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Access to Energy for the Urban Poor

The Malian Case

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1. Terms of Reference

Main objective of this study is to identify key issues which have to be addressed in order for the poor urban communities to access higher grades and more sustainable forms of energy.

Output of the case study should cover
a) a description of the current status of poverty and access to energy in Mali
b) between 5 and 10 detailed case examples of actual cases
c) conclusions and recommendations from the case study experiences

Case Study Requirements
The report is to produce detailed case examples which inform the larger project, so that project recommendations are based on real examples, and which should concentrate on:

- Access to Energy
- Cooking fuels and technologies

Cross-cutting themes to be considered in all cases are:

- Energy-service provision
- Economics of urban energy
- Health and Environment

It is intended that the case studies cover the technical, socio-economic, legal and environmental problems and opportunities. The cases may illustrate successes or failures of particular initiatives and should identify key stakeholders and their role in the energy scheme. In some cases the interface with rural areas may also be addressed.
The case studies may be based around
* a particular location or community
* implementation of a particular technology
* a particular energy need
* a particular policy or strategy
* a particular funding policy
* a multi-national or bilateral initiative
* ownership and management models
* community participation

2. Summary

1. The population of Mali totals about 8 million of whom about 2 million live in towns of over 30,000 inhabitants, 1.2 million in the capital of Bamako and surrounding agglomerations (e.g.Kati). Most of the other urban settlements - see map - do not exceed 100,000 inhabitants. Mali's degree of urbanization thus approaches 25% and therefore the country is essentially rural by Western definitions of urbanization. However, compared to the rest of sub=Saharan Africa many of Mali's urban settlements are quite old some having a millenarian tradition.

2.Urban poverty is something new arising from the disjunction of a traditional social system where people like artisans and laborers were dependant and provided for by a class of free farmers and warriors for whom they worked. Rural-urban migration has increased after the coup against the former government and the revolt in the north so that squatting can no longer be controlled.

3. The household energy sector is characterized by the predominance of wood as major cooking and heating fuel which provides ninety one per cent of the energy requirements of households. See Table 1 and 2.

4. Malian urban households operate under a severe budget constraint, which limits also its energy use and make it opt for the cheapest forms of energy, wood and charcoal. While a kilogramm of wood costs 21 FCFA, charcoal is available at 60 FCFA per kilo. Lamp kerosene, gas, fuel and batteries come in third and fourth position in the household budget for such uses as lighting, heating, transport by motocycle and operation of radios, torches and television.

5. Budget constraints and lack of concrete information about saving potentials are among the major factors responsible for the slow adoption of energy-saving equipment, financial reasons being more prominent. Absence of any form of consumer credit e.g. possibility of payment in installments, also restricts the greater diffusion of energy conservation equipment in households and the informal artisan and processing sector.

6. Continued publicity and awareness creation about energy waste, especially of the most commonly used Fourneau Malgache are necessary to alleviate the urban poors' budget constraint; partial subsidies for certain types of equipment in the form of instalment arrangements and for development and testing of energy-saving equipment appear useful; concentration on those poor in the informal and semi-commercial sectors who derive their income from cooking and food processing would induce further fuel economies.

3.Urbanization

The total population of Mali is estimated at 8 million; of these about 2 million live in towns of over 30,000 inhabitants, approximately 1.2 million alone in the capital of Bamako and surrounding agglomerations (e.g.Kati). Most of the other urban settlements - see map - do not exceed 100,000 inhabitants). Mali's degree of urbanization thus approaches 25% and the country remains essentially rural by Western definitions of urbanization. However, in the African context, urbanization is not only old but relatively high compared to other countries. The historical role of towns as regional markets and centers of intercontinental trade with a stable population applies to many settlements, particularly Djenne, Tombuctou and Gao, but even many smaller agglomerations of considerable age. The trans-Saharan trade which was channelled through many of these desert-side towns dates back to Roman times. Literacy, cultural diversity, professional specialization and socio-economic stratification are characteristic of these urban areas just like elsewhere in the world.

Based on their origins we can distinguish four major categories of urban centers in Mali: a. traditional religious and market centers like San,, Djenné, Tombouctou as mentioned above, b. villages of traditional chiefs or kings (e.g. Kita, Ségou, Sikasso, Bandiagara);c. headquarters of the colonial administration (e.g. Kayes, Bougouni, Mopti) and breaking points for transport and traffic (Koulikoro, Mopti).

Table 1 and map 1 show the major urban settlements and population figures, based on an average of 5 members per household (see methodological remark in 8.1.)

