

PDBAD454

I. SUMMARY AND RECOMMENDATIONS

A. Face Sheet

AGENCY FOR INTERNATIONAL DEVELOPMENT <b>PROJECT PAPER FACESHEET</b>		1. TRANSACTION CODE <input checked="" type="checkbox"/> A ADD <input type="checkbox"/> C CHANGE <input type="checkbox"/> D DELETE	
3. COUNTRY/ENTITY Africa Regional (Burundi)		4. DOCUMENT REVISION NUMBER Original	
5. PROJECT NUMBER (7 digits) <input type="text" value="698-0410.09"/>	6. BUREAU/OFFICE A. SYMBOL <input type="text" value="AFR"/> B. CODE <input type="text" value="06"/>	7. PROJECT TITLE (Maximum 40 characters) <input type="text" value="Accelerated Impact Program (Burundi Alternative Energy-P"/>	
8. ESTIMATED FY OF PROJECT COMPLETION FY <input type="text" value="7"/> <input type="text" value="9"/>		9. ESTIMATED DATE OF OBLIGATION A. INITIAL FY <input type="text" value="78"/> B. QUARTER <input type="text" value="2"/> C. FINAL FY <input type="text" value="78"/> (Enter 1, 2, 3, or 4)	

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

A. FUNDING SOURCE	FIRST FY			LIFE OF PROJECT		
	D. FX	C. L/C	D. TOTAL	E. FX	F. L/C	G. T
AID APPROPRIATED TOTAL	214	276	490	214	276	4
(GRANT)	( 214 )	( 276 )	( 490 )	( 214 )	( 276 )	( 4 )
(LOAN)	( - )	( - )	( - )	( - )	( - )	( - )
OTHER U.S.						
HOST COUNTRY	-	695	695	-	695	6
OTHER DONOR(S) CRS	-	90	90	-	90	
TOTALS	214	1,061	1,275	214	1,061	1,2

11. PROPOSED BUDGET APPROPRIATED FUNDS (\$000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE		E. 1ST FY <input type="text" value="78"/>		H. 2ND FY		K. 3RD FY	
		C. GRANT	D. LOAN	F. GRANT	G. LOAN	I. GRANT	J. LOAN	L. GRANT	M.
(1) ST	712	878	-	490	-	-	-	-	-
(2)									
(3)									
(4)									
TOTALS				490	-	-	-	-	-

A. APPROPRIATION	N. 4TH FY		O. 5TH FY		LIFE OF PROJECT		12. IN DEPTH EVALUATION SCHEDULE
	C. GRANT	P. LOAN	R. GRANT	S. LOAN	T. GRANT	U. LOAN	
(1)	-	-	-	-	490	-	<input type="text" value="1"/> <input type="text" value="2"/> <input type="text" value="7"/>
(2)							
(3)							
(4)							
TOTALS	-	-	-	-	490	-	

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

1 = NO  
 2 = YLS

14. ORIGINATING OFFICE CLEARANCE SIGNATURE:		15. DATE DOCUMENT RECEIVED IN AID/CO, OFFICE OF AID OPERATIONS, DATE OF DISTRIBUTION	
TITLE: Terry Lambacher AID Affairs Officer Actg. Director		CONCURRENCE: DATE SIGNED: <input type="text" value="78"/> <input type="text" value="11"/>	

## BURUNDI ALTERNATIVE ENERGY - PEAT

### I. PROJECT BACKGROUND

#### A. Burundi's Ecological Problem

Burundi is situated in the Highlands of the Congo-Nile Divide, along the western branch of the East African Rift Valley. With an expanding population of 3,800,000 inhabiting only 10,745 square miles, Burundi is one of the most densely populated countries in Africa. The country's annual rate of population growth has recently been estimated at 2.7%.

Eighty percent of Burundi's population lives in high altitude regions exceeding 5,300 feet. The climate is definitely not tropical at this altitude; hail storms and frost occur frequently. Evenings are cold, with temperatures averaging 37-48°F. Under these harsh climatic conditions fuel for warmth of the rural peasants and their animals is nearly as important as fuel for food preparation. Because of population densities approaching an average of 354 persons per square mile ( 580 persons per square mile of arable land ), Burundi is experiencing a rapidly depleting supply of wood. As the only source of thermal energy, wood is harvested by the rural peasants from either the remaining groves of trees or from single trees isolated on the slopes of hills. In 1977 the fuel consumption of the rural populations will be an estimated 3,981,571 metric tons of wood, increasing to an estimated 4,126,686 metric tons by 1979. Given such an increasing demand for firewood which has already so seriously depleted Burundi's forests, it is further estimated that sufficient reserves exist for only the next ten years.

The environmental consequences of unchecked deforestation are potentially disastrous. Surviving forests are limited to less than 2 percent of the total land area of Burundi, or less than 1,000 acres, having been cleared over the centuries for farming and grazing lands. Serious erosion has resulted in the short-term, resulting not only from heavy rainfalls averaging 40-60 inches per year but also from poor agricultural practices. In the medium-term, if Burundi continues to lose its natural forests, the climate may change considerably and become less favorable for agricultural production. The rate of evapotranspiration may become upset; water tables may decline; springs may dry up; water runoff may increase; and the dry seasons may intensify. A small country such as Burundi, subjected to growing human and cattle population pressures, cannot ecologically survive if the land is not managed with considerable care.

#### B. A Solution for Thermal Energy Requirements

Burundi has no known fuel deposits, such as coal, lignite, oil or natural gas. Burundi's only viable alternative energy source which can be economically exploited with existing technology is a relatively recently identified reserve of peat, estimated to be sufficient for 200 years of non-industrial thermal use.

A survey completed in 1959 by a professor of geology at Butare University in Rwanda identified approximately ~~two billion cubic meters of wet peat~~ in Burundi. This alternative source of energy was not considered significant at the time, however, because of a perceived adequate reserve of firewood for thermal energy requirements. It was not until the late 1960's that agronomists and soil engineers began to forecast serious shortfalls in the rural energy sector, predicting that there are simply not enough trees to satisfy the energy requirements of Burundi's rapidly expanding population.

