PD-AAY-958

0041

SUDAN RENEWABLE ENERGY PROJECT

ANNUAL REPORT

(NOVEMBER 1983 - OCTOBER 1984)

DONALD B. PETERSON
MATTHEW S. GAMSER

NOVEMBER, 1984.

A. Overview:

1. Renewable Energy Development Grants procedures set up and 29 grants issued.

2. Dissemination Unit established within RERI.

3. Some 21 forestry/fuelwood grants initiated in agricultural schemes, small farms, villages, and nurseries.

4. New charcoal production stove design introduced into Khartoum Market and commercial production and sales now exceed 500 stoves/month.

5. Charcoal Production study reveals earth kiln efficiencies higher than originally thought and notes potential for pelletizing charcoal fines.

6. Photovoltaic devices purchased and ready for field testing.

7. University of Khartoum/University of New Mexico training program initiated, and short-term training plan completed.

8. Five Peace Corps Volunteers arrive in Sudan and begin work under SREP.

9. USAID Evaluation completed, noting progress being made.

B. Institutional Development:

1. Staffing and Organization:

This year the SREP developed strong working ties with the ERC/RERI staff. Activity schedules which assigned RERI staff to each priority area were written. Further, a Second Annual Work Plan for 1 July,1984- 30 June,1985 was developed which assigned RERI and other staff to the five priority areas.

In addition, the SREP/RERI staff are now housed in the same office; first in the "Barracks" and later to the new NCR Building near Street 61 and Cemetery Road. This has also helped considerably in coordinating activities.

As a result of the TransCentury Manpower Study Recommendations, a Dissemination Unit was added to the RERI Organization Structure. This unit assists all priority areas in the dissemination of the individual technologies.

2. Short Term Training

The 2nd Annual Work Plan included the first schedule of short term training for RERI and related institution staff.

Use of local and third country (other than U.S.) training sources has been emphasized. Twenty-five staff have been scheduled for training. Last year (Nov 1983 - Oct 1984) short term training included:

Shadia Nasr Eldin (RERI) - Kenya, Charcoal Stove Dissemination Seminar

Shomo Shaa El Din (RERI)	-	Kenya, Charcoal Stove Dissemination Seminar
Ahmed Hassan Hood(RERI)	-	Sweden, Bioenergy Seminar.
Mohd Osman (RERI)	-	U.S., Rural Project Management.
El Tayeb El Bashir (RERI)	-	Kenya, Charcoal Stove Study Tour.
Awatif Mahmoud (RERI)	-	Kenya, Charcoal Stove Study Tour.
42 students, Khartoum Polytechnic.	-	Renewable Energy Technology Applications.
12 staff (U of Khartoum, Remote Sensing, RERI, NCR, & NEA)	-	Project Evaluation Course.

Future short term training is scheduled in

Agroforestry	-	Kenya
Photovoltaic installation	-	Kenya
Dissemination	-	Georgia Tech
Renewable Energy Applications	-	Botswana
Language, Computer, & Accounting	-	Local

3. Long Term Training:

The Renewable Energy Technologies Diploma/M.Sc. Program was organized during November and December of 1983 and the first eight students began courses in January 1984.

Project areas selected by the students were the following:

a. Charcoal Production from Cotton Stalks.
b. Factors influencing farmers to Grow Trees in Irrigated Farms in Northern Sudan.
c. Biomass estimation by regression technique and energy content of some fuelwood species.
d. Optimization and Applications of Photovoltaic Systems.
e. Simple solar peanut dryers.
f. Solar Ponds and Thermosyphon system.
g. Generating Electricity from the Wind.
h. Passive Solar Tracking.

The eight students are completing their first year at the University of Khartoum and are now planning their second year of study in the U.S. and Khartoum. At this time plans are to send, six to the University of New Mexico and two to Texas A & I, for 3 to 7 month periods.

