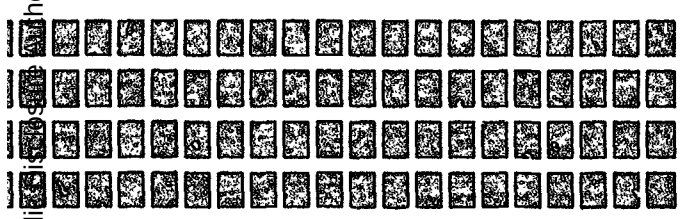


ESMAP

Energy Sector Management Assistance Programme

DECEMBER 1991

Public Disclosure Authorized

Haiti

Household Energy Strategy

Report No. 143/91

JOINT UNDP / WORLD BANK
ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

PURPOSE

The Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP) was launched in 1983 to complement the Energy Assessment Programme, established three years earlier. ESMAP's original purpose was to implement key recommendations of the Energy Assessment reports and ensure that proposed investments in the energy sector represented the most efficient use of scarce domestic and external resources. In 1990, an international Commission addressed ESMAP's role for the 1990s and, noting the vital role of adequate and affordable energy in economic growth, concluded that the Programme should intensify its efforts to assist developing countries to manage their energy sectors more effectively. The Commission also recommended that ESMAP concentrate on making long-term efforts in a smaller number of countries. The Commission's report was endorsed at ESMAP's November 1990 Annual Meeting and prompted an extensive reorganization and reorientation of the Programme. Today, ESMAP is conducting Energy Assessments, performing preinvestment and prefeasibility work, and providing institutional and policy advice in selected developing countries. Through these efforts, ESMAP aims to assist governments, donors, and potential investors in identifying, funding, and implementing economically and environmentally sound energy strategies.

GOVERNANCE AND OPERATIONS

ESMAP is governed by a Consultative Group (ESMAP CG), composed of representatives of the UNDP and World Bank, the governments and institutions providing financial support, and representatives of the recipients of ESMAP's assistance. The ESMAP CG is chaired by the World Bank's Vice President, Operations and Sector Policy, and advised by a Technical Advisory Group (TAG) of independent energy experts that reviews the Programme's strategic agenda, its work program, and other issues. The Manager of ESMAP, who reports to the World Bank's Vice President, Operations and Sector Policy, administers the Programme. The Manager is assisted by a Secretariat, headed by an Executive Secretary, which supports the ESMAP CG and the TAG and is responsible for relations with the donors and for securing funding for the Programme's activities. The Manager directs ESMAP's two Divisions: The Strategy and Programs Division advises on selection of countries for assistance, carries out Energy Assessments, prepares relevant programs of technical assistance, and supports the Secretariat on funding issues. The Operations Division is responsible for formulation of subsectoral strategies, preinvestment work, institutional studies, technical assistance, and training within the framework of ESMAP's country assistance programs.

FUNDING

ESMAP is a cooperative effort supported by the World Bank, UNDP and other United Nations agencies, the European Community, Organization of American States (OAS), Latin American Energy Organization (OLADE), and countries including Australia, Belgium, Canada, Denmark, Germany, Finland, France, Iceland, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Sweden, Switzerland, the United Kingdom, and the United States.

FURTHER INFORMATION

For further information or copies of completed ESMAP reports, contact:

The Manager
ESMAP
The World Bank
1818 H Street N.W.
Washington, D.C. 20433
U.S.A.

or

The Executive Secretary
ESMAP Consultative Group
The World Bank
1818 H Street, N.W.
Washington, D.C. 20433
U.S.A.

HAITI

HOUSEHOLD ENERGY STRATEGY

DECEMBER 1991

EXCHANGE RATE

US$ 1 = Gourdes 5.0 = Haitian $1

US$ 1 = FF 5.8

CONVERSION FACTORS

Petroleum Products	tons/m3	MJ/kg
LPG	0.55	45.7
Kerosene	0.8	43.5
Diesel	0.84	43.3

Woodfuels		
Wood (air dry, 20% humidity)	0.7	17.0
Charcoal (10% humidity)		29.0
Bagasse (50% humidity)		7.5

Electricity	TOE/GWh
Final Energy	86
Primary Energy	283

Others

1 US Gallon = 3.785 liters
1 barrel = 159 liters
1 TOE = 41.87 GJ = 10 million kcal
Charcoal production efficiency = 20% (in weight)
1 stere of wood = 1 m^3 (stacked) = 0.6 m3 (round wood)
1 carreau = 1.29 ha

ACRONYMS AND ABBREVIATIONS

AFVP	Association Française des Volontaires du Progrès
AOP	Agroforestry Outreach Project
BAPP	Bureau d'Approvisionnement en Produits Pétroliers
BDPA	Bureau de Développement de la Production Agricole
BIT	Bureau International du Travail
BME	Bureau des Mines et de l'Energie
BRH	Banque de la République d'Haïti
CPNAP	Commissariat à la Promotion Nationale et à l'Administration Publique
DRE	Direction des Ressources Energétiques (BME)
EdH	Electricité d'Haïti
ESMAP	Energy Sector Management Assistance Programme
FAC	Fonds d'Aide et de Coopération
FAO	Food and Agriculture Organization
FEPP	Forestry and Environmental Protection Project
GoH	Government of Haiti
IDA	International Development Association
LPG	Liquified Petroleum Gas
MARNDR	Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural
ODH	Operation Double Harvest
NGO	Non Governmental Organization
OLADE	Latin American Energy Organization
TFAP	Tropical Forestry Action Plan
PFN	Projet Forestier National
UNDP	United Nations Development Program
REDI	Renewable Energy Development Institute
SRF	Service des Ressources Forestières
TOE	Ton Oil Equivalent
USAID	United States Agency for International Development

TABLE OF CONTENTS

Page No.

TABLES:

FIGURES:

ANNEXES:

MAPS:

FOREWORD

This study was completed as an activity of the Joint World Bank/UNDP/Bilateral Aid Energy Sector Management Assistance Program (ESMAP). Financing for the study was provided mainly by the Norwegian Government, as well as by UNDP, the French Government and the Japanese Fund. The study was implemented with the assistance of and in close coordination with the BME/UNDP/OLADE Energy Sector Strengthening Project (HAI/89/031) and with the teams involved in the preparation of the IDA financed Forest and Environmental Protection Project.

ESMAP and its consultants worked with their main counterpart, the Bureau of Mines and Energy (BME) as well as will the Forest Resources Service (FRS), the Bureau for Petroleum Product Supply (BAPP) and the main Haitian organizations operating in the sector.

The study coordinator in the BME was Loctamard Antilus, Director of Energy Resources. Nicole Dieudonné, Guilen Aurelien and Naquin Medina also participated in the study. Violette Derosiers was responsible for survey data entry (carried out at the BME), with assistance from Marie Mercie Dieujuste and Eunide Germain.

The main authors of the following report are Philippe Durand (Task Manager, ESMAP) and Michel Matly (Energy Economist, coordinator of the consultant team). The study team included Jocelyne Durany-Jakob and Carole Roy (Consultants, Sociologists), Joséphine Arpaillange (Energy Statistician, ESMAP), Christian Bonaparte (Consultant, Marketing Specialist), Calixte Clérismé (Consultant, Sociologist) and Kevin Fitzgerald (Energy Statistician, ESMAP), as well as about thirty presenters and pollsters.

This study is based on a major data collection effort comprising both quantitative and qualitative information collected from December 1989 to May 1990. During this time, the following main surveys and in-field inquiries were carried out: household survey, market polls and surveys of small businesses in Port-au-Prince; surveys of charcoal retailers and transporters in Port-au-Prince and in the main cities; surveys of rural merchants and charcoal producers in the main areas which supply charcoal to Port-au-Prince; counting the number of charcoal entries at Port-au-Prince (see Annex XIII).

EXECUTIVE SUMMARY

Environmental Degradation

1. Haiti's environment is undergoing a gradual process of severe degradation, which has immediately perceptible and sometimes irreversible effects, especially with regard to loss of soils and decreasing agricultural yields. Even though this environmental problem has arisen partially due to multiple non-energy factors (demographic pressures, agricultural techniques, irregular land tenure practices), the fact remains that woodfuel consumption, especially urban charcoal consumption, is a major contributor to deforestation. This is not a newly noted phenomenon: experts have cited it for more than a decade. However during that time, no coherent, comprehensive program has been proposed or undertaken by the Haitian Government with assistance from international development agencies.

2. It is significant that in Haiti -- frequently cited as one of the countries in the world where environmental destruction has reached an alarming phase -- there is no recent inventory of forest or biomass resources, nor any serious analysis quantifying the extent of deforestation. Without fundamental data needed to accurately evaluate the current state of the biomass stock and its annual growth, alarmist accounts of the approaching demise of the last Haitian tree persist. Independently of the uncertainties surrounding wood-energy supply potential, deforestation in Haiti is an incontestable reality; it is therefore important to reduce the pressure on forest resources generated by woodfuel consumption, especially charcoal consumed in Port-au-Prince.

Reforestation and Management of Forest Resources

3. The only national-scale projects related to this problem have been carried out by the private sector. They comprise mainly the agro-forestry tree planting projects run by non-governmental organizations operating throughout the country. Although these plantations are expensive and their overall success has been relative, several million new trees grow in Haiti each year as a result of these efforts. An additional advantageous outcome is that tree planting has become ingrained into traditional peasant practices. However, tree planting efforts represent only partial solutions to Haiti's deforestation problem. Based on the latest analyses of deforestation, at least 23 million surviving trees would need to be planted each year, i.e. nearly 10 times the current rate, in order to reverse the destruction of national forest resources.

4. Public management of forest resources, already relatively ineffective, has continued to worsen. In 1986, a new stage was reached: monitoring of forest exploitation disappeared almost totally. Since then, charcoal exploitation has spread throughout the country, starting from areas where large-scale production was already the norm, so that now almost all regions of Haiti market charcoal for the capital. In some parts of the country, particularly along the northwest peninsula,

charcoal production plays a major role in the rural economy and has become an important source of income for numerous peasants.

5. The large scale plantations approach has been abandoned because of the lack of financial profitability which in turn prompted landholders away from this option. Also, investments for reforestation and forestry research under the National Forestry Project have produced only minor results relative to the deforestation problem. The project achieved somewhat limited progress with increasing the effectiveness of forestry control; but the Forestry Service still monitors only 10% of the charcoal trade.

Management of Household Energy Demand

6. Several projects have addressed the problem of charcoal conservation (BME, NGOs). Results were negligible due to the small size of the projects, lack of resources and dispersed efforts. Although studies show that the charcoal cookstoves currently in use are highly inefficient, there have been no commercial-scale promotion of improved models.

7. The initiative for developing charcoal substitutes has been taken by the private sector, which introduced portable butane gas stoves (Bip Ticheri) and engaged in large-scale publicity campaigns to promote this fuel. The Government assisted private sector efforts by decontrolling gas prices and applying favorable foreign exchange conditions to fuel imports in 1987, with extension of the same conditions to the import of Bip cookstoves in 1989.

Costs of Household Fuels

8. Extensive use of charcoal in Haiti's cities is, to a very large extent, an indirect consequence of the high gas prices which result from current supply and distribution arrangements. In fact, the Haitian gas market is a de facto monopoly, characterized by small and often outdated installations and gas prices among the highest in the Caribbean, if not the world. It is a captive market for the petroleum company which holds a monopoly over the entire supply of gas -- from gas purchases on the international market to retail distribution.

9. Under the current situation -- no other supply alternatives, decontrolled gas prices, no taxes or tariffs -- the official gas policy is prejudicial against the State itself, depriving it of much needed resources. This policy costs the economy about $2.5 million annually, has no direct benefits to the consumer and only marginally provides incentives for the use of gas as a charcoal substitute. Under a more normal price structure, the gas could be lightly taxed, and the supplier margins would be reduced so that the final price is much less costly for the consumer.

10. Analyses show that under normal conditions of supply, gas becomes the best financial option for the consumer and the best economic option for the country. Market studies underscore that gas is also the fuel which is most likely to successfully substitute for charcoal in urban Haitian

households: the market potential is for conversion of 25% to 50% of households in the capital depending on which pricing assumptions are retained, as compared to a potential market share of less than 10% for its direct competitors, kerosene and electricity. The upper estimate, 50%, is substantially higher than the current rate of market penetration: only 15% of Port-au-Prince households use gas as the only or primary fuel. However, this is far below the estimated 70% utilization rate by households in the capital of the Dominican Republic, though the fuel is heavily subsidized (and the price of charcoal is two times higher than in Haiti).

11. The household energy sector is in complete economic disequilibrium and thus rapid intervention is needed. Peasant charcoal producers subsidize urban consumers since wood is acquired at a price far below its replacement cost -- prices which reflect a "mining" mentality in the exploitation of forestry resources -- thereby contributing to degradation of the environment and the rural economy. International organizations subsidize reforestation activities and even part of the operating costs for the forestry services, while elsewhere ineffective collection of charcoal-related taxes represents a recoverable loss of nearly $1 million annually. The public authorities subsidize the gas sector to a considerable extent through its favorable import policies; unfortunately, no benefits accrue to either the consumer or the State, even though the State itself is sorely in need of more sources of operating revenues.

Action Priorities

12. The primary objective of any intervention in these areas is to gradually restore the financial and economic equilibriums in the sector through: lowering significantly the price of gas; allowing charcoal prices to increase substantially; introducing mechanisms for the State to generate revenues from the marketing of both fuels, sufficient for financing operations and partial investments by the public entities responsible for managing the sector.

13. Intervention also will be centered only on several main themes which represent important stakes for the country and which are likely to have significant impacts. These themes will be addressed in a manner so that the scale of intervention will have national impacts.

14. Intervention requires the State to affirm its political willingness to act at the highest levels, and to make a more accurate accounting of its strengths and weaknesses, by seeking intervention of existing non-governmental and private entities, and by negotiating when necessary with the local populations.

15. Finally, intervention in the household energy sector must be designed as a contribution to solve the problem of environment degradation. A household energy strategy would therefore not hinder but rather complement and reinforce the country's global strategy for natural resource management.

Strategy Components

16. The proposed strategy contains measures designed to effectively redress quickly the current dramatic situation in the sector by intervening on four levels -- the four components of the recommended strategy:

a. opening the gas market,

b. generating charcoal savings,

c. modernizing the charcoal sector,

d. sector monitoring and evaluation.

17. The first component of the strategy, opening the gas market, will create conditions for real competition in the gas sector, thus producing downward pressure on the gas prices to the benefit of consumers. It also will facilitate access to gas as a primary fuel and to gas appliances by the less privileged classes (middle classes and upper levels of the poorer households). This will be accomplished by either installing new receiving, storage and filling infrastructure or by enlarging existing infrastructure, with possibly temporary recourse to gas imports supplied from the Dominican Republic. The various possibilities of partnerships between private or institutional operators, both local and foreign, should be studied, as well as the legal, regulatory and fiscal aspects of the prerequisites and consequences of partnership choices.

18. The second component of the strategy is the large-scale distribution of improved charcoal stoves in Port-au-Prince and in the four major secondary cities in Haiti. In fact, even under the most favorable assumptions of substitution by other fuels, the proportion of households which will continue to use charcoal will remain significant: about one in every two, on average in the major cities. The distribution will target household users of round stoves and "potaje" cookstoves, as well as small roadside food vendors ("manje kwit"). A total distribution of 80,000 stoves is anticipated at the end of three years.

19. The third component targets the reorganization and rationalization of charcoal exploitation. Charcoal exploitation will be redistributed geographically through the use of regional production quotas, which will ensure that charcoal production is carried out in areas where the risks to the environment are acceptable. The component will help the Haitian Government to more effectively control the flows of charcoal, especially for marketing in the capital, and to collect taxes associated with charcoal transport. The component is based on definition and implementation of a Supply Master Plan for Port-au-Prince, strengthening and improvement of controls on charcoal transport and of the tax collection system, contribution to defining a priority rural development program to compensate local populations for losses generated by application of charcoal quotas, and

implementation of an assistance program for charcoal producers in zones where charcoal exploitation will continue.

20. The fourth component includes creation of a Steering Unit for the strategy. The Steering Unit will assure permanent supervision and coordination of the household energy sector and will assure cooperation between the various sector participants, as well as coordination and evaluation of activities carried out as part of the strategy. In order to promote coherence in the sector, the Steering Unit will also oversee adjustments to pricing and fiscal policy and legislation concerning the different fuels. At the fiscal level, the strategy includes improved collection rates for charcoal prices and a new tax on the price of gas once the gas price structure has been revised so that gas can be distributed throughout Haiti at lower prices (para. 16).

Strategy Results

21. The main outcomes of the Strategy will be to stabilize charcoal consumption in Haiti and to gradually transform as much charcoal production as possible into a sustainable, financially profitable and environmentally benign economic activity. Specific outcomes for the strategy once the four components have been implemented are the following:

a. gradually increase in the proportion of urban consumers using gas as the primary fuel, with a target percentage of 35% of Port-au-Prince households in 1996 and 50% in 2001 (10% and 20% respectively in other cities);

b. development of gas consumption from 7,000 tons at present to 23,000 tons in 1996 and 41,000 tons in 2001;

c. use of improved stoves by one of every two charcoal consumers in Port-au-Prince by the year 2001;

d. gradual drop in charcoal consumption (and thus decreased pressure on national forest resources) by 43% of projected 2001 consumption, through substitution by gas and distribution of improved stoves.

e. improvement of conditions for charcoal production and rationalization of the access to forest resources in the main charcoal exploitation districts (Supply Master Plan for Port-au-Prince), including improved tax policy and better enforcement of regulations concerning charcoal commerce (tax collection rates for charcoal transport to go from 10% in 1990 to 60% in 1996);

f. vocational training and assistance for developing professionalism among 500 small-scale charcoal makers.

22. The impacts of this strategy on the national economy are the following:

a. relative increase in petroleum product imports of 12% by 2001, all other things being equal. This is equivalent, in terms of the current level of external trade, to 4% of the countries total exports.

b. income generated by charcoal exploitation in the main production zones to remain constant (or, under normal conditions, to increase due to efforts to increase the real producer price).

Costs and Financing

23. Implementation costs for the strategy total US$ 10.5 million over the 1992-1994 period: US$ 0.8 million for the stove distribution program, (which is included in IDA's Forestry and Environmental Protection Project) US$1.4 million for modernizing the charcoal sector, US$ 7.5 million for petroleum investments (mostly private), and US$ 0.8 million for monitoring and evaluation. Total recurrent costs are estimated at US$900,000 over the period 1995-2001. The simplified economic and financial analysis gives a financial IRR of 10% and an economic IRR of 40% for the period 1992-2001.

24. Considering the urgency of implementing the Strategy's components, obtaining the necessary funding should be among the Government's priorities. Several bilateral donors traditionally active in the energy and forestry sectors could be approached, such as France, Canada, USAID and Germany. Other resources might also be tapped, such as the Haiti Economic and Social Fund in the recently-created Global Environment Facility.

I. OVERVIEW

General Socio-Economic Overview

Deterioration of the Economy

1.1 By far the poorest country on the Latin American continent, Haïti has been in the midst of a sustained economic and social crisis for over a decade. This crisis is manifested by a continuous decline in per capita GDP averaging 1 to 2% per annum since 1985 and estimated at nearly 4% in 1989. The drop in GDP has had repercussions in all economic sectors. The decreased demand for imports, associated with the economic slowdown and the resulting reduction in the population's purchasing power, has been totally offset by declining exports, decreasing of foreign aid and the loss of tourism revenues. Thus the trade deficit, which was about 40% in 1989, remains substantial. In the formal commercial sector, the level of salaried employment has continued to drop: according to the National Bank of Haïti (Banque de la République d'Haïti - BRH), the number of employees in the formal sector declined by 10% between 1986 and 1989. The effects of the crisis have not spared the informal sector: during the last three years, about 20% of the 3300 mini and small businesses located in the capital have been forced to shut down.

Declining of Purchasing Power in Urban Areas

1.2 Inflation was relatively moderate until recently but now is on the rise; officially estimated at 7%, actual inflation figures were in the range of 15 to 20% in 1989. The prices of most basic products have increased substantially: food products such as oil, meat, eggs and sugar rose by 30 to 80% between February 1989 and February 1990. Construction materials also increased by 25% during the same period (30% for timber alone). By contrast, the minimum salary in Haïti (H$ 100/month) has not changed since 1984. A progressive weakening of Haïti's currency is linked with this inflation. At the beginning of 1990, there was a 40% differential between the nominal rate of exchange (5 Gourdes per $1) and the actual rate offered on the parallel market. There results a continued erosion of purchasing power in urban households, particularly among the middle classes, whether it be for purchases of imported supplies and products (automobile purchases, for example, have dropped from nearly 6000 in 1985 to 2500 in 1989) or more simply for purchases of local products.

Activity Slowdown in Rural Areas

1.3 Agricultural activity has been on the decline for several years, as evidenced by a decrease in its value added in 1989; in constant terms, value added already had fallen by 10% from 1986 to 1989. Agricultural activity decline is particularly noticeable at the level of crop exports for products such as cocoa (production was halved between 1985 and 1988) or sugar cane (production went from 2 million tons in 1985 to 350,000 tons in 1989). Inflation coupled with a decline in international market prices act as disincentives to rural producers: the tendency now is

to move away from export-oriented cash crops and raise food crops instead. The eradication of pigs also has deprived the peasants of one of their rare sources of monetary income. Marketed production and monetary income in rural areas thus have been reduced considerably, producing inflationary repercussions on the prices of products flowing onto the national market.

Demographic Pressures

1.4 With an estimated population of 5.8 million in 1990, Haïti has a population density of 215 inhabitants per km², one of the highest in the hemisphere. This creates a growing pressure on the environment due to demand for new agricultural land. Even so, the annual growth rate for the rural population is estimated at only 0.7% for the period 1982-2000, while the growth rate for the urban population would reach nearly 5% during the same period; the capital, Port-au-Prince, represents nearly 20% of the total population. This urban population, most of whom consume charcoal, thus constitutes a rapidly growing threat to the environment.

The Energy Sector

National Energy Demand

1.5 Per capita consumption of commercial energy in Haïti is among the lowest in the world and certainly the lowest on the Latin American continent. Estimated at 1.8 barrels of oil equivalent (b.o.e.), annual per capita consumption is only half that of the Dominican Republic, one third that of Jamaica or Barbados, and one quarter that of Cuba. These comparisons are even more striking for electricity consumption, which measures about 51 kWh per capita annually in Haïti, versus 430 kWh in the Dominican Republic, 510 kWh in Jamaica, and 1410 kWh in Cuba. Only a fraction of Haïti's population has access to commercial energy; kerosene, used for lighting, is the only fuel in widespread usage. Gas 1/ and electricity are used by a very small segment of the population, almost exclusively in urban areas (the national electrification rate is less than 15%).

1.6 The most recent energy consumption data (for the year 1985) are summarized in Table 1.1. Residential energy consumption represents more than half the total energy demand, followed by the commercial sector (21% of national demand), industry and transport. The table emphasizes the preponderance of the woodfuels sector in national energy supply: fuelwood, which by itself represents 70% of the national supply, charcoal and sugar cane bagasse. Haïti currently is more than 80% self-sufficient in energy due to residential use of wood in rural areas and of charcoal in urban area. Still, it also should be noted that fuelwood, bagasse and, to a lesser extent, charcoal, are used largely by the industrial sector; thus these fuels cumulatively represent 63% of energy consumption by industry.

1/ References to gas in this report imply Liquid Petroleum Gas (LPG).

Table 1.1: Final energy consumption, 1985

(1000 TOE)	Residential	Industry	Transport	Commercial	Public	Total
Coal		36.5				36.5
Petroleum products	17.4	49.0	121.5			187.9
LPG	2.7				1.2	3.9
Electricity	10.1	11.1		1.2	3.1	25.5
Charcoal	88.9	1.5				90.4
Fuelwood	635.1	49.8		286.5		971.4
Bagasse		86.0				86.0
TOTAL	754.2	233.9	121.5	287.7	4.3	1401.6

1.7 Several surveys and evaluations by the BME and within the framework of this study show the breakdown of charcoal and fuelwood consumption by category of consumer. This breakdown is presented in Table 1.2, which shows both the levels of woodfuel consumption and their equivalent in terms of wood cutting. One will note:

(a) the importance of charcoal, which is only consumed by less than 30% of the population, but represents 40% of the demand for wood,

(b) the importance of non-residential charcoal consumption, estimated to represent 20% of the total charcoal consumption,

(c) the importance of Port-au-Prince for charcoal consumption; with two-thirds of the national consumption.

Table 1.2: Woodfuel Consumption in Haiti, 1990

	Charcoal (1000t)	Woodfuel (1000t)	Wood equivalent (1000t) (a)	(1000m3) (b)	%
Port-au-Prince					
Households	160		800	1,143	21
Informal sectors, others	40		200	286	5
Bakeries/dry cleaning		20	20	29	1
sub total	200	20	1020	1458	27
Other urban					
Households (c)	65	30	355	507	9
Informal sectors, others	15		75	107	2
Bakeries/dry cleaning		20	20	29	1
sub total	80	50	450	643	12
Rural					
Households		2100	2100	3000	56
Guildives		130	130	186	4
Oil factories		30	30	43	1
sub total		2260	2260	3229	61
Total Haiti					
Households	225	2130	3255	4650	87
Others	55	200	475	680	13
Total	280	2330	3730	5330	100

Notes: (a) Charcoal production efficiency estimated at 20% (in weight).
(b) Wood density estimated at 0.7 tons/m3.
(c) 90% of households use charcoal.

Source: Surveys of ESMAP/BME/OLADE/PNUD, 1990 (Annex IX).
Revised BME data (1987).

The Weight of Petroleum Imports

1.8 Despite the dominance of woodfuel in the national energy balance, petroleum imports represent a considerable weight on the Haitian economy. Petroleum imports amounted to nearly 50% of total exports in 1982, when oil prices peaked. After falling sharply to just 20% in 1987, the ratio between oil imports and total exports has begun to increase once again, due partly to the continued erosion of exports of goods and services and partly to the sustained demand for energy (Annex X).

1.9 Thus in 1989, the energy bill absorbed more than 30% of the country's export revenues. Kerosene and LPG represent 10% in volume and about 20% in value of all petroleum product imports to the country. Although gas consumption is very limited (about 10,000 tons in 1989), the value of gas imports alone is equivalent to 4% of the total value of Haïti's exports.

Costs of Commercial Energy in Haïti

1.10 One of the reasons for low consumption of commercial energy is without doubt that Haïti is one of the Central American and Caribbean countries where petroleum products and electricity are most expensive. A comparison of prices in Haïti and the Dominican Republic demonstrates this: even taking into account the overvaluation of Haitian currency (a 40% margin estimated between the official market rate and the parallel rate relative to the dollar), the price of kerosene and diesel are about two times higher in Haïti, that of electricity three times, and LPG prices nearly five times higher than in the Dominican Republic (see Annex II), where LPG is heavily subsidized.

1.11 Conditions for marketing and distribution are such that major differentials also exist between the economic costs of the various fuels in Haïti and in other Central American and Caribbean countries. This is particularly true for LPG, a fuel which is not under government price control.

Household and Small Industry Consumption in Urban Areas

Residential Consumption

1.12 The categorization of Port-au-Prince households by fuel (primary and secondary) is summarized in Table 1.3. Charcoal is the most utilized fuel, consumed by 90% of the capital's households. The most affluent classes are abandoning the use of charcoal (only about 2/5 of the 20% most affluent households use charcoal as their primary fuel). Those who consume charcoal only (62% of the population) use about 0.44 kg per capita daily. Taking into account secondary uses of charcoal, daily per capita consumption in the capital for all households combined is estimated between 0.36 kg (based on weighings carried out in 22 households) and 0.42 kg (based on a survey of 400 households). This results in a total residential consumption for Port-au-Prince approaching 160,000 tons in 1990 (based on the results of the household survey).

Table 1.3: Cooking Fuel Use in Port-au-Prince according to Living Standard Quintile (in percentage)

		Low	Medium Low	Medium	Medium High	High	Total
CHARCOAL							
	Only or main fuel	89.7	96.6	97.8	83.8	41.1	80.8
	Secondary fuel	6.4	2.4	2.2	11.3	32.8	10.9
	Total	96.1	99.0	100.0	95.1	73.9	91.7
GAS							
	Only or main fuel	1.3	1.3	2.5	13.9	55.8	15.1
	Secondary fuel	1.3	3.7	3.7	31.0	22.0	12.0
	Total	2.6	5.0	6.2	44.9	77.8	27.1
FUELWOOD							
	Only or main fuel	7.7	1.2	0.0	0.0	0.0	9.3
	Secondary fuel	6.4	4.9	1.3	0.0	0.0	2.5
	Total	14.1	6.1	1.3	0.0	0.0	11.8
ELECTRICITY							
	Only or main fuel	1.3	0.0	0.0	0.0	2.5	3.5
	Secondary fuel	2.6	0.0	3.8	11.3	6.3	4.5
	Total	3.9	0.0	3.8	11.3	8.8	8.0
KEROSENE							
	Only or main fuel	0.0	1.2	0.0	2.5	1.3	1.3
	Secondary fuel	0.0	0.0	3.8	3.8	1.3	1.8
	Total	0.0	1.2	3.8	6.3	2.6	3.1

Source: Survey ESMAP/BME/OLADE/PNUD, 1990
Note: See Annex X for the definition of the living standard variable and average income and food expenditure for each quintile.

1.13 Among the other fuels, gas is of special note, as nearly 27% of households currently are equipped with gas stoves or gas cookers, and more than half of these (15% of total) use gas as the primary fuel (see Table 1.4). In fact, use of gas is well established mainly in high-income households (half use it as the primary fuel) and middle-income households (those with incomes of more than $250/month). Use of gas among households with more modest incomes still is relatively limited: however, the arrival of "popular gas" with the dissemination of Bip single-flame butane has generate an initial penetration of this market. More than 50% of portable gas cookstoves are sold to households with incomes of less than $250/month (the last three quintiles of the population).

1.14 Other fuels are used only by small segments of the population: wood used in poor households (2.1% in open fires and 4.1% in portable cookstoves); kerosene, which one finds in use among the fringes of middle- to high-income population (0.8% primary usage and 5.3% in stoves/cookers); and electricity (0.8% primary usage and 5.3% in stoves/cookers) used uniquely in affluent households.

1.15 Household energy consumption in the secondary cities of Haïti (the main ones being Cap Haitien, Les Cayes, Gonaïves and St Marc) apparently is comparable so that in the capital, with charcoal predominating. The proportion of households using gas and kerosene for cooking is much lower, however, and residential consumption of fuelwood is still widespread, especially in certain port neighborhoods situated along city outskirts.

Table 1.4: Cooking Equipment in Port-au-Prince
In Percentage of Total Households

		Main Stove	Secondary stove	Other stove
Wood				
	Three stones	1.8	2.5	-
Charcoal				
	Round stove	55.3	10.3	-
	"Potajé" stove (metal)	13.6	3.5	-
	"Potajé" stove (blocks)	7.0	3.8	-
	Square stove	4.0	2.3	-
	Improved stove	1.5	0	0
Total		81.4	19.9	2.3
Gas				
	Bip Tichéri	3.5	5.8	1.5
	Plate	1.5	0.3	0
	Cooker	9.8	7.0	2.5
Total		14.8	13.1	4.0
Kerosene		1.0	1.5	1.3
Electricity		1.0	4.5	1.3
TOTAL		100.0	41.5	9.0

Source: Surveys ESMAP/BME/OLADE/PNUD 1990.
- Less than 1%.

Charcoal Cookstoves

1.16 There are various metallic traditional cookstoves available (see Table 1.4); the dominant types are the following:

(a) the round stove (or its square version), which sells for prices varying from $1.5 to $2, is used by two-thirds of the households,

(b) the "potajé" stove, consisting of two or three burners supported by a metallic or cement block frame, is used by nearly 30% of the households, generally the most affluent. The metallic model of this "top of the line" stove costs from $15 to $20, and the "block" model sells for about $3 to $5 per burner.

1.17 The lifespan of these stoves is approximately one year. The round single-burner stoves (as well as their square version) are produced by "réchauliers" (craftsmen who specialize in making portable cookstoves), and the potajé stoves by iron or metal masons. An estimated 200 réchauliers can be found in the capital.

Consumption by Small Industry

1.18 With regard to wood and charcoal consumption by the urban productive sector, a distinction must be made between two main categories:

(a) productive activities in the informal sector, which often consume charcoal;

(b) bakeries and dry-cleaners, which use mostly firewood.

1.19 Among the activities of the informal sector, small roadside restaurants and hot food vendors represent the bulk of charcoal consumption: a study carried out in 1989 by the Center for the Promotion of Female Workers estimates that there are nearly 80,000 sale points of food products in Port-au-Prince, of which 20,000 consist of small "manjé kwit" restaurants (one for eight households). Even if these figures are overestimated, they show the informal sector's importance in the capital. The household survey estimates that charcoal consumption linked to home-based productive activities of this sort accounts for 20% of total residential consumption: thus in Port-au-Prince, about 40,000 tons of charcoal are consumed by these activities annually, bringing the total consumption of charcoal in the capital to 200,000 tons/year.

1.20 The BME's 1987 census identifies 836 bakeries (146 in Port-au-Prince) and 113 dry-cleaners (94 in Port-au-Prince). Some of these companies have switched from kerosene to gas (approximately 30 bakeries and 13 dry-cleaners): hence 95% of the bakeries and 90% of the dry-cleaners in Haïti consume firewood exclusively. Total consumption, respectively, is estimated as 24,000 and 10,000 tons of wood.

Consumption by Households and Small Industry in Rural Areas

Residential Consumption

1.21 Various activities have been undertaken to assess rural fuel consumption, generally within the framework of reforestation projects. They show that firewood is almost exclusively the only fuel used in rural areas for cooking food and related activities. Various estimates of the quantities consumed give figures converging around 500 kg/year of firewood per capita. In most cases, this wood is gathered free of charge by the peasants on their land; in certain regions, however, especially in large agricultural zones where sugar cane or "vetiver" are cultivated, rural marketing of firewood is beginning to appear, sometimes even for residential uses. The use of

charcoal is relatively limited and concentrated in a few areas with large charcoal production activities.

Consumption by Small Industry

1.22 In 1985 there were 473 "guildives" and "moulins-guildives" (small companies producing sugar and drinking alcohol), mainly in the southwest peninsula of the country. Some of the moulin-guildives use bagasse from sugar cane and more modern guildives use diesel, but most of these small industries use large wood. This is also the case with 31 essential oil factories; a few more than half use firewood for their oil extraction process. It is estimated that in total, the annual wood consumption of these small enterprises is 130,000 tons and 30,000 tons, respectively.

Woodfuel Resources

Forest Resources

1.23 The extent of Haiti's forest resources is not well-known; the last estimation was based on aerial photographs taken in 1978, and comprised only natural forest formations. A World Bank environmental study (BDPA) undertook an evaluation of forest resources based on the 1982 land use map which was established using the aerial views from 1978 (see Table 1.5). As this map was not created specifically for forestry needs, the estimates which are drawn from it -- the most complete and most precise of all existing estimates -- remain at best approximate, even according to the authors of the map. Still, it is possible to note the importance of fallow land and tree crops as standing inventory for biomass, and probably the principal source of wood in Haïti.

Table 1.5: Biomass Standing Stocks in 1988

	Area (1000 ha)	(%)	Volume (1000 m3)	(%)
Broad-leaf forest				
dense	14	1%	2100	4%
degraded	50	2%	2500	5%
regeneration	80	3%	3200	6%
Pine forest				
dense	8	0%	1200	2%
open	20	1%	600	1%
very open	40	1%	520	1%
Agro-pastural forest				
prosopic forest	5	0%	250	1%
shrubs (dense)	100	4%	2500	5%
shrubs (open)	185	7%	2405	5%
Mangroves	15	1%	525	1%
Dense tree crops (fruit trees, coffee)	170	6%	5100	10%
Open tree crops	400	14%	6400	13%
Others (herbaceous crops, short rotation fallows, savannas, rocks, etc.)	1682	61%	10095	20%
TOTAL	2769	100%	37395	76%

Source: BDPA, 1989

Charcoal Supply Networks

1.24 Charcoal is distributed through an extremely decentralized urban retail and wholesale network. In the greater Port-au-Prince region (Port-au-Prince, Delmas, Carrefour, and Pétionville), there are an estimated 3000 sales points, as presented in Table 1.6. There are nearly 200 large warehouses with capacity for more than 50 bags and, at the other end of the scale, nearly 1500 mostly female, small retailers (the marketing of charcoal, both at the wholesale and retail levels, is carried out mostly by women). Much of the charcoal is sold in the markets, including the wharfs, which comprise nearly 3/4 of the market for sales in bags.

Table 1.6: Charcoal retail posts counted in Port-au-Prince

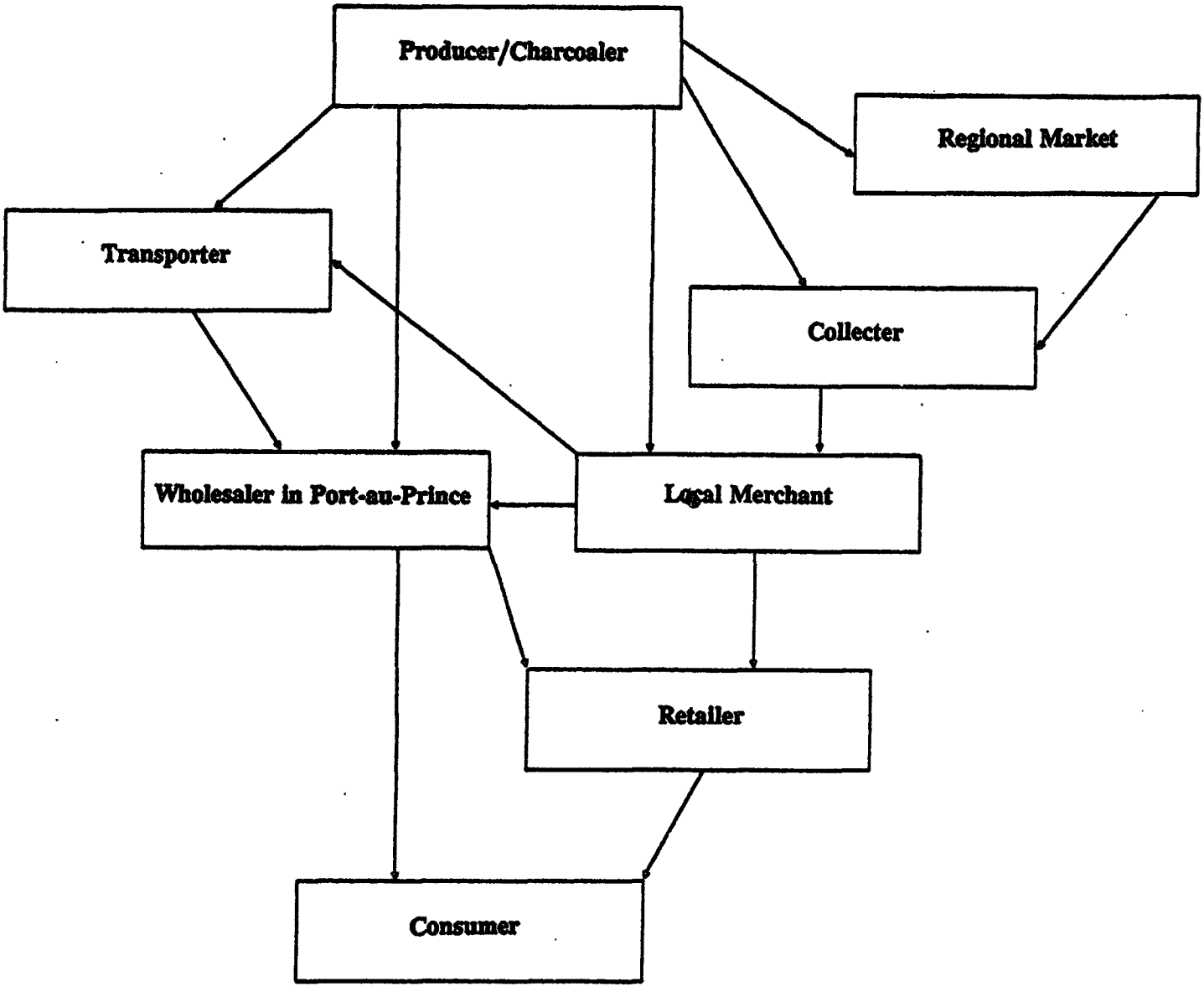
Number of retail posts	Less than 1 bag	1 to 10	11 to 50	More than 50	Total	%
Port-au-Prince	749	277	280	117	1,423	62
Carrefour	282	134	131	44	591	26
Delmas	119	37	24	2	182	8
Pétionville	57	34	23	2	116	5
Markets	581	283	309	151	1324	57
Shops	23	15	10	3	51	2
Along the street	0	184	139	11	334	14
Along the road	603	0	0	0	603	26
Total counted	1,207	482	458	165	2,312	100
%	52	21	20	7	100	
Total estimated	1,800	520	500	180	3,000	
%	60	17	17	6	100	

Source: BME, 1990

1.25 Approximately 37% of the charcoal consumed in the capital is transported by boat from the ports of the two peninsulas and from Gonaïve island; the remaining 63% is delivered by truck or other various modes of road transport. The practice of "charbon-provision" which refers to charcoal transported in passenger vehicles to escape regulation by public officials -- a practice tolerated by the Forestry Service up to a limit of 10 bags -- is widespread. About 15% of the charcoal supply enters the city by this means. Charcoal generally is delivered by rural merchants (usually female, referred to as "madame Saras") who hire transport to come and sell charcoal in the city (see Figure 1.1).

1.26 Charcoal production, entirely done with traditional methods, has been the object of only some limited investigations. The charcoal producers use small capacity stacks (5 to 10 bags) of various forms ("parasol", circular, or rectangular "bateau" kilns). The observed yield by weight are quite high (20%) in areas with larger-scale production, but it seems that yields are lower in areas where carbonization activity recently has been established. As there is very little quantitative data, a campaign to take measurements from a representative sample of kilns is very much needed.

Figure 1.1: Charcoal supply systems in Haiti according to Stevenson (1985)



Expansion of Charcoal Production

1.27 A comparison of two maps, one created in 1980 (Atlas CNRS 1985), the other in 1990 based on information obtained from various surveys conducted during this study, shows how charcoal production has become widespread throughout Haïti. The extension of charcoal production dates primarily from 1986, when public control over forest exploitation in Haïti disappeared for all practical purposes.

1.28 The origin zones of charcoal delivered to Port-au-Prince in 1980 and in 1990 are shown in Table 1.7; the results of a revised count of the volumes of charcoal entries in Port-au-Prince are also given in Annex IV. A progressive diversification of supply to the capital can be seen; to the traditional production zones in the northwest and the south have been added new zones, notably the Grande Anse (southwest peninsula) and the Central Plateau. There are no longer hardly any zones in the country, with the exception perhaps of the far northeast, where charcoal is not produced for Port-au-Prince (see maps for 1980 and 1990 in Annex XIV).

Table 1.7: Production areas of Charcoal since 1979
In percentage

Department	1979	1985	1990
North West	50	33	21
South	30	36*	2
Central	10	15**	13
Gonave	10	3	5
Grande-Anse	0	-	13
South East	0	9	3
West	0	4	26
Artibonite	0	-	13
North	0	0	4

* Including Grande-Anse
** Including Artibonite
Source: Karl Voltaire, 1979
University of Maine, 1986

Supply Margins and Revenues

1.29 The cost to the residential buyer of charcoal in Port-au-Prince, when sold by the bag, is about 1 Gourde/kg: each bag costs 40 Gourdes and weighs on average 38 kilograms. When sold in small quantities ("lots") with unit value varying between 0.5 and 1.5 Gourdes, charcoal costs on average 25% more (1.25 Gourdes/kg). In pots or baskets, the cost of better quality charcoal ("gayak" wood) can even reach 2 Gourdes/kg (see Annex X). In the other cities, charcoal is a little less expensive: sold by the bag, it costs about 0.7 Gourde/kg in main cities such as Les Cayes or Cap Haïtien, 0.5 Gourdes in smaller towns such as Gros Morne or Camp Perrin (southwest peninsula).

1.30 The charcoal producer's share of the retail price has decreased unremittingly; this is related to the general stagnation of income in Haïti's rural areas. However, a "professional" producer places a value of 1.5 Gourde/hour on his work, which is comparable to the income of a peasant (8 to 9 Gourdes/day) and around 30% higher than the rate of a day laborer (6 Gourdes for a 5 to 6 hour day, see Annex 10).

1.31 Although some wholesalers and transporters have rather large sales figures from marketing charcoal, basically because of the large volumes concerned (a truck making 100 trips annually can generate a net annual income of $10,000 to $15,000), the margins for transporters, wholesalers and retailers conform to the standards generally found in networks for wood and charcoal.

1.32 On the basis of information collected during various surveys, the transport price for charcoal is about 0.1 Gourde/day/kilometer (regression analysis performed on a dozen loads delivered by road, and about 50 statements made by transporters). Taking into account the transport costs in Haïti, which fluctuate between $1.1 and $2 per km for a larger trucks according to the state -- paved or unpaved -- and topography of the roadway (see Annex X), the transporter earns a net margin of approximately 30% to 40%. The urban intermediaries (wholesalers and retailers) earn a gross cumulative margin of 25% of the retail price (see Table 1.8).

Table 1.8: Charcoal Price Structure

	Gourdes/Bag (d)	Gourdes/Ton	%
1. Producer/charcoaler/collector price	14-17	368-446	35-42.5
2. Transport to Port-au-Prince (a)	6-9	158-236	15-22.5
3. Tax	1	26	2.5
4. Intermediaries/other margins	5-6	131-158	12.5-15
5. Wholesaler purchase price (1+2+3+4)	28-30	736-788	70-75
6. Wholesaler margin (b)	5-6	131-158	12.5-15
7. Retailer margin (sale by bag)	5-6	131-158	12.5-15
8. Average price per bag	40	1050	100
9. Retailer's additional margin (c)	8-10	210-263	20-25

Notes: (a) Including loading/unloading cost.
(b) Wholesaler's margin can be 6+7 when the wholesaler sells directly to consumers.
(c) Sale in small quantities ("lot", basket, pot, etc.).
(d) Bag of 38 kg in average.

Source: Surveys ESMAP/BME/PNUD/OLADE of 67 charcoal transporters in the North-west, South-west and West regions.

Wood Supply Network

1.33 Because transport costs are high relative to the sales price of fuelwood, the supply networks for this fuel are considerably shorter than those for charcoal. Thus, a large part of the supply for bakeries in Port-au-Prince comes from nearby "mornes" (small isolated hills) and from

areas close to the Central Plateau; in Gonaïves, wood is supplied from the mangroves. Firewood trucks headed for the capital usually follow routes which allow them to avoid official controls. The guildives and essential oil factories usually are supplied with wood from fruit trees (mangoes, avocadoes), as these trees often are judged useless or too numerous by the peasants since the eradication of pigs.

Petroleum Product Supply

1.34 Liquid petroleum products are imported by SITCO (Shell International), Exxon and Texaco Trader from refineries operating in the region. Kerosene normally comes from Curacao from a former Shell refinery which now is operated by a subsidiary of Pétroleos de Venezuela. Products are transported by General Purpose tankers with 36,000 to 40,000 ton capacity, which then continue on towards the Bahamas.

1.35 Propane gas furnished by SITCO to two distribution companies, Tropigaz and Haïti Gaz, comes from Punta Cardon (Venezuela), Mexico, or the United States. Gas is transported to Haïti by tankers owned by Tropigaz five times per trimester. The transport costs are considerable: 30 cents/gallon, equivalent to about $150/ton (see para. 3.47).

1.36 With regard to propane storage, Tropigaz has three tanks, one with 30,000 gallon capacity, bought from Esso in 1953, and two others with 63,000 gallon capacity, installed in 1978. In addition, Haïti Gaz owns a unit with 30,000 gallon capacity. Thus the total storage capacity is low (400 tons in water, i.e. 320 tons of gas), and is only sufficient to guarantee a little less than 15 days of supply, with frequent shortages of 1 or 2 days. Tropigaz also has a bottling plant with three filling lines, with a total capacity of 8000 gallons per day (16 tons/day), also quickly approaching saturation.

