

**GLOBAL
ENVIRONMENT
FACILITY**

MOHAMED T. EL-ASHRY
CHIEF EXECUTIVE OFFICER
AND CHAIRMAN

April 24, 1997

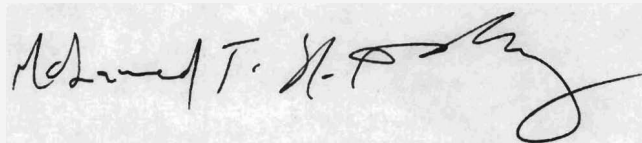
Dear Council Member:

The World Bank, as the Implementing Agency for *Republic of Senegal: Sustainable and Participatory Energy Management Project*, has submitted the attached proposed project document for CEO endorsement prior to final approval of the project document in accordance with World Bank procedures.

Over the next four weeks, the Secretariat will be reviewing the project document to ascertain that it is consistent with the proposal included in the work program approved by the Council in April 1996, and with GEF policies and procedures. The Secretariat will also ascertain whether the proposed level of GEF financing is appropriate in light of the project's objectives.

If by May 22, 1997, I have not received requests from at least four Council Members to have the proposed project reviewed at a Council meeting because in the Member's view the project is not consistent with the Instrument or GEF policies and procedures, I will complete the Secretariat's assessment with a view to endorsing the proposed project document.

Sincerely,



cc: Alternates, Implementing Agencies, STAP

ENVIRONMENTAL FACILITY

The World Bank as the implementing agency for renewable energy project has submitted the attached CBO endorsement proposal for the World Bank procedure.

Over the next four weeks, the Secretariat will be reviewing the project document to ensure that it is consistent with the proposal included in the work program approved by the Council in April 1996, and will CEB review and proceed with the Secretariat work on the project.

If by May 22, 1997, I have not received requests from you to have the proposed project reviewed at a Council meeting, my view on the project is not consistent with the instrument of CEB procedures. I will complete the Secretariat's assessment with a view to end proposed project document.

Very truly,
[Signature]




THE WORLD BANK/IFC/M.I.G.A.

OFFICE MEMORANDUM

DATE: April 17, 1997

TO: Mr. Mohamed T. El-Ashry, Chief Executive Officer, GEF

FROM: Lars O. Vidaeus, Chief, Global Environment Division 

EXTENSION: 3-4188

SUBJECT: **Senegal: Sustainable and Participatory Energy Management Project
Final Council Review/CEO Endorsement**

1. Attached are two copies of the final project document for clearance prior to its circulation to the Council and your final endorsement.
2. The scope and objectives of the project as presented here are unchanged from those reviewed and approved by the Council when it endorsed April 1996 work program.
3. In commenting on the proposal, Council members requested: (a) clarification of coordination arrangements with a complementary GTZ-supported project with similar objectives and involving the same partner agencies; (b) more detailed specification of the planned activities, project risks and the risk mitigation measures; and (c) clarification of project's links to biodiversity conservation activities in the adjoining Niokolo-Koba National Park. A Council member also commented on the large scale of the financial commitment and suggested splitting the program into two phases and assessing the results of the first phase before embarking on the second.
4. These four comments have been addressed in the final document. The project's links to and coordination arrangements with the complementary GTZ project are detailed in the government's Project Implementation Plan and reflected in the project document (Chapter 5, paragraphs 5.29 and 5.30). The project description (Chapter 5, Section B) summarizes the project activities, and the risks and mitigatory measures are presented in Chapter 6, Section D. The project's contribution to biodiversity conservation in the Niokolo-Koba National Park is highlighted in the project objectives and description summary and referenced later in the main document. Finally, in response to the suggestion to phase the project, it has been divided into two phases, a resource assessment and planning phase and an implementation phase, the launch of which will be conditional on successful completion of the first phase. These are outlined in Chapter 5, Section E, which describes the implementation program.
5. We would appreciate prompt clearance of the document for circulation to the Council.

cc. Messrs. Utria, Roddis (AFTU2); Uprety (LEGAF); Broadfield, Nikolov (ENVGC)

MEMORANDUM

OFFICE

DATE: 1/17/88
TO: Mr. [redacted]

FROM: Mr. [redacted]

RE: [redacted]

Enclosed are two copies of the final project
to the Council and your final endorsement

scope of the project as presented here are unchanged from
that endorsed by the Council when it endorsed April 1986 work pro-

In commenting on the proposal, Council members requested: (a) clarification of
implementation arrangements with a complementary GIZ-supported project with similar
objectives and involving the same partner agencies; (b) more detailed specification of the
project's links to biodiversity conservation activities in the adjoining Ntoko-Koo
National Park. A Council member also commented on the large scale of the financ-
ing and suggested splitting the program in
two of the first phase before embarking on the

These four comments have been addressed in the final document. The project's
to and coordination arrangements with the complementary GIZ project are detailed
in the government's Project Implementation Plan and referred to in the project document
Chapter 3, paragraphs 3.1 and 3.2. The project description (Chapter 2, Section
2.1) outlines the project's objectives, and the risks and mitigation measures are present
in paragraph 2.1.2. The project's contribution to biodiversity conservation in the
Ntoko-Koo National Park is highlighted in the project objectives and de-
scription, and referenced later in the main document. Finally, in response to
the question to phase the project, it has been divided into two phases, a resource
assessment and planning phase and an implementation phase, each of which is
outlined in Chapter 3.

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Document of
The World Bank

Report No 16357-SE

STAFF APPRAISAL REPORT

REPUBLIC OF SENEGAL

SUSTAINABLE AND PARTICIPATORY ENERGY MANAGEMENT PROJECT

April 22, 1997

Urban, Water and Energy 2
Africa Region

CURRENCY EQUIVALENTS

Currency Unit	1 CFA Franc (FCFA) ¹
US\$1	FCFA 500 (March 1997)

ENERGY CONVERSION FACTORS AND MEASURES

1 ton of air-dried wood	0.41 toe
1 ton of charcoal	0.69 toe
1 ton of liquefied petroleum gas	1,095 toe
1 ton of kerosene	1.04 toe
1,000 kWh of electricity (thermal @33% efficiency)	0.2606 toe
Wood-to-charcoal conversion efficiency (traditional)	18%
Wood-to-charcoal conversion efficiency (improved kiln)	25%
Useful energy efficiency from carbonization (traditional)	30%
Useful energy efficiency from carbonization (improved kiln)	43%
Efficiency of traditional wood stoves	15%
Efficiency of improved wood stoves	23%
Efficiency of traditional charcoal stoves	20%
Efficiency of improved charcoal stoves	27%
1 cubic meter of firewood (solid)	0.8 tons
1 stacked cubic meter of firewood	0.4 tons
1 Hectare	2.47 acres
1 kilometer	0.625 miles

ABBREVIATIONS AND ACRONYMS

ATI	Appropriate Technology International
CERER	Center for Study and Research on Renewable Energy
CILSS	Permanent Inter-State Committee for Drought Control in the Sahel
CNE	National Energy Committee
CSE	Center for Ecological Monitoring
DE	Department of Energy
DEFCCS	Department of Water, Forests, Hunting and Soil Conservation
ENDA	Environment and Development in the Third World
MEFP	Ministry of the Economy, Finance and Planning
MEMI	Ministry of Energy, Mining and Industry
MEPN	Ministry of the Environment and Protection of Nature
PAFS	Senegal Forestry Action Plan
PETROSEN	Senegal Petroleum Company
PRG	Regional Gas Program
RENES	Senegal Energy Redeployment Program
RPTES	Review of Policies in the Traditional Energy Sector
SAR	African Refining Company
SENELEC	National Electricity Company

FISCAL YEAR

Government of Senegal

January 1- December 1

REPUBLIC OF SENEGAL

SUSTAINABLE AND PARTICIPATORY ENERGY MANAGEMENT PROJECT

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Map: IBRD 28722

Vice President:	Jean-Louis Sarbib, AFRVP
Country Director:	Mahmood Ayub, AFC14
Technical Manager:	Max Pulgar-Vidal, AFTU2
Task Team Leader:	Boris Utria, AFTU2

This report is based on the ESW undertaken in Senegal through the Africa Regional Program "Review of Policies in the Traditional Energy Sector - RPTES" between 1993 and 1996. A draft Project Implementation Document prepared by the Government of Senegal was pre-appraised in November 1996, and appraised in March 1997. The ESW and project teams comprised Messrs./Mmes. Boris Utria (Economist and Task Team Leader), Max Wilton (Senior Energy Economist), Ignatius Menezes (Senior Economist), Demba Balde (Participation Specialist/NGO Liaison Officer), Mathieu Koumoin (Energy Economist), Azedine Ouerghi (Energy Economist), Kishor Uprety (Lawyer), Amadou Toure (Procurement Specialist), Ellery Stokes (Participation Specialist), Suzanne Roddis (Program Assistant), Susana Hristodoulakis (Operations Analyst), and Salima Haddour (Project Assistant). Catherine Cassagne and Simon Rietbergen were the peer reviewers of the project.

REPUBLIC OF SENEGAL

SUSTAINABLE AND PARTICIPATORY ENERGY MANAGEMENT PROJECT

CREDIT AND PROJECT SUMMARY

Borrower:	Republic of Senegal
Beneficiaries:	Ministry of Environment and Protection of Nature Ministry of Energy, Mines and Industry
Poverty Category:	Program of Targeted Intervention
Amount:	SDR 3.8 million (US \$ 5.2 million equivalent)
Terms:	Standard IDA, with 40 years maturity
Commitment fee:	Standard
Financing Plan:	See Estimated Financing Plan (p. v)

Project Objectives and Description:

The objective of the project is to meet an important part of the rapidly growing urban demand for household fuels, without the loss of forest cover and the ecosystem's carbon sequestration potential and biodiversity. This objective would be met through: (a) the implementation and monitoring of 300,000 hectares of environmentally sustainable community-managed forest resource systems in the Tambacounda and Kolda regions of Senegal, creating a protection zone around the Niokolo-Koba National Park (Biosphere Reserve); (b) the promotion of inter-fuel substitution and improved stoves initiatives; and (c) the strengthening of the institutions involved in the management of the sector, and the promotion of the participation of the civil society (private sector, academic institutions, and NGOs community) in the operation of the sector. The project would finance: (a) an assessment of vegetation cover, an assessment of availability of dead wood and other preparatory activities; (b) community-based forest management activities in 300,000 ha; (c) promotion of rural-based micro-enterprises and private sector and NGO-based inter-fuel substitution activities; (d) consultant services for supervision work, delivery of services and various technical studies; (e) technical assistance; and (d) materials, equipment and goods.

Project Benefits:

The project would: (a) sustainably produce some 860,000 tons of fuelwood (equivalent to 155,000 tons of charcoal) during the implementation period and would thereafter establish a permanent system capable of producing more than 300,000 tons of fuelwood (equivalent to 55,000 tons of charcoal

REPUBLIC OF SENEGAL

SUSTAINABLE AND PARTICIPATORY ENERGY MANAGEMENT PROJECT

I. BACKGROUND

A. GEOGRAPHY AND CLIMATE

1.1. Senegal's topography is generally flat, and altitude is less than 50 meters above sea level over 75 percent of the territory. Senegal has a semi-arid tropical Sudano-Sahelian climate, with a relatively narrow temperature span. The rainy season is limited to a single summer monsoon and rainfall has declined significantly in the last 40 years. It fluctuates widely from one region to another, ranging from 1,000 mm/year in the south to less than 300 mm/year in the north. Vegetation runs from bushy steppes in the north to forest stands in the south and southeast. The central regions consist of Sudano-Sahelian and Sudano Savannah. Senegal's soils are dry and sandy in the north, ferrous in the central regions and lateritic in the south. In general, fertility is very poor and the soil is extremely vulnerable to wind and erosion from rain.

B. DEMOGRAPHICS

1.2 In 1988, Senegal's population was 6.9 million. Of which 39 percent was living in urban, making Senegal the most highly urbanized country in the Sahel region. Women make up 51.4 percent of the total population and children under age 15, 30 percent. National demographic growth is estimated at 2.9 percent per year (3.8% in urban areas and 2.1% in the countryside). If current demographic trends remain unchanged, total population will rise to some 12.6 million by the year 2010, of which 6.1 million will be urban (48%), with 3.4 million people clustered in the Dakar region alone. Urban growth will increase demand for food, fuel, timber and other natural goods and services. If the productivity of natural resources does not increase and they are not managed sustainably, it will be necessary to increase imports of food, energy, construction material, etc.

C. THE ECONOMY

1.3 At independence Senegal had one of the most developed economies in West Africa. Its economy deteriorated, however, due to a gradual loss of regional markets, prolonged drought and weak management. In 1994, Senegal's gross national product (GNP) was estimated at US \$3,710 million and its per capita GNP was US \$611.

1.4. Senegal's adjustment efforts date back to 1980 and were supported by four Bank macroeconomic adjustment operations (SALs) in 1980, 1986, 1987, and 1990, and two sector adjustment operations (SECALs), including one in the financial sector in 1989 and another in the transport sector in 1991. These adjustment operations contributed towards stabilizing macroeconomic conditions and achieved a partial liberalization of the economy. A fourth SAL was introduced in 1990 which focused on the removal of labor market rigidities, the reduction of

government subsidies, and the implementation of a more aggressive privatization program. Since the beginning of the 1990s, however, the economy experienced a serious decline with a contraction of output in key sector. Low economic activity resulted in a shrinking tax base which forced the government to reverse import tariff reduction and to increase the taxation of petroleum products. In 1992-93, the economy declined even further as the difficulties of pursuing an adjustment strategy based on internal deflationary policies became more acute. The fiscal deficit and the balance of payment positions worsened; the fiscal balance (excluding grants) declined from a 0.2 percent surplus in 1991 to a 3.9 percent deficit in 1993. During the period 1988-1993, Senegal's economic growth stagnated at an average of 1.7 percent per annum.

1.5 In an attempt to reverse this economic deterioration, in mid 1993 the government adopted a series of internal adjustment measures including cuts in public sector wages. However, these measures were not sufficient to restore the competitiveness of the economy and its growth prospects. The decline in investments and exports, widespread smuggling and custom fraud, and increasing macroeconomic imbalances made inevitable the January 1994 devaluation of the FCFA. With the devaluation, Senegal has now gained a unique opportunity to restore competitiveness and export-led growth, taking advantage of its strategic location and its sizable human resource base. Increasing GDP growth, reducing inflation and stabilizing prices, and reducing the current account and budget deficits are the principal macroeconomic challenges facing Senegal for the foreseeable future. Generating a strong supply-response by the private sector, increasing labor productivity, improving natural resource management patterns to reduce environmental degradation and loss of productive capacity, revitalizing urban enclaves and promoting rural development opportunities will all have to be actively pursued if those challenges are to be met.

II. THE SECTORAL CONTEXT

A. ENERGY SOURCES AND CONSUMPTION

2.1. Senegal has a modest but relatively diversified energy resource base. Under present conditions, however, its use is associated with either major environmental risks (forest-based fuels - fuelwood and charcoal) or substantial investment outlays for exploration (hydrocarbons, lignite) and mobilization (hydroelectricity, solar and wind power).

1. Fossil Fuels

2.2 Senegal is largely dependent on expensive imported petroleum products. Fossil fuels in the form of heavy petroleum was discovered in the 1950s at the Dôme Flore in Casamance (100 million tons) and natural gas and light petroleum in the 1960s at Diam Nadio Kabor near Dakar. Between 1987 and 1992 these reserves produced 61,000 barrels of crude and 31 million m³ of natural gas. In 1991 a deposit of 400 million m³ of gas was discovered at Diam Nadio and is being used for power generation. An additional gas deposit estimated at 10 million m³ was discovered at the same location in 1996, but it will take some time before it can be economically mobilized. Since there is no residential piped gas infrastructure in Senegal the new natural gas discovery will not be a factor in foreseeable household interfuel substitution schemes. There is a reserve of peat of some 39 million m³ along the Dakar coast at St. Louis.

2. Hydro

2.3 The country's hydroelectric potential, based on the Senegal and Gambia rivers, is estimated at about 1,000 MW capable of producing 280 Gwh in an average year. The development of the Senegal River under the OMVS should make it possible to have a supply of hydroelectric power generated by facilities at the Manantali site in Mali. It is expected that this could provide Senegal with 280 GWh/year (out of total domestic consumption of some 900 GWh) and would save SENELEC (National Electricity Company) some 150,000 tons of fuel per year of the current consumption of 300,000 tons.

3. Traditional Fuels (Fuelwood and Charcoal)

2.4 The potential supply of energy wood is not well known. In 1980, forest land was estimated at 12 million ha (60% of the country's area), with very variable types of stands: closed and open forest represent 20 percent of the woodlands and Savannah and steppe 80 percent. Depending on the source and assumptions used, annual total productivity was estimated for that same year to be between 13.4 million m³ (1991 PASF/terroir management studies) and 8.6 million m³ (1981 PDDF). Availability was estimated in 1980 at 7.3 million m³/year (PDDF) and accessible reserves at 3.1 million m³/year (PAFS, World Bank). Table 2.1 presents 1980 estimates of Senegal's forestry potential. It is estimated that some 80,000 ha of forest stands disappear each year due to land clearing for agriculture, bush fires, the production of charcoal, overgrazing and scarce rainfall. Annual deforestation for charcoal production alone is estimated at more than 30,000 ha per year. In the last ten years, an average of 190,000 ha/year was lost to forest fires throughout the national territory.

2.5 A recent study conducted by the government of Senegal with World Bank support concluded that the availability of woody biomass in Senegal may have been previously underestimated both in terms of volume of stocks and yield potential.² Available forest stock information (estimated on the basis of primary data collected prior to 1980) indicates that there are some 44,000 km² of woodlands and forests, 29,000 km² of savanna woodlands, 43,000 km² of savannas and 32,000 km² of Sahelian steppe grasslands. Yields are now estimated to be between 1 ton/ha/yr and 2 ton/ha/yr, depending on the geographic location and specific stock composition. Under improved rainfall condition, natural stocks growth could be even higher. Pending confirmation by a comprehensive assessment of vegetation cover in the Tambacounda and Kolda regions (included in the proposed project), it is now estimated that Senegal should still have sufficient forest resources to meet most -- if not all -- of the demand for woodfuels for at least the next two decades under sustainable forest management schemes. Implementing sustainable management would imply exploiting the existing forest stocks at or below the annual growth (yield) level and would therefore result in maintaining the original stocks over time.

Table 2.1: Forestry potential in 1980

Region	Area (1) '000ha	Stocks (2) '000 m ³	Production potential from : ('000 m ³ /year)				
			Nat. stands	Degradation	Plantations	Total	Accessible
West	142	500	28	42	6	76	57
Louga	1,180	1,400	131	130	2	263	62
Fleuve	2,098	3,000	253	300	1	554	119
Sine	527	5,200	282	175	7	464	311
Saloum							
East. Senegal	5,206	68,200	3,470	735	4	4,209	1,176
Casamance	1,732	60,600	2,673	400	5	3,078	1,395
Total	10,884	138,900	6,837	1,782	25	8,644	3,130

(1) Productive woodland area, i.e., not including fallow woodlands, mangroves and national parks.

(2) Standing volume for trees > 10 cm overbark, diameter at breast height.

Source: PDDF and World Bank.

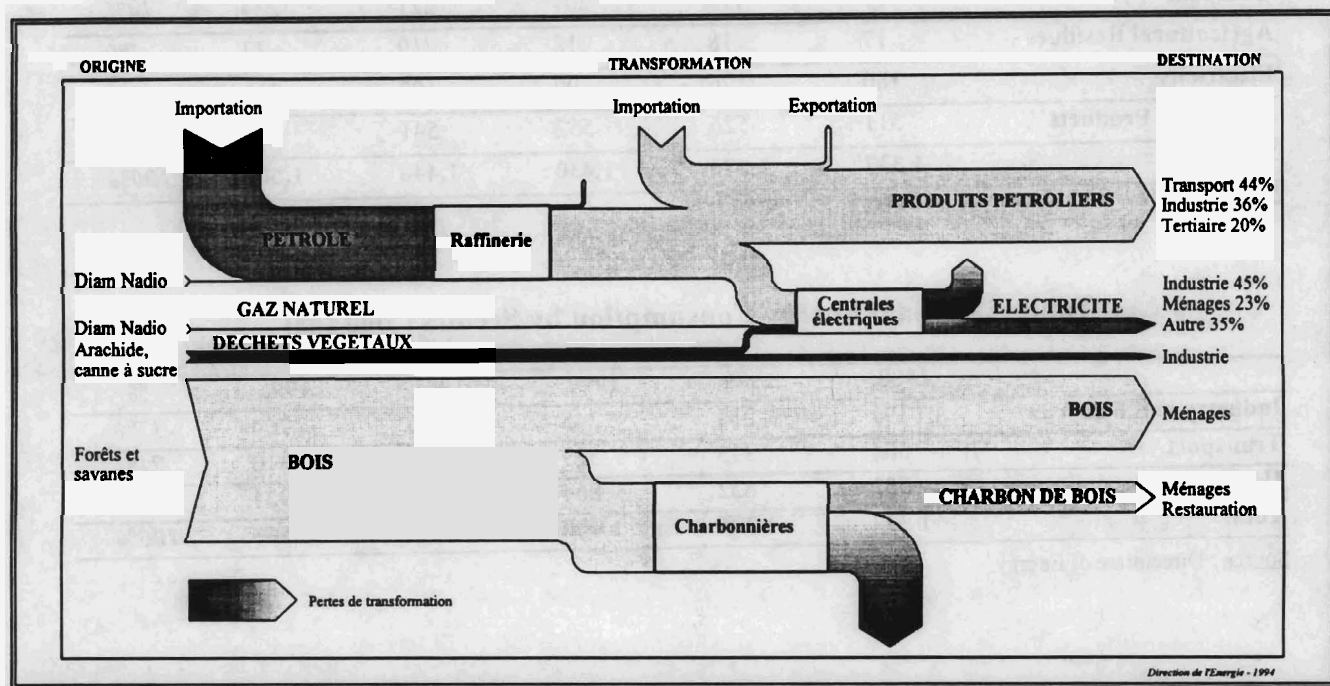
4. Other Potential Resources

2.6. There is a relatively large availability of agricultural residues, but their energy use has not yet proved to be more attractive than their use as fertilizers and/or cattle supplements. On the other hand, byproducts from agro-industrial processing such as groundnut shells and bagasse offer more attractive prospects and have been used by the industries that produce them (SONACOS and CSS) to generate electricity for some time. With an average daily radiation of some 5.4 kWh/m² Senegal has a considerable solar energy potential for applications such as small scale electricity production (PV), water pumping and heating and drying of fish and agricultural products.

² Jensen, Axel M., Elements d'économie spatiale des énergies traditionnelles, RPTES Discussion Paper Series, World Bank, October 1994.

2.7. Figure 2.1 present Senegal's energy flows matrix.

Figure 2.1: Energy Flows Matrix of Senegal



5. Energy Consumption

2.8. Total final energy consumption in Senegal for 1992 was estimated at some 1.5 million tons of oil equivalent (TOE), and a per capita energy consumption of 195 kilograms of oil equivalent (KOE), which is relatively high compared to most West African countries. Out of the estimated total energy consumption, forest-based traditional fuels (firewood and charcoal) -- mostly used for household cooking purposes -- represented 53 percent, petroleum fuels 34 percent, electricity 12 percent and agricultural residues 1 percent. The household sector is the principal energy consumer (58%) followed by transport (20%), industry (17%) and the tertiary sector (5%). Total charcoal consumption in 1992 was estimated at 330,000 tons (equivalent to 1.8 million tons of fuelwood), of which 76 percent is consumed in the principal urban areas. The city of Dakar alone has an estimated consumption of almost 150,000 tons of charcoal per year. Total consumption of fuelwood was estimated at some 1.5 million tons in 1992, 86 percent of which is consumed in the rural areas. Tables 2.2 and 2.3 present final energy consumption by energy resource and by economic sectors, respectively.

Table 2.2: Final Energy Consumption ('000 toe)

	1988	1989	1990	1991	1992	Average %
Fuelwood	569	580	591	602	613	39%
Charcoal	181	194	207	221	234	14%
Agricultural Residues	17	18	18	19	22	1%
Electricity	180	176	190	192	213	12%
Petroleum Products	511	526	552	541	566	34%
Total	1,337	1,376	1,430	1,446	1,505	100%

Source : Revised from Directorate of Energy

Table 2.3: Final Energy Consumption by Sectors ('000 toe)

	1988	1989	1990	1991	1992	%
Industry and Fisheries	191	231	243	236	264	17%
Transport	304	313	323	315	310	21%
Households	802	832	864	895	931	62%
Total	1 337	1 376	1 430	1 446	1 505	100%

Source : Directorate of Energy

B. ENERGY SECTOR INSTITUTIONS AND POLICIES

1. Sectoral Institutions

2.9. Institutional structure and actors. Energy policy choices, directions and coordination are overseen by the National Energy Commission, an inter-ministerial entity chaired by the Prime Minister. The National Energy Committee headed by the Minister of Energy implements the directives formulated by the Commission. Administrative and technical oversight of the sector falls under the Ministry of Energy, Mining and Industry (MEMI) with the exception of the supply of woodfuels, which is the responsibility of the Ministry of the Environment and Protection of Nature (MEPN). MEMI oversees certain parastatal companies and mixed-capital enterprises: SENELEC, in charge of electric power production, transmission and distribution; SAR (African Refining Company), responsible for imports and production of petroleum products; GPP (Petroleum Trade Group), responsible for the distribution of petroleum products; PETROSEN (Senegal Petroleum Company), responsible for oil exploration; and CTS (Senegal Peat Company), responsible for the development of peat reserves. Other ministries are key players, including the Ministry of the Economy, Finance and Planning; the Ministry of Infrastructure and Land Transportation, responsible for oversight of hydrocarbon transportation; the Ministry of Modernization and Technology and the Ministry of Water Resources, both of which are involved in solar energy programs; the Ministry of National Education, which has oversight of the CERER (Center for Study and Research on Renewable Energy); ENSUT (National School for Advanced Studies in Technology); and the "Cellule de Combustibles Domestiques", which is an inter-ministerial body

created in 1993 to serve as a formal link between the different governmental institutions and operators in the sector.

2.10. From the different ministries that play an operational role in the household and traditional energy sectors, MEPN is by far the best organized and endowed in human and material resources and is technically capable of fulfilling its assigned responsibilities. Currently MEPN is managing some 300 projects through out the country, most of which are donor- supported and which include capacity building and institutional development components. The Water and Forest Directorate (DEF/MEPN) has implemented a gradual reorganization process over the last two years, giving special priority to the strengthening of its regional structures. That process was implemented as part of the ongoing process of administrative decentralization to increase the Forestry Service's supervision and field extension services. While the forestry service, including the several technical support units (forestry operations, planning, cartography, monitoring and evaluation, etc.) has sufficient and technically qualified staff to undertake complex projects, the multi-sectoral nature of participatory forest management systems will require the mobilization of additional expertise from other governmental agencies (agriculture extension, rural development, women affairs, rural infrastructure, etc.) and the NGO community.

2.11 MEMI, on the other hand, has serious limitations in its ability to effectively discharge its assigned responsibilities as it lacks the necessary staff and resources to do so and has little control over the operation of the enterprises it is supposed to oversee. With institutional development support from the World Bank and the Dutch and German Cooperations the Energy Directorate has recently managed to improve its situation, but the strengthening of its planning and policy making and supervision functions are still badly needed. This will imply moving away from actual field implementation of projects -- which has been the traditional means of securing resources -- and focusing on more on analytical and planning functions and sector monitoring and supervision.

2.12 Coordination and institutional problems in the power sector are similar to those encountered in the petroleum sectors. In addition to that, poor management of SENELEC has led to a growing deficit of power generation capacity, deterioration of facilities, low level of access to electricity, and high costs. SAR's refinery is uneconomic and has led to high prices of petroleum products.

2. Sector Policies

2.13 The national energy policy is set forth in the RENES program formulated in 1980 and revised in 1991 and in the document issued by the Inter-ministerial Energy Council (1993). The global objectives of the GoS energy policy are: (a) to limit consumption of imported energy; (b) to rehabilitate the electric power production and transmission infrastructure; (c) to shift production and consumption toward local energy sources; and (d) to reduce consumption of environmentally destructive energy sources (wood and charcoal).

2.14 Official forestry policy, establishing new post-colonial guidelines for exploitation of woodfuels, was initially addressed by the Master Forestry Development Plan (1981). The Master Plan was then revised during the formulation of the Forestry Action Plan (1993) and is now framed within the new forestry code of April 1995 (*Decret 95-357*). This new code introduced major changes to the previous regulatory framework, including the recognition of the rights of the local communities to exploit state-owned forest land and to capture revenues directly from their regulated exploitation. In addition to those significant changes, the legislative

decrees sanctioning the administrative decentralization have already been signed, with which local communities are, *inter alia*, further insulated from centralized decisions on forest and natural resource issue.

2.15 The GoS has now articulated its energy policy around the following points:

- the stabilization of the potential supply of woodfuels through the transfer of responsibility for the management of natural forests from the Forestry Service to the local community and the implementation of sustainable community-based forest management systems;
- the sustainable exploitation of existing natural forests and the rationalization of forestry operations through the **implementation of a national participatory natural resource management program**;
- the diversification of fuels available to consumers, by developing the use of butane, introducing peat-based charcoal briquettes to the market and studying the possibilities for using kerosene for cooking;
- savings in consumption (improved stoves) and in the transformation of wood into charcoal (better carbonization methods); and
- a shift towards full cost pricing of energy products so that the market prices reflect the real economic costs.

III. THE HOUSEHOLD ENERGY SECTOR

A. ENERGY CONSUMPTION IN THE HOUSEHOLD SECTOR

3.1. There were an estimated 1.3 million households in Senegal in 1992 with an average size of 6 persons. In Dakar alone there were an estimated 156 thousand households, with an average household size of 12 persons. The consumption of energy by the household sector was estimated in 1992 at about 0.9 million toe. That total was made of 1.5 million tons of wood, 330,000 tons of charcoal (equivalent to more than 3.3 million tons or 4.2 million m³ of wood), 40,000 tons of gas butane and some 10,000 tons of kerosene.³ Figure 3.1 presents a breakdown of energy consumption by the household sector for 1992. Table 3.1 presents a breakdown of household energy consumption by fuel and by region for 1987 and 1992. Table 3.2 presents a breakdown of traditional fuels consumption in the household sector in terms of toe and wood equivalence (m³).

Table 3.1 Household Energy Consumption by fuel and Region (1987-92)

('000 toe)

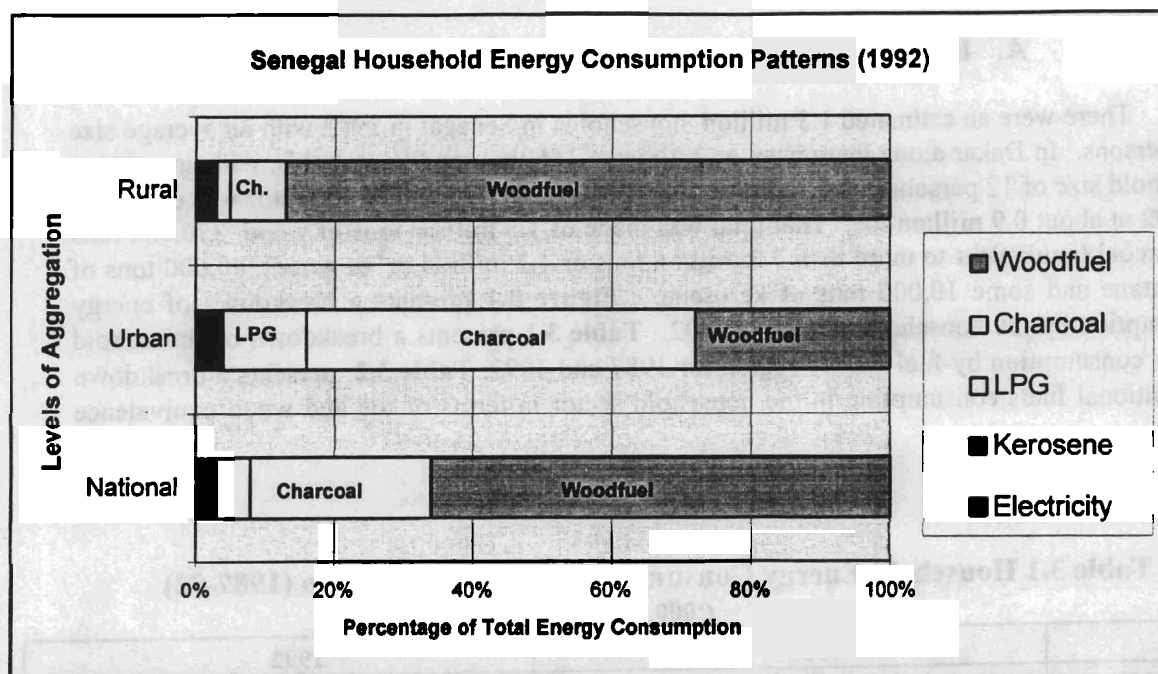
REGION	1987				1992			
	Fuelwood	Charcoal	Gas	Total	Fuelwood	Charcoal	Gas	Total
Dakar	2	92	10	104	3	103	27	133
Thiès	5	11	1	17	5	10	3	18
Kaolack	6	7	0	13	7	11	1	19
Ziguinchor	2	8	1	11	6	11	1	18
Saint Louis	4	9	1	14	3	13	1	17
Other Cities	27	15	1	43	70	41	5	116
Total urban	46	142	14	202	94	188	38	320
Rural	501	14	2	517	520	46	7	573
Total	547	156	16	719	614	234	45	893

Source: DNEF

3.2. Household energy demand patterns are determined by a combination of factors including but not limited to geographical location (urban/rural and distance/accessibility to supply sources), family size, relation between level of household incomes and fuel prices (purchasing capacity), market availability of fuels, and cultural habits (fuel choices and method of fuel use). An analysis of the tables 3.1 and 3.2 and of various studies in the sector reveals the following key trends:

³ Kerosene is used for lighting (sometimes for starting fires) and hence does not compete with the others.

Figure 3.1: Senegal: Household Energy Consumption Patterns (1992)



Source: Energy Directorate

Table 3.2: Household Consumption of Traditional Fuels (1987-92)

('000 tons)

REGION	1987			1992		
	Fuelwood	Charcoal	Total Wood Equivalent	Fuelwood	Charcoal	Total Wood Equivalent
Dakar	6	132	737	8	147	825
Thiès	11	16	102	12	14	209
Kaolack	15	11	74	18	15	122
Ziguinchor	9	12	76	14	15	119
Saint Louis	4	13	75	6	18	150
Autres villes	66	22	186	172	59	502
Total urbain	111	206	1,250	230	268	1,927
Rural	1,111	20	1,225	1,267	65	1,600
Total	1,222	226	2,475	1,497	333	3,527

Source: World Bank and Energy Directorate

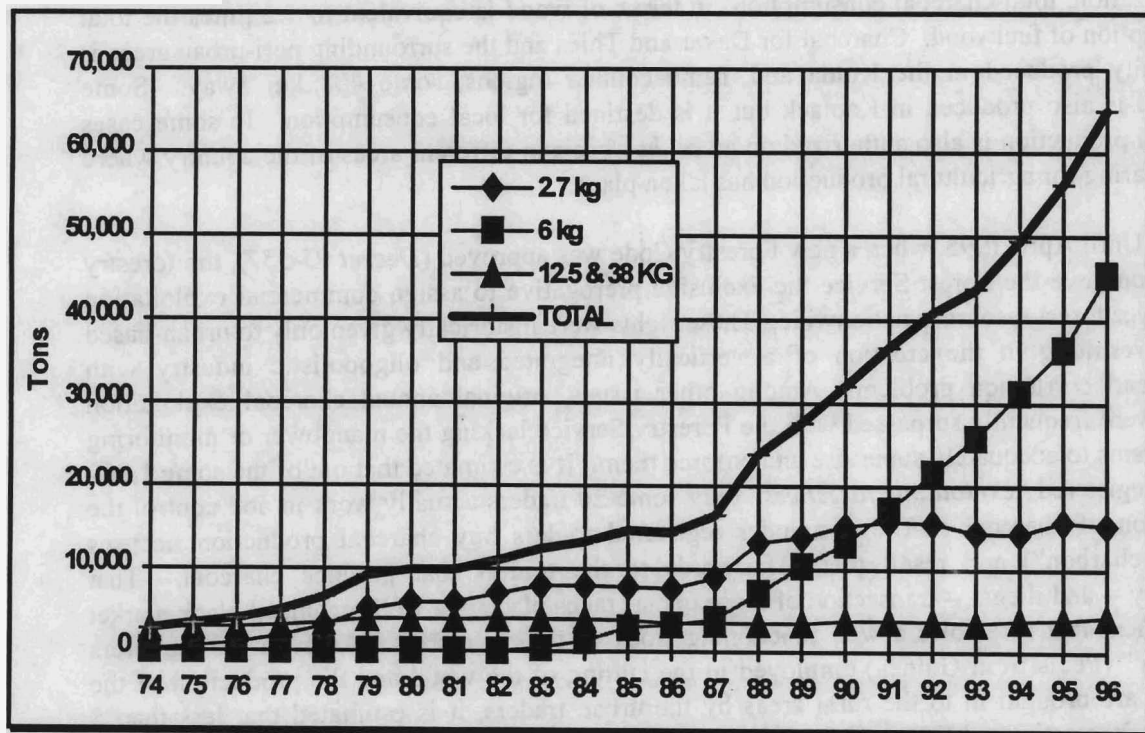
- The consumption of fuelwood dominates in the rural areas, gas tends to replace charcoal as the primary household fuel in Dakar and Thies (given end-use efficiency differences charcoal consumption is still higher than LPG on nominal terms), and charcoal is still the main household fuel in the other secondary cities;

Gas is making substantial inroads in the principal cities, but charcoal is still consumed in large quantities because urban consumers tend to use several fuels, often concomitantly;

- The consumption of charcoal is concentrated in the Cap Vert peninsula and in the Thies region, which is home to most of the country's urban dwellers; and
- Charcoal represents about 27 percent of final consumption of traditional fuels but accounts for 55 percent of the out-take of forest resources for energy use. Most of the wood collected by rural dwellers comes from dead wood, whereas charcoal is produced most of the time from the cutting of live trees. This highlights the high proportion of forestry resources extracted for charcoal.

3.3. Consumption of LPG has gone from 3,500 tons in 1974 to 16,000 tons in 1987 and then to approximately 65,000 tons in 1996. The penetration of LPG in Senegal has been promoted by an aggressive program of cross-fuel subsidies, which is currently estimated at 5 billion FCFA per year. The promotion of LPG in Senegal has been primarily supported by the subsidy policy of the government since 1974 and by the CILSS/FED Regional Gas Program (1990-93). Consumption of LPG has increased by some 12 percent per year for the last five years (well over population growth) and by now more than 70 percent of urban households and 25 percent of rural families utilize LPG on a regular basis. Nation wide it is estimated that close to 45 percent of households have purchased LPG stoves. Furthermore, in 58 percent of households in Dakar and 43 percent of households in Thies LPG have replaced charcoal as the primary cooking fuel. Figure 3.2 present the evolution of LPG sales by bottle Size between 1974 and 1996.

Figure 3.2: Senegal: Evolution of LPG Sales by Bottle Size (1974-96)



Source: Energy Directorate

3.4. Kerosene is used in the household and informal sector essentially for lighting purposes only. A couple of pilot activities were done in the mid 1980s by CERER and the World Bank's Energy Management Assistance Program to test the feasibility of introducing kerosene as a cooking fuel. Although small consumer trials showed that kerosene could be utilized for cooking purposes, a stove fully suited to the local cooking needs was never found. At that time the kerosene research was oriented towards finding the most energy efficient stove possible, rather than the most "marketable" one, as defined by consumer acceptance.

3.5. The consumption of wood energy in the informal and industrial (artisanal) sectors has not been studied extensively and therefore is not well known. However, it is thought to be very low (5%) in relation to the household sector and very frequently directly associated to it (informal household-based enterprises). Small restaurants are the leading commercial energy consumer in the cities. A survey conducted in 1991 showed that there were some 3,000 restaurants with an estimated annual consumption of 4,200 tons of wood (half of Dakar's fuelwood consumption), 3,600 tons of charcoal (3% of household consumption) and 700 tons of gas (2% of household consumption). Other urban users of woodfuels include tailors (ironing), cloth-dyers, pot makers and blacksmiths. Bakeries are permitted to operate wood-fired ovens only in the rural areas.

B. STRUCTURE AND FUNCTIONING OF THE TRADITIONAL ENERGY MARKETS

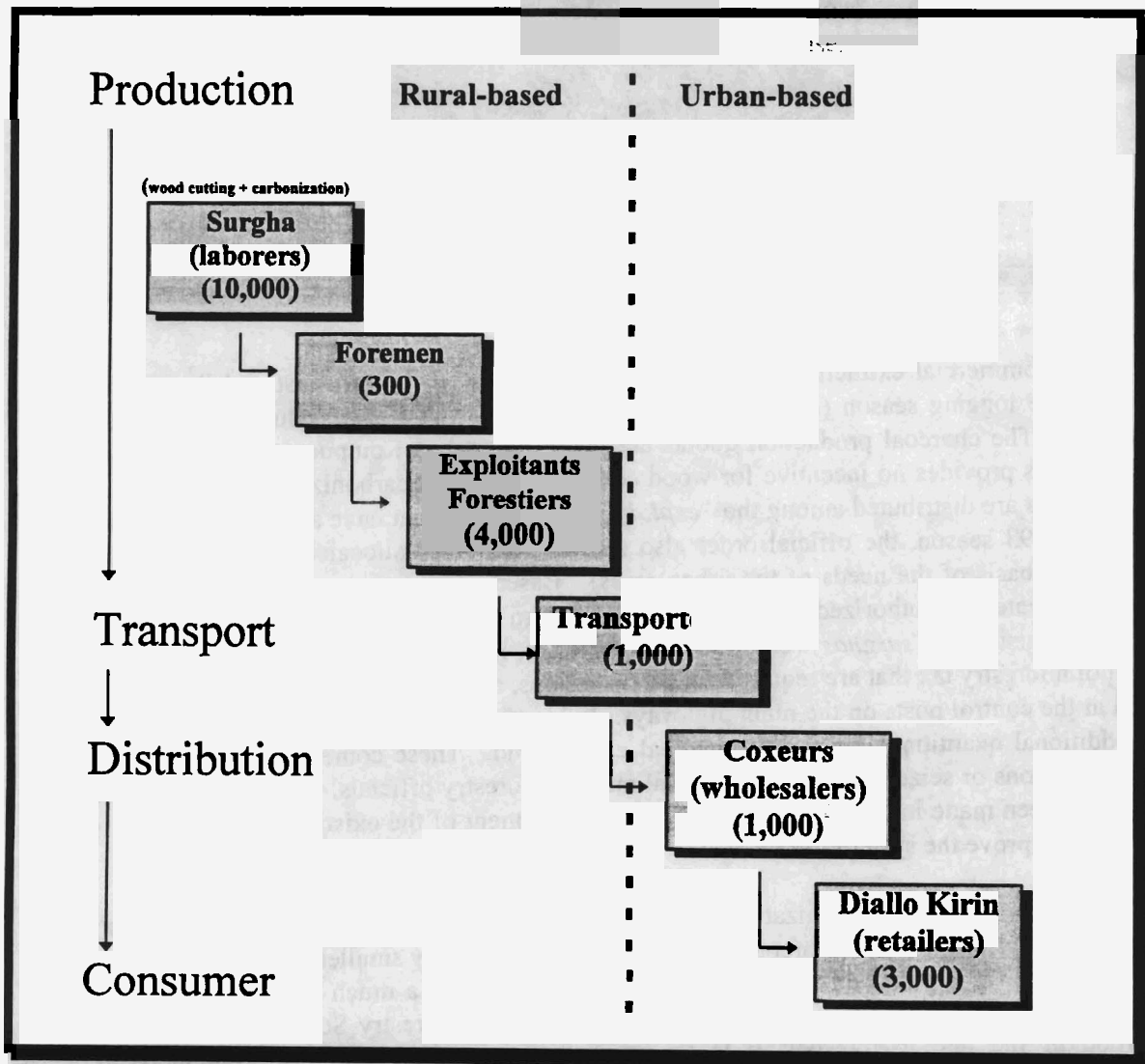
1. Urban Traditional Energy Markets

3.6 The supply of woodfuels to the urban and peri-urban areas is based on geographically concentrated and non-sustainable forest resource management practices (clear cutting). Given the relatively low efficiency of wood-to-charcoal conversion (18%) due to inefficient carbonization, total charcoal consumption in terms of wood is equivalent to 1.2 times the total consumption of fuelwood. Charcoal for Dakar and Thies and the surrounding peri-urban areas is essentially produced in the Kolda and Tambacounda regions, some 400 km away. Some charcoal is also produced in Kaolack but it is destined for local consumption. In some cases charcoal production is also authorized on an *ad hoc* basis in different areas of the country where land clearing for agricultural production has taken place.