Table 1 Population and Demand for Fuelwood in Urban Settlements

Region/Capital	Households (1987)	Population (1987)	Annual Demand in metric tons **	
Kayes	31,923	159,615	58,260	
Koulikoro	33,559	167,795	61,245	
Sikasso	48,481	242,405	88,478	
Ségou	58,977	294,885	107,633	
Mopti	46,450	232,250	84,771	
Tombouctou	25,317	126,585	46,204	
Gao	20,212	101,060	36,887	
Bamako	158,160	790,800	288,642	
TOTAL	423,079	2,115,395	772,120	

Source: Analyse du Secteur d'Energie, 1995

** annual demand for fuelwood is calculated on the basis of a daily consumption per person of 1 kilogram

The growth of urban settlements usually takes place from a historical center towards a modern periphery with urban land use plans being only established by the colonial administration (for example San, described in several monographies dates back to 2 local Marka and Bobo families, supplemented by Bozo and Fulani hamlets who established 4 quarters by the XI th century. Rights to urban land rest with those traditional families. Other ethnic groups and traders later establish additional quarters around the primary groups, who are asked for permission to settle and land use. Theoretically, the prerogative to give titles to land - to foreigners - always rests with the founders. Therefore, the older landholding families are usually richer and better off, whereas those most recently immigrated and settling on someone else's land are generally the urban poor. In Bamako this trend is particularly marked: immigrants from the surrounding countryside or from abroad are settled on the fringes in new quarters while the local population holds the oldest and most central locations. Urban authorities lag behind in the surveying and allocating of plots, even though these can constitute the main source of communal income. Therefore many settlers in the periphery are considered as squatters without enjoying no title security to their homes.

4. Urban Poverty

One indicator of urban poverty in Africa is certainly landlessness or lack of access to soil resources. In the Malian (and African) urban context lack of ownership or access to urban land means relative poverty as land owners are able to capitalize on their possessions from urban growth and land development by administration or commerce. The traditional land holding families of Bamako, and a few others have accumulated wealth in the past from the sale of plots necessary for the expansion of the city; but in the past twenty years it was rather the families from outlying villages who have sold farmland for suburban settlement.

Droughts and political upheaval, which have hit Mali severely in 1984 and 1992, have led to increased migration from the rural areas because of lack of rainfall, poor harvests and famine so that even those with access to land could no longer feed themselves and fled with the consequence that towns have filled rapidly with poor migrants.

In addition to landlessness we have taken an indicator of 'poor' as a monthly income below 50,000 FCFA per household (even though the lowest salary level for civil servants is around 25,000 FCFA, the SMIG has been increased from 18.800 in 1990 to the double in 1994)). Lack of access to electricity is another indicator of poverty, for our purpose.

In Bamako, the peripheral and most recently settled areas are those least electrified and the poorer urban population is likely concentrated in these areas. For the total of Bamako, a representative sample shows that 63.5% of the households do not have electricity in their home even though this varies greatly by quarter (see table 7 below).

Outside Bamako, there are only six towns with regular electricity supply from the grid: Koulikoro, Fana, Dioila, Koutiala, Segou and Sikasso. The regional capitals (Mopti, Tombouctou, Gao, Kidal, Kayes) other towns and dependent on diesel-operated thermal plants and the importation of fuel. In view of the age of these plants

power supply is irregular and unreliable. In our view an appropriate household energy strategy will concentrate on the provision of the energy requirements at adequate cost without rendering the country too dependant on imports and foreign exchange. In that context, the concentration on hydro-energy and other renewable local resources makes sense, whereas substitution by fossil fuels (gas, kerosene, petrol) should only be made if clearly more economical.

5. Demand for Fuel

Table 2 extrapolates population growth till 2000 at an assumed annual growth rate of 2,4% From these population figures we have calculated future annual demand in fuelwood, based on an assumption of future linear population growth. Barring any special developments like severe drought the urban population will grow from 425,000 to an estimated 586.000 households in the year 2005. By then fuelwood requirements will have risen to 1,1 million tons per year. It can be assumed that firewood and charcoal prices will rise as a consequence. The urban poor population is likely to increase to more than 300,000 households.

Table 2 Urban Demographic Growth and Estimated Demand for Wood Fuel

Year	Urban Households	Urban Wood Demand t	Total est.demand t [1]
1987	425,000	772,119	4,355,000
1993	436,000	795,700	5,114,000 (1992)
1996	470,000	857,750	5,457,000 (1995)
2000	518,000	954,350	6,085,000
2005	586,000	1,069,450	no estimate

The demand for other sources of energy, electricity, gas, kerosene and petrol can only be estimated from past consumption trends. We have annual rates of increase of 10% for electricity, gas and petrol, but only 5% for kerosene.