1.37 Butane gas also is supplied by SITCO, mainly from Venezuela, and resold to Sodigaz by Shell Haïti. In 1988, Shell made investments of $800,000 for distributing Bip stoves and butane. The investments included:

(a) reception facilities and two storage units with a total actual capacity of 130 tons (150 nominal) ($600,000)

(b) a filling center with capacity of 900 to 1000 bottles per day (per cycle of 8 hours), or approximately 3000 bottles daily for three cycles ($100,000).

(c) various preliminary marketing studies, including a study of the target client (see para. 3.53) ($100,000).

1.38 Both bottling plants for propane and butane are located in Port-au-Prince, which absorbs the quasi-totality of butane consumption and most of propane consumption. Propane and butane bottles are transported to other main cities by trucks and sold by distributors at a price reflecting additional transport cost (for instance the refilling of a 12 kg propane bottle costs about 40% more in Cap Haïtien than in Port-au-Prince).

1.39 The Shell group plans to restructure its storage and bottling system in the medium term to face forecast demand of butane and propane at their current prices. It is possible that marketing of propane then would be dropped in favor of increased marketing of butane as part of a Caribbean butane strategy designed by headquarters, which projects the creation of a major storage center of butane in the area (possibly in Puerto Rico).

Institutional Framework and Ongoing Actions

Institutional Framework

1.40 Among the major public institutions concerned with the sector, the Bureau of Mines and Energy (BME), through its Directorate of Energy Resources (DER), is responsible for (i) promotion of national energy resources and, more generally, of all forms of energy which could contribute to the country's development; (ii) rational energy use; and (iii) environmental protection in relation to mining and quarries. The DER is staffed by nine professionals and had an annual budget of 1 million Gourdes in 1988. Its activities include management of various energy projects in cooperation with French assistance and OLADE: energy statistics, development of solar and wind energy, improved stoves, and use of bagasse. The DER currently is the recipient of a program to strengthen its operations, financed by PNUD and OLADE (Energy Sector Strengthening Program), of which this study is a component. One of the main objectives of the program will be to prepare a National Energy Plan.

1.41 At the Ministry of Agriculture, Natural Resources and Rural Development (MARNDR), the Forest Resources Service (FRS) is responsible for protecting, managing and developing national forest resources. In particular, it is responsible for implementing the National Forest Project, which will enter its second phase in 1992 (Forest and Environmental Protection Project). However, as with many rural development activities in Haïti, most of the reforestation activities are carried out by numerous non-governmental organizations (NGO), both Haitian and foreign, because of difficulties encountered at the MARNDR such as: limited operating budget, lack of coordination, lack of policy continuity and lack of motivation among the employees.

1.42 With the exception of public installations for security stocks of diesel and kerosene, the Haitian petroleum sector is totally private. Three companies share the market: Texaco, Esso and Shell. The latter is the only company which markets LPG. Within the Ministry of Industry and Commerce, the Bureau for Petroleum Product Supply (BAPP) supervises the sector and

regulates the price of liquid fuels; in practice, although BAPP is conscious of the distortions in the price of gas (as shown in the third chapter), its resources and means to act are limited.

Charcoal Regulation and Taxation

1.43 A decree dated October 1987 grants MARNDR the ability to authorize and control the cutting of wood and also gives wood-consuming companies a period of 6 months to substitute wood by other fuels. In practice, this decree has not been applied. On the contrary, all control over forest exploitation -- and charcoal exploitation in particular -- has disappeared since 1986. This engenders two main negative consequences for the sector: the universalization of charcoal production throughout the country and the slowdown of price increases for charcoal.

1.44 There is a tax on the transport of firewood and charcoal, levied at the district level. In addition, the forestry service has a number of checkpoints, which operate with unequal degrees of effectiveness (see map no. 2 for Port-au-Prince in Annex XII). Transport permits certifying payment of the transport tax and the number of corresponding bags (often underestimated) are verified by forestry agents at the checkpoints. The official tax on charcoal, originally 0.25 Gourdes, has risen since October 1989 to 1 Gourde per bag. The forestry service records show that 368,000 and 513,000 bags were checked during the fiscal years (October to September) 1987/88 and 1988/88, respectively. This amounts to respectively 14,000 and 20,000 tons of charcoal, i.e. less than 10% of the charcoal which in fact was marketed in Port-au-Prince.

1.45 Special effort is being made to improve the monitoring of the volumes transported and to improve collection of the charcoal tax, with positive results as shown in Table 1.9. Despite these improvements, there is room for much more progress: an estimated $800,000 additional revenues in charcoal taxes could be collected by the State if control was fully efficient. The firewood tax theoretically is 1 gourde per piece of wood, in general 1 gourde per stere; in practice, it rarely is collected.

Table 1.9: Charcoal Tax Revenues

(x1000 Gourdes)	Total revenue	Monthly revenue	% of theoretic revenue
29 August - 15 December 1988	48.8	13.9	2
3 January - 30 March 1989	75.0	25.0	4
10 April - 11 July 1989	146.2	48.7	8
11 July - 31 October 1989	150.9	40.8	7
31 October - 29 December 1989	141.4	70.7	12

Source: MARNDR, Forestry Project.

1.46 Besides the official taxes, there is an entire unofficial system of levies, the revenues from which do not go to State Treasury. This was true before 1986 in the case of charcoal exploitation, where the merchant often had to pay local authorities more than 3 times the value of

the official tax. This is still the case for charcoal transport; the transporter must make a contribution, either in charcoal or money, at various checkpoints along his route. Thus his real net margin is diminished.

Tree Planting Strategies

1.47 Numerous reforestation projects are underway in Haïti, mainly as part of programs for non-governmental assistance to rural areas: an environmental study (IDA/BDPA) catalogued more than 80 projects aimed at limiting deforestation (soil conservation, seedlings, plantations, etc.) A Tropical Forestry Action Plan (TFAP) will be formulated during 1991/92 under the supervision of PNUD and FAO in order to coordinate the different projects under a common policy framework. With regard to plantations, two approaches have been attempted, with very different results: large plantations and agroforestry.

1.48 The use of large plantations as a strategy for fighting deforestation was attempted under mainly the Operation Double Harvest (ODH) financed by CARE, one of four components in the Agroforestry Outreach Project (AOP) financed by USAID, which has met largely with failure; as a result, the large plantation option has been completely abandoned at present. The ODH sought to implement large peri-urban plantations on land belonging to major landholders: this project was halted in 1987, mainly because of a lack of interest on the part of the landholders. Moreover, the National Forestry Project (IDA Credit) included an energy plantation pilot component, which was based on creation of planted perimeters at three sites (covering a total 350 ha) and on management of part of the Pins forest (for an area covering nearly 6,000 ha). Despite positive results with regard to strengthening the FRS and preparation of the second phase of the project, the results were relatively disappointing for the pilot plantations, largely because of the lack of counterpart funds, negative reactions from the rural population, and the influence of external factors (climate, livestock). Because of the lack of financial profitability of such plantations, the second phase of this project is therefore oriented towards agro-sylviculture formulas established at the level of rural communities and management of forestry resources.

1.49 The objective of the agroforestry approach is to promote various types of tree planting integrated into Haitian cultivation practices. The AOP Project in the northwest of the country and the "Pyebwa" Project which was implemented by a network of more than 400 NGOs in the rest of the country, have been quite successful with very small-scale rural forestry projects. According to the BDPA, approximately 8 million trees have been planted annually as part of these projects over the past 10 years. There have been several evaluations of the success rate for planting schemes of this type, with varying results -- the trees' survival rate is 80% according to CARE, 33% according to a more rigorous evaluation carried out by the Pyebwa Project, and between 50 and 60% according to other project evaluations. A realistic tree survival rate after one year could be considered 40%: thus about 3 million planted trees survive each year. By comparing the cost of the AOP Project (US$ 3 million annually) and the other main projects engaged in this type of planting with the number of surviving trees, the cost per surviving tree in these agroforestry plantations is estimated at US$ 1.5 (however, some estimates go as high as $10 per surviving tree).

These figures only include the cost of international foreign aid, and the cost of the land and the labor costs should be added to obtain total cost.

Improved Stoves

1.50 Several small projects to distribute metal improved charcoal stoves have been launched in Haïti, but only with very limited results:

(a) Between 1983 and 1988, the first National Forestry Project included a $90,000 component for distributing improved stoves financed by the Canadian Center for International Research and Development (CIRD). This project, implemented by BME, consisted of evaluation of existing traditional cookstoves, development of adapted improved stoves (BME models) and trial dissemination in two small cities on the central plateau, Lascahobas and Belladère (30 stoves were distributed).

(b) In 1989, the BME received assistance from OLADE for a new pilot program to distribute nearly 600 portable cookstoves (BME model), with total financing of $15,000. A preliminary phase included developing a working set for the craftsmen (tools, templates) and training a dozen craftsmen. Then, in association with two NGOs and with technical assistance from BIT for training, the BME opened three workshops in Port-au-Prince and recruited six craftsmen. According to expected results of the pilot program, an anticipated 7200 stoves -- sufficient to supply about 5% of the households in the capital -- will be distributed by mid-1991, under additional financing of $15,000.

(c) At the beginning of 1989, the French Association of Volunteers for Progress (AFVP) opened two training workshops targeted at the "manjé kwit" market (small restaurants) and trained ten stoves craftsmen. The trainees began by producing a commercial line consisting of four model stoves of varying sizes (the BME model with feet): 500 stoves have been sold since September 1989, but mainly for domestic use.

(d) Finally, some larger wood-fueled models were implemented in restaurants in public institutions, with the technical assistance of the Renewable Energy Development Institute (REDI).

1.51 Thus, approximately US$ 120,000 has been invested in improved stoves (not counting the various missions by experts), and about 600 portable cookstoves actually have been disseminated over the past 7 years. This total may seem small, but nonetheless there have been certain positive outcomes to these trials. The most important of these is the design of a model adapted to the needs of more modest Haitian households. This model competes with the traditional round stove, which is used by 2/3 of all households. It has a satisfactory efficiency (30% in theory, and about 25% in actual use -- representing a 30% theoretic improvement in efficiency over the traditional

stove), and it appears to be well accepted by the consumers (reasonable level of sales by the AFVP, positive reactions from groups during market testing carried out for the study).

1.52 Another important outcome, obtained through the activities of BME and AFVP, is the result of comparisons of various methods for manufacturing the stoves and organizing their production and sales. The BME's approach was to employ three groups of two artisans and to manufacture the stoves out of sheets of new galvanized steel, for a net production cost of $7 (in fact the stoves are marketed for $5 to $6 a piece). The AFVP decided to use sheet metal made from material recovered from drums and junked cars, and to let the artisans operate autonomously once they were trained. The sales price of the stoves thus constructed is $4 for the producer, $5 for the retailer. Given experiences with this type of project in other countries, the AFVP approach, which depends on the autonomous initiative of the craftsmen and an initial market penetration using low cost products (possible through use of recycled manufacturing materials), seems preferable. However, if a shortage of recoverable material arises (likely to cause the price of recovered materials to increase), the use of new sheet metal would be necessary.2/ Besides, a demand for improved stoves constructed from new sheet metal is likely to exist already because of their superior durability or for aesthetic reasons.

Substitution

1.53 Efforts to substitute other fuels for wood and charcoal, namely kerosene and LPG, concern mainly the domestic sector. A program also has been undertaken for small businesses and rural enterprises, although with limited success.

1.54 The domestic use of kerosene for cooking is relatively limited. No promotion programs have been undertaken, especially by the Government, and thus there is only a limited but dynamic marketing of the product by the private sector (approximately 1500 stoves sold annually). One company, Haïti Métal, manufactures and markets the stoves, which are sold for between $20 (one burner, no stand) and $43 (two burners, with a stand). In 1989, this market totaled 1140 units, with more than 90% of the two burner model. Other companies market stoves imported from Venezuela (Haïti Gaz) and from southeast Asia (Electrotostore, with 200 stoves sold in 1989).

1.55 With regard to the small businesses and industries, the former National Bank for Agricultural and Industrial Development (NBAID), with assistance from the European Community), introduced a program to substitute wood with petroleum products. Any company which wanted a loan had to switch to a fuel other than wood. About twenty bakeries switched to kerosene, and a few others to propane, under this plan.

2/ The current price of new sheet metal appears excessive (sales price nearly double the CIF price); nonetheless, given the experiences in other countries (Senegal, for example), allowing large metal workshops to directly import sheet metal in order to mass produce and sell improved stoves does not seem viable, as distribution of the stoves (which is difficult to organize) certainly would cost more than the resulting savings on material costs.

1.56 Propane gas. Tropigaz imports propane, and distributes it along with another company, Haïti Gaz, in four sizes of bottles -- 5 kg (a very limited number), 12.5 kg bottles (most of the market), 25 kg and 50 kg -- and in bulk (1000 kg) for large companies. In 1989, Tropigaz came under the control of Shell Haïti, when the Caribbean and Latin American operations of Tropigaz were acquired by Shell.

1.57 In 1986, Tropigaz made an inventory of its bottles, which numbered 66,000 in the 12.5 kg size and 25,000 in the 50 kg size. Taking into account all sales since 1986, equivalent estimates for 1990 would total 85,000 and a little less than 30,000 respectively. This averages out to about 2.1 bottles per user (assuming 50,000 propane consumers, of whom just under 80% reside in the capital).

1.58 Various local firms distribute imported cookers fueled by propane gas. The least expensive come from Latin America (the "Llama azul" from Venezuela, for example) and vary in price from $50 to $70. Given the purchase cost for a bottle ($73.4 for a 12.5 kg bottle, without the pressure regulator), the minimal initial investment is $120 to $150, a very high cost for most urban households. Only several hundred cookers at the lower end of the scale (cooker without an oven) are sold annually. Tropigaz also has commercial cookers for institutional restaurants and small food vendors (between $400 and $500, plus the regulator and the 50 kg bottle, i.e. an initial investment of $550 to $800).

1.59 Butane Gas. In March 1989, Shell began marketing the "Bip Tichéri" stove through the Sodigaz company. This is a single burner butane cookstove which already is distributed in various West African countries. The stoves and containers are bought in France at ADG (Camping Gaz) and the stand is manufactured in Haïti. Shell has received government support through a "balance of payments assistance agreement", signed in October 1989, which allows it to import materials under an exchange rate of 5 Gourdes per dollar. The agreement provides a total authorization of FF 30 million in 1990 (US$ 5.2 million) for importing bottles and stoves, renewable in subsequent years. An initial authorization was granted in December 1989 (FF 1,655 million, or about $280,000) to import 14,000 units, followed by a second authorization of FF 3 million (US$510,000) in May 1990 to import 25,000 units. If the 40% devaluation of the Gourde is taken into account, the subsidy accruing to the Bip program from the Haitian Government amounts to about US$300,000, equivalent to $8 per stove (see Table 1.10).

Table 1.10: BIP Price

	Import Price FF	Import Price US$	Exchange 1 for 5 $Haitian	40% over-valuation $Haitian
Container	80	13.79	13.79	19.31
Burner	31	5.34	5.34	7.48
Customs and Administrative duties			0.77	1.07
Pot support			3.25	3.25
Stove support			4.00	4.00
Gas			2.12	2.12
Equipment cost			29.27	37.23
Sodigas sale price			2.23	-5.73
Sodigas margin			31.5	31.5
Retail price			37.5	37.5
Distribution margin			6.00	6.00

Exchange rate: US$1 = FF 5.8
Source: SHELL Haiti, June 1990.

1.60 Promotion of butane has been very successful: 32,400 portable stoves, 44,500 bottles and 640 tons of gas (311,000 gallons) were sold in 14 months (between March 1989 and April 1990). The rhythm of portable stove has slowed down in May 1990 (only 500 stoves sold, as compared to a previous average of 2000/month) for two main reasons, according to project promoters: the price increase for the stove from $29.5 to $37.5 in February 1990, and also a certain exhaustion of the market, which initially was sustained by purchases made by institutions and businesses for their employees. However, butane penetration started again in 1991 with a 10% increase in the sales of gas when comparing the first semesters of 1991 and 1990, and a 20% increase when comparing the first two quarters of 1991. In addition, Shell intends to introduce the 6 kg butane bottle on the market, which should lead to a further increase in gas sales.

1.61 In the initial start-up phase, the company sold the stove-container combination to customers for a price $4 below its net cost at wholesale level. This was done to promote the distribution of the product; the loss was recovered by increasing the margin on the sales of butane by $0.50 per gallon. This inflated margin (it is difficult to label it a cross subsidy in the absence of regulation of gas pricing) was a shrewd marketing decision for the companies: currently, every sale of a portable stove provides a guaranteed market of about 18 gallons annually, based on an average of 1.2 recharges per month. This represents a profit of $9/year, more than twice the $4 lost on each stove sale. Access to a advantageous exchange rate in addition to the increased price of the Bip portable stove, now selling for $37.5, has allowed the company to balance its sales price. Still, the price of butane remains at $3 per recharge.

Legislation and Pricing Policy for Petroleum Products

1.62 The Haitian State sets the price of liquid petroleum products through its Petroleum Technical Committee, which consists of representatives from the Ministry of Industry and Commerce (through the BAPP), the Ministry of Finance, the Central Bank, and the BME. The margins for kerosene (price at the pump) are negotiated between the State, the petroleum companies, and the National Association of Petroleum Product Distributors (ANADIP). In April 1990, the margins were set at about 20% for the companies and 5% for the distributors; they appear reasonable compared to countries with similar distribution networks. The companies receive a preferential exchange rate (5 Gourdes/US$1) when importing products, equivalent to a state subsidy of about 40% of the CIF value of the products. This preferential arrangement was only applied to LPG in January 1987; LPG is now imported at an exchange rate of 5 to 1.

1.63 Kerosene had not been taxed for many years in order to promote its use in the productive sector (bakeries, for example). However, this has given rise to problems related to competition with diesel fuel (fraudulent distribution and usage of kerosene). In October 1985, new taxes were applied to kerosene, totalling nearly 35% of the retail price. It should be noted, however, that in order to decrease the price to the consumers located in the provinces and in rural areas, kerosene is sold duty-free outside Port-au-Prince, in "yellow" gallon containers. The 50 cent/gallon value of detaxation pays in effect for the reusable empty container. About 500,000 gallons are sold in this manner each year, equivalent to a little less than 10% of the national consumption.

1.64 The prices of gas (propane and butane) are fixed by the two distribution companies, Shell for butane and Tropigaz (100% Shell owned) for propane, with formal notification given to the Ministry of Commerce. This de facto monopoly in the gas market leads to cumulative margins for the petroleum company which seem to be high in relation with similar markets in other countries: in April 1990, the cumulative margins were 57% of the retail price of propane and 71% of the retail price for butane (47% for Shell Haïti and Sodigaz, and 24% for the retailer). The LPG tax was ended in March 1987. This decontrol and the drop in price, as well as the preferential exchange rate, accompanied by an intensive campaign launched by distributors, all incited a massive increase in gas sales (more than 75% since 1987), and in the sales of cooking equipment.

II. MAIN ISSUES

2.1 The main issues affecting the household energy sector in Haiti must be taken into account when developing a household energy strategy. These are:

(a) the environmental impact of woodfuel utilization on forest resources;

(b) the impact on the balance of payments of encouraging the use of imported fuels as substitutes;

(c) existing distortions in the gas market;

(d) the essential role of charcoal production in the rural economy;

(e) the weakness of the institutional framework.

Impacts on Forest Resources and the Environment

2.2 The current estimate of forest resources drawn from available data (see para. 1.23) was established using projected growth rates for forest formations and wood consumption. Several factors make this approach very imprecise and limit the extent to which the rate of deforestation can be evaluated:

(a) there are only extremely fragmentary data on the growth of natural forest formations (the evaluation of yields from the secondary shrub formations used in most charcoal production is based on unverifiable hypotheses in the current situation) and even on the growth of planted trees.

(b) the impacts of reforestation using isolated trees or rural micro-plantation is not quantified;

(c) the exact role of woodfuel consumption in the deforestation process within Haiti has not been identified clearly and quantitatively. This is particularly the case for self consumption in rural households: it is difficult to quantify wood consumption in supply/demand balances when the source of this consumption is felled wood or wood gathered from the wastes of land clearings or tree pruning.

(d) the impact of other phenomena such as the subdivision of agricultural plots into small parcels, the increase in the cultivation of food crops, and the reduction in cultivation of cash crop is difficult to evaluate and quantify.2/

2.3 Although in certain cases environmental damage caused by intensive charcoal exploitation can clearly be demonstrated, charcoal exploitation is only one of the causes, and probably not the principal one, of deforestation in Haïti. Among other causes of deterioration of Haïti's environment are:

(a) increased demographic pressure and its corollaries: the subdivision of agricultural plots, farming on lands not appropriate for agriculture;

(b) poorly adapted and harmful agricultural techniques combined to extensive tree felling;

(c) insecurity regarding land tenure discourages the use of cultivation practices which maintain soil fertility, and on the contrary encourages overexploitation of the land and discourages investments;

(d) the lack of capital and income for the small peasants: they generally must fall back on subsistence farming of food crops, using very erosive production techniques, and have recourse to the production of charcoal as a complementary source of monetary income.

2.4 Degradation of the environment has immediately perceptible effects, especially with regard to erosion, loss of sediments, and decreased agricultural yields. Thus, overexploitation of the Haiti's ligneous potential does not constitute only a decapitalization of available wood: It also has secondary effects on erosion and alters local hydrology.

2.5 It is difficult to estimate the rate of deforestation in Haiti given the lack of recent data and reliable historical comparisons. According to the BDPA study, the estimated forest cover (degraded ot dense broad leaf forests and pine forests) was only 220,000 hectares in 1988, amounting to less than 10% of the productive biomass surfaces and less than 30% of the wood capital. The greater uncertainty surrounds evaluation of wood resources available from non-forest sources: shrub formations, tree crops, herbaceous crops, savannas, etc -- i.e. 90% of the surfaces concerned. The sensitivity to error for these projections is rather large (see Annex I): all other things being equal, if the 1978 figures represent an overestimate of 25%, the forest cover would

---

2/ Furthermore, these phenomena can have opposite effects. For example, the reduction in the number of coffee plantations can deprive some areas of an important wood resource (pruned cuttings from coffee and shade trees or wood obtained from felling old plantations), whereas the subdivision of large parcels usually increase the length of tree hedges which are also an important, and regular source of firewood and timber.

disappear entirely by 1992 (an event which, fortunately, seems unlikely); if on the other hand they were underestimated by 25%, there are sufficient trees in Haiti to satisfy the firewood and charcoal needs for the next 20 years without jeopardizing renewal of the resource (independently of other causes of degradation of the resource).

2.6 It would prove unfounded to question the consensus on deforestation in Haiti, or even to reject the conclusions concerning the gradual disappearance of resources. Yet it is unfortunate that the lack of reliable information on wood resources and on the impacts of firewood and charcoal consumption on deforestation makes it impossible to precisely design and measure interventions needed in this domain, especially for charcoal substitution. There are serious economic constraints associated with partially dismantling the national charcoal sector, as with increasing petroleum imports; thus environmental justification of such actions must be carefully supported.

2.7 Experience with other projects -- mainly those implemented in West Africa -- proves that detailed inventories often provide data which is very different from the first estimates of the resource's condition and availability, especially for the non-forest resources (isolated trees, wood from fallow land, wood from pruning) which provide the core source of wood energy. This brings to fore the importance and urgency of undertaking an inventory of wood resources, based on aerial photos and on-site crosschecks as planned under the IDA Forestry and Environmental Protection Project (probable start in 1992).

2.8 Nonetheless, it is clear that deforestation in Haiti is an uncontestable reality, even if the scope of its causes and effects largely exceeds the basic problem of wood energy supply and demand. Thus one of the fundamental objectives of an energy strategy for households is to slow the deforestation phenomenon by reducing the pressure caused by woodfuels consumption.

Impact on the Balance of Payments of Promoting Petroleum Substitutes for Wood and Charcoal

2.9 The large energy plantations have encountered so many obstacles that this option basically has been abandoned in favor of the agroforestry approach. However, will the latter be able to ensure reconstitution of forest resources sufficient for preserving the national forest endowment? Under the current assumptions about the resource, it appears doubtful: the current rhythm of agroforestry tree planting, already quite sustained, would have to be multiplied by a factor of 7 or 8 in order to obtain nearly 23 million surviving plants each year (see figures in Annex I). This effort would cost approximately $30 million per year, based on the current costs of such operations.

2.10 Thus actions which target consumption of woodfuels, essentially in urban areas would be needed: energy conservation, substitution by petroleum fuels. Under the same assumptions as cited above, a drastic reduction in charcoal consumption would be needed to prevent the obliteration of Haitian forest resources. Even if charcoal consumption were cut in half by 2000 -- a considerable task -- with continued reduction efforts after 2000, this would only delay the

theoretic disappearance of the forest by about 15 years. In order for the resource to be maintained in its current state, an almost complete termination of charcoal consumption in the capital and main cities of Haiti within the next ten years would be needed (Annex I). Therefore it is clear that interventions are needed not only to conserve charcoal but also to substitute it.

2.11 It is possible to estimate the impact on the trade balance in terms of imported gas or kerosene at current CIF prices if petroleum fuels were to be substituted for an equivalent level of charcoal consumption.3/ Consumption of charcoal in Port-au-Prince is estimated at 200,000 tons (consumption by households and the small productive sector) in 1990, and at 100,000 additional tons in other urban areas. The annual cost to the country of importing gas or kerosene in quantities the equivalent of the current urban consumption of 300,000 tons of charcoal would amount to about US$35 million (with theoretic CIF prices, see Table 3.2), equivalent to about 25% of Haiti's export receipts in 1990. Thus promotion of charcoal substitution potentially could be a very costly solution for the country, and would only be justified if charcoal exploitation presented an irreversible threat to the environment.

The Haitian Gas Market: A Distorted Situation

2.12 Gas imports and most of gas marketing in Haïti -- for both propane and butane -- are carried out by Shell and its various subsidiaries (Sodigaz, Tropigaz). Although other petroleum companies appeared interested in this market, they have not explicitly voiced their interest, probably because of the country's difficult political situation. The de facto monopoly inherited by Shell presents several problems for the country and constitutes a major handicap to the development of gas as a substitute for charcoal.

2.13 One of these problems is the current storage capacity. In the case of propane, it is extremely limited: a little less than 15 days of storage, which often leads to depletion of stocks. Because storage is limited, deliveries must be made in small quantities, at considerable transport costs which burden the product's CIF price (in 1990, the transport costs practically as much as the gas). In fact, although the Haitian Government has invested in storage for other strategic products such as diesel and fuel oil, it has no security stock facilities for gas. Nor do the petroleum companies plan in the short term to invest in new storage or new bottling facilities.

2.14 The main problem involves the establishment of gas prices (see paragraph 3.46 for more details). In a monopoly situation and in the absence of state regulation, the margins established by the companies seem to be very high: between 60% and 70% of the retail price, split between the importers and the distributors. By comparison, the combined margins for gas in a

---

3/ Taking into account the fuels calorific values and the efficiencies of related stoves, it is estimated that 1 kilo of kerosene is equivalent to about 3 kg of charcoal, and 1 kg of gas is equivalent to 3.7 kg of charcoal. At current CIF prices (respectively 0.68 and 0.77 Gourdes per gallon), kerosene or gas imports to substitute for charcoal would contribute a nearly identical weight to the trade balance.

number of countries rarely represent more than 30% of the sales price, even in cases where the markets are very limited (West Africa, for instance). In the case of a landlocked country such as Burkina Faso, which has a very small market (nearly 800 tons, versus 7000 tons in Haiti) and where gas is transported by road from the coast for a distance of more than 1000 kilometers, butane gas taxed at a rate of more than 20% sold for about US$ 1/kg in 1989. This is equivalent to the untaxed retail price of the butane sold along Haïti's coast.

2.15 Throughout many countries, the State used taxes and perequation to absorb the much of the profit produced by the drop in international oil prices (up to August 1990). In the case of Haïti, however, it was the importer who apparently benefitted most.4/ This distorted situation is not a fact which can be separated from the analysis of the sector, as it has direct implications for the problems of comparing costs of household fuels and on taxation of petroleum products.

Charcoal Production: An Essential Economic Activity for Rural Areas

2.16 Three important factors characterize Haiti's rural milieu:

(a) increasing demographic pressure on agricultural lands, due to increases in the population density from 300 to 400 inhabitants/km^2 between 1965 and 1985 (whereas in some areas, estate lands and large agricultural domains have been abandoned),

(b) a decrease in the size of cultivated land parcels: the percentage of cultivated parcels measuring one "carreau" (1.29 ha) or less increased from 40 % to 70% between 1950 and 1971, when the last agricultural census was taken,

(c) a decrease in the value added of agriculture per unit from $185 in 1965 to $172 in 1985 (1976 constant prices), a decrease which undoubtedly has intensified in the last years.

2.17 In a situation like this, any energy strategy which has as an objective the reduction charcoal production activities must take into account the economic importance of this activity in rural areas and the social repercussions which could be brought about due to the loss of income for some producers. Annual revenues in the charcoal sector amount to about $50 million, more than in the electricity sector, more than half those of the petroleum sector and about one third the industrial value added in Haiti. This also represents an annual injection of $15 million by the urban consumers into Haiti's rural economy (at the level of production and of rural marketing of charcoal).

4/ Under current conditions, with few investments and a quite precarious supply system, the small propane market in Haiti provides almost as much margin to the petroleum company and the related distributors as the combined propane sales provide to the different importers and distributors operating in the Dominican Republic, which has a market 12 times as large (about 100,000 tons/year).

2.18 In terms of employment, it is estimated that more than 150,000 people are involved in charcoal supply from rural production up to retail marketing; at least 67,000 of these are charcoal producers 5/. Charcoal production is an income source for a large number of urban distributors: for the small neighborhood retailer, charcoal marketing constitutes a non-negligible complementary income source, and for certain wholesalers and transporters the income generated is substantial.

2.19 Charcoal production also has become a crucial source of income for the economic survival of some areas which are especially disadvantaged, and more and more, for a substantial portion of Haïti's rural areas. The subdivision of farm land, the eradication of pig husbandry, the abandonment of coffee cultivation in favor of food crops are all factors which encourage the peasant to turn towards one of the few activities from which monetary income is assured: charcoal production.

2.20 In the district of Anse Rouge, one of the areas in which charcoal production has long been established, the forestry services estimate that there are 4000 charcoal producers and 2000 merchants (there often is overlap between the two activities). Most of the rural households and a large number of the urban households in that district are engaged in producing and marketing charcoal which, along with salt production, is the only possible activity. In other districts of the Artibonite or in the north of the country, such as Saint Michel l'Attalaye or Dondon, between 50% and 80% of the active rural population is engaged in charcoal production, and in other areas with better agricultural possibilities (northeast, southwest), between 20% and 30% of the population.

2.21 According to surveys of charcoal producers in the Artibonite and in the northwest of the country, charcoal income has become more important to the peasant than agricultural revenues (even though it is not possible to precisely estimate the very variable ratio between income from the two activities). In similar surveys undertaken in the south of the country, the money from charcoal generally only appears as an occasional source of income, except during drought periods. It is significant that this activity, generally the work of small peasants (as is still the case in the south) now is done in the north by medium and large peasants. This appropriation of charcoal production and marketing activities by the local petit-bourgeoisie (persons of influence, merchants) in the Artibonite and in the north of the country occurs at all levels, including charcoal collection and transport to consumption centers, whereas these activities are carried out by peasants in the south.

5/ Estimate obtained by dividing the total charcoal consumption by the average estimated production of a single charcoal producer.

A Weak Institutional Context

2.22 The efficiency of the Haitian private sector varies according to the participants. The private sector has proven quite successful in case of charcoal marketing, which functions in a satisfactory manner without large investments, and also in the case of butane promotion, which in three months had achieved its initial objectives for dissemination. Its efficiency has been less obvious in the case of kerosene; its promotion as a cooking fuel has not been successful. In most cases the private sector has adequately fulfilled its role: the responsibility for distributing fuels and cookstoves is incumbent upon the private sector alone, with the assistance of and under the regulation of public authorities.

2.23 Various indicators illustrate the specific institutional difficulties in Haiti, and above all the budgetary constraints faced by Haitian institutions. In order to operate satisfactorily, a central administration should have a central operating budget (minus salaries) equivalent to about half the total salaries. However, the 1988 operating budget for the central administration was situated at only one third of normal needs. The two ministries involved in the different aspects of the energy sector, the MARNDR (supervising ministry for the forestry sector) and the Ministry of Public Works, Transport and Communications (supervising ministry for the energy sector) find themselves in particularly critical conditions: these two ministries were forced to operate in 1987/88 with expenditure allocations equivalent respectively to only 10% and 12 % of their actual operating needs; while the BME, with a 7% ratio between operating expenses and salaries, was granted only 20% of its budgetary needs to work with.

2.24 Without funds to finance operating and maintenance expenditures, the administration cannot operate normally. The limited impact of various laws implemented in the energy sector (such as the requirement that businesses switch from wood to other fuels), the lack of coordination between the various projects, the delays and the negligible results achieved in implementing programs in the past (such as the projects to distribute improved stoves), are examples of this.

2.25 A substantial number of activities financed by international aid tend to bypass public authorities, preferring the efficiency of local organizations, in particular the thick network of NGOs (minimum of 400) operating throughout Haïti. This solution, which is very advantageous for short-term and quick interventions and activities, gives rise to a certain number of problems when a long-term perspective is taken: dispersion of efforts, uncoordinated approaches, duplication of interventions, and difficulties with supervision, etc.

2.26 Because of these problems, the government should make a renewed effort to fulfill its mandate by defining the directions and coordinating the actions taken for household energy. Given the weak institutional framework, it thus would be necessary to the extent possible:

(a) to concentrate strategy on a small number of components, to avoid dispersion of public intervention on minor topics;

(b) to take into account the current weakness of intervention means and plan for necessary strengthening of institutions (adequate coordination between the government and NGOs) and of logistics.

Principles of a Household Energy Strategy

2.27 Whatever the degree of reliability in the information on the resource and on its evolution, the preceding paragraphs showed that none of the planned solutions up to the present -- forestry plantations, improved stoves, substitution fuels -- would be able to provide in and of itself the solution to the problems of degradation of woodfuel resources.

2.28 The choices with regard to planting, managing existing forest resources, conditions related to its exploitation, and also to reducing specific consumption by the various wood and charcoal consumers and substitution with other fuels all appear complex and interdependent. It thus is necessary to incorporate all these items into a coordinated action program, which fully takes into account the various aspects, energy and forestry related, economic and social. Thus an energy strategy for the sector must be defined and implemented which simultaneously addresses the following needs:

(a) to decrease the pressure on Haitian forestry resources, and more generally on the environment, caused by woodfuel consumption;

(b) to supply at least cost stoves and energy fuels adapted to the needs and financial means of different categories of consumers;

(c) to improve the efficiency of production, distribution and utilization of household fuels;

(d) to preserve the interest of rural woodfuels producers, especially those for whom charcoal production is a main economic activity, by allowing them to exercise their activity in a more efficient framework or by assuring their reconversion.

2.29 Analysis of the situation allows several guiding principles of the strategy to be defined, which are the following:

(a) take into account the characteristics of household energy demand; the strategy should be based on analysis of the actual market for fuels and stoves, take into account consumer preferences and financial means in order to define solutions which are diversified and adapted to their needs.

(b) define a pricing policy which reflects the economic costs of supply and distribution of household fuels, in a least cost approach for the country;

(c) gradually restore the financial balance of the sector through eliminating existing distortions. Through the means of preferential exchange rates, the Haitian economy subsidizes petroleum fuels and, since recently, portable gas stoves. In addition, under current pricing conditions for woodfuels, the smallholder owners of wood covered areas subsidize the price of charcoal to the benefit of the urban consumer by selling wood at a price generally lower than replacement costs: this is possible at the cost of forestry resource-mining production techniques, which induce degradation of the environment and of the rural economy in the medium term.

(d) improve fiscal revenues from household fuels; this would allow at least partial self financing of investments in the energy sector. In fact, neither the current tax structure, nor the existing methods and efficiency to collect taxes are sufficient for the State to have resources to invest in improvements for energy supply and consumption.

(e) focus interventions on a small number of essential themes: the importance of certain priority action themes, the urgency of an intervention at a large enough level and the difficulty of undertaking multiple interventions in the current institutional context all incite to limitating the of strategy to some major components.

(f) take advantage of all relevant organizations present in Haiti (NGOs, communal sections, institutions, associations) as co-implementors of the various strategy components.

III. THE STRATEGY

3.1 In countries like Haïti where woodfuels consumption is dominant, a household energy strategy generally should be centered on two principal axes:

(a) interventions on woodfuel supply-side: improved production and marketing of wood and especially charcoal;

(b) interventions on fuel demand-side, mainly through

(i) substituting wood and charcoal with other fuels, especially petroleum products;

(ii) improving conditions for using wood and charcoal, in particular by the distribution of more efficient energy products.

A. Interventions on Woodfuel Supply

3.2 In order to define the options for supply-side intervention, the present economic situation of charcoal exploitation must be analyzed. This analysis demonstrates the need for complementarity between demand-based and charcoal supply-based strategies, and allows the resources and actions needed to modernize the charcoal sector to be defined.

Current Economic Situation of Charcoal Exploitation

3.3 The evolution of real charcoal prices can be examined using a relatively long timeseries (dating from 1953 to the present) which was compiled by the IHSI as part of its price index series. Use of this type of statistical abstract, where charcoal is included in a basket of commodities, generally does not yield the most reliable gauge, because measures of charcoal price relative to weight are not accurate and are generally made with a small sample. Nonetheless, this abstract undoubtedly is one of the better sets of timeseries data available in Haïti. Three principal periods of evolution are evident from the data (see Figure 3.1):

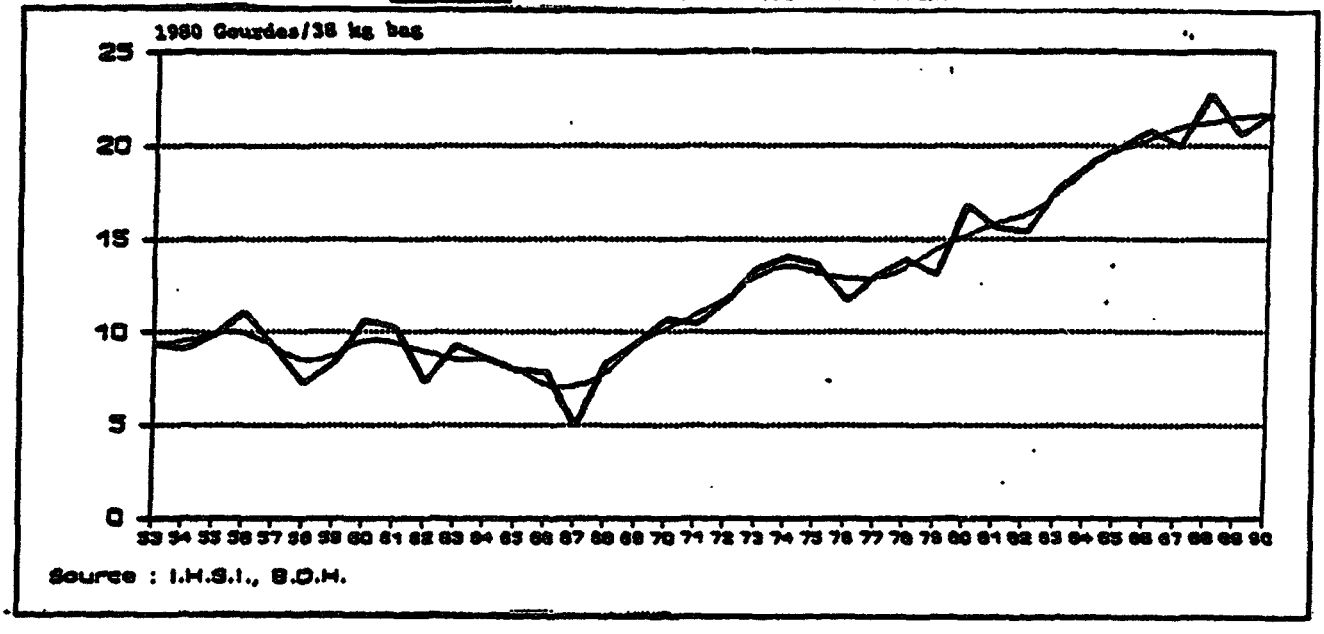
(a) during the first period, up to 1967 (the year when cyclone Cléo struck), charcoal prices decreased in real terms,

(b) during the second period, from 1967 to 1985, charcoal prices rose rapidly,

(c) during the third period, from 1987 to the present, charcoal prices grew more slowly.

3.4 Several explanations are possible for these successive trends. The relative drop in real charcoal prices from 1950 to 1967 undoubtedly is due to the relative abundance of wood during that time. In addition, the 1960s were punctuated by a succession of cyclones (Flora in 1963, Inès in 1966, and the strongest, Cléo in 1967) during which substantial quantities of wood were felled, thus providing "cost-free" materials to produce charcoal inexpensively for the urban population.

Figure 3.1: Charcoal Price - 1953 - 1990 Trend



3.5 The opposite tendency of prices after 1967 can be explained by the evolution of the resource supply: relatively abundant before 1967, wood became increasing scarce in subsequent years. The development of major and secondary roadways in the north and south at the beginning of the 1970s opened Haïti's rural areas to the modern economy, temporarily producing a downward effect on prices. However other factors once again contributed upward pressure on prices, including increased transportation costs and the progressively spreading practice by local authorities of illegally collecting part of the costs of charcoal transport and marketing.

3.6 The recent slowdown in the growth of real charcoal prices can be explained by:

(a) at the demand level, increased competition from new fuels. The threshold at which petroleum fuels become competitive with wood-based fuels has been surpassed: in terms of useful energy, propane gas and kerosene have become less expensive than charcoal (see para. 3.42 to 3.45).

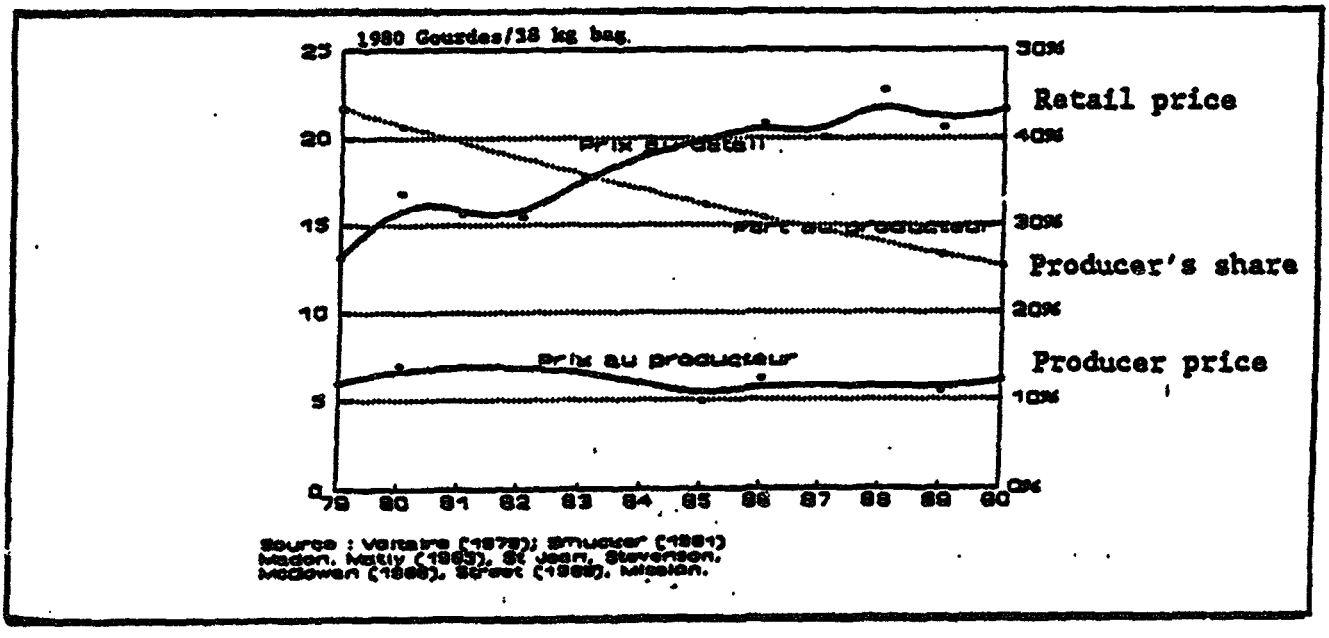
(b) several factors on the supply side which are the more likely determinants in the downward pressure on charcoal prices. They include:

(i) the relative decrease in rural incomes, and thus the decrease in the opportunity costs of peasant labor;

(ii) and in particular, from 1986 onwards, the suspension of local controls on forest exploitation, which prompted the spread of charcoal production throughout the country.

3.7 None of the price evolutions produced benefits for charcoal producers; in fact the contrary is true. The producer's share of the retail charcoal price has decreased continuously for the past ten years (see Figure 3.2). Charcoal price increases primarily have been due to increasing intermediary costs; the producer price has remained constant. This means that the producer's actual income has dropped, if the newly-recognized fact of increasing monetary value of the wood used for charcoal production is taken into account.

Figure 3.2: Producer's Share of Charcoal Price
1979 - 1990 Trend



3.8 In fact, the time when charcoal production was based primarily on access to a "free" resource is essentially past. Nearly 60% of charcoal producers operating on land other than their own buy the wood used for carbonization, either through direct purchases or, more frequently due to insufficient cash flow, by splitting the charcoal sales price with the wood supplier. In the case where wood is purchased directly, the producer pays an average of 3 to 3.5 Gourdes for the quantity needed to produce one bag of charcoal, equivalent to H$ 2/m³ or H$3/ton of wood (assuming a

weighted carbonization efficiency of 20%). When the charcoal price is shared, the split most often is 40% to 50% for the wood supplier (about 4 Gourdes per bag) and 50% to 60% for the charcoal producer: in this case, the equivalent price of wood for the producer is nearly H$ 3/m³ or H$ 4/ton.

3.9 Thus the 1990 price of wood used for carbonization is less than half the cost of planting wood, estimated by FAO at US$5.4/m³ or US$7.7/ton for the larger plantations. Another comparison to be made is with the present costs of planting trees under agroforestry projects: each surviving tree costs about US$1.5 and annually yields -- independent of the environmental benefits to the rural economy of planting trees -- about 3 US cents (based on productivity of 10 kg/year, calculated in terms of current prices of wood used in carbonization). Finally, these figures can be compared with the estimated environmental costs of deforestation -- namely loss of sediments, reduced soil productivity, and erosion (see Annex XII) -- which in Haiti are about US$ 23/ton of wood (Hosier and Bernstein, 1989).

3.10 The fact that a monetary value has been attached to wood used in charcoal exploitation indicates an ongoing transition in the perception of deforestation in Haïti. Whereas deforestation previously was noted only by specialists, its impacts now directly affect the wood consuming population. However, the cost of wood is yet not enough to induce rational exploitation of wood resources or even the development of a specific economic rent associated with wood planting. Replanting efforts must be pursued, but in strictly financial terms, they are not profitable at present. Based on the FAO cost estimates, planting wood could be profitable if producer costs more than double to 18 Gourdes/m³ (split 6 Gourdes for the charcoal producer and 12 Gourdes to the wood supplier). This would imply a 20% increase in urban retail prices, which is acceptable if less expensive fuel alternatives also are available to consumers. Petroleum fuels already provide less costly alternatives for households able to invest at least $30 or $40 for a portable cookstove. In addition, the recommended improved stoves program would permit consumers to save up to 20% on fuel expenditures for a modest initial investment of only $4 to $5.