In May, Dr.William Gross from the University of New Mexico assisted the University of Khartoum in the development of the joint UK/UNM program. Dr. Gross recommended that:the program focus more on renewable energy technologies and their direct application and commercialization; more field work be included in the program; and more emphasis be given to practical applications of the technologies.

The second cycle has been delayed until September 1985 in order to give more time to evaluate the progress of the first cycle both at the University of Khartoum and the University of New Mexico.

4. Dissemination:

The RERI formed a dissemination unit to promote the commercially feasible technologies now being demonstrated. The director was hired in January and 9 staff assigned to the section. Activities under the Dissemination Unit are: public demonstrations, T.V. and radio program on renewable energy technologies, publications, and workshops.

C. Technology Development and Dissemination:

1. General

Technology Development and Dissemination under SREP is carried out primarily through the Renewable Energy Development Grants Program and consultancies (local and overseas). These means enable the small ERC/RERI staff to reach out to capable institutions, enterprises and individuals throughout the project area and help them to implement the five technologies. Thus, the small organization is able to extend its work farther afield without the costly creation of regional, provincial and local infrastructure.

During this project year 29 Renewable Energy Development Grants were issued, totalling over LS 300,000 and $ 50,000. Most of the grants were in the Forestry/Fuelwood area.

SREP used 10 local consultants and 5 overseas consultants during the past year.

Local Consultants

Hamza Hamoudi	Forestry Advisor (PSC)
Khelefalla Sid Ahmed	Forestry Advisor (PSC)
Soumaya Suliman	Dissemination (PSC)
Abdel Aziz Bayoumi	Agroforestry-Northern Region
Ali Sal im	Agroforestry-Northern Region
Kamal Osman Khalifa	Agroforestry-Northern Region
Hassan Osman Abd el Nour	Charcoal Production-Blue Nile
Taj el Din Nasroun	Metal Charcoal Kiln Trials
William Ibrahim	Wood/Charcoal Energy Content Analysis
Jamal Shabaak	Charcoal Stove Production

Overseas Consultants

Lester Bradford	Forestry/Fuelwood
Derek Earl	Charcoal Production
Maxwell Kinyangui	Charcoal Stoves
Carolyn Husky	Dissemination
Claudia Huff	Dissemination

Three of the local consultants worked full-time within ERC/RERI on a personal service contract basis. They helped greatly in adding background and experience in the biomass area and dissemination. The others worked on shorter term assignments in the forestry/fuelwood and charcoal production areas. Future development and dissemination work will be assisted by the 5 newly arrived Peace Corps Volunteers, who are assigned to the forestry/fuelwood, wood fuels combustion, charcoal production, and dissemination areas.

It is hoped that over 50 grants will have been awarded by the end of the coming year, and that more grants will emerge from the charcoal stove, charcoal production, and wood fuels combustion areas. SREP has allocated LS 500,000 for grants alone in the July 1984 - June 1985 planning period (formerly the Sudanese fiscal year).

The next year will also see more local consultancies in all technology areas. Overseas consultancies are scheduled for agroforestry cost/benefit analysis, charcoal stoves, dissemination, and pelletizing of charcoal fines and other agricultural residues. The presence of 5 Peace Corps Volunteers will further assist the development of technology dissemination channels and on the job training for ERC/RERI staff in extension/dissemination work.

2. Forestry/Fuelwood:

a) Staffing - SREP was greatly assisted in the Forestry/Fuelwood area by local and overseas consulting. While the ERC/RERI was most interested in this technology area, it had no staff with forestry experience one year ago. Since that time 3 staff have been added with forestry backgrounds: the head of the Dissemination Unit, Gaafar El Faki and 2 of his new team, Maha and Asma. These new staff have worked in other biomass areas of SREP, leaving the primary responsibility for development and dissemination work in forestry/fuelwood in the hands of long-term local consultants.

b) Technical Assistance - Mr. Hamza Hamoudi, a retired senior Forestry Department official with some 40 years of work experience in Sudan, officially joined SREP as full-time consultant forestry advisor in November 1983. For some months before this time he had assisted the project as leader of the forestry/fuelwood advisory group formed to generate project ideas in this technology area.