6. Supply of Fuel: Access to Energy and Energy Service Provision

Wood and Charcoal

More than 5 million tons of wood and charcoal will be consumed by the year 2000 (Table 3) one fifth or more by the urban population alone. Already in 1995 the amount of wood and charcoal imported - as recorded by the forestry control posts - into the cities approached one million tons (Table 4); adding the quantities not being accounted for by the forestry statistics will certainly yield a higher figure.

Table 3 [2] Consumption of Wood and Charcoal

[1] Total Wood Equivalent for rural and urban areas, Based on Analyse du Secteur de l'Energie Domestique, 2e Rapport d'Avancement, MALI SED, 1997

[2] See note above

Year	Wood Consumption t	Charcoal Consumption t
1987	3,963,000	53,000
1992	4,597,000	73,800
1995	4,828,000	90,000
2000	5,271,000	117,000

The quantities of wood and charcoal transported annually to the urban areas (see Table 4) follow the the estimated annual demand: somewhere under 1 million tons for the year 2000 (in Table 2). We can therefore conclude that the urban population seems to be adequately supplied. In fact, the 881,000 tons transported into the towns in 1995 exceed the estimated demand for 1996 (857,000 tons) by 24,000 tons. This may be an indicator that there may be excess supply or that the demand estimate may be too low.

Table 4 Fuel Transported to the Major Towns (1995)[3]

Town	Wood t	Charcoal t	Total Wood Equiv. t
Kayes	36,200	2,800	50,200
Koutiala	58,100	3,200	74,100
Ségou	101,000	4,700	124,500
Mopti	82,400	5,400	109,400
Bamako	329,000	38,000	523,000
TOTAL			881,300

Can production keep track of rising demand?

By comparing consumption estimates from table 2 with the supply estimates for the national forests one may attempt to establish a fuelwood balance. The annual wood production of approximately 28 million tons appears sufficient to supply the requirement of 5 million tons in the year 2000 - rural and urban combined. Only about 1 million tons is currently produced and supplied to the urban areas.

Table 5 Estimated Potential Supply of Wood (1987-1991)[4]

Region	Forest Area km ^{2}	Volume '000 m ^{3}	Productivity m ^{3}/ha/year	Potential Production metric tons/year
1. Kayes	10,644,000	159,087	0.81	8,621,640
2. Koulikoro [5]	7,565,000	104,341	0.94	7,111,100
3. Sikasso	5,516,905	165,722	1.48	8,163,680

[3] SED, Survey by Service d'Information et Evaluation du Projet, Forest Traffic Control Module
[4] after Projet d'Inventaire des Ressources Ligneuses , quoted in Analyse du Secteur d'Energie Domestique in Second Progress Report, Mali SED, 1997.
[5] the second region supplies most of the District of Bamako which has no forest resources of its own

4. Ségou	4,727,750	51,905	0.60	2,836,200
5. Mopti	4,342,900	34,138	0.36	1,563,120
TOTAL[6]	32,797,155	515,204		28,295,740

But the production potential cannot be realized by the actual exploitation of forests, due to a deficient road network which makes it uneconomical to haul fuelwood for long distances. For example the road network in the first region is so deficient that the 10.6 million km ² of forest can hardly be accessed at all and cannot supply the city of Bamako. For similar reasons, abundant reserves of wood from the deforestation of the Manatali dam site could not be evacuated for lack of transport and remain unutilized.[7] Fuelwood for the capital comes from the second and third regions, but even here access roads, transport vehicles and production are so deficient that supply is interrupted, in particular during the rainy season, and the accessible areas are so heavily deforested that they are unable to regenerate wood. Efforts should be undertaken to harness this resource for urban consumption. Similarly, the exploitation of dead wood resources in the Niger inundation area around lake Debo, while one of the targets of the Energy Strategy (SED), is in its beginnings. From our interviews with the Bozo we have the impression that the local fishermen exploit the resource for smoking but there are no data either on the magnitude of the reserves nor the rate of exploitation which certainly merit study if this sis to be counted upon.

Individual Consumption of Wood and Charcoal

Household consumption surveys undertaken in Bamako in 1991 by the GTZ Improved Stoves Project (PFA) measured a daily average consumption of 0,68 kg of wood and 0,33 kg of charcoal per person, roughly 1 kilogram, in households (giving 5 kg for an average household of 5; in the rural areas consumption is somewhat less but household size is larger) In the informal sector consumption ranges from 10 to 25 kilogram per day. This sector involves meat grillers, dyers, fish smokers, potters, beer makers, food sellers and others.

Gas

The consumption of butane, promoted since 1992 by the Projet Gaz Butane benefits from a subsidy of 78 F/kg to the producers, is still relatively low. Consumption has even been declining by 1.5% following the devaluation of 1994, and has since been progressing by 11 and 15%. In household consumption the part of gas is still low, the main consumers being commercial establishments (restaurants, institutional kitchens, boutiques et magasins). However, it enters more and more into the habits of households and roadside cafés for the morning preparation of breakfast (heating of water for hot beverages). Still there are some limitations e.g. unfamiliarity with or fear of the handling of gas stoves.