The Government of Burundi (GRB) is aware of the country's ecological crisis and is presently giving high priority to developing peat fuel to meet the country's energy requirements in an effort to save the natural forests. The first step was the establishment in March 1977 of a national peat office within the Ministry of Mines and Geology. The office is called the Office National de la Tourbe, or, by its French acronym, ONATOUR. ONATOUR is charged with developing the peat industry in Burundi for (a) non-industrial energy requirements, (b) industrial energy and non-energy requirements and (c) energy requirements for developing and processing nickel deposits. ONATOUR is responsible for all phases of peat production, including not only harvesting, but also marketing and distribution. ONATOUR's first priority, however, is the development of peat for non-industrial energy requirements because the requirements for thermal energy in the rural sector are most urgent. Peat for this purpose, moreover can be produced (or harvested) relatively quickly and at marginal cost using labor-intensive, non-mechanical techniques.

The ONATOUR staff includes a director and several engineers and geologists. The total staff in the ONATOUR headquarters in Bujumbura numbers about 20. This core staff is supplemented by contract day laborers who are hired by ONATOUR to work at the peat harvesting sites presently being established at Igenda and Kashiro. There are approximately 50 laborers working at each site who are supervised by ONATOUR site managers.

### C. AID Interest in Peat Production

Since the establishment of the A.I.D Development Office in Bujumbura (CDO/ Bujumbura) in February 1977, the Country Development Officer has been exploring possibilities for a modest assistance program. In establishing contacts with GRB officials and donor and PVC representatives, the CDO soon became aware of the potential for AID assistance in developing peat as an alternative energy source in Burundi. There has been very little experience with peat production to date; initial experimentation with peat as a heating source was undertaken by UNDP/UNIDO. From 1972-1975, a UNIDO ceramics engineer conducted a study of the use of peat for kilning bricks and tiles in Bujumbura (UNDP/UNIDO Project No. BDI 73 009). Although experiments were successful, a full-scale project was not designed because of U.N. budgetary constraints in 1975.

Catholic Relief Services (CRS) first supported small-scale efforts on the testing of peat efficiency in rural areas in September 1975. At the request of the GRB, CRS has contracted for the services of an experienced Irish peat cutter who arrived in Burundi in February 1977. Since his arrival, the peat cutter has been working with ONATOUR on the development of the two peat extraction sites. (It is important to note, in this regard, that Ireland is the principal producer of the world's peat supplies and that Irish peat cutters are uniquely qualified to provide the needed expertise in peat production.) On the basis of discussions with both ONATOUR and CRS, CDO/Bujumbura has developed this pilot project which will be the first AID project in Burundi.

## II. PROJECT DESCRIPTION

### A. Goal

The potential exists for developing Burundi's peat reserves as an alternative energy source, especially, and most urgently, for non-industrial needs. The supply of firewood will be exhausted within the next ten years unless an alternative source for thermal energy in the rural areas is developed without delay. Concurrent with the development of peat for fuel, however, will be the "sensitizing" of the rural population to (a) the consequences of unchecked deforestation and (b) the availability of peat as an alternative thermal energy source to wood. The goal of this pilot project, therefore, is to increase the availability and acceptability of peat as an alternative energy source in Burundi. Such an objective cannot be realized nationally within the timeframe of this pilot project. If successful, however, this project will be expanded into a longer term, full-scale project which will achieve this goal.

### B. Project Purpose

The purpose of this project is (1) to assist ONATOUR in developing Burundi's peat reserves for non-industrial thermal energy requirements and (2) to develop and design alternative approaches to encourage rural peasant consumption of peat as a thermal source energy. As the operative GRB agency for developing the peat industry, ONATOUR controls all phases of peat harvesting, marketing and distribution. At the present time, ONATOUR requires assistance in operating effectively and efficiently. Assistance will be offered in (a) personnel recruitment and management, (b) the introduction of financial controls and an accounting system, (c) experimentation in appropriate technology in peat production and (d) the conduct of necessary research studies. The strengthening of ONATOUR's capacity and capability will constitute a first important step towards the development of peat as a small-scale, rural industry in Burundi. However, in addition to institution-building, the basic focus of the project will be research and development activities to test acceptance of peat in the rural sector.

To an extent, the Burundian population will have no choice but to accept peat for fuel when the supply of wood is depleted, but the rationality of acceptance is an assumption which cannot be made until the sociological aspects of the problem have been considered. It is for this reason that the project will be implemented on a pilot basis. The dual purpose of the project can be achieved within a two-year period, and the feasibility of peat as an alternative energy source will have been established or disproven.

Accomplishment of the project purpose is supported by the end-of-project status. The following conditions will have been achieved by mid-FY 1980.

(a) ONATOUR will be functioning efficiently in managing an expanding peat industry. As peat production is increased, ONATOUR will recruit additional staff, establish sound management practices and regulate the distribution of quality peat to both rural and urban markets;

(b) peat production will be underway on approximately .02% of Burundi's unusable land. Peat is found in bog areas which are not suitable for agriculture or livestock grazing. In the short-term, therefore, there will be no decrease in Burundi's agricultural production. In the long-term, the effect of peat production may actually be an increase in arable land area. A rehabilitation study of the bog areas will be undertaken to recommend what crops may be suitable for cultivation on the land;

(c) studies of methods of extraction; marketing, distribution, and quality control will be completed;

(d) sociological studies on the acceptance of peat as a viable alternative to wood and charcoal will be completed.

The research and development studies will indicate the feasibility of expanding peat harvesting in Burundi on a large-scale basis under the aegis of an effective GRB organisation. These studies will also serve as the basis of the design of a longer term, follow-on AID project in peat production as an alternative energy source.