3.11 The evolution of charcoal prices presents a basic problem with regard to which strategy should be adopted. The strategies to be considered can be described in terms of two extremely different options, both of which carry strong potential environmental risks:

(a) The first option is to retain the current policy: let charcoal consumption increase at its natural pace. Resource shortages gradually will induce the cost of wood to rise until the associated economic rent develops. When the fact that Haïti's environmental deterioration is due to multiple causes -- not just wood offtake for charcoal production -- is taken into account, planting and cultivating trees for energy use becomes then another means of environmental preservation, just as with the cultivation of coffee and banana plantations in other countries. However, will the environmental damage caused in the meantime not be irreversible?

(b) Another option is to forego supply-side intervention and focus strategy on substitution and energy conservation. The induced decrease in charcoal consumption would diminish the pressure of wood offtake on forest resources. However the policy of intervening only on the demand-side also carries certain risks: a downward pressure will develop on charcoal prices, and subsequently on the cost of wood. This will tend to perpetuate the "mining" character of current forestry practices, in which the resource is exploited without concern for its renewability.

3.12 These considerations emphasizes the need for a global strategy of intervention incorporating both energy and forestry aspects:

(a) demand-side interventions to induce energy substitution and energy conservation;

(b) supply-side interventions to establish conditions which will render wood and charcoal prices more expensive, namely through rational exploitation of wood resources due to a modernized charcoal sector.

Modernizing the Charcoal Sector

3.13 Interventions on the conditions of charcoal marketing and production must be a principal element of the strategy. This will convert exploitation of forestry resources from its present "mining" model into a cohesive system for rationally managing a renewable national resource. Two important factors which would hinder development of a rationalized system must be taken into account:

(a) institutional weaknesses in the supervision of the sector, and the foreseeable difficulties this supervising entity will have when attempting to implement required improvements;

(b) the lack of any systematic study of the charcoal sector, its role in the peasant economy, and its impacts on the environment in each exploitation zone.

3.14 These constraints shape and color to a large extent the contents and organization of supply-side intervention. As a result, it is recommended that a specialized, autonomously managed and financed unit temporarily be established within the MARNDR. This unit would be responsible for analyzing the different aspects of charcoal exploitation (including the conditions for enforcing laws and fiscal policy) and for coordinating and supervising the projects and programs to modernize the charcoal sector.

3.15 The unit's operations will be developed in coordination with and as a complement to actions undertaken within the framework of the new Forestry and Environmental Protection Project 6/, on the three following priority themes:

(a) geographic reorientation of charcoal offtake;

(b) modernization of the supply network;

(c) better collection of taxes on charcoal.

Geographic Reorientation of Charcoal Offtake

3.16 Restraining the conditions of charcoal supply is one of the key solutions to induce an increase in the price of charcoal, and especially in the price of wood used for carbonization. Undoubtedly, it is unrealistic to propose a total ban on charcoal production in some areas. Nonetheless, it is possible to constrain charcoal shipments from these areas to the urban markets: in certain zones, maximum quotas, regulated by local officials, would be allocated restricting the quantities of charcoal which could be transported to Port-au-Prince and the other main cities. Effective application of the quotas will depend on the compliance of local authorities; it should be noted that in some areas, these very authorities already have implemented similar measures, usually by defining exit quotas for charcoal from their districts. This is the case in the Hinche and Grande Anse districts, where local measures consistent with those proposed for national application have been adopted due to initiatives by local authorities.

3.17 In order to assure effective implementation of the measures recommended, it is important that any quota policy, which necessarily would penalize some charcoal production zones, be negotiated on the local level and in particular with the affected charcoal producers. It may be necessary to include the producers in a sort of compensation program, where specific priority programs are introduced to mitigate the impacts on charcoal producing families in areas affected by the quotas.

3.18 Restriction of charcoal production is very much needed, and quickly. Areas of the country which would be affected by these restrictions include:

6/ The FEPP will include the following components: (a) institutional strengthening for the MARNDR, including improvements to the tax regime for woodfuels; (b) specific forestry and environmental programs, including management of the Reserve Pine Forest (28,000 ha) and an inventory of national forest resources; and (c) promotion of improved charcoal stoves by the BME. The total amount of the IDA credit is US$ 25.9 million; the project is slated to begin in 1992.

(a) in order of priority, new production zones where the activity only recently -- and chaotically -- has been established;

(b) more established production zones where affiliated forestry exploitation has caused significant damage.

3.19 The new production zones would be targeted first: as charcoal exploitation has not yet become ingrained in the local peasant economy of these areas (and thus they can more easily absorb the loss in income from charcoal production), this will facilitate implementation of a quota policy and limit its impact. While it is difficult to generalize, the zones to be targeted for the most part, would include the Central Plateau, the Grande Anse and more generally the southwest peninsula and the southeastern part of the country, as well as the older supply zone in the South. These areas cumulatively already represent 30% of Port-au-Prince's current charcoal consumption (see Figure 3.3). The main areas from which charcoal should continue to be supplied to Port-au-Prince thus would be limited: the north, the northwest, the Artibonite, the west and Gonave Island, which currently provide 70% of the charcoal sold in Port-au-Prince. 7/

3.20 In the zones which would come under supply quotas, charcoal production conditions can be summarized as follows: there are in total about 24,000 part-time charcoal producers, usually small peasants, who make charcoal only a few months out of the year. The income received from charcoal is considered secondary contingency income, complementary to agricultural incomes: less than $100 annually, or less than half the average monetary income from agriculture in these areas (more than $200).

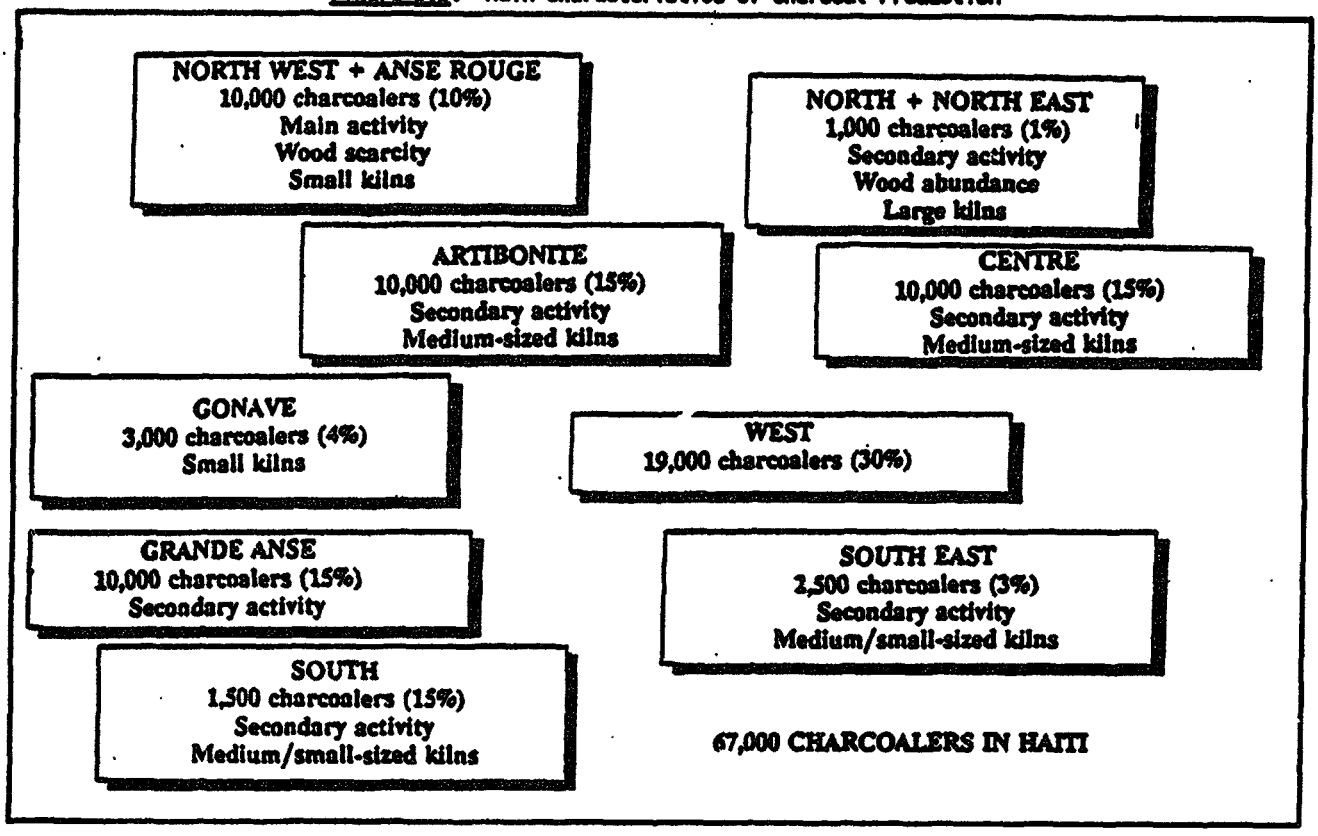
3.21 Based on what is known regarding the local supply networks, depriving these areas of the Port-au-Prince market would cause unemployment of about 15,000 to 20,000 charcoal producers maximum and an overall loss of income amounting to 10 million Gourdes. This is a far from negligible loss, whether observed from the macroeconomic level of the affected provinces or from the macroeconomic level of the peasant. Actual impacts at district level should be analyzed on a case by case basis, in order to determine the full extent of negative effects on the local economy and the means by which these effects can be mitigated.

3.22 To be successful, implementation of the planned quotas must first be technically feasible. Although it is impossible to ban completely production in certain zones (Haiti's history of forestry management is rich with inapplicable decrees), technically it should be possible if not to prevent, at least to definitely hinder illicit shipments of charcoal coming from the prohibited zones. This would be possible by limiting charcoal transit on major road axes (the roads to

---

7/ Once a charcoal supply master plan is established for Port-au-Prince (see paragraphs 4.26 and 4.27), sustainable production capacity of each zone would be determined in terms of maximum quantity of wood and charcoal that could be produced each year, according to the characteristics of woodfuel resource base in these zones.

Figure 3.3: Main Characteristics of Charcoal Production



Source:Charcoal volumes count; Transporters' surveys; Field surveys
ESMAP/BME/OLADE/UNDP 1990

Léogane, Miragoane, Kenscoff, and to the east of Gonaïves, and the road to St Michel de l'Attalaye) and increasing control of charcoal transported by boat.

3.23 Technical feasibility of the quota proposal is not the only condition for its success; neither the ability of the local people to adapt to regulations which are contrary to their interests, nor the possibilities of overriding control mechanisms through illicit agreements, should be underestimated. Implementation of the quota system necessarily must be accompanied by a collaborative effort with the main local authorities in the affected zones -- representatives of the State and of the local communities, the NGOs, and specialists working in the field -- to define and negotiate at the local level the means by which income losses caused by limiting access to the charcoal markets of Port-au-Prince can be compensated.

3.24 Compensation most likely would take the form of a priority action program targeting the peasants most affected by the restricted charcoal markets. The modalities of this program should be defined at the local level, and could take various forms, based on local priorities. In some areas, charcoal revenues are linked with the cost of schooling (supplies, enrollment fees), which

could be reduced; elsewhere compensation could take the form of assistance for reviving pig husbandry; elsewhere still programs to commercialize wood products, especially those from the wood of fruit trees, would be appropriate. These actions are for the most part outside the scope of an energy strategy and, once defined, should be implemented within the framework of existing or future rural development programs.

3.25 Consolidated financing for such a program at the national level could be assured in part by the Haitian government, but mainly by a group of institutional or non-governmental lenders. Also, some proposed actions easily could be included in social action programs such as the future Economic and Social Fund. Taking into account the overall estimated loss of revenues by charcoal producers, the total cost of a rural development program of this type could range from US$ 3 to 5 million over a three year period. This program would be implemented by rural organizations already operating in the affected zones as soon as the restrictions on charcoal marketing, or even a total restriction of wood offtake in some zones, are effectively in place and operational.

Modernization of Supply Networks

3.26 In the zones which would continue to supply charcoal to the capital (see para. 3.18), the situation will be the opposite of that described above: charcoal marketing will inject additional economic resources into the supply provinces (in amounts at least equivalent to the losses in the quota zones, and probably greater, since limiting the exploitation zones should make producer prices rise), but at the cost of concentrating and increasing within a smaller area the pressure on forestry resources due to charcoal exploitation.

3.27 The objectives of the project components for charcoal conservation and substitution, described in Section B, are to decrease this pressure. However, the problem also can be addressed partially by improving the existing conditions for charcoal production. In the older, more established production zones, such as Anse Rouge for example, charcoal exploitation has developed sort of professionalism: the activity provides regular employment with incomes of over $150/year, exceeding agricultural incomes in areas with weak cultivation potential. In these areas, many medium-scale peasants are employed by this activity, which in other areas is reserved for small peasants. The proposed strategy should benefit from this existing professionalism, which manifests itself in carbonization practices which are less destructive to local forestry resources. The professional nature of charcoal exploitation in the traditional production zones not only provides a guarantee of efficiency, but equally helps improve availability of wood for carbonization (through better management of existing resources).

3.28 In other zones (especially in the areas targeted for quotas, but also in certain areas where production is strongly established), charcoal exploitation is still relatively new and has not yet damaged the local resources. Although newly established producers in these areas have the opportunity to use better quality wood, their carbonization methods are still far from below on par with those of the producers in the more established areas. Pre-drying wood ("dégorgé") is used only

by a minority of the producers in the area (30%), those precisely who are originary from a traditional charcoal production area. The more recently a producer has ventured into charcoal exploitation, the less efficient are his techniques for stacking wood in the kilns ("boat" kilns or "parasol" kilns, the Haitian equivalent of the Casamance kiln used in Senegal) and carbonization.

3.29 However, it is clear that among its professional charcoal producers, Haiti possesses an incontestable prowess in charcoal making: the weighted yields obtained from kilns in established charcoal producing areas, about 20% (measurements by USAID, 1976 and by the BME in 1985 and 1990), are among the best in the world, and are altogether comparable to those obtained with metal and brick ovens. It is necessary to make good use of this charcoal-making tradition and to help it spread throughout the areas concerned:

(a) by finding new operating areas for the experienced charcoal makers who operate in areas where resources are near exhaustion;

(b) by training qualified charcoal producers in the new production areas;

(c) by finding means to supply qualified producers with wood sufficient for their production needs, while taking into account environmental concerns.

3.30 The objective is to arrive eventually to a point where qualified charcoal making constitutes a real profession (such is the case in the more established traditional production zones). Peasants thus would benefit more from supplying wood for carbonization to the professionals, rather than carbonizing it themselves. To a certain extent, this is the current situation: about one third of the charcoal producers surveyed operate on their own land, whereas more than half purchase wood or split the price of charcoal made with wood obtained from small landholders (see Table on page 12 of Annex X).

Improving the Charcoal Taxation System

3.31 The system for taxing wood and charcoal must be improved so that the woodfuels subsector itself can partially finance its rationalization and modernization by contributing significantly (which is not yet the case) to the operating costs of a forestry service responsible for managing the subsector and by financing a share of the public investments in the subsector. The amount of the charcoal tax does not need to be increased in the short term, but rather the existing system must be improved:

(a) by simplifying the system of collecting and transferring funds;

(b) by pursuing improved control, including a better rate of charcoal tax collection.

3.32 The current system of local, decentralized tax collection by local MARNDR agents generally is a good system; tax collection at the entrance to the cities would be more problematic (greater risks of attacks on the posts, etc.) Some improvements are possible nonetheless at two levels: the actual collection of the tax, and the transfer and reallocation of funds. The improvements would be designed to avoid excessive handling and movements of funds, which currently are easily subject to bureaucratic hassles and embezzlement.

3.33 It would be preferable to relieve the forestry agents of their tax collecting duties and to reassign this responsibility to a fiscal agent, namely the local tax collector for the Ministry of Finance. Subsequently, collection of charcoal taxes should be transferred to payer-agents in local villages (village tax collectors), as provided for in the 1987 Constitution.

3.34 In fact, it would be a good idea to eventually pass a local tax statute for charcoal, for three main reasons:

(a) The efficiency of collection will be proportional to the share of the tax receipts which directly benefit the local administration responsible for collecting it.

(b) The system of having the district taxes on forestry operations sent to the capital, then returned to the district level (though not always the same district) is very difficult to manage under current circumstances.

(c) A local tax system will allow the development of a differential tax system based on local conditions of wood resource availability and management.

3.35 A portion of the tax revenues should go to the Forestry Fund (the current Special Fund for Reforestation) to finance Forestry Services activities, and the remaining funds could be used by the local authorities for local priorities, especially those concerning reforestation and environmental protection. Periodic discussions between the central and local authorities, (e.g., with the boards of communal sections) could be held concerning use of these funds, with the forestry authority reserving the supervisory rights to activities and bringing its own technical assistance to the use of these funds.

3.36 Current efforts to improve the control of charcoal supply should concentrate on strengthening the operations at existing control posts: repairing some posts (in particular the one situated at the wharf of the Cité Soleil); training agents at the forestry assigned to control duties; the implementation a simple computerized system for collecting and treating data. Additionally, some supplemental control posts will need to be set up, in particular at Port-au-Prince, at Gonaives and at Cap Haitien.

B. Demand-Side Interventions

3.37 The supply-side interventions for wood and charcoal are inseparable from demand-side interventions -- those to introduce and promote substitution fuels and more efficient equipment. The approaches used in the demand-side intervention, which constitutes the second axis of the strategy, are determined in large part by two related factors:

(a) the economic conditions of substituting for wood and charcoal,

(b) the fuel and stove markets.

Economic Conditions for Charcoal Substitution

3.38 Competition among the three main fuels -- charcoal, kerosene and gas -- must be analyzed on three levels of comparison. They are the following:

(a) the "financial cost" of the fuel: the cost of fuel at the final user's level, a cost which will depend on the retail price, the fuel's calorific value, and the cost and efficiency of associated stoves.

(b) the current economic costs" of the fuel: the cost to the national economy, excluding taxes, exchange differentials, subsidies, and all artificial mechanisms which modify the fuel price.

(c) the "theoretic economic costs" of the fuel: the cost of the fuel under the hypothesis that measures would be taken to improve the supply and distribution systems, and that the evolution of the demand would entail variations of supply costs.

Comparative Fuel Prices

3.39 The evolution of the costs of cooking with charcoal (purchased by the bag) and with three competing petroleum fuels -- propane, butane and kerosene (cost at the pump or bulk price) -- are given in Figure 3.4 for Port-au-Prince. The costs of associated stoves are not included in these calculations. The figure illustrates the following points:

(a) the progressive increase in the cost of cooking with charcoal, as described previously,

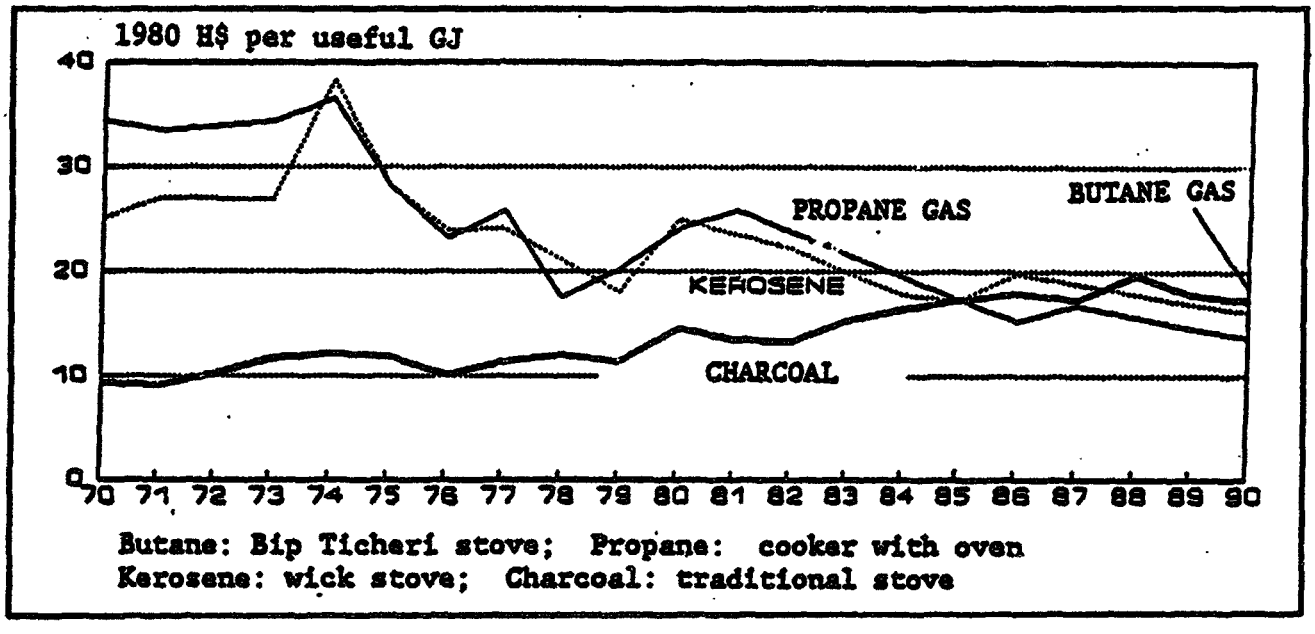
(b) the correlating drop in the price of petroleum fuels, including the more distinct drop in propane during the last few years, primarily due to taxation decisions,

(c) decontrolled propane became competitive with charcoal in 1985, and kerosene, after subjected to new tax controls, became competitive again in 1988,

(d) of course these costs depend on the stoves used: thus with more efficient stoves than those presently used (portable pressurized kerosene cookers, improved charcoal stoves), kerosene and charcoal costs are on par with those of propane,

(e) under current conditions, butane is more expensive than competing fuels.

Figure 3.4: Costs of Cooking with Charcoal, Kerosene and Gas



3.40 Amortization and maintenance cost of stoves are incorporated into the calculations presented in Table 3.1 (a summary of the detailed tables attached in Appendix VI). These figures confirm the preceding conclusions: cooking with charcoal, kerosene or propane gas essentially costs the same for the Port-au-Prince consumer (about H$ 30 to 35 per useful GJ), with butane being distinctly more expensive.

3.41 Two remarks, however, ought to be noted. The first concerns how fuels are purchased: if the households do not purchase variable quality charcoal in bags or in smaller portions (75% of households purchase charcoal in this manner), but prefer to purchase selected charcoal, sold in pots or baskets, their cooking costs is almost double the previous estimates.

3.42 The quantities in which kerosene is purchased also are important. Most of the present users of portable kerosene stoves purchase their fuel by gallon at the pump. However there are only on the order of 70 service stations in Port-au-Prince. With the development of the

kerosene market consumers would purchase kerosene from retailers. The fact that kerosene can be purchased daily in small quantities is one of its greatest advantages as a fuel: thus it becomes more accessible to lower-income households or to those with irregular incomes. However this service also comes at a price: the selling price of a 1-liter bottle is 30% more expensive than the price when purchased by the gallon at the pump.

Table 3.1: Compared Costs of Cooking in Port-au-Prince, 1990

Fuel	Stove	Type of Purchase	Financial Cost of Cooking US$/Useful GJ
Charcoal	Round traditional	Bag	35.0*
Charcoal	Round improved	Bag	27.8*
Charcoal	Potajé traditional	Bag	38.4
Charcoal	Potajé improved	Bag	31.6
Kerosene	Wick	Filling Station	34.9*
Kerosene	Wick	Bottle	46.1
Kerosene	Pressurized	Filling Station	27.8
Kerosene	Pressurized	Bottle	36.5
Propane	Cooker	Current price	30.8*
Propane	Cooker	Theoretic price	15.3
Butane	Bip	Current price	50.1*
Butane	Bip	Theoretic price	15.4

Note: * Currently used in Haiti

3.43 The other more fundamental remark concerns the current structure of the price of gas, as presented in Table 3.2. The various components of that price are reviewed in turn, beginning with the FOB price. The FOB purchase prices for gas, 29 and 40 cents per gallon respectively for propane and butane, presently are about 5 cents above the Mt. Belvieu spot market postings. This is not a temporary or conjectural phenomenon: for the past five years or more, petroleum products, and particularly gas, have been imported at prices 3 to 5 cent higher than the spot market price per gallon. For the 30,000 tons imported during this period, this represents an overall cost of US$ 600,000 for the Haitian economy.

3.44 The transport component in the gas price structure -- about 30 cents per gallon of gas, or $150 per ton of gas -- is quite elevated compared to the costs of gas transport in, for example, Jamaica (US$ 40/T for an annual market of 45,000 tons) or the Dominican Republic (US$ 50/T for an annual market of 35,000 tons). These differences cannot be explained only by the very reduced size of deliveries, which arrive every 15 days in Port-au-Prince. According to a BAPP study, if gas transport were open to competition, the cost would become fixed at around US$100/T under present conditions, and gradually would level out to around US$50/T (10 cents per gallon) if the gas market were to grow substantially and if new reception facilities and adequate storage infrastructure were installed.

3.45 The limited size of the Haïtian market also is not the only explanation for the high combined margins (approximately 60% for propane and more than 70% for butane) for importing and distribution companies. The usual combined margin in similar market situations in neighboring markets or other micro-markets (in Africa, for example) is between 30 and 35%.

Table 3.2: Costs of Importing Gas and Kerosene

Fuel Unit	Kerosene Gallon	Propane Gallon (1)	Propane Gallon (2)	Butane Gallon (1)	Butane Gallon (2)
FOB price US cents	58.0	29.0	29.0	34.0	34.0
Transport US cents	2.2	29.7	10.0	28.8	10.0
Insurance US cents	0.0	0.0	0.0	0.0	0.0
Customs Duty US cents	1.9	0.9	0.9	1.0	1.0
CIF price US cents	62.1	59.6	39.9	63.8	45.0
Weight kg	3.1	2.1	2.1	2.1	2.1
CIF price $/kg	0.2	0.3	0.2	0.3	0.2
Calorific value MJ/kg	43.5	45.7	45.7	45.7	45.7
CIF final energy $/GJ	4.6	6.4	4.3	6.8	4.8
Stove efficiency %	40%	60%	60%	50%	50%
CIF useful energy $/GJ	11.5	10.6	7.1	13.6	9.6

Notes: (1) Current transport cost: $140/ton
(2) Transport cost at one-third of its current level

3.46 A comparison of the price structure for propane in Haiti with that in the Dominican Republic is quite instructive: the Dominican Republic market for propane is 12 times larger and also strongly competitive. The CIF price there is practically half that of Haïti and the price before subsidies are added is three times lower. Once subsidized, the propane costs five times less for the customer than in Haïti (see Table 3.3). This comparison does not take into account, however, possible differences between Haïti and the Dominican Republic with respect to corporate taxes on benefits. It is also worth mentioning that the assessment of investment risk is probably different in these two countries; in Haïti, Shell applies a rate of return on investment of 15%, which is probably higher than the rate applied by private firms in the Dominican Republic. However, these possible differences could not totally explain the large margin difference that exists between the two countries. A detailed review of the price structure of butane and propane should therefore be conducted, in close collaboration with the gas importer and distributors, and with the BAPP; this would be included in the proposed study of the options to develop the LPG market in Haiti (see Annex XI).

Table 3.3: Comparison of Propane Price Structures in Haiti and Dominican Republic

	Haiti Propane April 1990 (Cents/Gal)	%	Dominican Rep. Propane April 1990 (Cents/Gal)	%	Haiti versus Domin. Rep.
FOB price	29.0	19%	23.0	47%	1.3
Transport	29.7	20%	10.0	20%	3.0
Customs duty	0.9	1%	0.0	0%	
CIF price	59.6	40%	33.0	67%	1.8
Misc. duties	5.1	3%	0.0	0%	
Ex-customs price	64.7	43%	33.0	67%	2.0
Margins	85.3	57%	16.2	33%	5.3
Retail price without subsidy	150.0	100%	49.2	100%	3.0
Subsidy	0.0	0%	16.4	33%	0.0
Retail price	150.0	100%	32.8	67%	4.6

Source: BAPP

3.47 Herein lies the problem of the competition among fuels. The price structure of kerosene is relatively sound: there is competition among distributors and the price components are negotiated with the State. However, if the basic components of the gas price structure were to be revised, its retail price would reach about 60 cents per gallon: refilling costs for a 12.5 kg container would amount to $4, and for the Bip container, 4 Gourdes. If prices were revised downward in this manner, gas (butane or propane) would become the cheaper fuel, distinctly lower priced than competing fuels. With the present tax regime, the cost of cooking with gas, including amortization and maintenance costs for stoves, would then be two times lower than the cost of cooking with charcoal or kerosene.

Real and Theoretic Economic Costs of Cooking Fuels

3.48 Comparison of economic costs takes into account the real costs of different fuels and stoves. Thus the analysis takes costs net of the various taxes (especially kerosene taxes) and subsidies which are applied directly or indirectly through foreign exchange mechanisms. The price of wood used in the analysis is different from the current market value; rather it reflects replacement costs using agroforestry planting techniques and takes into account the reference prices for the labor, the margins for producers, transporters, wholesalers and retailers, and the exchange rate (see Appendix V); thus the economic cost of charcoal is less than its current retail selling price.

3.49 It is apparent from this comparison that under present circumstances, kerosene is the most economic solution when it is purchased at the pump (between US$18 and US$22 per useful GJ). The costs arrived at for other fuels are, in ascending order: charcoal (between US$20 and US$27 per useful GJ) and gas (US$29 and US$44 per useful GJ respectively for propane and butane). Clearly, under current prices, the country's most economic solution is to substitute

kerosene for charcoal. Otherwise, agroforestry planting is the next best solution, with gas substitution being the least economic (see Table 3.4). If the base cost of gas is revised to reflect its real economic costs, the situation is reversed: Its economic cost falls to around US$15 per useful GJ, thus making it the best alternative for the country, not only for Port-au-Prince but also in the provincial towns where charcoal is about 30% cheaper than in the capital.

Table 3.4: Compared Economic Costs in Port-au-Prince, 1990

Fuel	Stove	Type of purchase	Current economic cost of cooking US$/ useful GJ	Theoretic economic cost of cooking US$/ useful GJ
Charcoal	Round traditional	Bag	24.5	29.3
Charcoal	Round traditional	Bag	19.5	23.2
Charcoal	Potajé traditional	Bag	26.9	31.6
Charcoal	Potajé improved	Bag	22.1	25.8
Kerosene	Wick	Filling stat.	22.6	22.6
Kerosene	Wick	Bottle	30.3	30.3
Kerosene	Pressurized	Filling stat.	18.7	18.7
Kerosene	Pressurized	Bottle	24.7	24.7
Propane	Cooker	Container	28.6	14.0
Butane	Bip	Container	44.4	14.9

Compared Impacts on the Balance of Payments

3.50 In terms of the impacts of importing petroleum products on the balance of payments, there is also a tendency for the options to reverse their order of desirability if gas prices are revised (see Table 3.3). Under present price conditions, the impact of petroleum imports is about the same for both kerosene or gas (slightly lower in the case of propane, a little higher in the case of butane). Importing gas is the least cost option when gas prices are revised.

3.51 In conclusion, the gas solution appears the most advantageous for consumers and the country, but only if necessary measures are taken to open the market to greater competition and if necessary investments are made for storage and distribution infrastructure. However, the various parameters which govern consumer choices for purchasing equipment and switching to another fuel, need to be analyzed to determine if the gas market is worth a promotion effort. The market for fuels and stoves is, therefore, analyzed in the following section.

The Market for Fuels and Stoves

Current Users of Improved Stoves, Gas Stoves and Kerosene Stoves

3.52 The characteristics of Port-au-Prince households that currently use gas and kerosene are as follows:

(a) the 40,000 residential users of propane gas are distinguished by their level of income: almost all affluent households and a majority of the upper-middle income households own gas equipment. Whatever the income level, more than one in every two households which own gas equipment use gas as the primary cooking fuel.

(b) the 20,000 new Bip purchasers have a profile somewhat like households of the previous category (see Table 3.5): larger, well-to-do households which have been reluctant to make the switch to gas and purchase Bip as contingency equipment; middle class households; and even the better-off among poorer households (nearly 10% of households with monthly incomes of less than $72 per capita have purchased a Bip). However, the further removed this market penetration is from the traditional propane markets, the more likely purchases of Bip equipment are made for contingency use; on the average only one Bip owner in three uses it as the primary cooking appliance. Finally, the owners of Bip are younger than the average: 50% of Bip users are less than 30 years old, 80% less than 40 years old.

Table 3.5: Bip Ticheri's share of the gas market in thousands of Households

			Socio-economic stratum					
	Total	%	Low	%	Medium	%	High	%
Propane Stove								
Primary	20.3	54	1.4	50	10.4	50	8.6	59
Secondary	17.6	46	1.4	50	10.4	50	5.9	41
Bip Ticher								
Primary	6.3	33	0.5	10	2.7	26	3.2	70
Secondary	13.1	67	4.1	90	7.7	74	1.4	30
Total households	180.0	100	114.3	100	49.1	100	16.7	100

Note: See Annex 10 for the definition and boundaries of thr three socio-economic groups.
Source: ESMAP/BME/OLADE/PNUD Surveys, 1990

(c) the 5,500 household users of kerosene are well-off to middle class households with the same type of income. However they tend to be not only older than Bip users (two-thirds of women who cook with kerosene are between 30 and 40 years old), but they also have larger than average households (often 6-8 people per household).

Consumer Acceptance of Different Stoves and Fuels

3.53 Various recent consumer studies have been conducted to analyze their incentives and resistances to switching fuels and related equipment. One of these studies was conducted by Shell in preparation for promoting the Bip stove using butane gas. The survey was conducted in October 1987 among 160 medium to high income people (154 respondents). Survey results indicate that households have a strong interest in possibly switching fuels, with a distinct preference for propane gas. In relation to gas, these households consider the use and initial investments for kerosene to be less expensive and kerosene to be less dangerous. However, the respondents -- all non-users and representatives of only part of the Port-au-Prince population -- also consider kerosene to be much less practical, fast and clean. In order of preference, gas was chosen by 50% of the households, followed by charcoal (22% of the households), electricity (21%) and finally kerosene (7%).

3.54 Stove models were presented to about 60 people of all socio-economic classes during the present study (see models in Appendix III). Improved charcoal stoves drew very positive responses from those participating in the presentations: reassuring image, well-adapted to Haitian cooking 8/, easy to use. These stoves are still not known to a majority, but a quarter of the participants know that they can be purchased at Saint Martin or at Cité Soleil (in particular stoves of the AFVP workshops). For models constructed with recovered sheet metal, an acceptable price would be about 20 to 25 Gourdes ($4-$5) according to the participants.

3.55 The kerosene stoves received a more modified response during the surveys of test groups of users. Owners of this type of stove consider it a rapid, clean and practical way of cooking. However, during group meetings, participants complained that existing models on the market (Haïti Métal) were out-dated and poorly constructed. While participants did not fully reject these models, to which they attach certain advantages (adaptation to large cooking pots, quickness of cooking), they focused their attention on other models, such as the Peruvian pressurized kerosene cookstove. Many would be interested in purchasing this model if it were priced no more than $25 for one burner and $50 for two.

3.56 During the survey conducted for this study, Bip Ti Cheri owners cited a dozen reasons behind their decision to purchase Bip. Tied for first place among these reasons were the ease of lighting the cookstove and the publicity campaign. This confirms that Bip is a good product, but also shows that its promoters were very successful with their advertising. The group meetings confirmed interest in butane-based portable stoves: it is considered easy to light, fuel efficient, easy to use. Disadvantages included its poor adaptation to use with large cooking pots and the costs of recharging butane containers; these were reasons cited by the one-third of surveyed households who rejected this model.

8/ However a two-burner (Deux-Feux) model would be better adapted, as the cook no longer would have to use two round cookers (réchaud rond) at the same time.

Potential Markets for Stoves and Fuels

3.57 The market potential in Port-au-Prince for the different stoves and fuels (for primary use) was determined based on different analyses conducted during the study. A factor analysis of socio-economic characteristics, purchasing behavior, and energy consumption practices of households polled in the capital (see Appendix VII) showed a certain number of fundamental parameters that determine the choices of stoves and fuels. These determining factors are in decreasing order: (i) purchasing ability (level, regularity); (ii) ability to investment; (iii) willingness to modernize (or concern for tradition); (iv) household size; and (v) introversion of household (or on the contrary, openness to the external world).

3.58 On the basis of both this analysis and the results of the stoves presentation, five target groups were identified 9/, with different profiles:

(a) Group A: households without budgetary or rigid dietary constraints;

(b) Group B: households of more than six people, with a variable but regular income;

(c) Group C: average-sized households with a certain level of education;

(d) Group D: households with low or irregular income;

(e) Group E: modern, progressive households.

3.59 An evaluation of the market potential of each of the principal types of stoves and fuels was conducted for each of these groups under two scenarios: (i) gas prices remain at their present level, and (ii) gas prices are reduced appreciably to levels two times less than their present level. In the latter case, a sensitivity analysis was also carried out for the respective market shares for the main stoves and fuels in relation to exogenous factors (inflation, income level) or endogenous factors (distribution policies, price of equipment, loan availability, advertising strategy for promoters of different equipment).

3.60 The results, detailed in Appendix VIII, are summarized in Table 3.6. This table describes the potential markets in Port-au-Prince for the different fuels and stoves for primary use. The results mainly show:

(a) relatively interesting prospects for substitution with the possibility, all things being equal, of inducing over 40% of households to switch to a primary fuel other than charcoal;

9/ The sum of these groups represents the total population of Port-au-Prince.

(b) the strong preference for gas among all substitution possibilities (27% of households; 10% opt for kerosene and 3% for electricity) 10/. The market for "popular gas" (Bip or possibly other portable stoves) could absorb most potential new gas users, thus attaining up to two thirds of the gas market;

(c) the entrenchment of a substantial portion of households (60% of the total) which are resistant to substitution and will continue to use charcoal, either in a small round stove (46%) or a potajé stove (14%);

(d) the possible level of market penetration by round improved stoves, encompassing 40% of small stoves users and a little less than 20% of the total households.

Table 3.6: Results of the market study in Port-au-Prince

	1990	Port-au-Prince Market (1)	(2) Med	(2) Max	(2) Min	Reference Santo Domingo 1988
Charcoal stoves						
Traditional stove	60%	27%	20%	18%	22%	
Improved stove	2%	19%	18%	17%	20%	
Potajé stove	22%	14%	9%	8%	10%	
Sub Total	84%	60%	47%	43%	52%	28%
Kerosene stove	2%	10%	6%	5%	7%	3%
Gas stove						
Propane cooker	9%	10%	16%	19%	14%	
Butane stove	4%	18%	28%	32%	25%	
Sub Total	13%	27%	44%	50%	39%	68%
Electric plate	2%	3%	2%	2%	2%	2%
TOTAL	100%	100%	100%	100%	100%	100%

Notes: (1) Market potential, price structures unchanged
(2) Market potential, significant decrease of gas price
Med: Average gas penetration
Max: Maximum gas penetration
Min: Minimum gas penetration
Source: Market tests: ESMAP/BME/OLADE/PNUD

3.61 An appreciable downward evolution in gas prices would reinforces these tendencies. Under the most optimistic hypotheses, gas would attain market shares of 50% in the capital city, cutting into the charcoal market (especially among potajé users), and also gaining significantly on kerosene and electricity. This would facilitate shifts from conventional gas to popular gas and

10/ The percentage preferring kerosene would be greater than 10% if kerosene prices were decontrolled like LPG. However, if the price of LPG were reduced, LPG preference would override that for kerosene and electricity.

therefore would benefit both types of gas in equal shares. It also would in no way negate the need to begin efforts to distribute improved stoves to the population segments who continue to use charcoal.

3.62 It is apparent from the market analyses that, even under optimistic scenarios of substitution, the percentage of charcoal users would remain around 40% in the medium term. Mounting a conservation program thus remains a priority. In addition, the likelihood is high that market penetration by the small round improved stove will be successful in all cases: estimates are between 40% and 50% of current users of the older round stove model.

3.63 The conclusions of this analysis correspond to those of the analysis of financial and economic costs for the different fuels. The market analysis suggests that gas has the best chance of achieving massive substitution; and the cost analysis shows that it is possible to make significant interventions at the price structure level in order to promote gas use among urban Haitian consumers.

3.64 Therefore, it is necessary to examine the feasibility and the conditions of those components which correspond to the two main axes of the energy strategy, designed to alleviate the pressure of woodfuel consumption on the Haitian environment in the short term:

(a) the reduction of urban charcoal consumption through promotion of gas substitution;

(b) energy savings achieved through distributing more efficient systems of cooking with charcoal.

Gas Promotion

3.65 Whether it be in terms of comparative costs of different fuels or of consumers' preferences, gas is the best substitution option for charcoal in the capital and the main Haïtian cities. However, as previously seen, the current gas market is not optimal, on three distinct levels:

(a) the cost of supply on the international market and of transporting gas to the island;

(b) the capacity of docking and storage facilities;

(c) the margins taken by importers and distributors.

3.66 As a consequence, the price of gas is increased in an excessive fashion; the fuel thus is limited a small fraction of the population. Continuation of this situation could be understood in an environmental context different from Haiti's: the well-off customer incontestably benefits from reliable and high quality service, and the pressure which LPG imports exert on the balance of

payments remains minimum under current conditions. However, as has been previously discussed, massive LPG distribution in substitution for charcoal is urgently needed. Thus steps must be taken to open the gas market.

3.67 Two fundamental options are available to public authorities for developing the gas market: (i) negotiate an agreement with the current importer, which satisfies both parties and favors rapid expansion of the gas marke (a regulated "natural" monopoly) -- or (ii) encourage the creation of competing supply and distribution firms. The most simple of the options theoretically is to strike an agreement with the existing operator concerning regulated prices for propane and butane (return to the situation before 1987) and the new investment program for increasing storage and filling capacity. However the other option of encouraging the creation of one or several competing supplies has the advantage of addressing both the problems of investment and of prices: since the market will be increasing, it thus is preferable for the State to facilitate market entry by various competing suppliers rather than to negotiate with a single supplier. The option of geographic concessions that would be allocated by the Government to different operators for the main cities is not feasible at the moment due to the limited size of the potential market for gas sales in cities other than Port-au-Prince; however, this option should be reviewed again as soon as the potential market in these cities (Cap-Haïtien, Gonaïves, Les Cayes) justifies the installation of small bottling plants, probably during the next decade (see Annex IX for market estimates in main cities).

3.68 The appearance of a new supply and distribution company would stimulate competition not only in the "conventional" market for propane (12.5 kg and 50 kg, or even 100 kg containers), but also in the market for "popular gas" (butane), thanks to the distribution of 3 or 6 kg containers: the competition between 6 kg and 3 kg portable cookstoves is quite vibrant in certain West African countries (Senegal, Mali), which is beneficial to the consumer since it provides an array of diversified products. The new company could strengthen market growth by making it easier for middle-income households to purchase bottles (cross mechanism of the type adopted initially by Sodigaz, amortizing part of the price of a bottle over the sales of gas), and by researching and promoting adapted cookstoves. Possibilities include some one or two burner portable cookstoves such as those distributed in several African countries (Sahelian countries, Cameroun) or some models manufactured in the Dominican Republic.

3.69 Two options should be considered for importing gas to meet growing demand as the gas market develops:

(a) re-exportation from the Dominican Republic,

(b) creation of a new gas terminal (or enlarging the existing terminal).

3.70 Under the first option, an agreement should be reached with the Dominican Republic for importing gas from that country: a possibility which despite certain political risks (security of supply) ought to be considered, on the condition that the future transfer price of gas

supplied by the Dominican Republic reflects its economic cost. The Dominican Republic has a considerable storage capacity available to it, equivalent to more than five months of internal consumption. The Dominican Republic already plans to re-export LPG to other countries in the Caribbean in order to make its new terminal and storage center at Azua, located 150 km south east of Santo Domingo, profitable.

3.71 The Azua terminal is relatively close to Haiti (300 km from Port-au-Prince, with road transport costs about $500 by truck). It was deliberately located to capitalize on potential supply routes along the nearby north-south axis of the border. The comparatively limited needs of Haitian cities make this center a viable alternative, at least for the first years of gas promotion in Haiti. Transport from Azua would cost approximately $0.2 per gallon; thus gas arriving at Port-au-Prince from this source would cost less than the current CIF price based on sea transport (62 cents per gallon).

3.72 The other possibility is to construct an autonomous gas receiving terminal in Haiti (docking, storage and bottling facilities); this would represent an investment of about US$ 4 to 5 million. This option has several advantages, the most important being security of supply. In fact, the current importer, Shell-Haiti, already has a project of this type planned for the medium-term. It would be preferable to implement the project in an open competition framework:

(a) whether by setting up a competing importing and distribution company which would own and operate the installations,

(b) or by separating imports from distribution through installation of a proper receiving and storage infrastructure to be used by various distribution companies (including the current importer, if it is so inclined).

3.73 Under current circumstances, the Haitian government must not involve itself in the direct importation or distribution of petroleum products. All new schemes thus must depend largely on the private sector. This supposes a mobilization of new partners in Haiti's gas sector. Different options ought to be explored:

(a) At the Haitian level, various entrepreneurs (either Haitian or foreign parties conducting business in the country -- priority could be given to petroleum companies which already have operations in Haiti) could be interested in this type of set-up.

(b) At the international level, it may be possible to interest some large multinational petroleum companies who operate in the Caribbean, but who have not yet approached the Haitians.

(c) It is also possible to explore certain possibilities of regional cooperation: agreement with Trintoc (Trinidad and Tobago) or, in a framework comparable to the San José agreement, with Mexico or Venezuela.

3.74 Should creation of a new terminal be preferred, the investments required would be quite substantial. It may prove difficult to attract the necessary Haitian and foreign investors. During its preliminary research in 1988 and 1989, the BAPP had experience of this phenomenon: the country's situation provides disincentives to foreign investment. Although some international companies are interested in Haiti's gas market, they prudently are waiting for the situation to improve. In this case the State itself could be justified -- for external reasons (strong environmental justification) -- to participate in the initiative for this infrastructure. This can work from the level of a simple guarantee, or could include Government participation in a minority share of the investment. It is likely in this case that the Government's share would require the support of an international financial institution, which would simultaneously provide financial support and guarantee the operation.

3.75 In all situations, the State should endeavor to recapture tighter control over the conditions of gas importation and distribution, and notably over prices. It should also reinstitute a tax on gas, in order to finance the public effort in that domain: supervision of the sector and possible investments. Given the possibilities of reducing the existing margins, that small tax would not become a hindrance to the development of a gas market. Finally, the State should pay special attention to limit the environment impact of gas storage and distribution infrastructure, particularly concerning safety aspects through adequate norms and regulations. Similar safety concerns should exist at the level of consumers, to which education campaigns should be addressed by the State to ensure safe and efficient use of gas stoves.

Energy Conservation

3.76 Improved stoves programs must advance from the experimental, "minimalist" stage to a stage of large-scale distribution throughout the estimated markets in Port-au-Prince and the other main cities of Haiti. Private parties already operating in the sector (manufacturers, merchants, NGOs) could be drafted for implementing these distribution programs. It also is necessary that initiatives for product development and promotion be organized and coordinated. The BME should be responsible for organizational and coordinating functions, with regard to:

(a) product research and development,

(b) quality control and standards,

(c) coordination of activities for local promotion.

3.77 The stove developed by the BME or its existing variations in various workshops (AFVP, BIT) is undeniably a very good product with wide acceptance. It would be quite easy to organize distribution of the product among domestic consumers and, in its larger version, among the manjé kwit (small restaurants along the side of the road) within a relatively short period of

time. The analysis of market potential for stoves and fuels shows however that another category of equipment should be considered: the potaje stoves. Given the current and future market for these stoves (currently 30% of households, 10 to 15% there after, according to the market study), an improved model of the potaje stove should be developed for distribution to the small fraction of middle-high income households reluctant to switch fuels. Arbitrage on the use of recovered versus new material for stove manufacture should be left to the stove makers, who will reflect market signals (relative costs of materials and consumers' demand according to their preferences).

