, reduced the amount of expatriate short-term consultancies that could be provided from six (6) person-months (as stated in the Fourth Annual Work Plan) to only three and a half (3.5) person months. These consultancies were:

-	Dr. B. William Riall	Fuelwood Economics	1.5 pm
-	Dr. Russell deLucia	Water Pumping	1.0 pm
-	Richard McGowan	Water Pumping	<u>3.5 pm</u>
		TOTAL	3.5 pm

During the nearly five-year life of the SREP I project a total of 49.6 person-months of short-term expatriate consultancies have been provided to the project. These consultancies were carried out by 21 separate consultants: 11 from Georgia Tech, 7 from TransCentury and 3 from E/DI.

d. Local Consultants SREP I has continued to rely on Sudanese professionals as expert consultants to help in project implementation. During the Fourth Year of implementation the following local consultants participated in SREP work on either a full-time or short-term basis:

- o Hamza Hamoudi Project Leader,
Fuelwood/Forestry
- o Khalafalla Sid Ahmed Project Leader, Mechanized
Farming and Charcoal
Production
- o Omer A/El Khariem Agroforestry
- o Ali Khalid Ali Mechanized Farming
- o Ali Beheiry Information Center
- o Dr. Hamid Ibrahim (S.T.) Conventional Energy
(Pumping)
- o Ustaz Khiralla (S.T.) Hydrogeologist
Maghoub (Pumping)

- o Ustaz Amin Sabry (S.T.) Conventional Energy (Pumping)
- o Geographer (S.T.) Pumping

3. Participant Training

The SREP I TA contractor, Georgia Tech, was in evacuation status in the U.S. during the early part of the Fourth Year of implementation. Because of this, all short term participant training outside of Sudan was delayed until the latter part of the Fourth Year.

Short-term training in SREP I has continued to focus on developing and strengthening RERI/SREP staff skills and knowledge so as to better achieve overall project objectives. Short-term training activities during the Fourth Year were:

- o Dr. El Tayeb Idris Eisa Water pumping conference and observation tour in Botswana and Lesotho
- o Seddig Adam Omar and Nuralla Yassin Water pumping conference and observation tour in Botswana
- o Ms. Sana'a Saad and Ms. Hawa Makawi Secretarial and Computer Training Course in Cairo
- o Ali Khalid and Bedar El Dien Ismail Agroforestry Seminar in Kenya
- o Shommo Sha' EL Din Institutional Management Seminar in Denver, Colo., U.S.
- o Gaafar El Faki and Don Peterson Regional Charcoal Stove Workshop in Kenya

- o Ishraga Mohd Taha and Amin Kamil Dissemination and Stove Testing Field Visit in Kenya
- o Dr. El Tayeb Idris Eisa Arid Land Management Seminar in Cairo, Egypt

B. Technology Development and Dissemination

1. Grants Program

The Renewable Energy Development Grants (REDG) Program is a unique, active and successful component of the SREP. The judicious allocation of grants has enabled the ERC to mobilize the support of other government organizations, community groups, and individuals in carrying out renewable energy activities and objectives of the project.

During the first three implementation years, 72 grants (with 5 grantees receiving additional grants) were awarded for a total of LS 1,119,903. The distribution of the grants by priority area is described in Tables 1 and 2 on the following pages 9 and 10.

During the Fourth Year of implementation 11 grants were given out through March, 1987 for a total of LS 58,260. These were allocated as shown in Table 3 on page 11.

The review and approval of REDG proposals submitted to ERC continues to follow the same procedures as in prior years of the SREP. Physical monitoring and evaluation of approved grants is carried out by the staffs or teams of the priority technology projects. In the case of the Fuelwood/Forestry area, which has received by far the largest number of grants, an independent expatriate expert, Dr. Hosni El Lakany of Egypt, was brought in during the Third Year of implementation to technically evaluate the forestry grants. He recommended that the grants also be analyzed economically. Dr. B. William Riall of Georgia Tech spent a one and a half month

consultancy in Sudan on this subject during the latter part of the Fourth Year. He made an economic analysis of past forestry grants and developed models for future economic analysis for use by the RERI/SREP staff.

A grants administrator, Ms. Nahid Hassein, ensures that grant projects are followed-up and monitored on a timely basis. She also coordinates the review of new grant proposals using established SREP guidelines. Most grant proposals are reviewed and decided upon within six weeks of receipt of a proposal or grant application.

Table 1
Renewable Energy Development Grants
Awarded during First, Second and Third Year

Priority Area	No		Budget			Disbursement		
	1st 2nd	3rd year	1st & 2nd Year		3rd Year	1st & 2nd year		3rd Year
			LS	US\$	LS	LS	US\$	LS
Forestry/Fuel-wood	35	20 4A	376508	-	473836	305818	-	343030
Charcoal Stoves	6	1	154284	-	57400	97322	-	65614
Charcoal Production	1	-	9150	-	-	5950	-	3200
Wood fuel Combustion	1	-	33725	-	-	31225	-	285
Photovoltaics	5	A	7200	50500	800	6000	47925	800
Technical Journal	-	1	-	-	7000	-	-	3000
Totals	48	22 5A	580867	50500	539036	446315	47925	415928

A = Additional Grant

Table 2
Renewable Energy Development Grants
Awarded during Third Year Implementation

Description	Geographical Area					Disbursement through June, 1986 LS
	Kordofan LS	Central Region LS	Northern Region LS	Khartoum LS	Eastern Region LS	
a. Grants disbursement from July, 1985 through April, 1986	34142	208471	92248	155600	47000	278934
b. Grants awarded during May and June, 1986						
Arab Sudanese U. & F G.				825		*
Taha ElBashier				750		750
c. Disbursements during May and June, 1986						136245
TOTALS	34142	208471	92248	157175	4700	415929

* Seedlings given in kind.