### C. Outputs

Given the pilot nature of this project, outputs can be discussed only in general terms. They will, however provide a direct linkage to and are necessary for the accomplishment of the project purpose. Outputs include: (a) strengthening ONATOUR's management capability; (b) exploitation of Burundi's peat reserves on a pilot basis; (c) establishment of peat marketing and distribution systems to assure the availability of peat for the rural population; and (d) research and development activities on peat production and appropriate technology.

This two-year project will be undertaken on a pilot basis principally because of the lack of experience to date in peat production, the recent establishment of a national peat office and the limited knowledge of peat and its utility/acceptability in place of green wood and charcoal for thermal energy. Urban consumers of bulk black peat will include the central hospital, bakeries, private concerns producing bricks and tiles and the urban poor who currently buy firewood and charcoal for cooking and heating. Rural consumers will include mission hospitals, GRB social centers and the poor majority, including small farmers, herders, artisans and service workers in village and market towns who also currently are dependent on firewood and/or charcoal for thermal energy requirements.

Based on the above, the magnitude or quantifiable indicators of the outputs by the end of the project include:

- (a) a core ONATOUR staff at least 20 Burundians trained in management techniques, fully capable of handling an expanding peat production industry;
- (b) six peat extraction sites producing approximately 30,000 metric tons of processed peat per year;
- (c) design improvements made on peat production tools to maximize harvesting efficiency; and
- (d) approximately 3-5 peat related research studies completed.

Output assumptions include the following:

- (a) the acceptability of peat for thermal energy will be demonstrated and promoted through ONATOUR so that
- (b) ONATOUR's centralized management role can be lessened;
- (c) harvesting of peat directly by the rural population will be encouraged;
- (d) the acceptability and use of peat will gather momentum as a demonstration of rural self-help; and
- (e) the harvesting of forest reserves will decrease.

#### D. Inputs

The inputs required and as proposed have been determined on the basis of joint planning with GRB, the CRS Program Director and CDO/Bujumbura. CRS will be the implementing agency for this project given its experience in peat production to date in Burundi and its valuable contacts with sister agencies in Ireland. Since this will be AID's first technical assistance project in Burundi,

it is more appropriate to negotiate this project on a bilateral basis with the GRB than to provide assistance to CRS directly through an Operational Program Grant. The input requirements are discussed by category in order to indicate their interdependency, the need for coordination between the GRB, CRS and AID and to describe the role and function of each.

### I. Technical Assistance

Through funds provided in this project, CRS will recruit five technical advisors, including a Project Manager and four peat cutters. Although the CRS Program Director will oversee implementation of the project, including management controls and decisions, the Project Manager will be responsible for project administration on a daily basis. Working as a member of the ONATOURE staff, the Project Manager will assist in supervising the core staff, the peat cutters and the day laborers at the peat harvesting sites. The four peat cutters will function as technical advisors to the ONATOURE site managers, demonstrating efficient techniques of harvesting wet peat and processing the peat for distribution and marketing. Based on the successful assignment of an Irish National peat cutter since February 1977, CRS will contract for the services of Irish National peat cutter for the additional four positions financed under this project. French proficiency, although desirable, will not be a prerequisite for employment; in the case of peat production, actions speak louder than words. It is expected, however, that the Project Manager will have at least a working knowledge of French.

Funds also will be provided for short-term consultant services to undertake research and development activities. Consultants will undertake on-farm studies and basic market research studies to develop baseline data on rural consumer reaction to using peat fuel, demographic patterns and price determination. Studies will also be made of potential agricultural application of peat and peat-derived products, especially as a soil nutrient, and of new product uses. Experiments may be made on the transformation of peat into coke and briquettes; limited experiments to date have resulted in the invention of a prototype coking oven which can be assembled at a unit cost of less than \$ 600.00. In the area of appropriate technology, experiments will be made to improve the design of locally manufactured hand tools for cutting peat. Different tool designs will be tested on-the-job by the ONATOURE day laborers at the peat sites.

### 2. Commodities

The primary requirement is for vehicles to transport ONATOURE personnel and equipment and to distribute processed peat to the rural markets and urban centers. Two five ton trucks will be purchased. In addition, funds will be

used to purchase five all-purpose vehicles and two all-terrain motorbikes for use by the site managers. A procurement source and origin waiver is attached as Annex C. Equipment procurement will be limited to hand tools, boots wheelbarrows and polyethelene storage covers to protect the harvested peat during the rainy seasons. Procurement will be undertaken by CRS.

### 3. Other Costs

Funds will be provided to CRS for local staff support, administrative support and miscellaneous costs associated with the research and development activities. Local staff required to manage implementation include an Assistant Project Manager, an office secretary, an accountant to handle project accounts and an office driver. Burundians will be hired for these positions. Local expertise also may be available to undertake or participate in several of the research studies; in such cases, CRS will contract directly for the short-term consultant services. For example, a local contract with Ki-urundi-speaking social scientist or home economist would be a recommended approach to study the question of rural consumption practices such as the peat-burning techniques for home use. Administrative support costs will include vehicle maintenance and repair, office rent and the purchase of office supplies and equipment. In addition operating costs will include funds for in-country travel and per diem of project personnel between the harvesting sites and ONATOUR headquarters in Bujumbura. Funds are also included for one familiarization visit by ONATOUR staff to Ireland to observe peat production and land rehabilitation programs. One such familiarization visit to Ireland was financed by CRS in August 1977 and was successful that a second visit by other ONATOUR staff will be very worthwhile. CRS will be responsible for arranging the second visit.

### 4. GRB Contribution

The ONATOUR budget for the project will be used for salaries for the site managers at the six harvesting sites and for the day laborers at each site. Approximately 300 days laborers will be recruited and hired by ONATOUR. ONATOUR will also purchase heavy-duty vehicles for personnel and transportation of the peat to urban and rural markets. Administrative support costs, including travel allowances for ONATOUR care staff will also be provided.