3.78 Some traditional stoves seemingly are more efficient than average, such as the "capois" stove of Cap Haitien, and they should be tested. Also, various institutional and private initiatives for perfecting and distributing improved stove models have been undertaken (REDI, MARNDR, etc.). These initiatives should be channeled together by defining a testing and standards procedure for the various existing models or those which recently have been developed.

3.79 With regard to the producers training and field promotion, a network of local participants should be developed gradually with the support of the NGOs operating in the cities and neighborhoods where stoves would be distributed. A decentralized effort of this type should be coordinated by a single institution, possibly the BME. Training of craftsmen, promotion and information campaigns, and follow-up/evaluation should be designed and implemented by one or several NGOs which are competent in these areas.

Substitution and Conservation: Discarded Options

Least-Promising Short Term Options

3.80 Various alternatives have been discarded as they do not present favorable possibilities for addressing the current problems. They include: (i) use of lignite; (ii) use of agricultural, agro-industrial or urban wastes; and (iii) importation of charcoal or coal.

3.81 Haiti possesses several lignite deposits. The most well known, the Maissade deposit, has proven recoverable reserves of about 6.4 million tons. Other deposits have been identified in the Asile and Camp Perrin. A 1986 study (Stevenson) showed that exploitation of this lignite could be economically competitive with charcoal. However, the lignite is of relatively low quality: high humidity, high sulfur and high ash content -- thus rendering it unacceptable as a charcoal substitute for residential use as well as unusable in existing charcoal stoves. It could be used in industries, and a study to examine this possibility is planned under the guidance of the UNDP.

3.82 Similarly, the use of agricultural or agro-industrial wastes (as briquettes) also does not present a viable alternative for the residential sector. Main reasons for this are problems of acceptability among consumers and the lack of financial profitability. By contrast, there are some possibilities for using this fuel source in small industries, although experiments conducted in 1987

for the use of sugar cane bagasse by dry-cleaning establishments were inconclusive. This theme thus remains largely in the experimental stage. Haitian specialists have suggested to consider the use of gas produced from household urban waste in dumps organized following specific methods; on technical grounds, this producer gas could be cleaned, compressed and commercialized to be used for cooking purposes as the butane. Some experiences exist on this technology (in particular in Chile); these seem to indicate the lack of financial viability of such an operation in comparison with the use of butane gas, due to the high costs of dump management and producer gas processing.

3.83 Finally, it is possible to compare the current prices of charcoal with that of imported charcoal. Various price quotations (Plouvier, 1985, Projet Forestier 1989) place the wholesale price of imported charcoal from around US$8 per 38 kg bag (imported from Mexico), to US$10 per bag (imported in bulk from Surinam and put into bags in Haïti) and US$16/bag (imported from Brazil). Hence the retail sales price per bag would vary between 70 and 100 Gourdes, considerably higher than current prices. Importation of charcoal thus cannot be considered a viable alternative. It is not competitive with the various potential alternatives and it has none of the advantages but many of the disadvantages of the substitution option: lack of security of supply, aggravation of the balance of payment deficits. It can also present environmental risks for the producer countries. Importation of high quality coal, allowing its use as a cooking fuel, has also been examined. The Colombian export coal is a favorable case (low sulphur content, low humidity content, calorific value similar to charcoal): with a FOB price of about US$55/ton, retail price in Port-au-Prince could reach around Gourdes 780/ton (transport cost of US$15/ton; 60% margin for unloading, storage and distribution; US Dollar valued at 7 gourdes), which is about 25% cheaper than charcoal. However this option entails the same economic and political disadvantages as imported charcoal and it would probably face acceptance problems from the consumers, who, in addition, should buy new more expensive stoves for safety reasons (a chimney is necessary for CO evacuation); therefore coal importation is not a real option.

Secondary Options

3.84 Three topics for action could have been included among the strategy components. However, due to the limited size of the possible interventions and their foreseeable impacts, these options have finally not been considered as components of the strategy. The three topics are: (i) decreasing wood consumption, through its conservation, in rural areas; (ii) kerosene promotion in urban areas; and (iii) substitution of wood and charcoal in small industries.

3.85 Consumption of wood in rural areas represents most of Haïti's wood consumption, and thus could prove to be an important point of action for the household energy strategy. However two factors limit interest for an intervention in this domain:

(a) the real deforestation impacts of firewood consumption are still not certain: wood wastes frequently are generated by clearing the land and by pruning, practices which cannot be disassociated from agricultural practices;

(b) promotion of improved stoves in rural areas, even those initiated by very active promoters, generally have had very limited impacts and the results have been very disappointing with regard to the means employed, due to the characteristics of wood use in rural areas: non-monetarized wood collected for self-consumption.

3.86 The kerosene market in Haïti seems to be relatively small, especially if gas prices are reduced. Its use should be promoted as one of the alternatives, less important than gas but nonetheless valid, to charcoal. However, given the scantness of its the market, the private sector should be left to initiate promotion of this fuel. Further recommendations are:

(a) that in the course of actions to promote substitution at national level, the Government advance kerosene as one of the alternatives to charcoal;

(b) that the BME test the different models available on the market or those distributed in other countries (Colombia and Peru, for example);

(c) that the BME make itself known to Haïti Métal and other possible importers of kerosene stove models as a source of policy and technical assistance, and that it refer them to foreign manufacturers.

3.87 Substitution of wood and charcoal by petroleum products (kerosene, diesel or fuel oil) or by biomass-based fuels (for instance biogas produced from molasses in the guildives 11/ in small urban- or rural-based industries has not been included among the priority topics for the following reasons:

(a) overall consumption by these industries only represents about 5% of the total consumption of wood-based fuels (firewood, charcoal) in Haïti;

(b) this substitution does not appear to be profitable in a number of cases: especially the economic conditions of substituting diesel in the guildives are not met (See Annex X).

(c) the most dynamic of these companies, those which can afford to make investments (bakeries, dry-cleaners, oil factories) have already switched to other fuels;

(d) in the context of Haïti's current economic conditions, the other companies' willingness and ability to invest is less certain: the oil-manufacturing sector, for instance, has been in the midst of a structural crisis for several years;

11/ The MARNDR is currently implementing a demonstration project on this technology.

(e) finally, actions taken for the residential sector, mainly those which favor the lowering of gas prices, should have a secondary positive impact on small enterprises (restaurants, for example).

3.88 BME should make itself known to the companies so that it can be consulted by those who wish to renovate their infrastructure; BME could provide advise, suppliers' referrals and, when possible, prefeasibility studies of substituting other fuels for wood.

IV. STRATEGY COMPONENTS

4.1 The proposed Strategy is centered on three priority components designed according to the principle objectives outlined in the preceding chapter and taking into account the problems and constraints found in the sector. Less urgent actions and those with limited impacts have been omitted. The three strategy components are:

(a) opening the gas market,

(b) charcoal conservation,

(c) modernizing the charcoal sector.

4.2 Besides, a fourth priority component targets the coherence of actions undertaken as part of the strategy:

(a) strategy monitoring.

4.3 The above listing of the strategy's components do not imply priority ranking. Indeed, as pointed out in Chapter 3, implementing the four recommended components concomitantly and in a coordinated way is necessary to reach the main objectives of the Strategy, i.e. to curb down charcoal consumption and to increase the sustainability of charcoal production. Moreover, if the components had to be ranked, the result would obviously depend on the criteria chosen to compare the components. For instance, if easiness of implementation was the main criterion, the charcoal conservation component would rank first; however, if impact on charcoal consumption is the priority, then opening the gas market ranks first, while if the issue is to achieve sustainable charcoal production in the medium term, modernizing the charcoal sector becomes the main component. In any case, the component for policy formulation and strategy coordination is necessary to the success of each one of the three other components.

4.4 The outcomes expected from implementation of the strategy's three components are summarized in Figure 4.1. Details are provided in Annex IX. The strategy will be implemented over a three year period (1992-1994), but evaluation of the costs and benefits of project outcomes will extend over ten years (1992-2001). The latter corresponds more closely with the typical energy sector planning horizon. Projections of fuel consumption and market penetration rates for improved appliances or for substitution fuels are compared for two scenarios: implementation of

the strategy versus no change in relation to the consumption patterns in 1990 (percentage of users and unit of consumption for each fuel). 12/

4.5 The main outcomes of the Strategy will be to: (i) curb down the rapid increase of charcoal consumption and stabilize charcoal consumption; and (ii) to gradually transform - for the larger possible share - the remaining charcoal production into a sustainable, financially profitable and environmentally benign economic activity. Specific outcomes are the following:

(a) gradual reduction of charcoal consumption in Port-au-Prince and in main cities (and thus reduction of the pressure on national forest resources) of 13% (relative to 1991 consumption) by the year 2000, and of 45% relative to the consumption projected for 2001 assuming no changes. Annual charcoal consumption would stabilize at around 200,000 tons in 2001, assuming that new households (population growth) would all use LPG. This reduction of charcoal consumption will be induced by dissemination of improved stoves and substitution by gas with the following expected results:

(i) gradual increase in the proportion of urban consumers using gas as the primary fuel; the objective is 35% of Port-au-Prince households in 1996 and 50% in 2001. In other cities, the objective figures are 10% and 20% respectively. This would induce gas consumption to rise from the current 7,000 tons per annum to 23,000 tons in 1996 and 41,000 tons in 2001;

(ii) annual sales of butane portable stoves and gas cookers should reach 35,000 and 10,000 units respectively by 2001; more than 90% of the sales are expected in Port-au-Prince;

(iii) by the year 2001, in Port-au-Prince and the main cities, one out of every two charcoal consumer will be using an improved stove, as well as one of every two manjé kwit restaurant, for a total of 80,000 stoves put into use between 1992 and 1994.

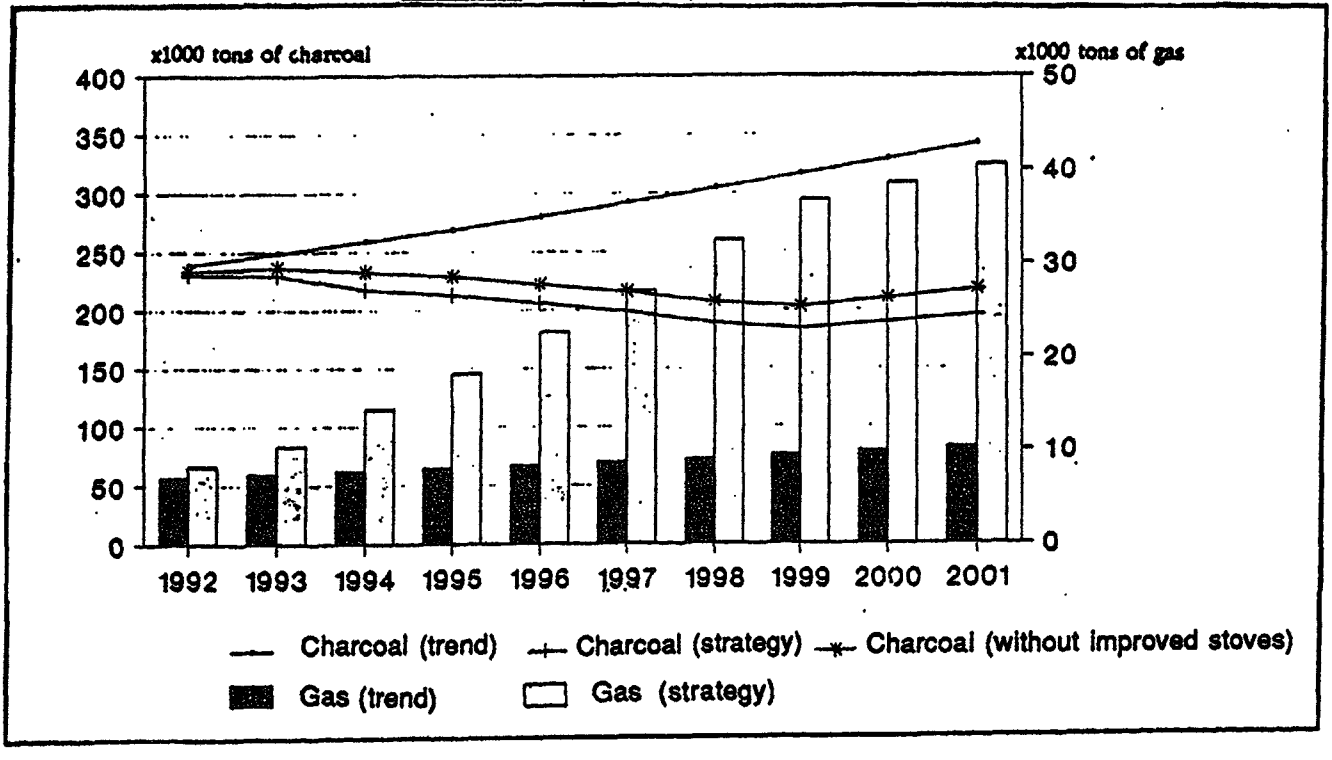
(b) improved conditions for producing charcoal and rationalization of access to forest resources in the main charcoal exploitation zones, manifested through the following outcomes:

12/ A trend scenario with unchanged consumption patterns in the future is based on the assumption that a conservation and substitution ceiling has been reached (gas penetration stopped, with current conditions for prices and infrastructure, and negligible dissemination of improved stoves).

(i) definition and implementation of a Supply Master Plan for Port-au-Prince, including the improvement of the fiscal system and of the control of charcoal flows (collection rate for transport taxes rising from 10% in 1990 to 60% in 1996);

(ii) training 500 professional charcoal producers in the use of higher yield charcoal making techniques and in simple methods of improved management. This would cover one of every 100 charcoal makers, spread out over the main charcoal exploitation zones and, to a lesser extent, in the zones under quotas.

Figure 4.1: Expected Impact of the Strategy



4.6 In addition, the economic consequences of the strategy are expected to be the following:

(a) increase in the total cost of petroleum product imports by 12% in the year 2001, all other things remaining equal. This represents an increase equivalent to 4% of total country exports in 1990, which is relatively small; 13/

(b) charcoal income in the main production zones will be maintained (and under normal circumstances will actually increase, because of efforts taken to improve the producer price in real terms).

Opening the Gas Market

4.7 Although it is the best choice for the country in both economic and financial terms, and as the preferred -- and potentially the least expensive -- fuel among consumers, gas suffers from a limited distribution in Haiti because of the current import and distribution system for the fuel. The strategy component addressing the opening of the gas market has several objectives:

(a) to obtain a significant reduction in the retail prices of butane and propane, by creating conditions of real competition in the supply of gas or by regulating the existing monopoly; and

(b) to facilitate access to gas usage and the acquisition of gas equipment for the lower income classes (middle class, upper levels of the poorer households) to induce its use as a primary cooking fuel.

4.8 The Haitian institution responsible for developing this project component should be the Division for Petroleum Product Supply (BAPP) within the Ministry of Commerce and Industry, in association with the BME. Within the framework of the strategy, the BAPP should:

(a) coordinate work on a preliminary study of the different potential options for importing and distributing gas, in association or in competition with the existing importer and distributors, including necessary reform of the existing legal and regulatory framework. (see the detailed terms of reference in Annex XI),

(b) propose the most favorable option(s) to the Government, then monitor and control proper implementation of the option adopted,

---

13/ These numbers are only indicative since the value of exports and the cost of imported petroleum products can fluctuate widely. In the case of oil price, despite some unpredictable and large variations, there seems to be a long-term trend for an annual increase of 2 to 3 % in real terms. This assumption leads to an average CIF price of about US$250/ton for LPG on the 1992-2001 period (also accounting for the decreasing cost of transport, which is linked to increasing volumes of gas used).

(c) propose adjustments needed for contracts, regulatory legislation, and fiscal policy which conform to the adopted option and more generally, to the other components of the strategy.

4.9 The technical options for opening the gas market which should be analyzed are detailed in the preceding chapter. They are the following:

(a) importing gas from the Dominican Republic, 14/

(b) creating a marine terminal and an autonomous storage and filling center,

(c) enlargement of existing receiving, storage and filling infrastructure.

For each potential option (alone or combined), the various possibilities of partnerships with private or institutional operators, foreign or national, should be examined, along with the legal, regulatory and fiscal consequences associated with the option(s).

4.10 The component to open the gas market specifically includes the following activities:

(a) financing for a study of the different potential options,

(b) support to the BAPP so that the institution participates directly in the analyses and missions, and so that afterwards it has the ability to carry out its regulatory function in the subsector.

(c) the estimated total for engineering studies and investments.

4.11 The estimated costs of the component conservatively take into account the most expensive option -- implementation of an autonomous gas terminal, including filling center. The investment hypotheses are sufficient for meeting increasing butane and propane demand up to 1996. They are:

(a) a gas terminal, equipped with two pumps and two gas pipelines (vapor 3", liquid: 6") of approximately 2 kms,

---

14/ Analysing this option should include the careful evaluation of associated risks of variation in the economic and contracting conditions of gas supply from the Dominican Republic.

(b) main storage capacity of 1500 tons, 15/ divided into five pressurized tanks with 300 ton capacity, with a fire prevention safety system (water tank and pumps),

(c) a filling system (with fire prevention safety dry system) equipped with eight balances with a maximum capacity equivalent to 60 tons/day (in two 8-hour cycles), capable of filling 3/6 kg and 12.5 kg containers, 16/

(d) an inventory of 230,000 3-kg containers (or 115,000 6-kg containers) and 100,000 12.5-kg containers. 17/

4.12 The total budget for this component is estimated at US$ 7.6 million (see Table 4.1 and Annex XIV). This total includes US$ 7.2 million in capital investments (all or a large part from private sources) and budgetary support for the BAPP of US$ 370,000, including the study of gas development options.

Charcoal Conservation

4.13 Objectives. Even under optimistic hypotheses for substitution by other fuels, a considerable proportion of households -- an estimated one of every two households on average in Haiti's major cities -- will continue to use charcoal. Distribution of improved charcoal stoves is thus an important component of the strategy. This component has two main thrusts:

(a) large-scale distribution of round improved stoves (BME model) to approximately 20% of the households in Port-au-Prince by the year 2001. This amounts to a total of 45,000 stoves in distribution in the capital by the third year after the component is launched, 15,000 stoves in the other main cities (20% of all households), and 7,000 stoves to the manje kwit restaurants in all main cities, for a total distribution of 67,000 stoves during the first three years.

15/ storage equivalent to about one month of gas consumption in 1996 (including existing storage).

16/ About 30 tons per day for each type of container.

17/ Numbers obtained by considering the preliminary following assumptions: butane and propane penetration rates as in Annex IX; household use of butane and propane as secondary cooking fuel in a number of households equal to 50% of households using gas as primary fuel; 1.5 container per household in average; distributors' container stock equal to 25% of households' stock; annual container replacement ratio of 5% of total stock.

(b) development of an improved potaje stove, and distribution of 16,000 units throughout the capital and other main cities by the end of three years.

4.14 This represents an overall charcoal savings of nearly 15,000 tons in 1994, or about 8% of total charcoal consumption in Haiti's main urban centers.

4.15 Action Priorities. In order to be successful, distribution of improved stoves must take place in the context of several coordinated activities:

(a) technical and marketing work for developing and testing stove models so that the recommended models are both fuel efficient and adapted to consumer needs. One or more improved models of the potaje stove should be among those developed;

(b) a study to review conditions for manufacturing (craftsmen, availability of sheet metal, etc.), marketing and promoting the two cookstove models in the main cities other than Port-au-Prince;

(c) training for traditional stove makers and iron masons to manufacture improved stoves according to adopted standards of performance and quality;

(d) making use of current traditional production networks for manufacturing improved stoves: rechauliers for the round stoves, iron-masons for making potaje stoves, with materials in use (recovered sheet metal, and subsequently new sheet metal probably);

(e) making use of existing distribution networks for marketing the stoves: sales by producers or by small intermediaries under normal conditions for retail sales (without Government intervention on prices or margins);

(f) a sustained publicity campaign, using different media outlets: especially radio, but also television stations and the printed press;

(g) promotion activities in the field, making use of communication means of local associations;

(h) follow-up and evaluation of the results of the distribution program; and,

(i) effective coordination between the different local organizations involved in promotion.

4.16 Institutional Framework. The best institutional set-up consists of bringing together the main actors already active in the area of improved stoves, and to assign to them responsibilities in the areas where they are the strongest:

(a) the BME for general supervision and coordination of the program through its Steering Unit (see para. 4.31-4.35), and more particularly for the technical aspects of research and development for the stoves; and

(b) one or more NGOs for the following aspects: training craftsmen, publicity and promotion, follow-up and evaluation in the field.

4.17 Components. The improved stove distribution program contains four components. The first, product design and quality control, will be carried out by the BME. The main activities of the component will be to develop stove models (especially an improved potaje), technical testing of proposed models, and quality control for cookstoves under distribution. The BME will receive short-term technical assistance for product development (foreign assistance) and consumer trials (local assistance) and will work in collaboration with one or more local craftsmen for the design and manufacture of the improved stove models. The BME will be furnished with necessary testing equipment (test banks) and its operating means will be strengthened. The main program administrators also will be expected to make study tours to gain from the experiences with improved stove programs in other countries.

4.18 The second component is a training component for craftsmen. The distribution objectives are based on training of 100 rechauliers (70 in Port-au-Prince and 30 in other cities) and 50 iron-masons (35 in Port-au-Prince and 15 in the other main cities -- Cap Haitien, Gonaïves, Les Cayes and St Marc. Several main areas will be covered in the training: improved manufacturing techniques, use of recovered or new sheet metal (with templates), parameters which affect the efficiency and durability of the stoves, benefits of using improved stoves, marketing techniques, etc.

4.19 The third component includes (i) organizing publicity campaigns through local and national media and (ii) field promotion for the stoves. The general design, organization and implementation of publicity campaigns will be the responsibility of Haitian public relations professionals. Campaigns will emphasize the advantages of improved stoves over traditional portable cookstoves, both from the consumer standpoint (charcoal savings, rapid and better controlled cooking, more durable appliance) and from the standpoint of the nation (reduced environmental degradation). Field promotion of the stoves is an important element for the success of the distribution program, as has been demonstrated by several recent (and successful) stoves projects, notably in Kenya (Jiko stove), in Niger and in Mali (Mai Sauki stove) or in Rwanda (Rondereza stove). Promotion techniques will include neighborhood exhibitions, contests and games, "moving" publicity (pick-up trucks with loud speakers) and standard "stationary" publicity (posters, stickers, T-shirts, etc.) Proper and efficient techniques for using the stoves will be explained and demonstrated, as well as energy-saving techniques for cooking (soaking grains, use of aluminum pots and lids, new recipes, etc.) The field promotion, encompassing Haïti's main cities, will have three poles -- Port-au-Prince, the north (Gonaïves, Cap Haïtien and St Marc) and

the south (Les Cayes). Groups of promoters will be assigned to each of the cities (four in Port-au-Prince and one in each of the other four cities). Educational and promotional documents will be developed with short term local technical assistance. To the extent possible, the coordinating NGO will make use of local groups for organizing the actual stove distribution.

4.20 The fourth component, program follow-up and evaluation, will be carried out by an NGO in tight coordination with the BME. It will comprise several points: a survey of improved stove users six months after the start of the distribution program (charcoal consumption, level of consumer satisfaction, correct use of the stoves, use of other recommended methods for improving cooking efficiency); regular and selective quality control for stoves manufactured by craftsmen (by a qualified inspector); evaluation of the manufacture and marketing of stoves (quantities produced, prices and margins, distribution network); evaluation of actual savings generated for charcoal (survey of a representative sample of consumers halfway through and at the end of the program, in 1994).

4.21 The total budget for the improved stoves distribution program amounts to US$ 825,000; the breakdown of this total is indicated in Table 4.1 (see detailed annual budget and schedule of activities in Annex XIV). This program will be included in the Forest and Environmental Protection Project (as the Household Energy Conservation component, with an additional budget of US$68,000 for implementation supervision), to be financed mainly by IDA. Implementation of the FEPP is scheduled for the beginning of 1992.

Modernizing the Charcoal Sector

4.22 The primary objective of the third component of the strategy, modernization of the charcoal sector, is to reorganize and rationalize charcoal exploitation. This component targets the geographic reorientation of charcoal offtake and the improvement of charcoal exploitation techniques to reduce environmental risks, while designing and implementing the component in collaboration and agreement with local population. Activities carried out as part of this component also should strengthen the Haitian Government's ability to better control charcoal transport, especially towards the capital, so that collection of associated taxes on the transport and marketing of charcoal proves more effective. Modernization of the charcoal sector consists of two sub-components:

(a) preparation of a Supply Master Plan for Port-au-Prince, and

(b) implementation of a technical assistance program for charcoal producers.

Supply Master Plan for Port-au-Prince

4.23 The Supply Master Plan for Port-au-Prince targets the geographic reorientation of the wood offtake used to produce charcoal consumed in the capital. The Master Plan will be based on field visits as well as existing resource mappings and those that will be prepared (fragmentary existing data, preliminary results of the resource inventory planned as part of the FEPP) and existing data on wood offtake (study results, specific complementary surveys). The Plan will highlight two types of zones which will receive priority during strategy implementation:

(a) preferential zones, where it would be better to locate wood offtake (among those where charcoal exploitation already takes place), and the approximate annual offtake which would be permissible;

(b) zones where the current rhythm of charcoal exploitation presents present or future environmental threats, which will be placed under observation and protection, with the cooperation of and under the responsibility of local populations and villages.

4.24 The Master Plan then must give conditions for redirecting wood offtake:

(a) by establishing maps on which the principal parameters which determine the conditions for charcoal exploitation are quantified: price of standing wood, land tenure patterns (public and private domain) and parcelling of land, socio-economic profile of farmers/charcoal producers, main economic activities and impact of charcoal production in the rural economy;

(b) by analyzing the exploitation conditions in priority zones and the mechanisms by which supply networks can be reorganized within the framework of existing rural development programs;

(c) by defining a possible program for compensating charcoal producers in the zones affected by quotas.

4.25 With regard to regulating charcoal production and supply, the Master Plan should establish the modalities to:

(a) define and implement a simple and flexible mechanism for determining transport quotas for charcoal originating from each region, and allow for quota negotiations between the State, the local authorities and charcoal sector professionals;

(b) define and implement mechanisms for enforcing the geographic reassignment of wood offtake by strengthening control of charcoal transport by both land and sea: in Port-au-Prince, establish more highway control posts (to control the quantities of

charcoal originating from the central plateau and from the south) and more control of the waterways (Cité Soleil wharf); improve the existing operating conditions at control posts in the capital, especially for sea transport (Lamantin, Mariani, Martissant); relocate several highway control posts (around Port-au-Prince and Cap Haïtien).

(c) implement mechanisms for monitoring the effectiveness of the control systems and for periodic adjustments;

(d) identify the principal parameters related to taxation on a regional basis in order to properly orient exploitation towards specific zones, and propose appropriate fiscal arrangements.

4.26 During the second phase of the Master Plan, a program of priority actions will be prepared for compensating losses due to the restrictions on charcoal exploitation in areas affected by the quotas. In each affected district, a united effort to identify actions specific to the local situation will form the foundation of this program. Local administrators and technicians will take the lead in defining the action program, with assistance from a specially recruited multidisciplinary team consisting of two rural sociologists and two agronomists (at least one with forestry experience and one rural engineer). Local priorities will be defined for each district, with the cooperation of local authorities and populations, and the resulting proposals will be consolidated into a priority action program to complement or strengthen existing rural development programs in these areas. Steps then will be taken to mobilize additional funds needed to implement the recommended actions.

4.27 Finally, the Master Plan could provide the geographic skeleton for a comprehensive action program for woodfuel supply (assistance to professionals, forestry management, agroforestry), and especially in the framework of the strategy, allow local priorities for support to charcoal producers to be determined.

Assistance to Charcoal Producers

4.28 The subcomponent for technical assistance to charcoal producers has two basic objectives:

(a) to improve the conditions of charcoal exploitation by more selective exploitation of available resources, to promote the use of the best techniques for cutting and carbonization and to improve the charcoal makers' management and organization of their business;

(b) to complete the knowledge of forestry technicians employed by the MARNDR concerning the constraints and potential actions within the charcoal sector, and to

thus assure complementarity between planning functions (Master Plan) and field actions.

4.29 A mobile intervention team should be established as part of an NGO based in close proximity to the zones in question (probably in the Artibonite or the North Peninsula) to carry out the proposed assistance program. The team should consist of a forester, a training administrator and 10 field trainers, divided into two carbonization teams. The tasks of the mobile intervention team, which will receive short-term technical assistance from experts in artisanal carbonization, will be:

(a) in the first phase, to identify and evaluate the production methods in use in the zones concerned, the problems affecting charcoal producers (especially with regard to access to wood), environmental problems caused by local charcoal exploitation and possible solutions;

(b) to organize hands-on training sessions in charcoal-making techniques in production workshops. These sessions can be offered on a regular, systematic basis in priority zones, district by district, or they can be organized on the request of rural development organizations (NGOs, Projects);

(c) to gradually assist the organization of some of the charcoal makers into professional groups by helping them to acquire simple management techniques and tools essential for their vocation.

4.30 The component to modernize the charcoal sector should be implemented by a specialized temporary unit, the Woodfuels Unit (Cellule Combustibles Ligneux - CCL), to be established within the Natural Resources Department of the MARNDR. The CCL will be provided with support from outside consultants, Haitian experts (sociologists, survey experts, charcoal makers) and by NGOs working in the field. The staff of the CCL, to be recruited for the Project duration will be:

(a) one Unit Chief, a forest exploitation expert,

(b) a technical team composed of a forestry inventory expert, a sociologist, an agro-economist and a cartographer,

(c) one administrative assistant, one secretary and three drivers.

4.31 The CCL will be responsible for preparing the Master Plan and for improving the control and monitoring of charcoal supply, as well as for preparing the priority action program. It will supervise implementation of the program of assistance to charcoal producers which will be implemented by a NGO. The CCL also will ensure that its activities are closely coordinated with

the Steering Unit for the Strategy (see para. 4.33) and with the Management of the Forestry and Environmental Protection Project, especially concerning FEPP's work to review and adjust natural resource legislation. In the institutional framework and policy guidelines set in the future by the MARNDR, the CCL's activities will complement and reinforce FEPP's efforts to protect the environment through a global strategy for natural resource management.

4.32 The budget for modernizing the charcoal sector totals US$ 1,357,000 over the three years of the Project (see Table 4.1 and detailed budget in Annex XIV). Recurrent annual budgets of US$2[illegible],000 between 1995 and 1997, US$100,000 for 1998 and 1999, and US$50,000 for 2000 and 2001 are planned for staff and operational costs of the CCL, which would progressively be taken over by the MARNDR as port of its regular budget.

Monitoring the Strategy

4.33 The three components of the Strategy will be coordinated and monitored by a Steering Unit for the Strategy (SU). The SU also will address the gradual redefinition of the institutional structure for activities within the framework of the Strategy. It will propose simplified mechanisms for interministerial coordination, especially between the supervisory institutions for the strategy (Ministry of Commerce and Industry, MARNDR and the Ministry of Public Work, Transport and Communications).

4.34 Specifically, the SU should:

(a) assist coordinated implementation of the different strategy components by identifying and mobilizing the required financing from national and foreign sources, by revising and evaluating the activities and schedules for each component,

(b) provide the Government and the different public and private organizations participating in the Strategy with data and information needed to carry out the Strategy,

(c) coordinate proposals for modifications to pricing and fiscal policy and/or regulations for the different household fuels and help to prepare and enact corresponding legal texts. Related to this, the strategy's impacts on fuel prices will concentrate on changing the terms for competition (incentives to lower gas prices, incentives to increase charcoal producer prices) rather than on tax mechanisms. Price related action, discussed in greater detail in Chapter 3, consists of two principal points:

(i) gradually improve enforcement of charcoal tax collection and make the tax part of the regular fiscal system by transforming it into a local tax in the

medium term (used in part to fund the national forestry fund) this activity will be coordinated with, or could be replaced by the study of woodfuel taxation and control which is planned in the proposed Forestry and Environment Protection Project; and

(ii) implement a low level gas tax -- a level which does not adversely affect efforts to lower the price of this fuel in order to promote its use in urban Haitian households. The tax will facilitate the State's involvement in new investments for the gas subsector. The financial analysis of the Project arrived at a minimum value of 5 US cents, assuming that the State's share of investments in gas importation and distribution is only 20%.

(d) establish close coordination with ongoing projects which are related to certain strategy components (for example, the Forestry and Environmental Protection Project, the AOP Project, and the Energy Sector Strengthening Project).

4.35 The SU could be set up within the BME or, if applicable, at a more adequate and influential location in the new institutional structure that will arise from institutional restructuring by the new Government. SU's staff, to be recruited for the project's duration, will consist of:

(a) an energy economist, Unit Chief, with at least five years experience in the various aspects of Haitian energy policy,

(b) an expert in computerized data analysis,

(c) one administrative assistant, one secretary and one driver.

4.36 In addition, the following specialized assistance will be provided for the SU:

(a) one technical adviser for a three year period,

(b) assistance from Haitian and international experts in the following areas: survey organization and implementation, computer assistance, rural and urban socio-economic analyses, fiscal and legal aspects.

4.37 This component will be carried out over a three year period. The total budget amounts to US$ 768,000 (see Table 4.1 and detailed budget in Annex XIV). A recurrent annual budget of US$50,000 between 1995 and 1997 is planned for staff and operational costs of the SU, which will thereafter be taken over by the host institution as part of its regular budget.

Economic Aspects

Strategy Costs

4.38 The summarized costs for the four strategy components are presented in Table 4.1; detailed annual budgets are given in Annex XIV. The total cost of the strategy is US$ 10.5 million over the three year period 1992-1994; three-fourths in foreign exchange and slightly less than 70% for the gas component alone 18/. Modernization of the charcoal sector represents 13% of total costs, and costs of the charcoal conservation and strategy monitoring components respectively represent 8% and 7% of the total. Estimated annual recurrent costs begin in 1995 at US$ 200,000 and decrease to US$50,000 by 2001; these costs concern mainly the component to modernize the charcoal sector and to a lesser extent the Strategy's monitoring component which are to be implemented over a longer period than the other components of the strategy. A small amount of additional funds will be required to assist the Government of Haiti in supervising the implementation of the strategy's components; the exact amount of these funds and the procedures for co-supervision will depend on the practices of the bilateral/multilateral donors involved in the strategy's financing and should be defined later with these donors.

18/ It should be noted that the State's participation in these investments for developing the gas market should be very limited (the financial analysis for the strategy assumes the State's share in these investments is only 20%).

Table 4.1: Summarized Budget of the Strategy's Components

	US$ (1000)	% of costs	% in for. currency
1. OPENING THE GAS MARKET	7572	72	89
Options review	86		100
Support to BAPP	226		84
Investments 1/	6000		89
Contingencies	1260		89
2. CHARCOAL SAVINGS 2/	825	8	21
Product development and coordination	98		73
Craftsmen training	48		31
Publicity and field promotion	384		8
Monitoring and evaluation	104		12
Contingencies	191		26
3. MODERNIZATION OF THE CHARCOAL SECTOR	1357	13	29
Woodfuels Unit	356		34
PAP Supply Master Plan/Control improvement	375		33
Compensation Program Definition	198		25
Technical Assistance to Charcoal makers	305		20
Contingencies	123		30
4. STRATEGY MONITORING	768	7	62
Staff	108		0
Technical Assistance	420		71
Miscellaneous	170		79
Contingencies	70		63
GRAND TOTAL 3/	10522	100	74

1/ Of which 80% private.
2/ Investment included in FEPP.
3/ Of which only US$5.8 million are public sector investment.

Financial and Economic Analysis

4.39 The simplified economic and financial analysis for the strategy is summarized in Table 4.2 and 4.3. Economic benefits of the strategy's implementation which are accounted for in this simplified analysis come mainly from the value of charcoal that is saved through the programs of LPG substitution and improved stoves dissemination. Implementing the modernization of the charcoal sector will transform part of charcoal production into an environment-benign activity in certain zones of production and limit the impact of this activity in other zones, which are indeed the potentially larger benefits of the strategy. However, it is clear that the extend of these benefits will depend on the Government interventions on the other causes of environment degradation in Haiti (in the framework of a global strategy for natural resources management) as well as an efficiency of the strategy's quota system; therefore these benefits are difficult to quantify and have not been considered in the simplified economic analysis of this study. Also the costs and benefits of the compensation program for areas affected by quotas, to be defined later and to be implemented through mechanisms beyond the scope of the proposed strategy, cannot be accurately estimated at this stage, and thus have been excluded from the analysis.

4.40 The strategy's impact on public finances can be evaluated through the financial analysis; the financial internal rate of return (IRR) is calculated at 10%. The analysis is based on the following assumptions:

(a) improved collection of charcoal taxes amounting to a collection rate of 60% of the total due in 1996 (i.e. six times the collection rate in 1990) and the same rate thereafter; the MARNDR's ongoing efforts to improve tax collection rates should help make it possible to achieve this objective; the analysis also takes into account the loss of charcoal taxes that would have been recovered in absence of the strategy (with a higher total charcoal consumption),

(b) a tax on gas beginning in 1992 of 5 cents per gallon, equivalent to only 3% of the 1990 retail price.

Table 4.2: Financial analysis

(1000US$)	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
COSTS										
Project costs	1511	1141	3195	200	200	200	100	100	50	50
Charcoal taxes	4	10	22	30	39	49	60	70	75	77
Sub Total	1515	1151	3217	230	239	249	160	170	125	127
BENEFITS										
Charcoal taxes	122	242	344	449	541	524	498	484	499	515
Gas taxes		248	344	433	541	645	773	877	920	965
Sub Total	122	490	688	882	1082	1169	1271	1361	1419	1480
Balance	-1393	-661	-2529	652	843	921	1110	1191	1296	1353
Consolidated	-1393	-2054	-4583	-3931	-3088	-2167	-1057	134	1430	2783
FIRR 9.8%										
NPV (10%)	-28									

4.41 The economic analysis shows the strategy's impacts on the national economy, especially those related to the balance of payments and reducing environmental destruction. The economic IRR was calculated at 40%, based on the following assumptions:

(a) The economic value of the wood saved by implementation of the strategy 19/ is estimated at US$160/ton of saved charcoal, equivalent to its economic value for environmental impacts (see Annex XII);

(b) reduction of gas transport costs relative to costs for the volumes which would have been sold if no strategy were implemented is estimated at US$ 100 per ton on average for the period 1994-2001;

(c) additional gas imports would cost in average US$250 per ton over the 1991-2001 period, and imports of gas cooking appliances would cost an average of US$150 for each new gas-using household for the period 1992-2001.

Tableau 4.3: Economic Analysis

(1000US$)	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
COSTS										
Project costs	1511	1263	7755	200	200	200	100	100	50	50
Equipment imports	597	927	1942	1794	2188	2097	2601	2082	739	775
Gas imports	286	731	1663	2525	3575	4581	5830	6829	7184	7556
Sub Total	2394	2921	11360	4519	5963	6878	8531	9011	7973	8381
BENEFITS										
Charcoal savings	885	2146	4719	6471	8597	10644	13171	15220	16024	16888
Gas savings			689	717	747	778	810	843	878	914
Sub Total	885	2146	4581	6040	7553	9265	11070	13371	15852	18528
Balance	-1509	-775	-5952	2669	3382	4544	5450	7052	8929	9422
Consolidated	-1509	-2284	-8236	-5567	-2185	2359	7809	14861	23790	33212
EIRR 40.3%										
NPV (10%)	13509									

Risks

4.42 Risks linked to strategy implementation were evidenced in the previous chapters; they relate to several aspects: technical, social, economic, financial and institutional. However, these risks are quite limited relative to the environmental risk associated with not implementing this strategy. In addition, the financing required for the strategy is relatively small, and implementing the strategy in phases and under monitoring of the Steering Unit will allow necessary adjustments to be made, if needed.

19/ Without taking into account wood savings generated by the proposed assistance program for charcoal producers. In fact, since the program only affects a limited number of charcoal producers because the real obtainable improvement rates for carbonization efficiencies are uncertain, wood savings from this program will be much smaller than the savings generated by use of improved stoves.

4.43 In technical areas, risks are associated with market penetration rates for LPG and improved charcoal stoves; target rates for the strategy may be over optimistic. However, the market study has yielded fairly reliable projections; also, the impacts of lower penetration rates on the economic and financial viability of the strategy are limited. For example, if gas were used as the primary cooking fuel in only 35% of the households in the capital, and 15% in other cities, the financial rate of return would decrease by only 1.5% (in absolute terms) and the economic rate of return by 1%. The impacts due to lower distribution rates for stoves are even less. Furthermore, negative technical impacts could easily be counterbalanced by appropriate taxing policies applied to the gas price. For example, a collection rate for charcoal taxes amounting only to 30% at the end of five years (instead of the 60% rate targeted by the strategy) can be balanced by a gas tax increase of 1.2 US cents per gallon; this represents an increase of less than 1% relative to the retail price.

4.44 In the area of social and human risks, the most substantial impacts will be those generated by restricting charcoal exploitation in zones affected by quotas or prohibitions. The producers and transporters in these zones will initially attempt -- certainly not without success -- to circumvent the quota system. However, dialogue with local authorities, gradual increases in effective enforcement of quotas and priority actions programs for compensation should limit these risks in the medium term.

4.45 On the economic level, there are certain risks surrounding the evolution of international LPG prices, as well as the economic value of charcoal in terms of its impact on the environment. With regard to the latter, a rather conservative value was retained in the analyses; given the various growing pressures on Haiti's environment, the value will tend to increase. If the average price of LPG during 1992-2001 is US$350 per ton (1990 dollars), instead of the estimated US$250, the economic IRR would still be quite acceptable (23%). Finally, the impact of LPG imports on the balance of payments would remain limited; in 2001, LPG imports at this higher price would represent less than 6% of the value of exports in 1990.

4.46 Institutional risks are much higher, since they involve financial, human and political constraints, as previously cited. However, the proposed approach for the strategy is helpful in mitigating the risks due to the weaknesses of subsector institutions -- involving consumers and producers in the definition and implementation of the strategy, decentralizing activities and giving specific roles to local authorities, coordination and monitoring by temporary units established especially for the project, partial sub-contracting of implementation to organizations and associations already operating in the field, strengthening the regulatory role of the State.

Financing

4.47 As discussed previously, one component of the strategy -- large-scale distribution of improved charcoal stoves -- is included in the IDA's proposed Forestry and Environmental

Protection Project. The other components will be part of the National Energy Plan which is being prepared by the BME with assistance from OLADE and the UNDP in the Haiti Energy Sector Strengthening Project. The Strategy's components should also be among the programs that will confirm the Tropical Forest Action Plan for Haiti, which is being prepared under the supervision of FAO and the UNDP. Considering the urgency of implementing the strategy, obtaining the necessary financing should be among the Government's priorities and should be relatively easy, given the recent increase of international assistance to Haiti. The Ministry of Planning, with possible assistance from the BME and the MARNDR, should first explore possibilities for bilateral financing from lenders already active in Haiti's energy sector, woodfuels subsector and forestry sector, especially France, Canada, USAID and Germany. Canada, France and the European Economic Communities (EEC) have already expressed interest in financing actions to limit the impact of charcoal use in the environment. Finally, other resources might also be tapped at the level of international donors, e.g. from programs supported or supervised by the World Bank, such as the Haiti Economic and Social Fund, ESF (for instance to finance specific compensation programs in areas under charcoal production quotas) or the recently created Global Environment Facility (GEF).