3.7. Until April 1995, when a new Forestry Code was approved (*Decret 95-357*), the forestry legislation gave the Forest Service the exclusive prerogative to assign commercial exploitation rights over forest resources nationwide. These rights were historically given only to urban-based traders resulting in the creation of a vertically integrated and oligopolistic industry with widespread corruption problems. Among other issues, original annual charcoal exploitation quotas were frequently surpassed with the Forestry Service lacking the manpower or monitoring mechanisms to adequately supervise and enforce them. It is estimated that out of the some 1,800 legally registered "*exploitants forestiers*" only some 20 traders actually work in and control the production of charcoal. The remainder registered traders buy charcoal production licenses ("quota charbon") and resell them afterwards to the traders that produce charcoal. That secondary -- and illegal -- transaction of those quotas takes place in a well organized black market environment that resembles a well functioning stock or futures market. As even the laborers "*surghas*" (Peuls from Guinea) employed in the cutting of the wood and the production of the charcoal are brought in to the rural areas by the urban traders, it is estimated that less than 5 percent of the estimated FCFA 30 billion (US \$60 million) annual turnover of the charcoal trade

remains in the rural areas. Charcoal is transported to the cities in 15-ton trucks belonging either to the same charcoal trader or to private transporters who use the charcoal as return freight. At the gateway to the cities, "coxeurs" (wholesalers) regulate the inflows of charcoal by directing shipments to retailers. The *coxeurs*, which are not an officially recognized or regulated group in the industry hold a strategic position as they control all distribution in the cities. It is estimated that as few as 10 *coxeurs* control the charcoal flows into the urban markets. The "*coxeurs*" purchase the load from the trader and then sell it on credit to the retailer. A large number of the retailers are also Guinean Peuls and are salaried (non-commission) employees of the *coxeurs*, whereby they only derive a small salary from the activity. The points of sale are called "*diallo kerin*." Figure 3.3 presents the structure of the charcoal labor chain in Senegal. Figure 3.4 present a typical 15-ton truck used in the transport of charcoal to the urban market. Approximately 25 15-ton trucks come into Dakar each day carrying some 375,000 tons of charcoal, equivalent to some 2,060 tons of wood.

Figure 3.3: Diagram of Charcoal Subsector Labor Chain (Official Registers)



Source: RPTES

Figure 3.4 Typical Senegalese 15-ton Charcoal Truck



3.8. The commercial extraction of wood products is regulated by a ministerial decree that determines the logging season (generally December to August) and the production quotas for each region. The charcoal production quotas are based on charcoal outputs and not on wood inputs and thus provides no incentive for wood conservation in the carbonization process. The regional quotas are distributed among the "*exploitants forestiers*" that have a extraction licenses (before the 1993 season, the official order also set reserve quotas allocated at the end of the season on the basis of the needs of the urban areas). Based on the quotas, forestry inspection officials delineate the authorized logging areas and assign the felling sites to the companies, which must register the "*surghas*" (employee certification), logging permits contingent upon the payment of a forestry tax that are required for all operations, and lastly, transport permits that are checked at the control posts on the main highways. Independent of the quotas set by ministerial order, additional quantities of wood or charcoal can be sold. These come from operations at private plantations or seizures of illegal charcoal made by forestry officials. While considerable progress has been made in the last two years in the enforcement of the existing regulations, it is necessary to improve the system further.

3.9. In general terms the organization of the urban and peri-urban fuelwood trade (520,000 tons/year) resembles that of the charcoal trade but poses considerably smaller environmental and social conflicts as it is based on the collection of dead wood over a much broader geographic area. Registered "*exploitant foretiers*" obtain permits from the forestry Service to collect the dead wood *in situ* and to transport it to the peri-urban and urban markets. Fuelwood is

transported in a combination of 15 and 30 tons trucks, where the latter are always used for the transportation of loads coming in to the markets from distances over 250 kilometers.

2. Traditional Energy Prices

3.10. Prior to the FCFA devaluation of January 1994, the regulated price of charcoal in the urban areas was FCFA 40 per kilogram, however, in practice retailers adjusted the weights and sold the charcoal for close to FCFA 60/kg. This situation was tolerated by the Commerce authorities because the official price had not changed since February 1986. The price of both fuelwood and charcoal were maintained stable by the government for such a long time essentially because of the fear that increasing them would generate civil disturbances and political unrest. However, after the FCFA devaluation, and the ensuing price increase of most basic commodities, made it possible to raise the price of charcoal without encountering major consumer resistance. Paradoxically, while average commodity prices increased by 30 percent, the price of charcoal was increased from FCFA 40/Kg to FCFA 95/Kg (US \$190/ton), equivalent to a 130 percent increase with respect to the previous official price or then 60 percent compared to the real market prices. It is important to note that since the revaluation of the charcoal prices, the government has made a point of enforcing the requirement that retailers use scales to weigh charcoal sold to customers. As a result of that, the incidence of price/quantity distortions has apparently diminished somewhat.

3.11. The price increase after the FCFA devaluation has had no positive impact on the rural communities. The price increase was expected to be accompanied by a rise in the logging fee (forestry tax). However, this measure was only recently adopted and until now the surcharge paid by consumers paid after devaluation had disproportionately increased the income of the *exploitants forestiers* and *coxeurs* vis-à-vis the other actors in the industry. Table 3.3 presents an estimation of the structure of the price of charcoal before and after the January 1994 CFA franc devaluation. From this table it is possible to observe that after the FCFA devaluation, the profit margin of the *exploitants forestiers* went up from 6 percent to 25.6 while the share of labor costs decreased from 21.7 percent to 12.7 percent. In addition to that, while there appears to have been a significant increase in the share of the retailers' profit margin (from 8.5% to 19.4%) it is necessary to keep in mind that the large majority of the charcoal retailers (*diallo kirin*) work for *coxeurs* at a fixed salary, hence their real margin is far smaller than the one suggested by the figures in Table 3.3. It is estimated that the real margin of the retailers is less than 6 percent, whereby the real margin of the wholesalers (*coxeurs*) is of the order of 17 percent and not 3.5 percent.

3.12 Current regulated market price of fuelwood is FCFA 40/kg (US \$80/ton). Prior to the FCFA devaluation the price was FCFA 30/kg. Since the FCFA devaluation and the stricter application by authorities of the price/quantity regulations, there is little distortion in real prices other than the normal seasonal price variation reflecting relative higher collection and transportation costs during the rainy season. The principal component of the fuelwood cost structure is transportation (50%), followed by exploitants/wholesalers margins (35%). The remainder 15 percent is divided between labor costs, taxation and handling costs. As a large proportion of the laborers in the fuelwood trade are also temporary expatriate workers, the fuelwood trade currently leaves little or no income in the rural areas.

Table 3.3: Estimated Structure of Actual Charcoal Prices (FCFA/bag)

Structure Items	1993		1994	
	FCFA	%	FCFA	%
Stumpage fee:	250	10.6	250	5.8
Production Stage:				
Labor cost	510	21.7	550	12.7
Other production related costs	305	13.0	340	7.9
Margin of "Exploitant"	140	6.0	1,095	25.3
Transport Stage:				
Loading/unloading cost	60	2.6	115	2.7
Transport cost	680	29.0	900	20.8
Marketing Stage:				
Margin of the Wholesaler	145	6.3	150	3.5
Operating cost	55	2.3	80	1.9
Margin of the retailer	200	8.5	840	19.4
Retail price:	2,345	100%	4,320	100%

Note: Real prices are calculated on the basis of a bag weighing 42 kg, while the official price structure used a base weight of 50 kg in 1993 and 45 kg in 1994.

Source: Energy Directorate (Modified).

3. Rural Subsistence Supply Systems

3.13. The consumption of fuelwood in the rural areas (1.5 million tons/year) is largely satisfied through geographically dispersed and sustainable subsistence practices (cutting of branches, selective felling of small trees and collection of dead branches). **Women and children** play a significant role in the collection of fuelwood. Rural consumption of charcoal is mostly limited to the areas where it is produced and is normally traded by the producers for food and lodging at the local communities. While rural consumption of woodfuels does not present significant environmental or energy supply-demand problems in the immediate future, it is necessary to assess the availability and accessibility of dead wood vis-à-vis the spatial dispersion of rural populations on a national basis to identify geographic areas of potential future conflict and develop pro-active medium-to-long term action programs to prevent them.

C. EXPECTED FUTURE TRENDS: THE CHARCOAL PROBLEM

3.14. A recent survey (June 1994) conducted in Dakar after the FCFA devaluation showed that the disproportionate increase in the regulated price of charcoal (100%) with respect to LPG (30%) stimulated the substitution of woodfuels by LPG and a general trend toward increased fuel savings. As a result, it is estimated that charcoal consumption in Dakar dropped from 150,000 tons in 1993

to 130,000 tons in 1994. However, as consumers in secondary cities are rapidly switching from wood to charcoal, total charcoal consumption is still on the rise, albeit at an apparently slower rate than before.

3.15. Charcoal consumption in the cities is growing at just over half the rate of urban demographic growth. That trend is expected to continue relatively stable resulting in that total urban charcoal consumption would continue to rise at approximately 2% per year, potentially reaching some 385,000 tons per year (equivalent to 2.1 million tons of wood) by the year 2000 and 470,000 tons (or 2.5 million tons of wood) by the year 2010. Under the current non-sustainable forest resource exploitation practices these figures would represent an approximate charcoal-related deforestation of 35,000 ha in 2000 and of 42,000 in 2010. For the city of Dakar alone, charcoal consumption would reach some 150,000 tons in the year 2000 (equivalent to 13,800 ha) and 185,000 tons in the year 2010 (equivalent to 16,800 ha).

3.16. On the other hand, if as a result of rapid economic growth and/or lower than expected petroleum prices, the vast majority of urban households were to switch to LPG or kerosene as a primary fuel and utilize charcoal as a secondary fuel, charcoal consumption would come down to about half the expected level at 2 percent annual growth. In such a case, expected total charcoal consumption would come down to some 190,000 tons in the year 2000 and to 230,000 in the year 2010. Similarly, charcoal consumption in Dakar alone would be some 75,000 tons in 2000 and 90,000 in 2010, respectively equivalent to a deforestation of approximately 7,000 ha and 8,400 ha.

3.17. In simplified terms (assuming non-sustainable exploitation with zero to 40 percent natural regrowth), the implication of the above figures is that under the most realistic scenario (2% annual growth), is that between now (1997) and the year 2000 total charcoal consumption in Senegal will result in an accumulated loss of anywhere from 60,000 ha to 100,000 ha of forest lands, and between now and the year 2010 a loss of anywhere from 270,000 ha to 450,000 ha, the later being equivalent to one half to two thirds of the total Tambacounda and Kolda forest lands.

D. SECTORAL ISSUES

3.18. Senegal's present and foreseeable macroeconomic and socio-economic conditions clearly suggest that the country will continue to depend on forest-based traditional fuels to meet the lion's share of its urban and rural energy needs well into the next century. While ongoing demand management (improved stoves programs and consumer education campaigns) and inter-fuel substitution (LPG and kerosene) efforts need to be continued incorporating the lessons learned to date, large increases of petroleum products imports cannot be sustained because of budgetary constraints and because current and expected low household income levels severely limit the potential for widespread inter-fuel substitution at non-subsidized market prices. Large cross-fuel subsidy programs among fuels (like the current LPG subsidy) would imply increased production costs and lower competitiveness of Senegal's economy, with wider macroeconomic impacts. Within that context, and until widespread economic growth allows for large scale substitution to take place, the principal challenge of the energy sector in Senegal will be to transform the existing non-sustainable commercial woodfuels supply system into one capable of supplying woodfuels -- particularly charcoal -- to the rapidly growing urban population in an sustainable manner.

3.19. Recent World Bank research work in Senegal has concluded that the availability of woody biomass in Senegal may have been previously underestimated both in terms of volume of stocks and yield potential. Pending confirmation by a proper vegetation cover inventory, it is now estimated that, under proper forest management schemes, the existing natural forest stocks should be able to sustainably meet most -- if not all -- of the demand for woodfuels for at least the next two decades. Implementing sustainable management would imply exploiting the existing forest stocks at or below the annual growth (yield) level and would therefore result in maintaining the original stocks over time. Yet, as both the government and the private sector lack the financial and human resources that would be necessary to adequately manage the country's forest resources, sustainable management could only be achieved through the active involvement of the rural population. Under the new forestry code, the right regulatory framework and the necessary technical assistance and supervision from the Forestry Service (MEPN) and other relevant government agencies and NGOs with competencies on land-use and rural development issues, the rural population should be able to assume the responsibility for the sustainable management of their forest resources. The participation of the rural communities in the commercial exploitation of the forest resources for the supply of woodfuels -- particularly charcoal -- to the urban markets would result in the creation of significant employment and economic development opportunities in the rural areas, with a considerable developmental impact for rural women.

3.20. The operation of the commercial woodfuels industry (particularly charcoal) has had overtime a number of negative environmental and social impacts, such as: the gradual loss of forest cover (approx. 30,000 ha/year) and thus of the **ecosystem's carbon sequestration capacity and biodiversity**; the degradation of the rural environment (particularly of the soils); the impoverishment of the rural areas; an acceleration of the rural exodus; and a massive transfer of wealth from the rural areas to the urban areas. In addition to those negative impacts, it is anticipated that within the near-to-medium future the **Niokolo-Koba National Park** (9,130 km²), which is an "International Biosphere Reserve Patrimony and Biosphere reserve" located in the south-eastern corner of the Tambacounda and Kolda regions, will come under threat of encroachment by charcoal exploitation practices. Should this be allowed to happen it would have irreparable biodiversity and ecological consequences at the national and global levels. As in the case of the management of forest stock, the government lacks the necessary resources -- and the private sector the interest -- to implement the required environmental protection mechanism to safeguard the Niokolo-Koba National Park from that potential encroachment. Here again, the responsabilization of the rural communities around the park area could lead to the implementation of effective and sustainable biodiversity protection measures. The combination of the community-based forest management activities with the protection of the Niokolo-Koba park could be achieved by implementing sustainable and participatory forest management units forming a buffer zone around the park area.

E. GOVERNMENT STRATEGY

1. Main Past and Ongoing Programs

LPG Promotion

3.21. In 1974 the Government launched an LPG promotion program intended to curtail the rapidly growing consumption of charcoal in the cities. Relatively low single-burner LPG stoves were introduced, and the controlled fuel price was set below cost. Under that program, annual LPG consumption increased from about 3,500 tons in 1974 to 16,000 tons in 1987, implying an average growth rate of 12% per year. In 1987 the Government added further stimulus to consumption by reducing the LPG price by about 40%; the result was an acceleration of sales, to reach over 50,000 tons in 1994. The annual growth rate in the period 1987-1994 averaged 18% per year.

3.22. The European Union (EU) provided further support to the government's butanization program through a regional butane program (Programme Régional de Gaz - PRG) to the CILSS member countries. The financial assistance to Senegal comprised investment in storage facilities and money for promotion and consumer education. The funds were channeled through the private distributors but, since the retail price was controlled anyway, the end use consumers did not benefit and the incremental impact on charcoal use was nil. For various reasons, the PRG was no success in other CILSS countries either, and in 1995 the EU formally discontinued the Program.

3.23. Meanwhile, the countries of the CFA zone had to adjust their pricing policies for the effect of the 100% currency devaluation in January 1994. The Government of Senegal protected LPG consumers by increasing the controlled price by only 30% whereas it allowed an effective price increase of domestically produced charcoal by 60%.

3.24. Although the different LPG promotion programs have displaced an estimated 90,000 tons of charcoal per year and, as a result, stabilized charcoal consumption in Dakar at around 130,000 tons per year, the overall effectiveness has been mixed. The benefit of subsidies has been captured only by higher-income urban households and small commercial establishments. The annual level of the subsidies reached FCFA 5 billion (or \$ 10 million) in 1995. It is argued that the subsidy is not a burden on the national treasury because it is financed out of petroleum product revenues. However, that implies inequitable income transfers within the economy and, since users of other petroleum products pay for the cross subsidy, it further has promoted a distortion of the entire framework of energy prices.

Dissemination of Improved Stoves

3.25. The dissemination of improved fuelwood and charcoal stoves in Senegal began in 1980 under the responsibility of the CERER, which developed two improved stoves (*Ban ak Suuf* and *Sakkanal*) with reasonable performance and consumer acceptance. However, by 1987, CERER had only been able to disseminate some 30,000 *Ban ak Suuf* fuelwood stoves in the rural areas and less than 10,000 *Sakkanal* charcoal stoves in the urban areas. Between 1988 and 1994 little progress was registered in the promotion of improved stoves. Currently, there are only few improved stove projects in operation and they are mostly focused on charcoal. These projects,

however, are still too small to make a visible impact and/or are largely dependent on donor support. It is estimated that only between 5 and 12 percent of Senegalese households have improved stoves.

3.26. Based on available information, the best program in operation today is the USAID-funded Appropriate Technology International (ATI) *Diambar* charcoal stove program. This program supports the production of stoves in Dakar and Thies. The Diambar stove, which consists of a ceramic interior covered in sheet metal, is proving to be very efficient (30-40%) under normal household use conditions and has a high consumer acceptability. A wider dissemination of this promising stove, however, has been limited by availability of investment credit to the small artisans who produce the ceramic and the metal shell. Current sales of *Diambar* stoves are reported at 20,000 per year at prices that vary from 2,000 FCFA to 4,500 FCFA depending on the size. At the estimated 30-40 percent efficiency range, a wider dissemination of the *Diambar* stove could result in a significant reduction in charcoal consumption and expenditures at the household level.

3.27. Other urban-based improved charcoal stove projects include the PAMEC project (metal and leather artisans project) from MEMI's Directorate of Artisanat which support artisans in Thies, Kaolack, Saint Louis and Louga; the ENDA-Graf which assists metal artisans in Dakar and Rufisque; and different small stove-related women's groups support activities by the Ministry of Women, Children and the Family.

3.28. While many reasons have been offered for the limited success of most improved stoves program in West Africa, recent work suggests that too much emphasis was given to technical performance (energy efficiency) and too little to consumer acceptability. The majority of the sociological field work undertaken did not have research objectives but rather was intended to convince consumers to utilize improved stoves through "sensibilization campaigns". With few exceptions consumers consistently were unable to perceive the benefit of improved stoves and penetration remained a function of direct donor-financed promotion efforts. As soon as donor financing was cut penetration stopped and households did not replace stoves when the time came to do so. The sociological studies were used to influence the technical design of stoves (pot size capability, type of food cooked, etc.) but not necessarily to design the stove's social marketability. As a result even highly performing stoves under laboratory conditions lacked the necessary consumer attractiveness (quality of material, presentation, marketing approach, etc.) to generate commercial success stories. At the same time, while it was expected that consumers would perceived the economic advantage of utilizing improved stoves, market price/quantity distortions and speculation (the practice to sell presumable kilogram units with as little as 700 grams of actual weight) rapidly eroded the expected saving because fuelwood and charcoal are not traded on the basis of standardized units but of money (i.e., 50 FCFA or 10 FCFA of charcoal). As the non-regulated fuel units shrank through time by up to 30% there went with it the possibility for consumers to perceive any concrete saving.

Forestry Projects

3.29. Many afforestation projects have been carried out in Senegal the course of the last decade to increase forest resources. At present, 30 programs are under way. The approach of these projects was long dominated by reforestation on force account. This had only a limited impact because of the high cost (US \$500 ~ US \$750 per hectare) relative to the benefits, the difficulty of protecting the forestry stands against over-exploitation and the lack of participation of the

rural communities. Recent years have seen a gradual shift from reforestation operations on force account to a more communitarian approach and with the integration of agro-sylvo-pastoral activities. Today, a large number of those projects focus on rural forestry and half of them include some training, information dissemination and education activities. By now some 150,000 ha. have been replanted since 1970. Despite the importance of the progress made, the current reforestation rate (close to 20,000 ha/year) is still well below that of deforestation and over the short-to-medium term the new plantations will not to play a significant role in the supply of wood products (charcoal included).

Improvement of Carbonization Techniques

3.30. A program to train charcoal makers in the use of improved kilns (the "Casamance" kiln) was undertaken between 1980 and 1986. The program trained more than 7,500 charcoal workers. For a relatively small investment (about FCFA 20,000), the kiln boosts the carbonization yield by 20%. Nevertheless, the program was discontinued because successive evaluations showed that the charcoal laborers ("*surghas*") continued to use their traditional carbonization methods in stead of the improved kilns. The principal reasons for this was the "*surghas*" complete dependence on the commercial charcoal traders ("*exploitants forestiers*"), who had no incentive to investment in kilns or to pay the additional cost to transport them into the charcoal production sites. As charcoal production quotas were set on the basis of charcoal quantities and not on the basis of areas or wood volumes, any additional production cost would only reduced the trader's profit margins.

3.31. As the new wood volume-based charcoal quota system comes into effect in 1997, it is expected that traders will have a clear incentive to utilize improved kilns, as doing so would maximize their revenues for the same level of effort and forest resources. While the traders could be expected to upgrade their carbonization practices within the next 2 to 3 years, all community-based charcoal production promoted by the proposed project will based on improved technology. The use of improved carbonization methods will be monitored throughout the proposed project and the economic and financial information obtained in the first three years of the project will be used for the elaboration of a new woodfuels pricing and fiscal policy due to be enacted by the government by December 2000 (para. 6.9.iii). The operation, monitoring and enforcement mechanisms for the production of charcoal by the rural communities will be stipulated within the "contract plans" (para.5.4.vii) that will be established between the government and the participating communities. The overall enforcement of the charcoal related regulatory and policy changes will be the responsibility of the Forestry Service. The Forestry Service will act on the basis of the monitoring and supervision systems that will be implemented by the project (forest resources exploitation, woodfuels trade flows and community participation).

2. Future Strategy

3.32. In order to address the existing problems and contribute towards the effective development of the traditional and household energy sectors in Senegal it will be necessary to undertake a well focused set of priority actions. It is obvious that numerous other things can and perhaps should be done to some degree, however, the limitation of human and investment resources imposes the need to retain focus over a small core group of complementary priority actions:

Institutional Issues and Options

- to strengthen the existing sectoral institutions (primarily the Direction des Eaux et Forêts and Direction de l'Énergie) and to upgrade their staff and means to plan, coordinate, monitor and evaluate sectoral activities and measures; and
- to elaborate and implement a sound communication strategy capable of maintaining the entire population (government agencies and civil society at large) informed of the developments in the sector, to lay the ground for necessary policy reform work (changes in pricing, charcoal quotas, taxation, forestry codes, forestry application decrees, land and tree tenure, etc.) and to effectively promote the different demand management measures and inter-fuel substitution fuels or equipment (improved stoves, gas, kerosene, etc.).

Traditional Energy Markets

- implement large scale community-based sustainable forest management systems capable of spatially fixing production of woodfuels for the rapidly growing urban markets (particularly charcoal) and promoting integrated natural resource management and biodiversity protection. In order to do this the following activities would have to be undertaken: a comprehensive inventory of forestry and other biomass resources, in conjunction with a survey of land use; participatory rural appraisals in target communities to ensure their participation in the proposed sustainable management plans; and make the necessary adjustments in the regulatory framework so as to create the right regulatory environment (land and tree tenure, taxation, revenues, etc.);
- promote the implementation of rural community-run improved charcoal kilns (Casamance kilns) at concentrated fixed locations in order to increase the efficiency of the charcoal carbonization and spatially organize its production; and
- support the economic diversification (including commercial timber plantations, urban and rural retail activities, LPG distribution, etc.) of the existing *exploitants forestiers* to reduce the potential conflicts of the gradual transfer of an important part of the industry and revenues to the rural communities.

Regulatory and Policy Issues and Options

- enact the necessary legislation to replace charcoal quotas in the areas under community management by sustainable annual production ceilings fixed by the management plan agreed between the government and the communities and, as a transitional measures, to ensure that the immediate vicinity of the villages in non-managed zones should be protected from indiscriminate cutting by an exclusion zone (e.g. a radius of several km);
- enact the application decree for setting-up of the Niokolo-Koba protection buffer zone;

- change the charcoal royalty system from its present charcoal output base to a wood input base in order to promote increase carbonization efficiency.
- review and simplify the current woodfuels regulatory systems to reduce its enforcement burden and to reduce the opportunities for process corruption; and
- establish a modern and strengthened system for monitoring and controlling forestry exploitation and flows of woodfuels, in order to ensure compliance with the forestry management plans, provide reliable data on a regular basis, increase forestry revenue and ensure the protection of the forest stocks and of biodiversity.

Energy Demand Management

- introduce standard weights and measures and improved charcoal handling (including the introduction of standardized bagging of charcoal at the retail level) in order to protect consumers from price/quantity speculation by retailers and to reduction of urban pollution;
- remove all controls on charcoal retail prices as soon as enforceable standard weights have been established and more competition has been introduced;
- promote the production and marketing of improved charcoal stoves in the urban center by the private sector and/or NGO community at non-subsidized market prices; and
- promote the use of improved stoves in the urban households through appropriate sensibilization and consumer information campaigns;

Inter-fuel Substitution Options

- review the procurement, storage and handling systems of the LPG and Kerosene in Senegal, with a view to identify the areas and issues which can be improve (cost, efficiency, transparency, and performance) in order to reduce either the need for governmental subsidies or their final retail prices;
- continue to support the dissemination of LPG by the private sector nationwide, through the standardization of retail prices (“perequation”), limited financial support to private sector entrepreneurs for the construction of decentralized depots and suitable promotion operations; and
- explore the potential of kerosene as a substitute fuel for the secondary cities of the country where the consumption of charcoal is increasing rapidly.

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IV. BANK GROUP/GEF ROLE IN THE TRADITIONAL ENERGY SECTOR

A. HISTORY AND LESSONS LEARNED FROM PREVIOUS BANK/IDA/GEF INVOLVEMENT

4.1. The proposed project incorporates the principal lessons learned over the past two decades in "household" energy and participatory natural resource management interventions in West Africa, including projects in Burkina Faso, Gambia, Mali and Niger. The lessons incorporated include but are not limited to the need to:

- (i) focus the priority for action in the traditional energy/household energy sector on the establishment of sustainable woodfuels supply systems capable of satisfying the growing and concentrated urban markets;
- (ii) enact a legal and regulatory framework that provides for the effective transfer of the control over natural resources from the Government to the rural populations;
- (iii) implement a simplified traditional and household fuels fiscal and pricing regulatory framework which avoids loopholes and opportunities for market distortions and "corruption";
- (iv) follow a natural resource and rural development approach to the implementation of community managed woodfuels supply schemes to ensure the materialization and sustainability of social and economic development under the project;
- (v) re-orient the role of governmental agencies towards policy formulation activities and away from actual project execution, and promote an increased participation of civil society (community, NGOs and private sector) in the implementation of non-subsidized project activities (inter-fuel substitution, improved stoves, etc.); and
- (vi) promote and maintain ample consultation/ participation of all the "stakeholders" throughout the entire policy-project cycle, and implement a sound communication strategy.

B. RATIONALE FOR BANK/GEF FINANCING AND CONSISTENCY WITH THE COUNTRY ASSISTANCE STRATEGY

4.2. The project is a logical progression of the new traditional energy sector development strategy developed with the Bank's assistance (RPTES Program) and is fully consistent with the agreed Country Assistance Strategy (CAS) of February 16, 1995. Its implementation would result in advancements in key areas of the Bank's development assistance agenda for Senegal, including -- but not limited to -- the rationalization and stabilization of the energy sector, promotion of sustainable forest and natural resource management practices, creation of participatory and gender-balanced rural development opportunities, private sector development, NGO community participation and reduction of environmental degradation. Further, the project would be fully consistent with the principles and recommendations of Agenda 21, the

Convention to Combat Desertification (CCD), the United Nations Framework Convention on Climate Change (UNFCCC), and the Beijing Declaration.

4.3. While the current institutional and policy environments of the forestry and energy sectors in Senegal justify Bank involvement and support, up until recently both sectors were plagued by serious problems, the least of which was a strong interference by political and economic interest groups in policy and institutional matters and even in daily operational issues within in the sector. Those problems, exacerbated by serious incidents like the clear-cutting of the Mbegue forest in 1992, led to the suspension of a Bank forestry sector project in 1992 (PICOGERNA) and to the refusal by the Bank and other donors to finance investment proposals presented by the GoS at an Energy Donors Round Table in 1992. Nevertheless, as in other Africa countries, Senegal has experienced a considerable process of political and institutional change in the last three years as a direct result of the ongoing push towards democratization and administrative decentralization. Whereas some time will still be required for Senegal to put that negative past behind, there is today a clear awareness in government that a repetition of incidents such as the clear-cutting of the Mbegue forest would result on seriously destabilizing internal and external political and economic repercussions.

4.4. Clearly marking the changes that have taken place in Senegal in the recent past, the new forestry code expressly provides for the transfer of responsibility from the Government to the rural communities for the sustainable management and exploitation of the existing natural forest resources, and establishes that all forest resources exploitation activities must now be consulted with and approved by the affected rural communities. This fundamental regulatory change -- which would have been unthinkable a decade ago -- is fully consistent with the overall trend toward administrative decentralization and has the full commitment of the Government at the ministerial and technical levels. Nevertheless, the still powerful -- although rapidly diminishing -- charcoal oligopoly that exists cannot and should not be dismantled overnight. An organized process of gradual transition and increasing participation of the rural populations in the woodfuels industry trade will be necessary in order to avoid sudden woodfuels market ruptures, and the negative energy, social and political consequences that would result from them. Such a gradual process is also necessary from environmental and energy efficiency points of view, as the rural population will need some time to assimilate both sustainable forest management and efficient carbonization practices and methods. Not allowing for such a gradual transition would result in low natural resource sustainability, decreased carbonization efficiencies and potential social and economic conflicts from the redistribution of part of the industry's income to the rural communities.

4.5. The sustainable woodfuels supply management component qualifies for GEF support under the short term projects window of the operational strategy for climate change. The component is a country sustainable development and global environment priority, likely to succeed. It is also highly cost effective in the short term (US \$ 4.30/t CO₂ after 7 years and US \$ 1.04/t CO₂ after 15 years). Its objective is carbon sequestration, which the strategy flags as a possible future operational program and on which early experience is sought. The participation of GEF in the project is necessary in order to assist the GoS in the financing of community-participatory activities ("*mesures incitatives*") and monitoring and evaluation systems designed to generate and/or guarantee the materialization of incremental global environmental benefits (climate change and biodiversity agendas). Through the implementation of sustainable forest resources management systems, the project will provide -- within the project area and dimension - for the production of 300,000 tons/year of fuelwood with a zero net emission effect, thus

significantly reducing ongoing CO₂ emissions. In addition, the project would establish a buffer zone around the **Niokolo-Koba National Park**, increasing the protection to biodiversity. Without GEF financing the GoS will lack the necessary funding to cover the proposed activities and thus the global environmental benefits would not be realized. In addition to the above, a highly cost effective improved charcoal stoves program activity (unit abatement cost of US \$0.34/t CO₂ after 7 years) will be included within project's Demand Management component. While this activity will **not** be financed by GEF its implementation is fully consistent with GEF's operational program for removing barriers to energy conservation and energy efficiency. The barriers in this case are shortage of up-front capital and lack of knowledge. **Annex 1** presents a descriptive summary of the **Niokolo-Koba National Park** and its national and global biodiversity significance. **Annex 2** presents a summary of the monitoring and evaluation activities of the GEF components. **Annex 3** presents a detailed discussion and calculations of the project's GEF incremental cost and expected global environmental benefits.

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V. THE PROJECT

5.1. **Background.** The proposed project was prepared by the GoS with assistance from the Bank's Africa Regional Program "Review of Policies in the Traditional Energy Sector - RPTES". Through the RPTES a national inter-ministerial team conducted between mid 1993 and late 1994, a comprehensive review of the traditional energy sector in Senegal, including the evaluation of the principal inter-fuel substitution issues and options (kerosene and LPG). Within that review, the regulatory, legal, pricing and fiscal frameworks of the sector and the evolution of its structure and functioning were studied in detail. The inter-ministerial RPTES team was led by the Directorate of Energy of the Ministry of Energy, Mining, and Industry (MEMI) and was integrated by other senior staff from the Directorate for Water and Forests of the Ministry of the Environment and Protection of Nature (MEPN), Ministry of Commerce, Ministry of Women Affairs, Ministry of Finance and Plan, and *inter alia*, the National CILSS Commission (CONACILSS), which are all members of the "*Cellule de Combustibles Domestiques*". By May 1995 the five RPTES participating countries presented their respective policy conclusions and recommendations and a draft of investment project at the "RPTES Donor Experts' Conference" at Maastricht, The Netherlands. After the Maastricht conference, the Senegal RPTES team went to work on the polishing of their proposed sectoral investment program based on the comments received from the several donor present. The basic project draft design was extensively discussed among different government agencies, the NGO community and several beneficiary consultation and participation activities have and will be done throughout project implementation (see section Beneficiary Participation and Consultation).

A. PROJECT OBJECTIVES

5.2. **Project Objectives.** The objective of the project is to meet an important part of the rapidly growing urban demand for household fuels, without the loss of forest cover and the ecosystem's carbon sequestration potential and biodiversity. This objective would be met through:

- (i) the implementation and monitoring of 300,000 hectares of environmentally sustainable community-managed forest resource systems in the Tambacounda and Kolda regions of Senegal, creating a protection zone around the Niokolo-Koba National Park (Biosphere Reserve);
- (ii) the promotion of private sector inter-fuel substitution and private sector and NGO-based improved stoves initiatives; and
- (iii) the strengthening of the institutions involved in the management of the sector, and the promotion of the participation of the civil society (private sector, academic institutions, and NGOs community) in the operation of the sector.

B. PROJECT DESCRIPTION

5.3. **Project Description.** The project consists of three components: (i) **Preparatory and Support Activities component**; (ii) **Sustainable Woodfuels Supply Management component**; and, (iii) **Demand Management and Inter-fuel Substitution Options component**. The project design includes a series of activities to ensure an effective participation of the rural population (“*measures incitatives*”) and thus guarantee the full achievement of the environmental sustainability objective of the project. The project also includes specific monitoring and evaluation activities (forest exploitation and wildlife) designed to evaluate the achievement of its global environmental objectives (maintenance of carbon sequestration capacity, CO₂ emission abatement and biodiversity conservation:

5.4. **Component I: The Preparatory and Support Activities** component would have an approximate duration of one calendar year and would finance technical assistance, equipment and operational costs to carry out:

- (i) A comprehensive assessment of vegetation cover in the Tambacounda and Kolda regions to generate the technical data necessary to design sound community-level sustainable forest management plans and to select the specific geographical areas to be covered by the project;
- (ii) A series of participatory rural appraisals to obtain the demographic, socio-economic, and cultural information necessary to prepare, with the local communities, the specific management plans. These Parse would pay special attention to the identification of relevant women’s development issues, specific training and capacity building needs;
- (iii) The design of monitoring and evaluation systems including: (a) a forest resources exploitation monitoring system for the Tambacounda and Kolda regions to evaluate the sustainability achieved by the community-managed systems and to supervise the operation of the non-community based woodfuels traders and their compliance with authorized exploitation plans; (b) a forest fire monitoring and response system for the community-managed areas to assist in the reduction of forest resource losses within the project area; (c) a rural community-based wildlife monitoring system to evaluate the compliance with and achievement of the project’s biodiversity objective; (d) a national woodfuels trade flows monitoring system to enable the correct quantification of the market requirements and the preparation of long-term woodfuels supply strategies at the national level; (e) kerosene and LPG penetration monitoring systems; and (f) urban improved stoves penetration monitoring system.
- (iv) The elaboration of capacity building and training programs, with special emphasis on the training and extension needs of the regional Forest Services offices, community groups and NGOs;
- (v) Institutional development and capacity building support to the different governmental agencies, community associations and NGOs that will participate in the implementation of the project, with special emphasis in the training and “recycling” of the Forest Service staff who will be directly responsible for the

implementation of the Sustainable Woodfuels Supply Management component and the staff of the Energy Directorate (MEMI);

- (vi) Elaboration of technical studies and assessments on demand management and interfuel substitution issues (kerosene stoves and penetrations strategies, improved charcoal stoves, energy pricing, etc.);
- (vii) The preparation of a detailed implementation plan for the annual participatory forest management modules, including the preparation of standard Government-rural community "Contract Plans";
- (viii) The preparation of a detailed implementation plan for the Demand Management and Inter-fuel Substitution Options Component, including the selection of the private sector and NGO initiatives to be supported by the project; and
- (ix) The design of a comprehensive project implementation communication strategy to promote increased participation of civil society (community, NGOs and private sector) in the management and operation of the sector.

5.5. **Component II:** The Sustainable Woodfuels Supply Management component would finance technical assistance, small tools and field equipment for the rural communities, vehicles and office and field equipment for the Forest Service (regional offices), forest fire control equipment, and community projects (carbonization units, agro-forestry enterprises, etc. (*micro-realizations communitaires*) to carry out:

- (i) The implementation of sustainable community-managed forest management systems over an area of 300,000 ha within a total period of six years, from which woodfuels would be produced. The project would seek to reinforce the buffer zone around the Niokolo-Koba National Park (international "Biosphere Reserve"). This component would implement annually increasing "forest/natural resource management modules", starting at 15,000 ha in the second year up to 100,000 ha in the seventh year;
- (ii) An assessment of the availability of and access to woodfuels for rural subsistence consumption at the national scale, paying particular attention to the availability of dead wood vis-à-vis the geographic dispersion of the rural population;
- (iii) Technical support and extension services to the participating rural communities and NGOs for the implementation of the participatory management modules and for the exploitation/production and marketing of woodfuels and other potential wood and non-wood products;
- (iv) Support for the establishment of rural-based micro-enterprises, such as community-operated carbonization units, agro-forestry processing units, etc.; and
- (v) The implementation of a comprehensive communication strategy in support of the implementation of the Sustainable Woodfuels Supply Management component.

5.6. **Component III: The Demand Management and Inter-fuel Substitution Options** component would finance technical assistance, vehicles and office equipment for the *Direction de l'Energie*, purchase of 1,000 kerosene stoves for a pilot program; purchase of LPG bottles and burners to carry out:

- (i) Support for the re-organization and modernization of the urban charcoal trade to establish long-term supply agreements (contracts) between rural communities and urban traders -- to guarantee the unconstrained entry of community-produced woodfuels to the urban markets -- and to permit the standardization of the marketing units and the cleaning of the urban environment (charcoal bagging);
- (ii) Providing technical assistance and limited financial support for the economic diversification of existing urban charcoal traders ("*exploitants forestiers*"). Proposal received include enterprise diversification into LPG retail, gas service stations, foodstuffs retail and light transport activities. The financial support to be provided by the project would be limited to organizational and training activities;
- (iii) The execution of specific technical and market-feasibility studies to support the further promotion of LPG and Kerosene as substitute household fuels (the kerosene study will complement a proposed GTZ-funded study within the recently launched German-Senegalese Household Energy Assistance Project); and
- (iv) Providing support for the continuation of inter-fuel substitution options (kerosene and LPG) and dissemination of improved stoves by the private sector and NGOs.

C. PROJECT COSTS AND FINANCING PLAN

5.7. **Project Cost and Financing.** The total project cost is estimated at US \$19.9 million, with a foreign exchange component of about US \$18.7 million (94%). The financing plan includes US \$1.2 million from GoS (para. 7.1.iii), US \$5.2 million from IDA, US \$4.7 million from GEF, and US \$8.8 million to cofinanced by the Dutch Government. The GEF Council has already approved the request for funding for the project (US \$4.7 million) (para. 7.2.i). The GEF funding includes US \$500,000 from the Danish Environmental Program. It is important to note that, as outlined above, the financing plan does not include the large in-kind financing from the rural communities (sustainable forest management) and NGOs (community support and improved stoves activities), nor the investments that are expected from the promotion of private sector activities (modernization of the charcoal filiere and inter-fuel substitution).

5.8. **GEF Incremental Costs.** The incremental cost of the "GEF Alternative scenario" is US \$4.66 million. This represents the cost for the implementation of activities within the Preparatory and Support Activities and the Sustainable Woodfuels Supply Management components related to community-participation, integrated natural resources management, institutional development and the monitoring and evaluation of global environmental benefits.

5.9. It is estimated that over the project duration of 7 years the GEF Alternative Scenario would achieve a total CO₂ emission abatement of 1.1 million tons at an incremental cost of US \$4.30/ t CO₂. Over 15 years, the GEF Alternative scenario would result in a CO₂ emission

abatement of 4.5 million tons at an incremental cost of US \$1.04/t CO₂ (see Annex 3 for a detailed calculation of the project's Incremental Cost and Global Benefits).

D. BENEFICIARY CONSULTATION AND PARTICIPATION

5.10. The sectoral development strategy and investment proposals prepared by the GoS were widely discussed at all levels of Government and with the civil society, including the private and academic sectors and the NGO community, during national participatory seminars and workshops. A special national workshop for "*exploitants forestiers*" was held in 1994 and periodic consultations were sustained since with key sector entrepreneurs to ensure their support for the implementation of the envisaged policies and investments. Three regional workshops (including delegations from Burkina Faso, Gambia, Niger, Mali & Senegal) were held to promote a regional discussion of country policy findings and investment proposals and cross-country comparisons and to allow for a direct exchange of experiences. **Table 5.1** presents a summary of the participation plan for the proposed project (para. 7.1.iii). **Annex 4** presents a descriptive summary of the project's participation action plan.

5.11. In December 1995 three "Project Design Workshops" (Government agencies, NGOs & private sector and donor community) were held in Dakar to further review the proposed project's design concept. A large NGO community consultation meeting was held in Dakar in late March, 1996 to prepare a series of direct beneficiary (rural community) consultation workshops which took place in April 1996.

5.12. Because of the nature of the proposed project, its participation and beneficiary consultation aspects are of critical importance. The participation activities that would be undertaken within the project have as main objective assuring that the implementation of the project will be based on beneficiary representative participation (para. 7.1.ii).

E. PROJECT IMPLEMENTATION

5.13. The Ministry of Environment and Protection of Nature (MEPT) and the Ministry of Energy, Mines and Industry (MEMI) through the appointment of a **National Project Director** (NPD) and the establishment of a **Project Coordination Unit** (PCU) would be jointly responsible for the overall implementation of the project (para. 7.2.ii). The implementation of the Preparatory and Support Activities component would be under the joint responsibility of MEPT and MEMI as this component includes preparatory activities related to areas of competence of both ministries. The National Water and Forest Directorate (NWFD/MEPT) alone would be responsible for the implementation of the Sustainable Woodfuels Supply Management component of the project. The Energy Directorate (DE/MIME) would be responsible for the implementation of the Demand Management and Inter-fuel Substitution Options component. The existing "Cellule de combustibles domestiques" would serve as a "consultative group" for the project and would provide the institutional conduit for multi-agency coordination. Moreover, a small formal high-level "Steering Committee" for the project will be set-up to oversee the implementation of the project and provide guidance on important issue that arise. This Steering Committee will be formed by senior representatives of the Borrower, the project's donor agencies and, possibly, representatives of the civil society.

Table 5.1: Summary of proposed Participation Action Plan (PAP)

Key Elements of the Plan
<ul style="list-style-type: none"> • Based on a Consultative and Participatory Process: The design of this plan resulted from a consultative process of Policy Formulation and Project Identification involving several key stakeholders. In addition, a series of National and Regional Participatory Project Preparation Workshops were conducted by the Government of Senegal between December 1995 and April 1996 to obtain feedback and suggestions from representatives of civil society on the overall project strategy.
<ul style="list-style-type: none"> • NGO Oversight: The Government of Senegal will choose an NGO to be responsible for the monitoring of the SPEMP-PAP. This “lead” NGO will be responsible for promoting, monitoring and reporting on all participatory activities during the project implementation phase.
<ul style="list-style-type: none"> • Phase of Preparatory and Support Activities: The first 12-18 months of the project will be dedicated to participatory preparation activities, as well as other support activities. The participatory preparation activities will allow communities to design their own community management plans as well as for the project team to obtain additional social, economic, ecological, and functional information necessary for project implementation. Once the actual implementation of the sustainable woodfuels management systems begins, additional PRAs will be conducted in the rural communities that are expected to join the project in the subsequent year.
<ul style="list-style-type: none"> • Role of Women, Youth and NGOs⁴: Due to their critical role in resource management and development, women, youth and NGOs have been identified as key participants and will play a fundamental role throughout the life cycle of the project.
<p>Participatory Methodology Training for Government Officials: General sensitizing of government decision makers on participatory approaches and their impact on development is planned as a key component of capacity building and institutional development activities for the Government of Senegal.</p>

5.14 The project includes a Preparatory and Support Activities components which entails the detailed design and preparation of all major project investment components. As such, the Preparatory and Support Activities component is intended to serve like a “project preparation facility (PPF)”. A PPF was not considered for this project because of the relatively small size of the overall operation did not warrant the establishment of a PPF. Rather, an initial component through which design issues would be finalized and which would constitute a condition of disbursement for the investment activities of the two additional components (supply and Demand) (para. 7.3). Table 5.2 presents an implementation calendar for the SPEMP project. The implementation of the project -- and in particular the preparatory and support services component -- will make full use of the accumulated Bank and non-Bank experience accumulated thus far in the sub-region in similar forest/natural resources management projects. Among Bank projects, the SPEMP activities will closely review: (i) Burkina Faso: Programme National de Gestion Terroir (PNGT); (ii) Niger: Energy II; (iii) Mali: Household Energy Project (HEP); and Mali: Programme de Gestion des Ressources Naturelles (PGRN). Other non-Bank projects to be

⁴ Non-Governmental Organizations here also refers to Community Based Organizations (CBOs)

studies, include: (i) Burkina Faso (UNDP/FAO): Programme National de Aménagement Forestiers (PNAF); (ii) Senegal (Dutch Cooperation): Previnova; and (iii) Gambia (GTZ): Forestry Project.