### 5. CRS Contribution

CRS will provide funds for limited equipment and local salary support. Operating costs for the project office will also be provided, including travel funds for the CRS Program Director to monitor project implementation.

## III. TECHNICAL ANALYSIS

Peat deposits are fossil deposits, and therefore the project will impact on the consumption of natural resources. The formation of peat is the first stage in the centuries-long process of decomposition of vegetation which eventually results in the formation of coal. The development rate of peat is

approximately one foot per thousand years. As has been previously mentioned, Burundi's peat reserves are estimated to be sufficient for two centuries of non-industrial use, principally for thermal energy demand. Alternative thermal energy sources in Burundi are limited to wood and wood derivatives. Since it consists mainly of cellulose, containing nearly 45% oxygen, wood compares unfavorably with most other fuels as a source of heat. Calorific values indicate the higher efficiency of peat: 4,800 kcal/kg for green wood; 4,000-8,000 kcal/kg for charcoal; 5,400-7,200 kcal/kg for peat. Peat can also be manufactured into briquettes more easily than charcoal, making an excellent means of recovering waste peat material.

Burundi's peat deposits are geographically dispersed but generally are found on a north-south axis in valleys along the Congo-Nile Crest. Areas of deposits range from a few hectares to 30 square kilometers. The peat harvesting sites which will be exploited in this pilot project will average five hectares, producing approximately 1,000 metric tons of dry peat per hectare annually.

The actual harvesting, or cutting, of peat is preceded by simple drainage procedures to drain excess water in the cutting and working areas into neighbouring swamps. Using labor-intensive techniques and minimal equipment, trapezoidal drainage channels are dug, with length and depth dependent on the topography of the bog area and the depth of the deposit. After draining for about two months under optimum conditions, the peat bogs are sufficiently dry for harvesting. Following removal of surface soil the peat is cut manually with specially designed spades (called slains) into brick-size, blocks, or sods. The freshly cut peat is then spread out for drying along the side of the producing peat bog. After 4-8 weeks, the cut peat is completely dried and can be stacked. The dry peat is then usable directly as an energy source or can be further transformed into other products, such as briquettes or coke. The techniques involved in harvesting and drying peat are simple. In a labor-intensive operation, such as proposed in this project, equipment requirements are basically limited to slains, wheelbarrows and rubber boots.

During this two year pilot stage of peat production in Burundi, ONATOUR will harvest and market all peat on its own behalf. Proceeds from the sale of peat to primarily urban consumers will be additive to the GRB budget for ONATOUR and will be used for ONATOUR's contribution to operating expenses under the project. After the utility of using peat instead of firewood as a source of heat is successfully demonstrated during the pilot stage, it is anticipated that the actual peat harvesting will be done on a voluntary basis for personal consumption by the rural peasants in the areas of the peat reserves, ONATOUR's role will be then less operational and more supervisory such as establishing national policy for private exploitation and marketing and directing an environmental management system. ONATOUR will also continue an on-site supervisory role.

Given a high rate of unemployment in Burundi, the recruitment of day laborers will pose no problem. A full discussion of the environmental impact is included in the attached initial Environmental Examination (Annex B) which recommends a Negative Determination. Pending operational experience to the contrary, this pilot project is judged to be technically/and feasible. /sound Environmental impact will be continuously during entire project life.

#### IV. FINANCIAL ANALYSIS AND PLAN

##### A. Project Funding Summary

As shown below, the estimated total cost of the project is \$ 1,275,000. It is proposed that AID will finance \$ 490,000. The GRB will contribute the equivalent of \$ 675,000, and Catholic Relief Services will provide \$ 90,000.

##### PROJECT FUNDING SUMMARY

<u>Source</u>	<u>Foreign exchange</u>	<u>Local currency</u>	<u>Total</u>	<u>% of total</u>
AID	233,000	257,000	490,000	38
GRB	-	695,000	695,000	55
CRS	-	90,000	90,000	7
TOTAL	233,000	1,042,000	,275,000	100

##### B. Cost Analysis

U.S. technician' cost are based on the salary scales and employment allowance offered by Catholic Relief Services. A basic salary of \$ 8,000-10,000 per year is considered adequate for recruiting Irish national peat cutters, primarily based on the employment of the Irishman presently working at ONATOUR. Burundian staff to be hired for the project office will be compensated according to the in-country labor scales, Commodity costs are based on estimates for vehicles, hand tools, wheelbarrows and boots provided by local suppliers. Polyethelene storage covers will be procured from the U.S. at a single unit cost of \$ 5.00. A combined inflation and contingency factor of 10% has been added to the total life-of-project cost. The GRB cost calculations are based on the ONATOUR annual budget which, in turn, is based on prevailing wage and commodity prices in Burundi.

##### C. Summary Cost and Financial Plan

The project costs and financial plan are summarized in the table below. All of the foreign exchange requirements are to be provided by AID through CRS. Of the AID contribution, 45% represents dollar costs, and the equivalent of 52% represents local costs. The latter consists mainly of administrative support costs.

SUMMARY COST ESTIMATES AND FINANCIAL PLAN

Sources	AID		GRB		CRS		TOTAL	
	FX	LC	FX	LC	FX	LC		%
USE								
Technical Services	190,000	-	-	117,000	-	4,000	311,000	24
Commodities	18,000	80,000	-	396,000	-	11,000	505,000	40
Other costs	-	157,000	-	182,000	-	75,000	414,000	33
Inflation/ Contingency	25,000	20,000	-	-	-	-	45,000	3
<b>TOTAL</b>	<b>233,000</b>	<b>257,000</b>	<b>-</b>	<b>695,000</b>	<b>-</b>	<b>90,000</b>	<b>1,275,000</b>	<b>100</b>

D. AID Obligation

Life-of-project financing will be provided in FY 1978 as indicated by component in the table below. The proposed obligations will be made under the Africa Regional project, Accelerated Impact Program, No. 698-