Table 3
Renewable Energy Development Grants
Awarded during Fourth Year Implementation

Priority Area	Geographical Area		Disbursed through March 1987 LS
	Northern Region LS	Khartoum LS	
<u>Fuelwood/Forestry</u>			
Mohd Nageeb		750	750
Elyass A/Rahman		200	200
Shahab ElBinaa		750	1100
Suliman Gasim		750	750
Darfurian Student Association		750	750
Arbab Mohd A/Rahman		2000	
Kamir EL Joudab	9350		
Goz EL Hag	20000		
Tubura EL Mahmia	7700		
Dongla Nursery	15510		
<u>Charcoal Stoves</u>			
Sakiana Institution		500	500
TOTAL	52560	5700	4050

Installments paid on grants awarded during previous years 110423

Disbursed during Fourth Year through March 31, 1987 114473

2. Charcoal Stoves

During the Fourth Year of implementation the charcoal stove program:

- o Continued promotion of the all-metal canun-el-duga stove,
- o Expanded the introduction of the ceramic-metal (el Jiko) stove in the Khartoum area, and
- o Designed and developed an all-metal stove to use charcoal briquettes produced from agricultural wastes, such as groundnut shells.

The all metal duga stoves continue to be promoted through market demonstrations, open-day fairs, and extension efforts of non-governmental entities such as CARE, ADRA, and women's organizations. These efforts stress the benefits derived from the use of this stove, primarily the reduced time of cooking and the fuel savings possible. A television commercial planned for June, 1987 will use the media to gain wider public coverage so to stimulate increased demand for the stove.

SREP conducted workshops in stove-making continue to be the main dissemination vehicle for stoves. Three such formal workshops with about fifteen participants each were given this year; two in the White Nile and one in the Khartoum area. Also, four flying workshops (conducted in the producer's workplace) were implemented. In coordination with SREP, CARE is expanding production in El Obeid, Gedaref, and more recently in Khartoum.

The Fourth Annual Work Plan called for production initiation in the formal manufacturing sector without lessening the continued emphasis on the informal one-man stove maker. SREP distributed metal stove models and templates to a number of small to medium size metal workshops. The concept was to start stove production as a sideline using surplus metal and scraps left over from regular product manufacturing. These sheet metal shops were identified on the basis of the NEA "Marketing Study for the Improved Charcoal Stove".

Unfortunately, this approach failed because of a general scarcity of metal and increased prices. These shops increased the efficiency of their regular production (through design changes) and had little waste or left over metal for stove making. Despite the problem of metal scarcity and high prices, SREP provided technical assistance, primarily marketing help, to an engineer (previously employed by SREP) who started his own stove making business.

The SREP Dissemination Unit conducted workshops for both ceramic liner and metal cladding producers for the el Jiko stove. A survey of clay workers and the ceramic firing techniques used was conducted to identify possible ceramic liner producers. This type of production is increasing as CARE, in coordination with SREP, has introduced a specially designed molding machine from Kenya to produce ceramic liners.

A monthly report of stove activities indicates production levels, numbers of stove makers, prices for both stoves and charcoal, and problems and constraints encountered. These monitoring reports indicate a sharp decrease in stove production this year as compared to last year; approx 5000 during 1986/87 vs. approx 8000 in 1985/86. This decline in production can be attributed primarily to the scarcity of metal. The number of stove makers has remained relatively constant; between 20 to 30 in Khartoum. The monitoring team also obtained feedback from a sampling of the households who received the 1000 stoves distributed in Khartoum during the marketing survey of last year. One minor grant was awarded for the stove program during the Fourth Year of implementation.

The National Stove Center was established at Soba, and is now nationally recognized as a stove testing center. In addition to stove testing, a new stove was developed. A joint effort involving the NEA, UNDP and the Center developed an all metal stove designed especially to use groundnut shell briquettes. The prototype has been laboratory tested, and is ready for field testing, now scheduled for June, 1987. The

National Stove Network, with offices hosted at the NEA, a national coordinating body, to assure optimal application of resources and to avoid duplication of effort in the development promotion, testing and dissemination of cook stoves and cooking fuel, was also established this past year.

3. Fuelwood/Forestry

Fuelwood/forestry activities during the Fourth Year concentrated on follow-up and monitoring of on-going projects. Much of the work of the previous year's 24 grants, mostly for forest nurseries, was completed during calendar year 1986. During the Fourth Year 10 grants totalling LS 57,760 were awarded for fuelwood/forestry projects.

During the Fourth Year projects with the irrigated sector included:

- o 50 feddans at Seieit planted with Eucalyptus and Casurina interplanted with karkadi. Some Eucalyptus has reached a height of one and a half meters after five months. Although it was not completely harvested, the karkadi crop was successful
- o Construction of a new nursery at Essileat with a total of 50,000 seedlings planted of Eucalyptus, Conocarpus and Cassia Simaia and other species
- o 36 feddans of shelterbelts planted along the main canal of the Goz El Nugara (White Nile Agricultural Corporation) scheme; nursery beds constructed and planted; and 7,500 seedlings were grown

In the Nile Province Forestry 3 kilometers of trees were planted along the canal of the Kaboushia scheme, making a total of 11 kilometers.