[6] the 6th and 7th and 8th regions (Tombocutou, Gao and Kidal) are estimated not to have productive forests

[7] one of the conditions for the loan by an international consortium was the use of the forest from the dam site, this was cut under an EEC project. There si no capacity on the railroad for transport to Bamako.

Table 6 Consumption of Gas Butane (in tons)

	1990	1991	1992	1993	1994	1995	1996	1997
	t	t	t	t	t	t	t	t
Consumed	834	992	1488	1596	1769	1747	1936	1981

Gas is relatively competitive to wood or charcoal given the monthly expenditure (see households budgets in section 8), the price of the 12 kg recharge being 4000 F (or 333 F/ per kg) but the cost of equipment (bottle and stove cost about 50,000 FCFA) appear prohibitive to many household managers.

Hydrocarbonates (Fossil Fuels)

Kerosene use is the most widespread fuel for lighting at the household level, but the SED has attempted to popularize kerosene by introducing 2500 kerosene stoves of the Chinese type and is searching for private operators to assure their distribution. With a price of 120-200 F/litre kerosene is cheaper than gas (333 F, see above) or petrol (400 F per liter). Petrol and Diesel (250-275 F/l) enter household consumption as fuels for generators, grinding mills and other engines, and petrol for means of transport (cars, motocycles, mobylettes). The consumption of petrol products is as follows:

Lamp Kerosene	42,221	metric tons (1997)
Diesel	182,164	metric tons (1997)
Petrol	61,322	metric tons (1997)
Super petrol	22,514	metric tons (1997)

A tentative comparison of energy prices thus compares wood favoraby with all the other sources of energy:

Wood	22 F/kg (in Bamako)
Charcoal	65 F/kg
Kerosene	150 F/kg
Gas	333 F/kg
Diesel	265 F/l
Petrol	400 F/l

Electricity

Total installed capacity in Mali is about 230 MW, to which will be added 150 MW by 2005 when the hydro-electric power plant at Manantali comes online.
Electrification: for Bamako, it appears, from a representative sample of 1000 households established by the SED for monitoring, that about two thirds of the households are electrified (see Table 7). On map 1 we have located the main quarters of Bamako and shaded those with under 40 per cent electrification in red, thus showing the non-electrified areas. Interestingly they are new extension areas along the roads either to Koulikoro or on the SE bank of the Niger river while the peripheral quarters on the road to Guinea, on the other hand, are all electrified. A rural - solar - electrification program is in the beginning stage.

Electricity compares with difficulty with the other fuels but for cooking is definitely too expensive, about 3 kWh for a single meal, besides the cost of the electric stove and meter.
Batteries are an important source of household energy for radio, cassette players, television sets (58% of the households for radio-cassette players, and 15% for TV sets, according to the SED, 1996 Progress Report). We could confirm this in our sample. We have to distinguish between the acid-liquid batteries, which can be recharged and which can operate for about 2 years, and the carbon or alkaline dry batteries which are thrown away after a few months and constitute a major pollution hazard - note that some of the carbon batteries are recycled. There are many ways of improving efficiency through service and collection centers for recharging and disposing old batteries.

Map of Bamako

Table 7. Electrified Areas and Households in Bamako

Quarter	No.of Sample Households electrified	Pct.hh. electrified	Total No of hh
1.Bankoni	22	47	47
2.Boulkassoumbugou	20	57	35
3. Jélibougou	40	83	48
4. Fadjiguila	0	0	23
5.Korofina Nord	35	85	41
6. Sikoroni	3	33	9
7.Bagadaji	6	75	8
8.Bozola	6	100	6
9.Hippodrome	29	81	36
10.Medina Koura	20	87	23
11.Missira	15	65	23
12.Niarela	16	89	18
13.Quinzambougou	34	100	34
14.T.S.F.	16	89	18
15.Badialan	4	80	5
16.Badialan 2	5	100	5
17.Badialan 3	9	80	12

18. Bamako Koura	18	65	21
19. Daresalam	29	85	34
20. Dravéla	5	100	5
21. Dravéla Bolibana	2	50	4
22. Tomikorobougou	7	70	10
23.Niomirambougou	11	85	13
24.Ouolofobougou	9	100	9
25.Djicoroni	19	49	40
26.Hamdallaye	36	56	64
27. Lafiabougou	61	91	67
28.Sebenikoro	0	0	38
29. Badala SEMA	12	80	16
30.Badalabougou	16	51	31
31.Daoudabougou	2	5	37
32.Kalabancoura	0	0	22
33.Quartier Mali	18	58	31
34.Torokorobougou	16	64	25
35.Banankabougou	10	66	15
36. Faladjé	24	70	34
37.Magnambougou	17	89	19
38.Niamakoro	1	8	13
39.Sogoniko	35	73	48
TOTAL	628	64	987

Segou, Fana, Koutiala and Niono (major cotton, rice and sugar growing and ginning areas) are connected to the national grid. Sikasso and the souther towns are connected to the Ivory Coast grid. Kayes, Mopti, Tombouctou, Gao and many smaller towns (e.g. Bandiagara, Jenne, Dioila, Bougouni) are provisioned with electricity from thermal plants run with imported diesel (gasoil).