AID OBLIGATION BY COMPONENT

Component

I. <u>Technical Services</u>	(99,000)	171,000
A. <u>Long-term</u>		
Project Manager	43,000	
Irish Experts	54,000 (6man/year at 9,000)	
B. <u>Short-term</u>	72,000	
Economist	35,000	
Social anthropologist	37,000	
II. <u>Commodities</u>		138,000
Project utility vehicles (5)	46,000	
5 ton trucks (2)	38,000	
All terrain motorbikes	2,000	
Peat production equipment	18,000	
Storage covers	18,000	
I mobile house unit (self-contained)	16,000	
III. <u>Other costs</u>		136,000
Local staff support	31,000	
Administrative support	60,000	
Operating costs inc. travel	10,000	
Short-term consultant services	35,000	
Sub-total	445,000	445,000
Inflation/Contingency (10%)	45,000	45,000
GRAND TOTAL	490,000	490,000

E. Expenditures

The table below indicates estimated annual expenditures for AID, the GRB and CRS.

ESTIMATED ANNUAL EXPENDITURES AND PROJECT COSTS

SHOWN BY SOURCE OF CONTRIBUTION

FISCAL YEAR

<u>AID</u>	FISCAL YEAR		
	78	79	TOTAL
Technical services	76,000	95,000	171,000
Commodities	120,000	18,000	138,000
Other costs	68,000	68,000	136,000
Sub Total	264,000	181,000	445,000
<u>GRB</u>			
Technical services	40,000	77,000	117,000
Commodities	150,000	246,000	396,000
Other costs	82,000	100,000	182,000
Sub total	272,000	423,000	695,000
<u>CRS</u>			
Technical services	2,000	2,000	4,000
Commodities	7,000	4,000	11,000
Other costs	35,000	40,000	75,000
Sub Total	44,000	46,000	90,000
Inflation/Contingency	20,000	25,000	45,000
Grnad Total	589,000	686,000	I 275,000

V. ECONOMIC ANALYSIS

Data on the cost of peat production is based on ONATOUR's experience over the past fifteen months at the first peat extraction site at Igenda. Approximately 2,000 MT of dry peat have been harvested and are being transported and sold to rural institutional consumers (mission hospitals and GRB socialcenters). The total production and distribution cost is \$ 22.33 per metric ton. The breakdown is :

<u>TOTAL Cost per Metric Ton</u>	
Extraction	\$ 2.51
Equipment	. 60
Storage	.80
Transport & distribution	<u>18.42 (82%)</u>
Total	\$22.33

The annual estimated production of dry peat at each site is 5,112 metric tons. Total production and estimated cost/revenue is:

<u>Year</u>	<u>Extraction Site</u>	<u>Metric Tons</u>	<u>Cost/Revenue</u>
1	3	15,336	\$ 342,452.88
2	6	30,672	\$ 684,985.76

It is assumed that ONATOUR will be able to sell its total peat production at cost. The revenue generated from the sale of peat will be placed in a revolving fund and used to cover ONATOUR's operating costs of production and distribution, including salaries of the site managers and day laborers. A percentage of the proceeds deposited in the fund will also be used to supplement the financing for the research and development activities. The procedures governing joint GRB-AID control of the fund will be detailed in the Grant Agreement, including examples of the types of experiments which will be undertaken in the rural sector.

Assuming that an average of 50 day laborers will work at each site, by the end of the second year of the project, three hundred persons will be employed. The monthly salary will average \$ GRB officials have indicated that they do not believe that this marginal increase in purchasing power will contribute to rural inflation or disturb the traditional marketing mechanism. As women traditionally do most of the agricultural work, food production is not expected to decrease.

As a source of thermal energy, dry peat on a cost per calorie basis is 40% less expensive at current market prices than dry wood and 80% less than charcoal.

Of course this applies only for urban consumers because, generally speaking rural peasants incur no cost for wood collection. Experience to date indicates that a consistent quality and continuity of supply for the urban market has been achieved. After a period of consumer familiarity, it can be reasonably assumed that dry, non-processed peat will be economically viable. As indicated previously, market research and distribution studies will be undertaken through this project which will indicate appropriate selling prices to expand the market to not only the urban poor, but also the rural poor. It should also be noted that ONATOUR is empowered with a number of administrative options to discourage the use of wood and charcoal once the acceptability of peat has been established. For example, ONATOUR is authorized to prohibit the resale of wood in both urban and rural areas.

The following table indicates that, by the end of this pilot project, approximately 0.7% of total non-industrial energy requirements will be peat or peat-derived,

<u>Year</u>	<u>Population</u>	<u>Non-Industrial Energy Requirements</u>		<u>% of total Peat-derived Energy</u>
		<u>Mt of wood</u>	<u>Mt of peat</u>	
1977	3,788,942	3,981,517	3,000	0.1
1978	3,881,034	4,058,720	15,336	0.4
1979	3,939,352	4,126,686	30,672	0.7

This table include about 95% of Burundi's population as consumers and does not take into account automobile and electricity or gas substitution for either wood or peat non-industrial energy requirements.

This pilot project will obviously have no measurable impact on Burundi's balance of payments or trade situation. Local industries will benefit, however, from the local procurement of equipment and supplies.

## VI. SOCIAL ANALYSIS

One of the most important aspects of this pilot project will be to determine the acceptability of peat as a substitution for wood by the rural poor. Research and development activities supported under the project will include not only experiments in appropriate technology, but also studies on peat usage and associated social patterns. To the extent possible, Burundian research talent will be used to either conduct or assist in the studies.

In terms of current energy consumption, approximately 95% of the rural population uses wood fires for cooking and heating. Although produced in the rural areas, charcoal is not widely used but is transported to the urban centers for sale.

All firewood is collected by the younger members of a Burundian household at least several times a week. The cooking and heating fires are generally prepared by women. Actual cooking is traditionally done in the interior of the home, primarily for improved heat retention and warmth. Wood is also used to heat livestock enclosures in the evenings. ONATOUR is aware of the change required in the traditional custom of using wood fires and will give priority to educating the rural population in the use of peat fires.