In Kassala Province two nurseries, at Umzebil and Abu Nahal produced 50,000 and 15,000 seedlings respectively.

Dr. William Riall of Georgia Tech came to Sudan in December, 1986 on a S.T. consultancy to do an economic analysis of forestry projects. These were the projects which had been evaluated earlier by Dr. Hosni Lakany. Dr. Riall left behind models for economic evaluation of future projects for use by the RERI/SREP staffs.

4. Mechanized Farming

During the Fourth Year of implementation the mechanized farming project concentrated its activities in the Damazine area working with two major agricultural companies: the Damazine Agricultural and Animal Production Company (DAAPCO) and the Arab-Sudanese Blue Nile Agricultural Company Ltd (ASBNACO). The objectives of this work with these two mechanized farming companies is to:

- o Leave uncleared areas as natural shelterbelts for areas being cleared for next season's agricultural production,
- o Plant shelterbelts in areas which have already been cleared, but where no natural shelterbelts were left,
- o Produce charcoal from the trees from the cleared areas, and
- o Establish flying nurseries on the companies' premises to supply seedlings for the shelterbelts to be planted.

Lack of an assured year-round water supply prevented the establishment of permanent nurseries in the two companies' areas. It was necessary, therefore, to use "flying" nurseries where seedlings for the shelterbelts can be brought and cared for temporarily before planting season. To accomplish this grants were given to two permanent nurseries; the Forest Research Nursery in Rosaries and the Forestry Department Nursery in Damazine, for rehabilitation and to upgrade their capacities for producing seedlings. Both nurseries have been successfully rehabilitated and are producing seedlings for the DAAPCO and ASBNACO flying nurseries as well as for other mechanized farms.

Implementation results have been mixed. For example, the 1986 shelterbelt planting by DAAPCO, 2 kms by 40 meters wide, was accidentally ploughed under. On the other hand, the 1985 shelterbelt planting has about a 40% survival with Neem and Cassia trees up to 2 meters in height. The ASBNACO 1986 planting of gum arabic (Hashab) was overcome by grass weeds with less than 5% survival, owing to a lack of routine weeding.

Charcoal production using the cleared trees has not been successful during the Fourth Year. This was because of a lack of forward planning by the two companies and because the companies did not contract with traditional charcoal burners to produce charcoal. Also, extended crop harvesting beyond the normal season prevented the selection of areas to be cleared until late in the year. However, it has been reported that three million sacks of charcoal were produced in this area during 1986 through individual permits issued by the Forestry Administration. A large area where these permits were issued is situated within the mechanized farming areas of the two companies.

SREP technical assistance is being extended to three individual mechanized farmers in the Blue Nile area to be selected by the Mechanized Farmers Union. Preparations for this work will be made in the last months of the Fourth Year. The plantings for the three farms selected will begin in the Fifth Year of implementation.

One member of the mechanized farming project activity will be given short-term training in the Fourth Year. Ali Khalid will attend the Agroforestry Seminar in Nairobi, Kenya in June, 1987.

5. Briquetting

The briquetting team completed field-testing of briquettes in villages of the Rahad Agricultural Scheme in late May of 1986. In the early part of the Fourth Year of implementation their report of the Rahad work was drafted, critiqued, revised and finalized. The testing in Rahad indicated a need to:

- o improve the overall cotton stalk charring process
- o improve the finished quality of the briquettes
- o obtain a larger sample of end-user acceptability and develop a marketing plan for the briquette product
- o refine the rough economic analysis based on better data than obtained during the first test.

From August to November, 1986 the team designed and built a new prototype hydraulically operated briquetting machine. This briquetter will produce briquettes quicker at higher pressures and require less labor than the previous pneumatic briquetter. The resulting briquettes will be of higher quality also. From September to December, 1986 the team tested waste starch, gum arabic and molasses as binders for making charcoal briquettes from carbonized cotton stalks. Previously all briquettes had been produced using cellulose fibers from waste paper. Laboratory tests revealed that starch bound briquettes were superior to paper fiber, gum arabic or molasses bound briquettes. They have high strength, hold together well, are relatively smokeless, and generally have better combustion characteristics than briquettes bound with the other binders. Even though starch briquettes burned cooler and gave a slower heat than wood charcoal, they were found to be satisfactory for all household cooking with the exception of cooking requiring high, quick heat, such as for boiling water, frying eggs, etc.

The prototype hydraulic briquetter was laboratory tested and then will be field-tested in the Rahad Scheme by the briquetting team for two months from March 15 to May 15, 1987. The Dissemination Unit of RERI/SREP will conduct an acceptability survey and carry out test marketing of the briquettes in the Rahad Scheme villages during the final months of the Fourth Year. The originally scheduled field demonstration/test in the Gezira is now postponed until the Fifth Year of implementation.

The farm workers on the Rahad Scheme employed to make cotton stalk charcoal briquettes and to operate the briquetting machinery have been trained by the briquetting team to perform these jobs. The process involves gathering bundles of cotton stalks and carbonizing them at field locations. Grinding the charred cotton stalks, mixing with the binder, compressing the mixture into briquettes, and sun drying the briquettes for a day or takes place at a central location.

6. Water Pumping

The solution of Sudan's water supply problems has surfaced as a priority, particularly in rural areas where only forty percent of water requirements are met. Because of the potential of renewable energy for pumping water, it was adopted as a priority technology area for SREP attention during the Fourth Year of implementation. The activities began with the consultancy of Dr. Vaughn Nelson, of West Texas State University, in March/April of 1986. This consultancy laid the groundwork for a long-term study on renewable energy technology (RET) applications for water pumping in Sudan.