1. Component I: The Preparatory and Support Activities

5.15 The assessment of vegetation cover in the Tambacounda and Kolda regions will be undertaken by the Inventory and Cartography Division of the Forestry Service with support from the *Centre de Suivi Ecologique* (CSE) and of specialized consultant assistance. An initial review of the different methodologies that have already been used in Senegal to undertake forest and vegetation cover inventories will be made. On the basis of that, one methodology will be chosen or design to undertake the intended vegetation cover assessment. It is envisaged that the chosen methodology will be later adopted as the standardized methodology for subsequent forest/vegetation cover inventories and assessments in Senegal. The reason for conducting a vegetation assessment as opposed to a narrower forest resource assessment is to obtain the information necessary to design the community-based natural resource management strategies and plans envisaged by the project (forest, agriculture, herding, extraction, etc.).

5.16 The participatory rural appraisals constitute the principal participatory activity of the preparatory and Support Activities Component and are expected to provide the basis for the identification and selection of the rural communities to be included in the project. The execution of the PRAs will be done by locally active NGO groups under the supervision of the regional Forestry Service agencies. The base methodology for the PRAs will be prepared by the Forestry Service of the PCU with assistance of specialized consultants as required (individuals and/or NGOs). The resulting methodology will be subject to specific IDA approval. The first batch of PRAs should be completed by the end of the first year of project implementation. As conditions in the rural communities are expected to change over time, only a limited number of PRAs will be conducted during the Preparatory and Support Activities Component (approximately 40 PRAs). The remaining PRAs will be undertaken in years 2, 3, 4, 5 and 6 of the project implementation schedule. The initial 40 PRAs however are expected to provide the necessary input to design "standard" participatory and sustainable forest management modules.

5.17 The design of monitoring and evaluation systems (forest resources exploitation; forest fire; wildlife; national woodfuels trade flows, kerosene and LPG penetration; and improved stoves) will be done by specialized consultants (individuals, private firms and/or NGO) under the supervision of the PCU. This activity should be completed by the end of the first year of project implementation.

5.18 The elaboration of capacity building and training programs and the preparation of a detailed implementation plan for the annual participatory forest management modules (including the Government-rural community "Contract Plans") will be done by the Forestry Service with support from specialized consultants and technical assistance groups. Among other, it is envisaged that FAO will play a role in the development and implementation of the intended capacity development and training programs as a cooperation agency. This activity should be completed within the first 18 months of project implementation.

Table 5.2: Senegal SPEMP: Project Implementation Plan

Project components & Sub-components	MONTHS						
	1-12 (18)	13(19)- 24	25 - 36	37 - 48	49 - 60	61 - 72	73 - 84
Component I: Preparatory and Support Activities							
1. Vegetation cover assessment (Tamba/Kolda).	■■■■■■■		□□	□□	□□	□□	
2. Preparatory Participatory rural appraisals.	■■■■■■■						
3. Design of monitoring and evaluation systems:		<i>Monitoring & Evaluation Schedule During Implementation</i>					
Forest Resources exploitation (FRE)	■■■■■■■	□□	□□	□□	□□	□□	□□
Forest Fire (FF) & Wildlife (W)	■■■■■	□	□	□	□	□	□
Woodfuels Trade Flows (WTF)	■■■■■■■	□□□□□□	□□□□□□	□□□□□□	□□□□□□	□□□□□□	□□□□□□
Participation (P) & Developmental impacts (DI)	■■■■■■■	□□	□□	□□	□□	□□	□□
Kerosene & LPG Penetration (IF) & Improved Stoves (IS)	■■■■■■■	□	□	□	□	□	□
4. Elaboration of capacity building program/field extension guides.	■■■■■						
5. Institutional development and capacity building (DEF & DE).	■■■■■■■						
6. Preparation of implementation plan for participatory forest management modules (Component II).	■■■■■						
7. Preparation of implementation plan for Component III.	■■■■						
8. Design project communication strategy (components II & III).	■■■■■						
Component II: Sustainable Woodfuels Supply Management							
1. Implementation of sustainable forest management systems.							
Annual participatory rural appraisals (modules 2 - 6)			■■■	■■■	■■■	■■■	
Module 1: 15,000 ha		■■■■■■■					
Module 2: 25,000 ha			■■■■■■■				
Module 3: 40,000 ha				■■■■■■■			
Module 4: 50,000 ha					■■■■■■■		
Module 5: 70,000 ha						■■■■■■■	
Module 6: 100,000 ha							■■■■■■■
2. Undertake national dead wood assessment.		■■■■■■■					
3. Support & extension services participating villages and NGOs.		■■■■■■■	■■■■■■■	■■■■■■■	■■■■■■■	■■■■■■■	■■■■■■■
4. Support for establishment of rural micro-enterprises.		■■■■■■■	■■■■■■■	■■■■■■■	■■■■■■■	■■■■■■■	■■■■■■■
5. Implement woodfuels component communication strategy.		■■■■■■■	■■■■■■■	■■■■■■■	■■■■■■■	■■■■■■■	■■■■■■■
Component III: Demand Management & Interfuel Substitution							
1. Support to re-organization/modernization of charcoal trade.		■■■■■■■	■■■■■■■	■■■■■■■			
2. Support for economic diversification of charcoal traders.		■■■■■	■■■■■■■	■■■■■■■	■■■■■■■	■■■■■■■	
3. LPG and kerosene technical/ market-feasibility studies.		■■■■■■■	■■■■■■■				
4. Support promotion of LPG/kerosene and improved stoves.		■■■■■■■	■■■■■■■	■■■■■■■	■■■■■■■		

5.19 The preparation of a detailed implementation plan for the annual participatory and sustainable forest management modules (including the preparation of standard Government-rural community "Contract Plans") will be done by the Forestry Service with support from specialized consultants and technical assistance groups. The implementation plan would be designed with the direct participation of the rural populations taking into account the multifunctionality of the existing agro-ecosystems and thus the socio-economic parameters and interests of the local community. This activity should be completed by the first year of project implementation.

5.20 The preparation of a detailed implementation plan for the Demand Management and Inter-fuel Substitution Options Component will be done by the Energy Directorate with specialized consultant support as needed, and should be completed by the first year of project implementation.

5.21 The design of a comprehensive project implementation communication strategy for the entire project will be done by specialized consultants under the supervision of the PCU. This activity should be completed by the first year of project implementation.

2. Component II: Sustainable Woodfuels Supply Management

5.22 The implementation of sustainable community-managed forest management systems will be based on the legal transfer of the responsibility for the management and exploitation of the forest resources to the rural communities. The expected implementation cycle of the community-based participatory system in any given area/community is expected to last a total of three years, going from full project involvement during the first year to gradual disengagement starting on the second year until the third year, when mostly project funded monitoring and evaluation systems would remain in place. As of the end of the first year of field implementation the participating communities will be expected to assume an increasing responsibility over all implementation aspects, including the funding from local revenue of follow-up technical assistance. This sub-component will cover a total area of 300,000 ha -- reinforcing the protective buffer zone that has been established around the **Niokolo-Koba National Park** -- within the six years of field implementation period (year 2-7) in accordance with the approximate incremental schedule presented in **Table 5.3**.

5.23 The national dead wood assessment will be executed by the Forestry Service with specialized support from the *Centre de Suivi Ecologique* (CSE). The field work of the assessment will be combined with the regular field activities of the regional Forestry Service agents. This activity should be completed by the end of the second year of project implementation.

5.24 The activities of technical support and extension for the implementation of the participatory forest management modules and for the exploitation/production and marketing of woodfuels (the introduction of improved carbonization technologies and other potential wood and non-wood products) will be executed under different operational arrangement including, as needed, a combination of Forestry Service agents, technical assistance support (FAO) and selected specialized NGOs. In the case of carbonization activities, special attention will be given to the monitoring and enforcement of the agreed improved methods and production standards.

Table 5.3: Incremental Implementation Schedule of Community-based Sustainable Woodfuels Supply Management Systems

Year	Actual (ha)	Accumulated (ha)
12-18 months (Prep. Phase)	0	0
2	15,000	15,000
3	25,000	40,000
4	40,000	80,000
5	50,000	130,000
6	70,000	200,000
7	100,000	300,000

5.25 The support for the establishment of rural-based micro-enterprises (community-operated carbonization units, agro-forestry processing units, etc.) will be done by the PCU under supervision of the two ministries (MEPT and MEMI). Micro-enterprise proposals will be identified by the participating communities and or NGOs and elaborated by them with/without specialized consultant support (individuals/NGOs). These proposals will be evaluated by the PCU and decided upon on the basis of their individual merit. The size of the individual proposal will vary but will be limited to a maximum equivalent of US \$4,000 per village at any point in time. The support for micro-enterprise development would be mobilize only when there is a clear and tangible cofinancing of the local community in cash and/or kind (labor, natural resources, tools, etc.). In the case of improved charcoal production, decision on support will be further subject to the identification of monitoring and enforcement mechanisms for ensuring the compliance at the community level with the charcoal related regulatory and policy framework. The specific evaluation criteria, mechanisms and modalities for the mobilization of the micro-enterprise development support will be finalized (satisfactory to IDA) during the Preparatory and Support Activities Component. This sub-component will be executed throughout the full project implementation year 1-7) by specialized consultants (individual and/or firm) under the supervision of the PCU.

5.26 The implementation of the communication strategy for the Sustainable Woodfuels Supply Management component. This sub-component will be executed throughout the entire project field implementation cycle (year 2-7) by specialized consultants (individual and/or firms) under the supervision of the PCU.

3. Component III: Demand Management and Interfuel Substitution Options

5.27 The support for the re-organization and modernization of the urban charcoal trade to establish long-term supply agreements (contracts) between rural communities and urban traders (to guarantee the unconstrained entry of community-produced woodfuels to the urban markets) and to permit the standardization of the marketing units and the cleaning of the urban environment (charcoal bagging);

5.28 The provision of technical assistance and limited financial support for the economic diversification of existing urban charcoal traders ("exploitants forestiers") will be based on the proposal generated directly by charcoal traders. Thus far the proposals received include

enterprise diversification into LPG retail, gas service stations, foodstuffs retail and light transport activities. The financial support to be provided by the project would be limited to organizational and training activities and it would be executed by the Energy Directorate through specialized private sector and enterprise development consultants and/or firms.

5.29 The execution of specific technical and market-feasibility studies to support the further promotion of LPG and Kerosene as substitute household fuels will complement a GTZ-funded study within the recently launched German-Senegalese Household Energy Assistance Project. The main activity envisaged under this sub-component is limited to technical and market feasibility research on kerosene stoves (including pilot testing of 1,000 stoves). This sub-component would be executed by specialized consultants under the supervision of the Directorate of Energy and should be completed within the third year of project implementation.

5.30 The provision of support for the continuation of inter-fuel substitution (kerosene and LPG) and dissemination of improved stoves by the private sector and the NGO community will be undertaken by the Directorate of Energy. Although it is expected that the private sector will take charge of the implementation and funding of LPG and kerosene activities beyond the proposed limited support activities (kerosene stove promotion and LPG decentralized depots), it is possible that additional funding might be mobilized through GTZ or other sources to support the expansion of kerosene as a least cost household fuel. All further LPG expansion activities should be financed by the private sector. The support to the dissemination of improved stoves is intended to provide limited investment funds to expand the market-based production capacity of existing competitive stove manufacturer. No funding will be provided for stove scientific research activities. Investment funding support will be approved only for stove options that prove to be feasible on a non-subsidized production/full cost recovery basis. Based on the proposals identified thus far, it is anticipated that the **ATI DIAMBAR** stove would qualify for the intended investment funding support.

F. PROCUREMENT AND DISBURSEMENT

5.31. **Table 5.4** summarizes the project cost by disbursement category and proposed procurement method. A detailed procurement plan and timetable are given in **Annex 5**. Senegal's procurement laws and regulations are consistent with IDA procurement guidelines. No special exemptions, permits or licenses need to be specified in Credit documents for international competitive bidding (ICB), as Senegal's procurement regulations allow IDA procedures to take precedence over any contrary provisions in local regulations.

5.32 **Civil Works.** The civil works program (US \$1 million) includes a large number of very small contracts for the implementation of supporting community projects such as well diggings, construction of rural health centers and other civil work components of income generating activities within the implementation of the Integrated Natural Resource Management Modules (over an area of 300,000 ha) under the Sustainable woodfuel component (II). Civil works contracts financed under the credit will be awarded through NCB procedures. Due to spread and high transportation costs, these civil works contracts are unlikely to attract foreign or large firms that use modern equipment. Foreign bidders, however, would not be precluded from submitting bids. Civil works contract management for the supporting community projects will be delegated to NGOs or other private entities as appropriate.

Table 5.4: Summary of Proposed Procurement Arrangements
(in US\$'000 equivalent)
net of taxes and duties

Procurement Methods

Project Element	International Competitive Bidding	Local Competitive Bidding	International Shopping	Local Shopping	Consulting Services	N.B.F.	TOTAL COST
A. Civil works	-	1,043.6 (109.9)	-	-	-	-	1,043.6 (109.9)
B. Equipment, vehicles	2,564.30 (329.6)	-	-	-	-	-	2,564.3 (329.6)
C. Goods and services	135.4 (8.1)	-	5,330.3 (1,433.1)	-	-	-	5,465.7 (1,441.3)
E. Consultant services	-	-	-	-	3,573.2 (547.7)	-	3,573.2 (547.7)
F. Recurrent costs	-	-	-	7,271.3 (2,761.6)	-	13.2	7,284.5 (2,761.6)
	2,699.7 (337.7)	1,043.6 (109.9)	5,330.3 (1,433.1)	7,271.3 (2,761.6)	3,573.2 (547.7)	13.2 -	19,931.3 (5,190.1)

Note: The figures in parentheses are the amounts to be financed by IDA.

5.33 Equipment. Equipment requirements (US \$2.5 million) include vehicles under the Preparatory and Support Activities Component (I), vehicles (4X4s and motorcycles) and fire control trucks for the implementation of Integrated Natural Resource Management modules under the Sustainable woodfuel component (II), and vehicles under the Demand Management and Interfuel Substitution Options Component (III). Equipment financed under the credit will be awarded through ICB, NCB procedures or, provided that the aggregate amount of such procurement does not exceed US \$150,000 equivalent, through the United Nations Development Program's Inter-Agency Procurement Services especially for office equipment and vehicles.

5.34 Goods. Goods financed under the credit (US \$5.4 million) include under the Sustainable Woodfuels Supply Management Component, small tools and field equipment for the rural communities, office and field equipment for the Forest Service (regional offices), small forest fire control equipment and purchase of equipment for the implementation of supporting community projects. Under the Demand Management and Inter-fuel Substitution options component, office equipment for the DE, purchase of 1,000 kerosene stoves for the pilot program; purchase LPG bottles and burners. Goods will be grouped into packages of at least US \$100,000 each and procured through ICB in accordance with the *Bank's Guidelines for Procurement under IBRD Loans and IDA Credits* (January 1995, revised January and August 1996). Standard bidding documents developed by the Bank will be used. A preferential margin of 15 percent or the applicable customs duty, whichever is less, over the c.i.f. prices of competing goods for all ICB procurement will be given to domestic firms in accordance with the

Bank's guidelines. Small quantities of goods such as office supplies, consumable materials, and small tools and field equipment for the rural communities, which are available off-the-shelf and cannot be grouped into bidding packages of at least US \$25,000 may be procured through prudent international and local shopping, based on Price quotations of at least three reliable suppliers, or through the United Nations Development Program's Inter-Agency Procurement Services especially for office equipment and vehicles, provided that the aggregate amount of such procurement does not exceed US \$150,000 equivalent. All bids will be submitted on a c.i.f. basis for imported goods and on ex-factory basis for locally manufactured goods.

5.35 Consultant services. Consultant services financed under the credit (US \$3.5 million) include long-term resident technical assistance in the form of TA personnel for the DE (US \$0.3 million) and consultant services for training activities and execution of studies (vegetation cover assessment, design of monitoring and supervision systems, energy demand, etc.). In particular, the training activities for consulting services will be required include all the capacity building, institutional development (governmental institutions, civil society and NGOs), and participatory activities of the Project. Within the Preparatory and Support Activities Component (I) the main training activities will entail capacity building and institutional development of the Forestry Service and Energy Directorate staff and participatory rural appraisals work. Within the Sustainable woodfuel component (II) key training activities will be focused on the rural communities and NGOs that will be responsible for the direct implementation of the sustainable forest management modules. Within the Demand Management Component (III) the main training activities will include the staff of the Energy Directorate and support services to the Charcoal Traders (economic reconversion sub-component). International and local consultants providing specialist services financed by IDA would be selected through *Quality-and Cost-based* and *Least Cost* procedures, in accordance with the *Bank's Guidelines for the Use of Consultants* (February 1997). The standard Letter of Invitation and Form of Contract as developed by the Bank will be used for appointment of consultants. Simplified contracts will be used for short-term assignments, i.e. those not exceeding six months, carried out by individual consultants. Individual consultants will be recruited on the basis of comparison of at least three (3) CVs taken from a roster organized by specialties. Single-source hiring of individual consultants, if any, is subject to Bank prior review. Services to be contracted include technical assistance, training, thematic studies, monitoring and evaluation, contract management services for civil works, and auditing. The NGOs or other private entities who are delegated Construction management for the implementation of community-support projects will recruit the necessary consultant services for design.

5.36 Review by IDA. IDA-financed contracts for works and goods above the threshold value of US \$100,000 equivalent will be subject to IDA prior review procedures. The review process would cover 80 percent of the total value of the amount contracted for goods and 56 percent of the amount contracted for civil works. Selective post-review of contracts awarded below the threshold levels will apply to about one in three contracts. Draft standard bidding documents for NCB will be reviewed by and agreed upon with IDA. Prior IDA review will not apply to contracts for the recruitment of consulting firms and individuals estimated to cost less than US \$75,000 and US \$35,000 equivalent respectively. However, the exception to prior IDA review will not apply to the Terms of Reference of such contracts, regardless of value, to single-source hiring of firms, to assignments of a critical nature as determined by IDA or to amendments of contracts raising the contract value above the prior review threshold.

5.37 **Proposed Procurement Arrangements.** During *negotiations* agreement was reached on monitoring of procurement as well as the Bank's Standard Bidding Documents for ICB and the standard procurement documents for NCB to be developed, reviewed by, and agreed upon with IDA. The Government will submit to IDA for review: (a) a draft procurement plan; (b) a draft Procedural Manual for Management and procurement; and (c) a draft bidding document for the construction program and major equipment, as well as draft letters of invitation for consultants services, related to activities financed by IDA during the first project year. The Government will submit to IDA the final versions of these documents and gave assurances at *negotiations* that it will apply the procurement procedures and arrangements outlined in the above documents.

5.38 **Disbursements.** The project is expected to be completed over a seven-year period, with the IDA Credit disbursed over 8 years, according to the categories shown in **Table 5.5**, below. The estimated disbursement profile is shown in **Annex 6**. Disbursement of the Credit will be fully documented except for expenditures which would be made against Statements of Expenditure (SOEs) valued at less than US \$100,000 equivalent for firms and US \$50,000 equivalent for individual consultants. Documentation for withdrawals under SOEs would be retained by the PCU for review by IDA supervision missions and for semi-annual audits.

Table 5.5: Allocation and Disbursement of the IDA Credit

(US\$ '000)
net of taxes and duties

Disbursement Category	Total	% of Expenditures Financed
1. Civil Works	109.9	100 of foreign expenditures and 90 of local
2. Equipment, vehicles	329.6	100 of foreign expenditures and 90 of local
3. Goods and Services	1,441.3	60 of local expenditures Part B.4 of the project
5. Consultant Services	547.7	100
6. Recurrent Costs	<u>2,761.6</u>	90
Total:	5,190.10	

5.39 Specific disbursement conditions would assure that the project components were fully funded (by IDA, Government and other cofinanciers) before contracts were awarded. The satisfactory completion of component I will be a pre-condition of disbursement for components II and III. **Table 5.6** gives the estimated disbursement schedule for IDA credit. The closing date of the credit would be December 31, 2004.

G. ACCOUNTING, AUDITING AND REPORTING

5.40 **Special Account.** To facilitate disbursements, the Government will open a Special Account (SA) in a commercial bank in Dakar to cover IDA's share of eligible expenditures, managed by the Project Coordinating Unit (PCU). The authorized allocation for the SA would be US \$450,000 equivalent. IDA will make an initial deposit of US \$250,000 equivalent into the SA upon credit effectiveness and will replenish the SA upon receipt of satisfactory proof of incurred eligible expenditures. Replenishment will be accompanied by up-to-date bank statements and reconciliation of the SA. To expedite the implementation of day-to-day activities and effect small payments for local training programs involving frequent expenditures in local

Table 5.6: Estimated Disbursement Schedule for the IDA Credit
(in US\$' 000)
(by Categories- including Contingencies)

Disbursement Category	1997	1998	1999	2000	2001	2002	2003	Total
1. Civil Works	37.07	32.77	40.06					109.90
2. Equipment, vehicles	73.26	32.13	55.96	97.76	35.11	28.11	7.28	329.60
3. Goods and Services	312.82	301.38	240.78	205.88	142.82	135.24	102.37	1,441.30
5. Consultant Services	100.97	79.62	74.07	185.35	96.21	11.48		547.70
6. Recurrent Costs	570.12	423.50	429.13	346.35	342.59	326.15	323.76	2,761.60
Total:	1,094.23	869.40	840.01	835.34	616.73	500.98	433.40	5,190.10

currency at the district level, a SGSA (Second Generation Special Account) will be opened at each of the Kolda and Tambacounda regions. Each district Forestry officer will be responsible for establishing a yearly budget for the activities to be carried out, and necessary funds would be regularly provided on the basis of justification. Accounts of the SGSA will be reconciled every quarter with the PCU accountant, and funds made against eligible expenditures will be replenished through the project account. Justifications of expenditure eligibility will be handed over to the project accountant and kept as supporting documents for the use of the Statement of Expenditures procedure.

5.41 The PCU would establish and maintain its accounts in accordance with International Accounting Standards, and would conserve all the documentation related to project expenditures. A detailed proposal on the accounting system and procedures to be followed and a profile of personnel needed and equipment required would be prepared by consultants. The conditions for the establishment of a financial management and accounting system for the project, acceptable to IDA, were agreed during *negotiations*. The PCU will at all times keep financial records in accordance with sound accounting practices to reflect its operations and financial position. These records would be made available to visiting Bank missions and independent auditors. The project accounts, including the SA and the SGSA, will be audited annually, in accordance with International Standard of Auditing, by independent external auditors acceptable to IDA. In order to facilitate the post review of procurement decisions not subject to IDA prior review, the auditor's TOR would include a provision for a separate opinion on the consistency of such procurement decisions with Bank Procurement Guidelines and provisions. The audited accounts and the auditor's report, including the Management Letter (Long Form) and a statement as to whether or not IDA funds had been used for their intended purpose and a separate opinion with respect to statement of expenditures and the Special Account, as well as the SGSAs, would be submitted to IDA within six months of the end of the fiscal year for the Project. Assurances to this effect were reached at *negotiations*. Agreement was reached at *negotiations* on the selection procedures for the awarding of a multi-year contract for the auditing the Project accounts (para. 7.1.iii).

5.42 Overall implementation of the project would be supervised on an annual basis by IDA and disbursements would be contingent on the satisfactory compliance with all project conditions. In addition to annual supervision, the project would be evaluated in accordance with established IDA procedures at mid-implementation (first semester of the fourth year) and at its completion. Three specific monitoring systems have been included in the project to systematically evaluate the implementation process of key components and the realization of the

expected national and global benefits. These are: (i) a forest resources exploitation monitoring system for the Tambacounda and Kolda regions, to supervise compliance with established exploitation plans and to evaluate the achievement of resource sustainability and to assess the impact of the project activities in the adjacent areas (Niokolo-Koba National Park and other open forests); (ii) a wildlife monitoring system, to evaluate the realization of the intended biodiversity objectives and benefits, with particular emphasis on the monitoring of endemic and threatened species; and (iii) a national woodfuels trade flows monitoring system, to evaluate compliance with established woodfuels transport and market quota regulations (source, volume and destination). In addition to these activities, the project would include a systematic monitoring and evaluation of the: (i) promotion and penetration of kerosene and LPG as substitute household fuels; (ii) dissemination and cooking performance of improved stoves; (iii) participation of civil society (with emphasis on women) in design, decision making and implementation activities within the project; (iv) developmental impacts on women; and (v) realization of institutional development and capacity building objectives. All monitoring and evaluation activities will be based on an ex-ante assessment, will be carried out through implementation to allow for necessary design adjustments, and will be followed-up after completion to evaluate the long-term sustainability of the project's national developmental and global environmental achievements.

H. PERFORMANCE INDICATORS, MONITORING AND SUPERVISION PLAN

5.43 Table 5.7 present a summary of the project's key performance indicators and monitoring and supervision plan. Annex 7 presents a detailed matrix of key performance indicators, monitoring arrangements and supervision plan.

Table 5.7: Performance Indicators, Monitoring and Supervision Plan

Narrative Summary	Key Performance Indicators	Monitoring and Supervision																								
<p>CAS Objectives:</p> <p>A. Facilitate the supply response from the rural sector.</p> <p>B. Addressing environmental issues.</p> <p>C. Internalization and consensus building.</p>	<p>a.1. Creation of a supply of woodfuels from community-based sustainable forest management system.</p> <p>a.2. Increased supply of other agricultural products from community systems.</p> <p>b.1. Increased sustainability of land use.</p> <p>b.2. Increased sustainability of wildlife.</p> <p>c. Increased participation of civil society project design and implementation.</p>	<p>a.1. Annual evaluation of woodfuels trade flows.</p> <p>a.2. Annual evaluation of participation.</p> <p>a.3. Annual evaluation of developmental impacts.</p> <p>b.1.Annual evaluation of forest resource exploitation.</p> <p>b.2.Annual wildlife impact evaluation.</p> <p>c.1.Annual evaluation of participation.</p>																								
<p>Project Development Objectives:</p> <p>A. Reduce woodfuel-related deforestation and loss of biodiversity.</p> <p>B. Reduce net CO₂ emissions</p> <p>C. Increase income generation for rural population, with special attention to women.</p>	<p>a. Reduce deforestation by:</p> <table border="0"> <tr> <td><u>Date</u></td> <td><u>Ha./yr.</u></td> </tr> <tr> <td>B-line:</td> <td>1,000</td> </tr> <tr> <td>M-term:</td> <td>5,200</td> </tr> <tr> <td>Full imp.:</td> <td>20,000</td> </tr> </table> <p>b. Reduce net CO₂ emissions by:</p> <table border="0"> <tr> <td><u>Date</u></td> <td><u>Tons/yr.</u></td> </tr> <tr> <td>B-line:</td> <td>25,000</td> </tr> <tr> <td>M-term:</td> <td>130,000</td> </tr> <tr> <td>Full imp.:</td> <td>510,000</td> </tr> </table> <p>c. Generate revenues in partic. villages:</p> <table border="0"> <tr> <td><u>Date</u></td> <td><u>US\$/yr.</u></td> </tr> <tr> <td>B-line:</td> <td>150,000</td> </tr> <tr> <td>M-term:</td> <td>780,000</td> </tr> <tr> <td>Full imp.:</td> <td>3,000,000</td> </tr> </table>	<u>Date</u>	<u>Ha./yr.</u>	B-line:	1,000	M-term:	5,200	Full imp.:	20,000	<u>Date</u>	<u>Tons/yr.</u>	B-line:	25,000	M-term:	130,000	Full imp.:	510,000	<u>Date</u>	<u>US\$/yr.</u>	B-line:	150,000	M-term:	780,000	Full imp.:	3,000,000	<p>a.1. Annual evaluation of forest resource exploitation.</p> <p>a.2. Annual wildlife impact evaluation.</p> <p>b.1. Annual climate change assessment.</p> <p>c.1. Annual evaluation of development impacts.</p> <p>c.2. Annual evaluation of participation.</p>
<u>Date</u>	<u>Ha./yr.</u>																									
B-line:	1,000																									
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<u>Date</u>	<u>US\$/yr.</u>																									
B-line:	150,000																									
M-term:	780,000																									
Full imp.:	3,000,000																									
<p>Project Outputs:</p> <p>A. Sustainably produce fuelwood.</p> <p>B. Increase urban use of improved charcoal stoves.</p> <p>C. Increase inter-fuel substitution.</p>	<p>a. Annual sustainable production of fuelwood:</p> <table border="0"> <tr> <td><u>Date</u></td> <td><u>Tons/yr.</u></td> </tr> <tr> <td>B-line:</td> <td>15,000</td> </tr> <tr> <td>M-term:</td> <td>80,000</td> </tr> <tr> <td>Full imp.:</td> <td>300,000</td> </tr> </table> <p>b. Marketing of improved charcoal stoves (cummul.)</p> <table border="0"> <tr> <td><u>Date</u></td> <td><u>Stoves</u></td> </tr> <tr> <td>B-line:</td> <td>20,000</td> </tr> <tr> <td>M-term:</td> <td>100,000</td> </tr> <tr> <td>Full imp.:</td> <td>255,000</td> </tr> </table> <p>c.1. Incremental penetration of kerosene.</p> <p>c.2. Incremental penetration of LPG in urban markets.</p>	<u>Date</u>	<u>Tons/yr.</u>	B-line:	15,000	M-term:	80,000	Full imp.:	300,000	<u>Date</u>	<u>Stoves</u>	B-line:	20,000	M-term:	100,000	Full imp.:	255,000	<p>a.1. Bi-annual progress report.</p> <p>a.2. Bi-annual field supervision.</p> <p>b.1. Bi-annual progress report.</p> <p>b.2. Bi-annual evaluation of stove penetration.</p> <p>b.3. Bi-annual field supervision.</p> <p>c.1. Bi-annual progress report & field supervision.</p> <p>c.2. Annual LPG and Kerosene penetration evaluation.</p>								
<u>Date</u>	<u>Tons/yr.</u>																									
B-line:	15,000																									
M-term:	80,000																									
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VI. PROJECT IMPACT

A. ECONOMIC ANALYSIS

6.1. The economic analysis of the natural resource management activities in developing countries has been the subject of much work and controversy. Different methodologies have been elaborated for individual cases making use of available data (resource stocks, depletion and regeneration rates, real prices, economic value, etc.) and relative social values (environmental conservation, resource sustainability, social preferences, etc.).

6.2 In the absence of a clear methodological consensus (Bank or elsewhere), a simplified economic analysis methodology was developed for the evaluation of the proposed project. The methodology and evaluation results are presented in detail in **Annex 8**. The approach adopted is based on the following basic guidelines:

Project components. All three components of the project (Preparatory and support Activities Component; Sustainable Supply Management Component; and Demand Management and Inter-fuel Substitution Options Component) were included in the economic analysis as they are judged to be necessary and integral elements of the proposed investment. Within that context, no differential valuation treatment was given to investments for productive (forest management, improved kilns, improved stoves, inter-fuel substitution options, etc.) or non-productive sub-components (data generation and gathering, institutional development, capacity building, social support services, communication strategy, etc.).

Time horizon and Discount rate. Given the long-term nature of the expected project impacts, a minimum 20-year horizon was adopted for the evaluation of the project. A discount rate of 12 percent was applied to all project components and sub-components.

Project costs. All budgeted costs during project implementation (7 years) were included in the economic analysis of the project. From years 8 to 20 continued implementation costs were assessed at approximately 10 percent of year 7, gradually decreasing at a relative rate of 10 percent per year until year 20.

Project benefits. While the proposed project is expected to result in a large number of quantifiable and non-quantifiable benefits, the economic analysis undertaken limited the valuation to the following benefits: (i) value of “sustainable” wood production from the implementation of the sustainable and participatory forest/natural resource management systems; (ii) value of incremental charcoal production from the promotion of improved kilns; (iii) value of global environmental impacts (CO₂ abatement and biodiversity conservation) from the implementation of the sustainable and participatory forest/natural resource management systems; (iv) value of rural income generation and transfer from the direct sales of fuelwood by the participating rural communities; (v) value of “other” rural revenues from the development of parallel agro-forestry production activities in the participating communities; and (vi) value of charcoal saving due to the promotion of improved charcoal stoves. As the full elaboration and quantification of other project activities (promotion of inter-fuel substitution options, economic reconversion of charcoal traders, modernization of the charcoal industry, etc.) will be done during the

Preparatory and Support Activities component (Component I) it was judged premature to make estimates on their respective possible benefits (the full cost of those activities was however included in the project cost).

6.3 The 20-year horizon evaluation of the project resulted in an Economic Rate of Return (ERR) of 37.3% and a net present value (NPV) at 12 percent discount rate of US \$ 34.2 million. According to these economic evaluation results, the proposed project would be a fully justifiable and competitive developmental investment for Senegal.

6.4 Sensitivity analyses were done for five key parameters: (i) level of sustainable forest yields (0.5 - 2.0 ton/ha/yr); (ii) fuelwood producer prices (US\$ 10 - 30/ton); (iii) carbonization efficiency of improved kilns (18% - 30%); (iv) level of "other" realizable rural income (15% - 40% of expected fuelwood sales); (v) Charcoal market prices (US\$ 190 - 360/ton). **Table 5.7** presents a summary of the sensitivity analysis of the five key parameter, including the main value variations considered ("base", low and high) and the respective switching value.

Table 5.7: Results of the Sensitivity Analysis

PARAMETER	Values	NPV (US million)	ERR (%)	Switching Value
BASE RESULTS:		43.2	37.3	
Sustainable Forest Yield	<i>B:</i> 1.00ton/ha/yr			0.15 ton/ha/yr
	<i>low:</i> 0.5 ton/ha/yr	8.4	20.1	
	<i>High:</i> 2.0ton/ha./yr	96.2	64.1	
Fuelwood Producer Price	<i>B:</i> US\$15/ton			n.a.
	<i>low:</i> US\$10/ton	24.1	31.3	
	<i>High:</i> US\$30/ton	64.6	52.7	
Carbonization Efficiency	<i>B:</i> 25%			6.7%
	<i>low:</i> 18%	17.3	26.1	
	<i>High:</i> 30%	46.3	44.5	
Other Rural Income	<i>B:</i> 20%			-200%
	<i>low:</i> 15%	33.2	36.7	
	<i>High:</i> 40%	38.2	39.8	
Charcoal Market Price	<i>B:</i> US\$190/ton (*)			n.a.
	<i>low:</i> US\$190/ton (*)	34.2	37.3	
	<i>High:</i> US\$360/ton	49.7	46.4	

Note: (*) Current market price.

6.5 On the basis of the results of the sensitivity analyses conducted, the proposed project would continue to be a fully justifiable and competitive developmental investment for Senegal.

B. SOCIAL AND ENVIRONMENTAL IMPACTS

6.6 The project would: (i) sustainably produce some 860,000 tons of fuelwood (equivalent to 258,000 tons of efficiently produced charcoal) over a six year period and would establish a permanent system capable of producing more than 300,000 tons of fuelwood (equivalent to 90,000 tons of efficiently produced charcoal or 27% of total consumption) per year on a sustainable basis; (ii) reduce woodfuels-related deforestation in the Tambacounda and Kolda regions by some 20,000 ha/year, and as a consequence reduce net CO₂ emissions by **510,000 tons/yr** and reduce the loss of biodiversity by the establishment of sustainable forest systems and of a protective buffer zone around the **Niokolo-Koba National Park**; (iii) generate employment and economic development opportunities in 250 rural villages in the Tambacounda and Kolda regions and including women in the management and marketing of woodfuels and other related income generating activities; (iv) generate during the implementation period more than US \$10 million in direct revenues to 250 villages from the trade of woodfuels, and generate additional revenues to the communities from related natural resource management and exploitation activities (agro-forestry, livestock keeping, non-fuelwood forest products, etc.); (v) on a sustainable annual basis after the end of the project, generate direct revenues in excess of US \$3 million to the participating villages from the trade of woodfuels, and generate additional revenues from related natural resource management and exploitation activities; (vi) reduce CO₂ emissions by **420,000 tons/yr.** by the distribution of 225,000 improved charcoal stoves; (vii) increase the availability and access of low income households to more reliable and efficient charcoal stoves and to modern fuels; and (viii) strengthen the planning, policy making and implementation supervision capacity of the traditional energy sector institutions, while increasing the participation of the civil society (private sector, academic institutions, and NGO's community) in the management and operation of the sector.

6.7 **Environmental Aspects (Category C).** The project is expected to: (i) reduce deforestation and soil degradation through the implementation of sustainable forest management practices on a large scale; (ii) contribute to reducing the loss of carbon sequestration capacity and of biodiversity that results from the prevailing non-sustainable exploitation of woodfuels and from forest fires and, over time, increase carbon sequestration capacity and stabilize biodiversity through the extension of sustainable natural resource management practices nationwide; (iii) reduce CO₂ emissions through the promotion of better carbonization techniques and the promotion of more fuel efficient household stoves; (iv) reduce urban charcoal pollution and contamination (soil and water) and reduce incidence of respiratory diseases (continuous exposure to charcoal dust) among charcoal handlers and retailers (which are mostly women) through the modernization of the charcoal marketing standards (sealed bags); and (v) reduce indoor air pollution and reduce health risks to women through the promotion of improved woodfuel stoves.

6.8 The project is not expected to have negative environmental impacts. The relocation of production sites to other areas is not likely to happen because:

- (i) there are no other geographic areas in Senegal with forest resources (volume and density) which can be economically exploited to supply the large woodfuels urban markets;
- (ii) areas with sufficient forest resources -- and not necessarily more fragile -- in (Casamance) and outside Senegal (Guinea) are 350 to 500 km further away from

the urban markets than what Kolda and Tambacounda. Their exploitation would imply dramatically increase transportation costs (up to 50%);

- (iii) the existing charcoal production control system, albeit cumbersome and inequitable, has been historically effective in controlling spatial production of charcoal and there is no basis to believe that it would be any less effective under the project, particularly given that there is stated government commitment for project implementation; and
- (iv) the willingness of individuals to engage in illegal charcoal production would be determined by the profitability of doing so. As illegal charcoal production would happen over and above the officially approved production quota, illegal production would result on product surpluses. Illegal charcoal would then be transacted at below official wholesale prices rendering its profit margin much lower than the legal trade. The larger the surplus, the lower the parallel wholesale price would be. The probability of this actually happening is near to zero because potential illegal producers would be discouraged by the prospects of reduced market prices, increased transportation costs and high probability of being caught and of receiving stiff fines in the process. In any event, the project includes monitoring and evaluation systems (forest exploitation and transport flows) designed to capture any illegal production and/or movement of woodfuels. The monitoring of woodfuel transport flows in the Senegalese case are far simpler than in other West African countries (e.g. Mali) because there is only one access route from the production sites (south- west and south of the country) to the urban markets capable of handling the 15 and 30 ton trucks a day that are used in the trade. Illegal charcoal flows from Ziguinchor to Dakar through the Gambia river ferry would be subject to far easier control mechanism at the ferry docks and the respective national border check-points;

C. PROJECT SUSTAINABILITY

6.9 The sustainability of the project would be achieved by the following key design factors:

- (i) the effective transfer of responsibility for the management of the forest resources from the Government to the rural communities;
- (ii) the effective opening-up of the woodfuels trading system;
- (iii) a gradual change in woodfuels fiscal and pricing policies and mechanisms -- which will be designed on the basis of project's field experience and the findings of several studies and enacted by December 31, 2000 -- to *inter alia*: promote sustainable management of forest resources by rural communities; discourage the exploitation of woodfuels from non-managed forest areas; promote the use of improved carbonization technologies; maximize direct woodfuel-related revenues at the producer level; and, optimize the economic efficiency of the sector taking into account the real economic value of woodfuels (para. 7.1.iv); and

- (iv) the strengthening of the long-term capacity of the rural communities to manage their forest resources sustainably.

6.10 Specific activities and monitoring systems have been included in the project design to address all these issues.

D. PROJECT RISKS

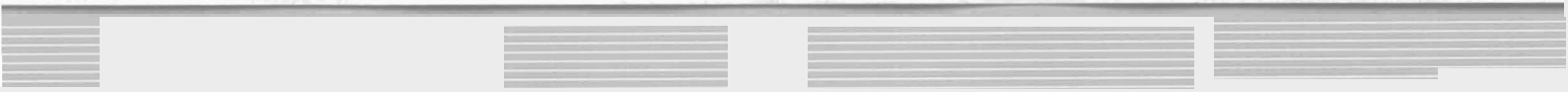
6.11 While it is expected that in the process of transferring part of the industry's activity to the rural communities the project will affect a small portion (27%) of charcoal traders and of expatriate charcoal laborers ("*surghas*"), that impact cannot be seen in isolation from the ongoing Africa-wide process towards democratization and local community empowerment. Senegal is no different than other countries in the region, and numerous instances of major structural change are already underway throughout the economy. Nevertheless, recognizing that the reaction of the traditional traders and "*surghas*" pose a **moderate risk** to the project, special attention was paid to including them in the preparation of the project. Furthermore, two project activities were specifically designed to support the existing traders to adjust to the new situation (see "Project Description" section). Also, other activities were designed to monitor and prevent possible implementation interference (see "Monitoring and Evaluation" section). Also, the project would be only one of numerous government-lead developmental activities which would be supported by official regulatory and legal measures.

6.12 Since the project will limit the exploitation of woodfuels in the project area to the participating rural communities, the possibility that charcoal production by traditional traders could switch to other areas of the country has been raised. This, however, is not expected to occur as charcoal production is regulated by government and is now subjected to the new provisions of local community approval. Should traditional traders attempt to relocate their activities, the affected local communities would be legally empowered to stop them and -- contrary to the past -- the Government would be obliged to protect the communities' interests. Should this happen, however, the project includes a forest resource monitoring system which, operated independently from the Government and with international donor supervision, would be responsible for reporting non-regulated forest exploitation.

6.13 The risk of an illegal relocation of charcoal production happening and resulting in increased environmental degradation of more ecologically fragile areas has been raised but considered negligible after further examination. A detailed Environmental Impact Discussion Note that was prepared for internal discussion early on in the project preparation phase is available in the project files.

6.14 Finally, the risk that the rural populations might not be able to achieve full sustainable management of the forest resources cannot be entirely ruled out. Nevertheless, even in that case, the project would result in a considerable transfer of welfare to the rural communities with unquestionable economic development opportunities and social benefits and significant national and global environmental benefits.

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VII. AGREEMENTS REACHED AND RECOMMENDATION

Agreements Reached

7.1 During negotiations, the following agreements were reached with the Government of Senegal:

- (i) Government's counterpart funding of a total amount of US \$1.2 million (para. 5.7);
- (ii) Selection of a suitable NGO to supervise the implementation of the project's Participation Action Plan - (PAP) (para. 5.10, 5.12 and Table 5.1);
- (iii) Issuing of a multi-year contract to an independent auditing firm, acceptable to IDA, for the auditing of the Project accounts (para. 5.41); and
- (iv) Preparing and adopting, no later than December 31, 2000, a revised woodfuels fiscal and pricing policy acceptable to IDA which shall include, *inter alia* mechanisms to: promote sustainable management of forest resources by rural communities; discourage the exploitation of woodfuels from non-managed forest areas; maximize direct woodfuel-related revenues at the producer level; and, optimize the economic efficiency of the sector taking into account the real economic value of woodfuels (para. 6.9).

Conditions of Effectiveness

7.2 The following will be conditions of effectiveness:

- (i) The signature of the Global Environmental Facility (GEF) Grant Agreement for US \$4.7 million related to the project (para 5.7); and
- (ii) The recruitment, mobilization and or assignation of the staff for the Project Coordination Unit (PCU), and make all other necessary institutional and staffing arrangements for the implementation of the project (para. 5.13).

Condition of Disbursement

7.3 The following will be condition of disbursement:

The implementation satisfactory to IDA of Component I: Preparatory and Support Activities will be a condition of disbursement of the funds for the implementation of Component II: Sustainable Woodfuels Supply Management and Component III: Demand Management and Inter-fuel Substitution Options of the project (para. 5.14).

Recommendation

7.4 With the above agreements and actions, the proposed project would be suitable for an IDA credit of SDR 3,800,000 (US \$5.2 million equivalent) on standard terms to the Republic of Senegal.