7. Policy, Strategies and Projects in the Household Energy Sector

7.1. The Case of Cooking Fuels and Technology, exemplified by a Case Study of the Projects Foyers Améliorés and the Domestic Energy Strategy (SED)

We will concentrate here on the case of the Domestic Energy Strategy (SED) , a national and World Bank funded policy-making and implementation program to improve the fuel supply to the urban areas. It builds on two earlier bilateral Projet Foyers Améliorés (PFA), that of the United Nations Sahelian Office (UNSO) in the First Region, and that of GTZ-DNAS in the other regions (from 1988 to 1997).

Since the late eighties market and policy studies of the little known traditional energy sector funded by the World Bank such as ESMAP and RPTES [8] have resulted in the design of a national Domestic Energy Strategy (SED) whose goal is to conserve some 300,000 tons of fuelwood by the year 2000 (i.e. 300,000 t less than in 1995). This Domestic Energy Strategy is co-funded by the World Bank, the GEF and the Netherlands Government (for the forestry sector) and was formulated during the early nineties.

The UNSO and GTZ Programs for Improved Stoves preceding the SED from 1988 to 1996 have developed a appropriate models of improved stoves as an answer to the increasing deforestation and shortage of wood; they have elaborated sensitization strategies to induce consumers to reduce fuel consmption: two types of stoves were developped and tested: the monomarmite for wood, called Teliman, and the multimarmite mixte for wood and charcoal, called Nafaçaman (voir photographs in appendix) but also the clay stove for home-production. Initial attempts were also made to develop a ceramic stove from local raw material. Tests have shown that the stoves may save up to 45 per cent of wood compared to the traditional three-stone stove, depending on conditions.[9] Thus between the years 1991 and 1997 an increasing number of metal and banco stoves have been diffused (Table 8), to about 200,000 households. The impact of these projects was non negligeable as far as the spread of knowledge about the improved stove was concerned, so that Foyer Amélioré has become a trade name with almost every malian housewife. The impact was nevertheless limited with regard to the numbers diffused and actually used, namely 200,000 units over 10 years. One of the major problems has always been the lack of available raw material, whose prices increased especially after the 1994 devaluation of the West African Franc.

A major effort was made by the Project FA to initiate a network of 25 producer associations where blacksmiths were trained in the technical aspects of stove construction (a know how which has benefitted the SED) and in the organizational skills necessary for running an association (Table 9) .

Table 8 Producer Associations initiated by the Projet Foyers Améliorés GTZ-DNAS

Name of the Association	Locality	Creation Date	Members	Capital	Revolving Fund	Reimbursed till 31/7/ 1997	Profits 96
Kelenya	Sikasso	23.12.1992	20	1 314 553	1 000 000 F	100 %	2 439 300 F
Kelenya	Koutiala	22.01.1993	15	256 810F	270 000 F	100 %	423 230 F
Benkadi	Mopti	15.10.1992	15	113 600 F	350 000 F	100 %	203 600 F
Sabunyuman	Ségou	23.11.1992	16	49 645 F	350 000 F	100 %	235 378 F
Jama Jigi *	Bamako	26.10.1993	21	52 000 F	500 000 F	100 %	69 000 F
AAB	Bougouni	31.10 1993	07	170 756 F	900 000 F	100 %	628 335 F
Mougnal	Douentza	1996	18	2500 F	0		0
Amagouan	Bankass	06.09.1995	30	51 000 F	0		98 900
Dangaly	Bandiagara	25.06.1996	15	?	0		pas de bilan

[8] Energy Systems Management and Planning; Review of Policies in the Traditional Energy Sector

[9] The interdependence of fuel savings and cooking conditions have been underemphasized in the extension strategy: to realize the 40% fuel economy it is very important to use the stove in a wind free location, otherwise draft and wind will lead to faster cooking but also highe consumption. In some areas where cooking is traditionally done inside, even the traditional stove will realize comparable fuel economy and be an efficient means of combustion.