In addition to the work that has been done in this area under SREP, both the Sudan Wind Energy Project sponsored by the Netherlands Government (SWD) and the Special Energy Project under German (GTZ) sponsorship have agreed during the Fourth Year of SREP implementation by exchange of correspondence with ERC/RERI to cooperate in the implementation of the SREP pumping project. Further, it is Government of Sudan policy that all external donors on renewable energy technology (RET) water pumping will coordinate their assistance through the SREP project.

During the Fourth Year of implementation, an SREP I water pumping team of four applied researchers (engineers) was appointed, namely:

- o Seddig Adam
- o Nuralla Yassin
- o Nahid Yagoub
- o Ibrahim Mohamed Zein

7. Dissemination

One of the unique components of SREP I is its emphasis on the dissemination/commercialization of the renewable energy technologies it develops in the five priority areas. The most active dissemination activities have been in the charcoal stoves and fuelwood area. Unlike other research and development projects, SREP I has effectively followed up the development work with active efforts in dissemination/commercialization.

The Dissemination Unit of the RERI is now a going organization with 8 professional staff assigned conducting a number of activities related to SREP I RETs. There are two components to the work of the Unit: the dissemination/extension activities and the Renewable Energy Information Center.

The dissemination/extension activities also include market surveys and analyses within its scope, so as to consider consumer preferences when formulating dissemination/commercialization strategies. A marketing training course was given at Georgia Tech in Atlanta at the end of the Third Year of implementation. This training enhanced the skills of several of the Unit's staff, increasing their awareness of the inter-relationship of market knowledge to production and dissemination. The Unit provides support in all dissemination aspects to the priority technology project teams. It also continues to conduct charcoal stove making workshops and market demonstrations. It publishes a monthly monitoring report with statistics on the implementation of the priority technology projects.

The other important component of the Dissemination Unit is the Renewable Energy Information Center. The Center is housed at the site of the RERI/SREP I offices in the NCR building. It is carrying out the objectives which were stated in the Fourth Annual Work Plan. The Center is the focal point for most renewable energy studies. It has strengthened the RERI capability to research and develop applications of renewable energy technologies.

The Center is staffed with two information managers and two librarians. It is equipped with 2 MacIntosh and 2 Osborne

computers with attendant peripheral equipment and 3 microfiche readers. It has a collection of 1271 books, 16 journals and 109 microfiches on water/sanitation, dissemination, and on major renewable energy subjects including biomass, solar and wind. In the period from February, 1986 through March, 1987, the Center had 206 registered users: 117 from the RERI/SREP I staff and 89 from external organizations, e.g., the University of Khartoum.

C. Procurement

In addition to minor procurement of office materials and supplies locally with local currency, an amount of \$ 11,562 was expended on overseas procurement from May, 1986 through March, 1987 on the following categories of commodities:

Vehicle Spare Parts	\$ 2,696
Computers and Information Center	4,335
Laboratory Equipment and Instruments	1,308
Office Equipment and Supplies	1,145
Freight, insurance, fees, etc	<u>2,078</u>
TOTAL	\$11,562

Overall procurement for the life of the project through March, 1987 totals \$ 275,555.

D. Budgets and Expenditures

1. Technical Assistance Contract

The dollar expenditures in the Georgia Tech contract through February 28, 1987 total approximately \$ 2,854,500. It is expected that the costs of the short-term training programmed for April, May and June, 1987 together with procurement, home office, and contract close-out costs over the remaining four months (i.e., March through June, 1987) will exhaust the remaining funds in the contract. Georgia Tech is gratified that it was able to execute the contract through

approximately 4 years and 9 months (from October, 1982 through June, 1987), approximately 3 months longer than the 4 years and 6 months originally called for in the contract. Also, it is worth noting that more short-term training was implemented, more procurement undertaken, and more person-months of short-term consultancies provided than originally contemplated in the RFP and contract.

2. Trust Fund

The Trust Fund is a USAID local currency (LS) account established to provide support for the contractor in such items as housing, local travel, communications, and for Peace Corps Volunteer operations in SREP I. See Table 4 on page 22.

3. Project Account Funds

These are funds allocated as agreed upon between the Sudan Ministry of Finance and Economic Planning, the NCR and USAID to carry out the priority technology project activities of the SREP. See Table 5 on page 23.

Table 4.

Sudan Renewable Energy Project (SREP I)

<u>Cost Category</u>	<u>overall Budget</u>	<u>Disbursement Jul 86-Mar 87</u>	<u>Cumulative Disbursement</u>
1. Office Support	173,000	38,193.50	136,182.16
2. Local Travel: SREP	51,000	4,584.30	48,682.70
USAID		-	11,760.00
3. Miscellaneous	81,000	1,859.25	78,939.95
4. Housing: SREP	321,000	-	72,867.91
USAID		74,247.68	243,536.40
5. Communications	52,000	4,090.14	49,109.93
6. Peace Corps Volunteers Support	455,440	15,520.20	356,130.01
TOTALS	1,133,440	138,495.07	997,209.06

Table 5
Project Account (Sudanese Pounds)
Fourth Annual Work Plan
Financial Report July, 1986 through March 31, 1987