THE NIOKOLO-KOBA NATIONAL PARK

DESCRIPTIVE SUMMARY

(Extract from: Monographie National sur la Diversité Biologique: Chapitre 3: “Les Modes de Gestion des Ressources Naturelles Au Sénégal et leur Evolution”
IUCN-Sénégal, (1995)

(Working level translation from original French text)

The Niokolo-Koba National Park is located on the border of the administrative regions of Tambacounda and Kolda, on the Gambia River, near the Guinean border on the South-East of Senegal. It is located inside a slightly undulating region with chains of hills reaching an altitude of about 200 meters, separated by vast areas of lower situated floodplains that are covered by water during the rainy season. The Gambia river and its two main tributaries, the Niokolo-Koba and the Koulountou, pass through the park. The vegetation is constituted of mainly dry forests, wooded savannas, Sudanian trees and shrubs with principal species such as *Pterocarpus erinaceus*, *Bombax costatum*, *Erythrophleum africanum*, *Sterculia setigera* and a number of *Combretum* species. According to FAO/UNEP (1981), 78% of the country's “forêt galeries” are located inside this park. About 1,500 plant species have been registered inside this park. An example of the region's valuable flora can be found in the laterite zones. Here several species reside at their most western limit of distribution, for example *Eragrostis popeguini*, *Adelostigma perrottetii*, *Andropogon felicis*, *Cyathula pobeguini* and several species of *Lepidagathis*. Around 80 mammal species, 330 bird species, 36 reptile species, 2 amphibious species and 60 fish species are found in the Park, along with numerous invertebrates. Carnivores include the panther *Panthera pardus*, the lion *P. leo* and the African wolf *Lycaon pictus*. The Park's three main water streams are the habitat for the buffalo *Syncerus caffer*, the antelope *Hippotragus equinus*, the eland of Derby *Taurotragus derbianus* (some 1,000), the *Colobus badius temmincki*, the three African crocodiles: the Nile crocodile *Crocodylus niloticus*, *C. cataphractus* and *Osteolaemus tetraspis*, four turtle species and the hippopotamus *Hippopotamus amphibius*. The park is the last refuge in Senegal for the elephant *Loxodonta africana*. About 150 chimpanzees *Pan troglodytes* live in the forest galleries of the park and vicinity of Mount Assirik (the North-West limit of their distribution). Among the birds, we find the bustard of Denham *Neotis cafra denhami*, the *Bucorvus abyssinicus*, the *Dendrocygna viduata* and the eagles *Polemaetus bellicossus* and *Terathopius ecauiatus*.

The Mikolo-Koba National Park is located in the north-western part of the Democratic Republic of the Congo, on the border with the Kasai region. It covers an area of approximately 1,000 km² and is situated in the transition zone between the tropical rain forest and the savanna. The park is home to a rich diversity of plant and animal species, including several endangered species. The vegetation is primarily composed of primary forest, with a high density of trees and a complex structure. The climate is characterized by high humidity and frequent rainfall throughout the year. The park is a vital habitat for many species, including the Congo gorilla, the Congo chimpanzee, and the Congo forest elephant. It also plays a crucial role in the conservation of the Congo basin's biodiversity and the protection of its natural resources.

MONITORING AND EVALUATION OF THE GEF ACTIVITIES

1. The monitoring and evaluation of GEF activities included in the project are: (i) the forest resources exploitation, (ii) the wildlife distribution, (iii) the socio-economic situation of the target group and (iv) the community-participation and institutional involvement.
2. The actors involved in these monitoring and evaluation activities will be the *Centre de Suivi Ecologique*, the Forest Service, the villagers, some technical assistance and NGO's (yet to be identified) which are involved in natural resources management. Although the final evaluation of the impact of this component of the project will be a joint effort of the different actors, not all monitoring activities will always be undertaken by all actors. The exact role of each actor within the different activities will be discussed in the field.
3. Before the project interventions start, actual trends in land use in the districts of Kolda and Tambacounda will be investigated through satellite remote sensing, statistics and field trips. The focus will be on the:
 - location of villages, roads, water streams, watershed areas, arable land, forest land, grazing land, fallow land cultivated land and severely degraded land,
 - human population densities,
 - composition and densities of wildlife and livestock,
 - composition and productivity of crops,
 - identification of forest types and their condition (maturing state, clear-cut, burnt etc.),
 - identification of grazing land types and their condition (perennial, overgrazed, burnt etc.).
4. Participatory Rural Appraisal's (PRA) will be undertaken to verify the above obtained data and to gather more specific information on the present situation of:
 - delimitation of village territory borders
 - land tenure practices and conflicts (e.g. who decides where and when forest land will be cleared for agricultural expansion),
 - village community structures,
 - NGO's active in natural resources management,
 - collaboration between village-communities, the Forest Service, Centre de Suivi-Ecologique, and NGO's,
 - variety of income resources,
 - composing elements of the agro-ecosystems (e.g. is hunting an important source of income, and so yes for whom?),
 - identity of important non-fuelwood products present in the forests.
 - identity of various stakeholders (with gender specification) involved in different components of the agro-ecosystems with special attention for the forest component (both fuelwood and non-fuelwood products)
 - location and practice of subsistence fuelwood collection
 - interest of different villages in collaborating with the project.

5. From these data a "baseline situation on a regional level" (not to be confused with the "GEF Baseline Scenario" mentioned before) will be described. This document will (i) represent an improved comprehension of the interaction of the different components of the agro-ecosystems, (ii) facilitate the selection of villages that will take part in the project and (iii) enable evaluation of the projects impact during project implementation and at its completion.

6. Once the participating villages are selected, a more detailed description of the baseline situation of these villages will be prepared. That information will be particularly detailed on the condition of the forest with regard of both flora and fauna species which are highly valued either by local and/or global standards. (e.g. the tree *Pterocarpus erinaceus* is of interest for timber, fuelwood and fodder production but is threatened in the region).

7. **"Monitoring in the field at the regional level"** will continue annually throughout the project cycle and will be concentrated on forest exploitation and wildlife and livestock (distribution and density).

8. Concerning forest exploitation, the monitoring will include the location and size of the deforested areas, the type of forest concerned and the apparent cause for deforestation (agricultural expansion, charcoal production, forest fire or other). If the cause was "clear-cut for charcoal production" the logging technique practised will be recorded (species harvested, height of cutting, etc.). If the cause was forest fires, the damage will be described. Subsequently, the villages where forest cutting took place - excluding those which are selected within the project and therefore will have special treatment - will be visited to verify the apparent cause and to inquire whether the villages were in control and if so why, how and by whom the decision was made.

9. The forest exploitation monitoring will primarily be undertaken by the "*Centre the Suivi Ecologique - CSE*" in collaboration with the Forest Service. The visits to the villages will strengthen the collaboration between these services and the local communities while creating environmental awareness. Also the villages will be instructed to contact these services in case they are confronted with illegal intrusion and/or tree cutting by outsiders.

10. Regarding wildlife and livestock distribution and density the monitoring will be undertaken seasonally as to cover the movements of the animals. This activity will most likely be executed by NGO's (e.g. IUCN) in collaboration with the *Centre the Suivi Ecologique* and the villagers. This again will strengthen the collaboration between services, NGO's and villagers while creating environmental awareness and discouraging illegal hunting.

11. **"Monitoring in the field at the village level"** in the selected villages will continue annually after the implementation of sustainable forest management practices. The monitoring will again be focused on forest exploitation and distribution and density of wildlife and livestock.

12. During forest exploitation monitoring, the parameters to be investigated are:

- location, size and condition of severely degraded parcels which are put aside and receive regeneration treatment
- location and size of deforested area for agricultural expansion
- location and timing of forest fires
- location and timing of forest grazing

- location and amounts of wood harvested for charcoal production
- harvesting techniques practised (clear-cut, or selective logging)
- height of logging, diameter and identity of species harvested
- forest damage caused by other reasons such as natural disasters

13. Within the village community, the results will be compared with the original sustainable forest management plan and if necessary the management plan for the next year will be adjusted. If, based on the results, the new forest management appears to create a need for adjustment in other areas of the agro-ecosystem, assistance in these areas will be provided by the project (e.g. intensification of agriculture). This process of regular adjustment of forest management planning will be a learning process for both the forest agencies and the villagers, while strengthening their collaboration and making them independent of technical assistance after project implementation.

14. Regarding the monitoring of wildlife and livestock density and distribution, the number per species (with distinction of common, endemic or threatened species if it concerns wildlife) and the location and the vegetation type where they were encountered will be recorded seasonally. As in the regional monitoring, this activity will strengthen collaboration between services, NGO's and villagers while creating environmental awareness and discouraging illegal hunting.

15. At the end of the project, the compilation of data from the annual monitoring and evaluation activities on both regional and selected villages level, will be used to evaluate the impact of the project on forest resources exploitation, biodiversity conservation, socio-economic situation, community-participatory and institutional strengthening within the region.

Demand Management and Inter-fuel Substitution Options (Non-GEF funded activities)

16. Within the Demand Management and Inter-fuel Substitution component the improved woodfuel stoves sub-component will be subject to periodic monitoring and evaluation.

17. The monitoring and evaluation will be a joint action between the producers, the retailers, the users, technical assistance and NGO's (yet to be identified) with particular interest for issues related to women and either health or environment. The exact organisation of the monitoring and evaluation will be designed by the actors in the field during the Preparatory and Support Activities component.

18. Before the implementation of the improved stoves sub-component, monitoring of potential users will focus on:

- number of people per household
- number and type of woodfuel stoves used
- daily cooking tasks of these stoves
- daily amount of woodfuels used per household
- how and from where woodfuels are obtained
- woodfuel prices and mode of payment (how, who)
- average lifetime of traditional woodfuel stoves
- price paid for woodfuel stoves and mode of payment (how, who)
- where is being cooked, indoors or outdoors
- symptoms of respiratory problems within the household related to the smoke of cooking

- complaints about traditional woodfuel stoves
- interest in improved woodfuel stoves

19. These data will be used for the description of the baseline situation and for the selection of potential users interested in participating in the monitoring procedures.

20. When a traditional woodfuel stove is to be replaced by an improved woodfuel stove the user will be asked to record: (i) the daily woodfuel use since using the improved woodfuel stove, (ii) whether the situation in regard to respiratory problems has been improved in case there were such problems prior to the use of improved stoves, (iii) the appreciation of the improved stove in general and (iv) suggestions for modification of the improved stove if considered important.

21. The results will be used to (i) verify the combustion efficiency of the improved stoves (ii) to verify its supposed mitigation power related to respiratory problems and (iii) to consider users comments in the production of new stoves.

INCREMENTAL COSTS AND GLOBAL ENVIRONMENTAL BENEFITS

A. Broad Development Goals

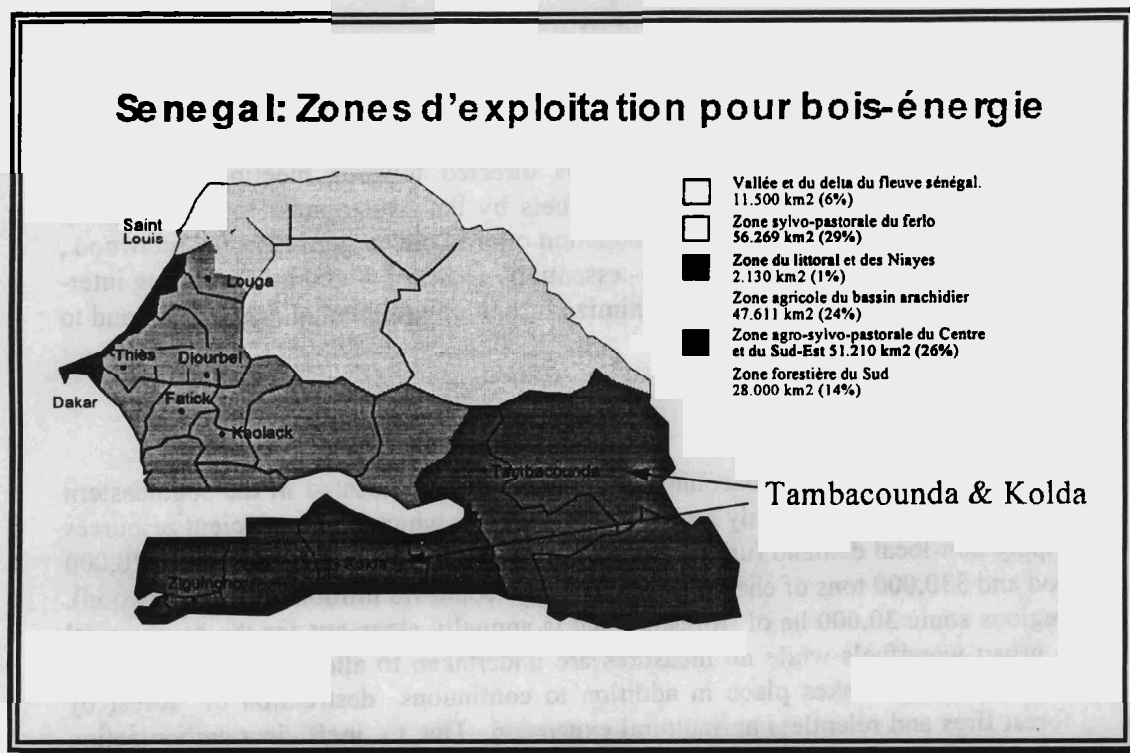
1. Senegal's traditional energy sector policy is directed towards meeting the rapidly growing urban demands of traditional forest-based fuels by the development of community based sustainable forest management, by the introduction of efficient carbonization of fuelwood, by the promotion of improved woodfuel stoves -- essentially charcoal -- and by promoting inter-fuel substitution. This strategy is expected to minimize further environmental degradation and to foster rural development.

I. Business-as-Usual Scenario

2. At this point in time, the Tambacounda and Kolda regions (located in the southeastern part of the country, **Figure 1**) are the only regions of the country which have sufficient resources to be able to supply non-local demand (urban) for woodfuels, estimated in 1992 at some 520,000 tons of fuelwood and 330,000 tons of charcoal (equivalent to some 1.8 million tons of fuelwood). Within these regions some 30,000 ha of forested land is annually clear-cut for the commercial production of urban woodfuels while no measures are undertaken to allow regeneration. This non-sustainable deforestation takes place in addition to continuous destruction of forest by uncontrolled forest fires and relentless agricultural expansion. Due to inefficient carbonization of fuelwood toward charcoal (18% vs. 30%), the exploitation pressure on forests is unnecessary high. Presently, the charcoal business is effectively in the hands of some 20 urban families with little participation in the production activities or the sharing of the profits by the rural communities. Although specific governmental regulations exist to orient and monitor the exploitation of the forest resources and the Forestry Service (Ministry of Environment and Protection of Nature) is responsible for the conservation of the country's forest patrimony, the Government does not have the financial resources or manpower capacity to control the situation on the ground let alone to implement government-run sustainable forest resource management in the country.

3. In the absence of any form of integrated land-use planning and/or strategies, the forest areas that are clear-cut are not allowed to regenerate because after the forest is removed the land is immediately used either for agriculture, grazing or subsistence fuelwood collection. The situation of Senegal follows the same destructive land-use pattern consistently observed throughout other developing countries. The continued non-sustainable (clear-cut) commercial exploitation of forest for the supply of woodfuels and particularly of charcoal, results in a continuous loss of carbon sequestration capacity (decrease of forest stocks) and hence an increase in **net** CO₂ emissions. In addition to the resulting generalized environmental degradation, the current geographic location and the expected exploitation expansion path poses a considerable risk to the Niokolo-Koba National Park, which is located in the intersection of the Tambacounda and Kolda regions, and which has been classified as a national and international "Biosphere Reserve".

FIGURE 1: Senegal: Woodfuels exploitation Zones



II. Baseline scenario

4. The Forestry Service would implement a traditional free standing forestry management project. Very little collaboration would take place with the population residing in the project area. Sustainable forest management would be mostly undertaken by the Forestry Service. Ideally, they would partially clear-cut the forest based on the regeneration cycle of the forest ecosystem and allowing for fallow periods, prevent forest fires and protect the area against other uses such as agricultural and grazing activities. However, because of the Government's limited manpower, they would only be able to achieve these goals partially (50%). Only Forestry Service agents would receive training in sustainable forest management. The project would cover a non-contiguous and dispersed target area of 300,000 ha within the Tambacounda and Kolda regions, most likely close to existing roads to facilitate the access. As the rural population would have a minimal involvement in the implementation of the project and in the sharing of the resulting economic benefits, the project - being mostly dependent on continuous and direct governmental management, would only have a limited effect within the specific target area and for the duration of the project. No improved charcoal production would be introduced because this has been tried earlier by the Government through the promotion of the "Cassamance kiln" and did not work due to poor program design and implementation. On the other hand, an improved stove dissemination program by the private sector and NGO community would be supported to reduce woodfuels demand. At the end of the implementation of the free-standing forestry management project -- and in the absence of a follow-up project -- the sustainable management practices introduced in the target area would not be self-sustainable, the area's

forest stock would be prey to the traditional non-sustainable exploitation and land-use patterns and, thus, the accrual of global environmental benefits would end. Furthermore, as carbon sequestration capacity, CO₂ emissions and biodiversity are directly related to the state of conservation of the forest stocks, in the long-term, the Baseline Scenario would equal the Business-as-Usual Scenario in terms of global environmental benefits.

Global Environmental Objective

5. The global environmental objective of the proposed GEF financing would be to bring the **net** CO₂ emission associated to the production of charcoal in the project area to zero, to maintain and expand the existing carbon sequestration capacity, and to protect and maintain the biodiversity in the Niokolo-Koba National Park which would be endangered by both the Business-as-Usual and the Baseline scenarios.

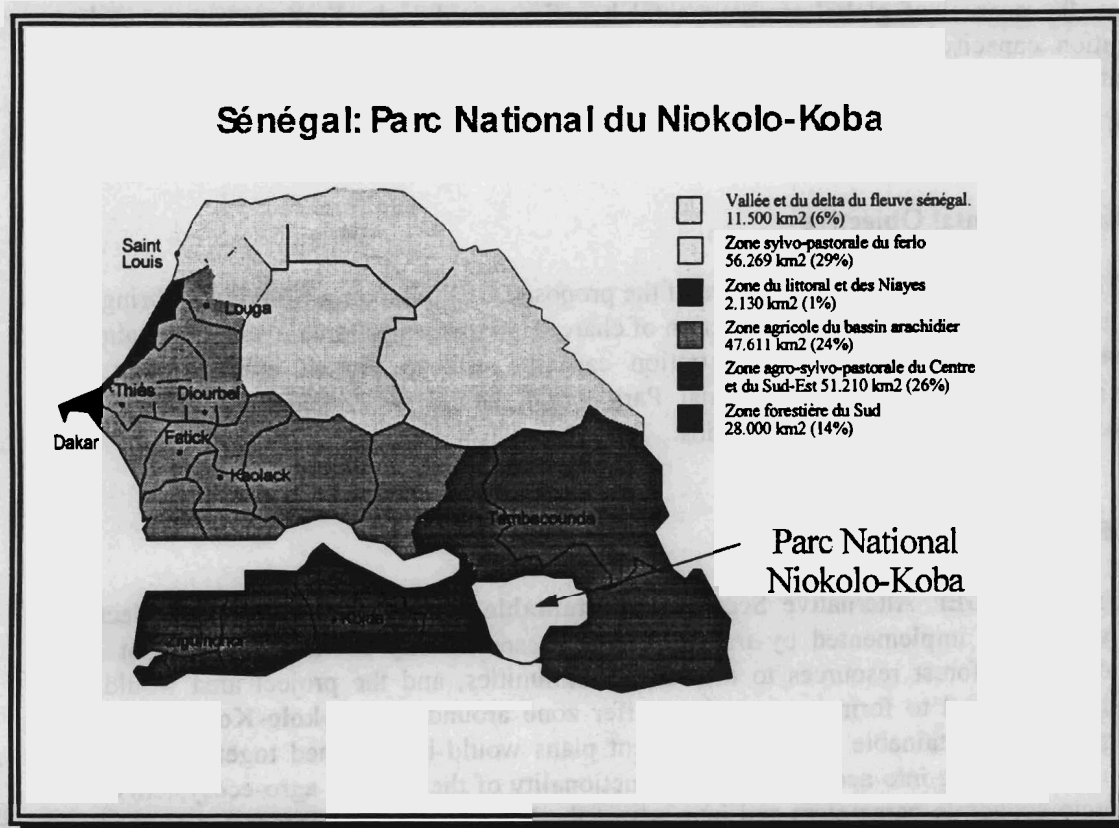
III. GEF Alternative Scenario

6. Under the GEF Alternative Scenario, **sustainable** forest management, by selective logging, would be implemented by transferring the responsibility for the management and exploitation of the forest resources to the rural communities, and the project area would be specifically established to form a protective buffer zone around the **Niokolo-Koba National Park (Figure 2)**. Sustainable forest management plans would be designed together with the rural populations taking into account the multifunctionality of the existing agro-ecosystems and thus the socio-economic parameters and interests of the local community. Integrated forest fire strategies would be developed instead of total forest fire prevention by exclusion. Rural and community development activities would be undertaken and support for the establishment of rural micro-enterprises would be provided in order to motivate the local populations to adequately manage and develop the rural environment. Improved carbonization, reaching 30% efficiency, would be introduced. All these actions together would reduce **losses** in carbon sequestration capacity and in biodiversity and would result in zero net CO₂ emission from the woodfuels-related activities in the project area. Institutional development of and capacity building at the governmental agencies and community structures would also be included to support sustainability and proliferation of the project's achievements after the completion of its implementation. Monitoring activities would be implemented to evaluate the effects and, if necessary, to adjust management strategies.

Costs

7. The difference in cost of the project between the Baseline and GEF Alternative scenarios is **US \$4.66 million** for the implementation of activities related to community-participatory activities, integrated natural resources management, improved carbonization and monitoring and evaluation of global environmental benefits of the project. **Table 1** presents a summary of the cost of project under the Baseline and GEF Alternative scenarios.

FIGURE 2: Senegal: National Niokolo-Koba Park



Costs Effectiveness

8. It is estimated that over the project duration of 7 years the GEF Alternative Scenario would achieve a **total CO₂ emission abatement of 1.1 million tons** at a unit abatement cost of **US \$4.30/ t CO₂**. Over 15 years, the GEF Alternative scenario would result in a CO₂ emission abatement of **4.5 million tons** at a unit abatement cost of **US \$1.04/t CO₂**.

Additional Domestic Benefits

9. In addition to a direct transfer of welfare to the rural communities resulting from the management and commercial exploitation of woodfuels, it is expected that the rural population will be able to obtain additional benefits and revenues from other activities such as Agroforestry, livestock keeping and exploitation of non-fuelwood forest products. While quantification in monetary terms is not possible, the protection and maintenance of the **Niokolo-Koba National Park** would enhance the country's and the project area eco-tourism prospects.

GEF Incremental Cost Calculation Summary
Senegal: Sustainable and Participatory Energy Management Project - SPEMP

Baseline Scenario	Total Cost	(%)
Woodfuels Supply Management Sub-components (*)	11,540,000	81
Energy Demand Management Sub-components	2,700,000	19
TOTAL PROJECT COST	14,240,000	100
GEF Alternative Scenario	Total Cost	(%)
Woodfuels Supply Management Sub-components (*)	16,200,000	86
Energy Demand Management Sub-components	2,700,000	14
TOTAL PROJECT COST	18,900,000	100
Incremental Cost of GEF Alternative Scenario	Total Cost	(%)
Woodfuels Supply Management Sub-components (*)	4,660,000	100
Energy Demand Management Sub-components	0	0
TOTAL GEF PROJECT COST	4,660,000	100

(*) Includes sub-components in Project Components I and II.

B. Methodology and Analyses of the Incremental Cost of the GEF-Financed Supply Management Sub-components (Sub-components included within the Preparatory and Support Activities and the Sustainable & Participatory Woodfuels Management Components)

CO₂ emission abatement

10. Under the Business-as-Usual Scenario (clear-cut followed by grazing, crop growing and/or continuous subsistence wood collection) no forest re-growth would occur. Therefore, the **net** emission of CO₂ would equal the total amount emitted by the burning of wood harvested (100% of CO₂ emission level). The Baseline Scenario (sustainable forest management achieving only 50% of sustainability) would result in a **net** CO₂ emission level of 50% during the life of the project.¹ The **GEF Alternative Scenario** (achieving 100% forest regeneration during and after project implementation) would result in a **zero net CO₂ emission level**.

11. The productivity of the savanna woodlands in the area is estimated at 30 m³ of fresh wood per ha equaling 15 ton of fuelwood.² Under effectively sustainable forest management, 1 ton of fuelwood/ha/year can be harvested.³ This is the harvest intensity simulated under the GEF Alternative Scenario. For the Business-as-Usual Scenario and the Baseline Scenario an annual harvest intensity of 1.7 t/ha is simulated in order to arrive at an equal amount of charcoal production in each of the different scenarios, given a carbonization efficiency of 30%⁴ in the GEF Alternative Scenario and of 18%⁵ in the other scenarios. Thus, the comparison of the

¹ Although it is expected that at the end of the project (year 7) it would gradually revert to the 100% non-sustainability, a sustainability level of 50% was maintained throughout the 15 year period to avoid complicating the analysis with additional assumption on the rate of reversal from 50% sustainability to 100% non-sustainability. Factoring a gradual reversal to non-sustainability would result in higher benefits for the GEF Alternative Scenario.

² Jensen, A.M. (1995), Examen des Politiques, Strategies et Programmes du Secteur des Energies Traditionnelles. Evaluation des données sur les ressources ligneuses: Burkina Faso, Gambia, Mali, Niger et Senegal. World Bank, Africa Region (Consultant Report).

³ Jensen, A. M. (1995). op cit.

⁴ Floor, W. and Van der Plas, R. (1992). CO₂ Emissions by the Residential Sector: Environmental Implications of the Inter-fuel Substitution. Industry and Energy Department Working Paper. Energy Series, Paper 51. World Bank, Industry and Energy Department. PRE.

⁵ Feinstein, C. and Van der Plas (1991), Improving Charcoaling Efficiency in the Traditional Rural Sector. Industry and Energy Department Working Paper. Energy Series, Paper 38. World Bank, Industry and Energy Department. PRE.

scenarios is based on differences in amounts of fuelwood harvested and the corresponding net CO₂ emissions resulting from varying degrees of forest management sustainability. The amount of carbon sequestered in 1 ton of harvested fuelwood equals 1.7 t of CO₂.⁶ The impact of possible natural hazards such as drought, windstorms or diseases was not taken into account.

12. The total area managed during the implementation of the project increases as follows:

- year 1: none (detailed studies and preparation of management plans)
- year 2: 15 000 ha
- year 3: 40 000 ha
- year 4: 80 000 ha
- year 5: 130 000 ha
- year 6: 200 000 ha
- year 7: 300 000 ha

13. A comparison was made between these scenarios during the 7 year project - starting wood harvest in the second year- and over 15 years. The 15 year time period was chosen because it equals the period after which any fixed area in the region under an exploitation of 1 t of fuelwood/ha harvested by clear-cutting without regrowth, would be totally clear-cut.

14. For the sake of simplicity, this approach ignores the influence of the different scenarios on the sequestration capacity of the forest ecosystem as a whole by not taking into account the varying influences of selective logging and clear-cutting on aspects such as forest age, species composition, underground biomass, soil condition, herbaceous vegetation, fauna and alternative land use. However, since under both the Business as Usual Scenario and the Baseline Scenario all forested land will finally be converted in either pasture or agricultural land, the GEF-alternative Scenario would appear even more favorable on the long term in regard of CO₂ emission abatement because the carbon sequestration capacity of forest land is generally much higher than that of pasture or agricultural land.

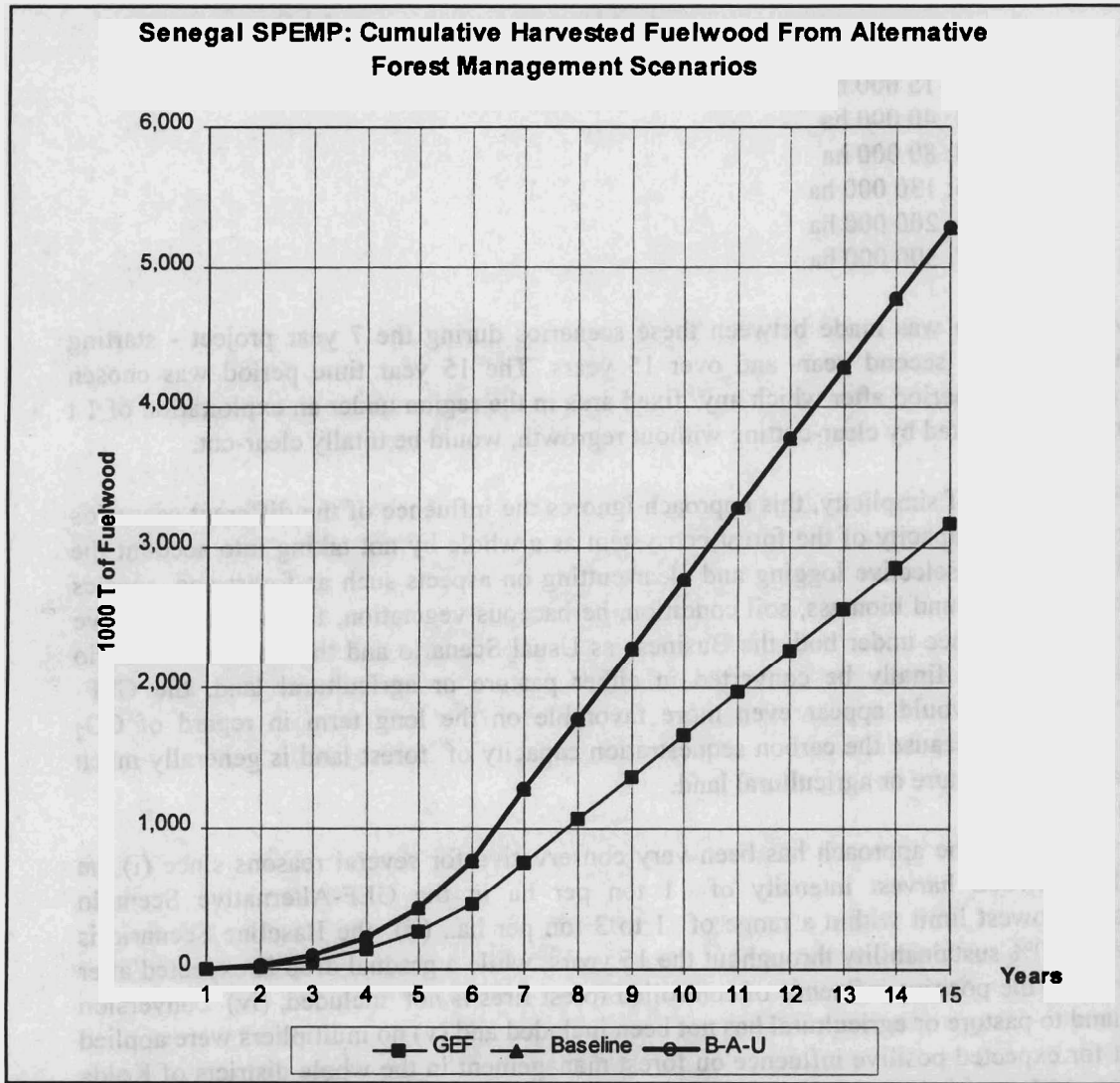
15. In summary, the approach has been very conservative for several reasons since (i) the sustainable fuelwood harvest intensity of 1 ton per ha in the GEF-Alternative Scenario represents the lowest limit within a range of 1 to 3 ton per ha., (ii) the Baseline Scenario is maintained at 50% sustainability throughout the 15 years, while a gradual drop is expected after the 7 years, (iii) the positive influence of controlled forest fires is not included, (iv) conversion of forest land to pasture or agricultural has not been included and (v) no multipliers were applied to account for expected positive influence on forest management in the whole districts of Kolda and Tambacounda.

16. Figure 3 presents the cumulative amounts of fuelwood harvested to produce equal amounts of charcoal under the carbonization efficiencies of the different scenarios over the 15-year period. The carbonization efficiency under the GEF Alternative Scenario is 30% and under the Baseline Scenario and the Business as Usual Scenario is 18%.

⁶ Floor, W. and Van der Plas, R. (1992). op.cit.

17. Figure 4 presents the cumulative amounts of net CO₂ emission under the different degrees of harvest sustainability of the different scenarios over the 15-year period. The harvest sustainability is zero in the Business as Usual Scenario, 50% in the Baseline Scenario and 100% in the GEF Alternative Scenario.

FIGURE 3

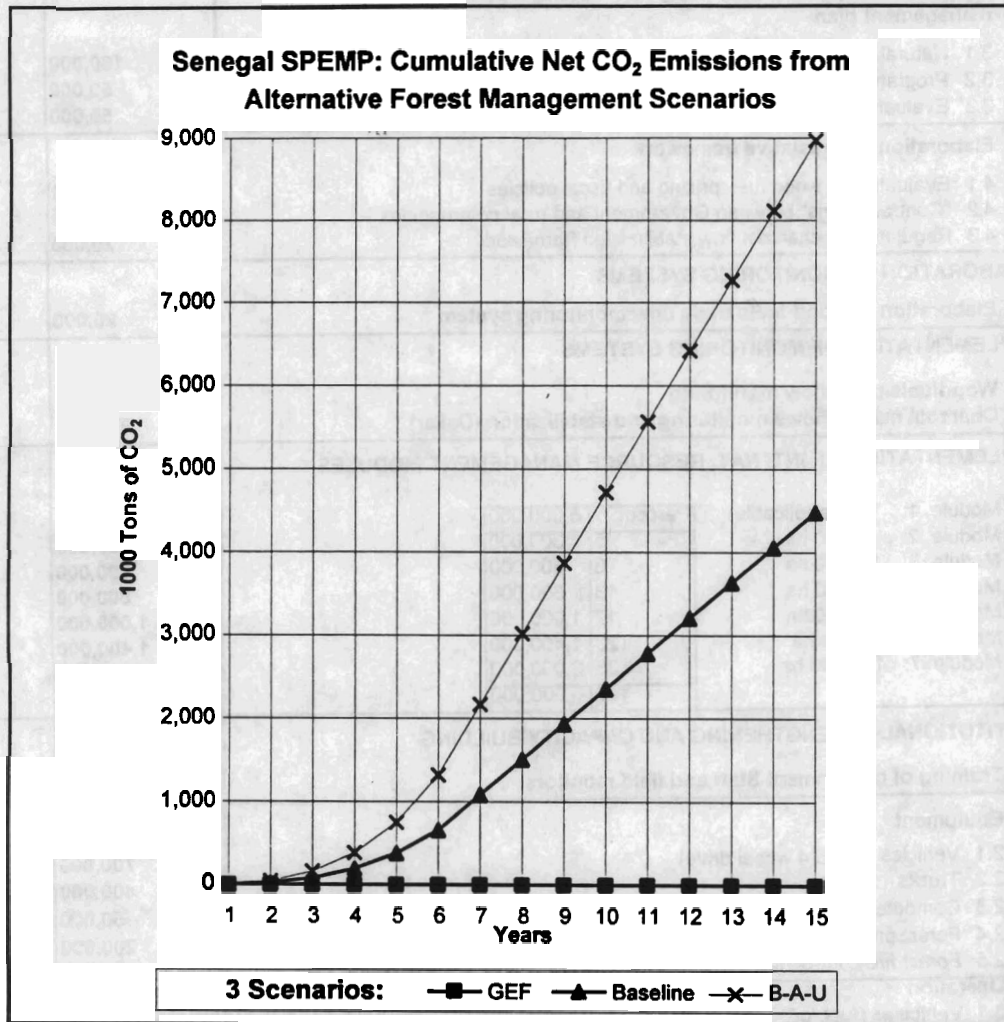


Cost

18. The difference in cost of the supply management sub-components (included within the project's Components I and II) between the Baseline and GEF Alternative scenarios is US \$4,660,000. This difference results from the implementation of: (i) technical activities design to enlarge the project from a simple free standing forestry project to a natural resource management project and to include monitoring and evaluation systems and mechanism for the

activities designed to increase the participation of the rural community in the strict enforcement of sustainable forest management and, thus, expected to result in the achievement of the global environmental benefits. Tables 2 and 3 respectively present a detailed descriptive cost structure of the Baseline and GEF Alternative scenarios for the project's Supply Management sub-components.

FIGURE 4



Cost effectiveness

19. The unit abatement cost of the project's Component I under the GEF Alternative Scenario is US \$4.30/t CO₂ after 7 years and US \$1.04/t CO₂ after 15 years.

TABLE 2: BASELINE SCENARIO COST

Woodfuels Supply Management Sub-components (Includes sub-components within the Project's Components I and II)	Cost Breakdown	Total Cost
I. COLLECTION OF DATA & ELABORATION OF PLANS		
1. Selection & prioritization of areas for intervention (300,000 ha)		
1.1 Forest inventory in Tambacounda & Kolda (600,000ha.)	800,000	
1.2 Implementation plan (selection & prioritization)	30,000	830,000
2. National dead wood availability assessment	100,000	100,000
3. Elaboration of participatory integrated natural resources management plan		
3.1 Natural forest management plan	100,000	
3.2 Program for forest fire prevention	50,000	
3.3 Evaluation of infrastructure improvement needs (road, rur.serv. centres etc.)	50,000	200,000
4. Elaboration of legislative framework		
4.1 Evaluation of wood fuel pricing and fiscal policies	50,000	
4.2 "Contract-plans" between Government and rural communities	60,000	
4.3 Regulation of charcoal flow stabilization framework	20,000	130,000
II. ELABORATION OF MONITORING SYSTEMS		
1. Elaboration of wood fuels trade flow monitoring system	20,000	20,000
III. IMPLEMENTATION OF MONITORING SYSTEMS		
1. Woodfuels trade flow monitoring	90,000	
2. Charcoal market flows monitoring and stabilization (Dakar)	750,000	840,000
IV. IMPLEMENTATION OF INT. NAT. RESOURCE MANAGEMENT MODULES		
1. Module 1: (not applicable)		
2. Module 2: 15,000 ha	300,000	
3. Module 3: 25,000 ha	500,000	
4. Module 4: 40,000 ha	800,000	
5. Module 5: 50,000 ha	1,000,000	
6. Module 6: 70,000 ha	1,400,000	
7. Module 7: 100,000 ha	2,000,000	6,000,000
	6,000,000	
V. INSTITUTIONAL STRENGTHENING AND CAPACITY BUILDING		
1. Training of government Staff and field monitors	415,000	415,000
2. Equipment		
2.1 Vehicles (2 and 4 wheel drive)	700,000	
2.2 Trucks	400,000	
2.3 Computers and mapping materials	50,000	
2.4 Forest prevention equipment	200,000	
2.5 Forest fire control tools	300,000	1,650,000
3. Operation		
3.1 Vehicules (fuel, oil, spare parts)	920,000	
3.2 Office supplies	140,000	
3.3 Communication (telephone, fax etc.,)	140,000	1,200,000
VI. COMMUNICATION STRATEGY	155,000	155,000
TOTAL COST Supply Management Sub-components	11,540,000	11,540,000

TABLE 3: GEF ALTERNATIVE SCENARIO COST

Woodfuels Supply Management Sub-components (Includes sub-components within the Project's Components I and II)	Cost Breakdown	Total Cost
I. COLLECTION OF DATA & ELABORATION OF PLANS		
1. Selection and prioritization of areas for intervention (300,000ha)		
1.1 Vegetation cover inventory in Tambacounda and Kolda (600,000 ha)	950,000	
1.2 Participatory Rural Appraisal (socio-economic assessment)	100,000	
1.3 Elaboration of prioritized implementation plan	50,000	1,100,000
2. National dead wood availability assessment	100,000	100,000
3. Elaboration of participatory integrated natural resources management plan		
3.1 Natural forest management plan	100,000	
3.2 Village territory management plan (" <i>gestion terroir</i> ")	100,000	
3.3 Program for regeneration of ecologically degraded lands	70,000	
3.4 Program for forest fire management	50,000	
3.5 Program for training and capacity building of rural population	80,000	
3.6 Evaluation of infrastructure improvement needs (road, rural service centres etc.)	50,000	
3.7 Integrated natural resources management plan	100,000	550,000
4. Elaboration of legislative framework		
4.1 Elaboration of wood fuel pricing and fiscal policies	50,000	
4.2 "Contract-plans" between Government and rural communities	90,000	
4.3 Regulation of charcoal flow stabilization framework	20,000	160,000
II. ELABORATION OF MONITORING SYSTEMS		
1. Elaboration of vegetation and fuelwood exploitation monitoring system	30,000	
2. Elaboration of wood fuels trade flow monitoring system	20,000	
3. Elaboration of wildlife monitoring system	20,000	
4. Elaboration of community-participation monitoring system	20,000	80,000
III. IMPLEMENTATION OF MONITORING SYSTEMS		
1. Vegetation and fuelwood exploitation monitoring	120,000	
2. Woodfuels trade flow monitoring	90,000	
3. Wildlife monitoring	120,000	
4. Community-participation monitoring	120,000	
5. Charcoal market flows monitoring and stabilization (Dakar)	750,000	1,200,000
IV. IMPLEMENTATION OF INT. NAT. RESOURCE MANAGEMENT MODULES (including inputs: I.3.1 - I.3.7. & I.4.1. - I.4.4.)		
1. Module 1: (not applicable)		
2. Module 2: 15,000 ha	5	350,000
3. Module 3: 25,000 ha	8	583,333
4. Module 4: 40,000 ha	13	933,333
5. Module 5: 50,000 ha	17	1,166,667
6. Module 6: 70,000 ha	23	1,633,333
7. Module 7: 100,000 ha	33	2,333,333
	100	\$7,000,000
		7,000,000
V. SUPPORT TO RURAL MICRO-ENTREPRISES (investment funds for activities on IMPROVED CARBONIZATION, agro-forestry, etc.)	1,000,000	1,000,000
VI. INSTITUTIONAL STRENGTHENING AND CAPACITY BUILDING		
1. Training of government staff and monitoring agents (participatory discussing technics, training and extension of forestry management)	600,000	
2. Training of rural communities (forest management, IMPROVED CARBONIZATION, agriculture, pastoralism, cooperatives management, etc.)	1,000,000	1,600,000
3. Equipment		
3.1 Vehicles (2 and 4 wheel drive)	700,000	
3.2 Trucks	400,000	
3.3 Computers and mapping materials	100,000	
3.4 Forest management tools	200,000	
3.5 Forest fire control tools	300,000	1,700,000
3.5 Forest fire control tools	300,000	1,700,000
4. Operation		
4.1 Vehicules (fuel, oil, spare parts)	920,000	
4.2 Office supplies	140,000	
4.3 Communication (telephone, fax etc..)	140,000	1,200,000
VII. COMMUNICATION STRATEGIES	500,000	500,000
TOTAL COST Supply Management Sub-components	16,200,000	16,200,000

C. Incremental Cost of Demand Management Activities With Global Environmental Benefit Not Financed by GEF

CO₂ emission abatement

1. The Government of Senegal has long sought to promote the use of improved stoves. However, it has been unable to make the use of improved stoves either operational or sustainable. This is so because most stove programs implemented until now were run as Donor-Government managed activities, which invariably collapse as soon as donor financing and technical supervision ran out. As a rule, these projects worked on the basis of large consumer price subsidies, whereby there was little long-term incentive for the private sector to produce stoves outside direct donor financed pilot programs. When the cost of the expatriate technical assistance is considered, it is estimated that the cost per disseminated stove elevates well beyond the US \$100 level. On the other hand, during recent policy analysis work (RPTEs Program), the Government reached the conclusion that a new generation of consumer-accepted improved charcoal stoves (Sakanal, Diambar, etc.) exists and is already being successfully produced and marketed at full cost by several NGO's in the principal urban centers of the country. Those new initiatives are severely constrained in volume of operation (10,000 to 20,000 stoves/year) by a lack of investment and working capital. Thus, lack of access to credit or other financial instruments is the principal constraint to the successful market-based dissemination of the promising new generation of improved charcoal stoves by small scale and micro-enterprises and NGO's. GEF financing of this activity would contribute to the elimination of market barriers.

2. Within that context, the Baseline Scenario would be limited to the promotion by Government of the improved stove concept within its general consumer education activities and campaigns. No other investment or technical assistance activities would be carried out.

3. Within an "Environmentally enhanced" scenario - parallel to the GEF Alternative scenario -- the project would promote for a period of five years (shorter than the life of the project) the production and marketing of improved stoves by the private sector (small and micro-enterprises) and/or NGO's at **full factor cost** by establishing a rotatory working capital fund (US \$ 300,000) for small and micro-enterprises and NGO's which have market-proven stoves but lack the necessary resources to invest in the expansion of their production capacities. Additionally the project would undertake basic monitoring and evaluation of the improved stove programs and would set up a professional improved stove promotion campaign.