Timbé							
Sini Nyesigi	San	1996	10	12 500 F	30.000 F	100%	12 500
Ben Kadi	Kolondiéba	1996	16	?	40 000 F	100%	pas de bilan
	Tominian	1996	04	?	200.000 F		pas de bilan
	Niono	1996	12	17 000 F	40 000 F	100%	17 000 F
	Macina	1996	14	?	40 000 F	100%	pas de bilan
Sini Nyesigi	Bla	1996	14	18 750 F	150.000 F	100%	30 145 F
	Sofara	1996	11	0	20.000 F	20 000	pas de bilan
Tafadis	Gao	13.07.1994	32		160.000	100%	
Hou Nafa	Tombouctou	11.07.1997	19		155.000	35000	
Ass. Artisanale	Kita				0		
A.F.I.	Tonka	17.07.1992	10		60.000		
Coopérative des forgerons	Koulikoro	13.06.1992	32		0		
	Kayes	1997	07		0		
Ass. Forg. de	Sadiola				0		
Ass. Forg. de	Kadiolo				0		
Ass. Forg. de	Tenenkou				0		

Table 9 Improved Stoves distributed under the GTZ Projet Foyers Améliorés (by region)

	Bamako	**Ségou**	**Mopti**	**Sikasso**	**Kayes**	**Gao**	**TOTAL**
1988	18.540						**18.540**
1989	5.960						**5.960**
1990	2.627	179	853		32		**3.710**
1991	1.869	338	553				**2.760**
1992	2.601	174	1.755	172			**4.702**
1993	4.986	797	1.538	1.087	224		**8.632**
1994	8.976	3.226	4.108	1.899			**18.209**
1995	12.660	2.487	5.299	1.245			**21.691**
1996	10.975	2.209	5.396	1.208		98	**20.076**
1997(30.6)	3.097	1.430	2.367	349			**7.243**

Table 10 Improved Stoves distributed under the GTZ Projet Foyers Améliorés (by type)

Stoves	1992	1993	1994	1995	1996	1997
metal	4702	8632	18209	21691	20076	14243
clay	6000	5000	10000	11000	11000	n.k.
totals	10702	13632	28204	31691	31076	n.k.

7.2. National Energy Policy and Domestic Energy Strategy (SED)

The major lines of national energy policy are determined by a 10 year forecast of energy consumption, and by the primary objective of an equilibrium between demand for wood fuels and its availability from national forest resources. A Piloting Unit is

responsible for guiding the substitution of wood fuel, the development and distribution of fuel-saving equipment and taxation of wood fuel to permit the financing of the rural forestry sector, the management of forest reserves and to adopt fuel-saving equipment (improved stoves for wood, charcoal, kerosene and gas). In terms of electricity, the objective is to satisfy the increased demand by bringing on line new plants, in particular the hydro-electric dam of Manatali. In the fossil fuel sector, liberalization of prices and greater competition are, combined with quality controls, to increase supply for a growing demand from industrial and commercial clients. In the renewable energy sector, exemption from import taxes is to encourage the private sector to introduce equipment, by selecting the most promising and efficient systems.

The **SED program**, planned from 1997 until the year 2001 and concerned mainly with the wood fuel sector has two components :

Supply Component

Management of village forests
Development of rural markets
Improvement of the efficiency of controls
Improvement of the efficiency of taxation
Support of the professionnels of the „wood and charcoal“ business
Recovery of dead wood

Demand Component

Development of new popular energy products (PEP) permitting to reduce the consumption of wood fuels
Monitoring and evaluation of actions

The supply component includes new legislation to regulate forest production and the supply of wood to the cities, among others by the recovery of dead wood. In addition, better management of forest reserves by village associations, more efficient marketing via communal wood markets and better control of entry points, are to result in a steady supply to the cities. The idea was that those regulatory measures lead to higher prices but up to the present the effects of these measures on price changes are yet to be seen.

On the demand side intended measures include the reduction of wood/charcoal consumption by 330,000 tons in the year 2000 through the partially subsidized distribution of 162,500 improved wood stoves, 73850 charcoal and 25,000 kerosene stoves. A national coordination unit set up by the Department of Energy (DNHE) and the Department of Forest Resources (DREFFH), called Unité de Pilotage (UPS), manages the program. During the years 1996/7 to 1999/2000 it expects to disseminate a total of 236,350 wood/ charcoal stoves (by means of contracts with local and regional NGO’s) in order to economize 146.800 tons of wood and 28.000 tons of charcoal. The efforts of the first phase of the SED appear somewhat timid, in view of the fact that it concentrates them mainly on the 75,000 charcoal stoves and leaves the

dissemination of the wood stoves entirely to the market[10]. The subsidy for charcoal is socially and ecologically unjust, as it favors the more affluent consumers of Bamako and the production of charcoal (6 tons of wood are used for the production of one ton of charcoal).