Mr. Hamoudi was joined in December 1983 by Dr. Lester Bradford, a forestry/agricultural extension specialist who had just completed a 4 year assignment for USAID in Southern Sudan. Dr. Bradford spent 9 months with Mr. Hamoudi and SREP. This was an exceptionally productive period during which almost all of the ongoing work in this technology area was initiated.

As the workload in forestry/fuelwood increased through the proliferation of renewable energy development grants, it became necessary to increase the consultant staff in this area. Mr. Khelefalla Sid Ahmed, another retired Forestry Department official, was

hired as a full-time advisor in June 1984 to concentrate on the development and monitoring of small farmer agroforestry projects. Since that time his scope of work has expanded to include advice to SREP-supported nurseries on the development of an extension/promotion strategy for tree seedling sale and distribution.

A three person consulting team, consisting of Abdel Aziz Bayoumi of DECARP, Kamal Osman Kalifa of Sudan Council of Churches, and Ali Saliim of the Central Forests Administration, undertook a one month consultancy for SREP in December and January to analyze potential agroforestry activities in the Northern Region. Their findings were published in SREP Report Number 1, "Study for the Establishment of Forestry Plantations: Shelterbelts and Canal Planting".

Jim Adams, a Peace Corps Volunteer forester, joined SREP at the end of October 1984. He will be working on community agroforestry development in the Gezira Scheme, from the base of the Um Tureibat Village Forestry Project.

c. Dissemination:-

SREP forestry/fuelwood work centered about the productive integration of forestry and agricultural activities. Some 21 grants were approved for a variety of projects following this theme.

Three grants, the Seleit Shelterbelt, Sudan Poultry Farm, and Ed Dom Cooperative Projects, involved the establishment of forestry activities in large agricultural schemes.

Two villages, Um Inderaba and Um Tureibat, began

forestry projects involving nursery establishment, shelterbelt planting, natural forest management, and other community tree growing activities. Um Inderaba received a follow-up grant for water supply improvement, based on the success of work-to-date and the potential for expanded activities in the future. The Green Deserts forestry project in Nile Province received a grant for work on natural regeneration of mesquite and new methods of thorn fencing for tree protection.

Ten individual farmers in Khartoum Province, one in Gezira Province, and one in Blue Nile Province, received grants to develop shelterbelt and woodlot plantings on their farms. The SREP forestry advisors worked with the farmers on species selection and planting design. SREP contributed tree seedlings and, in a few cases, additional material support for irrigation, while the farmers provided land preparation, labor, and protection.

These small farmer projects will serve as demonstrations to neighboring farmers of the ways in which trees can benefit agricultural interests while providing a sorely needed new source of fuelwood and poles.

To further encourage agricultural scheme and small farmer forestry SREP gave grants to the 2 government-run nurseries in the Khartoum Province, the Khartoum Forest Nursery and Soba Nursery. These grants enabled increased seedling production (from 30,000 per year to approximately 150,000,with further increases expected in the coming year), and the development of links between these nurseries and area farmers through the small farmer agroforestry grants. The coming year will see an increasing emphasis on the development of extension/

dissemination capacity within the staffs of the nurseries, to further increase seedling sales and distribution. Revenue from seedling sales will enable them to sustain higher seedling production levels.

d. Future Activities:

The next year will see the broadening of the geographic scope of forestry/fuelwood activities, within the same focus of developing agriculture/forestry integaration. SREP/ERC has been contacted by the Northern, Darfur, and Kordofan Regional Governments, and will look to support agricultural scheme, small farmer and community forestry activities in these areas.

SREP will also undertake a study of seedling demand in the Khartoum Province, using a local consultant, to guide area nurseries in market development for their expanded production.