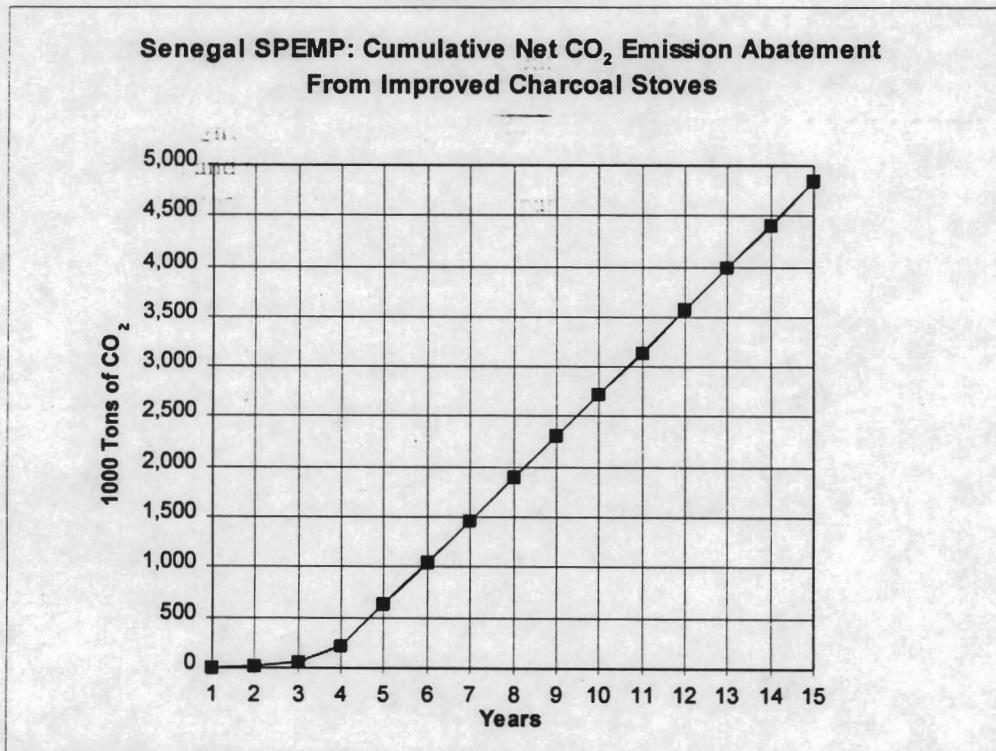
4. Within the GEF Alternative scenario, a total of **225,000** improved charcoal stoves would be produced and sold through the market during the first five years of the project. Stove production and sales would reach the following cumulative schedule:

year 1: 2,700
year 2: 8,300
year 3: 25,000
year 4: 75,000
year 5: 225,000

5. The CO₂ emission abatement of this activity was calculated for the project period of seven (7) years and for over a 15-year period (following the same standard used for the GEF funded activities). The underlying assumption for extending that calculation to the 7 and 15 year periods is that once the project manages to “kick-start” the private sector/NGO based production of improved stoves and the consumers have had a five year cycle of stove usage, there would be a continuously increasing market demand for stoves, without the need for continued governmental support. Based on the results of the evaluation of the 5-year program, the Government will either continue to use the rotatory fund as such or will apply the funds towards consumer energy education and awareness programs.

6. The new generation of improved charcoal stoves reduces the consumption of charcoal by 1.6 kg per day per household.⁷ Burning 1 kg of charcoal equals the emission of 3.2 kg CO₂. In line with those assumptions, the implementation of the improved charcoal stove activity within the GEF alternative Scenario would result in a net total CO₂ emission abatement of 1.5 million tons over 7 years and of 4.8 million tons over 15 years. Figure 5 presents the cumulative net CO₂ emission abatement expected to result over a 15-year period from the implementation of 225,000 improved stoves. It was assumed that a permanent park of 225,000 improved stoves would remain in use by households through continuous reposition after the project target is met at the seventh year of implementation. If the improved charcoal stoves result to be less efficient than what has been estimated (and documented) thus far, the CO₂ abatement benefit of this activity may be slightly lower than anticipated.

FIGURE 5



⁷ AT International (1996). Reducing Charcoal Use in Senegal. (Draft proposal presented to the World Bank). Washington DC. USA.

Cost

7. The total cost of the proposed 5-year improved stoves activities is **US \$500,000**. This cost would be divided between: (i) a research and analysis funds to review and evaluate private sector and NGO investment proposals; (ii) a rotatory investment fund (US \$300,000) to support selected private sector/NGO initiatives; (iii) support to pilot sales and promotion campaigns (US \$100,000); and (iv) monitoring and evaluation of the impact of the improved stoves (US \$50,000).

8. The difference in cost of the proposed demand management sub-components between the Baseline and the enhanced scenario (US \$500,000) is exclusively attributed to the implementation of the improved stoves activities. **Tables 4 and 5** respectively present a descriptive cost structure of the Baseline and the Environmentally Enhanced scenarios for the non-GEF funded demand management sub-components of the project.

Cost effectiveness

9. The unit abatement cost of the project's **Component III** under the Environmentally Enhanced Scenario is **US \$0.34/t CO₂** after 7 years and **US \$0.10/t** after 15 years.

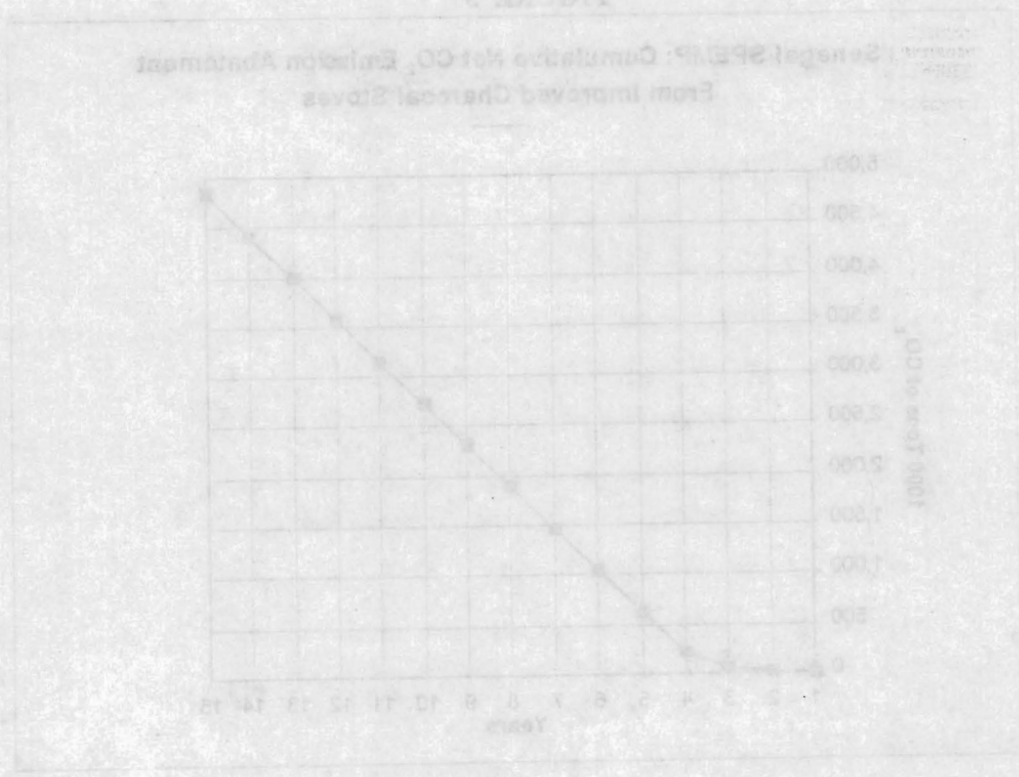


TABLE 4: BASELINE SCENARIO COSTS (Non-GEF Sub-components)

Energy Demand Management Sub-components (Includes sub-components in the Project's Components I and III)	Cost Breakdown	Total Cost
I. SUPPORT FOR THE MODERNISATION OF THE CHARCOAL INDUSTRY		
1. Identification of entrepreneurs & analysis of proposals	50,000	
2. Mobilisation of support funds	100,000	
3. Monitoring and evaluation	30,000	180,000
II. SUPPORT FOR		
1. Identification of entrepreneurs & analysis of proposals	50,000	
2. Mobilisation of support funds	250,000	
3. Monitoring and evaluation	30,000	330,000
III. KEROSENE: SUPPORT FOR INTER-FUEL SUBSTITUTION		
1. Complementary studies to GTZ-GoS Energy program	30,000	
2. Research on appropriate stoves	30,000	
3. Import of pilot stoves	20,000	
4. Marketing and support for sales of pilot stoves	50,000	130,000
IV. BUTANE GAS (LPG): SUPPORT FOR INTER-FUEL SUBSTITUTION		
1. LPG procurement and distribution study	50,000	
2. Identification of entrepreneurs & analysis of proposals	50,000	
3. Mobilisation of support funds and monitoring	200,000	300,000
V. COMMUNICATION AND STOVE MARKETING STRATEGY		
1. Technical seminar and workshops	50,000	
2. Publication of technical documents and general information	100,000	
3. Public information and consumer campaigns	150,000	
4. Publicity campaigns	200,000	500,000
VI. INSTITUTIONAL STRENGTHENING AND CAPACITY BUILDING		
1. Implementation of TA team at the Energy Directorate		
1.1 Long-term personnels	200,000	
1.2 Temporary personnel	50,000	
1.3 Transport and field work costs	50,000	300,000
2. Training of Energy Directorate staff	100,000	100,000
3. Implementation of energy information system- SIEP	100,000	100,000
4. Equipment		
4.1 Vehicles (2 wheel drive)	40,000	
4.2 Computers and communication	60,000	100,000
5. Operation		
5.1 Vehicles (fuel, oil & spare parts)	60,000	
5.2 Office supplies	60,000	
5.3 Communication (telephone, fax etc.)	40,000	160,000
TOTAL COST Energy Demand Management Sub-components	2,200,000	2,200,000

TABLE 5: ENVIRONMENTALLY ENHANCED SCENARIO COSTS (Non-GEF)

Energy Demand Management Sub-components (Includes sub-components in the Project's Components I and III)	Cost Breakdown	Total Cost
I. SUPPORT FOR THE MODERNISATION OF THE CHARCOAL INDUSTRY		
1. Identification of entrepreneurs & analysis of proposals	50,000	
2. Mobilisation of support funds	100,000	
3. Monitoring and evaluation	30,000	180,000
II. SUPPORT FOR		
1. Identification of entrepreneurs & analysis of proposals	50,000	
2. Mobilisation of support funds	250,000	
3. Monitoring and evaluation	30,000	330,000
III. KEROSENE: SUPPORT FOR INTER-FUEL SUBSTITUTION		
1. Complementary studies to GTZ-GoS Energy program	30,000	
2. Research on appropriate stoves	30,000	
3. Import of pilot stoves	20,000	
4. Marketing and support for sales of pilot stoves	50,000	130,000
IV. BUTANE GAS (LPG): SUPPORT FOR INTER-FUEL SUBSTITUTION		
1. LPG procurement and distribution study	50,000	
2. Identification of entrepreneurs & analysis of proposals	50,000	
3. Mobilisation of support funds and monitoring	200,000	300,000
V. SUPPORT FOR PRODUCTION & DISTRIBUTION OF IMPROVED STOVES		
1. Identification of entrepreneurs & analysis of proposals	50,000	
2. Mobilisation of support funds	300,000	
3. Support for pilot sales and marketing	100,000	
4. Monitoring and evaluation of impact of improved stoves	50,000	500,000
VI. COMMUNICATION AND INFORMATION STRATEGY		
1. Technical seminar and workshops	50,000	
2. Publication of technical documents and general information	100,000	
3. Public information and consumer campaigns	150,000	
4. Publicity campaigns	200,000	500,000
VII. INSTITUTIONAL STRENGTHENING AND CAPACITY BUILDING		
1. Implementation of TA team at the Energy Directorate		
1.1 Long-term personnels	200,000	
1.2 Temporary personnel	50,000	
1.3 Transport and field work costs	50,000	
2. Training of Energy Directorate staff	100,000	400,000
3. Implementation of energy information system- SIEP	100,000	100,000
4. Equipment		
4.1 Vehicles (2 wheel drive)	40,000	
4.2 Computers and communication	60,000	100,000
5. Operation		
5.1 Vehicles (fuel, oil & spare parts)	60,000	
5.2 Office supplies	60,000	
5.3 Communication (telephone, fax etc.)	40,000	160,000
TOTAL COST Demand Management Sub-components	2,700,000	2,700,000

PROJECT PARTICIPATION ACTION PLAN

Introduction

1. For the past three years, the Government of Senegal, with the support of the World Bank, has been in the process of formulating a traditional energy policy as well as identifying a project to address its critical problem of rapidly decreasing traditional household fuel sources. The process of both Policy Formulation and Project Identification has been participatory, relying upon **multi-disciplinary and inter-ministerial teams** working on a consensus basis. Further, a series of consultations with NGOs and the private sector representatives were held to obtain comments. These significant activities have led to the development of the Senegal's "Sustainable and Participatory Energy Management Project" (SPEMP) where participation will play a vital role in attaining project objectives. To clarify the role of participation as well as the participatory process and methodology to be utilized in the project, the following Participation Action Plan (SPEMP- PAP) has been developed.

KEY ELEMENTS OF THE PLAN

- **Based on a Consultative and Participatory Process:** The foundation for the design of this plan results from a consultative process of Policy Formulation and Project Identification involving several key stakeholders. In addition, a series of National and Regional Participatory Project Preparation Workshops were conducted by the Government of Senegal between December 1995 and April 1996 to obtain feedback and suggestions from representatives of civil society on the overall project strategy.
- **NGO Oversight:** The Government of Senegal will choose an NGO to be responsible for the implementation and monitoring of the SPEMP-PAP. This "lead" NGO will be responsible for promoting, monitoring and reporting on all participatory activities during the project implementation phase.
- **Phase of Preparatory and Support Activities:** The entire first year of the project will be dedicated to participatory preparation activities, as well as other support activities. The participatory preparation activities will allow communities to design their own community management plans as well as for the project team to obtain additional social, economic, ecological, and functional information necessary for project implementation.
- **Role of Women, Youth and NGOs¹:** Due to their critical role in resource management and development, women, youth and NGOs have been identified as key participants and will play a fundamental role throughout the lifecycle of the project.
- **Participatory Methodology Training for Government Officials:** General sensitizing of government decision makers on participatory approaches and their impact on development is planned as a key component of capacity building and institutional development activities for the Government of Senegal.

¹ Non-Governmental Organizations here also refers to Community Based Organizations (CBOs)

Background

2. The SPEMP "Executive Project Summary" notes that "the government and the private sector lack the financial and human resources that would be necessary to adequately manage the country's forest resources". Consequently, to obtain the project's objective (to meet an important part of the rapidly growing urban demand for household fuels), it is necessary to have the *active involvement* of the rural populations². For successful implementation of the project, community involvement must be systematic and representative of all stakeholders. In an effort to ensure systematic participation (participation that occurs in all stages of the project cycle, influences design and implementation, and is appropriately institutionalized), the following SPEMP - PAP has been developed. This plan, formulated in collaboration with the Government of Senegal, is based on, in addition to other activities, a series of **National and Regional Participatory Project Preparation Workshops** conducted by the Government of Senegal. These workshops, involving over 60 community representatives and NGOs and conducted between December 1995 and April 1996, gathered critical social, economic, and environmental data which has improved the overall project strategy and enhanced the knowledge base of the project team.³

Participants

3. The recent Participatory Project Preparation Workshops identified women, youth, and NGOs as key participants in the project. Special attention will be given to these groups, however, not at the exclusion or marginalization of others. For example, Senegal's new decentralization regulations identifies rural community councils as the statutory natural resource managers at the local level. As a result, rural community leaders will also play a critical role in the project. Other essential participants will include charcoal producers, the private sector, pastoralists, herders, bee-keepers, the government, and anyone else identified during the first year of preparation activities. Contact with representatives of some of these key groups has already taken place through the Project Preparation Workshops. **Table 2** is an initial listing of some of these contacts which will be built upon during the cycle of the project.

Process

4. In general, the participatory process to be followed during the project's lifecycle is expected to be fluid and iterative, continuously adjusting to meet the needs of the project and its participants. A "lead NGO" will be selected by the Government of Senegal to promote and monitor this process.

² "Rural populations" here refers to community populations, NGOs, and CBOs.

³ The National Participatory Project Preparation Workshops, held in Dakar December 1995 and March 1996, obtained advice and lessons learned from over 40 representatives of NGOs, the private sector, and CBOs working in the Traditional Energy Sector throughout Senegal. The Regional Participatory Project Preparation Workshops, held April 1996 in Tambacounda and Kolda, presented the project proposal to its principal stakeholders - local populations. Comments and suggestions were solicited regarding the proposed strategy from more than 80 representatives of NGOs, CBOs, community leaders, the private sector, and local government officials.

TABLE 2
NGOs, CBOs And Rural Communities Represented At The SPEMP Beneficiary
Consultation Workshops

NGOs	CBOs	RURAL COMMUNITIES
1. UICN	1. Groupement Féminin de Bakel	1. Présidents du conseils régionaux Kolda et Tamba
2. Winrock International	2. Groupement Féminin de Tamba	2. Président Communauté Rurale de Kounkané
3. Association des Jeunes pour l'Education et le Développement(AJED)	3. GIE Saré	3. Conseiller communauté rurale de Sinthiang Koundara
4. Plan International	4. Groupement Promotion Féminine Koussanar	4. Conseiller communauté rurale de Nianga
5. Réseau Africain pour le Développement Intégré(RADI)	5. Groupement Féminin Kédougou de Kolda	5. Conseiller communauté rurale de Mampatim
6. Organisation Communautaire de Regroupement Villageois(OCRV)	6. Union Nationale des coopératives Forestières de Kolda	6. Président communauté rurale de Bounkiling
7. CARITAS	7. Union des coopératives d'Eleveurs de Kolda	7. Président communauté rurale de Ndorna
8. Organisation Sénégalaise pour le Développement des Initiatives Locales (RADI)	8. Union des Groupements Féminins de Kolda	8. Président communauté rurale de Dioulacolon
9. Conseil des ONG d'Appui au Développement (CONGAD)	9. FENOFOR	9. Président communauté rurale de Pata
10. ACRA	10. Président Comité de Lutte contre les feux de brousse	10. Conseiller communauté rurale de Dioulacolon
11. AFRICARE	11. Union des Parents d'élèves de Kolda	11. Conseiller communauté rurale de Médina Elhadj
12. Association Française des Volontaires du Progrès (AFVP)		12. Conseiller communauté rurale de Médina Yoro Foula
13. Christian Children's Fund (CCF)		13. Conseiller communauté rurale de Maka
14. ASREAD		14. Président communauté rurale de Dialacoto
15. "7a"		15. Président communauté rurale de Missira
16. Centre d'Etudes Canadien International (CECI)		16. Président communauté rurale de Bébé
17. FID		
18. GADEC		
19. Fédération des Associations Féminines du Sénégal(FAFS)		
20. Concertation Nationale des Ruraux(CNCR)		
21. APCR		
22. ENDA		
23. Fédération des ONG du Sénégal(FONGS)		
24. Appropriate Technology International(ATI)		
25. RODALE		
26. Aide et Action		
27. Ile de Paix		
28. CSIVAD		
29. HOPE 87		
30. Maisons Familiales Rurales(MFR)		
31. Association des Jeunes Agriculteurs de Casamance(AJAC)		
32. KORA		
33. Vétérinaires sans frontière		
34. ARSAP		
35. Fédération des Associations et Groupements Villageois du département de Sédhiou(AFGVS)		

5. A series of participatory approaches consisting mostly of Participatory Rural Appraisals, consultative workshops, and social assessments will serve as the basis from which all else will evolve. From the participation point of view, there will be three phases in this project:

Participatory Planning and Preparation Phase (Year 1), Participatory Implementation Phase (Year 2-7), and Evaluation Phase. The following provides greater details on the anticipated participatory activities during these phases.

Participatory Planning and Preparation Phase: Year 1

6. The first year of the project will serve as a foundation for the six years to follow. During this critical year, a Project Implementation Plan will be defined in conjunction with the principal participants, notably women, youth, rural populations, NGOs, CBOs, charcoal producers, the private sector and the government. The following participatory activities, monitored by the lead NGO, will result in the development of the Project Implementation Plan:

- **Regional NGO Assessments:** Studies will be conducted of NGOs working in the two targeted regions, Tambacounda and Kolda, by an independent consultant or agency. The results of these studies will illustrate the capacity of NGOs working in the regions to participate in and promote and support participatory project implementation.
- **Organization of and Initial Implementation of Participatory Rural Appraisals:** Participatory Rural Appraisals (PRAs), conducted by NGOs or individual consultants, will serve as the backbone for the Project Implementation Plan. The PRAs, in addition to collecting necessary social and economic data, will allow communities to prepare their own community management plans based on indigenous knowledge, culture, and the existing resource base. At the end of the first year, this information will be synthesized with technical findings obtained by the Government to formulate technically, socially and economically sound community management plans. Together, the Government of Senegal and the lead NGO will then consolidate these community management plans into a detailed implementation plan for annual participatory forestry management modules as well as for inter-fuel substitution activities.

7. Information collected from the PRAs will highlight themes and subjects which could be useful in future PRAs or in other studies being conducted by the project. This information will also be incorporated into the design of the following programs:

- *capacity building programs for field agents and institutions;*
- *a monitoring and evaluation system; and*
- *a comprehensive communication strategy.*

8. During the first year, PRA facilitators will be selected. In addition, zones of intervention for initial exploratory PRAs will be identified based on ecological, socio-demographic, socio-professional, and administrative criteria. By the end of the first year initial exploratory PRAs will have been conducted in each "arrondissement", covering approximately 15 communities. This number will expand over the seven years, as illustrated in a later section of this plan, with the increasing number of community managed hectares.

9. Some of the participatory tools to be used in the appraisals may include semi-structured interviewing, focus group discussions, preference ranking, mapping and modeling, and seasonal and historical diagramming. These tools will reveal along with other information the following:

- soil and land conditions
 - land tenure practices and issues
 - ecological, environmental and agricultural history, culture, and practices
 - village community structures
 - roles of community members (i.e. gender roles)
 - livelihood analysis and variety of income resources
 - wealth ranking
 - important institutions and individuals in the community
 - NGOs and CBOs active in the community
 - NGOs and CBOs active in the community in the domain of natural resource management
 - important non-fuelwood products present in the forest
 - location and practice of subsistence fuelwood collection
 - community interest in natural resource management
 - community interest in the project
- **Community “Restitution” Workshops:** Once the results of the PRAs have been analyzed, “restitution” workshops to present and validate the findings will be held with communities which participated in PRA.
 - **Regional Implementation Plan Workshops:** At the end of the first year, Regional Workshops will be held to brief community representatives and local administrative officials on the Project Implementation Plan.

Participatory Implementation Phase: Years 2-7

10. As noted above, the six years of project implementation will see a gradual increase in community participation as the number of community managed forests increases. Support structures for participation will be established as well as the implementation of training and capacity building programs.

11. ***Participation:*** PRAs will continue to be the building block in designing community management plans as well as evaluating existing activities and systems. The number of PRAs to be conducted for planning purposes over the six year period is based on the number of communities to be enrolled on a yearly basis. **Table 3** is an estimation of yearly increase in “planning PRAs” which will total 250 by the seventh year:⁴

⁴ This table may change based on the demand by communities or other changes to the project design.

Table 3

Estimation Of Yearly Increase In PRAs

YEAR	# of PRAs
Year 1	15
Year 2	21
Year 3	27
Year 4	35
Year 5	39
Year 6	49
Year 7	64
TOTAL	250

Additionally, “evaluative PRAs” will be conducted annually in selected communities.

12. Issues raised in the first year of PRAs needing a more detailed assessment will serve as the basis for a *Socio -Economic Assessment* to be conducted during the second year of the project. This study will provide a more in-depth analysis of the targeted issues. Findings will be incorporated where appropriate into the project and PRA design to reinforce activities.

13. At the mid-point of the project, a *Beneficiary Assessment* will occur to assess views on the project’s implementation process and services being provided. This assessment will involve various beneficiaries in urban and rural areas as well as service providers such as charcoal producers, transporters, and the government to assess the initial impact of the project. This information will feed into an overall mid-term evaluation report.

14. *Support Structures*: To support the participatory process and ensure its representativity, several structures will be established early on in the implementation phase. Some of these structures will include:

- establishing or reinforcing communication mechanisms and collaboration systems in the zones of intervention,
- establishing consultative groups which will foster dialogue between village participants and the project team,
- establishing alternative mechanisms for conflict resolution and management among stakeholders, and
- establishing a mechanism for monitoring and evaluating participation by local populations

15. *Training and Capacity Building*: Continuous training and capacity building of local organizations and individuals will occur to further ensure sustainability. These activities will take place in technical domains as well as in the areas of financial management, strategic planning, monitoring and reporting, and participatory planning and management. In addition, particular attention will be given to the training and sensitizing of government officials in participatory approaches and their impact on development.

Evaluation Phase: Year 7

16. At the end of the project, a final independent evaluation will be conducted to assess the impact of the project, its sustainability, and its participatory approach. Participating and non-participating communities will be targeted in rural as well as urban zones. Within these zones, representatives of all stakeholders (e.g. women, youth, NGOs, local elected officials, pastoralists, herders, bee-keepers, charcoal producers, the private sector, the Government, and donors) will be surveyed for their views on the process and impact of the project. The evaluation team will be multi-disciplinary and its members independent, having had no previous involvement with the project. The team will be comprised of an NGO and Participation Specialist, an Environmentalist, an Energy Specialist, a Sociologist or Anthropologist with a focus on gender issues, an Institutional Development Specialist, and Economist. With this diverse group it is anticipated to obtain a broad as well as in-depth view of the project's results and impact. Upon its completion, a french version of the evaluation report will distributed to all the project's partners and made available at the Resident Mission.

16. At the end of the project, a final independent evaluation will be conducted to assess the impact of the project on sustainability, and its participatory approach. Participating and non-participating communities will be targeted in rural as well as urban zones. Within these zones, representatives of all stakeholders (e.g. women, youth, NGOs, local elected officials, peasants, herders, bee-keepers, charcoal producers, the private sector, the Government, and donors) will be surveyed for their views on the process and impact of the project. The evaluation team will be multi-disciplinary and its members independent, having had no previous involvement with the project. The team will be comprised of an NGO and Participation Specialist, an Environmentalist, an Energy Specialist, a Sociologist or Anthropologist with a focus on gender issues, an Institutional Development Specialist, and Economist. With this diverse group, it is anticipated to obtain a broad as well as in-depth view of the project's results and impact. Upon its completion, a final version of the evaluation report will be distributed to all the project partners and made available at the Resident Mission.

SENEGAL
SUSTAINABLE AND PARTICIPATORY ENERGY MANAGEMENT PROJECT

Expenditure Accounts Project Cost Summary

	(FCFA '000)			(US\$ '000)			% Foreign Exchange	% Total Base Costs
	Local	Foreign	Total	Local	Foreign	Total		
I. Investment Costs								
A. Goods and Services	237,475.00	589,525.00	827,000.00	474.95	1,179.05	1,654.00	71	9
B. Civil Works	184,800.00	277,200.00	462,000.00	369.60	554.40	924.00	60	5
C. Vehicles/Equipment	8,400.00	1,073,050.00	1,081,450.00	16.80	2,146.10	2,162.90	99	12
D. Materials	240,200.00	355,300.00	595,500.00	480.40	710.60	1,191.00	60	7
E. Studies	140,784.00	195,396.00	336,180.00	281.57	390.79	672.36	58	4
F. Fonds d'appui (Matching Funds)	619,700.00	271,300.00	891,000.00	1,239.40	542.60	1,782.00	30	10
G. Training	328,650.00	302,650.00	631,300.00	657.30	605.30	1,262.60	48	7
H. Campaigns	235,400.00	148,600.00	384,000.00	470.80	297.20	768.00	39	4
I. Consultants	126,128.00	189,192.00	315,320.00	252.26	378.38	630.64	60	4
Total Investment Costs	2,121,537.00	3,402,213.00	5,523,750.00	4,243.07	6,804.43	11,047.50	62	63
II. Recurrent Costs								
A. Gasoil/Gasoline	198,000.00	132,000.00	330,000.00	396.00	264.00	660.00	40	4
B. Office rental / local contracts	197,200.00	-	197,200.00	394.40	-	394.40	-	2
C. Transportation	392,500.00	-	392,500.00	785.00	-	785.00	-	4
D. Vehicle maintenance	428,070.00	285,380.00	713,450.00	856.14	570.76	1,426.90	40	8
E. Salaries	1,630,880.00	-	1,630,880.00	3,261.76	-	3,261.76	-	19
Total Recurrent Costs	2,846,650.00	417,380.00	3,264,030.00	5,693.30	834.76	6,528.06	13	37
Total BASELINE COSTS	4,968,187.00	3,819,593.00	8,787,780.00	9,936.37	7,639.19	17,575.56	43	100
Physical Contingencies	463,935.20	361,470.30	825,405.50	927.87	722.94	1,650.81	44	9
Price Contingencies	-	352,440.13	352,440.13	-	704.88	704.88	100	4
TOTAL PROJECT COSTS	5,432,122.20	4,533,503.43	9,965,625.63	10,864.24	9,067.01	19,931.25	45	113

SENEGAL
SUSTAINABLE AND PARTICIPATORY ENERGY MANAGEMENT PROJECT
 Expenditure Accounts by Components - Base Costs (US\$ '000)

	Preparatory and Support Activities			Sustainable Woodfuels Supply Management				Demand Manag. & Inter-Fuel Subst. Options				Physical Contingencies								
	Vegetation Cover Inventory (Part I)	Participatory Rural Appraisals	Elabor. of Integrated Natural Resource and Equipment System	Institutional Development and Equipment	Preparation Management Modules	Institutional Development	Micro-enterprise and promotion activities	Fonds d'invest. rural micro-enterprises	Global commun. strategy	Dead Wood Assessment/vegetation Inventories	Institut'l Develop.	Modernization of Charcoal Industry	Economic Diversif. of Charcoal Traders	Kérosène: substitution	LPG: inter-fuel substitution	Charcoal Improved Stoves	Other private initiatives	Total	%	Amount
I. Investment Costs																				
A. Goods and Services	-	-	-	-	425.0	-	1,229.0	-	-	-	-	-	-	-	-	-	-	1,654.0	10.0	165.4
B. Civil Works	-	-	-	334.0	-	590.0	-	-	-	-	-	-	-	-	-	-	-	924.0	10.0	92.4
C. Vehicles/Equipment	-	-	-	516.9	-	985.0	529.0	-	-	132.0	-	-	-	-	-	-	-	2,162.9	10.0	216.3
D. Materials	650.0	-	-	100.0	-	-	376.0	-	-	65.0	-	-	-	-	-	-	-	1,191.0	10.0	119.1
E. Studies	-	-	-	31.0	-	498.0	23.3	-	-	-	24.0	36.0	200.0	120	24.0	24.0	-	672.4	10.0	67.2
F. Fonds d'appui (Match)	-	-	-	152.0	-	-	920.0	-	-	-	40.0	-	-	60.0	150.0	140.0	120.0	1,782.0	10.0	178.2
G. Training	-	-	-	201.6	-	937.0	-	-	-	124.0	-	-	-	-	-	-	-	1,262.6	10.0	126.3
H. Campaigns	-	-	-	80.0	-	-	-	168.0	-	520.0	-	-	-	-	-	-	-	768.0	10.0	76.8
I. Consultants	60.0	-	54.0	42.4	-	-	4.2	-	-	470.0	-	-	-	-	-	-	-	630.6	10.0	63.1
Total Investment Costs	710.0	-	54.0	1,457.9	425.0	3,010.0	2,161.6	520.0	168.0	470.0	841.0	64.0	238.0	720	174.0	164.0	120.0	11,947.5	10.0	1,104.8
II. Recurrent Costs																				
A. Gasoil/Gasoline	-	-	-	-	-	660.0	-	-	-	-	-	-	-	-	-	-	-	660.0	5.0	33.0
B. Office rental / local cont	-	-	-	-	-	-	-	-	-	394.4	-	-	-	-	-	-	-	394.4	10.0	39.4
C. Transportation	105.0	-	-	10.0	-	-	-	-	-	630.0	40.0	-	-	-	-	-	-	785.0	9.5	74.5
D. Vehicle maintenance	-	-	-	226.0	-	1,000.4	-	-	-	-	200.5	-	-	-	-	-	-	1,426.9	5.1	73.2
E. Salaires	133.2	66.0	31.8	184.9	105.7	964.8	1,412.3	-	-	763.2	-	-	-	-	-	-	-	3,261.8	10.0	325.9
Total Recurrent Costs	238.2	66.0	31.8	420.9	1,057.7	2,252.2	1,412.3	-	-	1,393.2	634.9	-	-	-	-	-	-	6,528.1	8.4	546.1
Total BASELINE COSTS	948.2	66.0	65.8	1,878.8	530.7	5,235.2	3,573.8	920.0	168.0	1,863.2	1,475.9	64.0	238.0	720	174.0	164.0	120.0	17,575.6	9.4	1,650.8
Physical Contingencies	94.8	6.6	8.6	178.5	52.8	440.5	357.4	92.0	16.8	166.3	133.6	6.4	23.6	7.2	17.4	16.4	12.0	1,650.8	-	-
Price Contingencies	7.0	-	0.5	16.8	5.3	337.0	185.3	41.3	3.1	29.6	58.5	2.1	6.0	1.7	4.0	3.6	3.1	704.9	8.5	59.8
Total PROJECT COSTS	1,050.0	72.6	94.9	2,074.1	588.7	6,012.7	4,116.6	1,053.3	187.9	2,079.1	1,667.9	72.5	265.6	80.9	195.4	184.0	135.1	19,331.3	8.6	1,710.6
Taxes*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Foreign Exchange	475.6	-	36.2	1,138.1	355.9	3,351.3	1,979.9	344.9	30.8	339.8	680.6	31.1	95.8	29.4	69.3	65.6	42.7	9,067.0	8.6	782.7

(* US\$ 190,000 equivalent included within Government's contribution.

SENEGAL
SUSTAINABLE AND PARTICIPATORY ENERGY MANAGEMENT PROJECT
Expenditure Accounts by Years -- Base Costs
(US\$ '000)

	1997	1998	1999	2000	2001	2002	2003	Total	Foreign Exchange %	Amount
I. Investment Costs										
A. Goods and Services	425.0	236.0	250.0	260.0	169.5	169.5	144.0	1,654.0	71.3	1,179.1
B. Civil Works	334.0	290.0	300.0	-	-	-	-	924.0	60	554.4
C. Vehicles/Equipment	516.9	220.0	372.0	620.0	220.0	171.0	43.0	2,162.9	99.2	2,146.1
D. Materials	750.0	260.0	75.0	39.0	39.0	20.0	8.0	1,191.0	59.7	710.6
E. Studies	31.0	196.3	81.0	132.0	58.0	119.0	55.0	672.4	58.1	390.8
F. Fonds d'appui (Matching Funds)	152.0	490.0	430.0	190.0	150.0	200.0	170.0	1,782.0	30.4	542.6
G. Training	201.6	224.0	239.0	235.0	137.0	114.0	112.0	1,262.6	47.9	605.3
H. Campaigns	80.0	152.0	153.0	174.0	174.0	35.0	-	768.0	38.7	297.2
I. Consultants	156.4	124.2	120.0	120.0	70.0	40.0	-	630.6	60.0	378.4
Total Investment Costs	2,646.9	2,192.6	2,020.0	1,770.0	1,017.5	868.5	532.0	11,047.5	61.6	6,804.4
II. Recurrent Costs										
A. Gasoil/Gasoline	-	110.0	110.0	110.0	110.0	110.0	110.0	660.0	40	264.0
B. Office rental / local contracts	-	98.6	98.6	98.6	98.6	-	-	394.4	0	-
C. Transportation	115.0	115.0	115.0	115.0	115.0	105.0	105.0	785.0	0	-
D. Vehicle maintenance	226.0	186.5	210.0	217.4	225.0	181.0	181.0	1,426.9	40	570.8
E. Salaries	521.5	461.8	456.1	456.1	456.1	456.1	454.1	3,261.8	-	-
Total Recurrent Costs	862.5	971.9	989.7	997.1	1,004.7	852.1	850.1	6,528.1	12.8	834.8
Total BASELINE COSTS	3,509.5	3,164.5	3,009.7	2,767.1	2,022.2	1,720.6	1,382.1	17,575.6	43.5	7,639.2
Physical Contingencies	341.2	300.6	284.0	259.3	184.5	157.5	123.7	1,650.8	43.8	722.9
Price Contingencies	29.6	67.2	112.1	162.1	118.2	122.5	93.2	704.9	100.0	704.9
Total PROJECT COSTS	3,880.3	3,532.3	3,405.8	3,188.5	2,324.8	2,000.6	1,598.9	19,931.3	45.5	9,067.0
Taxes*	-	-	-	-	-	-	-	-	-	-
Foreign Exchange	2,005.8	1,545.1	1,572.1	1,647.3	948.0	816.0	532.9	9,067.0	-	-

(*) US\$190,000 equivalent within Government's contribution.

SENEGAL
SUSTAINABLE AND PARTICIPATORY ENERGY MANAGEMENT PROJECT
Project Components by Year - Base Costs
(US\$ '000)

	1997	1998	1999	2001	2002	2003	Total
A Preparatory and Support Activities							
1. Vegetation Cover Inventory (Part 1)	948.2	-	-	-	-	-	948.2
2. Participatory Rural Appraisals	66.0	-	-	-	-	-	66.0
3. Elaboration of Integrated Natural Resource Systems	85.8	-	-	-	-	-	85.8
4. Institutional Development and Equipment	1,878.8	-	-	-	-	-	1,878.8
5. Preparation Management Modules	530.7	-	-	-	-	-	530.7
Subtotal:	3,509.5	-	-	-	-	-	3,509.5
B Sustainable Woodfuels Supply Management							
1. Institutional Development	-	937.5	1,160.5	710.5	731.5	550.5	5,235.2
2. Micro-enterprise and promotion activities	-	943.7	654.4	487.9	479.9	429.4	3,573.8
3. Fonds d'investissement rural micro-entreprises	-	100.0	150.0	150.0	200.0	170.0	920.0
4. Global communication strategy	-	32.0	33.0	34.0	35.0	-	168.0
5. Dead Wood Assessment/Vegetation Inventories	-	352.2	352.2	302.2	272.2	232.2	1,863.2
Subtotal:	-	2,365.4	2,350.1	1,684.6	1,718.6	1,382.1	11,760.2
C Demand Management and Inter-Fuel Substitution Options							
1. Institutional Development	-	351.1	353.6	319.6	2.0	-	1,475.9
2. Modernization of Charcoal Industry	-	46.0	6.0	6.0	-	-	64.0
3. Economic Diversification of Charcoal Traders	-	112.0	112.0	6.0	-	-	236.0
4. Kérosène: substitution	-	30.0	42.0	-	-	-	72.0
5. LPG: inter-fuel substitution	-	74.0	100.0	-	-	-	174.0
6. Charcoal Improved Stoves	-	146.0	6.0	6.0	-	-	164.0
7. Other private initiatives	-	40.0	40.0	-	-	-	120.0
Subtotal:	-	799.1	659.6	337.6	2.0	-	2,305.9
Total BASELINE COSTS	3,509.5	3,164.5	3,009.7	2,022.2	1,720.6	1,382.1	17,575.6
Physical Contingencies	341.2	300.6	284.0	184.5	157.5	123.7	1,650.8
Price Contingencies	29.6	67.2	112.1	118.2	122.5	93.2	704.9
Total PROJECT COSTS	3,880.3	3,532.3	3,405.8	2,324.8	2,000.6	1,598.9	19,931.3
Taxes*	-	-	-	-	-	-	-
Foreign Exchange	2,005.8	1,545.1	1,572.1	948.0	816.0	532.9	9,067.0

(*) US\$190,000 equivalent within Government's contribution.

PERFORMANCE INDICATORS, MONITORING AND SUPERVISION PLAN

Narrative Summary	Key Performance Indicators ¹	Monitoring and Supervision	Critical Assumptions and Risks
Project Development Objectives			
<p>1. Reduce woodfuel-related deforestation and loss of biodiversity.</p> <p>2. Reduce net CO₂ emissions</p> <p>3. Increase income of participating villages, with special attention to women.</p>	<p>1. Reduce deforestation by: <u>Date</u> <u>Ha./yr.</u> B-line: 1,000 M-term: 5,200 Full imp.: 20,000</p> <p>2. Reduce net CO₂ emissions by: <u>Date</u> <u>Tons/yr.</u> B-line: 25,000 M-term: 130,000 Full imp.: 510,000</p> <p>3. Generate revenues in participating villages: <u>Date</u> <u>US \$/yr.</u> B-line: 150,000 M-term: 780,000 Full imp.: 3,000,000</p>	<p>1. Annual evaluation of forest resource exploitation.</p> <p>2. Annual climate change assessment.</p> <p>3. Annual evaluation of development impacts.</p>	<p>1. Effective participation of rural community on sustainable forest management systems.</p> <p>2. Implementation of: sustainable forest management systems; improved carbonization; and improved stoves.</p> <p>3. Project capable of providing effective rural development support to participating villages.</p>
Project Implementation and Outputs by Component			
<p>ARTA:</p> <p>1. Undertake Forest Resources Assessment (Tamba/Kolda).</p> <p>2. Undertake participatory rural appraisals.</p> <p>3. Design of monitoring and evaluation systems</p> <p>4. Institutional development and capacity building.</p> <p>5. Prepare implementation plan for PART B.</p> <p>6. Prepare implementation plan for project PART C and launch demand management studies.</p> <p>7. Design project communication strategy.</p>	<p>1. FRA completed by month 14 of implementation.</p> <p>2. PRAs for first 20 villages completed by month 12. (PRAs continued through year 6).</p> <p>3. M&E systems designed by month 12.</p> <p>4. Institutions and field implementation teams ready by month 14.</p> <p>5. Implementation plan ready by month 11.</p> <p>6. Implementation plan ready and studies launched by month 14.</p> <p>7. Comm. strategy design by month 8.</p>	<p>1.1. Quarterly progress report and annual supervision.</p> <p>2. <i>IDEM</i>.</p> <p>3. <i>IDEM</i></p> <p>4. <i>IDEM</i></p> <p>5. <i>IDEM</i></p> <p>6. <i>IDEM</i></p> <p>7. <i>IDEM</i></p>	<p>1. Technical capacity of project team and contracted consultants/NGOs.</p> <p>2. <i>IDEM</i>.</p> <p>3. <i>IDEM</i></p> <p>4. <i>IDEM</i></p> <p>5. <i>IDEM</i></p> <p>6. <i>IDEM</i></p> <p>7. <i>IDEM</i></p>

¹ Baseline and targeted values should be shown, with the latter divided into values expected at mid-term, end of project and full impact.

PART B:			
1. Implement sustainable community-based forest management systems.	1. Area under management: <u>Date</u> <u>Hectares</u> B-line: 15,000 M-term: 80,000 Full imp.: 300,000	1.1. Bi-annual progress report and field supervision.	1. 1. Effective participation of rural community and of provision of TA and support to rural communities.
2. Sustainably produce fuelwood	2. Annual sustainable fuelwood production: <u>Date</u> <u>Tons/yr.</u> B-line: 15,000 M-term: 80,000 Full imp.: 300,000	2. <i>IDEM</i>	2. <i>IDEM</i> .
3. Support for establishment of rural micro-enterprises.	3. Minimum villages assisted (50% of villages covered): <u>Date</u> <u>Villages</u> B-line: 5 M-term: 35 Full imp.: 125	3. Quarterly progress report and bi-annual supervision.	3. 1. Effective participation of rural community and existence of enterprise potential. 3.2. Effective provision of TA and support to micro-enterprises.
4. Implement communicat. strategy of PART B.	4. Publication of monthly newspaper article and quarterly newsletter.	4. Bi-annual progress report.	4. None.
PART C:			
1. Modernization of urban charcoal trade.	1. Marketing of bagged charcoal: <u>Date</u> <u>Tons</u> B-line: 2,000 M-term: 14,000 Full imp.: 50,000	1. Bi-annual progress report.	1.1. Effective participation of charcoal traders. 1.2. Technical competence of TA and support teams.
2. Technical assistance and limited financial support for economic diversification of charcoal traders.	2. Number of traders assisted. (no preset targets)	2. <i>IDEM</i>	2. <i>IDEM</i> .
3. Support promotion of LPG and kerosene (private sector) and improved stoves (NGO)	3.1. Incremental penetration of kerosene (no preset target). 3.2. Incremental penetration of LPG (no preset target).	3.1. Annual evaluation of Kerosene penetration. 3.2. Annual evaluation of LPG penetration.	3.1. Stable petroleum product prices. 3.2. Good supply response by private sector operators.
4. Increase urban use of improved charcoal stoves.	4. Marketing of improved charcoal stoves (cummul.): <u>Date</u> <u>Stoves</u> B-line: 20,000 M-term: 100,000 Full imp.: 255,000	4. Bi-annual evaluation of stove penetration.	4. Good supply response of NGO/private sector stove producers.