As peat is located in uninhabited valleys, no large-scale displacement of the local populations will occur. Given Burundi's high population density, no significant population shifts or labor migrations are anticipated. Squatter developments may occur, but the process will be closely monitored. Lastly, the peat bog itself has no cultural symbolism, and no archeological or historical sites are believed to be located in the project areas. A further discussion of the public health and occupational safety aspects of peat production is included in the Initial Environmental Examination.

## VII. IMPLEMENTATION PLANNING

### A. Administrative Requirements

#### I. GRB

A grant Agreement will be negotiated and signed with the Ministry of with the concurrence of the Ministry of Mines and Geology. The implementing GRB agency will be ONATOUR. ONATOUR's responsibilities for developing peat production industry in Burundi are detailed in Presidential Decree No. 100/33 of March 21, 1977. Under this decree, ONATOUR is responsible for :

(a) all phases of peat pre-exploitation, including site definition, soil sample analyses, topographic surveys, exploration profiles and land rehabilitation planning;

(b) site exploitation permits on its own behalf;

(c) utilization of the peat product; and

(d) marketing functions, including distribution, pricing and promotion of peat and peat-derived products.

Based on discussions with ONATOUR officials to date, ONATOUR also agrees that all equipment and AID-financed CRS personnel will be utilized exclusively for peat exploitation performed on behalf of the GRB.

2. AID

Upon obligation of AID funds under the terms of the Grant Agreement, CDO/Bujumbura will issue a PIO/T for the services of Catholic Relief Services. CRS will be the implementing agency for AID. CDO/Bujumbura will maintain close communications with Ministry officials and with ONATOUR to assure timely implementation of the project. REDSO/EA will provide legal, contracting and supply services as may be requested by CDO/Bujumbura. Disbursements will be made in accordance with established AID procedures. It is proposed that the contract with CRS provide that payment claims be submitted to the AID regional Controller in Nairobi for direct payment.

3. Catholic Relief Services

The CRS/Burundi Program Director will report directly to CDO/Bujumbura concerning the project implementation. CRS/Burundi will maintain a project office because of the lack of space in the ONATOUR facilities. Based on discussions with ONATOUR, CRS will recruit contract for the services of and backstop all project personnel. The project manager will be responsible for preparing AID financial and progress reports. Short-term consultant services required for the research and development activities will be procured by CRS with the prior approval of CDO/Bujumbura for specific studies.

4. Joint ONATOUR-CRS Implementation Responsibilities

Joint responsibilities include : programmatic and financial decisions scopes of work for all project personnel, specific areas for research and development activities, and allocation of vehicles and equipment to the project sites,

B. Implementation Plan

<u>Date</u>	<u>Action</u>	<u>Agency</u>
<u>FY 1978</u>		
December 1977	AIP submitted to AID/W	CDO
January 1978	Grant Agreement signed : (GRB, CRS and AID)	CDO; REDSO; GRB
March	CRS personnel arrive; vehicles and equipment purchased	AID/W; CDO; GRB
September	<u>Familiarization visit to Ireland</u>	GRB; <u>CDO</u>
<u>FY 1979</u>		
December	Annual PAR prepared	CDO
May	Three peat extraction sites operating	CDO; GRB

FY 1980

December

Project Evaluation performed to determine feasibility of long-term follow-on project AID/W; CDO

May

Research and development activities completed; total of six peat extraction sites operating; CRS personnel complete assignments; project completion report prepared. CDO; GRB

C. Evaluation Plan

Given the pilot nature of the project, only one evaluation will be required on the basis of this evaluation, however, a determination will be made on the feasibility of designing a full-scale, long-term project to develop peat as a small-scale rural industry in Burundi. Much of the information on which the determination will be made will have been collected in the research studies and experiments in appropriate technology. The evaluation is scheduled for December 1979. Assuming that a recommendation is made to design a follow-on effort, a design team can be fielded in early 1979 prior to the departures of the CRS project personnel. A Project Paper can be submitted for approval by Summer 1980 for an FY 1980 obligation prior to October 1980. The project evaluation should require no more than three weeks and will be conducted in cooperation with ONATOUR. In addition to this evaluation, CDO Bujumbura will submit project appraisal report in December 1978

D. Conditions, Covenants and Negotiating Status

The GRB is in full agreement with both the substance and design of this project CDO/Bujumbura has discussed respective responsibilities for implementing the project with ONATOUR and CRS over the past several months. No difficulties in negotiating the Grant Agreement are anticipated.

INITIAL ENVIRONMENTAL EXAMINATION

Project Country : BURUNDI  
Project Title : Burundi Alternative Energy Peat  
Project No. : 698-0410  
Funding : FY (s) 78  
Period of Project : Two Years  
IEE Prepared by : REDSO/EA

Environment Action Recommended : A negative determination is recommended. Harvesting peat from bog areas will provide alternate source of non-industrial thermal energy. It will help the country in saving its natural forest reserve. On a long-range basis, the land now defined as ineligible for cultivation will become arable land.

L.A. Cohen, Director, REDSO/EA  
T.L. Lambacher CDO/Burundi

Concurrence :

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Assistant Administrator's Decision:

Approved \_\_\_\_\_

Disapproved \_\_\_\_\_

Date \_\_\_\_\_

## I. INTRODUCTION

### A. Project Background

Burundi is located on the highlands of the Congo-Nile Divide along the western branch of the great East African Rift Valley. With an expanding population of 3,800,000 inhabiting the country's 10,745 square miles, Burundi is one of the most densely populated countries in Africa. The country's net annual rate of population growth has been recently estimated to be 2.8%.