3. Charcoal Stoves

a. Staffing:

The RERI brought on several new staff to work on both the development and dissemination of new charcoal stove designs. Shadia Nasir El Din and Fadia Mahjoub came to RERI from Ahfad College, where they had worked on the early development of improved stove designs. El Tayeb El Beshir became interested in this work through a renewable energy seminar given by SREP at the University of Khartoum in May, 1983. He joined RERI in September 1983.

When Gaafar El Faki Ali transferred from the National Energy Administration to become head of the Dissemination Unit, one of his first tasks was the dissemination of improved charcoal stoves. He then arranged for the transfer of Soumaya Suliman, an engineer from the Solar Energy section to take charge of stove dissemination activities. Awatif Mahmoud also of the Dissemination Unit, helped with media and other publicity.

At early demonstrations in markets throughout Khartoum just about every staff member of SREP, including secretaries, accountants, office managers and drivers, helped in raising public awareness of the benefits of this technology.

b. Technical Assistance:

Maxwell Kinyangui of E/DI paid 3 visits to Sudan, the first two to assist in the charcoal stove production contest, and the last to begin development of charcoal stove producer training workshops and to assess the

state of metal-ceramic stove development in the SREP-supported CARE El Obeid improved stoves project. Mr. Kinyangui has worked on improved stove production and dissemination in Kenya for many years. He played a key role in identifying potential stove producers among traditional artisans in Sudan, and in generating enthusiasm for the commercial development of canon elduga, an all metal improved stove utilizing small charcoal pieces (duga).

The development of SREP's improved charcoal stoves project also was assisted by the 2 dissemination consultants, Carolyn Huskey and Claudia Huff. Ms. Huskey concentrated on public demonstrations and promotional materials, while Ms. Huff supervised the development of the charcoal stove producers training workshop.

At the end of the project year, Jamal Sharbaak, a skilled metalworker, joined SREP as the trainer for charcoal stove producer workshops on a consultant basis.

c. Dissemination:

By the beginning of this project year the field test of the open draft improved stove design was nearing completion, and it was apparent that initial consumer reaction to the stove was very positive. Attempts to have the stove mass produced at the University of Khartoum, the Piaster Vocational School, and the Military Research Workshop fared poorly, and it was decided that existing commercial producers were better suited to manufacture canon elduga.

A contest was organized to attract all levels of

metalworkers to stove manufacture. During this time a second, controlled draft model was developed under the guidance of Maxwell Kinyangui. Twenty-eight entries were received between 1 January and 29 March 1984, and three prize winners were chosen. These were given a cash prize and a combined order for 1000 stoves (500 of each model).

RERI's Dissemination Unit then began a public education and promotional campaign involving the contest winners and its staff in market demonstrations, television and radio programs, and distribution of canon elduga pamphlets. The public response was very favorable, with 35 stoves sold in less than 2 hours at the first demonstration at Sajana Market, and more sold at subsequent demonstrations.

Soon new producers began making canun el duga, particularly the neighbors of Ibrahim Obeng, the third prize winner and a traditional charcoal stove maker. They brought their stoves to SREP organized public demonstrations, and also developed independent distribution and sales systems. By the end of the project year 14 producers from Ibrahim's area were making and selling canon elduga independent of SREP. Present production and sales from this area alone are estimated at over 500 stoves per month (exact records are difficult to obtain because of the independent nature of the operation).

Even with this expanded production, demand for canon elduga still far exceeds supply in the Khartoum Area. Also, stove quality varies greatly from producer to producer and, in some cases, from stove to stove. For these reasons, SREP has begun to develop and implement charcoal stove producer training workshops, in which

techniques for consistent high quality stove production are taught. Jamal Sharbaak, the contest first prize winner, was hired as trainer/consultant. The first 2 workshops were scheduled for Khartoum Industrial Area and Omdurman Industrial Area from 4-8 and 10-14 November 1984, respectively.