ECONOMIC ANALYSIS

General Context

1. The economic evaluation of natural resource management activities and investments in developing countries has been the subject of continued discussion during the last three decades. The lack of consensus among economists on the subject stems primarily from the difficulties in arriving at a proper valuation of the natural resources in question, delimiting the frontiers of the systems and activities under analysis, and defining the objective function of the problem under analysis.

2. Unlike most post-industrialized countries, where there are well established market systems and regulatory, public consultation and arbitrage mechanisms, developing economies are generally characterized by imperfect markets (information, access, etc.), regulated pricing schemes, and *inter alia* lack of public participation and consultation in natural resource allocation decisions.¹ The specific case of the forest resources in Senegal is a good example of that situation. As a direct legacy of the colonial period all land and forest resources "belong" to the national government. The government through less than transparent mechanisms has historically assigned the rights to commercial forest exploitation to a limited number of individuals in detriment of the vast rural populations, which have until recently lost their surrounding forest resources and related habitats without receiving any compensation for it nor being able to participate in the decision process. Forest lands have been systematically denuded for different purposes, such as, for the expansion of the agriculture frontier, the extraction of precious woods, construction materials, woodfuels and medicines. Operating under the assumption that those resources had no inherent economic value other than as processed inputs or products and that belonging to the state there was no need to compensate rural populations for their loss, forest resources have historically been valued at their direct cost of extraction, processing and handling. Under that scenario, the ecological value of the standing forest stocks, their social value and the value of their multiple economic linkages have been systematically disregarded. Government agencies and individuals have operated under that scenario driven by narrow political and financial interests, and have been able to do so for a long time because of the lack of political representativity of the rural populations. Economic analysts, on their part, constrained by lack of adequate information and quantifiable parameters, being pegged down to

¹ A good illustration of the practical differences in economic valuation between post-industrialized and developing countries is the comparison between the long standing discussion in the United States and Canada concerning the logging industry and its implications on the habitat of the endangered Spotted Owl and the forest logging industry in West African countries and their impact on the "endangered" rural communities. In the case of the Spotted Owl, the direct financial interests of the logging industry (included owners, labors, related business, etc.) have been successfully challenged over the years by the environmental and bio-diversity conservation interests of a much wider social constituency across the two countries. In the case of Senegal, large scale clear-cutting of forests by a handful of urban-based individuals (for the expansion of export agriculture, for construction materials, extraction of precious woods and woodfuels, etc.) has taken place since the colonial period with zero or near to zero consultation and or compensation to the affected rural indigenous populations.

classical evaluation techniques, and/or by being forced to define the frontiers and objective functions of the problems under analysis in a very narrow sectorial basis, have frequently been unable to contribute to the proper valuation of the resources.

3. If an "economic" analysis of a forest resource investment has to be undertaken, it stands to reason that the analysis must attempt to capture the society's value and not that of a small interest group. In an economy where the market functions in a relatively open manner and where all segments of society have representative participation in the process of making economic decisions (through the price mechanism or through other regulatory and/or consultative mechanisms) there would be little room to question classical welfare economics assumptions. On the other hand, in an economy plagued with market failures and where the actual distribution of welfare is extremely skewed, it is extremely difficult to agree that the economic value of standing forest stocks would be **zero** or anywhere near to it, as it has been frequently proposed. When examples of such zero valuation are examined in more detail, however, one readily realizes that more often than not that valuation was the result of the way in which the frontier and objective function of the analysis were defined.

4. If an economic analysis focuses strictly on the supply of woodfuels to urban markets and either assumes that the forest resources are "stock resources"² or that the prevailing woodfuels price structures already account for resource conservation through "stumpage fees" or other mechanism, then it would be possible to conclude that the financial costs of generating the intended supply of woodfuels (extraction, transportation and marketing) are the central parameters to account and that the real social value of the forest (not just to a few individuals) is already included as a production cost. Under that approach, an analysis could further focus on the cost of supplying a given volume of final useful energy (measured in terms of tons of oil equivalent or other calorific unit) and, on that basis, compare the economics of woodfuels supplies with other potential alternative energy sources. Such an analysis would not be appropriate for evaluating the **proposed "Sustainable and Participatory Energy Management Project"** in Senegal because of the following principal reasons:

- (i) the supply of woodfuels to urban markets is the desired energy outcome of the project, but doing so in an environmentally sustainable and socially equitable manner is an equally important objective;
- (ii) there is undisputed evidence that the prevailing forest resource exploitation schemes in Senegal are both ecologically and socially detrimental and non-sustainable;
- (iii) there is equally undisputed evidence that, at the scale at which forest resource are being exploited in Senegal for obtaining woodfuels (mainly charcoal), the resulting ecosystems degradation greatly affects other economic sectors like

² Natural "stock resources" are defined as resources which are finite within a human realizable timeframe. Fossil fuels are considered "stock resources" because although they have a natural generation process their natural production function runs in the millions of years and hence any unit consumed in the present would be irreversibly discounted from the existing stock. The economic implication of that is that their valuation would only need to account for the societal preference of consumption in time period t_0 vis-à-vis time period t_{0+n} .

- agriculture, and that as rural ecosystems degrade rural poverty increases, there is a loss of rural employment, and among many other impacts, an acceleration of rural exodus (with the consequent exacerbation of urban social and economic conflicts and costs);
- (iv) given the current a foreseeable level of woodfuel consumption, the economy can not possibly sustain large scale inter-fuel substitution programs based on expensive imported fuels;
 - (v) under the present system of exploitation resource costs and prices do not account for resource regeneration nor for compensation to the rural populations. Defined in that way, the proposed project can not possibly be evaluated either in its own merits or compared to the alternative supply of energy from a narrow direct factor cost perspective. Furthermore, if the now well accepted postulate that urban development holds the key to future aggregate economic growth in the African countries (and elsewhere) is factored into the analysis, establishing sustainable rural woodfuel supply systems for the urban energy markets would provide a stable and mutually beneficial rural-urban interaction market mechanism; and
 - (vi) forest resources in Senegal are "flow resources with a critical zone"³ and are already being used above their natural inflow rate resulting in an implicit loss a continued stream of quantifiable benefits (good and services) through time.

The Project Rationale

5. The supply of woodfuels to the urban and peri-urban energy market in Senegal is based on geographically concentrated and non-sustainable forest resource management practices (clear cutting). Given the relatively low efficiency of wood-to-charcoal conversion (18%) due to inefficient carbonization, total charcoal consumption is equivalent to 1.2 times the total consumption of fuelwood. Charcoal is currently produced in the Kolda and Tambacounda regions, some 400 km away from the principal urban (Dakar and Thies) and peri-urban markets.

6. Until recently forestry legislation gave the Forest Service the exclusive prerogative to assign commercial exploitation rights over forest resources nationwide. These rights were historically given only to urban-based traders resulting in the creation of a vertically integrated and oligopolistic industry with widespread corruption problems. Among other issues, original annual charcoal exploitation quotas were frequently surpassed with the Forestry Service lacking the manpower or monitoring mechanisms to adequately supervise and enforce them. It is

³ Natural "flow resources with a critical zone" are defined as natural resources which have a natural regeneration function within a realizable human timeframe, but if their use rate is greater than their natural regeneration rate (inflow rate) they become finite (stock resources) for practical purposes. The economic implication of that is that when used within the critical zone (net depletion) their valuation must include the forgone value of the lost regeneration and the resulting non-availability for continued use through time. Compared to stock resources -- say woodfuels vis-à-vis LPG -- either the valuation of the woodfuel (flow resources) has to be higher or the discount rate that it is applied to them needs to be lower in order to reflect the loss of the continued stream of benefits through time.

estimated that out of the some 1800 legally registered "*Exploitant Forestiers*" only some 20 traders actually work and control the urban charcoal trade. The remainder registered traders buy charcoal production licenses ("quota charbon") and resell them afterwards to the traders that actually produce charcoal. As even the temporary expatriate laborers (Guinean Fulbes, "sourghas") employed in the cutting of the wood and the production of the charcoal are brought in to the rural areas by the urban traders, it is estimated that much less than 5% of the annual turnover of the charcoal trade (US \$ 60 million) remains in the rural areas. The transport of the charcoal, which represents close to 20% of the final cost structure of the charcoal, is provided by independent trucking companies on a cash payment basis. Over the years, the operation of the charcoal industry has resulted in: (i) the gradual loss of forest cover (approx. 30,000 ha/year) and thus of the **ecosystem's carbon sequestration capacity and biodiversity**; (ii) the degradation of the rural environment (particularly of the soils); (iii) the impoverishment of the rural areas; (iv) an acceleration of the rural exodus; and (v) a massive transfer of wealth from the rural areas to the urban areas. In addition to these negative impacts, it is anticipated that the **Niokolo-Koba National Park** ("International Biosphere Reserve Patrimony", 9,130 km²), which is located in the south-eastern corner of the Tambacounda and Kolda regions and which is a declared national and international biodiversity patrimony and "Biosphere Reserve", will come under threat of encroachment within the next decade, with irreparable biodiversity and ecological consequences at the national and global levels.

7. The organization of the urban and peri-urban fuelwood trade (520,000 tons/year) resembles that of the charcoal trade but poses considerable smaller environmental and social conflicts. The consumption of fuelwood in the rural areas (1.5 million tons/year) is largely satisfied through sustainable subsistence practices (cutting of branches, selective felling of small trees and collection of dead branches). **Women and children** play a significant role in the collection of fuelwood. Rural consumption of charcoal is mostly limited to the areas where it is produced and is normally traded by the producers for food and lodging at the local communities.

8. Project Objectives. The objective of the project is to meet an important part of the rapidly growing urban demand for household fuels, without the loss of forest cover and the ecosystem's carbon sequestration potential and biodiversity. This objective would be met through: (i) the implementation and monitoring of 300,000 hectares of environmentally sustainable community-managed forest resource systems in the Tambacounda and Kolda regions of Senegal, creating a protection zone around the **Niokolo-Koba National Park** (Biosphere Reserve); (ii) the promotion of private sector inter-fuel substitution and private sector and NGO-based improved stoves initiatives; and (iii) the strengthening of the institutions involved in the management of the sector, and the promotion of the participation of the civil society (private sector, academic institutions, and NGOs community) in the operation of the sector.

9. Project Description. The project consists of three components: **Preparatory and Support Activities, Sustainable Woodfuels Supply Management and Demand Management and Inter-fuel Substitution Options.** The project design includes a series of activities to ensure an effective participation of the rural population ("*measures incitatives*") and thus guarantee the full achievement of the environmental sustainability objective of the project. The project also includes specific monitoring and evaluation activities (forest exploitation and wildlife) designed to evaluate the achievement of its global environmental objectives (maintenance of carbon sequestration capacity, CO₂ emission abatement and biodiversity conservation)

10. **Project Benefits.** The project is expected to: (i) sustainably produce some **860,000 tons** of fuelwood (equivalent to 258,000 tons of efficiently produced charcoal) over a six year period and would establish a permanent system capable of producing more than 300,000 tons of fuelwood (equivalent to 90,000 tons of efficiently produced charcoal or **27 percent** of total consumption) per year on a sustainable basis; (ii) reduce woodfuels-related deforestation in the Tambacounda and Kolda regions by some **16,000 to 20,000 ha/year**, and as a consequence reduce **net CO₂ emissions** by about **510,000 tons/yr** and reduce the loss of biodiversity by the establishment of sustainable forest systems and of a protective buffer zone around the **Niokolo-Koba National Park**; (iii) generate employment and economic development opportunities in 250 rural villages in the Tambacounda and Kolda regions and including women in the management and marketing of woodfuels and other related income generating activities; (iv) generate during the implementation period more than **US \$10 million** in direct revenues to 250 villages from the trade of woodfuels, and generate additional revenues to the communities from related natural resource management and exploitation activities (agro-forestry, livestock keeping, non-fuelwood forest products, etc.); (v) on a sustainable annual basis after the end of the project, generate direct revenues in excess of **US \$3 million** to the participating villages from the trade of woodfuels, and generate additional revenues from related natural resource management and exploitation activities; (vi) reduce CO₂ emissions by **420,000 tons/yr.** by the distribution of **225,000** improved charcoal stoves in urban areas; (vii) increase the availability and access of low income households to more reliable and efficient charcoal stoves and to modern fuels; and (viii) strengthen the planning, policy making and implementation supervision capacity of the traditional energy sector institutions, while increasing the participation of the civil society (private sector, academic institutions, and NGO's community) in the management and operation of the sector.

Other Project Options

11. With assistance of the Bank's Africa Regional Program "**Review of Policies in the Traditional Energy Sector - RPTES**", a national inter-ministerial team conducted a 2-year comprehensive review of the traditional energy sector in Senegal (fuelwood and charcoal), including the evaluation of the principal inter-fuel substitution issues and options (kerosene and LPG). Within that review, the regulatory, legal, pricing and fiscal frameworks of the sector and the evolution of its structure and functioning were studied in detail. The RPTES review concluded that given the country's present and foreseeable macroeconomic and socio-economic conditions, Senegal will continue to depend on forest-based traditional fuels to meet the lion's share of the country's urban and rural energy needs well into the next century. While ongoing demand management (improved stoves programs and consumer education campaigns) and inter-fuel substitution (LPG and kerosene) efforts need to be continued and improved to incorporate the lessons learned to date, large increases of petroleum products imports cannot be sustained because of budgetary constraints and because current low household income levels severely limit the potential for widespread inter-fuel substitution at non-subsidized market prices. Within that context, and until economic growth allows for such substitution to take place, the principal challenge of the energy sector in Senegal will be to transform the existing non-sustainable commercial woodfuels supply system into one capable of supplying woodfuels -- particularly charcoal -- to the rapidly growing urban population in an sustainable manner.

12. Previous Government run efforts at demand management (improved stoves programs and consumer education campaigns) and inter-fuel substitution (LPG and kerosene) have had mixed results. Without a significant shift in policy to promote an active involvement of the private sector in the expansion of interfuel substitution and demand management efforts at the massive level required would be neither fiscally sustainable nor sufficient. At close to US \$ 750 per ha⁴ forest plantation schemes have proven to be economically unfeasible though-out West Africa. The possibility to open additional forest areas for commercial exploitation of woodfuels has been evaluated and determined unfeasible due to the fragility of the forest stocks and the economic cost of extraction. The proposed project will therefore concentrate on introducing sustainable forest/natural resource management systems in the **Kolda** and **Tambacounda** regions for the supply of charcoal and will support a shift towards private sector-based promotion of improved charcoal stoves and least-cost interfuel substitution options.

13. Within that context, there is clear agreement between the borrower and the project participating donors that there are no other economically or technically feasible project alternatives capable of delivering the intended outputs, benefits and developmental impacts that the proposed is expected to deliver.

The Evaluation Methodology

14. Within the general and country-specific framework defined above, a deliberate effort was made to elaborate a simplified economic evaluation methodology yet capable of including the inter-temporal social valuation of the forest resources, the distributional effects of their exploitation, and the value of the benefits saved through the introduction of sustainable resource management practices and improved end-use energy technology and the principal measurable global environmental benefits.

15. Methodological disclaimer. As the only feasible alternative to the project is to do nothing, i.e., to continue to exploit forest resources in an environmentally unsustainable and socially inequitable manner in the exact same areas where the project would be implemented (Tambacounda and Kolda regions), considerations of transportation or other marketing costs were purposely excluded from the analysis. Fiscal impacts were also excluded from the analysis because they are estimated to be negligible, if not further supportive of the proposed project. Under the current woodfuels taxation system, actual collection of "stumpage fees" is less than 40%. The proposed project includes the strengthening of the control of woodfuel flows and is thus expected to increase the actual tax collection rates. On the other hand, the project will also introduce a differential taxation (50 percent reduction) favoring the proposed community-based sustainable forest management systems. Hence, it is estimated that the project will be either neutral or will have only a modest positive impact on fiscal revenues. The option of maintaining flat taxation rates to increase fiscal revenues was ruled out from the start as: (i) differential taxation

⁴ Data from plantation projects through-out Africa indicate a total cost range of US \$ 450 to US \$750 per hectare, where the higher end corresponds to projects within Sahelian edafoclimatic conditions and the lower end to projects in East and Southern Africa.

is required to provide a price protection from non-managed woodfuel exploitation⁵; and (ii) government collected "stumpage fees" are justified under the assumption that the tax collected will be reinvested in the regeneration of the forest stocks. Since this is not the case in Senegal, and through the implementation of the project the rural communities will be responsible for assuring the sustainability of the resource, there is no rational economic justification to maintain the same level of taxation for community managed and non-managed areas.

Project Components

16. All three components of the project (Preparatory and support Activities Component; Sustainable Supply Management Component; and Demand Management and Inter-fuel Substitution Options Component) were included in the economic analysis as they are judged to be necessary and integral elements of the proposed investment. No differential valuation treatment was given to investments for productive (forest management, improved kilns, improved stoves, inter-fuel substitution options, etc.) or non-productive sub-components (data generation and gathering, institutional development, capacity building, social support services, communication strategy, etc.).⁶

Evaluation Horizon and Project costs

17. Because of the long-term nature of the proposed project objectives and expected impacts, a project evaluation horizon of **20 years** was adopted. All budgeted costs during project implementation (7 years) were included in the economic analysis of the project. From years 8 to 20 realistic continued implementation costs were assumed at approximately **10 percent** of year 7 costs, gradually decreasing at a relative rate of 10 percent per year until year 20. That continued but phasing-out cost structure between years 8 and 20 was discussed and agreed upon with the borrower. **Table 1** presents the budgeted project costs by component and main sub-components per year for the 20-year project evaluation horizon. **Figure 1** presents the profile of project costs by component.

18. The implication of that cost structure is that the borrower recognizes that the subsequent cost of maintaining the system that will be put in place will be much smaller than that of its original introduction. The importance of that is that once the large up-front costs of institutional development and capacity building (both of governmental and civil society) are met, subsequent

⁵ This has been widely agreed upon and implemented in several forestry/natural resource/energy related Bank projects such as "Niger Energie II" and "Mali Energie Domestique".

⁶ Although it is normal practice to exclude non-productive components from economic analyses -- as it is difficult to calculate specific economic returns on things such as institutional development, capacity building, etc. -- in the case of the proposed project it was judged that those investments could not be dissociated from the expected project outcomes. If such investments are made and the project does not achieve its proposed objectives, they would amount to an unequivocal misallocation of scarce investment resources. In practical terms, the impact of including all project cost represent an added burden of proof for the overall merits of the project.

SENEGAL SPEMP: ECONOMIC ANALYSIS CALCULATIONS

PROJECT COMPONENTS/SUBCOMPONENTS	YEARS											
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	
A. Component I: Preparatory & Support Activities												
1. Vegetation Cover Inventory (part 1)	1,003	0	0	0	0	0	0	0	0	0	0	0
2. Participatory Rural Appraisals	70	0	0	0	0	0	0	0	0	0	0	0
3. Elaboration of Integrated Nat. Res. Managt. Systems	560	0	0	0	0	0	0	0	0	0	0	0
4. Elaboration of Legislative Framework	160	0	0	0	0	0	0	0	0	0	0	0
5. Elaboration of Monitoring Systems	90	0	0	0	0	0	0	0	0	0	0	0
6. Institutional development + Equipment (DE + DEF)	1,985	0	0	0	0	0	0	0	0	0	0	0
Sub-total Component I:	3,858	0	0	0	0	0	0	0	0	0	0	0
B. Component II: Sust. & Part. Supply Management												
1. Institutional Development + Equipment DEF	0	1,014	1,280	1,289	821	864	669	100	90	81	73	
2. Field Implementation	0	1,011	707	631	535	477	477	50	45	41	36	
3. Micro-enterprise Development Promotion	0	108	165	168	171	232	201	0	0	0	0	
4. Communication Strategy	0	32	33	34	34	35	35	0	0	0	0	
5. Dead Wood Assess./Veget. Cover Inventories (Part 2)	0	376	380	384	297	300	286	0	0	0	0	
Sub-total Component II:	0	2,542	2,566	2,506	1,859	1,962	1,603	150	135	122	109	
C. Component III: Demand Management & Substitution Options												
1. Institutional Development + Equipment DE	0	310	380	316	140	130	130	40	36	32	29	
2. Modernization of Charcoal Industry	0	60	10	10	10	10	10	0	0	0	0	
3. Economic Diversification of Charcoal Traders	0	100	100	10	10	10	10	0	0	0	0	
4. Kerosene Inter-fuel Substitution	0	38	45	0	0	0	0	0	0	0	0	
5. LPG Inter-fuel Substitution	0	88	115	10	10	10	10	0	0	0	0	
6. Charcoal Improved Stoves	0	330	10	10	10	10	10	0	0	0	0	
7. Communication Strategy	0	140	140	160	100	50	40	0	0	0	0	
Sub-total Component III:	0	1,053	800	516	280	200	190	40	36	32	29	
TOTAL PROJECT COSTS	3,858	3,594	3,366	3,021	2,139	2,162	1,793	190	171	154	139	
CUMMULATIVE PROJECT COSTS	3,858	7,452	10,818	13,839	15,978	18,140	19,933	20,123	20,294	20,448	20,586	

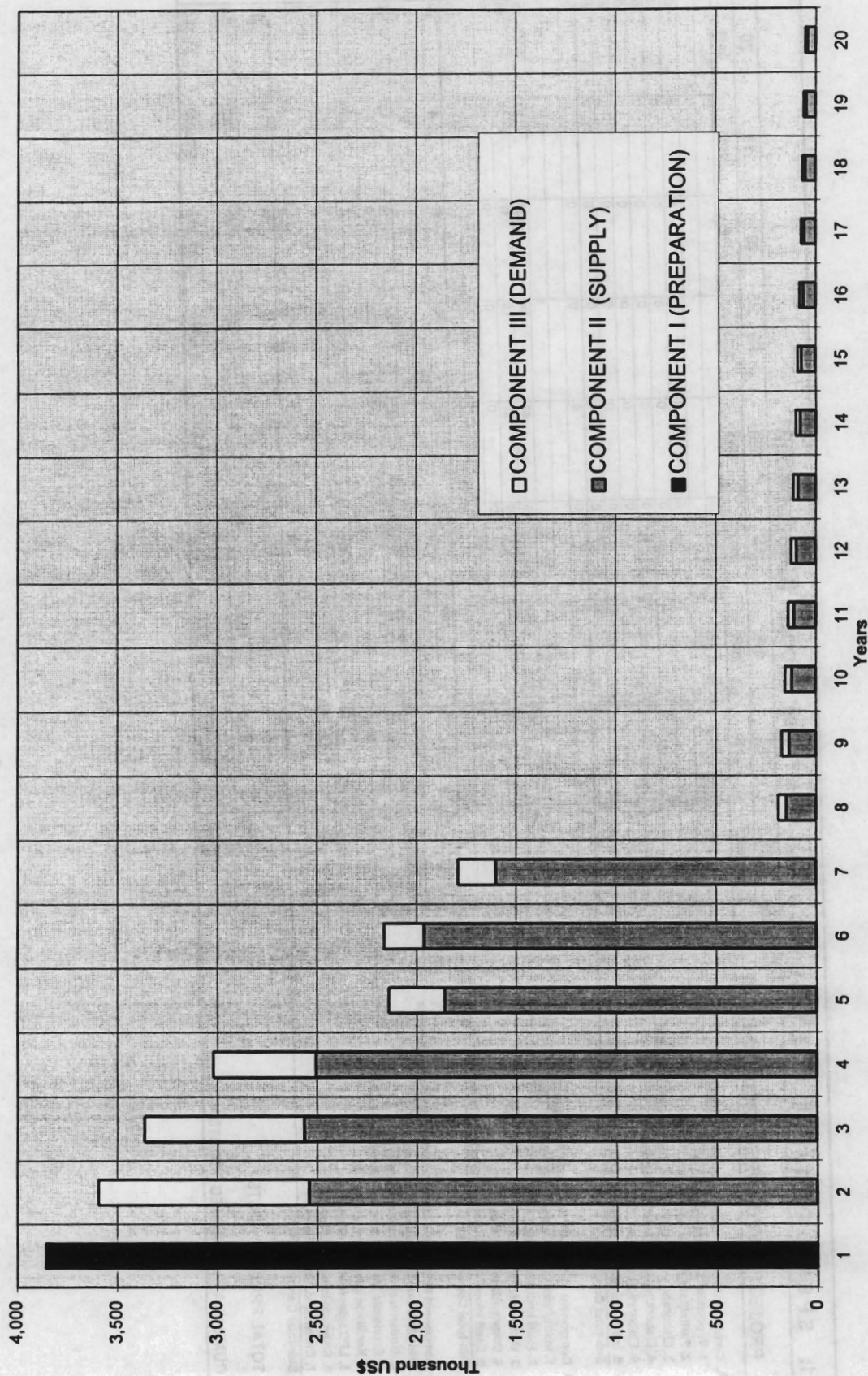
SENEGAL SPEMP: ECONOMIC ANALYSIS CALCULATIONS

Table 1: SPEMP: PROJECT COSTS BY COMPONENT (000' US DOLL (Continuation)

PROJECT COMPONENTS/SUBCOMPONENTS	YEARS											TOTAL															
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018		Total														
A. Component I: Preparatory & Support Activities																											
1. Vegetation Cover Inventory (part 1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,003			
2. Participatory Rural Appraisals	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70		
3. Elaboration of Integrated Nat. Res. Managt. Systems	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	550		
4. Elaboration of Legislative Framework	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160		
5. Elaboration of Monitoring Systems	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90		
6. Institutional development + Equipment (DE + DEF)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,985		
Sub-total Component I:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,858		
B. Component II: Sust. & Part. Supply Management																											
1. Institutional Development + Equipment DEF	66	59	63	48	43	39	35	31	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	6,684	
2. Field Implementation	33	30	27	24	22	19	17	16	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	4,266	
3. Micro-enterprise Development Promotion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,045	
4. Communication Strategy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	168	
5. Dead Wood Assess./veget. Cover Inventories (Part 2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,994	
Sub-total Component II:	98	89	80	72	65	58	52	47	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	14,156	
C. Component III: Demand Management & Substitution Options																											
1. Institutional Development + Equipment DE	26	24	21	19	17	15	14	13	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	1,703	
2. Modernization of Charcoal Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	
3. Economic Diversification of Charcoal Traders	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	240	
4. Kerosene Inter-fuel Substitution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	83	
5. LPG Inter-fuel Substitution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	220	
6. Charcoal Improved Stoves	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	380	
7. Communication Strategy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	630	
Sub-total Component III:	26	24	21	19	17	15	14	13	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	3,338	
TOTAL PROJECT COSTS	125	112	101	91	82	74	66	60	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	21,350	
CUMMULATIVE PROJECT COSTS	20,711	20,823	20,924	21,015	21,097	21,170	21,237	21,296	21,350	21,350	21,350	21,350	21,350	21,350	21,350	21,350	21,350	21,350	21,350	21,350	21,350	21,350	21,350	21,350	21,350	21,350	21,350

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FIGURE 1
SPEMP: Profile of Project Costs by Components
(20-Years Horizon)



investment (follow-up projects) to further expand the total area under community management should be much lower on a unit basis (per hectare cost) than what they are for this first project. The unit cost of the proposed project is of the order of US \$66.6 per hectare (including all project costs).⁷ Subsequent investments should not amount to more than US \$30 per hectare at current price equivalence.

Project Benefits and Valuation

19. While the proposed project is expected to result in a large number of quantifiable and non-quantifiable impacts the methodology adopted conservatively limited the valuation to the following expected project benefits:

(i) **“sustainable” wood production**: the benefit of the “sustainable” wood production expected to result from the implementation of the sustainable and participatory forest/natural resource management systems was defined as the net reduction in deforestation (loss of forest standing stocks) in a comparison between an area under sustainable management and an equivalent area under non-sustainable exploitation. A concept of area equivalence was introduced to avoid an overvaluation of benefits as the amount of wood output that would be extracted from a sustainably managed area (1 ton/ha) is not the same as from an area that is clear-cut (15 ton/ha). The equivalence was thus calculated on the basis of the total expected wood output of the area that will be placed under sustainable management at every year of the project and that wood volume was converted to hectare under clear-cut rates. As the areas under management increase from year 2 to 7 the equivalent non-sustainable areas were increased. For the areas under non-sustainable management a realistic 20 percent natural regeneration rate was assumed. The calculation of the net deforestation impact was computed as being the total deforestation minus the natural regeneration in a area non-sustainably exploited equivalent in wood output to the total area under sustainable management within the project. The effect of that model was that as the total area under management within the project scenario stabilized at 300,000 ha (sustainably producing an output of 300,000 tons of wood per year) an net deforestation of 16,000 hectares per year was accrued to the non-project scenario. That 16,000 ha was the result of a total of 20,000 ha deforested minus a 4,000 ha natural regrowth allowance. Over the 20-year project cycle the non-project scenario resulted in a net total deforestation of **248,800 ha**. By making that area/output equivalence it meant that during the period of analysis both scenarios (managed and non-sustainable) resulted in the same amount of wood production but the whereas 248,800 ha of forest were lost in the non-sustainable scenario, the sustainably managed scenario have conserved intact the original 300,000 hectares of forests.

Table 2.1, 2.2 and 2.3 presents the detailed calculation of the benefit of the “sustainable” wood production including parametric variations ranging from sustainable

⁷ If only the costs of the supply side management sub-components are taken into account cost of the implementation of community-based sustainable forest management systems would be of the order of US \$ 53/hectare. If only the direct field investment costs are taken into account the cost per hectare would come down to US \$ 35/hectare.

SENEGAL SPEMP: ECONOMIC ANALYSIS CALCULATIONS

Table 2.1: NET DEFORESTATION REDUCTION IMPACT FROM SUSTAINABLE & PARTICIPATORY FOREST MANAGEMENT

TOTAL HECTARES UNDER MANAGEMENT	0	1	2	3	4	5	6	7	8	9	10	11
SUSTAINABLE FOREST YIELDS:												
1.00 ton/hectare/year		15,000	40,000	80,000	130,000	200,000	300,000	300,000	300,000	300,000	300,000	300,000
1.50 ton/hectare/year		22,500	60,000	120,000	195,000	300,000	450,000	450,000	450,000	450,000	450,000	450,000
2.00 ton/hectare/year		30,000	80,000	160,000	250,000	400,000	600,000	600,000	600,000	600,000	600,000	600,000
NON-SUSTAINABLE EQUIVALENCE CALCULATION:												
HA CLEAR-CUT TO MATCH SUSTAINABLE PRODUCTION		1,000	2,667	5,333	8,667	13,333	20,000	20,000	20,000	20,000	20,000	20,000
		1,500	4,000	8,000	13,000	20,000	30,000	30,000	30,000	30,000	30,000	30,000
		2,000	5,333	10,667	17,333	26,667	40,000	40,000	40,000	40,000	40,000	40,000
REGROWTH PERCENTAGE PER LEVEL OF CLEAR-CUT		200	533	1,067	1,733	2,667	4,000	4,000	4,000	4,000	4,000	4,000
		300	800	1,600	2,600	4,000	6,000	6,000	6,000	6,000	6,000	6,000
		400	1,067	2,133	3,467	5,333	8,000	8,000	8,000	8,000	8,000	8,000
NET DEFORESTATION REDUCTION (-CLEAR-CUT + REGROWTH)												
1.00 ton/hectare/year		800	2,133	4,267	6,933	10,667	16,000	16,000	16,000	16,000	16,000	16,000
1.50 ton/hectare/year		1,200	3,200	6,400	10,400	16,000	24,000	24,000	24,000	24,000	24,000	24,000
2.00 ton/hectare/year		1,600	4,267	8,533	13,867	21,333	32,000	32,000	32,000	32,000	32,000	32,000
ANNUAL INCREMENT TO AREA UNDER MANAGEMENT:		15,000	25,000	40,000	60,000	70,000	100,000	100,000	0	0	0	0
ACCUMULATED AREAS (HA) UNDER EXPLOITATION:		15,000	40,000	80,000	130,000	200,000	300,000	300,000	300,000	300,000	300,000	300,000

Table 2.2: SENSITIVITY OF EXPECTED DEFORESTATION WITHOUT SUSTAINABLE FOREST MANAGEMENT

	1	2	3	4	5	6	7	8	9	10	11
1.00 ton/hectare/year											
PREVIOUS AREA UNDER EXPLOITATION (T-1)		0	14,200	37,067	72,800	116,867	175,200	259,200	243,200	227,200	211,200
ANNUAL INCREMENT OF AREA ON YEAR T		15,000	25,000	40,000	60,000	70,000	100,000	100,000	0	0	0
TOTAL AREA UNDER EXPLOITATION:		15,000	39,200	77,067	132,800	186,867	275,200	359,200	343,200	327,200	311,200
NET ANNUAL DEFORESTATION:		800	2,133	4,267	6,933	10,667	16,000	16,000	16,000	16,000	16,000
NET CARRY FORWARD:		14,200	37,067	72,800	116,867	175,200	259,200	243,200	227,200	211,200	195,200
1.50 ton/hectare/year											
PREVIOUS AREA UNDER EXPLOITATION (T-1)		0	13,800	35,600	69,200	103,800	162,800	238,800	214,800	190,800	166,800
ANNUAL INCREMENT OF AREA ON YEAR T		15,000	25,000	40,000	60,000	70,000	100,000	100,000	0	0	0
TOTAL AREA UNDER EXPLOITATION:		15,000	38,800	75,600	129,800	173,800	262,800	338,800	314,800	290,800	266,800
NET ANNUAL DEFORESTATION:		1,200	3,200	6,400	10,400	16,000	24,000	24,000	24,000	24,000	24,000
NET CARRY FORWARD:		13,800	35,600	69,200	103,800	162,800	238,800	214,800	190,800	166,800	142,800
2.00 ton/hectare/year											
PREVIOUS AREA UNDER EXPLOITATION (T-1)		0	13,400	34,133	65,600	101,733	150,400	216,400	186,400	164,400	142,400
ANNUAL INCREMENT OF AREA ON YEAR T		15,000	25,000	40,000	60,000	70,000	100,000	100,000	0	0	0
TOTAL AREA UNDER EXPLOITATION:		15,000	39,133	74,133	116,600	171,733	250,400	316,400	286,400	264,400	242,400
NET ANNUAL DEFORESTATION:		1,600	4,267	8,533	13,867	21,333	32,000	32,000	32,000	32,000	32,000
NET CARRY FORWARD:		13,400	34,133	65,600	101,733	150,400	216,400	186,400	164,400	142,400	120,400

SENEGAL SEMP: ECONOMIC ANALYSIS CALCULATIONS

Table 2.1: NET DEFORESTATION REDUCTION IMPACT FROM SUST.& PART.FOREST MGMT. (Continuation)

	12	13	14	15	16	17	18	19	20	TOTAL
TOTAL HECTARES UNDER MANAGEMENT	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
SUSTAINABLE FOREST YIELDS:										
1.00 ton/hectare/year	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	4,665,001
1.50 ton/hectare/year	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	6,997,502
2.00 ton/hectare/year	600,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000	9,330,002
NON-SUSTAINABLE EQUIVALENCE CALCULATION:										
HA CLEAR-CUT TO MATCH SUSTAINABLE PRODUCTION	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	311,000
	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	466,500
	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	622,000
REGROWTH PERCENTAGE PER LEVEL OF CLEAR-CUT	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	62,200
	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	93,300
	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	124,400
NET DEFORESTATION REDUCTION (CLEAR-CUT + REGROWTH)	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	248,801
1.00 ton/hectare/year	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	373,202
1.50 ton/hectare/year	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	497,602
2.00 ton/hectare/year										
ANNUAL INCREMENT TO AREA UNDER MANAGEMENT:	0	0	0	0	0	0	0	0	0	0
ACCUMULATED AREAS (HA) UNDER EXPLOITATION:	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000

Table 2.2: SENSITIVITY OF EXPECTED DEFORESTATION WITHOUT SUSTAINABLE FOREST MANAGEMENT (Continuation)

	12	13	14	15	16	17	18	19	20	TOTAL
1.00 ton/hectare/year										
PREVIOUS AREA UNDER EXPLOITATION (T-1)	195,200	179,200	183,200	147,200	131,200	116,200	99,200	83,200	67,200	N.A.
ANNUAL INCREMENT OF AREA ON YEAR T	0	0	0	0	0	0	0	0	0	300,000
TOTAL AREA UNDER EXPLOITATION:	195,200	179,200	183,200	147,200	131,200	116,200	99,200	83,200	67,200	N.A.
NET ANNUAL DEFORESTATION:	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	248,800
NET CARRY FORWARD:	179,200	163,200	147,200	131,200	116,200	99,200	83,200	67,200	51,200	61,200
1.50 ton/hectare/year										
PREVIOUS AREA UNDER EXPLOITATION (T-1)	142,800	118,800	94,800	70,800	46,800	22,800	-1,200	-25,200	-49,200	N.A.
ANNUAL INCREMENT OF AREA ON YEAR T	0	0	0	0	0	0	0	0	0	300,000
TOTAL AREA UNDER EXPLOITATION:	142,800	118,800	94,800	70,800	46,800	22,800	-1,200	-25,200	-49,200	N.A.
NET ANNUAL DEFORESTATION:	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	373,200
NET CARRY FORWARD:	118,800	94,800	70,800	46,800	22,800	-1,200	-25,200	-49,200	-73,200	-73,200
2.00 ton/hectare/year										
PREVIOUS AREA UNDER EXPLOITATION (T-1)	90,400	66,400	26,400	-6,000	-37,600	-69,600	-101,600	-133,600	-165,600	N.A.
ANNUAL INCREMENT OF AREA ON YEAR T	0	0	0	0	0	0	0	0	0	300,000
TOTAL AREA UNDER EXPLOITATION:	90,400	66,400	26,400	-6,000	-37,600	-69,600	-101,600	-133,600	-165,600	N.A.
NET ANNUAL DEFORESTATION:	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	497,800
NET CARRY FORWARD:	58,400	26,400	-6,000	-37,600	-69,600	-101,600	-133,600	-165,600	-197,600	-197,600

SENEGAL SEMP: ECONOMIC ANALYSIS CALCULATIONS

Table 2.3: ECONOMIC VALUE OF AVOIDED NET DEFORESTATION DUE TO SUSTAINABLE FOREST MANAGEMENT

	1	2	3	4	5	6	7	8	9	10	11
ACCUMULATED NET DEFORESTATION (HA)											
1.00 ton/hectare/year	800	2,933	7,200	14,133	24,800	40,800	56,800	72,800	88,800	104,800	
1.50 ton/hectare/year	1,200	4,400	10,800	21,200	37,200	61,200	85,200	109,200	133,200	157,200	
2.00 ton/hectare/year	1,600	5,867	14,400	28,267	49,600	81,600	113,600	145,600	177,600	209,600	
LOSS OF SUSTAINABLE OUTPUT (TONS/YR)											
1.00 ton/hectare/year	800	2,933	7,200	14,133	24,800	40,800	56,800	72,800	88,800	104,800	
1.50 ton/hectare/year	1,800	6,600	16,200	31,800	55,800	91,800	127,800	163,800	199,800	235,800	
2.00 ton/hectare/year	3,200	11,733	28,800	56,533	99,200	163,200	227,200	291,200	355,200	419,200	
VALUE OF AVOIDED FUELWOOD OUTPUT LOSSES (*)											
1.00 ton/hectare/year @ US\$ 20/ton	12,000	44,000	108,000	212,000	372,000	612,000	852,000	1,092,000	1,332,000	1,572,000	
1.50 ton/hectare/year @ US\$ 20/ton	27,000	99,000	243,000	477,000	837,000	1,377,000	1,917,000	2,457,000	2,997,000	3,537,000	
2.00 ton/hectare/year @ US\$ 20/ton	48,000	175,000	432,000	848,000	1,488,000	2,448,000	3,408,000	4,368,000	5,328,000	6,288,000	
1.00 ton/hectare/year @ US\$ 30/ton	24,000	88,000	216,000	424,000	744,000	1,224,000	1,704,000	2,184,000	2,664,000	3,144,000	
1.50 ton/hectare/year @ US\$ 30/ton	54,000	198,000	486,000	954,000	1,674,000	2,754,000	3,834,000	4,914,000	5,994,000	7,074,000	
2.00 ton/hectare/year @ US\$ 30/ton	96,000	352,000	864,000	1,696,000	2,976,000	4,896,000	6,816,000	8,736,000	10,656,000	12,576,000	
1.00 ton/hectare/year @ US\$ 40/ton	32,000	117,333	288,000	566,333	992,000	1,632,000	2,272,000	2,912,000	3,552,000	4,192,000	
1.50 ton/hectare/year @ US\$ 40/ton	72,000	264,000	648,000	1,272,000	2,232,000	3,672,000	5,112,000	6,552,000	7,992,000	9,432,000	
2.00 ton/hectare/year @ US\$ 40/ton	128,000	469,333	1,162,000	2,281,333	3,968,000	6,528,000	9,088,000	11,648,000	14,208,000	16,768,000	
(*) INCORPORATES ALLOWANCE FOR 20% NATURAL REGROWTH AND COUNTS ONLY ACTUAL LOSSES (-CLEARCUT+REGROWTH).											

SENEGAL SPEMP: ECONOMIC ANALYSIS CALCULATIONS

Table 2.3: ECONOMIC VALUE OF AVOIDED NET DEFORESTATION DUE TO SUST. FOREST MGMNT. (Continuation)

	12	13	14	15	16	17	18	19	20	TOTAL
ACCUMULATED NET DEFORESTATION (HA)										
1.00 ton/hectare/year	120,800	136,800	152,800	168,800	184,800	200,800	216,800	232,800	248,800	248,800
1.50 ton/hectare/year	181,200	205,200	229,200	253,200	277,200	301,200	325,200	349,200	373,200	373,200
2.00 ton/hectare/year	241,600	273,600	305,600	337,600	369,600	401,600	433,600	465,600	497,600	497,600
LOSS OF SUSTAINABLE OUTPUT (TONS/YR)										
1.00 ton/hectare/year	120,800	136,800	152,800	168,800	184,800	200,800	216,800	232,800	248,800	
1.50 ton/hectare/year	271,800	307,800	343,800	379,800	415,800	451,800	487,800	523,800	559,800	
2.00 ton/hectare/year	483,200	547,200	611,200	675,200	739,200	803,200	867,200	931,200	995,200	
VALUE OF AVOIDED FUELWOOD OUTPUT LOSSES (*)										
1.00 ton/hectare/year @ US\$ 20/ton	1,812,000	2,052,000	2,292,000	2,532,000	2,772,000	3,012,000	3,252,000	3,492,000	3,732,000	31,156,001
1.50 ton/hectare/year @ US\$ 20/ton	4,077,000	4,617,000	5,157,000	5,697,000	6,237,000	6,777,000	7,317,000	7,857,000	8,397,000	70,101,002
2.00 ton/hectare/year @ US\$ 20/ton	7,248,000	8,208,000	9,168,000	10,128,000	11,088,000	12,048,000	13,008,000	13,968,000	14,928,000	124,624,002
1.00 ton/hectare/year @ US\$ 30/ton	3,624,000	4,104,000	4,584,000	5,064,000	5,544,000	6,024,000	6,504,000	6,984,000	7,464,000	62,312,001
1.50 ton/hectare/year @ US\$ 30/ton	8,154,000	9,234,000	10,314,000	11,394,000	12,474,000	13,554,000	14,634,000	15,714,000	16,794,000	140,202,002
2.00 ton/hectare/year @ US\$ 30/ton	14,496,000	16,416,000	18,336,000	20,256,000	22,176,000	24,096,000	26,016,000	27,936,000	29,856,000	249,248,002
1.00 ton/hectare/year @ US\$ 40/ton	4,832,000	5,472,000	6,112,000	6,752,000	7,392,000	8,032,000	8,672,000	9,312,000	9,952,000	83,082,668
1.50 ton/hectare/year @ US\$ 40/ton	10,872,000	12,312,000	13,752,000	15,192,000	16,632,000	18,072,000	19,512,000	20,952,000	22,392,000	186,936,002
2.00 ton/hectare/year @ US\$ 40/ton	19,328,000	21,988,000	24,648,000	27,308,000	29,968,000	32,628,000	34,688,000	37,248,000	39,808,000	332,330,669
(*) INCORPORATES ALLOWANCE FOR 20% NATURAL REGROWTH AND COUNTS ONLY ACTUAL LOSSES (-CLEARCUT+REGROWTH).										
TOTAL										

forest yields of **1.00 tons/ha** to **2.00 tons/ha** and producer price ranging from US **\$15/ton** to US **\$40/ton**.

Since at the end of the 20-year horizon the total area under management still had a full stock of 15 tons/ha (300,000 ha @ 15 ton/ha = 4.5 million tons of wood) which could be maintained for continued sustainable exploitation or could be clear cut (or otherwise). The benefit of the sustainable wood production was then valued at the current producer price of wood of US **\$15/ton** (base scenario). The producer price as opposed to the current market price of wood was used because the final market price incorporates the value added of transportation and marketing.