Another potential risk of these measures is that an increased supply of fuelwood to the cities may lead to a reduction in price of wood or charcoal and a reduction of the incentive to save and economize fuel. The domestic energy program (SED)was to increase price levels in order to achieve a more efficient use of fuel resources. Yet whether the measures on the demand and supply side will have the desired effects is still the question. The appropriate price level in order to achieve sufficient fuel economy will need to be determined by the market.

Table 10. Dissemination Targets of the Strategy (in 1996)

Dissemination	1997	1998	1999	2000	TOTAL
wood stoves	23.000	34.700	46.500	58.250	162.500
Wood economised t	9.700	24.300	43.800	69.000	146.800
Charcoal stoves	9.500	15.750	21.000	27.600	73.850
Charcoal economised t	1.500	3.900	8.100	14.300	27.900

These targets have been revised to 68000 charcoal stoves. With the end of the GTZ Project in 1997 the wood stove target has to be realized by the free market and by the 25 producer associations initiated by the GTZ project.

Table 11. Realization of Distribution Targets of Improved Stoves 1997

Year	Kayes	Bamako	Sikasso	Mopti	Segou	Timbuktu	Gao	TOTAL
1997/98 target	2000	18000	3000	3000	3000	1500	1500	33500
1997 realzd	2440	14959	3576	2559	2781	1098	3274	30687
1998/99 target	3000	14000	3000	3000	3000	2000	3000	31000
1999 target	500	500	500	500	500	500	500	3500

Source: Bulletin d'Energie Domestique, no. 05/1er semestre 1998

7.3. Ownership in the Supply Chain (by energy category)

Electricity

EDM is a public company and has a monopoly in energy production and distribution: (8% are owned by Electricité de France, 14% by the Malian Caisse de Peréquation);

[10] In the planning stage it was thought the GTZ project would continue to disseminate wood stoves, but the German government was not agreed to continue the GTZ project beyond 1997. In 1996 the GTZ exceeded the 1997 objective of the SED (see Table 8). For 1997/98, the SED target of 33,500 was achieved by the SED, without counting the about 14.200 stoves disseminated by the PFA.

there are no regional or communal companies nor communal participations. The decentralisation process could, however theoretically, bring changes as foreseen by the decentralisation law. EDM is the only supplier of electric energy in the major towns and operates the hydroelectric dams as well (Selingue since 1994). Present supply is limited to 230 mW, and until the year 2005 an increase of 150 mW is foreseen. The Manantali dam is to add 450 mW of which roughly one third is to go to each of the three countries Mauritania, Senegal and Mali. By then increased demand is likely to absorb the added capacity so that expansion of the network will not affect other centers outside Bamako, Kayes and Kita.

Electricity pricing is done in two stages: up to 100 kW there is a small-scale consumer rate of 90 FCFA per kWh; above that consumption the rate amounts to 150 FCFA per kWh; for high and medium tension (industrial) 100 F/kWh. This is relative expensive compared to neighboring Senegal (83, 72 and 50 F). Moreover, high deposit and installation fees (54,000 F) restrict access, and for this reason many households make meter-sharing arrangements to save on consumption.(besides illegal connections, see also below: 'batteries').

Fossil Fuels

Free market forces appear to prevail in this sector in contrast to neighboring countries: not only is there no national petroleum company but also the multi-national oil companies involved in production (import) and distribution of petrol products)diesel,petrol, kerosene, LPG and butane gas) are partially deregulated (a maximum price is fixed), but moreover numerous private Malian operators compete in the distribution circuit whose market share has been growing from 5 to 10% over the last 5 years. They provide a cheaper alternative to the large trusts (e.g. 1 liter of diesel costs 275 F with the multi-nationals, but can be purchased at a retail price of 250 F with the private malian operators. Gas however, can only be obtained from Mobil and Total who also supply the bottles.

Wood Fuels

The market in wood fuels is only relatively liberalized: theoretically is it characterized by atomistic competition because the multitude of primary producers but this competition is seriously reduced by a capital-intensive transport ownership. In Bamako every major market has its separate wood and charcoal market which is dominated by one actor(vendeur de charbon) who has his permanent supplier . Thus there are only about 15 suppliers of wood and charcoal for the hundreds of thousands of consumers. In Bamako the same bundle of wood which costs 50 F at the producer one hundred kilometers away may cost 100 to 150 F. The 50 kg bag of charcoal which costs 1500 F in the rural market costs 3000 F at the retailer in Bamako.

In summary, electricity is practically a state monopoly, fossil fuels are distributed through the multi/nationals and a number of private national companies, wood fuels are produced and distributed through local and national suppliers.