In July 1984 SREP awarded a grant to CARE El Obeid to support its work on improved charcoal stoves in that area. CARE is working both on canon elduga and on the development of a metal/ceramic stove based on a successful Kenyan design. Maxwell Kinyangui briefly visited the CARE project in September 1984 to assess its progress and to give guidance on future metal/ceramic stove development work.

d. Future Activities:

The coming year will see continued emphasis on expanded canon elduga production and sales. The Dissemination Unit will implement new demonstrations and producer training workshops in Khartoum and other metropolitan areas around Sudan. Peace Corps Volunteers Brad Tyndall and Mary Clarkin already are an integral part of this work. The core of improved stove dissemination strategy will be to identify other organizations like CARE which have extension networks already in different regions, and to get them working with traditional stovemakers and other artisans in these areas.

The development of a new metal/ceramic stove design will continue in El Obeid. Kevin McNally, PCV, will assist in this work. Perhaps a contest will be used to encourage artisan participation. Once the design and production method is worked out, a producer training workshop for this model will be planned for this area. Subsequent workshops in other regions will disseminate the metal/ceramic as well as canon elduga designs throughout the project area.

4. Charcoal Production:

a. Staffing

The work to date in the charcoal production project has been implemented almost exclusively through local consultancies and cooperative efforts with the Forestry Administration/FAO Fuelwood Project. In the past year, three separate studies were conducted on the charcoal industry to determine the structure of the production and marketing systems and the overall efficiencies of this production. Initially, it was believed that earth kilns were very inefficient and that with minor modification significant efficiency increases could be made. However, SREP's studies have shown that earth kiln efficiencies in Sudan are much higher than had been estimated. Because of these results, a follow-up study on the charcoal production conversion factors has been organized which should further detail actual charcoal production efficiencies. The decision to introduce new charcoal kiln designs will be based on these findings.

b. Technical Assistance:

The charcoal production project used the services of a foreign consultant, Dr. Derek Earl and a national consultant, Dr. Hassan Osman El Nour, to define the type of initiatives most appropriate to improve the charcoal kilns presently being used. Dr. Earl, with over 15 years experience in charcoal production and forest management in Africa focused on the charcoal production methods in the Blue Nile Region of Sudan and Dr. El Nour studied the producer infrastructure, estimated the amount of charcoal being produced in the same region and conducted the SREP charcoal conversion study.

Dr. Taj El Din Nasroun of the Forestry Research Centre conducted tests on charcoal production using various wood species. Production took place in metal kilns of French design at the ERC headquarters in Soba, and included training in metal kiln operation for SREP and ERC Staff. Calorific analysis of wood input and charcoal product was made using an SREP procured bomb calorimeter and muffle furnace, under the supervision of Dr. William Ibrahim of the University of Khartoum.

Gaafar El Faki, Head of the Dissemination Unit, directed a study of charcoal marketing systems in the Central Region. The study involved RERI staff and members of the Central and Regional Forestry Departments.

c. Dissemination:

There will be no dissemination activities in this project area until the economic feasibility of various options is determined.

d. Future Activities:

The SREP will be conducting a second charcoal conversion study which will weigh all the wood used and charcoal produced in a limited number of kilns. This work again will be a joint effort between the SREP and Forest Administration. Jon Dore,Peace Corps Volunteer, will assist in this work to take place in the Gedaref and Damazine areas from November 1984 to June 1985.

Dr. Earl will return in January to help formulate a study to evaluate the economic costs and benefits of agriculture/forestry integration in the mechanized farming sector. Results of this study will be publicized through a seminar in late July.

A consultancy presently is being organized for Mr. Grant Curtis, senior researcher at the Georgia Tech Research Institute. Mr. Curtis has developed a low cost pellitizing process which can be used for agricultural residues and charcoal fines.

Derek Earls' first report pointed out the presence of significant supplies of charcoal fines at regional depots. Work is planned to estimate the potential volumes of charcoal fines and to experiment with the Curtis pellitizing process using these fines.