It is extremely important to note that the main driving parameter of the calculation of the sustainable wood benefits -- and thereto of most other project benefits -- is expected **sustainable forest yield**. Based on the most recent studies⁸ it is expected that the average sustainable forest yield in the Tambacounda and Kolda regions of Senegal will be between 1 and 2.5 tons per hectare with a high provability of it being closer to 2.00 tons hectare than to the lower limit. In order to avoid any risk of overestimation of project benefits all base calculation of the evaluation models were done using the lower limit (1.00 ton/ha) as the valid parameter. The implication of this is that if the sustainable yields prove to be higher, all project benefits which are directly related to or pegged to the sustainable wood output will be automatically increased. If the actual sustainable yield is confirm on the field at 2.00 tons/hectare, nearly all project benefits will double (see Tables 2.1, 2.2. and 2.3).

(ii) **incremental charcoal production**: the benefit of the incremental charcoal production expected to result from the promotion of improved kilns was defined as the additional charcoal that is expected to result from the a given amount of wood if that was produced with the existing traditional carbonization technology (18%). The improved charcoal kilns that have already been developed and tested in Senegal -- but which were unsuccessfully disseminated in the past for accounted reasons -- is estimated to have a carbonization efficiency of 30 percent. In order to avoid overvaluation of the expected benefits the base calculations were made utilizing a 25 percent efficiency rate. The economic value of the incremental production was calculated at the current market price of charcoal of US **\$190/ton**. It is expected that charcoal prices will rice through time, thus resulting in higher a higher level of economic benefits for the same level of incremental charcoal production. In order to avoid any risk of overvaluation of the expected benefits, the base calculations were done at the current market price of charcoal and the effect of higher charcoal prices were assessed during the subsequent sensitivity analysis.

Table 3 presents the detailed calculation of the benefit of incremental charcoal production for sustainable forest yields of **1.00 tons/ha** to **2.00 tons/ha** and charcoal market prices ranging from US **\$190/ton** to US **\$285/ton**.

⁸ Jensen, Axel M., Elements d'economie spatiale des energies traditionnelles, RPTES Discussion Paper Series, World Bank, October 1994.

(iii) **global environmental impacts:** the benefit of the global environmental impacts expected to result from the implementation of the sustainable and participatory forest/natural resource management systems was defined as the expected net abatement of CO₂ (in tons) and the conservation of bio-diversity in and around the project areas (particularly in the Niokolo-Koba National Park and "international biosphere reserve") and was valued at the US \$ 1.01/ton per ton of net CO₂ abated. The rationale for that was the value estimated for the CO₂ abatement utilizing the GEF global environmental benefits methodology and it corresponds to the grant funding provided by GEF for the proposed project. That price is estimated to reflect the global social value of CO₂ abatement. No specific valuation was given to the bio-diversity benefits but their value is assumed to be included in the CO₂ calculations. **Table 4** presents the detailed calculation of the global environmental benefits.

(iv) **rural income generation and transfer:** the benefit of rural income generation and transfer expected to result from the direct sales of fuelwood by the participating rural communities was valued at US \$15/ton, which is the current estimated "road side" laborer price of woodfuel in Senegal. While that current price does not include any valuation for the resource, the economic value of the wood was already accounted for within model by the "sustainable wood production" benefit (item i above). Also, while it is expected that when the rural communities take over the "production" of the wood the new producer prices will be higher, the current price was purposely maintained as the base figure to avoid any possible over estimation of the expected benefits. Several higher producer price scenarios were evaluated under the sensitivity analysis. Although it is frequently done in projects of social interest, no additional income transfer multiplier was added to the baseline calculations. Bank projects that compute income transfers benefits to poor income groups estimate that multiplier value at between 30 to 50 percent.

Furthermore, it is important to note that as the community managed systems mature it is expected that the communities will be able to engage in the direct production of charcoal as opposed to limiting their activity to the cutting of the wood, whereby the potential producer price to be applied would be that of the charcoal and not that of the wood. The current producer price of charcoal is of approximately US \$45/ton. At that point, rural revenues will increase considerably.

Table 5 presents the detailed calculation of the rural income generation and transfer benefits for sustainable forest yields of 1.00 tons/ha to 2.00 tons/ha, producer prices ranging from US \$15/ton to US \$40/ton.

(v) **"other" rural revenues:** the benefit of "other" rural revenues expected to result from the development of parallel agro-forestry production activities in the participating communities was valued as a linear function of the total revenues expected to result from the total sales of woodfuels by the rural communities. The rationale for that was that as the rural communities perceive an income from the sale of woodfuels they will have income to invest in other productive activities. The project includes support mechanisms and resources to assist communities which are prepared to invest their own resources in other economic activities. As revenues from woodfuels increase through time (or under

SENEGAL SEMP: ECONOMIC ANALYSIS CALCULATIONS

Table 4: GLOBAL ENVIRONMENTAL BENEFITS

GLOBAL ENVIRONMENTAL BENEFITS	YEARS	1	2	3	4	5	6	7	8	9	10	11
WOOD SAVED (TONS)		800	2,933	7,200	14,133	24,800	40,800	56,800	72,800	88,800	104,800	104,800
CO2 EQUIVALENT		1,360	4,987	12,240	24,027	36,360	48,160	60,560	72,760	85,160	97,560	109,960
ECONOMIC VALUE OF CO2 ABATEMENT		1,374	5,037	12,362	24,267	36,162	48,062	60,012	71,912	83,812	95,712	107,612

Table 4: GLOBAL ENVIRONMENTAL BENEFITS (Continuation)

GLOBAL ENVIRONMENTAL BENEFITS	YEARS	12	13	14	15	16	17	18	19	20	TOTAL
WOOD SAVED (TONS)		120,800	136,800	152,800	168,800	184,800	200,800	216,800	232,800	248,800	413,867
CO2 EQUIVALENT		205,360	232,560	259,760	286,960	314,160	341,360	368,560	395,760	422,960	703,573
ECONOMIC VALUE OF CO2 ABATEMENT		207,414	234,886	262,358	289,830	317,302	344,774	372,246	399,718	427,190	710,609

SENEGAL SEMP: ECONOMIC ANALYSIS CALCULATIONS

Table 5: VALUE OF INCOME TRANSFER TO RURAL COMMUNITIES

	1	2	3	4	5	6	7	8	9	10	11
1.00 ton/hectare/year											
ECONOMIC VALUE OF INCOME TRANSFER											
WOOD SALES FROM COMMUNITY PRODUCERS (TONS)		15,000	40,000	80,000	130,000	200,000	300,000	300,000	300,000	300,000	300,000
VALUE OF WOOD SALES AT MARKET PRICE		1,200,000	3,200,000	6,400,000	10,400,000	16,000,000	24,000,000	24,000,000	24,000,000	24,000,000	24,000,000
INCOME TRANSFER TO RURAL COMMUNITIES		225,000	600,000	1,200,000	1,950,000	3,000,000	4,500,000	4,500,000	4,500,000	4,500,000	4,500,000
ECONOMIC VALUE OF INCOME TRANSFER		238,250	630,000	1,260,000	2,047,500	3,150,000	4,725,000	4,725,000	4,725,000	4,725,000	4,725,000
VALUE OF "OTHER" EXPECTED REVENUES		47,250	125,000	252,000	409,500	630,000	945,000	945,000	945,000	945,000	945,000
1.50 ton/hectare/year											
ECONOMIC VALUE OF INCOME TRANSFER											
WOOD SALES FROM COMMUNITY PRODUCERS (TONS)		22,500	60,000	120,000	195,000	300,000	450,000	450,000	450,000	450,000	450,000
VALUE OF WOOD SALES AT MARKET PRICE		1,800,000	4,800,000	9,600,000	16,600,000	24,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000
INCOME TRANSFER TO RURAL COMMUNITIES		337,500	900,000	1,800,000	2,925,000	4,500,000	6,750,000	6,750,000	6,750,000	6,750,000	6,750,000
ECONOMIC VALUE OF INCOME TRANSFER		354,375	945,000	1,890,000	3,071,250	4,725,000	7,087,500	7,087,500	7,087,500	7,087,500	7,087,500
VALUE OF "OTHER" EXPECTED REVENUES		70,875	189,000	378,000	614,250	945,000	1,417,500	1,417,500	1,417,500	1,417,500	1,417,500
2.00 ton/hectare/year											
ECONOMIC VALUE OF INCOME TRANSFER											
WOOD SALES FROM COMMUNITY PRODUCERS (TONS)		30,000	80,000	160,000	260,000	400,000	600,000	600,000	600,000	600,000	600,000
VALUE OF WOOD SALES AT MARKET PRICE		2,400,000	6,400,000	12,800,000	20,800,000	32,000,000	48,000,000	48,000,000	48,000,000	48,000,000	48,000,000
INCOME TRANSFER TO RURAL COMMUNITIES		450,000	1,200,000	2,400,000	3,900,000	6,000,000	9,000,000	9,000,000	9,000,000	9,000,000	9,000,000
ECONOMIC VALUE OF INCOME TRANSFER		472,500	1,260,000	2,520,000	4,095,000	6,300,000	9,450,000	9,450,000	9,450,000	9,450,000	9,450,000
VALUE OF "OTHER" EXPECTED REVENUES		94,500	252,000	504,000	819,000	1,260,000	1,890,000	1,890,000	1,890,000	1,890,000	1,890,000

SENEGAL SEMP: ECONOMIC ANALYSIS CALCULATIONS

SENEGAL SPEMP: ECONOMIC ANALYSIS CALCULATIONS

Table 6: VALUE OF CHARCOAL SAVING DUE TO IMPROVED STOVES USE

	1	2	3	4	5	6	7	8	9	10	11
Charcoal savings due to Improved Stove Use											
Stoves Life cycle (@ 3 years per Stove)		10,000	10,000	10,000	20,000	20,000	30,000	30,000	30,000	30,000	30,000
					20,000	30,000	40,000	40,000	40,000	40,000	40,000
							55,000	55,000	55,000	55,000	55,000
							70,000	70,000	70,000	70,000	70,000
TOTAL NEW STOVES DISSEMINATED		10,000	20,000	30,000	40,000	55,000	70,000	70,000	70,000	70,000	70,000
TOTAL OF STOVES IN OPERATION PER YEAR		10,000	30,000	60,000	90,000	125,000	165,000	195,000	210,000	210,000	210,000
TONS of Charcoal consumption with Traditional Stove (20% efficiency)		50	150	300	450	625	825	975	1,050	1,050	1,050
TONS of Charcoal consumption with Improved Stove (40% efficiency)		30	90	180	270	375	495	585	630	630	630
Estimated Charcoal savings (TONS) due to Improved Stoves use:		20	60	120	180	250	330	390	420	420	420
Economic Value of Charcoal Savings at:											
US \$190/ton		3,800	11,400	22,800	34,200	47,600	62,700	74,100	79,800	79,800	79,800
US \$237/ton		4,740	14,220	28,440	42,860	59,250	78,210	92,430	99,540	99,540	99,540
US \$268/ton		5,700	17,100	34,200	51,300	71,250	94,950	111,150	119,700	119,700	119,700

SENEGAL SEMP: ECONOMIC ANALYSIS CALCULATIONS

Table 6: VALUE OF CHARCOAL SAVING DUE TO IMPROVED STOVES USE (Continuation)

	12	13	14	15	16	17	18	19	20	TOTAL
Charcoal savings due to Improved Stove Use										
Stoves Life cycle (@ 3 years per Stove)			70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
	70,000									
	70,000	70,000								
	70,000	70,000	70,000							
	70,000	70,000	70,000	70,000						
	70,000	70,000	70,000	70,000	70,000					
TOTAL NEW STOVES DISSEMINATED	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	1,135,000
TOTAL OF STOVES IN OPERATION PER YEAR	210,000	210,000	210,000	210,000	210,000	210,000	210,000	210,000	210,000	3,195,000
TONS of Charcoal consumption with Traditional Stove (20% efficiency)	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	15,975
TONS of Charcoal consumption with Improved Stove (40% efficiency)	630	630	630	630	630	630	630	630	630	9,585
Estimated Charcoal savings (TONS) due to Improved Stoves use:	420	420	420	420	420	420	420	420	420	6,390
Economic Value of Charcoal Savings at:										
US \$190/ton	79,800	79,800	79,800	79,800	79,800	79,800	79,800	79,800	79,800	1,214,100
US \$237/ton	99,540	99,540	99,540	99,540	99,540	99,540	99,540	99,540	99,540	1,514,430
US \$255/ton	119,700	119,700	119,700	119,700	119,700	119,700	119,700	119,700	119,700	1,821,150

Evaluation Results

22. The 20-year horizon evaluation of the project resulted in an Economic Rate of Return (ERR) of 37.35% and a net present value (NPV) at 12 percent discount rate of US \$ 34,235 million. Tables 7 and 8 present the summary of project costs and benefits flow and the economic evaluation of the project. According to these economic evaluation results, the proposed project would be a fully justifiable and competitive developmental investment for Senegal.

23. From Table 7 it can be observed that over the 20-year evaluation horizon the project has a total flow of US \$21.3 million of costs and US \$ 186.1 million of expected benefits, for a net non-discounted positive cost/benefit flow of US \$164.6 million. Figures 2 and 3 present the project's expected cost and benefits flow and the net cost-benefit flow for the entire 20-year evaluation horizon.

Sensitivity Analysis

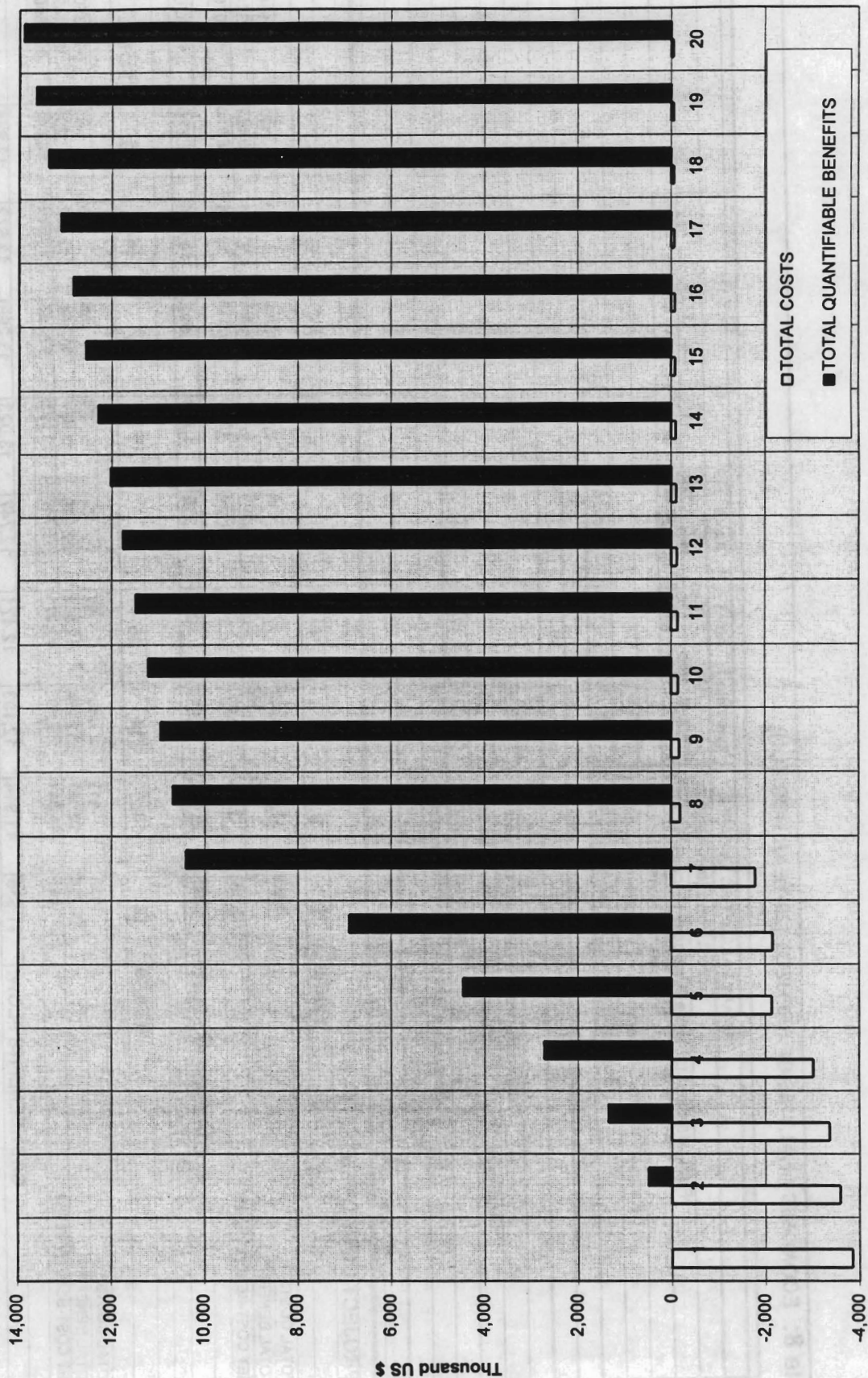
24. The selection of the key parameters for the sensitivity analysis of the project was made on the basis of their relative weight within the total expected benefits and on the sensitivity observed during the limited parametric variations included during the baseline evaluation of the project's benefits (included Tables 2.1 to 6, above).

25. From the total expected benefits calculated for the project the generation and transfer of rural income accounted for 39.4 percent, incremental charcoal production for 33.5 percent, sustainable wood production for 16.7 percent, "other" rural income for 7.9 percent and global environmental benefits and charcoal consumption savings combined for 2.5 percent. Figure 4 presents a breakdown of the project benefits by type of expected benefit for the 20-year evaluation horizon.

26. From the above 5 key parameters were selected for the sensitivity analysis of the project: (i) level of sustainable forest yields (0.5 - 2.0 ton/ha/yr); (ii) fuelwood producer prices (US \$ 10 - 30/ton); (iii) carbonization efficiency of improved kilns (18% - 30%); (iv) level of "other" realizable rural income (15% - 40% of expected fuelwood sales); and (v) charcoal market prices (US \$ 190 - 360/ton). Tables 9.1 and 9.2 present the detailed calculation of the sensitivity analysis for the five key parameter selected. Attachment A presents Figures A.1 through A.5 with the results of the sensitivity analysis for the five key parameter selected.

(i) sustainable forest yields: (0.5 - 2.0 ton/ha/yr): The most important parametric variable of the project is the average sustainable forest yields. This is so because the economic output of the sustainable forest management systems will depend on the realizable sustainable forest yield. Expected rural incomes will depend firstly on forest yields and then on wood producer prices. As the real forest yields are still based on estimates a higher degree of uncertainty exists with respect to the forest yields than to wood prices. Incremental charcoal production, "other" rural income and global environmental benefits are all positively (and herein assumed linearly) correlated to the

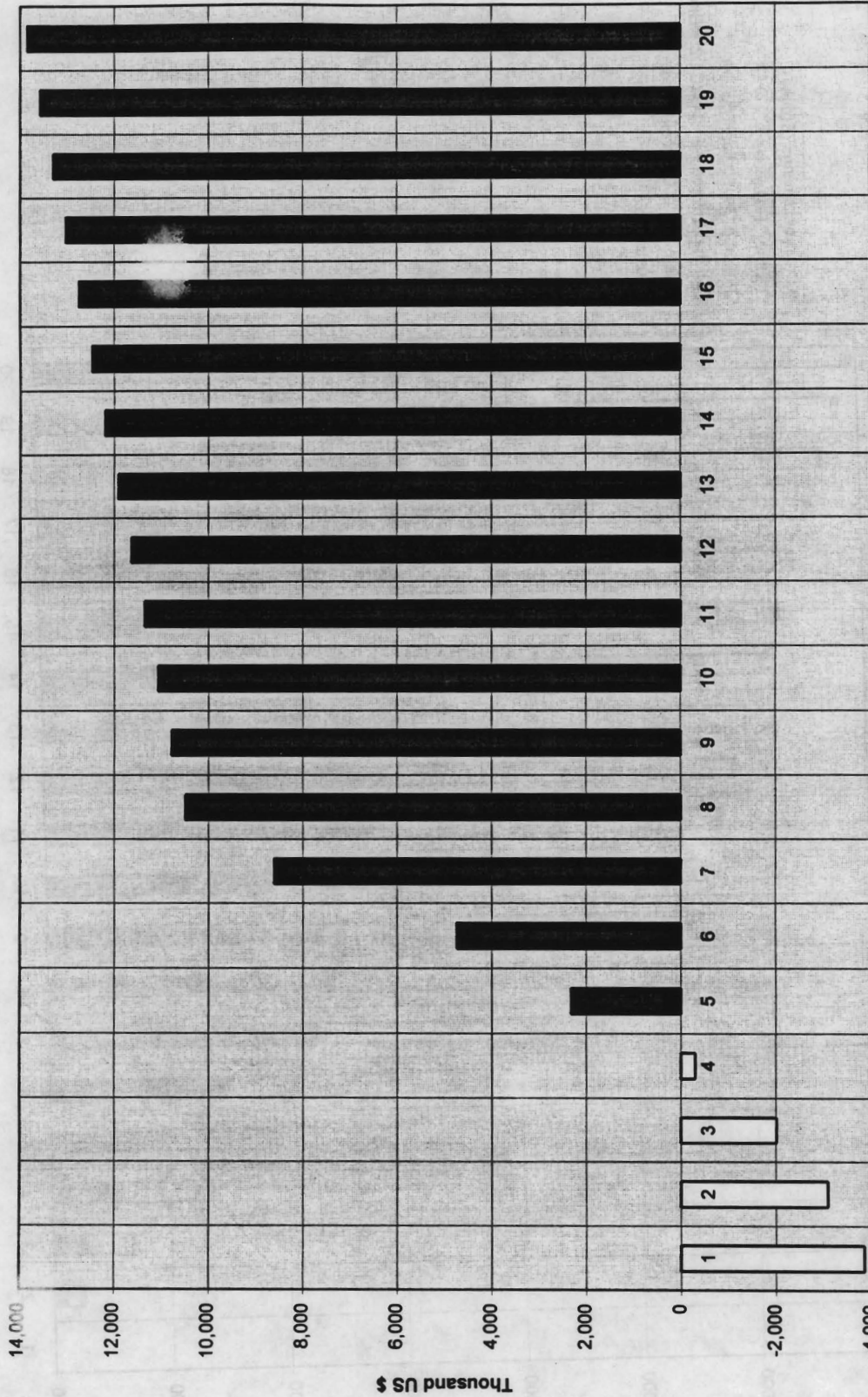
FIGURE 2
SPEMP: PROJECT COSTS & BENEFITS (20-Years Horizon)



Years

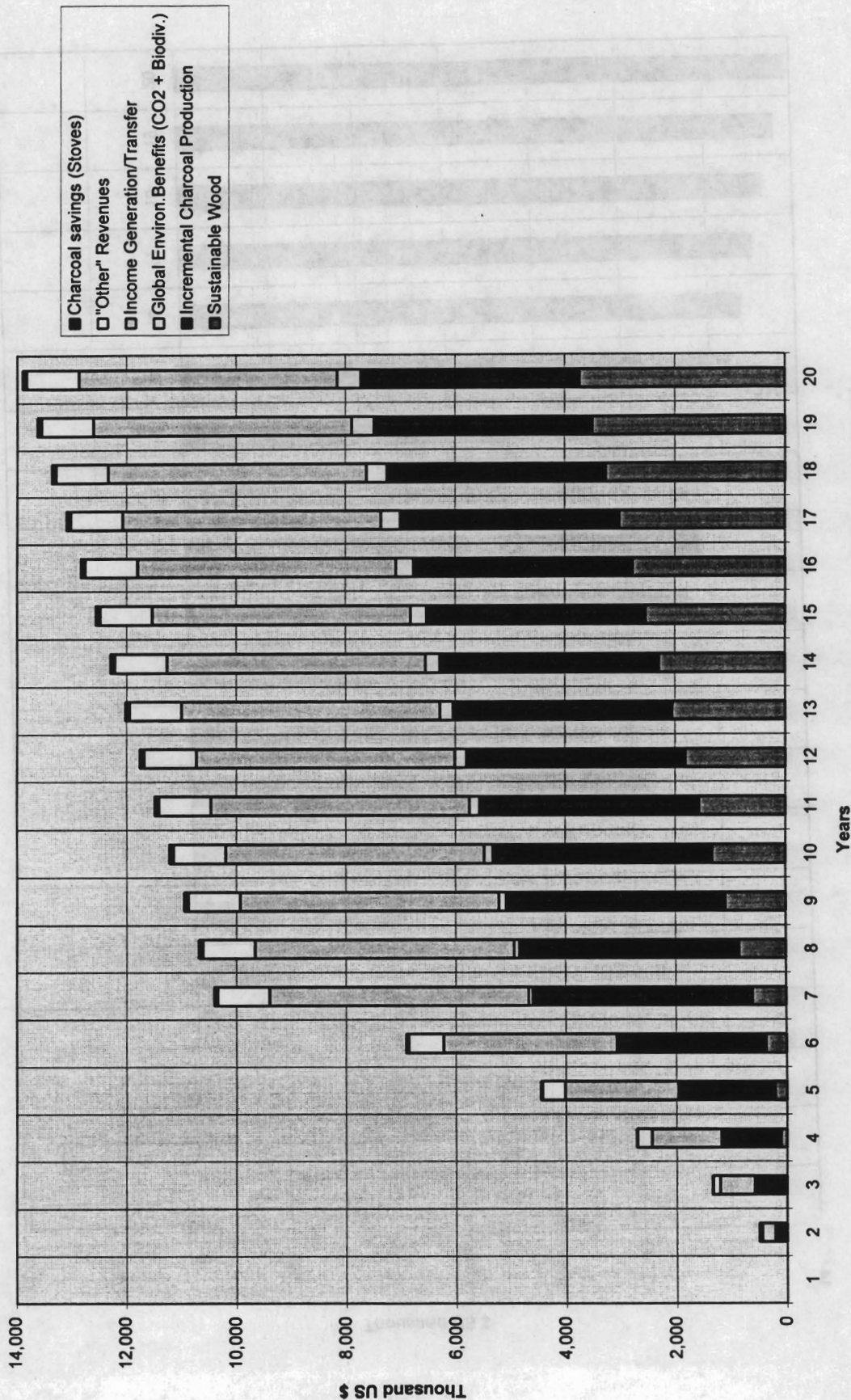
PROJECT COSTS & BENEFITS (20-YEAR HORIZON)

FIGURE 3
SPEMP: NET COSTS-BENEFITS FLOW (20-Year Horizon)



Years

FIGURE 4
SPEMP: Quantifiable Project Benefits (20 -Year Horizon)



GRAPHIC WILL BE COMPLETED FROM THE ASSESSMENT
LIFE TIME

SENEGAL SPEMP: ECONOMIC ANALYSIS CALCULATIONS

Table 9.1: SUMMARY OF SENSITIVITY ANALYSIS OF BASIC PROJECT PARAMETERS

	1	2	3	4	5	6	7	8	9	10	11
SUSTAINABLE FOREST YIELDS											
	-3,858	-3,346	-2,698	-1,680	47	1,209	3,271	4,951	5,043	5,127	5,209
0.5 ton/ha/year:	-3,858	-3,221	-2,361	-998	1,168	2,948	5,899	7,663	7,838	8,006	8,172
.75 ton/ha/year:	-3,858	-3,094	-2,017	-302	2,318	4,740	8,612	10,494	10,786	11,070	11,353
1.00 ton/ha/year:	-3,858	-2,966	-1,668	410	3,497	6,583	11,411	13,443	13,885	14,320	14,754
1.25 ton/ha/year:	-3,858	-2,836	-1,312	1,137	4,706	8,478	14,295	16,511	17,137	17,756	18,373
1.50 tons/year:	-3,858	-2,704	-950	1,878	5,944	10,425	17,264	19,697	20,541	21,377	22,212
1.75 tons/year:	-3,858	-2,571	-582	2,635	7,212	12,423	20,318	23,002	24,097	25,184	26,269
2.00 tons/year:	-3,858										
NPV=0 @F.Yield=0.14 ton/ha/yr											
FUELWOOD SUSTAINABLE PRODUCER PRICE											
	-3,858	-3,193	-2,284	-842	1,428	3,356	6,518	8,320	8,532	8,736	8,939
US\$ 10/ton:	-3,858	-3,094	-2,017	-302	2,318	4,740	8,612	10,494	10,786	11,070	11,353
US\$ 15/ton:	-3,858	-2,996	-1,751	238	3,207	6,124	10,706	12,668	13,040	13,404	13,767
US\$ 20/ton:	-3,858	-2,897	-1,484	778	4,097	7,508	12,800	14,842	15,294	15,738	16,181
US\$ 25/ton:	-3,858	-2,799	-1,217	1,318	4,987	8,892	14,894	17,016	17,548	18,072	18,595
US\$ 30/ton:											
NPV>0 @ producer price US\$0.00/ton											
IMPROVED KILNS EFFICIENCY											
	-3,858	-3,294	-2,549	-1,366	589	2,080	4,622	6,504	6,796	7,080	7,363
18% Carbonization Efficiency:	-3,858	-3,180	-2,245	-758	1,577	3,600	6,902	8,784	9,076	9,360	9,643
22% Carbonization Efficiency:	-3,858	-3,094	-2,017	-302	2,318	4,740	8,612	10,494	10,786	11,070	11,353
25% Carbonization Efficiency:	-3,858	-3,009	-1,789	154	3,059	5,880	10,322	12,204	12,496	12,780	13,063
28% Carbonization Efficiency:	-3,858	-2,952	-1,637	458	3,553	6,640	11,462	13,344	13,636	13,920	14,203
30% Carbonization Efficiency:											
NPV=0 @ Carbonization Efficiency= 6.7%											

SENEGAL SEMP: ECONOMIC ANALYSIS CALCULATIONS

Table 9.1: SUMMARY OF SENSITIVITY ANALYSIS OF BASIC PROJECT PARAMETERS (Continuation)

SUSTAINABLE FOREST YIELDS	12	13	14	15	16	17	18	19	20	ERR	NPV
	0.5 ton/ha/year:	5,290	5,369	5,447	5,524	5,600	5,675	5,750	5,823		
.75 ton/ha/year:	8,336	8,499	8,661	8,821	8,981	9,139	9,297	9,454	9,611	29.33%	20,916
1.00 ton/ha/year:	11,635	11,914	12,193	12,471	12,747	13,023	13,298	13,572	13,845	37.35%	34,235
1.25 ton/ha/year:	15,185	15,616	16,045	16,473	16,900	17,326	17,751	18,176	18,600	44.65%	48,430
1.50 tons/year:	18,989	19,603	20,216	20,828	21,439	22,049	22,658	23,267	23,874	51.46%	63,501
1.75 tons/year:	23,045	23,876	24,707	25,536	26,364	27,191	28,018	28,844	29,669	57.92%	79,448
2.00 tons/year:	27,353	28,435	29,516	30,596	31,675	32,753	33,831	34,907	35,983	64.11%	96,270
NPV=0 @F. Yield=0.14 ton/ha/yr											
FUELWOOD SUSTAINABLE PRODUCER PRICE											
	12	13	14	15	16	17	18	19	20	ERR	NPV
US\$ 10/ton:	9,141	9,340	9,539	9,737	9,933	10,129	10,324	10,518	10,711	31.32%	24,115
US\$ 15/ton:	11,635	11,914	12,193	12,471	12,747	13,023	13,298	13,572	13,845	37.35%	34,235
US\$ 20/ton:	14,129	14,488	14,847	15,205	15,561	15,917	16,272	16,626	16,979	42.83%	44,356
US\$ 25/ton:	16,623	17,062	17,501	17,939	18,375	18,811	19,246	19,680	20,113	47.92%	54,476
US\$ 30/ton:	19,117	19,636	20,155	20,673	21,189	21,705	22,220	22,734	23,247	52.70%	64,597
NPV>0 @ producer price US\$0.00/ton											
IMPROVED KILNS EFFICIENCY											
	12	13	14	15	16	17	18	19	20	ERR	NPV
18% Carbonization Efficiency:	7,645	7,924	8,203	8,481	8,757	9,033	9,308	9,582	9,855	26.08%	17,294
22% Carbonization Efficiency:	9,925	10,204	10,483	10,761	11,037	11,313	11,588	11,862	12,135	32.72%	26,975
26% Carbonization Efficiency:	11,635	11,914	12,193	12,471	12,747	13,023	13,298	13,572	13,845	37.35%	34,235
28% Carbonization Efficiency:	13,345	13,624	13,903	14,181	14,457	14,733	15,008	15,282	15,555	41.73%	41,496
30% Carbonization Efficiency:	14,485	14,764	15,043	15,321	15,597	15,873	16,148	16,422	16,695	44.53%	46,336
NPV=0 @ Carbonization Efficiency= 6.7%											

SENEGAL SPEMP: ECONOMIC ANALYSIS CALCULATIONS

Table 9.2: SUMMARY OF SENSITIVITY ANALYSIS OF BASIC PROJECT PARAMETERS

	1	2	3	4	5	6	7	8	9	10	11
"OTHER" RURAL INCOME											
15% Ratio "Other" income :	-3,858	-3,106	-2,049	-365	2,215	4,582	8,376	10,257	10,550	10,834	11,117
20% Ratio "Other" income :	-3,858	-3,094	-2,017	-302	2,318	4,740	8,612	10,494	10,786	11,070	11,353
25% Ratio "Other" income :	-3,858	-3,082	-1,986	-239	2,420	4,897	8,848	10,730	11,022	11,307	11,589
30% Ratio "Other" income :	-3,858	-3,070	-1,954	-176	2,522	5,055	9,085	10,966	11,258	11,543	11,826
35% Ratio "Other" income :	-3,858	-3,059	-1,923	-113	2,625	5,212	9,321	11,202	11,495	11,779	12,062
40% Ratio "Other" income :	-3,858	-3,047	-1,891	-50	2,727	5,370	9,557	11,439	11,731	12,015	12,298
NPV=0 @ Other rural income = -200%											
CHARCOAL MARKET PRICES											
US\$ 190/ton:	-3,858	-3,094	-2,017	-302	2,318	4,740	8,612	10,494	10,786	11,070	11,353
US\$ 240/ton:	-3,858	-3,041	-1,874	-16	2,782	5,452	9,679	11,563	11,857	12,141	12,424
US\$ 285/ton:	-3,858	-2,992	-1,745	242	3,199	6,093	10,639	12,526	12,821	13,105	13,388
US\$ 310/ton:	-3,858	-2,966	-1,674	385	3,431	6,450	11,172	13,060	13,356	13,641	13,924
US\$ 360/ton:	-3,858	-2,912	-1,531	671	3,895	7,162	12,238	14,130	14,427	14,712	14,995
NPV>0 @ Charcoal Price = US\$0.00											

SENEGAL SPEMP: ECONOMIC ANALYSIS CALCULATIONS

Table 9.2: SUMMARY OF SENSITIVITY ANALYSIS OF BASIC PROJECT PARAMETERS (Continuation)

"OTHER" RURAL INCOME	12	13	14	15	16	17	18	19	20	ERR	NPV
15% Ratio "Other" income :	11,398	11,678	11,957	12,235	12,511	12,787	13,062	13,336	13,609	36.72%	33,232
20% Ratio "Other" income :	11,635	11,914	12,193	12,471	12,747	13,023	13,298	13,572	13,845	37.35%	34,235
25% Ratio "Other" income :	11,871	12,151	12,429	12,707	12,984	13,259	13,534	13,808	14,082	37.97%	35,238
30% Ratio "Other" income :	12,107	12,387	12,666	12,943	13,220	13,495	13,770	14,044	14,318	38.58%	36,242
35% Ratio "Other" income :	12,343	12,623	12,902	13,180	13,456	13,732	14,007	14,281	14,554	39.19%	37,245
40% Ratio "Other" income :	12,580	12,859	13,138	13,416	13,692	13,968	14,243	14,517	14,790	39.80%	38,248
NPV=0 @ Other rural income = -200%											
CHARCOAL MARKET PRICES	12	13	14	15	16	17	18	19	20	ERR	NPV
US\$ 190/ton:	11,635	11,914	12,193	12,471	12,747	13,023	13,298	13,572	13,845	37.35%	34,235
US\$ 240/ton:	12,706	12,985	13,264	13,542	13,818	14,094	14,369	14,643	14,916	40.11%	38,780
US\$ 285/ton:	13,669	13,949	14,228	14,506	14,782	15,058	15,333	15,607	15,880	42.53%	42,870
US\$ 310/ton:	14,205	14,485	14,764	15,041	15,318	15,593	15,868	16,142	16,416	43.85%	45,142
US\$ 360/ton:	15,276	15,556	15,835	16,112	16,389	16,664	16,939	17,213	17,487	46.43%	49,686
NPV>0 @ Charcoal Price = US\$0.00											

actual sustainable wood output of the project, which in turn will be a direct function of realizable average sustainable forest yields. Current information indicates that average forest yields should be between 1 ton /ha/yr and 2.5 tons/ha/yr in the Tambacounda and Kolda regions. While 1.0 ton/ha/yr was used as the baseline value for the forest yields, the sensitivity analysis done accepted a yield range from 0.5 ton/ha/yr to the lowest expected yield. Yields of below 1.0 ton/ha/year, however, are considered to be unrealistic.

(ii) fuelwood producer prices: (US \$10 - 30/ton). Fuelwood producer prices were allowed to vary from US \$10/ton up to US \$30/ton. Scenarios for US \$15/ton, US \$30/ton and US \$40/ton were calculated as part of the baseline evaluation and are presented in Table 5 (above). Because of that the sensitivity analysis was used to fine tune the price range between the current US \$15/ton and US \$30/ton. Although a lower producer price than the current US \$15/ton is not expected to happen, a US \$10/ton scenario was also developed under a theoretical scenario that due to an unanticipated sudden acceleration of inter-fuel substitution of woodfuels, their demand would drop and thus potential future market-determined prices would come down..

(iii) carbonization efficiency of improved kilns: (18% - 30%). The carbonization efficiency of the traditional charcoal kilns is rated at 18 percent. Because of that it is expected that the lowest conversion efficiency of the improved kilns would be 18%. Below that level of efficiency their use would be immediately and justifiably discontinued in favor of the traditional charcoaling methods. Starting at 18 percent the sensitivity analysis covered gradual efficiency variation until the 30 percent mark. Efficiencies higher than 30 percent are considered unlikely under the expected field operation conditions in the project areas. Higher efficiencies would be possible but at much larger scales of operation than the one envisaged for the project.

(iv) "other" realizable rural income: (15% - 40% of expected fuelwood sales). This parameter is a function of the income generated from the direct sale of wood by the rural communities. While there is no empirical data in Senegal to substantiate a specific level of relation between one and the other, the level used for the baseline calculation (20 %) was chosen on the basis of estimates from project examples in Burkina Faso (Programme National de Aménagement Forestier - PNAF and Programme National de Gestion Terroir). Because of that lack of empirical data to back-up the estimation, the level of the parameter was allowed to come down as low as 15 percent and go as far as 40 percent. Given the project preparatory work done directly in the field with the beneficiary communities, it is expected that revenues from "other" economic activities will play a significant role in the economic development of the project areas. In all communities visited there are several initiatives for such parallel productive activities and the communities intent to mobilize the project support mechanism for that purpose. As the total share of this expected benefit over the overall benefits of the project is less than 10 percent, even if the ratio between wood income to other income were to be lower than the 15 percent allowed within the sensitivity analysis, it would not constitute a decisive factor in the project overall evaluation rating.

(v) Charcoal market prices: Based on the production and marketing track record of the improved stove that the project intend to support, there is no reason to believe that the

stove dissemination targets of the project would not be met. On the contrary, it is expected that the demonstration effect of the additional 225,000 that the project will support will further motivate the development and/or expansion of additional parallel private sector-based stove supplies at full factor cost. Also, while the long-term testing done by Appropriate Technology International (ATI) has established that the DIAMBAR stove has an incremental energy efficiency of 50% in order to avoid overestimation of benefits the stove's incremental efficiency gain over traditional stoves was fixed at 40 percent. Hence, there being no expected negative variations in either the rate of stove dissemination or the stove's energy efficiency, the sensitivity analysis of the improved stove component was limited to variations in the market price of charcoal from US \$190/ton to US \$360/ton. As the price of charcoal is only expected to rise over time, no negative price variation were modeled.

27. Table 10 presents a summary of the results of the sensitivity analyses conducted, including the main value variations considered ("base", low and high) and the respective switching value.

Table 10: Results from the Sensitivity Analysis

PARAMETER	Values	NPV (US million)	ERR (%)	Switching Value
BASE RESULTS:		43.2	37.3	
Sustainable Forest Yield	<i>B:</i> 1.00ton/ha/yr			0.15 ton/ha/yr
	<i>low:</i> 0.5 ton/ha/yr	8.4	20.1	
	<i>High:</i> 2.0ton/ha./yr	96.2	64.1	
Fuelwood Producer Price	<i>B:</i> US\$15/ton			n.a.
	<i>low:</i> US\$10/ton	24.1	31.3	
	<i>High:</i> US\$30/ton	64.6	52.7	
Carbonization Efficiency	<i>B:</i> 25%			6.7%
	<i>low:</i> 18%	17.3	26.1	
	<i>High:</i> 30%	46.3	44.5	
Other Rural Income	<i>B:</i> 20%			-200%
	<i>low:</i> 15%	33.2	36.7	
	<i>High:</i> 40%	38.2	39.8	
Charcoal Market Price	<i>B:</i> US\$190/ton (*)			n.a.
	<i>low:</i> US\$190/ton (*)	34.2	37.3	
	<i>High:</i> US\$360/ton	49.7	46.4	

Note: (*) Current market price.

28. On the basis of the results of the sensitivity analyses conducted, the proposed project would continue to be a fully justifiable and competitive developmental investment for Senegal.