Project Area	Charcoal Stoves	Fuelwood & Mech. Farming	Briquetting	Water Pumping	Dissemination
<u>Cost</u>					
<u>Category:</u>					
1. Consultancy and Subcontract					
- Budget	0.00	40,000.00	25,000.00	25,000.00	5,000.00
- Cum. Exp.	0.00	22,215.55	6,916.70	3,762.81	3,367.38
II. Field Test Support					
- Budget	10,000.00	15,000.00	5,000.00	10,000.00	11,000.00
- Cum. Exp.	2,275.25	6,100.22	570.00	1,017.92	1,770.79
III. Materials and Equipment					
- Budget	20,000.00	15,000.00	20,000.00	25,000.00	50,000.00
- Cum. Exp.	12,787.50	864.40	13,202.00	1,909.50	19,544.92
IV. Training Activities					
- Budget	0	0	10,000.00	0	20,000.00
- Cum. Exp.	0	0	0	0	3,958.00
V. Total					
- Budget	30,000.00	70,000.00	60,000.00	60,000.00	86,000.00
- Cum. Exp.	15,062.75	29,180.17	20,688.70	6,990.23	28,641.09
Total Budget			306,000.00		
Total Expenditure			100,562.94		
<u>Other Project Costs:</u>					
Grants:					
- Budget			475,000.00		
- Cum. Exp.			135,201.50		
Incentives:					
- Budget			60,000.00		
- Cum. Exp.			20,415.30		
Travel					
- Budget			50,000.00		
- Cum. Exp.			46,988.60		
Miscellaneous					
- Budget			0		
- Cum. Exp.			29,304.25		
Total					
- Budget			891,000.00		
- Cum. Exp.			332,172.59		

III FIFTH ANNUAL WORK PLAN (JULY 1, 1987 THROUGH JUNE, 1988)

A. Institutional Development

Near the end of the fourth year of implementation of SREP I, the ERC/RERI is widely recognized as the primary Government of Sudan organization for applied research and development as well as the dissemination/commercialization of renewable energy technologies. Further development and solidifying of this relatively new but going organization will occur as project and institutional management skills are strengthened in conjunction with the expansion and enhancement of technical capability in the priority technology areas. Both the local currency budget and the USAID dollar budget being authorized in support of SREP II activities specifically focus on and earmark funds for:

- o Long-term academic training in business and marketing
- o A variety of short-term management/technical training tours outside of Sudan
- o Short-term training activities within Sudan
- o On-the-job training for SREP staff who work with local and foreign short-term consultants.

RERI's institutional development will further progress from these planned training activities as well as from the experience gained from the day-to-day implementation of the SREP II activities planned for the Fifth implementation year as described in the following sections of this document.

The US dollar funding in support of SREP II was authorized by USAID/Sudan in late March, 1987. USAID plans to enter into a contract for technical assistance with a U.S. contractor as soon as possible following Georgia Tech's departure on June 30, 1987. The dollar funded short-term consultancies, short-term training outside of Sudan, and procurement (primarily for the water pumping project and dissemination activities), will necessarily have to await mobilization of the SREP II technical assistance contractor. At that time, the US contractor will:

- o Assist in the preparation of scopes of work for foreign short-term consultants, identify and contract with selected candidates, and monitor and supervise their activities in Sudan;
- o Assist in identifying short-term training activities outside Sudan, and assist in arranging for such approved training for SREP II staff;
- o Assist in preparing dollar-funded procurement requirements and procuring approved materials and equipment.

In the meantime, during the period between the departure of Georgia Tech and the mobilization of the SREP II dollar-funded contractor, RERI will:

- o Continue to carry out SREP associated training activities, to include initiating the M.Sc. program at the University of Khartoum in July, 1987; and several short-term SREP related training activities such as seminars, workshops and OJT with local consultants working in the priority technology areas;
- o Continue the implementation of all Project Account funded activities in the priority technology project areas as hereinafter described;
- o Continue the activities under the active Renewable Energy Development Grants program which, in the Fifth Annual Work Plan, will include special funding of LS 150,000 earmarked for applied Forestry Research Grants.

1. Energy Information Center

Additional journals and other reference materials related to SREP and renewable energy activities from other countries are required to further strengthen the already established and operating Energy Information Center. Actual dollar procurement of this additional reference material and additional equipment

must await mobilization of the SREP II technical assistance contractor.

2. Training

a. On-the-Job-Training (OJT): It is ERC/RERI policy that their own staff personnel as well as personnel from other organizations will work with both local and foreign consultants. This to provide OJT in the SREP II priority project areas to those institutions and individuals with limited experience. One or more SREP counterpart personnel will always be assigned to work with each short-term expatriate consultant.

b. Long-term Academic Training:

(1) Academic training resulting in an MSc. from the University of Khartoum is being planned under SREP II. This program is to be assisted by a U.S. visiting professor to the University of Khartoum for one year. It is planned for 10 students to be supported in this activity. Other than the visiting professor, there will be no US component to this training.

(2) Three US MBA/MSc's are also planned under SREP II. These would be regular two-year academic programs at US institutions to be selected by the candidates and RERI. The programs would emphasize education in marketing, project management, evaluation, and administration. This training is to be separately dollar funded by USAID/Sudan outside of the dollar-funded technical assistance contract. Final selections of candidates and US institutions will require USAID approval. Selected students should be nominated to USAID/Sudan as soon as possible so that all arrangements can be completed before the start of university classes in the U.S. in August/September, 1987.

c. Short-term Training:

(1) Local training to be carried out in Sudan and funded from the Project Account will encompass continued OJT for selected individuals working with local consultants who are engaged in priority project activities, as well as seminars and workshops to be announced and implemented as detailed in the following Project Activity Schedules.