Most of the population lives at an altitude in excess of 1500 meters. The climatic forces governing this 80% of the population are definitely not tropical; hailstorms and frost occur with some regularity. Evenings are cold averaging 18-28°C. Fuel for warmth of rural peasants and their animals is nearly as important as for the preparation of food. Because of population densities approaching 155 square kilometers, it is not difficult to conceptualize a rapidly depleting forest population. Rural poor harvest their energy requirements from either single trees isolated on the slopes of hills, or from a few remaining groves. Increasing demands for firewood have so depleted forests that only sufficient reserves exist for an additional ten years. Burundi has no known fuel deposits such as coal, lignite, oil or natural gas. Firewood is the only utilized source of thermal energy.

A recently identified reserve of peat estimated to be sufficient for two centuries of non-industrial use presents Burundi with a viable energy alternative. A survey completed in 1959 by a Professor of Geology at Butare University in southern Rwanda identified an estimated two billion cubic meters of wet peat in Burundi. This was not considered significant at the time because of a perceived adequate reserve of firewood for thermal energy. During the late 1960's, various agronomists and soil engineers began to forecast serious shortfalls in the rural energy sector; there simply were not enough trees to satisfy the energy requirements of this rapidly expanding population.

The government of Burundi has now assigned development of peat fuel the highest national priority. The government created a new peat management body in March 1977 referred to as ONATOUR (National Peat Office). ONATOUR is a state monopoly and controls all phases of peat harvesting production, distribution and marketing. A cadre of qualified personnel of diverse government bureaus were assigned to ONATOUR in June 1977. ONATOUR is responsible for the management of all peat resources. These can be divided into three major classifications: (1) non-industrial energy requirements, (2) industrial energy requirements and non-energy uses, and (3) energy for development and processing of nickel deposits. ONATOUR is most interested in developing peat for non-industrial energy requirements because this sector is consuming the largest reserve of thermal energy, and perhaps more importantly, can be developed using labor intensive, non-mechanical techniques.

## B. Project Description

The primary objective of this AID pilot project is to upgrade, strengthen and refine the management expertise of newly assigned personnel to ONATOUR. Catholic Relief Service/Burundi (CRS) will be the implementing agency because of its previous experience in the sector as well as its in-house administrative structure which lends itself towards project execution. CRS will emphasize the development of handcut peat as a non-industrial energy source and the thrust of the project will be to upgrade ONATOUR's capacity to manage the development of this sub-sector. Industrial applications of peat and related uses will not be ignored and will continuously be evaluated as a potentially suitable area for consideration as a separate project entity at a later date.

As ONATOUR is mandated very precise operational areas of control by the government, CRS has proposed three major complimentary activities : (1) personnel recruitment and management, (2) the introduction of acceptable financial controls and management accounting systems and (3) implementation of appropriate technology and market research studies.

During the two year life of project ONATOUR will harvest and market all peat on its own behalf. It will open three extraction sites per annum and will employ 50 laborers/site. An annual estimated production of dry peat/site is 5000 tons. Peat deposits are geographically dispersed but generally seem to run on a north-south axis in valleys along the Congo-Nils crest. Deposit size ranges from a few hectares to 30 square kilometers. After the two year life project it is anticipated that peat harvesting would be done by local residents for their own use with ONATOUR managing a national rule policy as well as an on site supervision role.

The harvesting (cutting) of peat will be preceded by simple excavation procedures designed to drain excess water in the cutting and working areas. Experience to date indicates that trapezoid drainage channels will not likely exceed 400 meters in length, six meters in depth and two meters in width. Length and depth will depend upon the topography of the bog area and depth of deposit. After drainage, bogs are suitably dry for harvesting in about two months under optimum conditions.

After removal of top soil (15-20cm), peat is cut into brick-size blocks with specially designed spades, Fresh cut peat is spread out for drying along the side of the bog. One cubic meter of fresh wet peat requires fifteen meters square of drying area. After a period of four to eight weeks, the dry peat is stacked. Drying and stacking areas progress with the cutting front. Dry peat is only 14% of the weight of a freshly cut sod. The dry peat is now usable directly as an energy source or can be transformed into other products such as coke or briquettes.

A set of pre-production criteria must be satisfied before exploitation of a bog. After a suitable area has been identified and sampled to ONATOIR, the bureau must receive clearance from the Ministry of Agriculture and the Ministry of Geology and Mines. Only land which is not suitable for cultivation, or land which has not been cultivated is eligible for exploitation. ONATOIR executes these additional pre-exploitation steps as part of an environmental management system: (1) site definition, (2) sample analysis, (3) topographic surveys, (4) exploration profiles and (5) rehabilitation plans. These steps have been completed for the next three sites scheduled for FY 78 pilot project development. At an average working area of five hectares per site, the total land which will be under active development at the end of project year II will be 30 hectares, or .02% of Burundi's unusable land, thereby making this a pilot project.

## II. DISCUSSION OF IMPACTS

### A. Land Use

Since the project sites are bogs, the land is useless for cultivation or any other development. While the wet, spongy ground will support the weight of a person walking on the bog, it is definitely not suitable as a construction site. Therefore, the project will not have impacts on existing land uses.

Peat harvesting operations will result in an alteration of the natural topographic which will be essentially lowering of a valley floor. After drainage and installation of controls to prevent back flows, top soil will be removed and the peat will be harvested systematically in layers. Once all usable peat is harvested, the top soil removed during initial operations will be mixed with the underlying clay soils. Cultivation of selected crops or pasture will then be undertaken. Thus, the project will have beneficial impacts on future land use by providing more productive land area.

### B. Ecology

The bogs are located within 1/4 mile of existing roadways. Thus, no virgin territory will be opened to development as a result of the project.

There are no indigenous wildlife species or migration routes on or in the vicinity of the project sites. The bogs contain no aquatic animal life, as determined through field surveys. Bird life residing in the project area are expected to migrate to adjoining swamps. This assumption is based on observations from previous peat removal operations in the country. As a result, the project will have no overall effect on area wildlife.

The reduction of water surface area may result in destruction of breeding habitats for insects and reduced moisture content in the surrounding atmosphere. Neither of these are considered to be significant impacts on the ecology of the area.