RESSOURCES FORESTIERES ET DEFORESTATION

VOLUMES SUR PIED EN 1978	Surfaces		Stock	
	(1000 ha)	(%)	(1000 m3)	(%)
Forets de feuillus				
denses	21.9	1%	3291	7%
degradees	62.1	2%	3103	6%
secondaires	97.9	4%	3916	8%
Forets de pin				
denses	9.2	0%	1373	3%
claires	24.7	1%	1112	2%
tres claires	47.4	2%	711	1%
Formations agropastorales				
forets de prosopis	11.8	0%	710	1%
Rack bois (dense)	99.2	4%	2975	6%
Formations buisonnantes (claires)	176.9	6%	3538	7%
Mangroves	17.0	1%	850	2%
Cultures arborees denses	199.6	7%	7984	16%
(vergers, cafeieres)				
Cultures arborees et vergers clairs	453.1	16%	9062	18%
Reste de l'espace	1548.8	56%	10840	22%
(cultures herbacees, jacheres courtes, savanes, affleurements, etc...)				
TOTAL	2769.5	100%	49465	100%

VOLUMES SUR PIED EN 1988	Surfaces		Stock	
	(1000 ha)	(%)	(1000 m3)	(%)
Forets de feuillus				
denses	14	1%	2100	4%
degradees	50	2%	2500	5%
secondaires	80	3%	3200	6%
Forets de pin				
denses	8	0%	1200	2%
claires	20	1%	600	1%
tres claires	40	1%	520	1%
Formations agropastorales				
forets de prosopis	5	0%	250	1%
Rack bois (dense)	100	4%	2500	5%
Formations buisonnantes (claires)	185	7%	2405	5%
Mangroves	15	1%	525	1%
Cultures arborees denses	170	6%	5100	10%
(vergers, cafeieres)				
Cultures arborees et vergers clairs	400	14%	6400	13%
Reste de l'espace	1682	61%	10095	20%
(cultures herbacees, jacheres courtes, savanes, affleurements, etc...)				
TOTAL	2769	100%	37395	76%

Source B.D.P.A., 1989

IMPACT DE LA CONSOMMATION ENERGETIQUE DE BOIS DE FEU ET DE CHARBON DE BOIS SUR LA RESSOURCE FORESTIERE

Variante de base (a partir des donnees B.D.P.A., 1989)

HYPOTHESES :

A. Hypotheses sur l'offre

Stock de bois en 1978 :	34626	000 Tonnes
Croit moyen du bois :	8%	par an
Rythme annuel de plantation :	3	millions de pieds survivants
Croit annuel d'1 pied :	10	Kg/an

B. Hypotheses sur la demande

Croissance population rurale :	1.40%	
Consommation rurale de bois :	500	Kg/cap/an
Croissance population urbaine :	3.15%	
Consommation charbon en 1989 :	305	000 Tonnes
soit par capita :	0.52	Kg/cap/jour
Croissance consommation de charbon :	3.15%	

RESULTATS :

	1990	2000	2010	2020
Ressource forestiere : (Millions de tonnes)	29	11	-37	-151
Consommation de charbon (Milliers de tonnes)	315	429	585	798

IMPACT DE LA CONSOMMATION ENERGETIQUE DE BOIS DE FEU ET DE CHARBON DE BOIS SUR LA RESSOURCE FORESTIERE

Variante : ressource forestière de 1978 supérieure de 25 %

HYPOTHESES :

A. Hypothèses sur l'offre

Stock de bois en 1978 :	43283	000 Tonnes
Croît moyen du bois :	8%	par an
Rythme annuel de plantation :	3	millions de pieds survivants
Croît annuel d'1 pied :	10	Kg/an

B. Hypothèses sur la demande

Croissance population rurale :	1.40%	
Consommation rurale de bois :	500	Kg/cap/an
Croissance population urbaine :	3.15%	
Consommation charbon en 1989 :	305	000 Tonnes
soit par capita :	0.52	Kg/cap/jour
Croissance consommation de charbon	3.15%	

RESULTATS :

	1990	2000	2010	2020
Ressource forestière : (Millions de tonnes)	50	58	65	68
Consommation de charbon (Milliers de tonnes)	315	429	585	798

IMPACT DE LA CONSOMMATION ENERGETIQUE DE BOIS DE FEU ET DE CHARBON DE BOIS SUR LA RESSOURCE FORESTIERE

Variante : accélération du reboisement agroforestier

HYPOTHESES :

A. Hypothèses sur l'offre

Stock de bois en 1978 :	34626	000 Tonnes
Croît moyen du bois :	8%	par an
Rythme annuel de plantation :	23	millions de pieds survivants
Croît annuel d'1 pied :	10	Kg/an

B. Hypothèses sur la demande

Croissance population rurale :	1.40%	
Consommation rurale de bois :	500	Kg/cap/an
Croissance population urbaine :	3.15%	
Consommation charbon en 1989 :	305	000 Tonnes
soit par capita :	0.52	Kg/cap/jour
Croissance consommation de charbon	3.15%	

RESULTATS :

	1990	2000	2010	2020
Ressource forestière : (Millions de tonnes)	29	19	20	36
Consommation de charbon (Milliers de tonnes)	315	429	585	798

IMPACT DE LA CONSOMMATION ENERGETIQUE DE BOIS DE FEU ET DE CHARBON DE BOIS SUR LA RESSOURCE FORESTIERE

Variante : réduction de moitié de la consommation totale de charbon de bois en 2000

HYPOTHESES :

A. Hypothèses sur l'offre

Stock de bois en 1978 :	34626	000 Tonnes
Croît moyen du bois :	8%	par an
Rythme annuel de plantation :	3	millions de pieds survivants
Croît annuel d'1 pied :	10	Kg/an

B. Hypothèses sur la demande

Croissance population rurale :	1.40%	
Consommation rurale de bois :	500	Kg/cap/an
Croissance population urbaine :	3.15%	
Consommation charbon en 1989 :	305	000 Tonnes
soit par capita :	0.52	Kg/cap/jour
Croissance consommation de charbon	-6.50%	

RESULTATS :

	1990	2000	2010	2020
Ressource forestière : (Millions de tonnes)	29	19	7	-15
Consommation de charbon (Milliers de tonnes)	315	161	82	42

IMPACT DE LA CONSOMMATION ENERGETIQUE DE BOIS DE FEU ET DE CHARBON DE BOIS SUR LA RESSOURCE FORESTIERE

Variante : disparition du charbon de bois à Port-au-Prince en 2000

HYPOTHESES :

A. Hypothèses sur l'offre

Stock de bois en 1978 :	34626	000 Tonnes
Croît moyen du bois :	8%	par an
Rythme annuel de plantation :	3	millions de pieds survivants
Croît annuel d'1 pied :	10	Kg/an

B. Hypothèses sur la demande

Croissance population rurale :	1.40%	
Consommation rurale de bois :	500	Kg/cap/an
Croissance population urbaine :	3.15%	
Consommation charbon en 1989 :	305	000 Tonnes
soit par capita :	0.52	Kg/cap/jour
Croissance consommation de charbon	-15.00%	

RESULTATS :

	1990	2000	2010	2020
Ressource forestière : (Millions de tonnes)	29	23	23	24
Consommation de charbon (Milliers de tonnes)	315	62	12	2

Figure A1.1: Ressource Forestière et Consommation de Combustible
Analyse de Sensibilité

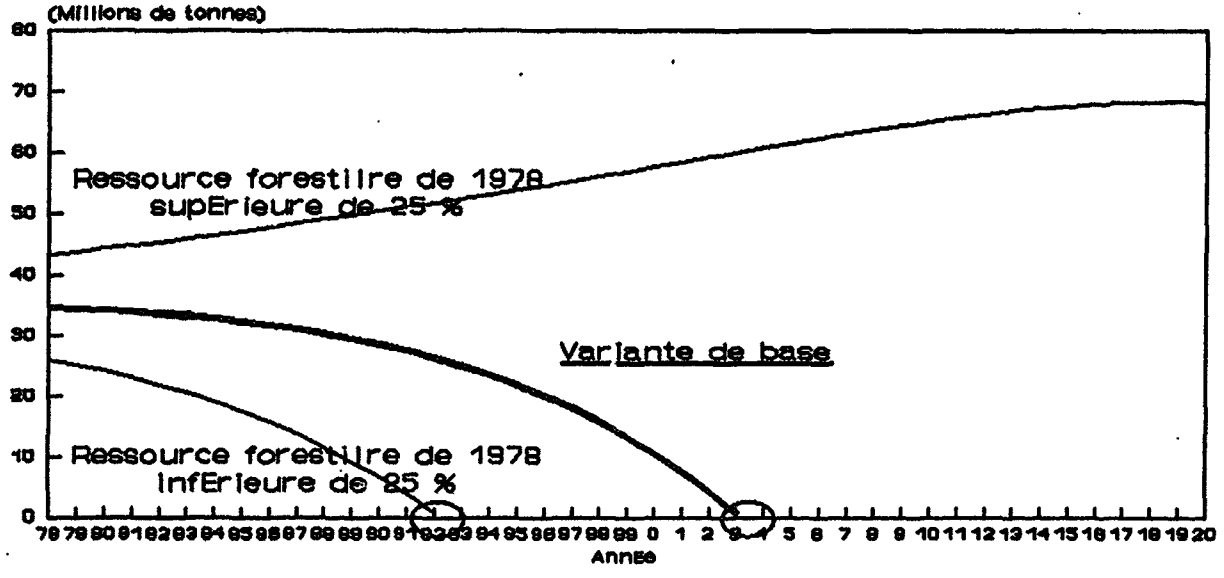


Figure A1.2: Ressource Forestière et Consommation de Combustible
La Solution Agroforestière

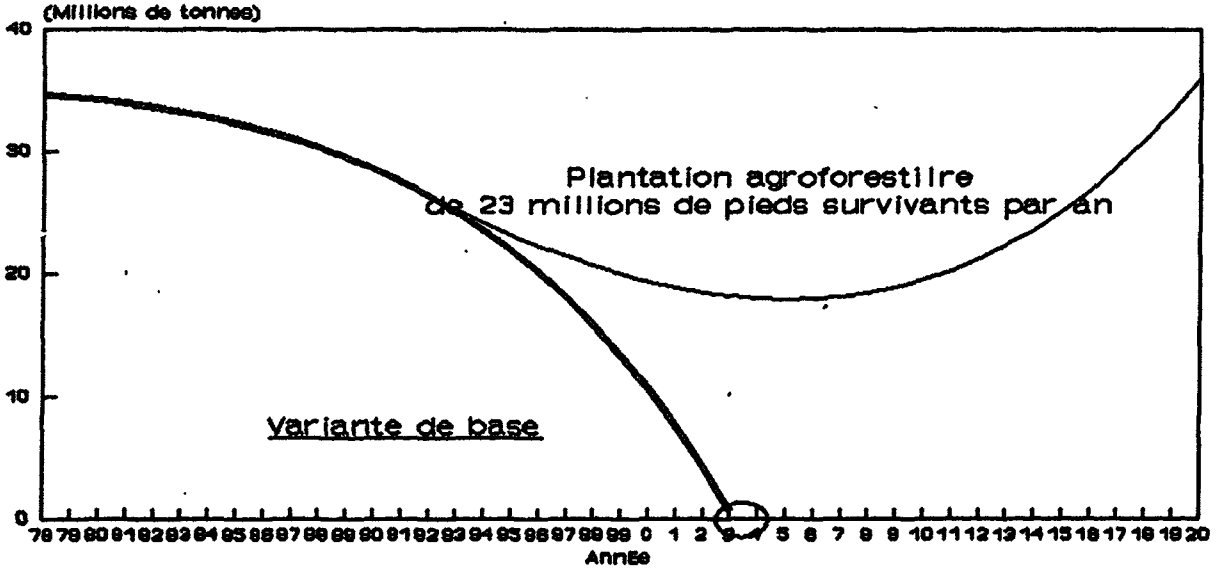


Figure A1.3: Ressource Forestière et Consommation de Combustible
Substitution: Scénario 1

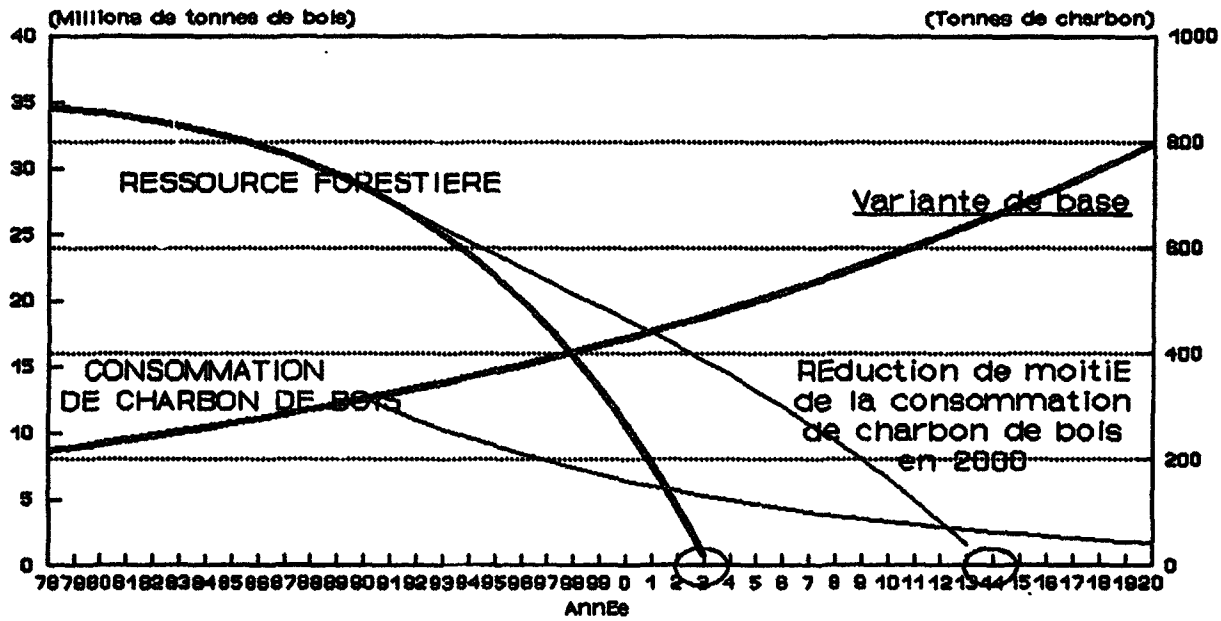
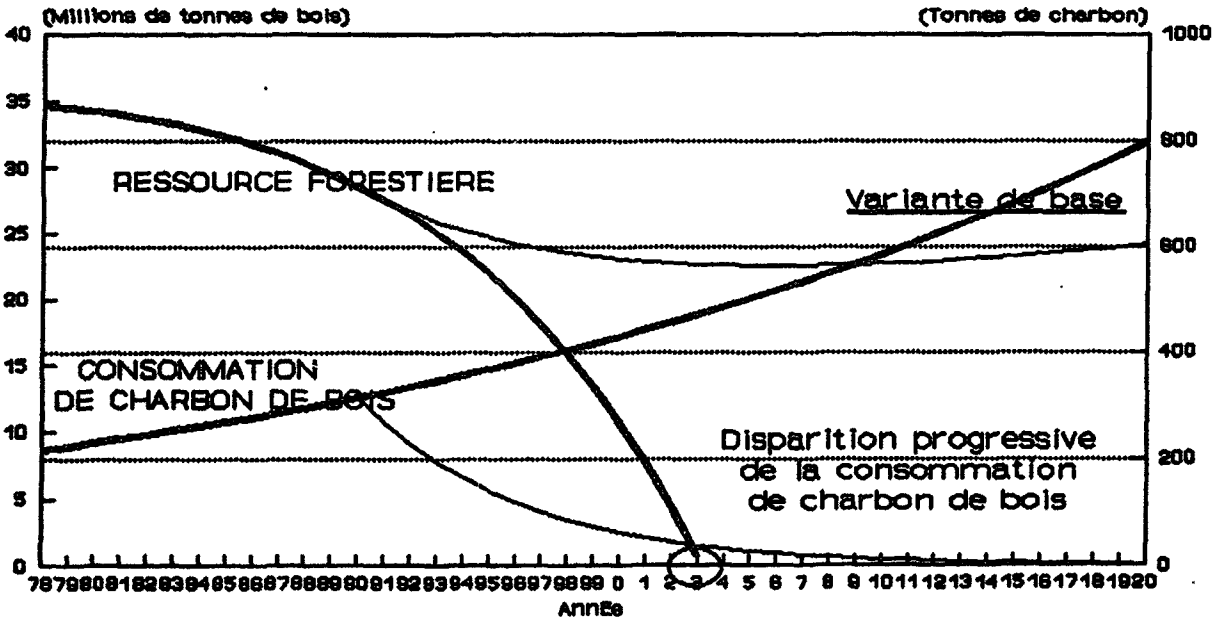


Figure A1.4: Ressource Forestière et Consommation de Combustible
Substitution: Scénario 2



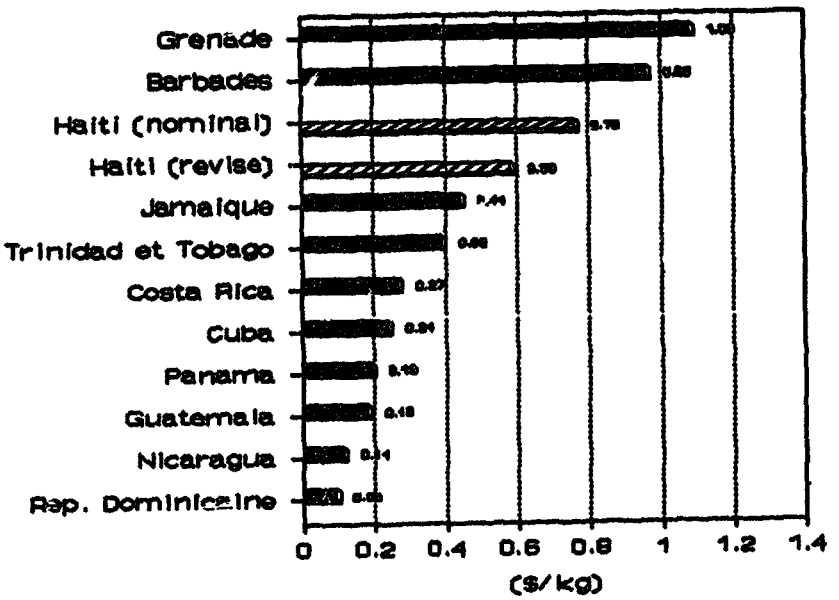
PRIX DE L'ENERGIE DANS LES CARAIBES ET EN AMERIQUE CENTRALE

PRIX DES COMBUSTIBLES DANS LES CARAIBES ET EN AMERIQUE CENTRALE

	L.P.G. ($/kg)	Kerosene ($/BBL)	Diesel ($/BBL)	Electricite domestique ($/kWh)
Barbades	0.96	43.7		16.0
Costa Rica	0.27	44.3	44.3	4.1
Cuba	0.24	13.4	10.4	9.0
Grenade	1.08	47.8	68.9	
Guatmala	0.18	36.7	35.0	5.0
Hati	0.76	55.9	64.7	16.8
Honduras		45.2	50.8	10.0
Jamaque	0.44	28.4	49.7	
Nicaragua	0.11	23.9	36.5	2.0
Panama	0.19	46.2	50.0	8.0
Rp. Dominicaine	0.09	18.2	16.5	4.7
Trinidad et Tobago	0.39	28.8	24.4	4.0

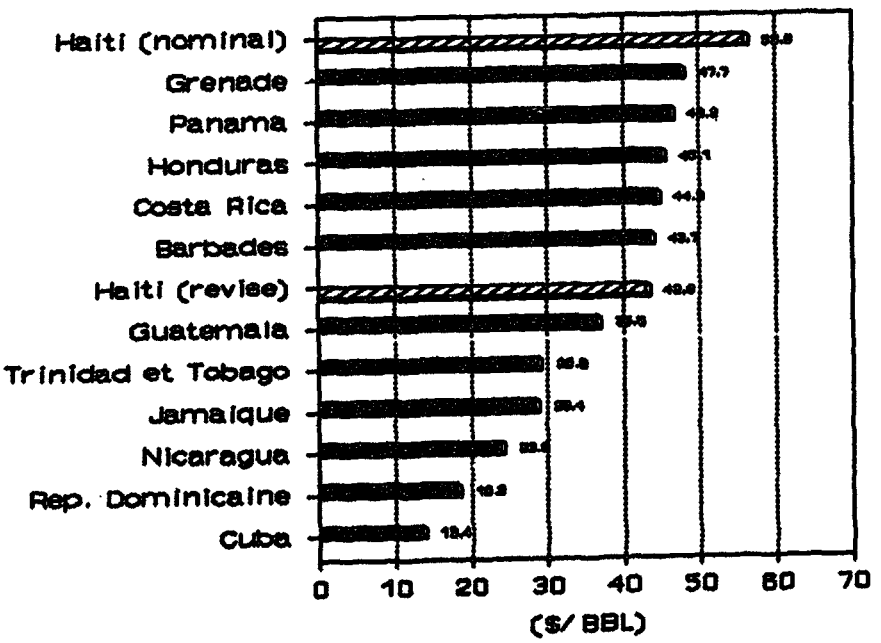
Source : OLADE, prix de Juin 1989

Figure A2.1: Prix du G.P.L. en Juin 1989



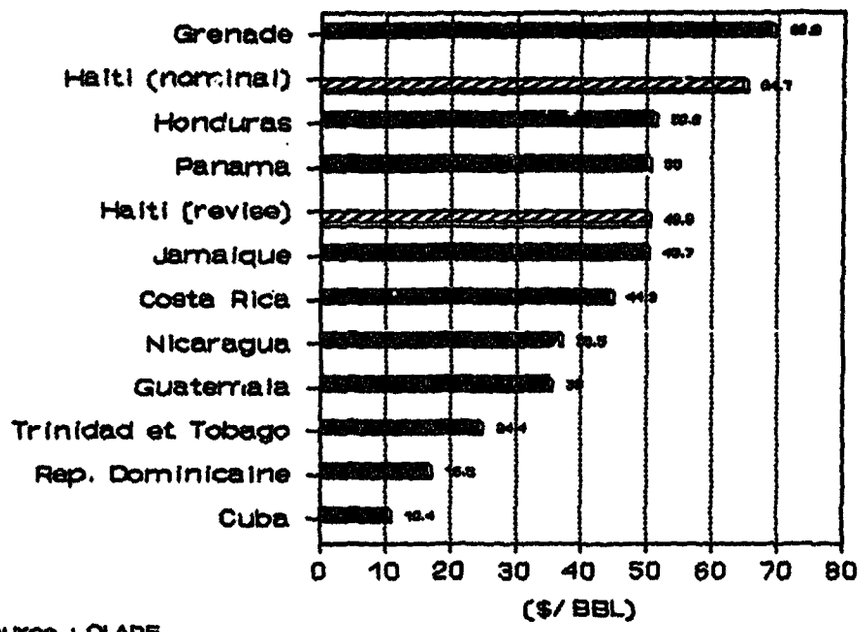
Source : OLADE
Haiti revise : prise en compte de la prime sur le Dollar

Figure A2.2: Prix du Kérosène en Juin 1989



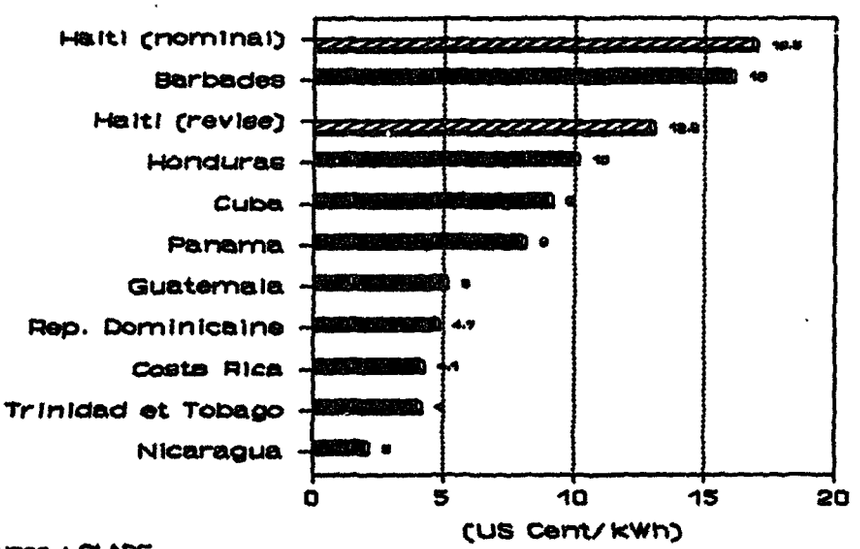
Source : OLADE
Haiti revise : prise en compte de la prime sur le Dollar

Figure A2.3: Prix du Diesel en juin 1989



Source : OLADE
Haiti revise : prise en compte de la prime sur le Dollar

Figure A2.4: Prix de l'Electricité Domestique en juin 1989



Source : OLADE
Haiti revise : prise en compte de la prime sur le Dollar

PRIX MOYENS DES COMBUSTIBLES ET DES RECHAUDS A HAITI ET EN REPUBLIQUE DOMINICAINE

	Hati		Rp. Dominicaine		
	(Gourde)	(US$)	(Peso)	(US$)	
Combustibles (prix de detail au kilo)					
Charbon de bois	1.05	0.15	2.00	0.31	
Kerosene	2.40	0.34	0.69	0.11	
Gaz propane	3.66	0.52	0.63	0.10	
Gaz butane	5.45	0.78			
Rechauds traditionnels a charbon					
Rechaud rond ou carre	9	1.3	8.5	1.3	
Rechaud type potaje	80	11.4	65	10.2	
Rechauds ameliores a charbon					
Rechaud B.M.E.	35	5.0	*Prix normal au producteur*		
Rechaud A.F.V.P.	20	2.9	*Prix au producteur*		
Rechauds a kerosene					
1 feu	100	14	185	29	
2 feux	155	22	240	38	
3 feux	300	43	400	63	
Rechauds a propane					
2 feux	300	43	215	34	(1)
3 feux	425	61	250	39	(1)
4 feux + four	1500	214	1200	189	(1) (2)
Bombonne vide de 25 kg			500	79	
Bombonne vide de 50 kg	1100	157			(3)
Rechauds a butane					
Bip 1 feu	186	27			

NOTES :

Haiti : 1 US$ = 7 Gourdes prix mars 1990

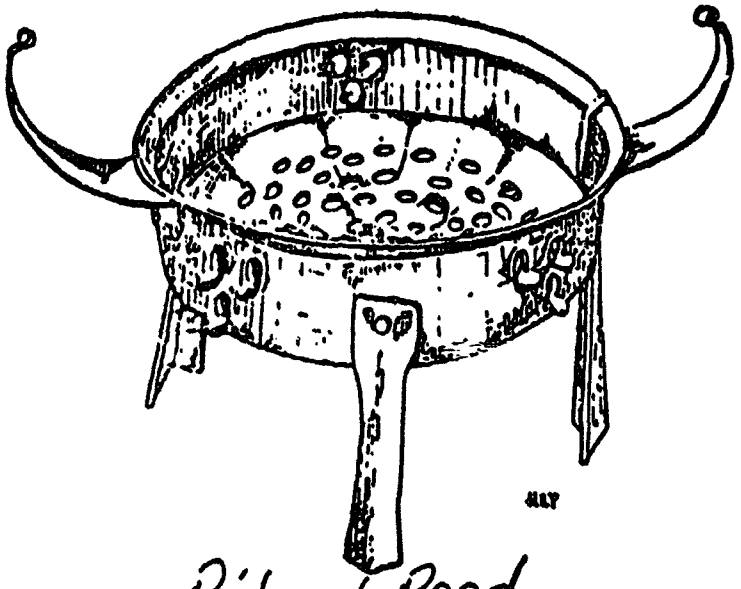
Republique Dominicaine : 1 US$ = 6.35 Pesos prix mars 1989

(1) Bombonne non comprise

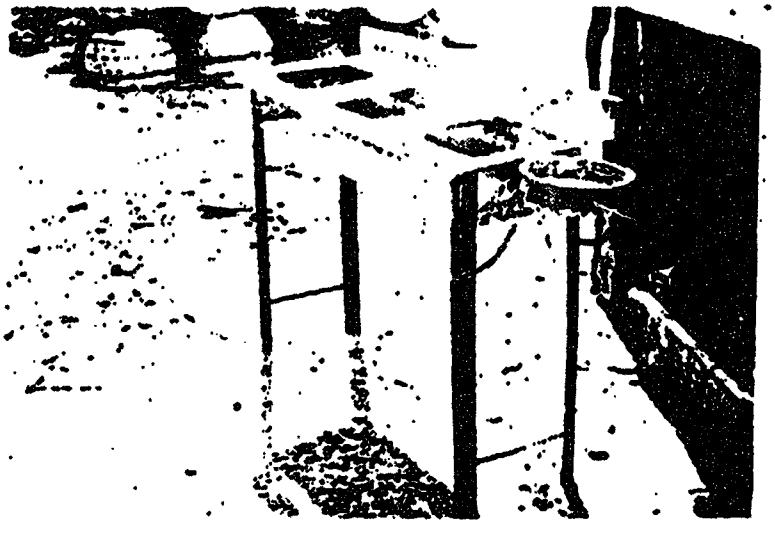
(2) Prix minimum

(3) Installation comprise

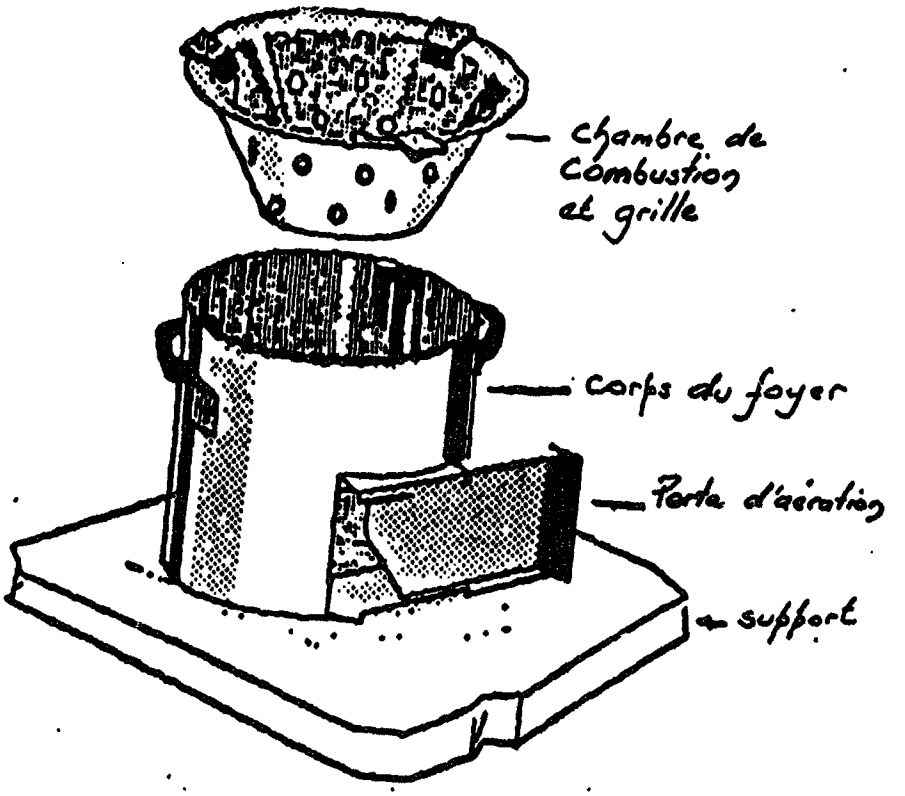
FOYERS EN USAGE A HAITI



Réchaud Rond
(haitien)
à charbon

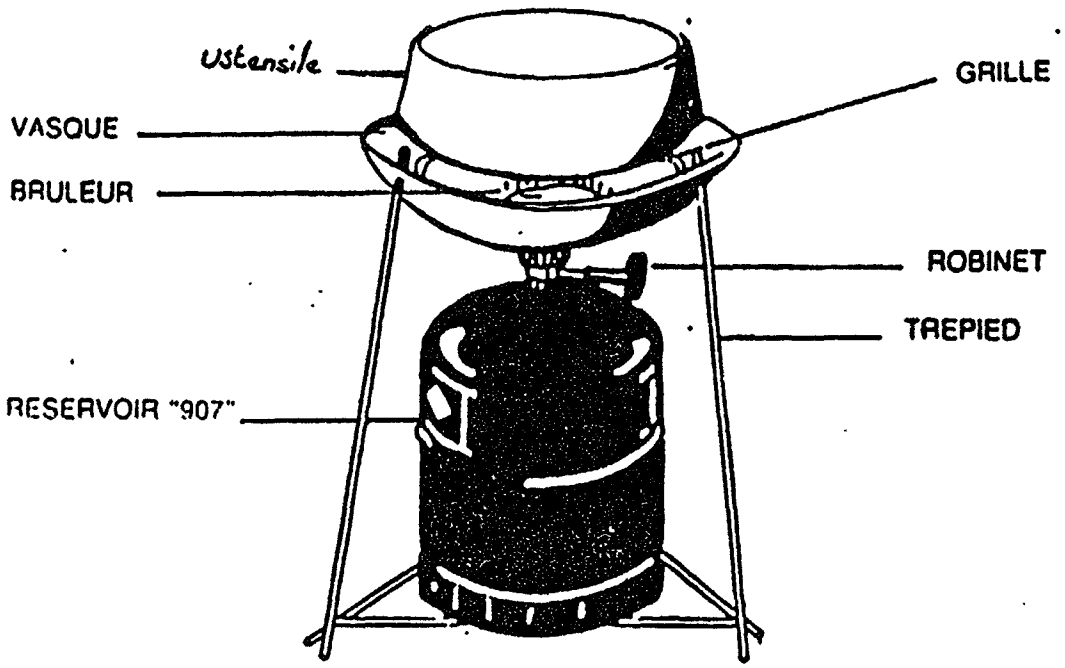


Réchaud "Potajé"

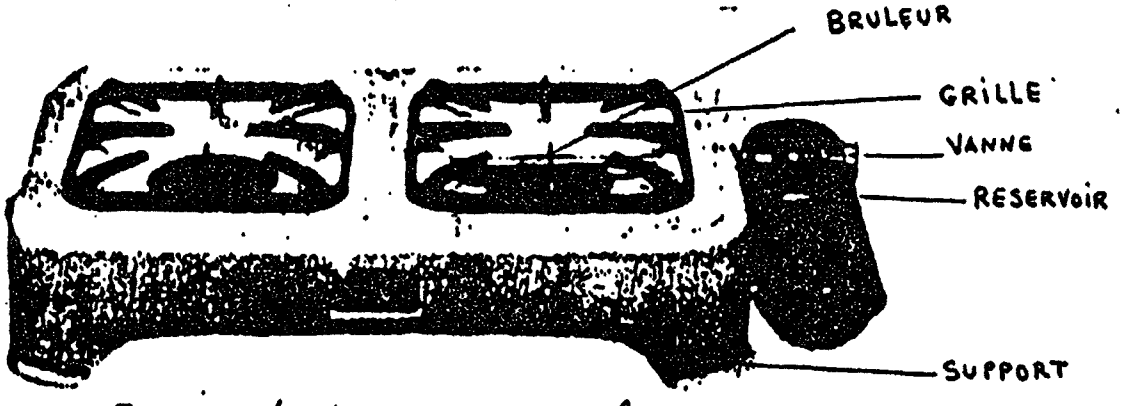


Foyer amélioré haïtien à charbon

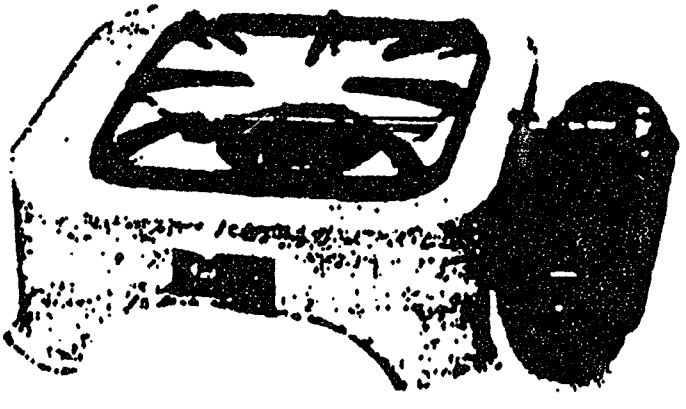
Réchaud Haïti. Métal
avec deux feux
(Kérosène à mèches)



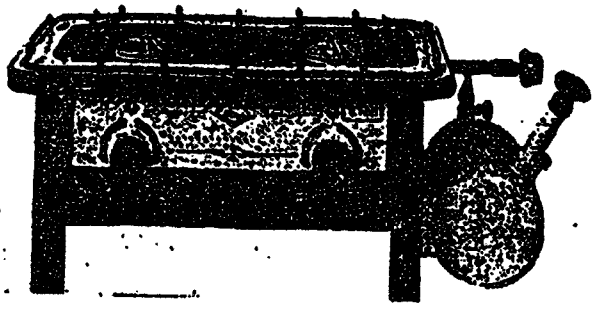
BIP (Tichéri)
Réchaud à butane



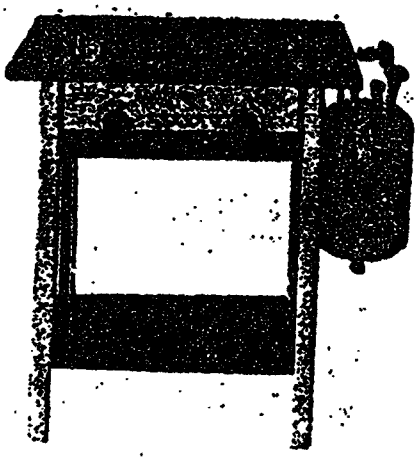
Foyer colombien avec deux feux
(Kérosène sous pression)



Foyer colombien avec un feu
(Kérosène sous pression)



Foyer péruvien à 1 feu
(Kérosène à pression)



Foyer péruvien à 2 feux
(Kérosène à pression)

Annexe IV

ENTREES DE CHARBON DE BOIS A PORT-AU-PRINCE

PROVENANCE DU CHARBON DE BOIS CONSOMME A PORT-AU-PRINCE

A. COMPTAGE ENTREE EN VILLE (UNE SEMAINE, FEVRIER 1990 x 52)

	Mode de transport					
	Route	%	Mer	%	Total	%
Departement						
Nord	5280	8%	0	0%	5280	6%
Nord-Ouest	8402	13%	5140	29%	13542	16%
Artibonite	16426	25%	0	0%	16426	19%
Centre	2278	3%	0	0%	2278	3%
Ouest	16992	26%	28	0%	17019	20%
La Gonave	2247	3%	3893	22%	6139	7%
Grande-Anse	7969	12%	8817	49%	16786	20%
Sud	2300	3%	0	0%	2300	3%
Sud-Est	3369	5%	32	0%	3401	4%
Non identifie	1077	2%	0	0%	1077	1%
TOTAL	66340	100%	17908	100%	84249	100%
%	79%		21%		100%	

B. CONTROLE SERVICES FORESTIERS (PREMIER TRIMESTRE 1989 x 4)

	Mode de transport					
	Route	%	Mer	%	Total	%
Departement						
Nord	536	4%	0	0%	536	2%
Nord-Ouest	931	7%	4737	51%	5668	26%
Artibonite	3465	28%	109	1%	3574	16%
Centre	4284	34%	0	0%	4284	20%
Ouest	0	0%	3850	42%	3850	18%
La Gonave	0	0%	147	2%	147	1%
Grande-Anse	3173	25%	423	5%	3595	17%
Sud	0	0%	0	0%	0	0%
Sud-Est	61	0%	0	0%	61	0%
Non identifie	0	0%	0	0%	0	0%
TOTAL	12449	100%	9265	100%	21714	100%
%	57%		43%		100%	

C. REDRESSEMENT DU COMPTAGE DES ENTREES

	Mode de transport					
	Route	%	Mer	%	Total	%
Departement						
Nord	5280	7%	0	0%	5280	4%
Nord-Ouest	8402	10%	18948	40%	27350	21%
Artibonite	16426	20%	0	0%	16426	13%
Centre	17135	21%	0	0%	17135	13%
Ouest	16992	21%	15399	33%	32391	25%
La Gonave	2247	3%	3893	8%	6139	5%
Grande-Anse	7969	10%	8817	19%	16786	13%
Sud	2300	3%	0	0%	2300	2%
Sud-Est	3369	4%	32	0%	3401	3%
Non identifie	1077	1%	0	0%	1077	1%
TOTAL	81197	100%	47089	100%	128286	100%
%	63%		37%		100%	

STRUCTURES DE PRIX DU GAZ ET DU KEROSENE

COMPARAISON DES STRUCTURES DE PRIX DU KEROSENE ET DU GAZ

Prix au détail

	Kerosene Avril 1990		Butane Avril 1990		Propane Avril 1990	
	(Cents/Gal)	%	(Cents/Gal)	%	(Cents/Gal)	%
Prix F.O.B.	58.0	*39%*	34.0	*15%*	29.0	*19%*
Transport	2.2	*1%*	28.8	*13%*	29.7	*20%*
Droit consulaire	1.7	*1%*	1.0	*0%*	0.9	*1%*
Prix C.I.F.	61.9	*42%*	63.8	*29%*	59.6	*40%*
Droits de wharfage	0.9	*1%*	0.7	*0%*	0.6	*0%*
Droits de douane	0.0	*0%*	0.0	*0%*	0.0	*0%*
Droits d'accises	50.0	*34%*	0.0	*0%*	5.0	*3%*
Prix ex-douane	112.9	*76%*	64.5	*29%*	65.2	*43%*
Marge des compagnies	29.1	*20%*	105.1	*47%*	78.8	*53%*
Marge des distributeurs	7.0	*5%*	54.0	*24%*	6.0	*4%*
Prix à la Pompe	149.0	*100%*	223.6	*100%*	150	*100%*
Total marges	36.1	*24%*	159.1	*71%*	84.8	*57%*

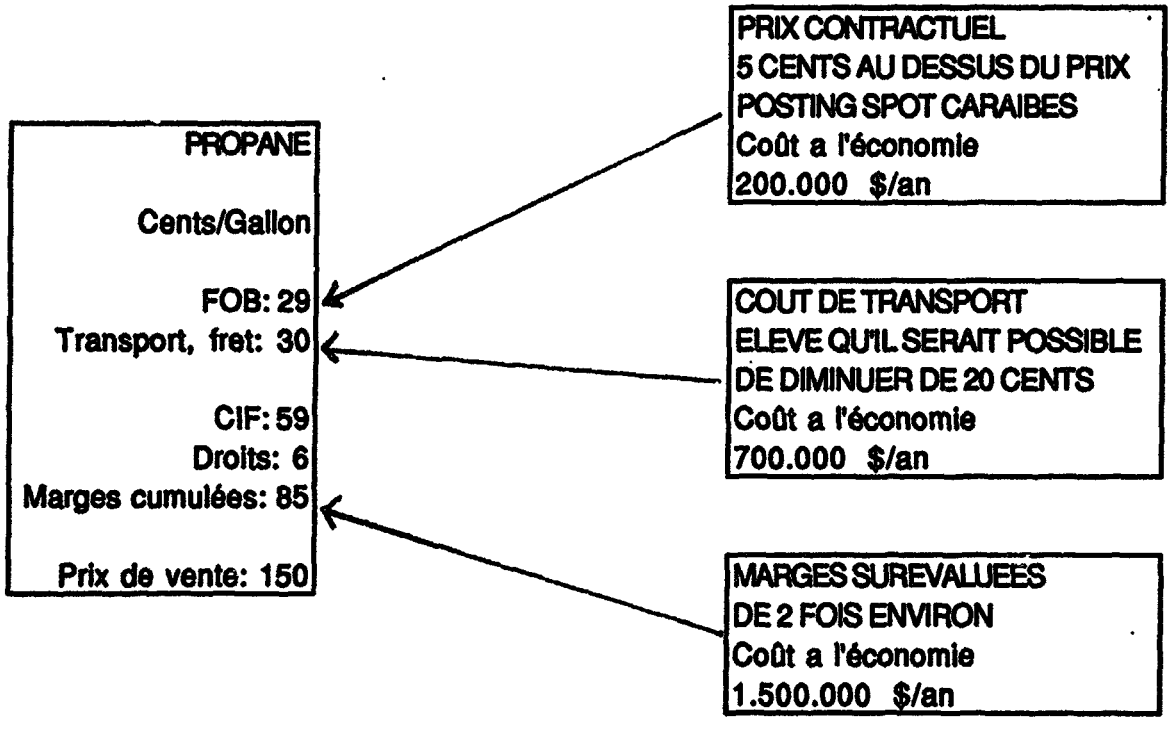
Prix de l'énergie utile

	Kerosene Avril 1990		Butane Avril 1990		Propane Avril 1990	
	($/GJ)	%	($/GJ)	%	($/GJ)	%
Prix F.O.B.	10.8	*39%*	7.2	*15%*	5.1	*19%*
Transport	0.4	*1%*	6.1	*13%*	5.3	*20%*
Droit consulaire	0.3	*1%*	0.2	*0%*	0.2	*1%*
Prix C.I.F.	11.5	*42%*	13.6	*29%*	10.6	*40%*
Droits de wharfage	0.2	*1%*	0.1	*0%*	0.1	*0%*
Droits de douane	0.0	*0%*	0.0	*0%*	0.0	*0%*
Droits d'accises	9.3	*34%*	0.0	*0%*	0.9	*3%*
Prix ex-douane	20.9	*76%*	13.7	*29%*	11.5	*43%*
Marge des compagnies	5.4	*20%*	22.3	*47%*	14.0	*53%*
Marge des distributeurs	1.3	*5%*	11.5	*24%*	1.1	*4%*
Prix à la Pompe	27.6	*100%*	47.5	*100%*	26.6	*100%*
Total marges	6.7	*24%*	33.8	*71%*	15.0	*57%*

Source : G.A.P.P. (Kérosène, Propane), Shell (Butane)

LA FACTURE DU GAZ

Possibilités de réduction maximum des coûts
2.400.000 $/an



COMPARAISON DES STRUCTURES DE PRIX DU KEROSENE ET DU GAZ (PRIX DU G.P.L. REVISES)

Prix au detail

	Kerosene Avril 1990		Butane Avril 1990		Propane Avril 1990	
	(Cents/Gal)	%	(Cents/Gal)	%	(Cents/Gal)	%
Prix F.O.B.	58.0	39%	34.0	56%	29.0	48%
Transport	2.2	1%	10.0	16%	10.0	17%
Droit consulaire	1.7	1%	1.0	2%	0.9	1%
Prix C.I.F.	61.9	42%	45.0	74%	39.9	66%
Droits de wharfage	0.9	1%	0.7	1%	0.6	1%
Droits de douane	0.0	0%	0.0	0%	0.0	0%
Droits d'accises	50.0	34%	0.0	0%	5.0	8%
Prix ex-douane	112.9	76%	45.7	75%	45.4	75%
Marge des compagnies	29.1	20%	12.2	20%	12.1	20%
Marge des distributeurs	7.0	5%	3.0	5%	3.0	5%
Prix la Pompe	149.0	100%	60.9	100%	60.6	100%
Total marges	36.1	24%	15.2	25%	15.1	25%

Prix de l'energie utile

	Kerosene Avril 1990		Butane Avril 1990		Propane Avril 1990	
	($/GJ)	%	($/GJ)	%	($/GJ)	
Prix F.O.B.	10.8	39%	7.2	56%	5.1	48%
Transport	0.4	1%	2.1	16%	1.8	17%
Droit consulaire	0.3	1%	0.2	2%	0.2	1%
Prix C.I.F.	11.5	42%	9.6	74%	7.1	66%
Droits de wharfage	0.2	1%	0.1	1%	0.1	1%
Droits de douane	0.0	0%	0.0	0%	0.0	0%
Droits d'accises	9.3	34%	0.0	0%	0.9	8%
Prix ex-douane	20.9	76%	9.7	75%	8.0	75%
Marge des compagnies	5.4	20%	2.6	20%	2.1	20%
Marge des distributeurs	1.3	5%	0.6	5%	0.5	5%
Prix la Pompe	27.6	100%	13.0	100%	10.7	100%
Total marges	6.7	24%	3.2	25%	2.7	25%

Structure Regionale des Prix du Charbon de Bois
En Gourdes par sac

Region	Nombre Enquetes	Prix au producteur/ collecteur	Cout de Transport	Marges des intermed./ autres	Prix d'achat grossiste
Nord-Ouest	19	13.6	10.3	6.4	30.3
Sud-Ouest	22	15.2	7.0	6.1	28.3
Ouest	26	16.9	7.3	5.6	29.8
Arbonite/Centre	7	14.7	5.4	4.9	25.4
Sud	3	10.0	6.1	8.9	25.0
Nord/Nord-Est	6	10.7	5.4	8.9	25.0
Sud-Est	2	16.5	4.5	5.0	26.0
Rep. Dominicaine	3	10.8	8.8	2.0	25.0

Notes:

(a) Le cout de transport inclut le cout de chargement, dechargement et la taxe

(b) Enquete realisee pendant la saison seche

(c) Cout transport par bateau: 4.5-5.5 Gourdes par sac

(d) Cout transport par vehicule: 7-10 Gourdes par sac

Source: Enquete ESMAP/BME/OLADE/PNUD de 90 transporteurs, Avril 1990.