(2) Short-term training outside of Sudan will continue to

to emphasize the enhancement of technical, managerial and organizational skills within RERI/SREP. Actual implementation of these training programs will require the presence of the SREP II technical assistance contractor. However, prior to the contractor's mobilization in Sudan, preliminary identification, planning and scheduling of some of these activities should be discussed between ERC/SREP and USAID, with the involvement and assistance of the USAID/REDSO Energy Advisor in Nairobi. Subjects for short-term training outside Sudan should include, but not be limited to:

- o Arid lands Management; Egypt
- o Water Pumping; Kenya, Somalia, Botswana
- o Charcoal stoves; Kenya
- o Marketing; United States
- o Applied Research Management; United States

An annual training plan for 1988 will be prepared in December, 1987 and presented to the Institutional Committee of the ERC and to USAID for review and approval.

B. Technology Development and Dissemination

1. General Strategy

As described in the Fourth Annual Work Plan, the overall strategy of technology development and dissemination/commercialization will continue in the Fifth implementation year of SREP, the first year of SREP II. As ERC/RERI becomes more involved and experienced in technology development, adaptation, application and transfer, increasingly it considers the end-users' needs and their perceptions through feedback, market surveys, and analyses and studies of the socio-economic acceptability of the RET's being commercialized. Production/manufacturing problems and constraints have also become a part of the consideration process.

The active and proven SREP I approach of using development grants to involve private sector individuals and organizations, and other governmental institutions, including local governments, to support commercialization of RET's will continue through SREP II. The grants program is well

established and will function effectively without active participation from the SREP II TA contractor, but will require prompt attention from USAID to the grant proposals submitted for concurrence after review and approval by the ERC Technical Committee. In the Fifth Year Work Plan LS 650,000 has been earmarked for the grants program of which LS 150,000 has been specially set aside for applied research in forestry.

The overall SREP objective is to demonstrate acceptable and effective RET's and successful methods of spreading the use, or commercializing, these technologies. Larger scale application and/or commercialization of such RET's must come about through replication by private commercial entities and other government agencies.

2. Charcoal Stoves

During the Fifth Year of Implementation the charcoal stove program will continue to promote improvements to and increased production of the all-metal el duga stove. It will also continue to emphasize the dissemination of the metal clad ceramic (el jiko) stove. It is intended to use more grants to help clay/ceramic producers, and metal cladding makers, to strengthen the commercialization of the el jiko stove.

SREP II will undertake the design, development and fabrication of a molding machine in Sudan to produce clay/ceramic liners for the el jiko stove. Local manufacture of such machinery will lessen the reliance on importation from Kenya.

Mechanical molding machines should be used to produce a quantity of ceramic liners simultaneously with the production of equal numbers of metal cladding and an aggressive promotion campaign. It is important that the demand for stoves not be overly stimulated so as to outstrip the supply of stoves. In this respect, the efforts of the liner and cladding producers, promoters, and other project implementators (e.g., CARE, FAO and other PVO's) must be well coordinated. This coordination can be facilitated through the National Cookstove Network (described in II. B. 2 above).

The Stove Design Center at Soba, attached to the Biomass Division of RERI, will conduct development activities in the areas of:

- o Laboratory testing of all varieties of charcoal stoves.
- o Ceramic liner production, to include firing techniques
- o Charcoal stoves designed especially to use briquetted agricultural wastes, carbonized as well as non-carbonized.

Producer workshops, marketing seminars for both stove makers and retailers, market demonstrations, marketing surveys and monitoring will continue as indicated on the Work Plan activity schedule on the next page. A twice yearly sampling follow-up will continue through the Fifth Year to obtain statistics on useage patterns and characteristics, breakage, benefits derived, savings, etc., on the original 1000 stoves distributed for the market survey in the Khartoum area.

5TH ANNUAL WORK PLAN

Project: Charcoal Stoves

P. 1 of 2

Activity	1987						1988						Responsible
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
1. Monitoring of stove production and sales.	x	x	x	x	x	x	x	x	x	x	x	x	Diss.Unit. Ratiba
2. Training workshops			x			x			x			x	Diss.Unit. Amin, Maha, Ishraga
3. Promotion campaign													
-Newspaper articles			x			x			x			x	Awatif, Maha
-Radio programmes			x						x				" , "
-TV. commercial						x						x	" , "
-Slogans and model erection in Khartoum				x									Diss.Unit Amin, Maha Ishraga.
4. Market demonstration		x			x			x			x		Diss.Unit Maha, Sammia Ratiba
5. Marketing seminars for retailers and producers			x			x	x					x	Diss.Unit Maha, Sammia
6. Survey of existing stoves													Diss.Unit Stove net- work

5TH ANNUAL WORK PLAN

Project: Charcoal Stoves

P. 2 of 2

Activity	1987						1988						Responsible
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
7. <u>Stove Centre:</u>													
-Testing of stoves	_____						_____				_____		Biomass Dept Shadia, Ratiba
-Ceramic liner testing and improvement	_____			_____				_____					Biomass Unit Amin
-Design and field test of new briquette stove		_____											Biomass Unit Shadia,Ratiba
-Design & develop ceramic Liner molding machine							_____						Biomass Unit EL Sheikh
8. Market studies			_____					_____					Diss.Unit Sammia/Maha
9. Initiation of grants	_____						_____						Diss.Unit Amin,Gaafar.

3. Fuelwood/Forestry

The fuelwood/forestry area is one of the larger activities of SREP and has enjoyed some success in promoting tree planting by individuals, village communities and agricultural schemes. The Fifth Year program will emphasize cooperative work with the Forestry Department and other entities to formulate grant proposals for further fuelwood/forestry demonstrations. Evaluations and studies will be made to appraise the replicability of the fuelwood/forestry work done by SREP so far. These will provide indications for future directions.