FIGURE A.1
ERR SENSITIVITY: FOREST YIELDS

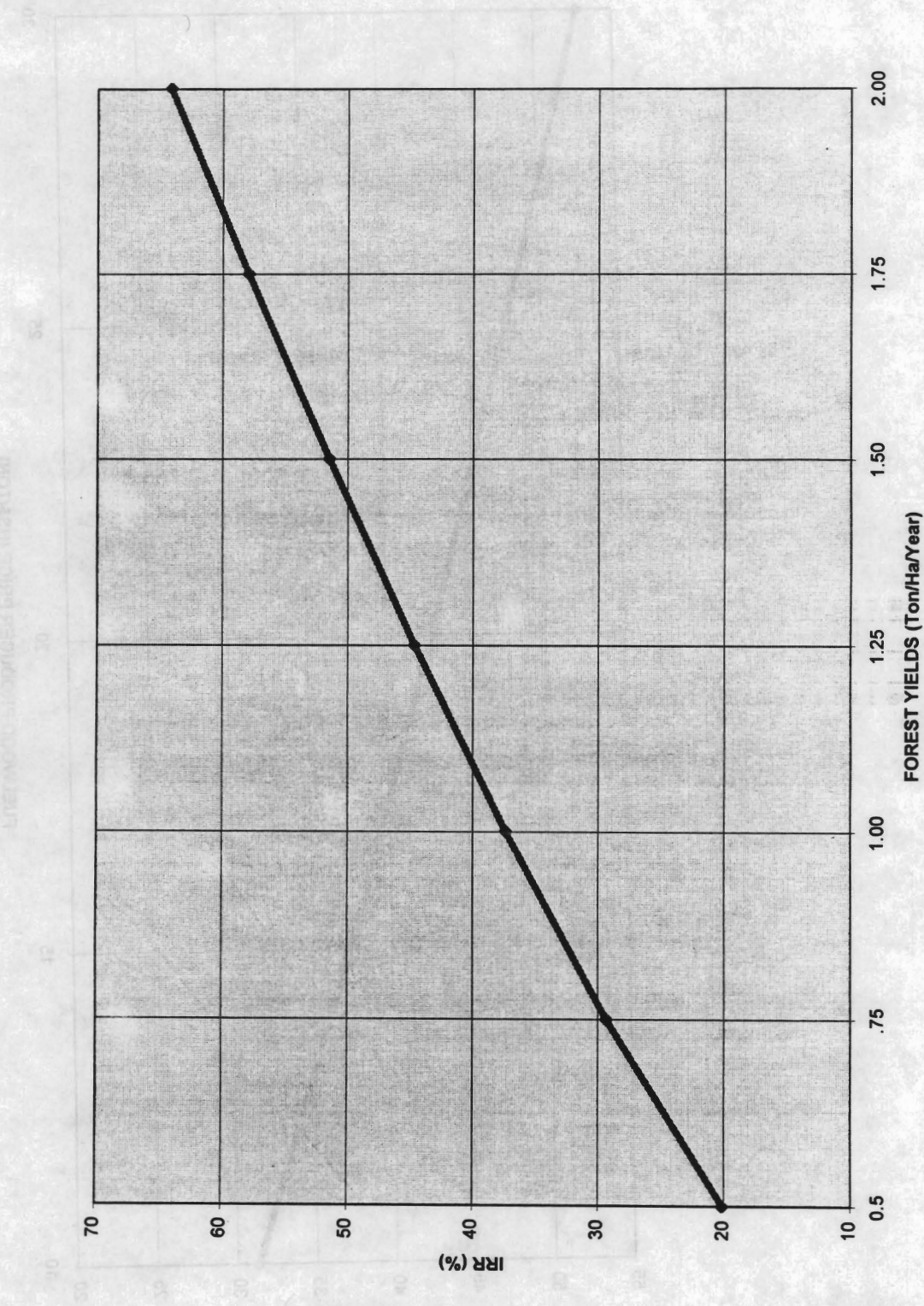


FIGURE A.2
ERR SENSITIVITY: WOODFUEL PRODUCER PRICES

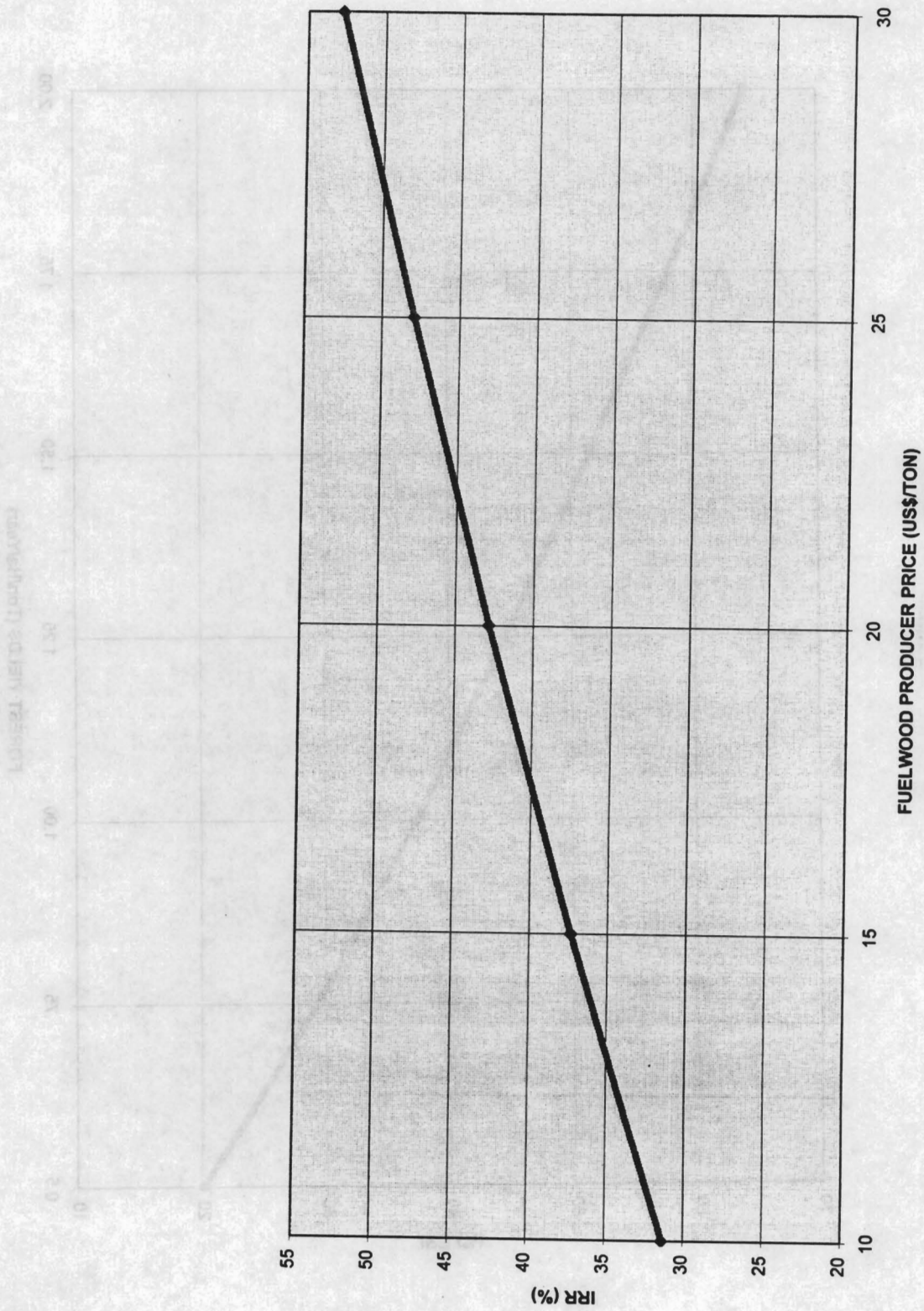


FIGURE A.3
ERR SENSITIVITY: CARBONIZATION EFFICIENCY

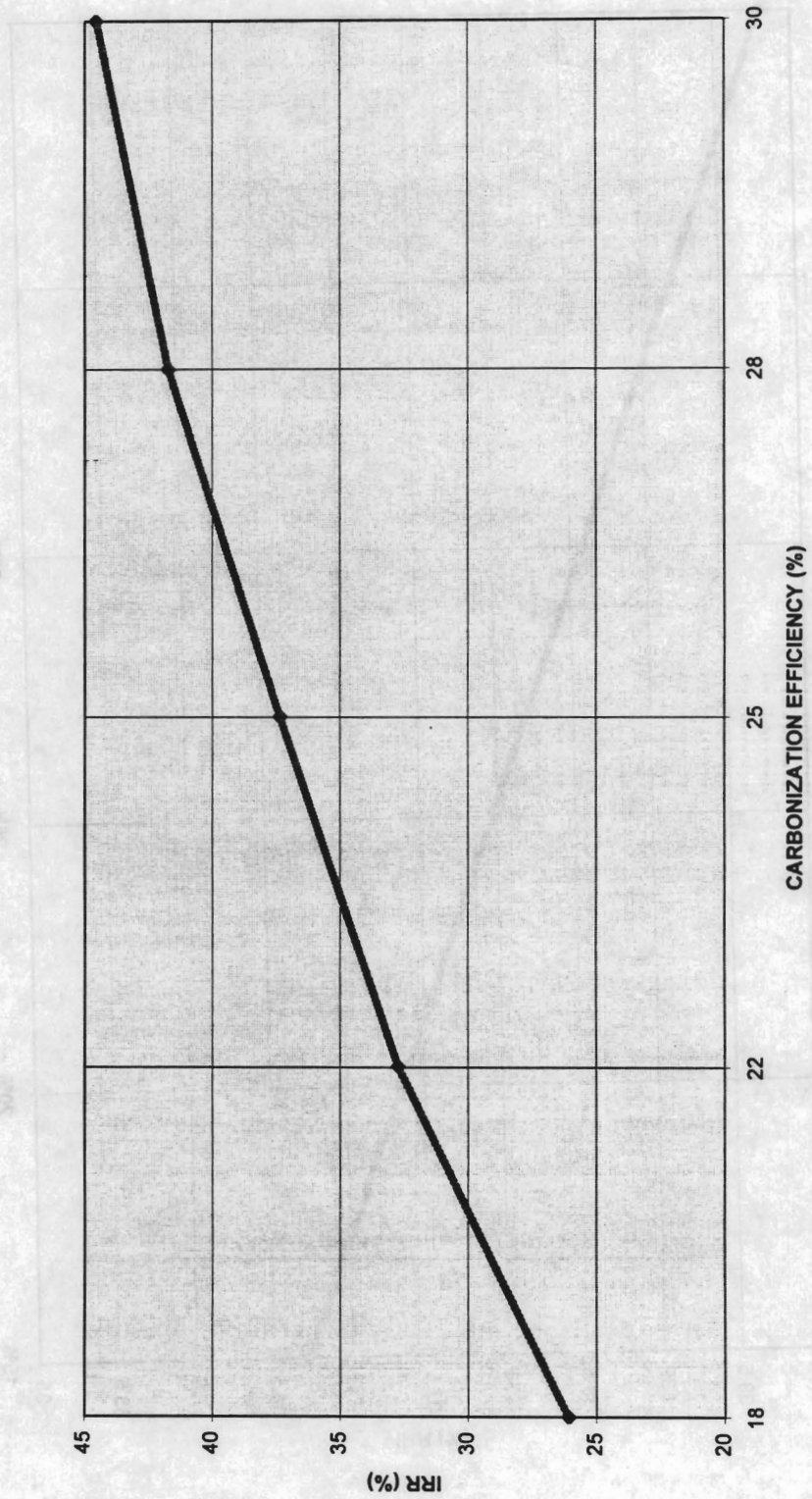
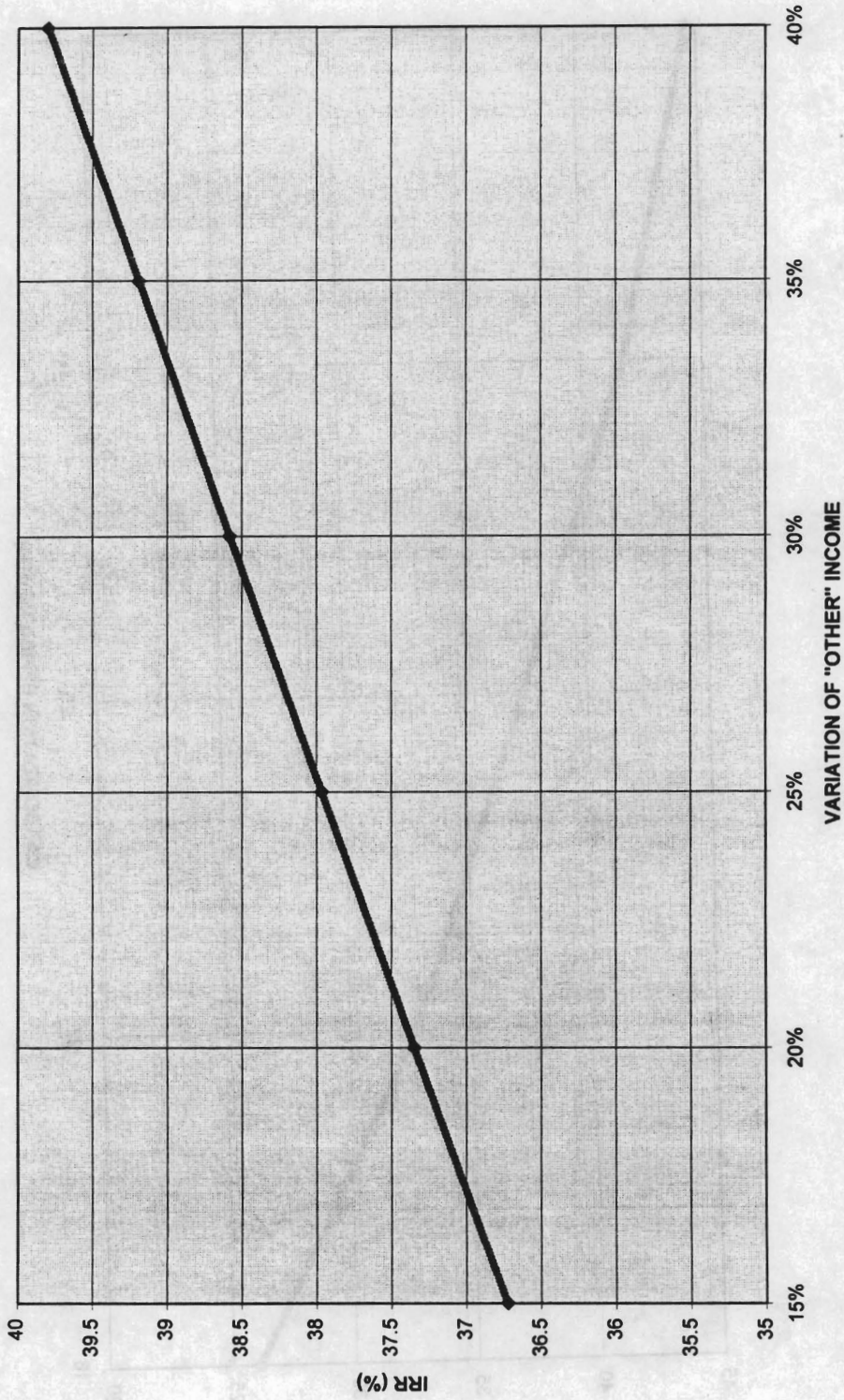
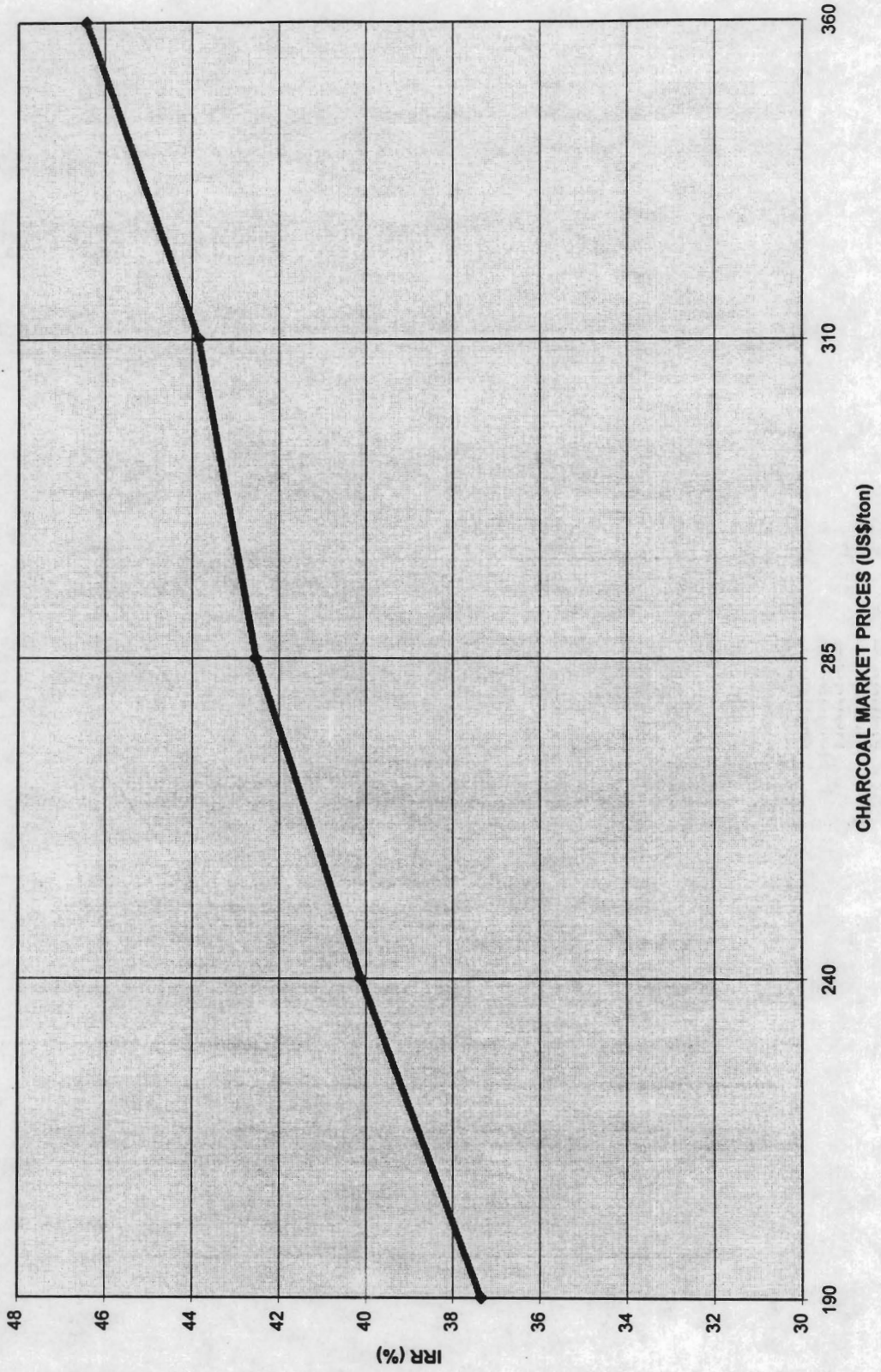


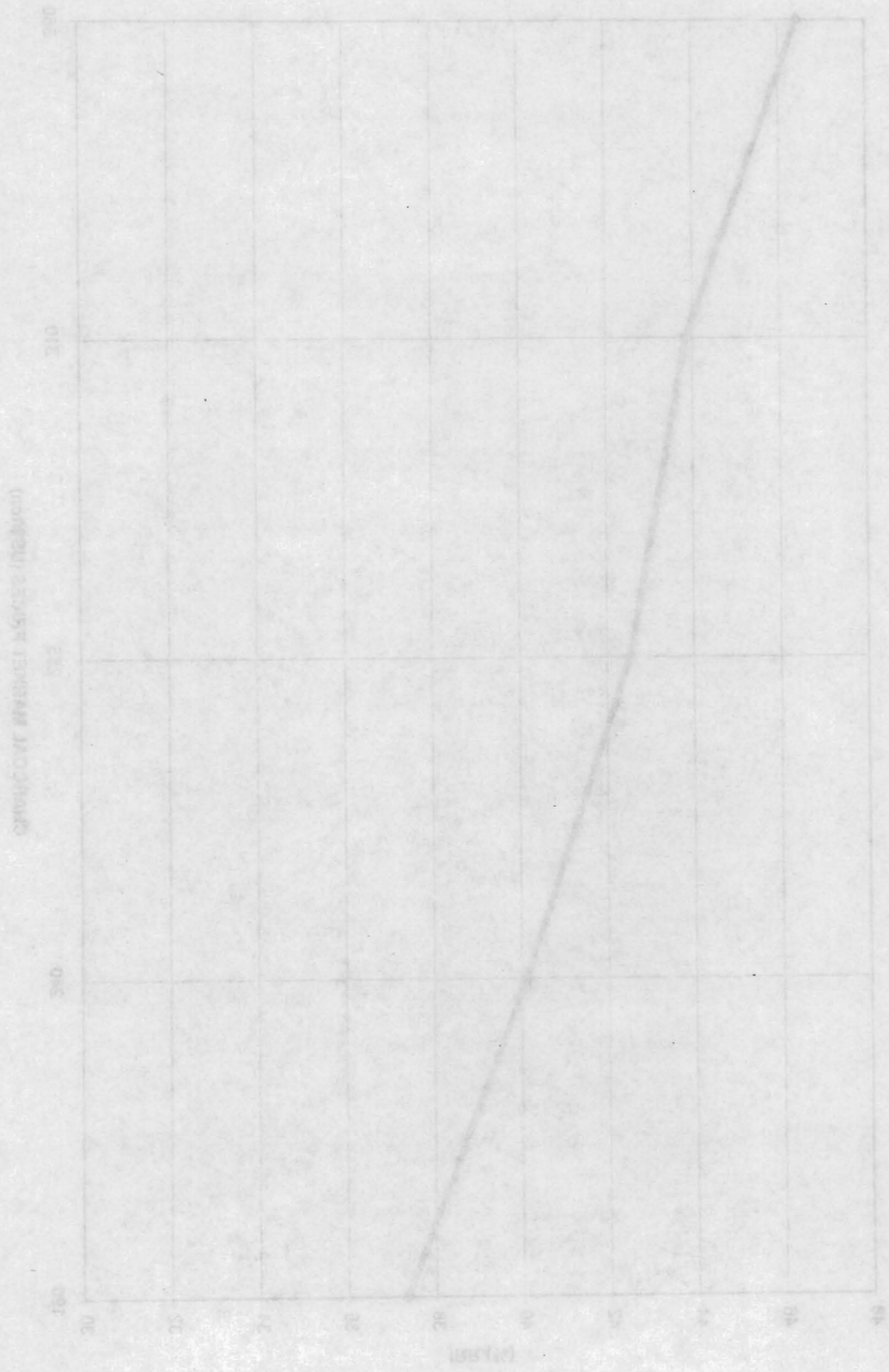
FIGURE A.4
ERR SENSITIVITY: OTHER INCOME



ERR SENSITIVITY: OTHER INCOME
FIGURE A.4

FIGURE A.5
ERR SENSITIVITY: CHARCOAL PRICES





EMIL BERNHALLA: CHECKOUT MILES
 FIGURE 1.2

ENERGY SECTOR POLICY LETTER

**Original French Text Signed by
the Minister of Economy, Finance and Plan
and
the Minister of Energy, Mines and Industry**

“LETTRE DE POLITIQUE DE DEVELOPPEMENT DU SECTEUR DE L’ENERGIE”

ENERGY SECTOR POLICY LETTER

Original French Text signed by
the Minister of Economy, Finance and Plan
and
the Minister of Energy, Mines and Industry

LETTRE DE POLITIQUE DE DÉVELOPPEMENT DU SECTEUR DE L'ÉNERGIE

LETTRE DE POLITIQUE DE DEVELOPPEMENT DU SECTEUR DE L'ENERGIE

30 janvier 1997

A- Objectifs

1. Le Gouvernement du Sénégal a mené de 1987 à 1992, avec le soutien de ses partenaires au développement, le premier projet sectoriel sur l'énergie. Ce programme a permis de mobiliser les financements nécessaires aux réhabilitations les plus urgentes et pour le renforcement des infrastructures. Il a également contribué à améliorer la capacité de gestion du secteur. Depuis quelques années, un nouvel environnement économique se met en place caractérisé par la mise en oeuvre d'un programme d'ajustement global de l'économie et de recentrage du rôle de l'Etat vers les fonctions de planification / régulation / contrôle.

2. Dans ce contexte, un projet Energie II, reposant sur un programme de réformes importantes dans le secteur de l'énergie, est en préparation. L'objet de la présente " **Lettre de Politique de Développement du Secteur de l'Energie** " (LPDSE) est de préciser les décisions prises par le Gouvernement ainsi que le calendrier des actions pour leur mise en oeuvre. Elle s'inscrit dans le cadre macro-économique défini par le Gouvernement, dont l'objectif est d'atteindre un degré de croissance économique substantiel, tout en préservant la stabilité financière et fiscale à moyen terme.

3. Ce cadre a été en particulier énoncé dans le contexte des accords signés par le Gouvernement avec les bailleurs de fonds internationaux. Il est détaillé, d'une part, dans le document-cadre de politique économique et financière (PFP) à moyen terme (1994-1997) et, d'autre part, dans la lettre de politique de développement du secteur privé, conclus en 1994 et soutenus par le Fonds monétaire international et la Banque mondiale. Le PFP, remis à jour en 1995 et 1996 a défini les actions générales que le Gouvernement a décidé de mettre en oeuvre dans le secteur de l'énergie. Elles sont détaillées dans la présente lettre.

B-Cadre macro-économique

4. En termes d'objectifs macro-économiques, la politique d'ajustement global vise à atteindre une croissance du PIB de 4,5% à 5% par an à partir de 1995 permettant chaque année une augmentation du revenu par tête de 2% au moins et la création de 20 000 emplois nouveaux. Elle doit en plus assurer, à partir de 1996, un retour du taux d'inflation, défini en terme de déflateur du PIB, à son faible niveau de 2 - 3% par an. Elle doit permettre une réduction progressive du déficit du compte courant extérieur (hors dons), de 9,8 % du PIB en 1994 à 6,8 % en 1997.

5. Le Gouvernement a mis en place un dispositif d'incitations et de sécurisation de l'investissement privé qui comporte en particulier le Code des Investissements, l'autorisation de rapatriements des capitaux et bénéfiques, la législation fiscale, la couverture des risques de convertibilité des monnaies et de variation de taux de change.

.../...

C-SITUATION ET CONTRAINTES DU SECTEUR

6. Le Gouvernement a procédé à l'analyse de l'ensemble **des contraintes et obstacles** auxquels est confronté le secteur, a formulé **des orientations et des stratégies** adéquates et a décidé de conduire des actions spécifiques dans chaque sous-secteur énergétique en vue d'atteindre les objectifs globaux qu'il s'est assignés.

C1-Constats d'ordre général

7. Le bilan énergétique du Sénégal fait apparaître, au niveau de l'énergie primaire, la prépondérance du bois (61%) provenant de l'exploitation des forêts naturelles, suivi du pétrole (37%), celui-ci étant presque totalement importé.

8. Le niveau des prix est réputé élevé au Sénégal en raison de contraintes objectives notamment l'absence de rente hydraulique ou pétrolière, la taille du système (liée à celle du marché) limitant les possibilités d'exploitation des économies d'échelle ou de recours à certaines technologies, et les ressources forestières limitées.

9. L'accès des populations aux formes d'énergies commerciales est faible.

C2- Contraintes par sous-secteur

C2.1-Le sous-secteur pétrolier

10. L'approvisionnement en hydrocarbures repose exclusivement sur les importations de la SAR (Société Africaine de Raffinage) qui s'élèvent environ à **900 000 tonnes par an**, représentant un coût d'environ en devises 75 milliards de F CFA en 1995, et **92 milliards** en 1996. La SAR est également la seule société de raffinage de pétrole brut. Elle est confrontée à deux problèmes majeurs : d'une part, la taille limitée du marché et, d'autre part, la vétusté des installations qui tardent à être renouvelées, ce malgré le "supplément" de **2,3 \$/bbl** qui lui est octroyé au titre de la rémunération de ses activités.

11. La production nationale est assurée par **PETROSEN** et représente moins de **1000 tonnes** de pétrole brut en 1995, vendu à la SAR et **55 millions de m³** de gaz qui alimentent des turbines à gaz de la SENELEC. La principale contrainte de PETROSEN reste le financement de ses activités dans le domaine de l'exploration, en particulier avec les difficultés de mobilisation de fonds publics.

12. La distribution des produits pétroliers est réalisée par quatre grandes sociétés qui se partagent le marché sans grande concurrence tandis que le transport des produits pétroliers est assuré depuis 1972 par un cartel de transporteurs affectés de façon réglementaire aux différentes sociétés.

.../...

13. La fixation trimestrielle des prix des produits pétroliers basée sur la parité importation a représenté la première étape de la réforme recommandée par l'étude du cabinet ADL de 1987. Certains volets de la réforme tels que la répercussion du prix du marché sur le prix de vente au consommateur n'ont pas encore été entièrement appliqués. Par ailleurs, le poids de la fiscalité sur le prix des produits pétroliers, notamment ceux utilisés par les industriels et le gas-oil, obère lourdement le coût des facteurs de production compromettant ainsi la compétitivité de l'économie et la relance de la croissance.

C2.2-Le sous-secteur électricité

14. L'électricité est uniquement d'origine thermique. La SENELEC a le monopole de la distribution et dispose d'un parc de production de 280 MW. Elle consomme 300 000 tonnes de produits pétroliers pour une production de 1 000 GWh par an. Elle rachète en plus une part des excédents d'énergie (4 GWh en 1994) des quelques auto-producteurs existants (ICS, la CSS et la SONACOS qui, avec un parc de 90 MW, produisent 100 GWh par an).

15. Le taux d'électrification au niveau national est de 25 % ; il est de 50% en zone urbaine et seulement de 5% en zone rurale. La population n'ayant pas accès à l'électricité reste très en dessous du niveau mondial (75 % contre 40%)

16. En outre, le ralentissement à partir de 1990 des investissements de la SENELEC (dû essentiellement au gel des financements des bailleurs) a eu pour conséquence la dégradation des outils de production et la détérioration des résultats économiques et financiers. Malgré le redressement noté récemment, les principaux problèmes (déficit important de puissance, relations financières difficiles entre l'Etat et la SENELEC, faiblesse du taux d'électrification) persistent toujours et leur résolution conditionne le succès durable des efforts d'assainissement engagés.

C2.3-L'électrification rurale

17. L'électrification rurale est encore très peu développée- puisqu'on compte en 1994 environ 250 villages électrifiés sur un total de près de 14.000- à cause principalement de l'absence de ressources adéquates pour assurer le financement des coûts très élevés d'investissement et d'exploitation dans un contexte de non-rentabilité financière des opérations d'électrification rurale. Si la tendance actuelle se poursuit, le pourcentage de la population rurale ayant accès à l'électricité ira en diminuant, dans la mesure où le taux de raccordement (2% an) est inférieur à celui de la croissance de la population (environ 3% an).

18. Le service de l'électricité en milieu rural est cependant source de progrès social important ; il facilite notamment l'accès aux services de santé et à l'éducation, permet la réalisation d'activités productives génératrices de revenus et, d'une manière générale, favorise le développement économique et social du monde rural. Ainsi, il contribue à freiner l'exode rural en fixant les populations sur leur terroir, et donc limite le développement incontrôlé des villes. L'électrification rurale représente, de ce fait, un enjeu considérable pour le Sénégal. Il apparaît donc fondamental de définir un cadre stratégique global qui permette la mise en place d'une véritable dynamique d'électrification rurale.

.../....

C2.4-Le sous-secteur des combustibles domestiques

19. La consommation nationale est estimée à **330.000 tonnes** de charbon de bois et à **1.500.000 tonnes** de bois, ce qui représente l'équivalent de plus de **4 millions de m³ de bois**. La demande en charbon de bois, satisfaite par un prélèvement concentré sur des ressources forestières fragiles, est à l'origine d'un défrichement annuel de **30.000 ha** de forêts naturelles.

20. Les modes d'exploitation actuelles pour la fourniture du bois énergie et du charbon de bois conduisent à une dégradation rapide du couvert forestier. Egalement, le front de l'exploitation forestière recule d'année en année, pour atteindre aujourd'hui des zones situées à plus de 400 km de la capitale. Enfin, la non-responsabilisation des populations locales ne permet pas une gestion efficace des ressources forestières de leurs terroirs.

21. La butanisation, menée depuis 1974 grâce à un système de subvention sur le prix du gaz butane et à des investissements privés importants en matière d'équipement et d'infrastructures de stockage, d'emplissage et de distribution, a aujourd'hui des effets visibles. Mais cette politique s'est révélée être d'un coût élevé pour l'Etat, atteignant actuellement 6 milliards de F CFA sous forme de subvention sur le prix du produit sans compter l'exonération des taxes sur les équipements gaz.

22. Enfin, les campagnes de promotion de foyers améliorés et de substitution de la tourbe au charbon de bois ont été sans grands résultats à ce jour.

D- Politique Energétique

23. Malgré les contraintes précédentes, le secteur énergétique du Sénégal présente des atouts sérieux pour son développement, entre autres :

- une industrie pétrolière complète fonctionnant selon des standards de classe internationale;
- un sous-secteur électrique organisé de manière rationnelle et recelant des ressources humaines compétentes, et;
- un sous-secteur des combustibles domestiques qui mise clairement sur une gestion durable des ressources forestières.

24. Dans ce contexte, la politique énergétique mettra l'accent sur trois dimensions fondamentales:

. **économique** : rationaliser les conditions d'approvisionnement, de production, de distribution et de consommation d'énergie, dans le respect des intérêts à long terme du pays;

. **environnementale** : respecter les équilibres écologiques fondamentaux et encourager une gestion rationnelle des espaces ruraux dans les zones d'exploitation forestière à usage énergétique;

. **sociale** : élargir l'accès des populations aux formes modernes d'énergie, condition sine qua non de réussite de la lutte contre la pauvreté, de l'amélioration de la santé des populations, de succès dans les efforts de réduction de l'analphabétisme, du développement de l'agriculture, de la promotion de la femme, etc.

25. La stratégie comporte des actions dans le domaine des sous-secteurs pétrolier et électrique ainsi que dans celui des combustibles domestiques. Celles-ci- incluent en particulier :

- la libéralisation des importations, du transport et de la distribution des produits pétroliers ainsi que l'abolition de la convention spéciale de la SAR et son remplacement par une surtaxe temporaire et dégressive sur les importations de produits finis;

- l'ajustement trimestriel automatique des prix des produits pétroliers en liaison avec l'évolution des cours internationaux;

- la modification du cadre légal et réglementaire afin de permettre un niveau élevé de concurrence et d'encourager l'implication du secteur privé dans l'investissement et la gestion du secteur de l'électricité;

- la privatisation et la restructuration de SENELEC; et,

- le transfert aux collectivités locales de la gestion et de l'exploitation des ressources ligneuses.

26. Pour mettre en oeuvre cette stratégie et les actions correspondantes, le Gouvernement a décidé de s'appuyer sur deux nouvelles entités, à savoir : (a) un Comité Interministériel de Pilotage des Réformes du Secteur de l'Energie, comprenant l'ensemble des départements ministériels concernés et ayant la responsabilité de coordonner et de diriger la mise en oeuvre des réformes; et (b) une Cellule Technique, composée de spécialistes requis, qui sera chargée de mener tous les travaux nécessaires pour la conduite de ces réformes ainsi que de la préparation et l'exécution du Projet Energie II.

E-Sous-secteur des produits pétroliers

27. Les activités de ce sous-secteur sont déjà exercées pour l'essentiel par des opérateurs privés, mais sous un mode monopolistique. Les réformes ont pour but de diminuer le coût des produits en libéralisant totalement ces activités et en stimulant la concurrence.

(iv) le système actuel de péréquation du transport sera revu, en raison du nouveau contexte de libéralisation, pour protéger les intérêts des consommateurs excentrés et assurer la couverture du territoire.

(v) la fiscalité sur les produits sera simplifiée et l'objectif de neutralité fiscale (par produit, par type d'usage) sera recherchée;

(vi) les subventions concernant les combustibles pour la production d'électricité et pour la consommation d'électricité de la Compagnie des Phosphates de Taïba seront éliminées.

32. En ce qui concerne l'exploration pétrolière, la politique du Gouvernement vise à intensifier la recherche d'hydrocarbures, pour augmenter les chances de découverte de gisements exploitables.

Dans ce contexte, le Gouvernement et la Société publique PETROSEN devront concentrer seulement leurs activités sur la promotion du bassin sédimentaire sénégalais; à cet effet, les textes régissant la société seront modifiés et adoptés **avant le 30 juin 1997**.

F-Electricité

33. Le sous-secteur de l'électricité fait face à des enjeux considérables qui conditionnent, dans une large mesure, le succès du programme d'ajustement. C'est la raison pour laquelle, le gouvernement attache une grande importance au développement de celui-ci.

34. Les objectifs principaux de la politique du gouvernement pour le sous-secteur de l'électricité sont : (i) d'assurer la garantie de l'approvisionnement en électricité de la population et des autres consommateurs dans les meilleures conditions de sûreté et de prix, compatibles avec la situation économique du pays; et (ii) d'accélérer l'électrification urbaine (60% en l'an 2000) et rurale (15% à l'an 2000).

35. Le Gouvernement a conscience que l'atteinte de ces objectifs ne pourra être réalisée sans, d'une part, trouver les voies et moyens de pérenniser les résultats encourageants obtenus ces trois dernières années au niveau de l'amélioration de la gestion et des résultats d'exploitation, et d'autre part, améliorer de manière substantielle l'efficacité et la productivité du sous secteur par une large implication des opérateurs privés. Cela nécessitera une restructuration importante du sous-secteur dont l'objectif est de: (i) confier au secteur privé la production et la distribution de l'électricité; et (ii) promouvoir la concurrence à tous les niveaux possibles et compatibles avec les caractéristiques du système électrique sénégalais.

F1- Cadre général

36. Il est retenu d'introduire d'importants changements dans la structure de l'industrie électrique et dans la propriété des moyens de production et de distribution de l'électricité. A cet effet, le Gouvernement a décidé la privatisation à *court terme* de la SENELEC. Par ailleurs, le Gouvernement ne souhaite pas créer de monopole privé durable ce qui, à *moyen terme*, implique d'introduire le plus possible de concurrence dans le secteur.

De plus la loi sur l'électricité explicitera les relations entre les différents acteurs; (2) le rôle de l'Etat concernant la politique électrique, la planification et la régulation, en particulier en ce qui concerne les principes de tarification; et (3) les modalités de fonctionnement de l'organisme de régulation.

Enfin, cette loi devra tenir compte de la politique de décentralisation, mise en vigueur en 1997, et du cadre futur de la coopération régionale en matière de production et de transport d'énergie électrique notamment au sein des pays membres de l'Organisation pour la Mise en Valeur du Fleuve Sénégal, de l'Organisation pour la Mise en Valeur du Fleuve Gambie et de l'Union Economique et Monétaire Ouest Africaine.

42. La mise en oeuvre de la Loi sur l'Electricité sera assurée par un organisme de régulation qui devra être créé et qui aura pour tâches essentielles: (1) d'accorder (et de retirer le cas échéant) les différentes licences d'exploitation (production indépendante, concessions); (2) d'interpréter et d'appliquer les principes de tarification définis dans la Loi; et enfin (3) de définir les standards et normes de fonctionnement du secteur électrique.

Ce sera dans un premier temps, un organisme gouvernemental situé au sein du Ministère chargé de l'Energie. Sa fonction opérationnelle de réglementation sera effectuée par une petite unité spécialisée et comprenant un nombre très limité de cadres.

Dans un premier temps, elle sera chargée de contrôler et d'approuver les processus d'appel d'offres compétitifs lancés pour obtenir des capacités additionnelles en production d'électricité.

F4- Maitrise de l'Energie

43. Le Gouvernement du Sénégal entend poursuivre et développer les efforts en matière de maitrise de l'énergie avec pour objectif de réduire la facture vis à vis des produits importés, de diminuer les coûts des facteurs de production et de contribuer à la protection de l'environnement global.

44. A cet effet, l'Agence pour la maîtrise de l'Energie dont la création est envisagée plus haut aura pour tâches d'identifier les potentiels d'économie d'énergie et de réaliser les actions d'information, d'appui et de conseil auprès des différents opérateurs. Elle étudiera d'autre part, les mesures fiscales et réglementaires à mettre en place pour encourager la maîtrise de l'énergie.

F5- Electrification rurale et périurbaine

45. Le développement de l'électricité dans les zones rurales et dans certaines zones péri-urbaines, que cela soit par développement des réseaux ou par moyens décentralisés, est coûteux et le produit peut s'avérer trop cher pour les populations concernées. Le Gouvernement envisage d'appuyer ces extensions par l'octroi de subventions dans le cadre de sa politique sociale. Leurs réalisation et exploitation pourront être confiées aux firmes de distribution privées les plus proches des zones concernées, selon des procédures d'adjudication réglementées.

46. Cet aspect devra faire l'objet d'analyses complémentaires et de propositions plus détaillées, en particulier pour ce qui concerne la programmation des investissements, les sources et les modalités de financement. Il est néanmoins attendu que la restructuration du secteur, telle qu'elle est décrite ci-dessus, facilitera le développement d'entités capables et intéressées à développer ces activités.

G. Combustibles domestiques

47. Le but général recherché est de: (i) valoriser de manière durable les ressources énergétiques issues de formations forestières nationales; (ii) faire bénéficier les collectivités locales de ressources tirées de l'exploitation forestière, et (iii) promouvoir des combustibles de substitution adaptés au modèle de cuisson sénégalais pour autant que leur faisabilité technique et économique est assurée.

48. En vue de la réalisation de ces objectifs, le code forestier, adopté en 1993 pour sa partie législative et en 1995 pour sa partie réglementaire, vise à introduire les réformes importantes suivantes:

- le charbon de bois sera produit à partir de la vente de bois sur pied en considération de la capacité de régénération des forêts. C'est dans ce sens qu'un décret présidentiel pris en 1996, vient de relever la redevance forestière et introduit un système de taxation différencié suivant que le bois provienne d'une zone aménagée ou de formations forestières naturelles.

- les collectivités locales concernées seront les gestionnaires légaux des forêts de leur terroir et les bénéficiaires des revenus issus de leur exploitation. A cet effet, les décrets d'application de la régionalisation, déjà signés en **janvier 1997**, consacrent entre autres, le transfert de la gestion des ressources forestières aux collectivités locales.

49. Dans ce contexte, les dispositions législatives et réglementaires du nouveau Code Forestier seront révisées, avant le **30 juin 1997**, pour tenir compte de la politique de régionalisation et pour offrir des garanties en matière de gestion de forêts et de transfert des ressources issues de l'exploitation forestière vers les populations rurales.

50. Dans le cadre de cette révision, les mesures suivantes seront précisées:

- 1) les gestionnaires légaux des ressources concernées seront les bénéficiaires des revenus issus de la vente du bois des forêts;

- 2) les quotas seront des quantités à prélever annuellement, fixées en terme de volume de bois sur pied ou de stère, en tenant compte de la capacité de régénération des forêts

- 3) les services forestiers mettront en place avant le **30 juin 1998**, les mesures nécessaires pour la réalisation d'une exploitation forestière raisonnée et contrôlée (quotas annuels) qui devront couvrir l'ensemble des superficies forestières du pays à l'horizon 2005. A l'an 2000, ces mesures devront couvrir les régions de Tambacounda et de Kolda.

51. En outre, le prix de charbon de bois sera libéralisé au plus tard le **31 décembre 1999**. Un système de régulation de la filière sera cependant mis en place pour éviter des risques en matière d'approvisionnement et pour assurer une situation de réelle compétitivité dans le sous secteur.

52. Un plan de suppression de la subvention sur le gaz butane sera adopté par le Gouvernement au plus tard le **31 décembre 1997**, pour tenir compte des contraintes financières de l'État. L'élimination de cette subvention se fera de façon progressive par tranches semestrielles et devra être complète le **31 décembre 1999**.

53. Enfin, le Gouvernement envisage la mise en œuvre de mesures adéquates en vue de diversifier les combustibles de cuisson proposés aux ménages. Il s'agira en particulier de promouvoir le kérosène -- dont l'introduction comme combustible domestique sera entreprise avant la fin de **juin 1998** -- et valoriser d'autres ressources potentielles nationales.

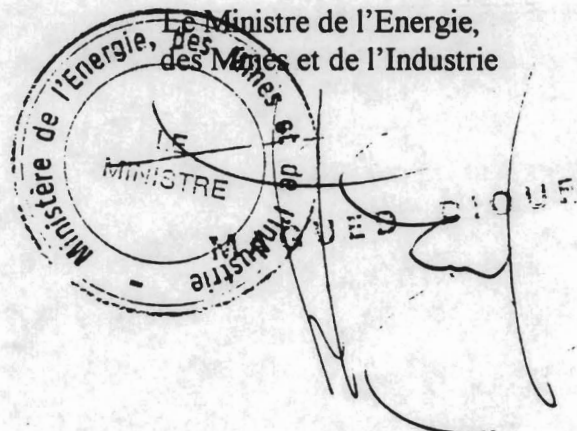
H - Approche et moyens à mettre en oeuvre

54. Le Gouvernement du Sénégal a conscience que la mise en oeuvre de l'ambitieux programme décrit ci-dessus demandera un effort substantiel, du temps et des ressources financières. Le soutien de la Banque Mondiale et d'autres bailleurs de fonds sera recherché.

Le Ministre de l'Economie,
des Finances et du Plan



Le Ministre de l'Energie,
des Mines et de l'Industrie



MINISTRE DE L'ENERGIE, DES MINES ET DE L'INDUSTRIE

41 En outre, le prix de chaque tonne sera libéralisé au plus tard le 31 décembre 1997. Un système de régulation de la filière sera cependant mis en place pour éviter des risques en matière d'approvisionnement et pour assurer une situation de l'équilibre compétitive dans le sous-secteur.

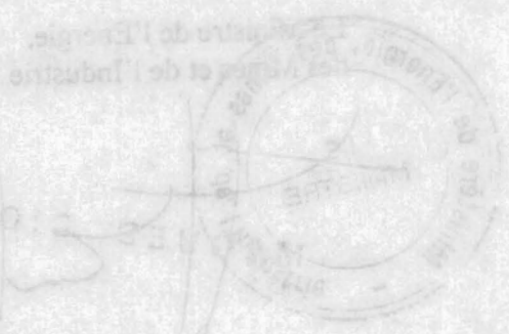
42 Le plan de suppression de la subvention sur le gaz-butane sera adopté par le Gouvernement au plus tard le 31 décembre 1997, pour tenir compte des contraintes financières de l'Etat. L'élimination de cette subvention se fera de façon progressive par tranches semestrielles et devra être complétée le 31 décembre 1999.

43 Enfin, le Gouvernement envisage la mise en œuvre de mesures adéquates en vue de diversifier les combustibles de cuisson proposés aux ménages. Il s'agit en particulier de promouvoir le kérosène - dont l'introduction comme combustible domestique sera entamée avant la fin de l'année 1998 - et d'explorer d'autres ressources potentielles nationales.

II - Approuver les moyens à mettre en œuvre

44 Le Gouvernement du Sénégal a convenu de la mise en œuvre de l'ambitieux programme de développement durable par un effort substantiel, du temps et des ressources financières. Le soutien de la Banque Mondiale et d'autres bailleurs de fonds sera recherché.

1998



Le Ministre de l'Économie
des Finances et du Plan

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SENEGAL SUSTAINABLE AND PARTICIPATORY ENERGY MANAGEMENT AND PROJECT CHARCOAL PRODUCTION AREA

SPREAD PROJECT AREAS
(WOODFUELS SUPPLY MANAGEMENT)

10, 15, 20, 25 CURRENT COMMERCIAL CHARCOAL
EXPLOITATION ZONES

PRIMARY ROADS

SECONDARY ROADS

SELECTED CITIES AND TOWNS

DEPARTMENT CAPITALS

REGION CAPITALS

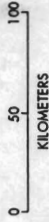
NATIONAL CAPITAL

DEPARTMENT BOUNDARIES

REGION BOUNDARIES AND NAMES

INTERNAL BOUNDARIES

KOUDA



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