5. Fuelwood Combustion:

The RERI staff has conducted limited laboratory tests of traditional wood stoves and 3-stove fires to measure their efficiencies. These tests will continue, but during this year it was decided that the emphasis in this project area should be small commercial/industrial applications of wood fuels. SREP issued a grant to NEA to support a survey of wood fuels use in Khartoum area industries. Based on the results of this study, new wood fuels combustion designs for bakeries, brick kilns, potteries, and restraurants will be developed and disseminated.

6. Photovoltaic Applications in Rural Areas

The photovoltaic project area has focused on small scale applications in rural area. Fifty thousand dollars was allocated to 4 grants. Each grantee imported photovoltaic devices which are now being prepared for field testing. After field tests, an evaluation report will be issued for each device.

a. Staffing:

The RERI has assigned one full time professional to the project. Actual field testing will be conducted by individuals in selected communities with the assistance of RERI staff.

b. Technical Assistance:

The RERI has several trained professionals in the photovoltaic technologies area. Therefore no outside technical assistance has been required.

c. Dissemination:

Based on the evaluation reports of the field tests, the economically feasible devices will be promoted.

d. Future Activities:

The photovoltaic devices will be field tested through March, 1985, and reported on in April, 1985.

D. Procurement:

The SREP has procured equipment to help in the implementation of the five priority areas. Purchases have been made in following areas.

1. Office equipment.
2. Forestry supplies.
3. Audio visual.
4. Transport.
5. Laboratory and Field Equipment.
6. Books & Technical Information.

E. SREP Project Organization and Staffing:

1. Peace Corps:

In November of 1983 the Energy Research Council requested to USAID the participation of Peace Corps Volunteers in the SREP. A proposal for 6 PCVs was submitted to Peace Corps in April 1984 and 5 volunteers were recruited and trained. The volunteers will begin their work November 1st in the following areas:

Mary Clarkin	-	Dissemination (Khartoum)
Bradley Tyndell	-	Dissemination (Khartoum)
Jim Adams	-	Forestry/Fuelwood (Um Tureibat)
Kevin McNally	-	Ceramic Stoves Kilns (El Obeid)
Jon Dorre	-	Charcoal Production (Gedaref/ Damazin).

It is expected that the volunteers major contribution will be to build up the extension activities in the RERI.

2. Staffing of SREP:

Short term technical assistance is discussed in each of the technology areas.

The SREP has two long term advisors, Chief of Party and Energy Economist. In November 1983, the original Chief of Party, Dr. Ron Larson, was replaced by Mr. Donald Peterson, Mr. Matthew Gamser remains the project's Energy Economist.

Whereas the original SREP scope of work demarcated clear divisions of responsibility for the 2 long term advisors, in practice both have become involved in all aspects of project implementation: technology development, dissemination, and economic and social

evaluation. It is expected that this overlapping responsibility will continue in the coming year.

F. Budget and Expenditures:

1.	Contract	$ 1,247,813
2.	Trust Fund	LS 291,455
3.	Project Account	LS 764,784
4.	Grants	$ 30,862.95

G. Problems/Issues:

SREP has progressed well in the past year, and there are no major problems or issues confronting the project. A good counterpart relation with ERC/RERI has developed, and a workable system for reviewing, disbursing, and monitoring grants has been established.

One issue to be resolved in the coming year concerns the contract scope of work obligations for SREP. USAID noted in April 1984 that project development, with its consent, was proceeding along somewhat different lines than those originally envisioned in the Project Paper and contract. This was partially due to the demands of the particular technologies selected, and also to changes in the organization of the counterpart agencies. The contractor was requested to draft an alternative scope of work that reflected these changes.

The revised scope of work was presented to USAID for review in May 1984 (see attachment). USAID decided to delay its consideration until after the review of project evaluation report. This has now taken place, and it is hoped that the revised scope of work can be reviewed, modified as necessary and incorporated into the contract as soon as possible.