The fuelwood/forestry program for the Fifth Year will continue to follow-up and monitor ongoing projects, and will also include:

- o A technical/economic evaluation of the agroforestry grants awarded in the past to the large agricultural schemes, for example, Seleit, Essileat, and the Blue and White Nile Corporations
- o Cooperation with the Forestry Department and with the grantees involved in planning and formulating grant proposals to:
 - promote agroforestry in the irrigated sector in both the Eastern and Middle Region, for example, with government corporations such as sugar companies and other irrigated agricultural schemes
 - initiate village forestry programs in Darfur and the Eastern Regions to establish demonstration sites for shelterbelts and agroforestry
 - further develop the already successful village forestry projects in Um Inderaba, Timade Hag EL Tahir and Turba Hamra to include an agroforestry component (integration of fuelwood and food)
- o A study to identify demonstration sites for village forestry and to plan for projects at those sites in order to enhance replicability of village forestry demonstrations, since SREP funds will be insufficient to implement all village forestry possibilities.

- o A workshop/seminar on fuelwood development models implemented in SREP I so as to gain insights as to future directions and to determine possibilities for wider replication

- o Continuous coordination with Forestry Research to identify areas and priorities in order to gain optimal linkages between the work funded by the LS 150,000 for applied forestry research and the regular SREP grants awarded for fuelwood projects.

Fuelwood project activities are scheduled as indicated on the following chart:

5TH ANNUAL WORK PLAN

Project: Fuelwood/Forestry

P. 1 of 1

Activity	1987						1988						Responsible
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
1. Follow-up & monitor on-going projects													Fuelwood Team Team
2. Evaluate agroforestry grants to large agric. schemes	<u>Seleit</u>		<u>Blue & White Mile Corporations</u>				<u>Essileat</u>		<u>Northern Region</u>				Fuelwood Team, Diss. Unit, Local Consultant
3. Develop grant proposals for:													Fuelwood Team, Forestry Dept. and Grantees
a. Agroforestry in irrigated sector	_____												" "
b. Village forestry in Darfur & Eastern Regions							_____						" "
c. Further develop village forestry to include agroforestry component							_____						" "
4. Study to identify new sites for village forestry	_____												Fuelwood Team, Dissemination Unit
5. Workshop/Seminar on fuelwood models in SREP I							_____						" "
6. Coordinate Applied Forestry Research Grants & regular SREP REDGs for fuelwood													Fuelwood Team, SREP Coordinator & Forestry Research

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4. Mechanized Farming

The mechanized farming project will continue along the same lines as in the Fourth Year but with greater emphasis on small individual mechanized farmers. It will continue the technical assistance to DAAPCO and ASBNACO to establish shelterbelts and to produce charcoal from the trees cleared from agricultural lands. SREP will also conduct a technical and economic evaluation of its past mechanized farming activities so as to determine a future course of action. This evaluation report should be complete by September, 1987.

SREP will also work with the Forestry Department to formulate a proposal for a grant to the Forestry Department in the Blue Nile Province to:

- o Rehabilitate nurseries
- o Provide seeds and seedlings, and
- o Initiate extension work on shelterbelts in the existing farms and the abandoned land in the Singa area.

The team will continue monitoring and following-up with DAAPCO and ASBNACO. A work plan will be developed with these companies for continuation of shelterbelt and charcoal production activities.

In the last half of the Fifth Year, in coordination with the Forestry Department and the Mechanized Farmers Union, SREP will identify six new small individual mechanized farmers with whom it will work on shelterbelt establishment for next season.

Mechanized farming activities are scheduled on the following chart:

5TH ANNUAL WORK PLAN

Project: Mechanized Farming

P. 1 of 1

Activity	1987						1988						Responsible
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
1. Plant shelterbelt & beat-up previous plantings with DAAPCO & ASBNACO	_____												SREP, DAAPCO and ASBNACO
2. Work with three individual farmers selected in Fourth Year	_____												SREP & Individual Farmers, Forestry Dept
3. Evaluation Report			_____										SREP
4. Rehab nurseries in Blue Nile & initiate extension work	_____												SREP, Forestry Dept
5. Monitoring & follow-up				_____									SREP, Forestry Dept
6. Develop work plan with DAAPCO & ASBNACO						_____							SREP, DAAPCO, ASBNACO
7. Identify new individual mechanized farmers for next season							_____						SREP, Forestry Dept, Farmers Union

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5. Briquetting

The briquetting team will draft the report of their field work in the Rahad Scheme during June to August, 1987. That report will cover:

- o The field evaluation of the hydraulic briquetting machine
- o Recommendations for the improvement in the design, fabrication and assembly of the briquetter
- o Production of charcoal briquettes from cotton stalks using different types of binders
- o Further analyses of the properties of the briquettes produced
- o Economic analysis of briquette production and use, and analysis of the household survey questionnaires to determine possible market demand.

Building on the Rahad experience, from September, 1987 through January, 1988 the team will modify the hydraulic briquetting machine design to:

- o Produce briquettes of a smaller size (1.5 and 1 inch briquettes vs the 2 inch briquettes now being made),
- o Use a double-action piston for compressing briquettes to increase production, and
- o Make other refinements to the design and fabrication.

The team will also continue laboratory experiments with and testing of briquettes made with different binding substances to determine physical, chemical and combustion properties. A brief survey will be conducted in the Khartoum area to obtain indications of acceptability of the various types and sizes of briquettes.