Ecological communities of bogs are mainly heterotrophic, wherein respiratory demand exceeds photosynthesis. The biological fertility is based on past production, organic matter accumulated over a period of time and often imported from another ecosystem. Thus, no outside ecological communities are dependent upon the bog's production for survival,

The upper ground surface of the bogs is spongy and uneven. Since the organic soil is dense the bog surface is not readily permeated by roots or nutrients. Vegetation consists of relatively few species: grasses and mosses. This vegetation is not suitable for cattle grazing and it is not used by local inhabitants of the area. No trees or other large terrestrial plants are within the area of the bogs. Therefore, injury to or death of such plants, which is usually experienced in swamp reclamation, will not be an impact of the project

In terms of the overall relationships between the bogs and surrounding ecological communities, no impact is foreseen from the project.

### C. Water Quality

Water drained from the bogs will be diverted into adjacent swamps which empty into surface streams. The composition of the water in the bog and swamp would be similar, containing high concentrations of humic acids (organic compounds derived from break-down of plant matter) and lignins, with relatively low amounts of nitrogen, sulfur, potassium and phosphorus. During formation of peat the so-called marsh gas evolves, consisting mainly of methane and carbon dioxide. Due to the release of carbon dioxide and other by-products of anaerobic breakdown, the water is acidic (ph 6-7).

The swamp will act as a holding pond for water drained from the bogs. This storage will allow for solids sedimentation, further break-down of organics, and element uptake by swamp vegetation, thereby serving as protection for the receiving water. Thus, no impact on surface waters will result from the project.

Impacts on ground water will be negligible if any. Minor lowering of the watertable may result in areas surrounding the bogs after drainage, with a comparable rise in the watertable around the swamps. The overall net effect will have no impact on the watertable of the area. Physical contamination is not a concern since surface waters are the only sources used for domestic water supplies.

### D. Natural Resources

Peat deposits are fossil deposits and thus the project will make commitment for consumption of natural resources. The formation of peat is the first stage in the long process of decomposition of vegetation, which eventually leads to coal formation. The development rate of peat is approximately one foot per thousand years. The peat reserve of Burundi is estimated to be sufficient for the total thermal energy demand of the country for two centuries of non-heavy industrial application.

Use of alternative sources of energy is presently an undertaking in most countries of the world. The alternatives in Burundi are limited (without use of foreign exchange to purchase energy sources from outside the country) to wood, or derivatives of wood, and peat. Wood consists mainly of cellulose, containing nearly 45% oxygen, with no fixed carbon. It thus compares unfavorably with most other fuels as a source of heat. The calorific value varies considerably because of the different amounts of oils and resins which differ according to the type of wood, averaging around 4,800 cal/kg.

Charcoal is the solid residue of dry distillation of wood. Charcoal produces little smoke, developing a heat of 4,000 - 8,000 cal/kg. Ignition of charcoal however, is difficult, requiring temperatures about 400°C above that for ignition of wood (200°C) or peat (225°C).

Peat has a calorific value of 5,400 - 7,200 kcal/kg, with approximately one half the fixed carbon composition of bituminous coal. Peat can be manufactured into briquettes more easily than charcoal, making an excellent means of recovery for waste remnants resulting from peat harvesting, transport, etc.

Based on the above discussion, and in view of the natural resource situation in Burundi, controlled exploitation of peat is definitely a beneficial environmental impact.

#### E. Air Additives/Public Health

The combustion of peat or wood will yield the same by-products. In an oxygen deficient environment, such as the initial stages of combustion, carbon monoxide is primarily formed. The volume of smoke and therefore carbon monoxide produced in the initial stages of burning is a function of the moisture content of the substance burned. Thus, the amount of smoke produced in burning peat will depend on the drying time allowed before use. The drying that occurs during transport and storage of the peat will remove sufficient quantities of moisture such that smoke generated by peat fire will be comparable, and in general much less than that from burning of freshly cut wood, which is the present practice.

The sulfur content of the peat is only 0,1 - 0,2%, and formation of sulfur dioxide is not a concern.

Peat has been successfully used for centuries in Europe (Ireland, Germany, Finland, URSS, Yugoslavia, etc.) with no discernable impact on human health. There is thus no greater health hazard through air pollution posed by substitution of peat for wood.

#### F. Cultural

Approximately 95% of the Burundi rural population uses wood fires for cooking or heating. Charcoal, while produced in the area, is not widely used; rather, it is transported to urban areas for sale. ONATOUR is aware of the change required in the traditional custom of using wood fires are started outside of the home, then moved inside for use in cooking and heating. Once this fact is learned, there should be no problem in acceptance of peat as a thermal energy source.

The bog has no cultural symbolism and no archeological or historical sites are located in the project area.

Due to ONATOUR involvement, the proposed peat extraction project will not contribute to squatter development. ONATOUR will also prepare a rehabilitation plan for the area after project completion.

G. Occupational Safety

The question of impacts on worker's health has been carefully reviewed by GRB and UN personnel. It has been concluded by Dr. Frederic Bartolli, WHO Representative, that peat cutters will not be exposed to a higher incidence of disease or sickness than the general population.

Due to methane gas generation in the bog, the possibility of fires does exist. Peat fires, however, spread very slowly and since there is no surface vegetation to ignite, any fire could be easily controlled and extinguished.

### III. RECOMMENDATION FOR ENVIRONMENTAL ACTION

Harvesting peat from bog areas will provide Burundi with an alternate source of non-industrial thermal energy. It will enable the country to save its forest reserve, which has depleted considerably in the last decade. The long-range effect will be that the land now identified as uncultivable will become cultivable. This is a pilot project activity and does not involve more than .02% of Burundi's unarable/unusable land or approximately 30 hectares of bog area, which will enable us to determine unknown effects, if any, for larger bilateral development assistance at a later date.

It is recommended that a negative determination be made.