COUTS FINANCIERS ET ECONOMIQUES DE CUISSON

COUTS FINANCIERS COMPARES DE CUISSON, PORT-AU-PRINCE, 1990

A. CUISINE AU CHARBON DE BOIS

Foyer		Rond tradition	Rond amelioré	Potaje tradition	Potaje amelioré
Unit d'achat		Sac	Sac	Sac	Sac
Combustible					
Prix de detail	$	8.0	8.0	8.0	8.0
Poids	kg	38.0	38.0	38.0	38.0
Prix de detail	$/kg	0.21	0.21	0.21	0.21
Valeur calorifique	MJ/kg	29.0	29.0	29.0	29.0
Cout energie finale	$/GJ	7.3	7.3	7.3	7.3
Efficacite foyer	%	21%	27%	21%	27%
Cout energie utile	$/GJ	34.6	26.9	34.6	26.9
Equipement					
Prix d'achat	$	2	4	16	20
Duree de vie	an	1	1	1	1
Amortissement	$/an	2.1	4.3	17.1	21.4
Energie finale	MJ/an	4500	4500	4500	4500
Cout equipement	$/GJ	0.5	1.0	3.8	4.8
Total					
Cout total de cuisson	$/GJ	35.0	27.8	38.4	31.6

NOTES :
Titre en grise, cas existant, sinon alternatives possibles.
Prix en $ haitien (a 5 Gourdes)

COUTS FINANCIERS COMPARES DE CUISSON, PORT-AU-PRINCE, 1990

B. CUISINE AU KEROSENE

Foyer		Rechaud meches	Rechaud meches	Rechaud pression	Rechaud pression
Unit d'achat		Gallon	Bouteille	Gallon	Bouteille
Combustible					
Prix de detail	$	1.5	0.4	1.5	0.4
Poids	kg	3.1	0.6	3.1	0.6
Prix de detail	$/kg	0.48	0.65	0.48	0.65
Valeur calorifique	MJ/kg	43.5	43.5	43.5	43.5
Cout energie finale	$/GJ	11.0	15.0	11.0	15.0
Efficacite foyer	%	35%	35%	45%	45%
Cout energie utile	$/GJ	31.6	42.7	24.6	33.2
Equipement					
Prix d'achat	$	31	31	50	50
Duree de vie	an	5	5	5	5
Amortissement	$/an	15.1	15.1	14.6	14.6
Energie finale	MJ/an	4500	4500	4500	4500
Cout equipement	$/GJ	3.3	3.3	3.3	3.3
Total					
Cout total de cuisson	$/GJ	34.9	46.1	27.8	36.5

NOTES :
Titre en grise, cas existant, sinon alternatives possibles.
Prix en $ haitien (a 5 Gourdes)
Achat en "moyen detail" : bouteille a rhum de 2 gourdes
Prix d'achat minimum d'un foyer 2 feux
L'amortissement des rechauds a kerosene comprend 20 %
pour la maintenance et les pieces detachees
On compte en plus 6 $ par an de meches pour les rechauds a meches

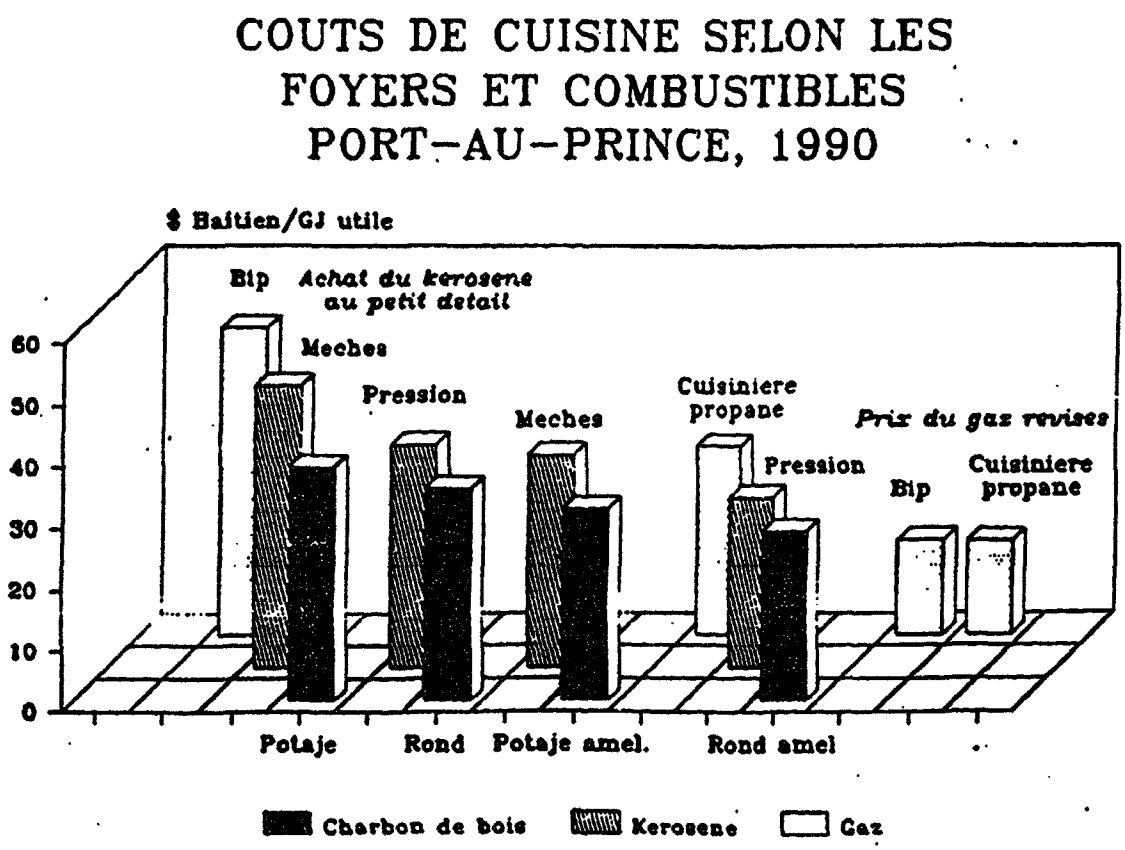
COUTS FINANCIERS COMPARES DE CUISSON, PORT-AU-PRINCE, 1990

C. CUISINE AU GAZ

Foyer		Cuisiniere	Cuisiniere	Rechaud Bip	Rechaud Bip
Combustible		Propane	Propane	Butane	Butane
Unit d'achat		Bombonne	Bombonne	Bombonne	Bombonne
Prix		Actuels	Revises	Actuels	Rviss
Combustible					
Prix de detail	$	9.0	9.0	3.0	3.0
Poids	kg	12.50	12.50	2.75	2.75
Prix de dtail	$/kg	0.72	0.30	1.09	0.30
Valeur calorifique	MJ/kg	45.7	45.7	45.7	45.7
Cout energie finale	$/GJ	15.8	6.5	23.9	6.5
Efficacite foyer	%	60%	60%	50%	50%
Cout energie utile	$/GJ	26.3	10.8	47.7	13.0
Equipement					
Prix d'achat	$	120	120	37	37
Duree de vie	an	10	10	5	5
Amortissement	$/an	20.5	20.5	10.8	10.8
Energie finale	MJ/an	4500	4500	4500	4500
Cout equipement	$/GJ	4.6	4.6	2.4	2.4
Total					
Cout total de cuisson	$/GJ	30.8	15.3	50.1	15.4

NOTES :
Titre en grise, cas existant, sinon alternatives possibles.
Prix en $ haitien (a 5 Gourdes)
On compte 60 $ pour l'achat de la bonbonne. Le prix du rechaud a propane (2 feux a 60 $) est un des moins cher rencontres en Haiti.
L'amortissement des rechauds a gaz comprend 20 % pour la maintenance et les pieces detachees

Figure A6.1: Coûts de Cuisine selon les Foyers et Combustibles
Port-au-Prince, 1990



COUT ECONOMIQUE ACTUEL DES COMBUSTIBLES

	Charbon Financier $ Haitien /sac	Econom. US$ /sac
Bois	0.7	0.5
Fabrication, commerce	7.1	5.0
Taxe	0.2	0.0
Cout	8.0	5.6

	Kerosene		Butane		Propane	
	Financier H Cent /Gallon	Econom. US Cent /Gallon	Financier H Cent /Gallon	Econom. US Cent /Gallon	Financier H Cent /Gallon	Econom. US Cent /Gallon
Prix C.I.F.	61.9	61.9	63.8	63.8	59.6	59.6
Droits de wharfage	0.9	0.6	0.7	0.5	0.6	0.4
Taxes	50.0	0.0	0.0	0.0	5.0	0.0
Marge des compagnies	29.1	26.2	105.1	94.6	78.8	70.9
Marge des distributeurs	7.0	4.9	54.0	37.8	6.0	4.2
Cout	149.0	93.7	223.6	196.7	150.0	135.1
Marge petit detail	52.8	36.9				
Cout petit detail	201.8	130.6				

NOTES :
Couts financiers exprimes en $ et cents haitiens (1 pour 5 gourdes)
Couts economiques :
Revenus locaux (bois, fabrication et commerce du charbon,
marges detail sur les produits petroliers) : deflateur 0,7
Marges des compagnies petrolieres : deflateur 0,9

COUT ECONOMIQUE THEORIQUE DES COMBUSTIBLES

	Charbon	
	Financier	Econom.
	$ Haitien /sac	US$ /sac
Bois	2.2	1.5
Fabrication, commerce	7.1	5.0
Taxe	0.2	0.0
Cout	9.5	6.7

	Kerosene		Butane		Propane	
	Financier	Econom.	Financier	Econom.	Financier	Econom.
	H Cent /Gallon	US Cent /Gallon	H Cent /Gallon	US Cent /Gallon	H Cent /Gallon	US Cent /Gallon
Prix C.I.F.	61.9	61.9	45.0	45.0	39.9	39.9
Droits de wharfage	0.9	0.6	0.7	0.5	0.6	0.4
Taxes	50.0	0.0	0.0	0.0	5.0	0.0
Marge des compagnies	29.1	26.2	12.2	11.0	12.1	10.9
Marge des distributeurs	7.0	4.9	3.0	2.1	3.0	2.1
Cout	149.0	93.7	60.9	58.5	60.6	53.3
Marge petit detail	52.8	36.9				
Cout petit detail	201.8	130.6				

NOTES :
Memes hypotheses que pour le cout economique actuel
Cout economique du bois fonde sur l'estimation F.A.O. de 7.7 US$/tonne pour une plantation energetique
Transport et marges revisees sur le gaz

Figure A6.2: Coût Economique Actuel Selon les Foyers et Combustibles Port-au-Prince, 1990

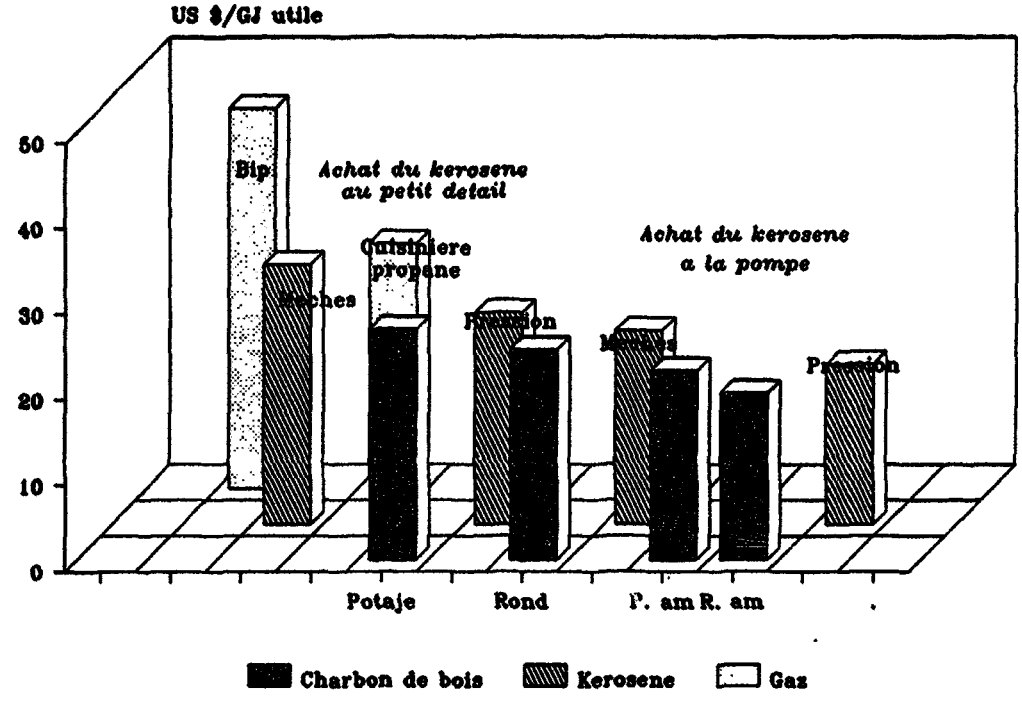
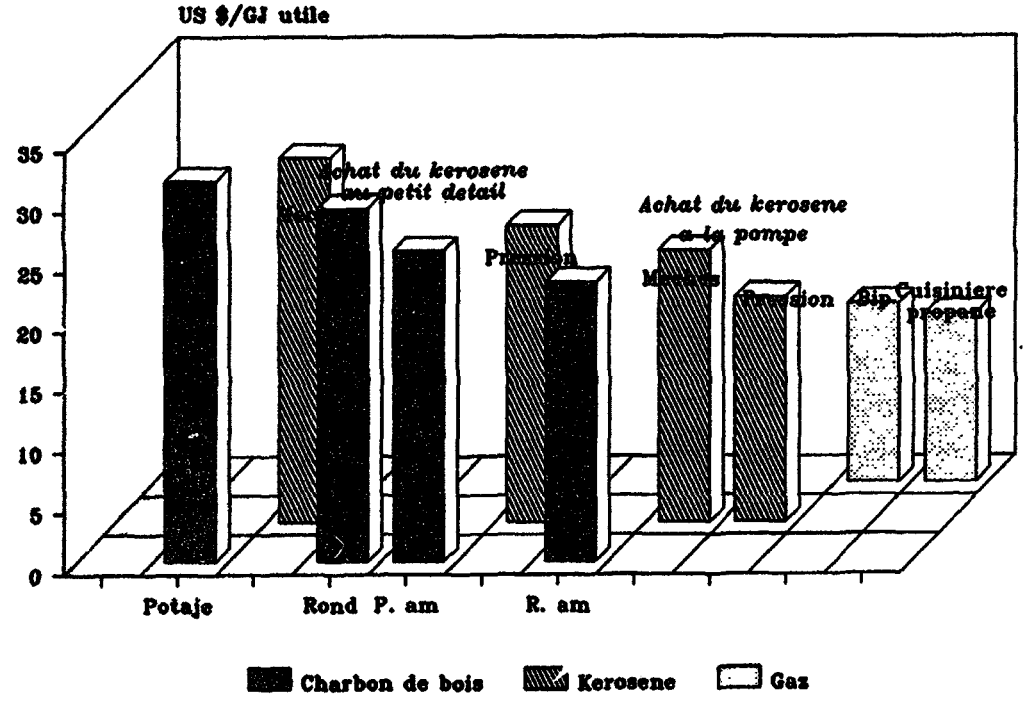


Figure A6.3: Coût Economique Théorique Selon les Foyers et Combustibles Port-au-Prince, 1990



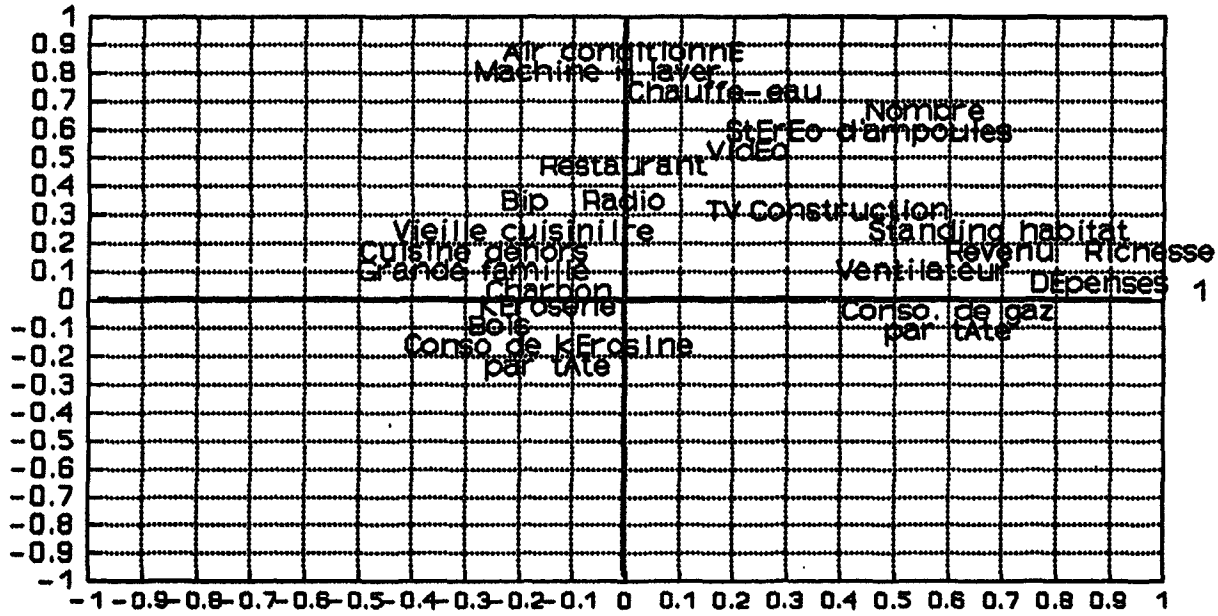
HOUSEHOLD SURVEY FACTOR ANALYSIS - MAIN AXES

The factor analysis allows to identify the main factors that explain the behavior of surveyed households. These factors can be materialized through the main axes along the area of points that correspond to these households on the graph.

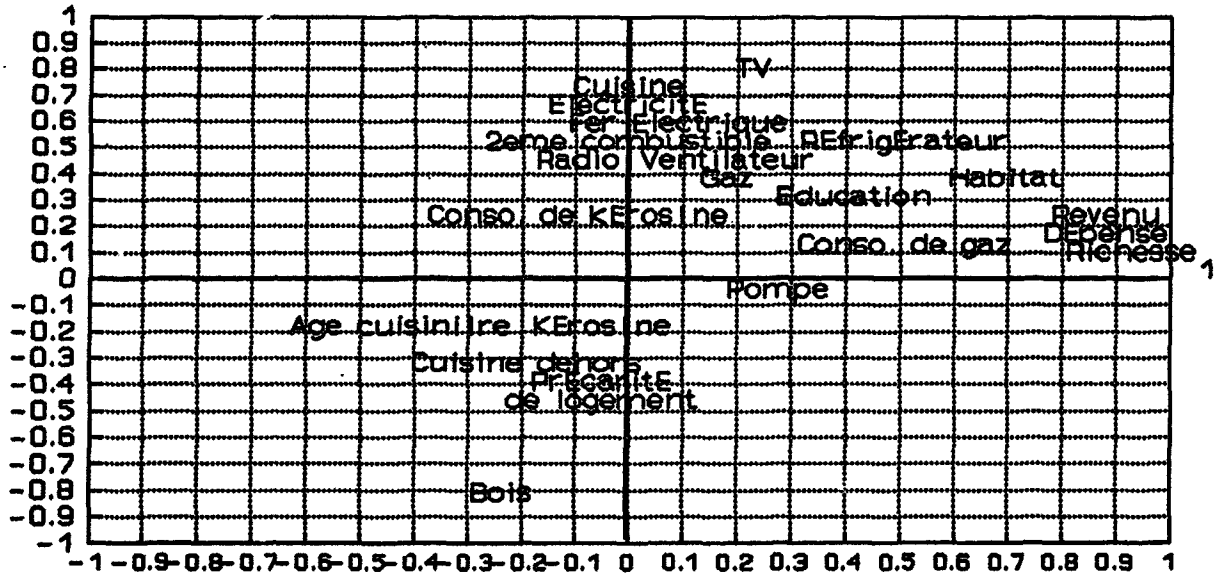
These factors could be explained by decreasing order of importance:

- **Axis 1:** Main factor of household behavious; this factor is linked to household income, mainly through household expenditure capability.
- **Axis 2:** This factor is related to investment capacity and assets of households.
- **Axis 3:** This factor opposes tradition (large families, tradional housing) to modernisation.
- **Axis 4:** This factor is related to household size mainly.
- **Axis 5:** This factor opposes the household retirement on the family nucleus and the opening towards external urban life.
- **Axis 6, 7 and 8:** These factors have little significance. It is only worth mentioning that they are related to the use of specific fuels: Charcoal (axis 6); gas (axis 7); Kerosene (axis 8).

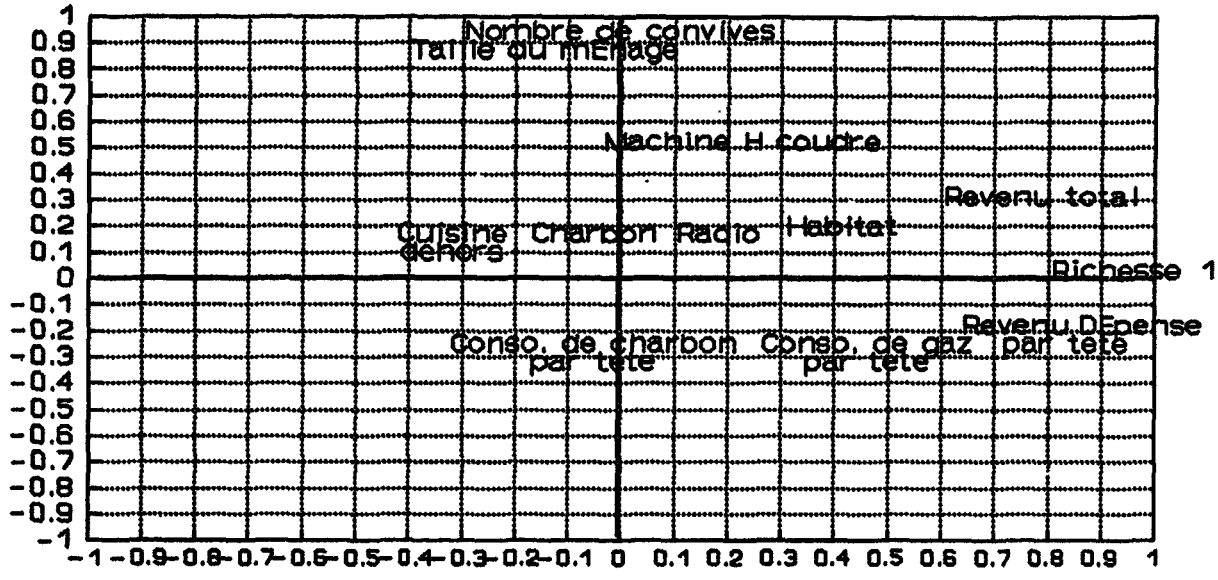
2


Air conditionné
Machine à laver
Chauffe-eau
Nombre d'ampoules
StErEo
Vidéo
Restaurant
Bip
Radio
TV
construction
Standing habitat
Vieille cuisinière
Cuisine dehors
Revenu
Richesse
Grande famille
Ventilateur
Dépenses
Charbon
Kérosène
Conso. de gaz par tête
Bois
Conso de kErosine par tête

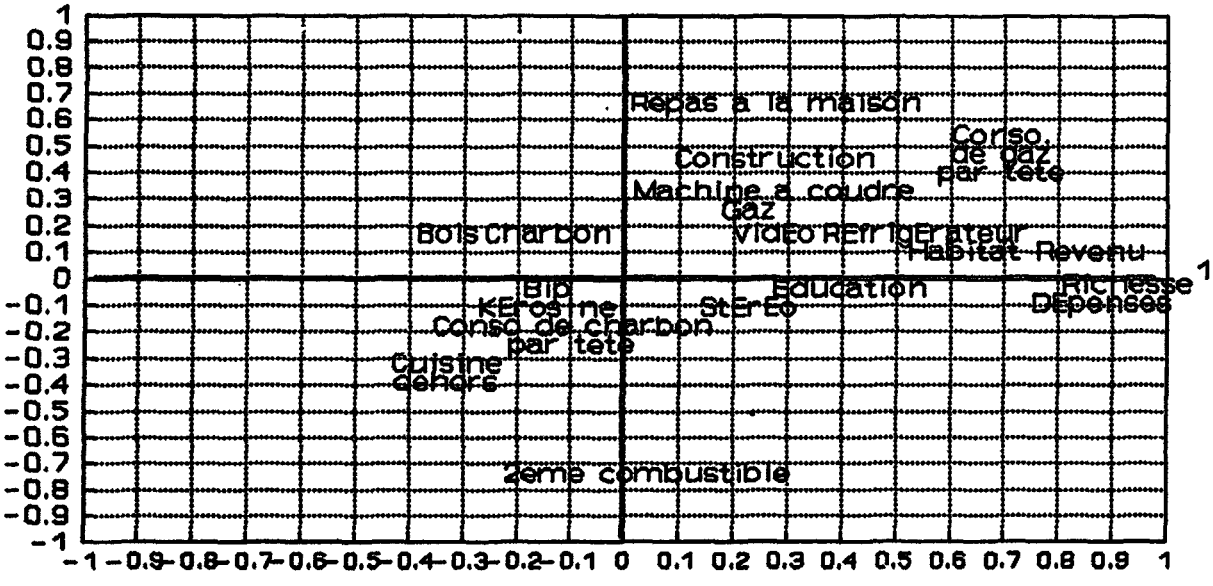
3


TV
Cuisine Electricité
fer Electrique
2eme combustible
RÉfrigÉrateur
Radio
Ventilateur
Gaz
Education
Habitat
Conso. de kErosine
Revenu
Dépense
Conso. de gaz
Richesse
Pompe
Age cuisinière
KErosine
Cuisine dehors
Précarité de logement
Bois

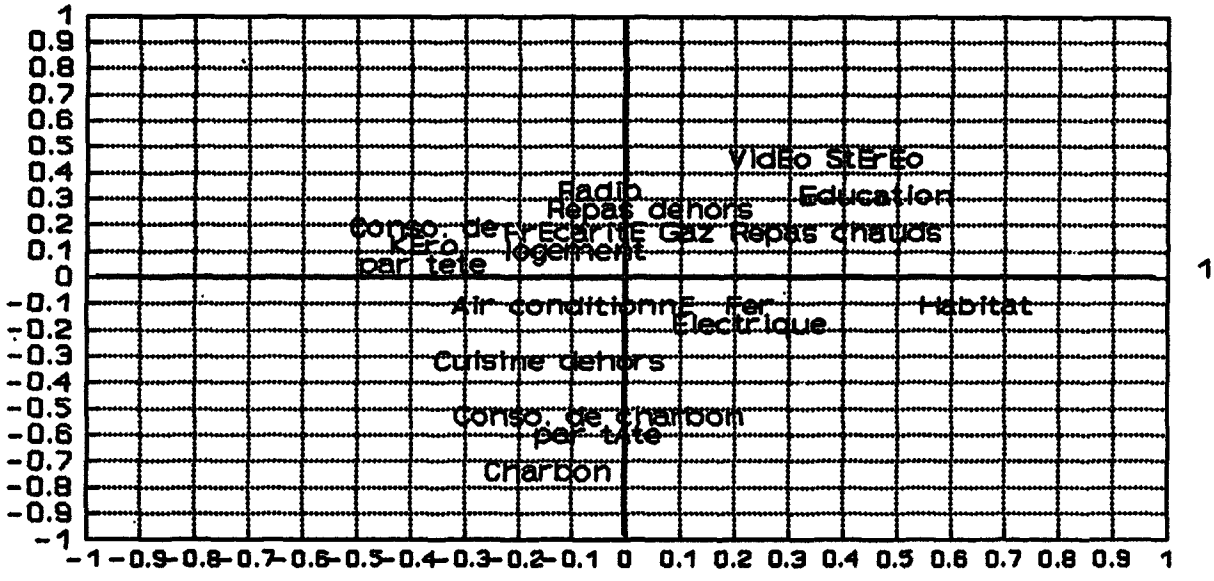
4


Nombre de convives
Taille du ménage
Machine à coudre
Revenu total
Cuisine dehors
Charbon
Radio
Habitat
Richesse
Revenu DEpense
Conso. de charbon par tête
Conso. de gaz par tête
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
-1 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

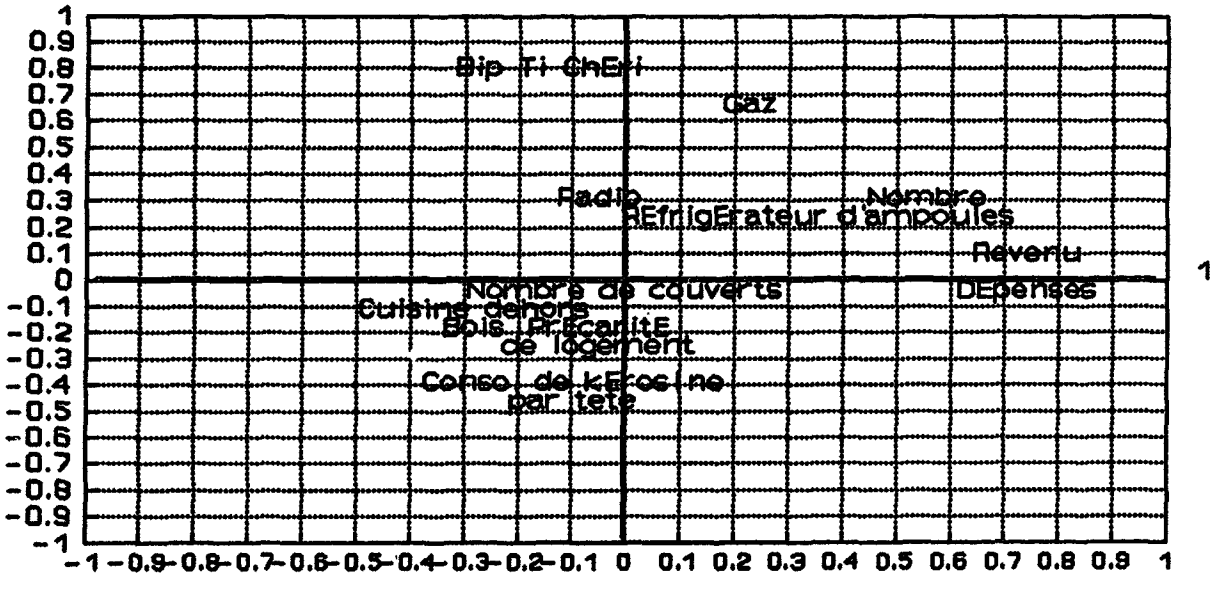
5

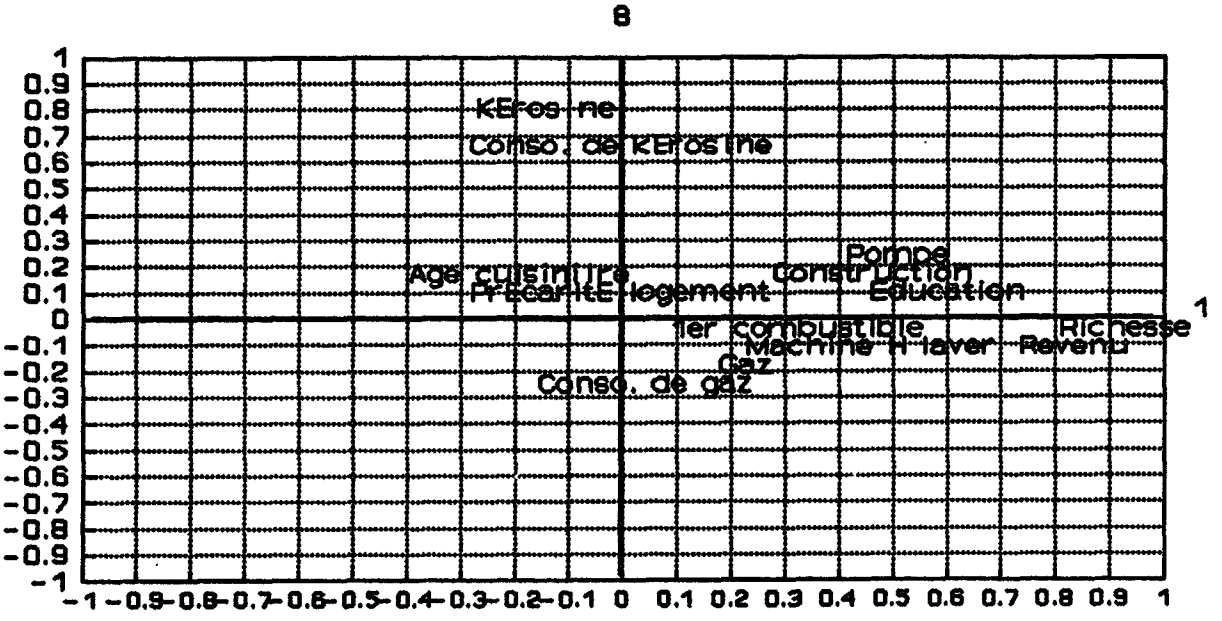

Repas à la maison
Conso. de gaz par tête
Construction
Machine à coudre
Gaz
Vidéo
Réfrigérateur
Habitat
Revenu
Bois charbon
Bip
Education
Richesse
Dépenses
Kérosène
StéréO
Conso de charbon par tête
Cuisine dehors
2ème combustible
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
-1 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

6


Video Stereo
Education
Radio
Repas dehors
Conso. de kEro. par tete
PrEcaritE logement
Gaz
Repas chauds
Air conditionnE
Fer Electrique
Habitat
Cuisine dehors
Conso. de charbon par tete
Charbon

7


Bip Ti ChEri
Gaz
Radio
REfrigErateur
Nombre d'ampoules
Revenu
DEpenses
Nombre de couverts
Cuisine dehors
Bois
PrEcaritE de logement
Conso. de kEro/ne par tete


8
Kerosene
Conso. de Kerosine
Age cuisinière
Precarite logement
Pompe
Construction
Education
Richesse
Revenu
Machine à laver
Gaz
Conso. de gaz
1
1 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0 -0.1 -0.2 -0.3 -0.4 -0.5 -0.6 -0.7 -0.8 -0.9 -1
-1 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

MARKET STUDY

1. Several consumer target groups were identified using household surveys, interviews with groups and product demonstrations. Each group has a separate socio-economic profile and reflects distinct attitudes. Five segments or target groups were distinguished in this manner, as described below.

2. An analysis of the different groups' attitudes towards fuels and stoves, and comparisons of these attitudes with their behavioral characteristics made it possible to evaluate the market potential of different portable cookstoves within the respective market segments.

3. This analysis first was conducted assuming the current relative price structure for fuels, then in a second case assuming a substantial drop in the price of gas.

Group A: Households Without Budgetary Constraints or Strict Dietary Preferences

4. This group consists primarily of rich households and the most well-off households of the middle class. They also are counted among the most educated households and those most responsive to information and commercial advertising. Of the total households in the capital, their relative weight can be estimated at about 10%. They have a higher than average ownership rate for cooking equipment, even though the utilization rate for these appliances is often limited. Organization of their households is quite flexible and is arranged around the constraints of the primary female in the house, who frequently is an active woman with employment outside the household.

GROUP A	Group Preference	Current Market	Potential Market
Traditional Cookstove	0%	18%	0%
Improve Cookstove	0%	0%	0%
Potaje Cookstove	40%	20%	24%
Kerosene Cookstove	4%	0%	5%
Propane Stove	50%	40%	50%
Butane Cookstove	5%	19%	20%
Electric Cookstove	1%	0%	1%

5. There are two main incentives influencing this group's purchases: (i) the appliance is an indispensable element of their social status; and (ii) it must contribute to simplification of household organization, in particular the primary female's duties. Neither the cost nor even the appliance's usefulness are determining factors for this group, although in the continuing economic crisis, these factors are more present in the minds of consumers. This is a group resolutely oriented towards gas (kerosene has only an ambiguous image within this group): 40% of these households are equipped to use propane. In addition, under the influence of the recent publicity campaigns, many have been quick to purchase the equipment needed to use butane gas (Bip)

6. Because of the income level of this group, a drop in gas prices should have only a limited impact. Above all, it should induce a switch from butane to propane; among propane users, a price drop would provide incentives for keeping larger household stocks (50 and 100 kg).

Group B: Households with More than Six People, with Variable, but Steady, Income

7. In this group, the determining factor for purchases is household size as well as the family's dietary practices (number of place settings, eating out or meals at home). Their steady income gives them a certain level of confidence with regard to investments, but in general their behavior lacks originality and they are not innovators. Their living standards are average, and they represent 30% of the population.

GROUP B	Group Preference	Current Market	Potential Market
Traditional Cookstove	20%	58%	20%
Improved Cookstove	20%	3%	15%
Potaje Cookstove	25%	26%	25%
Kerosene Cookstove	15%	0%	15%
Propane Stove	10%	9%	10%
Butane Cookstove	15%	3%	15%
Electric Cookstove	0%	1%	0%

8. With regard to stoves and fuels, the decision criteria for this group are linked more to constraints surrounding cooking arrangements than to the cost of cooking. The notion of cost savings is important (although fuel expenditures fall far below those for food) but no alternative appears more economic to them than another: this currently is the group least likely to change fuels. Gas is considered only a secondary fuel and these households were a little more influenced by the presentations of the improved charcoal stove and the kerosene stove.

9. Nonetheless, a substantial drop in gas prices could strike a sensitive chord within this group and provide the incentive for an important consumer movement towards propane and butane. Given the characteristics of these consumers (they have to be solicited, they themselves don't seek opportunities) a massive movement to gas would only be possible under scenarios including specifically adapted programs of credit for appliance purchases and widespread distribution of gas.

Group C: Average-Sized, Educated Households

10. These generally are average-sized households with limited income (between $200 and $400 per month), rather young and employed in lower-level salaried or wage-earning jobs. Their behavior is influenced substantially by their budgetary constraints (high costs of necessities) as well as by their desire to acquire appliances (motivated by ostentation or by desire for better living standards). They generally have well established decision criteria and are ready to make sacrifices to afford the equipment of their choice. These households represent about 20% of the population.

GROUP C	Group Preference	Current Market	Potential Market
Traditional Cookstove	10%	60%	10%
Improved Cookstove	20%	0%	20%
Potaje Cookstove	20%	23%	20%
Kerosene Cookstove	10%	5%	10%
Propane Stove	5%	10%	5%
Butane Cookstove	30%	2%	30%
Electric Cookstove	5%	0%	5%

11. By nature innovative in character, the members of this group are more likely to be interested by improved stoves and substitution, and in particular by products which are new to them, whether it be kerosene or butane. This interest is tempered by the fact that cooking is not the principal motivating factor behind their desire for change. Both for reasons of image and practicality, Bip is the stove best adapted to the aspirations of this group. Nevertheless, its future behavior is very likely to be shaped by publicity and information campaigns.

12. Because of their tight budgetary constraints, the consumers in this group are very sensitive to variations in price. A drop in the price of gas would provide the incentive for a large fraction of the consumers in this group to switch to that fuel, to the detriment of kerosene and of improved stoves.

Group D: Low-Income or Irregular Income Households

13. For the most part, these are average-sized households living at the subsistence level: they represent 35% of the population in the capital. Their income is very limited (between $70 and $150 per month) and their budgetary constraints are substantial, even though they sometimes receive assistance from emigrant relatives. More so than with other groups, they are affected by the choice of fuel: as it is an essential element of their day-to-day survival, proportionally fuel expenditures can play as large a role in their daily budget as food expenditures. They are not influenced very much by publicity and thus were not affected by recent promotion campaigns for gas. Their decision criteria are very different from those of the rest of the population, and their purchasing decisions often are a function of random additions to the family budget.

GROUP D	Group Preference	Current Market	Potential Market
Traditional Cookstove	55%	75%	55%
Improved Cookstove	25%	4%	25%
Potaje Cookstove	0%	15%	4%
Kerosene Cookstove	5%	2%	5%
Propane Stove	0%	0%	0%
Butane Cookstove	10%	0%	10%
Electric Cookstove	5%	4%	5%

14. Based on their own perception of their economic situation, the households in this group reject gas as being economically out of reach. They also have difficulty perceiving that kerosene use could be advantageous when faced with the multiple possibilities offered by charcoal. Thus a large majority -- based on their present economic constraints and fuel use patterns -- can only see charcoal as a future fuel alternative. As a result, they mostly are interested in improved cookstove models. Thus it is among this group that improved stoves have their best market opening, although enthusiasm for the model has been dampened somewhat by the published price for the BME model.

15. If gas prices were to fall substantially, a campaign to educate consumers about comparing the costs of fuels could draw a limited share of these low-income consumers (10 to 20%) to gas use. This assumes also that it will be possible to introduce gas into the retail networks for neighborhoods where these households are located.

Group E: Modern, Progressive Households

16. This is a rather narrowly defined group of households (5% of the population in the capital), very open to new ideas. Rather politicized and in general progressive, these households are sensitive to arguments such as the struggle against deforestation; they are influenced by western consumption modes and with steady, large incomes, they are able to make purchases in accordance with their views. However, they also are quite conscious of the family budget and are not insensitive to practical arguments.

GROUP E	Group Preference	Current Market	Potential Market
Traditional Cookstove	0%	50%	0%
Improved Cookstove	40%	0%	40%
Potaje Cookstove	0%	38%	0%
Kerosene Cookstove	20%	0%	20%
Propane Stove	10%	2%	10%
Butane Cookstove	30%	10%	30%
Electric Cookstove	0%	0%	0%

17. The households of this group have very precise expectations vis-a-vis different fuels and stoves. In the present situation, the stove which corresponds best to their expectations is the Bip butane cooker, but those who will continue to cook with charcoal will purchase improved stoves. In general, they are more interested by kerosene cookers than other groups, especially the new models presented at demonstrations, primarily because of their modern appearance and advertized high efficiency.

18. Vigilant [illegible]arket conditions, they cannot help but be influenced by decreases in gas pri[illegible]. A large number are likely to "jump ship" in favor of this fuel, if only they are offered advantageous terms for purchasing equipment (credit, especially) and bottles (cross-subsidize the initial purchase with the fuel price).

RESULTATS DE L'ETUDE DE MARCHE SUR PORT-AU-PRINCE

A. SITUATION ACTUELLE :

Cible	A		B		C		D		E		Total
Participation		10%		30%		20%		35%		5%	100%
Part de marche	Val	Tot	Val	Tot	Val	Tot	Val	Tot	Val	Tot	Tot
Rechauds a charbon											
Rechaud traditionnel	18%	2%	58%	17%	60%	12%	75%	26%	50%	3%	60%
Rechaud ameliore	0%	0%	3%	1%	0%	0%	4%	1%	0%	0%	2%
Rechaud potaje	20%	2%	26%	8%	23%	5%	15%	5%	38%	2%	22%
S/Total	38%	4%	87%	26%	83%	17%	94%	33%	88%	4%	84%
Rechaud a kerosene	3%	0%	0%	0%	5%	1%	2%	1%	0%	0%	2%
Rechauds a gaz											
Cuisiniere a propane	40%	4%	9%	3%	10%	2%	0%	0%	2%	0%	9%
Rechaud butane	19%	2%	3%	1%	2%	0%	0%	0%	10%	1%	4%
S/Total	59%	6%	12%	4%	12%	2%	0%	0%	12%	1%	13%
Rechaud electrique	0%	0%	1%	0%	0%	0%	4%	1%	0%	0%	2%
TOTAL	100%	10%	100%	30%	100%	20%	100%	35%	100%	5%	100%

B. MARCHE POTENTIEL, STRUCTURES DE PRIX INCHANGEES :

Cible	A		B		C		D		E		Total
Participation		10%		30%		20%		35%		5%	100%
Part de marche	Val	Tot	Val	Tot	Val	Tot	Val	Tot	Val	Tot	Tot
Rechauds a charbon											
Rechaud traditionnel	0%	0%	20%	6%	10%	2%	55%	19%	0%	0%	27%
Rechaud ameliore	0%	0%	15%	5%	20%	4%	25%	9%	40%	2%	19%
Rechaud potaje	24%	2%	25%	8%	20%	4%	0%	0%	0%	0%	14%
S/Total	24%	2%	60%	18%	50%	10%	80%	28%	40%	2%	60%
Rechaud a kerosene	5%	1%	15%	5%	10%	2%	5%	2%	20%	1%	10%
Rechauds a gaz											
Cuisiniere a propane	50%	5%	10%	3%	5%	1%	0%	0%	10%	1%	10%
Rechaud butane	20%	2%	15%	5%	30%	6%	10%	3%	30%	2%	18%
S/Total	70%	7%	25%	8%	35%	7%	10%	3%	40%	2%	27%
Rechaud electrique	1%	0%	0%	0%	5%	1%	5%	2%	0%	0%	3%
TOTAL	100%	10%	100%	30%	100%	20%	100%	35%	100%	5%	100%

Groupes-cibles :

A : Menages sans contraintes budgetaires ni rigidites alimentaires
B : Menages de plus de 6 personnes, a revenu variable mais regulier
C : Menages de taille moyenne, avec influence du niveau d'instruction (secteur secondaire, professions liberales)
D : Menages a faible revenu ou a revenu irregulier
E : Menages modernes, progressistes

C. MARCHE POTENTIEL, BAISSE SENSIBLE DU PRIX DU GAZ

Groupe-cible	A		B		C		D		E		Total
Participation		10%		30%		20%		35%		5%	100%
Part de marche	Val	Tot	Val	Tot	Val	Tot	Val	Tot	Val	Tot	Tot
Rechauds a charbon											
Rechaud traditionnel	0%	0%	10%	3%	5%	1%	45%	16%	0%	0%	20%
Rechaud ameliore	0%	0%	15%	5%	20%	4%	25%	9%	20%	1%	18%
Rechaud potaje	25%	3%	15%	5%	12%	2%	0%	0%	0%	0%	9%
S/Total	25%	3%	40%	12%	37%	7%	70%	25%	20%	1%	47%
Rechaud a kerosene	0%	0%	10%	3%	5%	1%	5%	2%	10%	1%	6%
Rechauds a gaz											
Cuisiniere a propane	60%	6%	20%	6%	15%	3%	0%	0%	20%	1%	16%
Rechaud butane	14%	1%	30%	9%	40%	8%	20%	7%	50%	3%	28%
S/Total	74%	7%	50%	15%	55%	11%	20%	7%	70%	4%	44%
Rechaud electrique	1%	0%	0%	0%	3%	1%	5%	2%	0%	0%	2%
TOTAL	100%	10%	100%	30%	100%	20%	100%	35%	100%	5%	100%

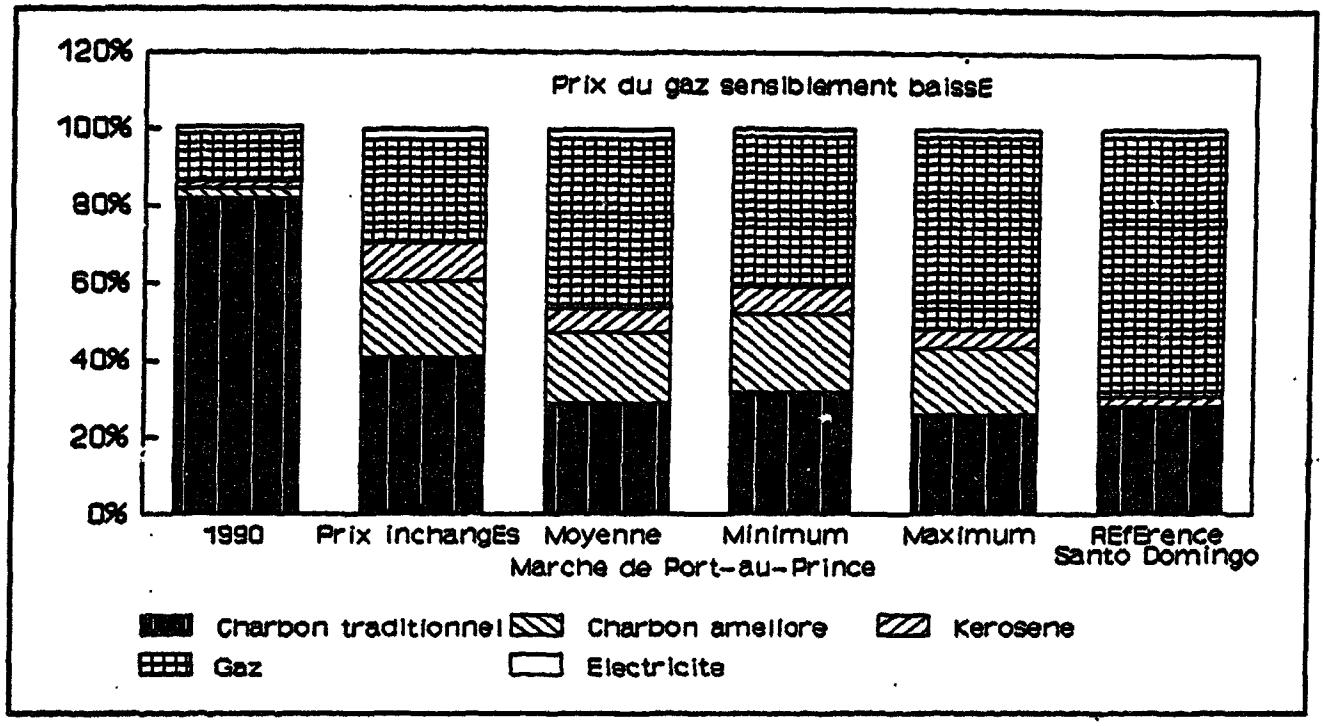
D. ANALYSE DE SENSIBILITE

Groupe-cible	A		B		C		D		E		Total	
Participation		10%		30%		20%		35%		5%		100%
Part de marche	Val	Sens	Val	Sens	Val	Sens	Val	Sens	Val	Sens	Tot	Sens
Rechaud traditionnel	0%	0%	10%	0%	5%	2%	45%	3%	0%	0%	20%	1.5%
Rechaud ameliore	0%	0%	15%	3%	20%	0%	25%	0%	20%	0%	18%	0.8%
Rechaud potaje	25%	4%	15%	0%	12%	1%	0%	0%	0%	0%	9%	0.6%
Rechaud a kerosene	0%	0%	10%	3%	5%	1%	5%	0%	10%	0%	6%	1.0%
Cuisiniere a propane	60%	3%	20%	4%	15%	5%	0%	0%	20%	2%	16%	2.6%
Rechaud butane	14%	5%	30%	6%	40%	2%	20%	2%	50%	4%	28%	3.6%
Rechaud electrique	1%	0%	0%	0%	3%	0%	5%	0%	0%	0%	2%	0.0%

CRITERES DE SENSIBILITE

Groupe A : Concurrence vente au detail, prix d'achat des bombonnes
Groupe B : Credit a l'equipement, couverture du reseau de distribution
Groupe C : Prix de l'equipement, inflation continue ou stagnante
Groupe D : Strategie de communication, couverture du reseau de distribution
Groupe E : Credit a l'equipement, prix d'achat des bombonnes