The next field demonstration and testing will be carried out in the Gezira during March to May, 1988. Following this field work, and the knowledge gained from it, hopefully plans can be developed to begin dissemination during the Sixth Year of implementation of socially acceptable, economically viable charcoal briquette products.

To enhance the experience and knowledge of the briquetting team, a short-term training activity was planned and approved for late in the Fourth Year of implementation. This was a briquetting study tour in Kenya tailored by Kengo in Nairobi specifically for the SREP I briquetting team. Unfortunately, because of insufficient dollar funds in the Georgia Tech TA contract and because of higher costs for other training activities in the Fourth Year of implementation, the Kenya briquetting training was deferred until SREP II. It is recommended that this training be rescheduled as soon as possible after mobilization of the SREP II TA contractor.

Briquetting activities for the Fifth Year of implementation are as scheduled on the following chart:

5TH ANNUAL WORK PLAN

Project: Briquetting

P. 1 of 1

Activity	1987						1988						Responsible	
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun		
1. Write up 2nd report	_____												Briquetting team	
2. Modify & build new prototype hydraulic briquetter			_____										" "	
3. Lab-test modified briquetter							_____						" "	
4. Analyze physical, chemical properties of briquettes w/ different binders			_____										" "	
5. Acceptability survey (Khartoum)							_____						" "	
6. Demonstration & test marketing, Gezira								_____						" "
7. Begin Dissemination											_____		Briquetting team & Dissemination Unit	

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6. Water Pumping/Lifting

In the Fifth Annual Work Plan, RET water pumping will become one of the principal priority areas of SREP II. Dr. Nelson, reinforced by deLucia and McGowan, recommended a set of activities and requirements to carry out this long-term study which will, if successful, have significant positive impact towards solving one of Sudan's more tenacious problems, that of adequate water for both agricultural and domestic use.

Given the project's importance in SREP II, the SREP Coordinator is committed to identifying a qualified individual, experienced in water supply, from outside the ERC to be appointed as the full-time Project Leader for this activity. The pumping team will continue to collect basic data by monitoring and testing existing RET water pumping installations consisting of:

- o Twelve wind pumps provided by the Dutch (SWD), which are geographically dispersed, including an installation in the Red Sea area which is being monitored and tested by the staff of the Sudan Oceanography Institute of the NRC.
- o Four solar pumps and four river turbines provided by the German (GTZ) SEP.

With the data thus being collected and adapting the standardized monitoring and testing methods learned from the Botswana training tour and the foreign consultancies during the Fourth Year of implementation, the pumping team will:

- o Develop design improvements in RET pumping systems
- o Develop RET pumping system prototypes for manufacture using locally available materials
- o Determine local manufacturing capability for RET pumps
- o Study the socio-economic acceptability of RET pumps (wind and solar pumps, river turbines, gasifiers, and animal traction) as compared to diesel systems of the same sizes and capacities.

The mobilization of the dollar-funded technical assistance contractor for SREP II is expected in the latter part of this Fifth Year of implementation. Other RET water pumping systems or devices which are not already available in Sudan, such as animal traction or gasifier systems, will then be procured. These RET systems will be installed at selected sites to be monitored and tested in the same manner as in the existing installations.

Water pumping activities for the Fifth Year of implementation are as scheduled on the following charts:

5th ANNUAL WORK PLAN

Project: Water Pumping

P. 1 of 2

Activity	1987						1988						Responsible
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
1. Monitoring & short-term performance testing of: Wind pumps, Solar pumps, River turbine, as compared to diesel pumps													Pumping Team
2. Purchase and install: a. Animal traction system b. Gasifier system													Pumping Team w/ TA Contractor Assistance
3. Monitor & short-term performance testing of animal traction and gasifier systems													Pumping Team

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5th ANNUAL WORK PLAN

Project: Water Pumping

P. 2 of 2

Activity	1987						1988						Responsible
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
4. Analyze and publish RET pumping systems performance													Pumping team with expat consultant
5. Technical, financial and economic evaluation of RET pumping systems													Pumping team with expat consultant
6. Continue basic data collection													Pumping team

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C. Procurement

As stated previously, there will be no dollar procurement until the new SREP II technical assistance contractor is mobilized and in place in Sudan. Hopefully, vehicle spare parts are in sufficient supply to keep SREP operating until that time. Of course, local procurement from Project Account funds will be made as required.

D. Project Account Budget

The chart on the following page outlines the Project Account budget by priority technology area. As of March 31, 1987, the sum of LS 1,165,000 has been earmarked for the Fifth Year of implementation (first year for SREP II) by the Ministry of Finance and Economic Planning and NCR in agreement with USAID/Sudan.

SREP II
PROJECT ACCOUNT BUDGET BY PROJECT AREAS

Thousands of Sudanese Pounds (LS 000)
 July 1, 1987 through June 30, 1988

Project Area	Consultancy & Subcontract	Field Test Support	Field Test & Equipt	Training	Total
Charcoal Stoves	-	10	20	-	30
Fuelwood Forestry & Mech. Farming	35	15	5	10	65
Briquetting	20	10	20	-	50
Water Pumping (incl. P.V.)	10	20	15	5	50
Dissemination	10	10	40	15	75
Sub-totals	75	65	100	30	270
Grants (including LS 150 for Applied Forestry Research)					650
Long-term Training (1987/88 Fiscal Year, Univ. of Khartoum)					125
Travel & Maintenance					60
Incentives					60
Grand Total					LS. 1,165