Figure A8.1: Marché des Combustibles et des Foyers



SCENARIO TENDANCIEL - SCENARIO VOLONTARISTE

PROJECTION DE CONSOMMATION DE COMBUSTIBLES

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Population (1000)													
Port-au-Prince	956	996	1037	1080	1125	1171	1220	1270	1323	1377	1434	1494	1556
Villes princip.	202	210	218	228	235	244	254	263	274	284	295	306	318
Total	1158	1206	1255	1307	1360	1416	1473	1534	1596	1662	1729	1800	1874

SCENARIO TENDANCIEL (structures de consommations inchangees)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Part des consommateurs de charbon de bois comme combustible principal													
Port-au-Prince	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%
Villes princip.	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Consommation unitaire moyenne de charbon (kg/an/capita)													
Total	215	215	215	215	215	215	215	215	215	215	215	215	215
Consommation domestique de charbon de bois (1000 t)													
Port-au-Prince	173	180	187	195	203	212	220	229	239	249	259	270	281
Villes princip.	39	41	42	44	46	47	49	51	53	55	57	59	62
Total	212	221	230	239	249	259	269	280	292	304	316	329	342
Part des consommateurs de gaz comme combustible principal													
Port-au-Prince	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Villes princip.	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Consommation unitaire moyenne de gaz (kg/an/capita)													
Total	48	48	48	48	48	48	48	48	48	48	48	48	48
Consommation domestique de gaz (1000t)													
Port-au-Prince	6	6	6	7	7	7	8	8	8	9	9	9	10
Villes princip.	0	0	0	0	0	0	0	1	1	1	1	1	1
Total	6	7	7	7	7	8	8	8	9	9	10	10	10

SCENARIO VOLONTARISTE

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Part des consommateurs de charbon de bois comme combustible principal													
Port-au-Prince	84%	84%	84%	82%	79%	76%	72%	68%	64%	60%	55%	50%	45%
Villes princip.	90%	90%	90%	89%	88%	86%	84%	83%	81%	79%	77%	75%	73%
Consommation unitaire moyenne de charbon (kg/an/capita)													
Total	215	215	215	213	210	204	204	204	204	204	204	204	203
Consommation domestique de charbon de bois (1000 t)													
Port-au-Prince	173	180	187	188	187	182	180	177	173	169	161	152	142
Villes princip.	39	41	42	43	43	43	44	45	45	46	46	47	47
Total	212	221	230	231	230	225	223	221	218	215	207	199	189
Total sans Foyers Ameliores	212	221	230	234	237	240	239	238	235	233	226	219	212
Part des consommateurs de gaz comme combustible principal													
Port-au-Prince	13%	13%	13%	15%	18%	24%	29%	35%	40%	46%	50%	50%	50%
Villes princip.	4%	4%	4%	5%	6%	8%	10%	11%	13%	15%	17%	19%	21%
Consommation unitaire moyenne de gaz (kg/an/capita)													
Total	48	48	48	48	48	48	48	48	48	48	48	48	48
Consommation domestique de gaz (1000t)													
Port-au-Prince	6	6	6	8	10	13	17	21	25	30	34	36	37
Villes princip.	0	0	0	1	1	1	1	1	2	2	2	3	3
Total	6	7	7	8	10	14	18	23	27	32	37	39	41

PENETRATION DES FOYERS AMELIORES

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
PORT-AU-PRINCE													
Menages (1000)													
# menages	159	166	173	180	187	195	203	212	220	230	239	249	259
% menages avec F.A. rond	0%	0%	1%	5%	10%	20%	20%	20%	20%	20%	20%	20%	20%
# menages avec F.A. rond	0	0	2	9	19	39	41	42	44	46	48	50	52
ventes F.A. rond (1000)	0	0	2	7	11	28	13	29	15	31	17	33	19
eco. de charbon (1000 t)	0	0	0	2	4	8	8	8	9	9	10	10	10
% menages avec F.A. potaje	0%	0%	0%	1%	3%	5%	5%	5%	5%	5%	5%	5%	5%
# menages avec F.A. potaje	0	0	0	2	6	10	10	11	11	11	12	12	13
ventes F.A. potaje (1000)	0	0	0	2	4	6	4	6	5	7	5	7	6
eco. de charbon (1000 t)	0	0	0	0	1	2	2	2	2	2	2	2	3
Manje kwi (1000)													
# de postes	19	20	21	22	23	24	24	26	27	28	29	30	31
% postes avec F.A.	1%	1%	1%	5%	10%	25%	25%	25%	25%	25%	25%	25%	25%
# postes avec F.A.	0	0	0	1	2	6	6	6	7	7	7	7	8
ventes F.A.	0	0	0	1	1	4	1	5	2	5	2	5	2
eco. de charbon (1000 t)	0	0	0	0	1	2	2	3	3	3	3	3	3
Eco. tot. charbon PAP (1000t)	0	0	0	3	6	12	13	13	14	14	15	15	16
AUTRES VILLES PRINCIPALES													
Menages (1000)													
# menages	34	35	36	38	39	41	42	44	46	47	49	51	53
% menages avec F.A. rond	0%	0%	0%	5%	10%	20%	20%	20%	20%	20%	20%	20%	20%
# menages avec F.A. rond	0	0	0	2	4	8	8	9	9	9	10	10	11
ventes F.A. rond (1000)	0	0	0	2	2	6	2	6	3	7	3	7	3
eco. de charbon (1000 t)	0	0	0	0	1	2	2	2	2	2	2	2	2
% menages avec F.A. potaje	0%	0%	0%	1%	3%	10%	10%	10%	10%	10%	10%	10%	10%
# menages avec F.A. potaje	0	0	0	0	1	4	4	4	5	5	5	5	5
ventes F.A. potaje (1000)	0	0	0	0	1	3	1	3	1	4	1	4	2
eco. de charbon (1000 t)	0	0	0	0	0	1	1	1	1	1	1	1	1
Manje kwi (1000)													
# de postes	4	4	4	5	5	6	7	9	12	16	23	34	51
% postes avec F.A.	0%	0%	0%	2%	5%	15%	15%	15%	15%	15%	15%	15%	15%
# postes avec F.A.	0	0	0	0	0	1	1	1	2	2	3	5	8
ventes F.A.	0	0	0	0	0	1	0	1	1	2	2	3	4
eco. de charbon (1000 t)	0	0	0	0	0	0	0	1	1	1	1	2	3
Eco tot CdB Aut. villes (1000t	0	0	0	0	1	3	3	3	3	4	4	5	6
Eco. tot. CdB Haiti (1000t)	0	0	0	3	7	15	16	16	17	18	19	21	22

PENETRATION DU GAZ

PORT-AU-PRINCE													
% menages avec rechaud butane	2%	4%	4%	5%	7%	12%	16%	20%	23%	27%	30%	30%	30%
# menages avec rechaud butane	3	7	7	9	13	23	33	42	51	62	72	75	78
ventes rechauds butane	2	3	2	4	8	13	13	17	21	24	27	24	28
% menages avec rechaud propane	9%	9%	9%	10%	11%	12%	13%	15%	17%	19%	20%	20%	20%
# menages avec rechaud propane	14	15	16	18	21	23	26	32	37	44	48	50	52
ventes rechauds propane	3	3	3	5	6	6	6	8	11	12	10	8	10
VILLES PRINCIPALES													
% menages avec rechaud butane	0%	0%	0%	1%	1%	3%	5%	5%	7%	9%	10%	12%	13%
# menages avec rechaud butane	0	0	0	0	0	1	2	2	3	4	5	6	7
ventes rechauds butane	0	0	0	0	0	1	1	1	2	2	3	4	3
% menages avec rechaud propane	4%	4%	4%	4%	5%	5%	5%	6%	6%	6%	7%	7%	8%
# menages avec rechaud propane	1	1	1	2	2	2	2	3	3	3	3	4	4
ventes rechauds propane	0	0	0	0	0	0	0	1	0	0	1	0	1

Notes:

. Personnes par menage: 6

. Duree de vie des equipements

Foyer ameliore: 2 ans

Rechaud butane: 3 ans

Cuisiniere propane: 5 ans

. Equipement a CdB ameliore ou a gaz par menage: 1

. Diminution moyenne de conso. de CdB pour menages utilisateurs de F.A.: 20%

. Les consommations unitaires de charbon de bois et de gaz sont des moyennes comprenant leur utilisation comme combustible principal et d'appoint

DONNEES GENERALES

Tableau A10.1: Projection de Population Urbaine et Rurale

	Population (milliers) (b)				Taux croissance %		
	1971	1982	1990	2000	50-71	71-82	82-2000
Population Urbaine (a)	707	1042	1510	2450	5.0	3.6	4.9
Port-au-Prince	507	720	996	1493	5.9	3.2	4.1
Autres villes	200	322	514	956	3.4	4.4	6.2
Cap Haitien	46	64	87	127	3.2	3.1	3.9
Gonaives	29	34	39	47	3.5	1.5	1.9
Cayes	22	34	51	84	2.9	4.0	5.2
St-Marc	17	24	33	49	3.1	3.2	4.1
Sous-total	114	156	210	308	3.2	2.9	3.9
Autres	86	166	304	648	3.2	6.2	7.9
Population Rurale	3623	4011	4318	4517	1.2	0.9	0.7
TOTAL	4330	5053	5828	6966	1.6	1.4	1.8

(a) Villes de plus de 5.000 habitants

(b) Malgré la baisse du taux de croissance constatée d'après les recensements IHSI, le taux de croissance sur 1982-2000 a été considéré égal à 1.8% au niveau national(voi le Rapport sur le Développement dans le Monde); les taux de croissance suivant le milieu (urbain, rural) ont été calculés sur cette base et proportionnellement aux taux de croissance indiqués par l'IHSI pour 71-82.

Source: IHSI (recensements de 1971 et 1982), Banque Mondiale (RDM)

Niveau de Vie

	Niveau de Vie (Factor) Quintiles					ALL
	0-20%	20-40%	40-60%	60-80%	80%+	Count
	Count	Count	Count	Count	Count	
GROUPE SOCIO-ECO						
Faible Revenu	77	76	60	32	5	250
Moyen	2	4	18	46	41	111
Aise			1	2	33	36
Revenu Quintiles (Gd/cap/mois)						
- 71.5	33	27	11	8	1	80
71.5 - 124	22	25	21	6		74
124 - 223	16	11	28	20	3	78
223 - 547	8	14	14	33	20	89
547 +		3	5	13	55	76
Food Expenditure Quintiles (Gd/cap/mois)						
- 50	34	32	12	3		81
51 - 80	21	17	20	14	1	73
81 - 125	12	15	22	24	11	84
126 - 210	10	9	19	24	17	79
211 +	2	7	6	15	50	80
ALL	79	80	79	80	79	397

Strategie Energie Domestique
Enquetes urbaines Port-au-Prince

Household Characteristics by Classification

	GROUPE SOCIO-ECO			Niveau de Vie (Factor) Quintiles					TOTAL
	Faible Revenu	Moyen	Aise	0-20%	20-40%	40-60%	60-80%	80%+	
Revenu du Menage (Gd/men/mois)									
Mean	794.0	2892.7	6273.0	405.2	609.8	989.2	1851.9	5513.4	1888.5
Median	500.00	2287.5	5400.0	338.33	500.00	750.00	1675.0	5000.0	850.00
Valid N	251	112	37	79	80	79	80	79	400
Revenu (Gd/cap/mois)									
Mean	175.7	546.4	1113.2	104.6	143.9	226.4	360.4	990.7	366.2
Median	100.00	372.50	868.88	80.00	89.29	140.00	253.57	750.00	170.92
Valid N	251	112	37	79	80	79	80	79	400
TAILLE MENAGE									
Mean	5.4	6.8	6.3	4.7	5.5	6.1	6.7	6.6	5.9
Median	5	6	6	5	5	6	6	6	5
Valid N	251	112	37	79	80	79	80	79	400
PERSONNES PARTICIPANTS									
Mean	1.7	2.1	2.2	1.6	1.7	1.8	2.1	2.1	1.9
Median	2	2	2	1	2	2	2	2	2
Valid N	251	112	37	79	80	79	80	79	400

Strategie Energie Domestique
Enquetes urbaines Port-au-Prince
BME / OLADE / ESMAP - Banque Mondiale/PNUD (MILAATAB)

ANALYSE PAR CARACTERISTIQUES SOCIO-ECONOMIQUES
Cooking Fuel Expenditures / Food Expenditures

	Food Expenditure Quintiles (Gd/cap/mois)					Niveau de Vie (Factor) Quintiles					All
	- 50	51 - 80	81 - 125	126 - 210	211 +	0-20 %	20-40%	40-60%	60-80%	80%+	
Charbon Cost/Food Cost											
Mean	.34	.21	.16	.11	.06	.31	.22	.15	.14	.05	.18
Valid N	81	74	84	80	81	79	80	79	80	79	397
Gaz Cost/Food Cost											
Mean	.01	.01	.02	.03	.04		.01	.01	.03	.06	.02
Valid N	81	74	84	80	81	79	80	79	80	79	397
Kerosene Cost/Food Cost											
Mean	.00	.00	.01	.00	.00		.00	.00	.01	.00	.00
Valid N	81	74	84	80	81	79	80	79	80	79	397
Cooking Fuels Cost/Food Cost											
Mean	.36	.22	.18	.14	.10	.31	.24	.17	.18	.11	.20
Valid N	81	74	84	80	81	79	80	79	80	79	397

Strategie Energie Domestique
Enquetes urbaines Port-au-Prince
BME / OLADE / ESMAP - Banque Mondiale/PNUD (ROY1TAB)

ANALYSE PAR CARACTERISTIQUES SOCIO-ECONOMIQUES
Combustibles Par Cuisine (per capita)

	GROUPE SOCIO-ECO			Food Expenditure Quintiles (Gd/cap/mois)					Niveau de Vie (Factor) Quintiles					All
	Faible Revenu	Moyen	Aise	- 50	51 - 80	81 - 125	126 - 210	211 +	0-20 %	20-40%	40-60%	60-80%	80%+	
Charbon (kg/cap/jour)														
Mean	.42	.46	.32	.30	.39	.43	.50	.49	.41	.46	.43	.48	.35	.43
Valid N	251	112	37	81	74	84	80	81	79	80	79	80	79	397
Gaz (combus.) (kg/cap/jour)														
Mean	.00	.07	.18	.00	.01	.02	.03	.14		.00	.01	.05	.13	.04
Valid N	251	112	37	81	74	84	80	81	79	80	79	80	79	397
Kerosene (combus.) (lt/cap/jour)														
Mean	.00	.01	.01	.00	.00	.00	.01	.01		.00	.00	.01	.01	.00
Valid N	251	112	37	81	74	84	80	81	79	80	79	80	79	397

Strategie Energie Domestique
Enquetes urbaines Port-au-Prince
BME / OLADE / ESMAP - Banque Mondiale/PNUD (ROY3TAB)

ANALYSE PAR CARACTERISTIQUES SOCIO-ECONOMIQUES
Charbon par Cuisine (kg/cap/jour): Users Only

	TAILLE MENAGE																All
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
GROUPE SOCIO-ECO																	
Faible Revenu																	
Charbon (kg/cap/jour)																	
Mean	1.36	.57	.58	.51	.40	.34	.28	.33	.26	.24	.23	.19	.	.20	.	.	.43
Valid N	6	13	39	35	45	34	25	21	9	12	3	2		2			246
Moyen																	
Charbon (kg/cap/jour)																	
Mean	.45	1.96	.68	.65	.51	.47	.40	.37	.46	.28	.23	.26	1.13	.	.22	.20	.51
Valid N	2	3	3	12	17	15	12	10	5	8	1	2	3		6	1	100
Aise																	
Charbon (kg/cap/jour)																	
Mean	.	.	.77	.85	.56	.51	.27	.28	.56	.27	.23	.	.	.	.14	.	.49
Valid N			3	2	4	4	3	2	2	2	1				1		24
Charbon (kg/cap/jour)																	
Mean	1.13	.83	.60	.56	.44	.39	.32	.34	.36	.25	.23	.23	1.13	.20	.21	.20	.46
Valid N	8	16	45	49	66	53	40	33	16	22	5	4	3	2	7	1	370

Strategie Energie Domestique
Enquetes urbaines Port-au-Prince
BME / OLADE / ESMAP - Banque Mondiale/PNUD (ROY6TAB)

ANALYSE PAR COMBUSTIBLES

	Food Expenditure Quintiles (Gd/cap/mois)										Total	
	- 50		51 - 80		81 - 125		126 - 210		211 +		Charbon (kg/cap/jour)	
	Charbon (kg/cap/jour)		Charbon (kg/cap/jour)		Charbon (kg/cap/jour)		Charbon (kg/cap/jour)		Charbon (kg/cap/jour)		Mean	Valid N
	Mean	Valid N	Mean	Valid N	Mean	Valid N	Mean	Valid N	Mean	Valid N		
bois												
0		1		2	.		.		.			3
charbon	.38	2	.15	2	.		.76	1	.		.36	5
charbon												
0	.31	68	.38	58	.43	58	.59	43	.78	19	.44	246
bois	.31	5	.25	5	.		.		.		.28	10
charbon	.		.		.		.		.70	1	.70	1
kerosene	.28	1	.		.41	3	.26	3	.		.33	7
gaz	.27	2	.84	6	.43	11	.45	12	.80	15	.60	46
electricite	.		.17	1	.49	5	.60	4	.53	4	.51	14
kerosene												
charbon	.		.		.		.44	3	.		.44	3
gaz	.		.		.		.			2		2
gaz												
0	.		.		.			5	.04	16	.03	21
charbon	.23	2	.	.	.47	6	.47	7	.43	20	.43	35
electricite	.		.		.		.		.16	4	.16	4
electricite												
0	.		.			1	.		.			1
charbon	.		.		.		.39	2	.		39	2
Total	.30	81	.39	74	.43	84	.50	80	.49	81	.42	400

Strategie Energie Domestique
Enquetes urbaines Port-au-Prince
BME / OLADE / ESMAP - Banque Mondiale/PNUD (DUROTAB(a))

ANALYSE PAR COMBUSTIBLES

	Food Expenditure Quintiles (Gd/cap/mois)										Total	
	- 50		51 - 80		81 - 125		126 - 210		211 +		Gaz (combus.) (kg/cap/jour)	
	Gaz (combus.) (kg/cap/jour)		Gaz (combus.) (kg/cap/jour)		Gaz (combus.) (kg/cap/jour)		Gaz (combus.) (kg/cap/jour)		Gaz (combus.) (kg/cap/jour)		Mean	Valid N
	Mean	Valid N	Mean	Valid N	Mean	Valid N	Mean	Valid N	Mean	Valid N		
bois												
0		1		2	.		.		.			3
charbon		2		2	.			1	.			5
charbon												
0	.00	68		58	.00	58	.00	43		19	.00	246
bois		5		5	.		.		.			10
charbon	.		.		.		.			1		1
kerosene		1	.			3	.00	3	.		.00	7
gaz	.03	2	.06	6	.04	11	.05	12	.16	15	.08	46
electricite	.			1		5		4		4		14
kerosene												
charbon	.		.		.		.04	3	.		.04	3
gaz	.		.		.		.		.10	2	.10	2
gaz												
0	.		.		.		.14	5	.20	16	.18	21
charbon	.03	2	.		.13	6	.15	7	.24	20	.19	35
electricite	.		.		.		.		.13	4	.13	4
electricite												
0	.		.			1	.		.			1
charbon	.		.		.			2	.			2
Total	.00	81	.01	74	.02	84	.03	80	.14	81	.04	400

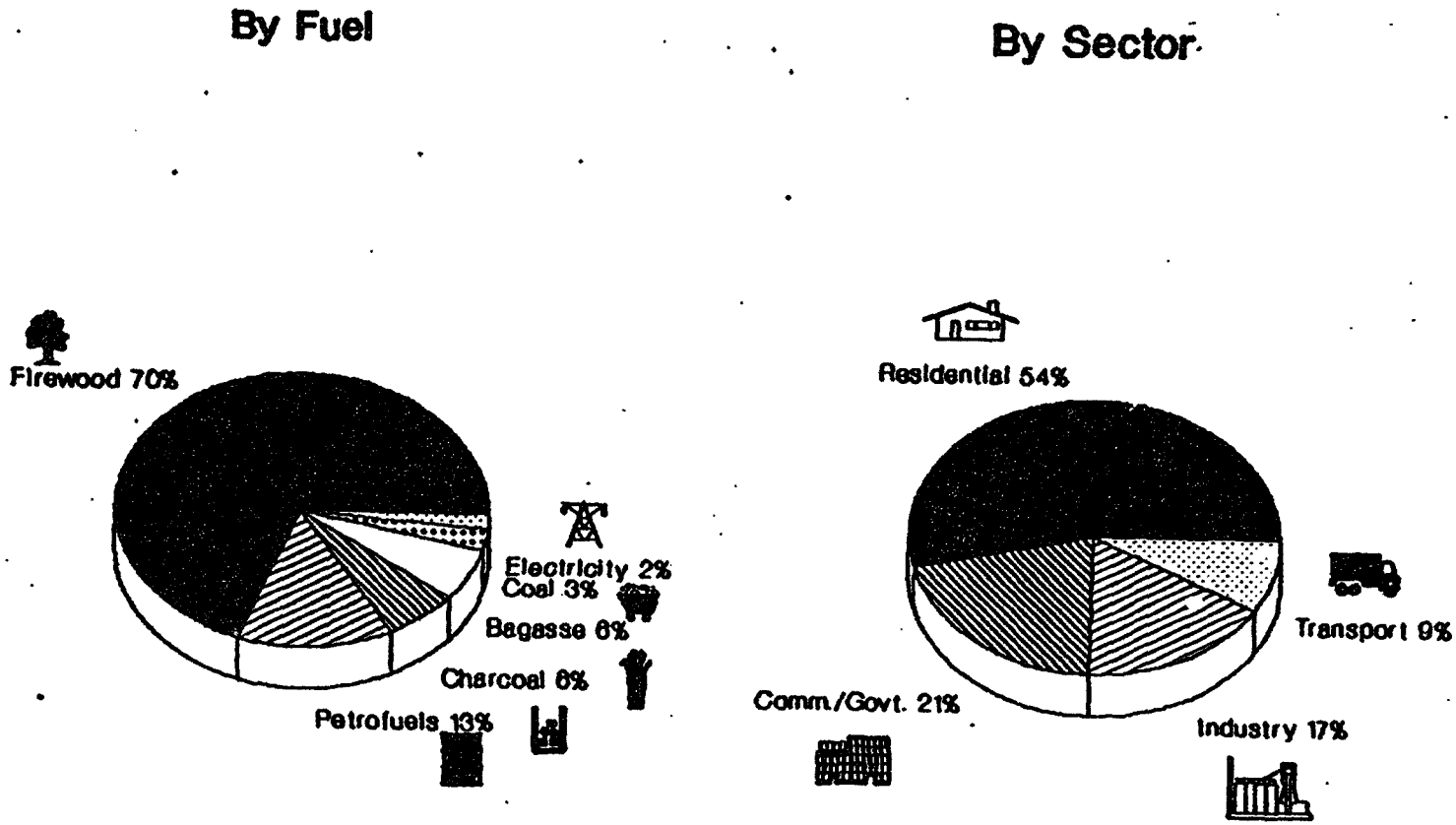
Strategie Energie Domestique
Enquetes urbaines Port-au-Prince
BME / OLADE / ESMAP - Banque Mondiale/PNUD (DUROTAB(c))

ANALYSE PAR COMBUSTIBLES

	Combustible Principal															ALL
	bois		char						kero		gaz			elec		
	Second.		Second.						Second.		Second.			Second.		
	none	char	none	bois	char	kero	gaz	elec	char	gaz	none	char	elec	none	char	
Group Socio-economique																
Faible Revenu																
Count	3	5	211	10		3	9	5	1			1	1	1	1	251
Row Percent	1.2%	2.0%	84%	4.0%		1.2%	3.6%	2.0%	.4%			.4%	.4%	.4%	.4%	100%
Moyen																
Count			34		1	4	30	8	2		10	20	2		1	112
Row Percent			30%		.9%	3.6%	27%	7.1%	1.8%		8.9%	18%	1.8%		.9%	100%
Aise																
Count			1				7	1		2	11	14	1			37
Row Percent			2.7%				19%	2.7%		5.4%	30%	38%	2.7%			100%
Niveau de Vie (Factor)																
Quintiles																
0-20%	3	4	65	5				1						1		79
20-40%			71	4			3		1			1				80
40-60%			63	1		3	6	4			1	1				79
60-80%			35		1	3	20	7	2		3	7	1		1	80
80%+			12			1	17	2		1	17	25	3		1	79
ALL	3	4	246	10	1	7	46	14	3	1	21	34	4	1	2	397

Strategie Energie Domestique
Enquetes urbaines Port-au-Prince
BME / OLADE / ESMAP - Banque Mondiale/PNUD (ROY7TAB)

Final Energy Demand, 1985



Source: Kool, 1986

Table A10.1: Taux d'Equipement Energétique Suivant Quintile de Niveau de Vie en Pourcentage du Total des Ménages

	Pauvre	Moyen Pauvre	Moyen	Moyen riche	Riche	Total
Ampoules	59	93	95	99	100	89
Radio/Radio Cassettes	8	81	95	99	100	77
Ventilateur	14	41	76	85	92	62
Télévision	0	15	91	99	99	61
Fer à repasser	11	34	63	83	91	56
Réfrigérateur	0	1	20	65	95	36
Stéréo	0	3	4	6	58	14
Machine à coudre	1	0	4	10	25	8

Source: Enquêtes urbaines Port-au-Prince.

Stratégie Energie Domestique BME/OLADE/PNUD/ESMAP.

CARBONISATION OCCASIONNELLE, CARBONISATION PROFESSIONNELLE

		Carbonisation occasionnelle	Carbonisation professionnelle
Tonnage initial de bois	Tonne	1	1
Rendement de la meule		14%	21%
Charbon produit	Tonne	0.14	0.21
Prix de cession du charbon	G/tonne	250	250
Revenu brut du charbon	Gourdes	35.0	52.5
Nombre d'heures travaillees	H/t. bois	20	20
Salaire horaire	G/heure	1	1
Imput travail paysan	Gourdes	20	
Imput travail charbonnier	Gourdes		20
Carbonisation paysanne			
Revenu net paysan	Gourdes	15	
Partage 40% paysan - 60 % charbonnier			
Revenu net paysan	Gourdes		21
Revenu net charbonnier	Gourdes		12

HYPOTHESES :
Rendement de 21 % mesure a Terrier Rouge, avril 1990
dans une grande zone de production charbonniere professionnelle du nord du pays
(les mesures realisees par le BME sur trois meules dans la Plaine du Cul de Sac
en 1985 ont indique un rendement moyen similaire: 18%).
Rendement diminue d'un tiers pour la meule
realisee par un charbonnier occasionnel (d'apres l'experience d'ESMAP
dans des pays ou les caracteristiques de la production charbonniere
sont similaires a celles d'Haiti, le Rwanda par exemple)
Temps de travail d'apres Projet Forestier et mesures B.M.E.
Salaire journalier de 6 Gourdes (1,2 $)

COUTS DE TRANSPORT

Répartition des coûts :

(US$/1000 km)	Pick-up		Camion Léger		Camion Lourd	
Carburant	115.4	*32%*	94	*16%*	150.3	*12%*
Lubrifiant	5.1	*1%*	6.4	*1%*	8.1	*1%*
Pneus	5.8	*2%*	24.3	*4%*	76.9	*6%*
Pièces détachées	68.8	*19%*	78.3	*13%*	231.5	*19%*
M.O. entretien	37.3	*10%*	110.5	*19%*	147	*12%*
Chauffeur		*0%*	55.7	*9%*	160.6	*13%*
Amortissement	70	*19%*	101	*17%*	210.9	*17%*
Frais financiers	63	*17%*	63.6	*11%*	151.8	*12%*
Autres coûts		*0%*	53.4	*9%*	113.7	*9%*
TOTAL	365.4	*100%*	587.2	*100%*	1250.8	*100%*

Cout T.T.C. :

(US$/km)	Goudron		Piste	
	Plat	Montagne	Plat	Montagne
Pick-up	0.33	0.37	0.45	0.44
Camion léger	0.55	0.79	0.66	0.91
Camion lourd	1.18	1.78	1.48	2.01

Source : Ministère des Transports, 1989

DONNES SUR LE REVENU AGRICOLE
Cas du Nord et Nord-Est du pays

	(S)				Produit	Bénéf	M	Prix	Val	M	Prix	Prix
	A	B	C	D	brut	b.terre	t	b.terre	c.a.p.	t	t.c.a.p.	j.trav.
Quartier Morin	2	3	3	3	810	400	2	2500	1.7	1	1450	1.6
St Raphael	3	3	3	2	900	1000	1	2200	1.7	1	860	1.5
Bord de Mer	2	3	3	2	615	1100	1	2500	1.7	2	1460	1.8
Plaine du Nord	2	2	3	2	400	380	2	1600	1.6	1	800	1.3
Camp Louise	2	2	2	2	545	350	2	2300	1.5	2	900	1.0
Terrier rouge	0	3	3	1	150	200	2	600	1.6	2	220	0.9
Ht Maribaroux	1	2	2	2	395	200	2	800	1.5	1	260	2.0
Grison Garde	2	1	2	2	316	600	2	160	1.4	2	340	1.0
Grand Bassin	0	2	2	1	285	630	1	640	1.7	2	340	1.0
Dondon	3	1	0	1	685	800	1	1000	2.5	2	500	1.0
Gde Riv du Nord	1	0	0	1	390	300	2	800	1.5	1	320	0.9
Moyenne					499	542		1373	1.7		677	1.3

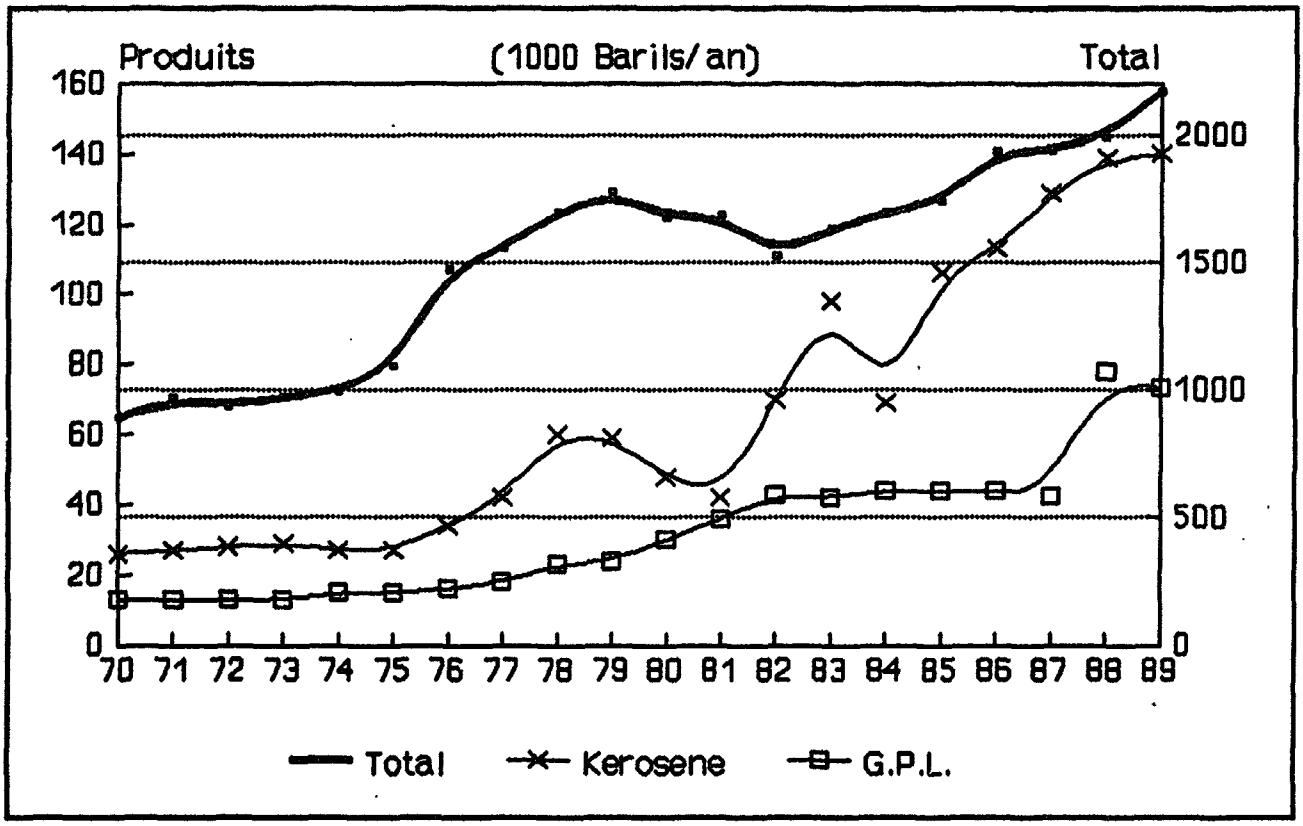
LEGENDE :

A : Alimentation en eau
B : Qualité du sol
C : Topographie
D : Accessibilité commerciale

0 Défavorable
1 Peu favorable
2 Favorable
3 Très favorable

Produit brut par carreau et par an, moyenne de l'échantillon
Bénéfice bonne terre (canne, banane, café, fruitiers), par carreau et par an
Mode de tenure : propriétaire (1), métayer ou autre (2)
Prix des bonnes terres, par carreau
Valorisation du travail agricole, en culture annuelle pluviale, par jour
Mode de tenure : propriétaire (1), métayer ou autre (2)
Prix des terres de culture annuelle pluviale, par carreau
Prix de la journée de travail

Figure A10.1: Importations Pétrolières
Evolution 1970-1989



Unités de vente de charbon de bois
Poids moyens à Port-au-Prince

Sac	38 kg
Charge	40 kg
Demi-sac	19 kg
Grande marmite	0.9 kg
Lot (1 gourde)	0.8 kg
Lot (0.5 gourde)	0.35 kg

Note: Il existe d'autres unités de vente, beaucoup moins fréquentes, comme panier, bol, cuvette, etc. Pour le calcul de la consommation de charbon par habitant, ces unités ont été comptabilisées en fonction de leur prix d'achat indiqué par le ménage (1 gourde = 0.7 kg)

Source: Enquête poids/prix BME
Enquêtes ménages Port-au-Prince ESMAP/BME/OLADE/PNUD.

Cost-Benefit Analysis of Diesel Oil Substitution
Guildive Case Study

Parameters		
Real discount rate =	12%	
Wood consumption =	5.5	truckloads/months
Capactity of wood truck =	10	tonnes/load
Cost of wood =	11000	Gourdes/truckload
Cost of wood =	110	Gourdes/tonne
Output of Guildive =	150	drums/month
Value of product =	775	Gourdes/drum
Cost of fuel/value of product =	5%	
Cost of diesel oil =	8.40	Gourdes/gallon
Cost of diesel burner retrofit =	$1200	
Cost of half-time wood stoker labor =	2500	Gourdes/year
Cost of diesel burner maintenance =	5%	capex/year
Lifetime of diesel burner retrofit =	8	Years
Efficiency of wood burner =	25%	
Efficiency of diesel burner =	75%	
Calorific value of wood =	15.0	MJ/kg
Calorific value of diesel =	43.5	MJ/kg

	Annual Financial Value a/ (US$)	Economic Conversion Factor	Annual Economic Value (US$)
Costs			
Capital Cost of Retrofit b/	242	1.00	242
Diesel Burner Maintenance b/	60	1.00	60
Diesel Oil	40,146	0.55	22,040
Sub-Total	40,448		22,341
Benefits			
Wood Saved	14,520	0.98 c/	14,193
Stoker Labor Saved	500	0.36	180
Sub-Total	15,020		14,373
Net Benefits	(25,428)		(7,968)

a/ Coverted at 5:1 Gourdes per US$
b/ Assumes duty-free import.
c/ Based on wood stumpage value of $5.40/m3 equals $7.71/tonne (FAO estimate of economic cost of plantation wood).

Economic Analysis Sensitivity Analysis	
Wood Burner Efficiency	Switching Value for Economic Stumpage Value of Plantation Wood
25%	$19.80/tonne
38%	$36.49/tonne

Source: Feinstein, 1990.

SHORT TERM ACTIONS

RECOMMENDED SHORT TERM ACTIONS FOR THE ONGOING UNDP/OLADE/BME ENERGY SECTOR ASSISTANCE PROJECT

1. The following short-term actions are recommended for inclusion in the UNDP/OLADE/BME Energy Sector Assistance Project as part of project preparation for the energy strategy for households and small businesses:

(a) measure the weighted efficiencies of charcoal kilns in newer charcoal production zones (assistance to BME)

(b) gather and test the different charcoal stove models which have not yet been tested: "Capois" cooker, aluminum improved stove of Michael Williams (BME)

(c) send a mission to the Dominican Republic to analyze inexpensive gas stoves models (BME)

(d) explore the feasibility of cooperative, regional (Latin American) solutions for setting up an LPG import and distribution company in Haiti to compete with the current importer: contacts should be made with the Dominican Republic, Trinidad, Venezuela and Mexico (OLADE assistance to BAPP);

(e) quick poll in secondary cities to determine the utilization rates and the price of cooking fuels, as well as the equipment used;

(f) analyze the possibilities and modalities for promoting improved stoves in secondary towns and cities (possibly in cooperation with AFVP).

STUDY OF THE OPTIONS FOR LPG IMPORTS TO HAITI

Background

1. The Republic of Haiti faces an extremely worrisome problem of deforestation and environmental deterioration which has come about in part due to the use of charcoal in urban centers, especially in the capital.

2. Of the possible interventions which could be made to reduce pressure on the environment caused by urban charcoal consumption, expanding the distribution of LPG should be considered a priority option, for the following reasons:

(a) For the most part, LPG commands a larger potential market among the

middle and well-to-do classes than do other fuels competing with charcoal, such as kerosene (between 27% and 50% of the household market for LPG, versus less than 10% for kerosene).

(b) Taking into account the quantities of gas involved and the importance of protecting the national environment, the projected impact of gas development on external balances (trade balance, balance of payments) appears acceptable even under current (poor) economic circumstances (by the year 2000, purchases of LPG would represent an increase in imports equivalent to 5% of 1989 export levels).

(c) Under current conditions of supply, propane is the least expensive cooking fuel. It also is likely to become the most economic cooking fuel option for the country, as soon as the conditions for supply and distribution have been normalized.

3. In fact, the conditions for supplying LPG to Haiti appear to be skewed. They can be summarized as follows:

(a) purchase and transport prices are substantially higher than international benchmarks,

(b) import and distribution margins are extremely high (combined margins represent 60 to 70% of the LPG retail price).

(c) existing capacity for docking and storage is very reduced (stocks of about two weeks).

4. This situation is due mainly to the lack of a regulatory mechanism for prices, arising from:

(a) the insufficiency of the Government's ability to exercise control over prices, and

(b) inadequate competition between petroleum operators (monopoly situation).

5. For these reasons, one of the components for the household energy strategy in Haïti is to encourage competition in the import and distribution of LPG, along the lines of three possible options:

(a) secure renegotiated terms for the existing operator under a concession agreement (contract-plan) which includes provisions for the price structure and investments,

(b) negotiate an agreement with the Dominican Republic, which currently possesses excess storage capacity. LPG could be re-exported to Haiti from the DR's new terminal at Azua,

(c) create autonomous infrastructure for docking, storage and bottling

near Port-au-Prince.

Objectives

6. The objective of the proposed study is to analyze the short-term and medium-term feasibility of these different options, and thereby recommend to the Haitian Government:

(a) the import option or options most suitable for both the country and the Haitian consumer in terms of price, supply security, etc.

(b) the bottling and distribution options for the "conventional" (propane) and "popular" (butane) markets for gas, relative to the options identified in (a).

(c) the most adequate institutional and financial frameworks for realizing the necessary fixed investments and for operations (import, bottling and distribution), including possible partners, and implementation conditions.

Scope of the Study

7. In association with Haitian counterparts, the consultants should: (i) review the price structure of butane and propane gas; (ii) make a critical evaluation of existing market studies and studies of LPG supply options; and (iii) evaluate the legal and regulatory framework for LPG supply and distribution.

8. On the basis of this analysis, the consultants will establish appropriate contacts with potential LPG suppliers and partners, especially petroleum companies in the following countries:

(a) Dominican Republic

(b) Caribbean and Latin American countries (Venezuela, Trinidad and Tobago, Mexico)

(c) other companies, especially multinationals operating in Haiti or in the Caribbean,

(d) as well as private Haitian operators who are likely to participate in future projects.

9. Subsequent to making these contacts, the consultants and their Haitian counterparts will make joint missions to visit parties who are likely to be interested in LPG import and distribution in Haiti, in order to:

(a) identify the possible operating arrangements with different potential partners and evaluate their degree of interest and potential commitment,

(b) identify and quantify the main parameters, financial and other (risks, for example), linked to the different potential options.

10. Based on the information gathered in Haiti and during the missions, the consultants will prepare a summary report:

(a) describing and evaluating the potential options and frameworks for (i) LPG imports and (ii) LPG distribution.

(b) itemizing and budgeting at least two of the most promising options, and proposing a detailed action program for their implementation,

(c) proposing adequate institutional mechanisms, in particular legal and regulatory aspects.

11. A seminar will then be organized to discuss the recommended option(s) and prepare implementation with relevant institutions, organizations and the private sector.

Organization and Costs

12. The study will be carried out over a six month period. It will be placed under the supervision of the Bureau for Petroleum Product Supply (BAPP) and carried out by a team composed of the following experts:

- an energy economist (ESMAP) for 6 weeks;
- a petroleum expert specializing in LPG import and distribution problems (2.5 months)
- a legal expert specializing in petroleum contract negotiation and institutional aspects (1.5 month).

13. The estimated budget for the study is as follows:

		US$
1.	Consultants	75,000
2.	Travel/Per Diem	30,000
3.	Seminar/training	15,000
4.	ESMAP cost	15,000
5.	Contingencies	15,000
TOTAL		150,000

ECONOMIC COST OF CHARCOAL

HAITI: FORESTRY AND ENVIRONMENTAL PROTECTION PROJECT1/

The Economic Price Range of Charcoal

1. This note briefly presents the results of three methodologies which can be used to calculate the economic price range for charcoal in Haïti. The three methods are: (a) border princing of the nearest substitute fuel (Appendix 1), (b) replacement value pricing (Appendix 2), and (c) marginal environmental cost pricing (Appendix 3). The most conservative approach (border pricing using kerosene as the substitute fuel) yields an economic price for charcoal of $139 per metric ton. By taking the replacement cost of wood based on industrial fuelwood plantations in Haïti, the economic cost of charcoal is $176 per ton. The most broad-reaching approach, incorporating marginal environmental costs, results in an economic valuation of $295 per ton. Thus, the three methodologies result in an economic price range of between $139-295 per ton, or $5.30, 6.70 and 11.20 per 38 kg. sack. Converting this to an economic pric in Haïtian gourdes/sack, the respective values are 37, 47 and 78 gourdes. In comparison with the existing financial price of 41.9 gourdes/sack, the economic price range is 88-186% of the market price.

2. Thus, taken at face value, the economic price range gives no guidance as to the direction that fiscal policy should take in guiding retail charcoal prices. Subjective decisions must be made as to which economic pricing methodology is most appropriate to use in the case of Haïti. Each has its drawbacks and advantages. Border pricing based on the least-cost substitute household fuel (kerosene) is unrealistic as (a) market tests indicate that kerosene is not a prefered fuel for urban Haïti consumers, (b) it is unlikely that a significant number of charcoal users would switch to kerosene, and (c) it is doubtful that the necessary foreign exchange could be made available to pay for massive substitution with an imported fuel. Replacement costing also has its disadvantages: (i) no industrial fuelwood plantations exist in Haïti so the estimated replacement cost of wood is subject to uncertainty and (ii) attempting to replace all wood used for charcoal production from plantations would run up against a number of constraints, e.g. availability of land and other key inputs. The central problem with marginal environmental costing is the paucity of accurate data on key variables such as the rate of soil erosion, the fertilizer value of tree specie and the degree of siltation caused by tree removal in representative deforested areas of the country.

3. Given the limitations of each method, but mindful of the need to arrive at a recommendation regarding economic pricing, a choice should be made as to which approach is most appropriate. The kerosene parity price can be dropped as it is not a real-world option. Replacement pricing is also unrealistic as industrial planting is unlikely to occur on massive scale. However, smallholder tree planting is occurring on a large scale and may be a more reasonable proxy for replacement costs. Based on smallholder reforestation costs, the replacement value of

---

1/ Note prepared by Mr. Josef Leitmann (ESMAP) during the FEPP Appraisal Mission in June 1990.

charcoal is $300/ton (see Appendix 4). Therefore, an appropriate economic value for charcoal in Haïti appears to be in the range of $295-300/ton, i.e., between the environmental and smallholder replacement costs. This implies a target retail price of 78-80 gourdes/sack, or an increase of almost 90% above the present price level.

APPENDIX 1

Parity Price of Least-Cost Substitute Fuel

The parity price of the least-cost substitute fuel is the economic value of the amount of kerosene required to deliver the same amount of energy as charcoal, taking into account the life-cycle costs of cooking equipment. This value is given by the equation:

$$PP = RV_c - RV_c * (LC_c - LC_k)/EC_c$$

where

PP	=	Parity Price
RV_c	=	Replacement Value of Charcoal
	=	$176.40/ton (see Appendix 2)
LC_c	=	Life-cycle Cost of charcoal (improved stove)
	=	$23.02 per delivered GJ
LC_k	=	Life-cycle Cost of kerosene (pressure stove)
	=	$18.25 per delivered GJ
EC_c	=	Energy Cost of charcoal (improved stove)
	=	$22.53 per delivered GJ

By substituting these values into the equation, one arrives at an economic substitute or parity price of $139/ton of charcoal.

APPENDIX 2

Replacement Value of Charcoal

CHARCOAL PRICE BUILD-UP, PORT-AU-PRINCE (REPLACEMENT VALUE) March 1990

	Price (Gourde/bag)a/	Price (US$/tonne)	% of Retail	Economic Conversion Factor	Economic Cost (US$/tonne)
Implied Wood Stumpage	3.7	19.36	9		42.79c/
Labor	6.8	35.56	16	0.36 d/	12.62
Producer's Mar	1.6	8.24	4	0.71 e/	5.85
PRODUCER PRICE at Farm Gate	12.0	63.16	29		61.26
Bag Cost	1.3	6.84	3	0.71 e/	4.86
Transport Tax	1.0	5.26	2		
Transport to Port-au-Prince	6.0	31.58	14	0.93 f/	29.29
Loading/Unload	1.2	6.32	3	0.36 d/	2.24
Intermediary Margins	7.0	36.84	17	0.71 e/	26.16
WHOLESALE PRICE	28.5	150.00	68		123.81
Wholesale Marg	5.6	29.47	13	0.71 e/	20.93
Transport to Neighborhoods	2.2	11.58	5	0.93 f/	10.74
Retail Margin	5.6	29.47	13	0.71 e/	20.93
RETAIL PRICE (sold by sack)	41.9	220.53	100		176.40
Breakdown Marg (-10%)	4.2	22.05		0.71 e/	15.66
RETAIL PRICE (sold in small qty.)	46.1	242.58			192.06

a/ Per sack of 38 kg charcoal.
b/ Transfer payment to government or collection agents.
c/ based on plantation wood @ $5.40/m^3 economic cost (FAO), equivalent to $7.71/tonne (700 kg/m^3). Estimated 5.55 tonnes of wood per tonne of charcoal, based on 20% carbonization efficiency (air-dry basis) and 10% losses in handling and transport.
d/ Based on rural unskilled labor shadow value of 0.5.
e/ 100% local cost.
f/ Based on estimated 75% foreign component.
Source: FAO (1990); Medina (1985); Mission estimates.

APPENDIX 3

Marginal Environmental Value of Charcoal

From a recent analysis of the economic value of wood in Haïti (Hosier and Bernstein, 1989), the marginal opportunity cost of a resource should reflect its long-run marginal value based on both its immediate environmental effects and the needs of future generations. Mathematically, this can be expected as:

$$MOC_r = MC + MEC_i$$

where MOC_r is the marginal opportunity cost of the resource, MC is the direct harvesting costs or marginal costs as normally perceived and MEC_i is the marginal external cost of the good to different sectors.

In this analysis, the harvesting cost (MC) is considered to be equal to the financial price of the woodfuel to the consuming sector. This is currently, at most, 35-50 Gourdes per tonne (US$5-7/tonne). The marginal external contribution of trees to soil improvement (MEC_1) is between US$12-20/TOE or US$4-6/tonne. The on-site contribution of trees to the reduction of soil erosion (MEC_2) is US$45/TOE or US$14/tonne. The off-site contribution of trees to sediment redution is calculated at US$10/TOE or US$3/tonne.

Therefore, the range for the economic value of wood in Haïti can be summed up as follows:

Element	Economic Value (US$/tonne)
MC	5-7
MEC_1 (soil improvement)	4-6
MEC_2 (soil erosion)	14
MEC_3 (sedimentation)	3
MOC_r	26-30

Thus, if no lower-cost environmental damage avoidance measures are available, the economic opportunity of wood on the stump in Haïti can be taken as between US$26-30 per tonne (US$18-21 per m^3).

CHARCOAL PRICE BUILD-UP, PORT-AU-PRINCE (ENVIRONMENTAL) March 1990

	Price (Gourde/bag)a/	Price (US$/tonne)	% of Retail	Economic Conversion Factor	Economic Cost (US$/tonne)
Implied Wood Stumpage	3.7	19.36	9		160.95c/
Labor	6.8	35.56	16	0.36 d/	12.62
Producer's Mar	1.6	8.24	4	0.71 e/	5.85
PRODUCER PRICE at Farm Gate	12.0	63.16	29		179.42
Bag Cost	1.3	6.84	3	0.71 e/	4.86
Transport Tax	1.0	5.26	2		
Transport to Port-au-Prince	6.0	31.58	14	0.93 f/	29.29
Loading/Unload	1.2	6.32	3	0.36 d/	2.24
Intermediary Margins	7.0	36.84	17	0.71 e/	26.16
WHOLESALE PRICE	28.5	150.00	68		241.97
Wholesale Marg	5.6	29.47	13	0.71 e/	20.93
Transport to Neighborhoods	2.2	11.58	5	0.93 f/	10.74
Retail Margin	5.6	29.47	13	0.71 e/	20.93
RETAIL PRICE (sold by sack)	41.9	220.53	100		294.56
Breakdown Marg (-10%)	4.2	22.05		0.71 e/	15.66
RETAIL PRICE (sold in small qty.)	46.1	242.58			310.22

a/ Per sack of 38 kg charcoal.
b/ Transfer payment to government or collection agents.
c/ based on plantation wood @ $19.60/m^3 economic cost (Hosier & Bernstein), equivalent to $29/tonne (700 kg/m^3). Estimated 5.55 tonnes of wood per tonne of charcoal, based on 20% carbonization efficiency (air-dry basis) and 10% losses in handling and transport.
d/ Based on rural unskilled labor shadow value of 0.5.
e/ 100% local cost.
f/ Based on estimated 75% foreign component.
Source: Appendix 2; FAO (1990); Hosier & Bernstein (1989); Mission estimates.

APPENDIX 4

Economic Valuation Based on Smallholder Replacement Costs

CHARCOAL PRICE BUILD-UP, PORT-AU-PRINCE (SMALLHOLDER REFORESTATION)
March 1990

	Price (Gourde/bag)a/	Price (US$/tonne)	% of Retail	Economic Conversion Factor	Economic Cost (US$/tonne)
Implied Wood Stumpage	3.7	19.36	9		160.50c/
Labor	6.8	35.56	16	0.36 d/	12.62
Producer's Mar	1.6	8.24	4	0.71 e/	5.85
PRODUCER PRICE at Farm Gate	12.0	63.16	29		184.97
Bag Cost	1.3	6.84	3	0.71 e/	4.86
Transport Tax	1.0	5.26	2		
Transport to Port-au-Prince	6.0	31.58	14	0.93 f/	29.29
Loading/Unload	1.2	6.32	3	0.36 d/	2.24
Intermediary Margins	7.0	36.84	17	0.71 e/	26.16
WHOLESALE PRICE	28.5	150.00	68		247.52
Wholesale Marg	5.6	29.47	13	0.71 e/	20.93
Transport to Neighborhoods	2.2	11.58	5	0.93 f/	10.74
Retail Margin	5.6	29.47	13	0.71 e/	20.93
RETAIL PRICE (sold by sack)	41.9	220.53	100		300.11
Breakdown Marg (-10%)	4.2	22.05		0.71 e/	15.66
RETAIL PRICE (sold in small qty.)	46.1	242.58			315.77

a/ Per sack of 38 kg charcoal.
b/ Transfer payment to government or collection agents.
c/ Based on smallholder tree planting costs averaging $1.50 per survived tree, with a present value of $30/ton of wood. Estimated 5.55 tonnes of wood per tonne of charcoal, based on 20% carbonization efficiency (air-dry basis) and 10% losses in handling and transport.
d/ Based on rural unskilled labor shadow value of 0.5.
e/ 100% local cost.

REPORTS AND WORK PERFORMED FOR THE STUDY

Consultants' Reports

- Socio-economic aspects and marketing of alternatives for fuel consumption, Christian Bonaparte, May 1990.
- Energy strategy for the residential sector and small businesses. Draft document. Michel Matly. June 1990.
- Woodfuel supply. Calixte Clérismé and Carole Roy. September, 1990.
- Energy demand in the residential sector. Carde Roy. October, 1990.

Field Studies (December 1989 - May 1990)

Residential Consumers in Port-au-Prince

(a) a survey of 400 households

(b) measurements of charcoal consumption in twenty households taken over a week-long period

(c) interviews with eight groups: five groups each representing different socio-economic characteristics; one group consisting of owners of butane stoves; one group of kerosene stove owners, and one group of households not connected to electricity

(d) a census of the types of stoves currently in use

(e) a survey of dietary habits among 150 school students,

(f) marketing demonstrations for cooking equipment given to five groups (66 total participants, 17 men and 49 women).

Non-Residential Consumers in the Capital

(a) a survey of 200 small businesses: 51 bakeries, 53 dry-cleaners, 47 "manjé kwi", 49 restaurants,

(b) individual and group interviews of business leaders in the different industrial categories affected by the strategy.

Firewood and Charcoal Marketing in Port-au-Prince and Other Main Cities

(a) a census of charcoal retail outlets in the capital: 2300 outlets polled

(b) a survey of 205 retail outlets in Port-au-Prince: 175 for charcoal and 30 for firewood

(c) a survey of 101 retail outlets in Cap Haitien, Gonaives and Les Cayes

(d) a canvass of new markets in Port-au-Prince and in some average towns to obtain a sampling (numbering approximately 250) of charcoal prices and weights.

Firewood and Charcoal Production and Supply Networks

(a) a count of the number of charcoal shipments entering Port-au-Prince during one week in February 1990.

(b) a survey of 100 transporters: 90 charcoal transporters and 10 firewood transporters

(c) a survey of 67 rural charcoal and firewood merchants in the north, northeast, the Artibonite and the south.

(d) a survey of 90 charcoal producers in the same areas,

(e) in-depth interviews with 10 district forestry agents.

BUDGET DES COMPOSANTES DE LA STRATEGIE

HAITI
FORESTRY AND ENVIRONMENTAL PROTECTION PROJECT
HOUSEHOLD ENERGY CONSERVATION SUB-PROJECT
TABLE 1: SUB-PROJECT BUDGET BY COMPONENT

COMPONENT/COST	1991/2 G	1991/2 US$	1992/3 G	1992/3 US$	1993/4 G	1993/4 US$	TOTAL G	TOTAL US$
A. NEW PRODUCT DEVELOPMENT								
Cookstove Expert (3 months)		36					0	36
Laboratory equipment		1					0	1
Prototype development	3						3	0
Consumer testing	3						3	0
Sub-total	6	37	0	0	0	0	6	37
B. ARTISANAL TRAINING (NGO CONTRACT)								
Preparation of training material	5						5	0
Rental of training sites (10x)	8		2				10	0
Per diem for trainees (30G/day)	62		10				72	0
Trainer salaries (300G/session)	4		1				5	0
Tool kits ($30/kit)		9		3				12
Templates (2/artisan * 30G)	18		6				23	0
Metal and rivets (460 stoves)		1		0			0	1
Training Coordinator (15000/m)	14		14				27	0
Miscellaneous	2		1				3	0
Overhead (15%)	17	2	5	0			22	2
Sub-total	129	12	38	4			167	15
C. PUBLICITY CAMPAIGN (PR FIRM CONTRACT)								
Campaign Coordinator (2500G/m)	25		30				55	0
Van		20					0	20
Van operational costs	5	3	5	3			10	6
Neighborhood demonstrations (20)	10		10				20	0
Billboards (18 m x 30)	180		360				540	0
Contests	15						15	0
TV and radio spots	200		400				600	0
T-shirts and decals ($3000)	60		90				150	0
Miscellaneous	50		100				150	0
Overhead (15%)	82	3	149	0			231	4
Sub-total	627	26	1144	3			1771	30
D. MONITORING AND EVALUATION (NGO CONTRACT)								
Monitoring Coordinator (2000G/m)	16		24		24		64	0
PAP Quality Controller (1000G/m)	8		12		12		32	0
Secondary Quality Controller	8		12		12		32	0
Transport & per diem	4		6		6		16	0
Statistician (1500G/m)	12		18		18		48	0
Initial consumer survey	23						23	0
Quality control labels (65K)	10		40		80		130	0
Office equipment		10					0	10
Miscellaneous	13		20		20		53	0
Overhead (15%)	14	2	20	0	26		60	2
Sub-total	108	12	152	0	198		458	12
E. INSTITUTIONAL STRENGTHENING (SME)								
Training/study tour		10					0	10
4x4 vehicle		20					0	20
Vehicle operational costs	3	2	3	2	3	2	8	5
Energy Economist (1500G/m)	18		18		18		54	0
Administrative Asst. (1000G/m)	12		12		12		36	0
Driver (750G/m)	9		9		9		27	0
Sub-total	42	32	42	2	42	2	125	35
F. ESMAP SUPERVISION								
Task manager (20 weeks)		14		14		18		46
Travel and per diem (5 trips)		4		2		4		10
Secretarial support		2		2		3		7
Report translation						5		5
Sub-total		20		18		30		68
TOTAL	911	138	1376	27	239	32	2526	196
PHYSICAL CONTINGENCIES (10%)	91	14	138	3	24	3	253	20
PRICE CONTINGENCIES (20%)	182	28	275	5	48	6	505	39
GRAND TOTAL	1183	179	1788	34	311	41	3284	255

HAITI FORESTRY AND ENVIRONMENTAL PROTECTION PROJECT
HOUSEHOLD ENERGY CONSERVATION SUBPROJECT
FIGURE 1: IMPLEMENTATION SCHEDULE

Project year	1991/2				1992/3				1993/4			
Calendar year	91	><			1992	><			1993	><		
Item/Action												
(a) New Product Development												
Rehabilitation of BME laboratory	X=>											
Efficiency testing of rechaud	X=>											
Evaluation of artisanal production system	X=>											
Prototype development	X=>											
Consumer acceptability testing	X=>											
Re-design (if necessary)	X=>											
(b) Artisanal Training												
NGO identification, selection, contracting	X=>											
Design of training materials	X=>											
Recruitment of trainers & trainees	X=>											
Training:												
Port-au-Prince stovemakers	X=>	X=>		X=>		X=>						
Port-au-Prince ironworkers		X=>	X=>		X=>							
Secondary city stovemakers		X=>	X=>									
Secondary city ironworkers			X=>									
Evaluation/re-design of curriculum	X=>											
Additional training as necessary						X=>						
Contract evaluation/re-negotiation			X=>									
(c) Publicity and Education Campaigns												
PR firm identification, selection, contracting	X=>											
Design of campaigns	X=>											
Implementation of campaigns		X=>										
Contract evaluation/re-negotiation			X=>									
Continued/re-designed campaign						X=>						
(d) Monitoring and Evaluation												
NGO identification, selection, contracting	X=>											
Initial consumer survey		X=>										
Quality control program		X=>				X=>				X=>		
Quarterly reporting		X=>	X=>			X=>X=>X=>X=>				X=>X=>X=>X=>		
Mid-term evaluation report						X=>						
Final evaluation report											X=>	
Contract evaluation/re-negotiation			X=>				X=>					
(e) Management Information												
Recruitment of Cookstove Expert	X=>											
Cookstove Expert consultancy		X=>										
NGO training contract (18 months)		X=>				X=>						
PR firm publicity contract (22 months)		X=>				X=>						
NGO monitoring contract (32 months)		X=>				X=>				X=>		
Energy Economist (36 months)	X=>					X=>				X=>		
Other BME staff (36 months x 2)	X=>					X=>				X=>		
BME training/study tour	X=>											
Vehicle procurement	X=>											

NB: Each "=" represents all or part of one calendar month

Tableau 2: BUDGET DETAILLE DE LA COMPOSANTE D'OUVERTURE DU MARCHE DU GAZ

Composante/Cout (x1000)	1992 G	1992 US$	1993 G	1993 US$	1994 G	1994 US$	TOTAL G	TOTAL US$
Etude options developpement		86						86
Appui au BAPP	70	70	55	75	55	45	180	190
Assistance tech. intern. (6 mois)		30		60		30		120
Deplacements/Missions	10	10	10	5	10	5	30	20
Formation	25	10	10	5	10	5	45	20
Economiste petrolier (3000G/m)	35		35		35		105	
Equipements		20		5		5		30
Investissements	125	125	125	125	3100	5080	3350	5330
Ingenierie	125	125	125	125			250	250
Genie civil					2500	600	2500	600
Mise a quai					75	280	75	280
Stockage					500	1600	500	1600
Embouteillage					25	100	25	100
Parc bouteilles						2500		2500
Total	195	281	180	200	3155	5125	3530	5606
Imprevus (20%)	39	56	36	40	631	1025	706	1121
Grand Total	234	337	216	240	3786	6150	4236	6727

Tableau 3: BUDGET DE LA COMPOSANTE DE MODERNISATION DU SECTEUR CHARBONNIER

(1000 US$)	Local	Devises	Total	91/92	92/93	93/94	Total
CELLULE COMBUSTIBLES LIGNEUX							
Personnel							
Responsable	24	0	24	8	8	8	24
Forestier	18	0	18	6	6	6	18
Agroeconomiste	18	0	18	6	6	6	18
Sociologue	18	0	18	6	6	6	18
Cartographe	18	0	18	6	6	6	18
Personnel administratif	60	0	60	20	20	20	60
Equipement							
3 vehicules	0	50	50	50	0	0	50
Ordinateurs/Materiel bureau	0	30	30	30	0	0	30
Fonctionnement	50	40	90	30	30	30	90
Deplacements	30	0	30	10	10	10	30
SCHEMA DIRECTEUR/AMELIORATION DU CONTROLE							
Construction/modification points controle	150	50	200	0	0	200	200
ATCT exterieure	0	75	75	50	25	0	75
ATCT haitienne	100	0	100	50	30	20	100
DEFINITION PROGRAMME COMPENSATION							
2 Sociologues	24	0	24	0	12	12	24
2 Agronomes	24	0	24	0	12	12	24
ATCT exterieure	0	50	50	0	25	25	50
ATCT haitienne	100	0	100	0	50	50	100
APPUI TECHNIQUE AUX CHARBONNIERS							
Forestier	18	0	18	6	6	6	18
Chef formation	12	0	12	4	4	4	12
10 Animateurs	45	0	45	15	15	15	45
ATCT formation	80	0	80	40	20	20	80
ATCT gestion	80	60	140	60	40	40	140
Fonds de roulement	10	0	10	5	5	0	10
Total	879	355	1234	402	336	496	1234
Imprevus	88	36	123	40	34	50	123
Grand total	967	391	1357	442	370	546	1357

Tableau 4: BUDGET DE LA COMPOSANTE DE PILOTAGE DE LA STRATEGIE

(1000 US$)	Local	Devises	Total	91/92	92/93	93/94	Total
Personnel							
Responsable	24	0	24	8	8	8	24
Forestier	18	0	18	6	6	6	18
Economiste	18	0	18	6	6	6	18
Pers. administratif	48	0	48	16	16	16	48
AT long terme	60	300	360	120	120	120	360
AT court terme locale	60	0	60	20	20	20	60
Formation/Promotion	10	35	45	15	15	15	45
Equipement							
2 vehicules	0	34	34	34	0	0	34
Ordi./bureau	0	16	16	16	0	0	16
Fonctionnement	25	50	75	25	25	25	75
Total	263	435	698	266	216	216	698
Imprevus (10%)	26	44	70	27	22	22	70
Grand total	289	479	768	293	238	238	768

ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME

COMPLETED ACTIVITIES

Country	*Activity*	*Date*	*Number*
	SUB-SAHARAN AFRICA (AFR)		
Africa Regional	Anglophone Africa Household Energy Workshop	07/88	085/88
	Regional Power Seminar on Reducing Electric Power System Losses in Africa	08/88	087/88
	Institutional Evaluation of EGL	02/89	098/89
	Biomass Mapping Regional Workshops	05/89	--
	Francophone Household Energy Workshop	08/89	103/89
	Interafrican Electrical Engineering College: Proposals for Short- and Long-Term Development	03/90	112/90
	Biomass Assessment and Mapping	03/90	--
Angola	Energy Assessment	05/89	4708-ANG
	Power Rehabilitation and Technical Assistance	10/91	142/91
Benin	Energy Assessment	06/85	5222-BEN
Botswana	Energy Assessment	09/84	4998-BT
	Pump Electrification Prefeasibility Study	01/86	047/86
	Review of Electricity Service Connection Policy	07/87	071/87
	Tuli Block Farms Electrification Study	07/87	072/87
	Household Energy Issues Study	02/88	--
	Urban Household Energy Strategy Study	05/91	132/91
Burkina Faso	Energy Assessment	01/86	5730-BUR
	Technical Assistance Program	03/86	052/86
	Urban Household Energy Strategy Study	06/91	134/91
Burundi	Energy Assessment	06/82	3778-BU
	Petroleum Supply Management	01/84	012/84
	Status Report	02/84	011/84
	Presentation of Energy Projects for the Fourth Five-Year Plan (1983-1987)	05/85	036/85
	Improved Charcoal Cookstove Strategy	09/85	042/85
	Peat Utilization Project	11/85	046/85
	Energy Assessment	01/92	9215-BU
Cape Verde	Energy Assessment	08/84	5073-CV
	Household Energy Strategy Study	02/90	110/90
Comoros	Energy Assessment	01/88	7104-COM
Congo	Energy Assessment	01/88	6420-COB
	Power Development Plan	03/90	106/90
Côte d'Ivoire	Energy Assessment	04/85	5250-IVC
	Improved Biomass Utilization	04/87	069/87
	Power System Efficiency Study	12/87	--
	Power Sector Efficiency Study (French)	02/92	141/91
Ethiopia	Energy Assessment	07/84	4741-ET
	Power System Efficiency Study	10/85	045/85
	Agricultural Residue Briquetting Pilot Project	12/86	062/86
	Bagasse Study	12/86	063/86
	Cooking Efficiency Project	12/87	--

Country	*Activity*	*Date*	*Number*
Gabon	Energy Assessment	07/88	6915-GA
The Gambia	Energy Assessment	11/83	4743-GM
	Solar Water Heating Retrofit Project	02/85	030/85
	Solar Photovoltaic Applications	03/85	032/85
	Petroleum Supply Management Assistance	04/85	035/85
Ghana	Energy Assessment	11/86	6234-GH
	Energy Rationalization in the Industrial Sector	06/88	084/88
	Sawmill Residues Utilization Study	11/88	074/87
Guinea	Energy Assessment	11/86	6137-GUI
Guinea-Bissau	Energy Assessment	08/84	5083-GUB
	Recommended Technical Assistance Projects	04/85	033/85
	Management Options for the Electric Power and Water Supply Subsectors	02/90	100/90
	Power and Water Institutional Restructuring (French)	04/91	118/91
Kenya	Energy Assessment	05/82	3800-KE
	Power System Efficiency Study	03/84	014/84
	Status Report	05/84	016/84
	Coal Conversion Action Plan	02/87	--
	Solar Water Heating Study	02/87	066/87
	Peri-Urban Woodfuel Development	10/87	076/87
	Power Master Plan	11/87	--
Lesotho	Energy Assessment	01/84	4676-LSO
Liberia	Energy Assessment	12/84	5279-LBR
	Recommended Technical Assistance Projects	06/85	038/85
	Power System Efficiency Study	12/87	081/87
Madagascar	Energy Assessment	01/87	5700-MAG
	Power System Efficiency Study	12/87	075/87
Malawi	Energy Assessment	08/82	3903-MAL
	Technical Assistance to Improve the Efficiency of Fuelwood Use in the Tobacco Industry	11/83	009/83
	Status Report	01/84	013/84
Mali	Energy Assessment (French)	11/91	8423-MLI
Islamic Republic of Mauritania	Energy Assessment	04/85	5224-MAU
	Household Energy Strategy Study	07/90	123/90
Mauritius	Energy Assessment	12/81	3510-MAS
	Status Report	10/83	008/83
	Power System Efficiency Audit	05/87	070/87
	Bagasse Power Potential	10/87	077/87
Mozambique	Energy Assessment	01/87	6128-MOZ
	Household Electricity Utilization Study	03/90	113/90
Niger	Energy Assessment	05/84	4642-NIR
	Status Report	02/86	051/86
	Improved Stoves Project	12/87	080/87
	Household Energy Conservation and Substitution	01/88	082/88
Nigeria	Energy Assessment	08/83	4440-UNI
Rwanda	Energy Assessment	06/82	3779-RW
	Energy Assessment (English and French)	07/91	8017-RW
	Status Report	05/84	017/84
	Improved Charcoal Cookstove Strategy	08/86	059/86
	Improved Charcoal Production Techniques	02/87	065/87

Country	*Activity*	*Date*	*Number*
Rwanda	Commercialization of Improved Charcoal Stoves and Carbonization Techniques Mid-Term Progress Report	12/91	141/91
SADCC	SADCC Regional Sector: Regional Capacity-Building Program for Energy Surveys and Policy Analysis	11/91	--
Sao Tome and Principe	Energy Assessment	10/85	5803-STP
Senegal	Energy Assessment	07/83	4182-SE
	Status Report	10/84	025/84
	Industrial Energy Conservation Study	05/85	037/85
	Preparatory Assistance for Donor Meeting	04/86	056/86
	Urban Household Energy Strategy	02/89	096/89
Seychelles	Energy Assessment	01/84	4693-SEY
	Electric Power System Efficiency Study	08/84	021/84
Sierra Leone	Energy Assessment	10/87	6597-SL
Somalia	Energy Assessment	12/85	5796-SO
Sudan	Management Assistance to the Ministry of Energy and Mining	05/83	003/83
	Energy Assessment	07/83	4511-SU
	Power System Efficiency Study	06/84	018/84
	Status Report	11/84	026/84
	Wood Energy/Forestry Feasibility	07/87	073/87
Swaziland	Energy Assessment	02/87	6262-SW
Tanzania	Energy Assessment	11/84	4969-TA
	Peri-Urban Woodfuels Feasibility Study	08/88	086/88
	Tobacco Curing Efficiency Study	05/89	102/89
	Remote Sensing and Mapping of Woodlands	06/90	--
	Industrial Energy Efficiency Technical Assistance	08/90	122/90
Togo	Energy Assessment	06/85	5221-TO
	Wood Recovery in the Nangbeto Lake	04/86	055/86
	Power Efficiency Improvement	12/87	078/87
Uganda	Energy Assessment	07/83	4453-UG
	Status Report	08/84	020/84
	Institutional Review of the Energy Sector	01/85	029/85
	Energy Efficiency in Tobacco Curing Industry	02/86	049/86
	Fuelwood/Forestry Feasibility Study	03/86	053/86
	Power System Efficiency Study	12/88	092/88
	Energy Efficiency Improvement in the Brick and Tile Industry	02/89	097/89
	Tobacco Curing Pilot Project	03/89	UNDP Terminal Report
Zaire	Energy Assessment	05/86	5837-ZR
Zambia	Energy Assessment	01/83	4110-ZA
	Status Report	08/85	039/85
	Energy Sector Institutional Review	11/86	060/86
	Power Subsector Efficiency Study	02/89	093/88
	Energy Strategy Study	02/89	094/88
	Urban Household Energy Strategy Study	08/90	121/90
Zimbabwe	Energy Assessment	06/82	3765-ZIM
	Power System Efficiency Study	06/83	005/83
	Status Report	08/84	019/84
	Power Sector Management Assistance Project	04/85	034/85
	Petroleum Management Assistance	12/89	109/89

Country	*Activity*	*Date*	*Number*
Zimbabwe	Power Sector Management Institution Building	09/89	--
	Charcoal Utilization Prefeasibility Study	06/90	119/90
	Integrated Energy Strategy Evaluation	01/92	8768-ZIM
	EAST ASIA AND PACIFIC (EAP)		
Asia Regional	Pacific Household and Rural Energy Seminar	11/90	--
China	County-Level Rural Energy Assessments	05/89	101/89
	Fuelwood Forestry Preinvestment Study	12/89	105/89
Fiji	Energy Assessment	06/83	4462-FIJ
Indonesia	Energy Assessment	11/81	3543-IND
	Status Report	09/84	022/84
	Power Generation Efficiency Study	02/86	050/86
	Energy Efficiency in the Brick, Tile and Lime Industries	04/87	067/87
	Diesel Generating Plant Efficiency Study	12/88	095/88
	Urban Household Energy Strategy Study	02/90	107/90
	Biomass Gasifier Preinvestment Study Vols. I & II	12/90	124/90
Malaysia	Sabah Power System Efficiency Study	03/87	068/87
	Gas Utilization Study	09/91	9645-MA
Myanmar	Energy Assessment	06/85	5416-BA
Papua New Guinea	Energy Assessment	06/82	3882-PNG
	Status Report	07/83	006/83
	Energy Strategy Paper	--	--
	Institutional Review in the Energy Sector	10/84	023/84
	Power Tariff Study	10/84	024/84
Solomon Islands	Energy Assessment	06/83	4404-SOL
South Pacific	Petroleum Transport in the South Pacific	05/86	--
Thailand	Energy Assessment	09/85	5793-TH
	Rural Energy Issues and Options	09/85	044/85
	Accelerated Dissemination of Improved Stoves and Charcoal Kilns	09/87	079/87
	Northeast Region Village Forestry and Woodfuels Preinvestment Study	02/88	083/88
	Impact of Lower Oil Prices	08/88	--
	Coal Development and Utilization Study	10/89	--
Tonga	Energy Assessment	06/85	5498-TON
Vanuatu	Energy Assessment	06/85	5577-VA
Western Samoa	Energy Assessment	06/85	5497-WSO
	SOUTH ASIA (SAS)		
Bangladesh	Energy Assessment	10/82	3873-BD
	Priority Investment Program	05/83	002/83
	Status Report	04/84	015/84
	Power System Efficiency Study	02/85	031/85
	Small Scale Uses of Gas Prefeasibility Study	12/88	--

Country	*Activity*	*Date*	*Number*
India	Opportunities for Commercialization of Nonconventional Energy Systems	11/88	091/88
	Maharashtra Bagasse Energy Efficiency Project	05/91	120/91
	Mini-Hydro Development on Irrigation Dams and Canal Drops Vols. I, II and III	07/91	139/91
Nepal	Energy Assessment	08/83	4474-NEP
	Status Report	01/85	028/84
Pakistan	Household Energy Assessment	05/88	--
	Assessment of Photovoltaic Programs, Applications, and Markets	10/89	103/89
Sri Lanka	Energy Assessment	05/82	3792-CE
	Power System Loss Reduction Study	07/83	007/83
	Status Report	01/84	010/84
	Industrial Energy Conservation Study	03/86	054/86
	EUROPE AND CENTRAL ASIA (ECA)		
Portugal	Energy Assessment	04/84	4824-PO
Turkey	Energy Assessment	03/83	3877-TU
	MIDDLE EAST AND NORTH AFRICA (MNA)		
Morocco	Energy Assessment	03/84	4157-MOR
	Status Report	01/86	048/86
Syria	Energy Assessment	05/86	5822-SYR
	Electric Power Efficiency Study	09/88	089/88
	Energy Efficiency Improvement in the Cement Sector	04/89	099/89
	Energy Efficiency Improvement in the Fertilizer Sector	06/90	115/90
Tunisia	Fuel Substitution	03/90	--
Yemen	Energy Assessment	12/84	4892-YAR
	Energy Investment Priorities	02/87	6376-YAR
	Household Energy Strategy Study Phase I	03/91	126/91
	LATIN AMERICA AND THE CARIBBEAN (LAC)		
LAC Regional	Regional Seminar on Electric Power System Loss Reduction in the Caribbean	07/89	--
Bolivia	Energy Assessment	04/83	4213-BO
	National Energy Plan	12/87	--
	National Energy Plan (Spanish)	08/91	131/91
	La Paz Private Power Technical Assistance	11/90	111/90
	Natural Gas Distribution: Economics and Regulation	01/92	125/92
	Prefeasibility Evaluation Rural Electrification and Demand Assessment	04/91	129/91
Chile	Energy Sector Review	08/88	7129-CH
Colombia	Energy Strategy Paper	12/86	--
Costa Rica	Energy Assessment	01/84	4655-CR
	Recommended Technical Assistance Projects	11/84	027/84
	Forest Residues Utilization Study	02/90	108/90

Country	*Activity*	*Date*	*Number*
Dominican Republic	Energy Assessment	05/91	8234-DO
Ecuador	Energy Assessment	12/85	5865-EC
	Energy Strategy Phase I	07/88	--
	Energy Strategy	04/91	--
Haiti	Energy Assessment	06/82	3672-HA
	Status Report	08/85	041/85
Honduras	Energy Assessment	08/87	6476-HO
	Petroleum Supply Management	03/91	128/91
Jamaica	Energy Assessment	04/85	5466-JM
	Petroleum Procurement, Refining, and Distribution Study	11/86	061/86
	Energy Efficiency Building Code Phase I	03/88	--
	Energy Efficiency Standards and Labels Phase I	03/88	--
	Management Information System Phase I	03/88	--
	Charcoal Production Project	09/88	090/88
	FIDCO Sawmill Residues Utilization Study	09/88	088/88
Mexico	Improved Charcoal Production Within Forest Management for the State of Veracruz	08/91	138/91
Panama	Power System Efficiency Study	06/83	004/83
Paraguay	Energy Assessment	10/84	5145-PA
	Recommended Technical Assistance Projects	09/85	--
	Status Report	09/85	043/85
Peru	Energy Assessment	01/84	4677-PE
	Status Report	08/85	040/85
	Proposal for a Stove Dissemination Program in the Sierra	02/87	064/87
	Energy Strategy	12/90	--
Saint Lucia	Energy Assessment	09/84	5111-SLU
St. Vincent and the Grenadines	Energy Assessment	09/84	5103-STV
Trinidad and Tobago	Energy Assessment	12/85	5930-TR

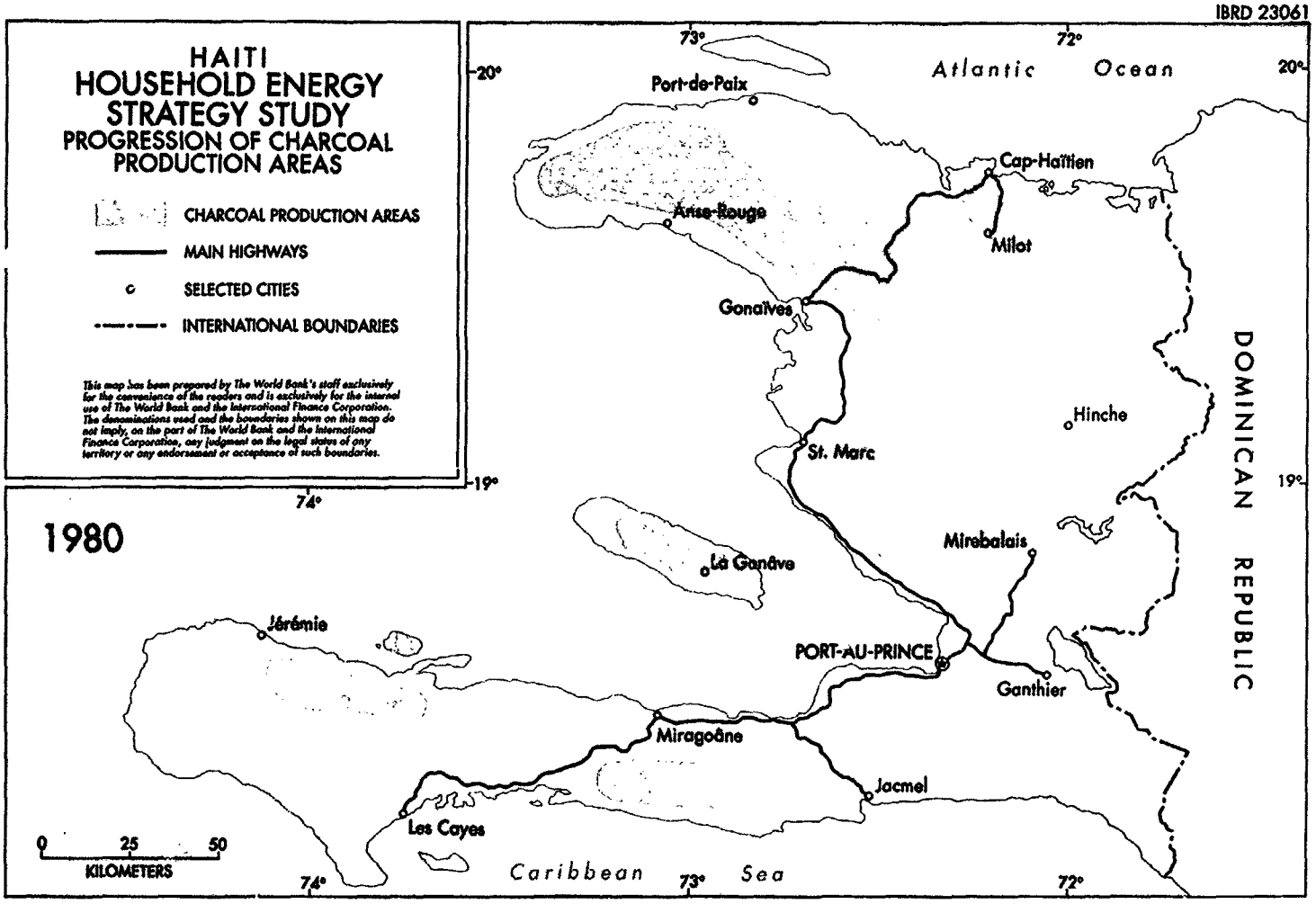
GLOBAL

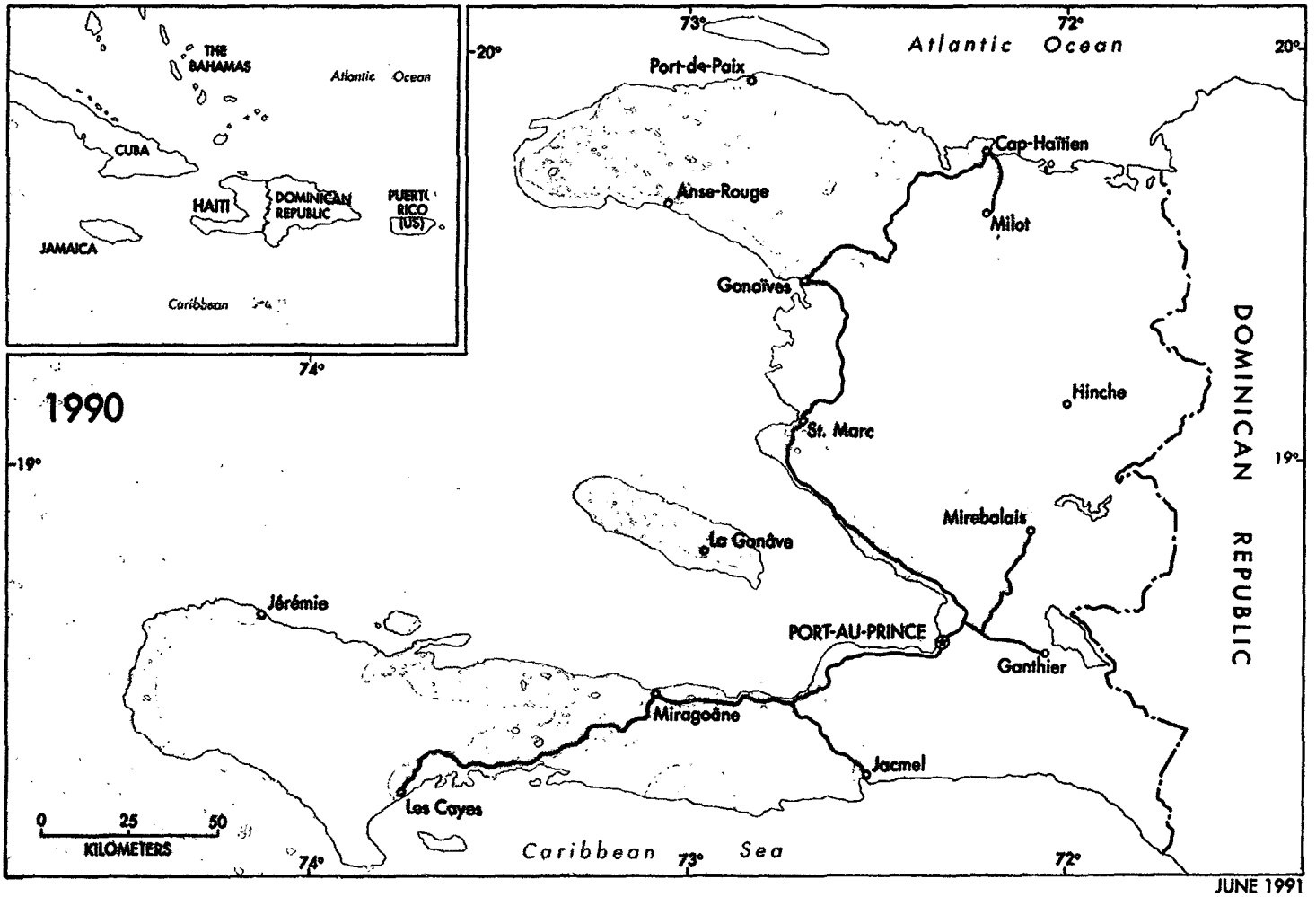
Energy End Use Efficiency: Research and Strategy	11/89	--
Guidelines for Utility Customer Management and Metering (English and Spanish)	07/91	--
Women and Energy--A Resource Guide		
The International Network: Policies and Experience	04/90	--
Assessment of Personal Computer Models for Energy Planning in Developing Countries	10/91	--

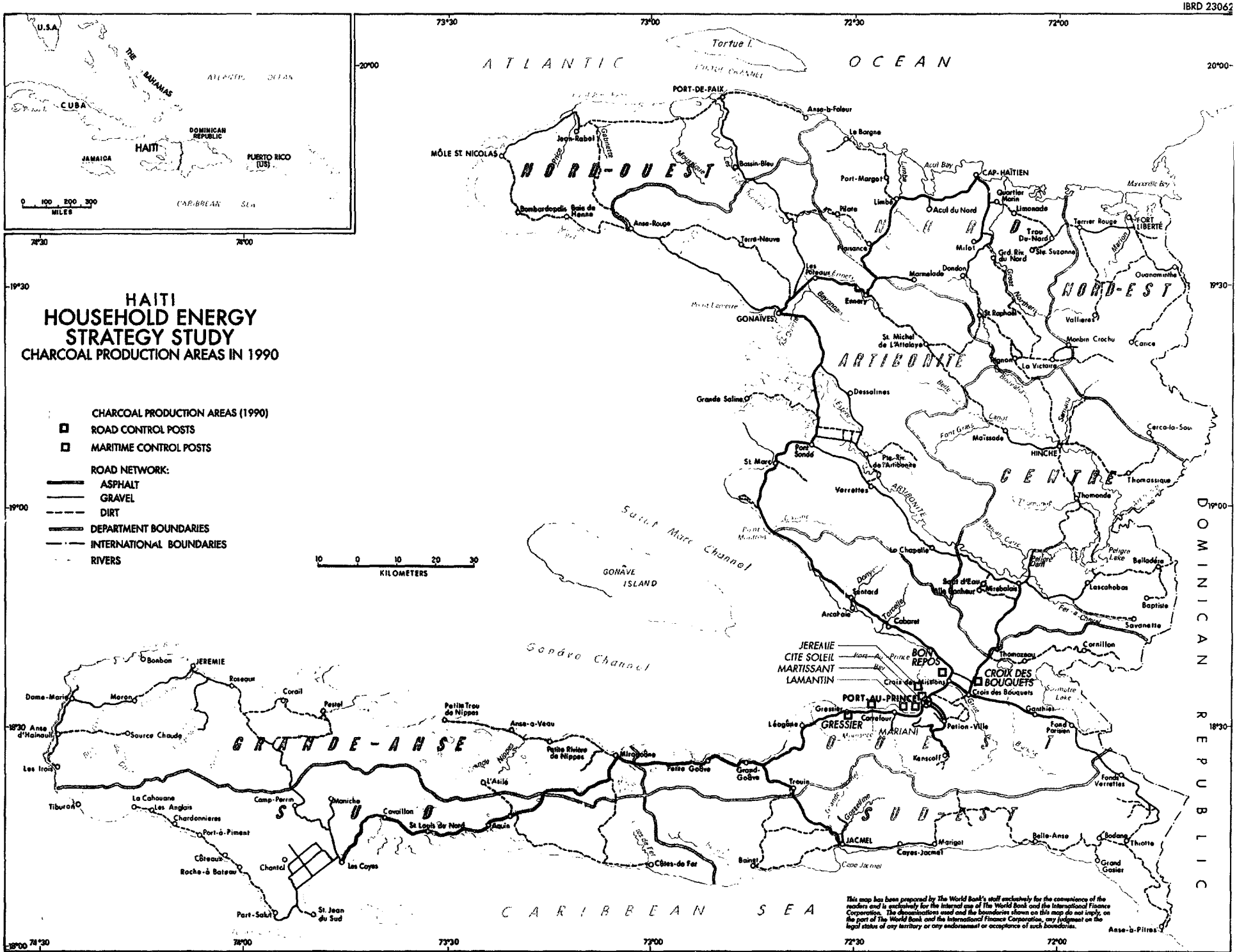
HAITI
HOUSEHOLD ENERGY STRATEGY STUDY
PROGRESSION OF CHARCOAL PRODUCTION AREAS

CHARCOAL PRODUCTION AREAS
MAIN HIGHWAYS
SELECTED CITIES
INTERNATIONAL BOUNDARIES

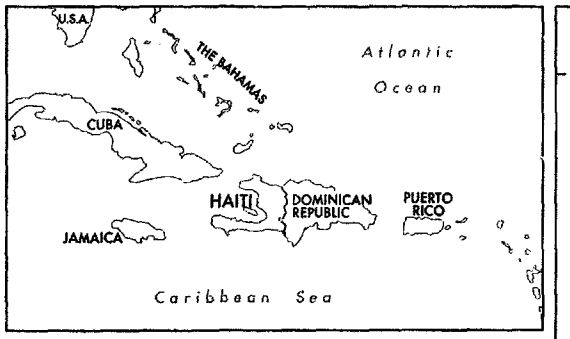
This map has been prepared by The World Bank's staff exclusively for the convenience of the readers and is exclusively for the internal use of The World Bank and the International Finance Corporation. The denominations used and the boundaries shown on this map do not imply, on the part of The World Bank and the International Finance Corporation, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.






HAITI
HOUSEHOLD ENERGY
STRATEGY STUDY
CHARCOAL PRODUCTION AREAS IN 1990
CHARCOAL PRODUCTION AREAS (1990)
ROAD CONTROL POSTS
MARITIME CONTROL POSTS
ROAD NETWORK:
ASPHALT
GRAVEL
DIRT
DEPARTMENT BOUNDARIES
INTERNATIONAL BOUNDARIES
RIVERS
KILOMETERS
MILES
U.S.A.
CUBA
JAMAICA
HAITI
DOMINICAN REPUBLIC
PUERTO RICO (US)
THE BAHAMAS
ATLANTIC OCEAN
CARIBBEAN SEA
ATLANTIC OCEAN
Tortue I.
PORT-DE-PAIX
Anse-à-Foleur
MÔLE ST NICOLAS
Jean-Rabel
Gosseline
Bombardopolis
Baie de Henne
Anse-Rouge
Terre-Neuve
Bassin-Bleu
Le Borgne
Port-Margot
Pilate
Limbé
Acul du Nord
CAP-HAITIEN
Quartier Morin
Limonade
Trou-Du-Nord
Terrier Rouge
FORT LIBERTÉ
Ste. Suzanne
Grd. Riv. du Nord
Mifot
Plaisance
Les Poteaux
Marmelade
Dondon
Ouanaminthe
Vallières
Monbin Crochu
Carice
St Raphaël
Esmery
GONAÏVES
St Michel de L'Attalaye
Hinche
La Victoire
Dessalines
Grande Saline
Pont Sondé
St Marc
Pte.-St. de l'Artibonite
Verrettes
Maïssade
Cerca-la-Source
Thomassique
Thomonde
Lascahobas
Belladère
Baptiste
Savanette
Cornillon
Arcahaie
Cabaret
Le Chapelle
Mirebalais
Saut d'Eau
Ville Bonheur
Petite Rivière de Nippes
Petit Trou de Nippes
Anse-à-Veau
Miragoâne
Petite Goâve
Grand-Goâve
Léogâne
Gressier
Carrefour
PORT-AU-PRINCE
Croix-des-Missions
Croix des Bouquets
Ganthier
Fond Parisien
Petion-Ville
Kenscoff
Fonds Verrettes
Trouin
JACMEL
Cayes-Jacmel
Marigot
Belle-Anse
Bodarie
Thiotte
Grand Gosier
Côtes-de Fer
Bainet
Les Cayes
Chantal
Camp-Perrin
Manicha
Cavaillon
St Louis du Nord
Aquin
Port-à-Piment
Chardonnieres
Les Anglais
La Cahouane
Tiburon
Roche-à Bateau
Côteaux
Port-Salut
St. Jean du Sud
Les Irois
Anse d'Hainault
Dame-Marie
Bonbon
JEREMIE
Roseaux
Moron
Corail
Pestel
Source Chaude
JEREMIE
CITE SOLEIL
MARTISSANT
LAMANTIN
BON REPOS
CROIX DES BOUQUETS
GRESSIER
MARIANI
GRANDE-ANSE
SUD
OUEST
SUD-EST
NORD-OUEST
NORD
NORD-EST
ARTIBONITE
CENTRE
DOMINICAN REPUBLIC
Gonâve Channel
Saint Marc Channel
GONÂVE ISLAND
Port-au-Prince Bay
Anse-à-Pitres
This map has been prepared by The World Bank's staff exclusively for the convenience of the readers and is exclusively for the internal use of The World Bank and the International Finance Corporation. The denominations used and the boundaries shown on this map do not imply, on the part of The World Bank and the International Finance Corporation, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.

IBRD 22676



HAITI
FORESTRY AND ENVIRONMENTAL PROTECTION PROJECT
PRINCIPAL FOREST RESOURCES

- Pine Forest
- Open Pine Forest
- Broad-leaf Forest
- Remnants of Broad-leaf Forest and of Coffee
- Coffee and/or Dense Tree Crops
- Degraded Dry Forest and Shrubs
- Mangroves

- Average Annual Rainfall in Millimeters
- Rivers
- Main Highways
- Secondary Roads
- Tertiary Roads
- International Boundaries

KILOMETERS 0 10 20 30 40 50
MILES 0 10 20 30

NOVEMBER 1990