7.4. Community Participation in Energy Production: Rural and self-managed markets

This is so far only a target of the Domestic Energy Strategy to be realized under the decentralisation strategy but we have to mention it as a new concept. In the future, local communities - which have so far not been constituted by local elections postponed several times - are to issue the wood-cutting permits and exploit their own local resources and keep part of the proceeds. Up to now private entrepreneurs are entering the local forest reserves with permits issued by a forest service representative from the Commandant de Cercle. Local communities have not benefitted in any way from the exploitation or depletion of their resources. However, one may doubt whether the philosopy behind the decentralisation strategy, viz. greater autonomy and self-rule on the basis of a greater internalization of local resources, can be realized given the lack of funds of central and local treasuries.

7.5. Low-Cost Electrification Options

Hydro-electric power is already one of the cheapest options available in Africa but, as recent years have shown, depends tremendously on annual rainfall. Mali has experienced severe power shortages in 1996 and 1997 - parallel to Ghana and Burkina Faso - with power outages of more than 12 hours daily from May through July 1996, and again in early 1997 and 1998 due to the low level of the Selingué lake and the failure of one of the diesel generators at Dares Salam. [11] EDM has hiked its electricity rates by 12 per cent in April 98 (and water rates by 36%!). Until the time that the Manantali power plant can send its power through the line to Bamako power rates are likely to increase.

Despite the long-standing existence of research centers like the CNESOLER and CRES (Centre National de l'Energie Solaire, and Centre Recherche en Energie Solaire) there is only one program for solar energy of recent origin, the rural electrification program of UNDP which is to electrify a pilot scheme of 10 villages. The cost of supply per kWh is not yet known.

7.5.1. Special Energy Requirements: small scale transformation and tea cooking

Unfortunately, the households in our sample do not practice many the many **small-scale food processing activities** for the market which are so common in Bamako and elsewhere, and require fuelwood energy: roasting of groundnuts, frying of plantains, frying of fish, meat grilling, tanning (boiling the bark which contains tanin), deep frying of beignets etc. There are a hundred end products which result from food processing via heat, and there are thousands of small processors using charcoal or wood to earn additional household income. (see special section in annexe). Policy

[11] The year 1997/98 was particularly severe in West Africa and most countries experienced power - and water -shortages due to lack of water in the dams. The year has fortunately created an awareness among governments and consumers that hydroelectric power has its limits and that centralised state monopolies will be insufficient for future energy production and distribution, mainly for financial reasons, and need to be supplemented by decentralized approaches and forms of regenerative energy, other than hydro power. In 1996, Selingué had to be spilled early because water needed to be sent down the Niger to reduce shortages in Niamey.

makers and donors should engage more in the so-called informal sector to improve efficiency of processes and equipment and thereby reduce energy consumption and increase output and income, because **from these incomes a large proportion of the urban poor gain their livelihood**.

Throughout Mali considerable amounts of charcoal - this author estimates 500,000 households using 100 g/day which yields 18.250 tons a year - are used for **tea ceremonies**, and during the long night hours watchmen have to spend outdoors. there are presently no alternatives to charcoal in the preparation of tea; most users utilize inefficient equipment (so-called coalpots or fourneaux à thé). An improved tea stove was designed by some of the blacksmiths producers of the Projet Foyers Amélioré but has not been publicized widely and not bought much due to its high price of 1500 F.

7.5.2. Energy for small enterprises

The informal sector and **especially women derive much of their incomes from food processing or the transformation of other products**. There are thousands of food stalls, small restaurants, meat grillers, fish smokers, millet beer brewers, groundnut driers or roasters, cloth dyers which use fire wood or charcoal on very inefficient applicances. Little attention has been given to this sector, ist fuel consumption and requirements, and to the potential for saving from more efficient methods and equipments. They would gain considerably from a drop in production cost. A **more detailed study of selected enterprises of the processing sector** under energy aspects is urgently needed in order to allow these enterprises an adaptation to the market.

8. Household Strategies of Energy Acquisition and Consumption

A look at some of the strategies of the poorer households to satisfy energy requirements and economize energy is needed. Let us consider some household budgets before making generalizations:

8.1. Case Studies

Households were sampled in the following way: first, the quarters with low electrification rates (see table 7) were taken, thus Daoudabougou, Kalabankoro, Fadjiguila, Sebenikoro, Sogoniko; then the households from the SED permanent energy sample in these quarters were interviewed, a minimum of 5 households by quarter.
For the household budgets we have concentrated on incomes and expediture flows but not on stocks (savings, holdings and other wealth). There are clearly parallel circuits of income and expenditure, such as the special reserves e.g. gold, jewelry, made for special expenditures (weddings, baptisms), but we have concentrated on the everyday cycle. Cultural dimensions account, as those familiar with Africa, know, for large variations e.g. funerals or weddings, where large numbers of visitors must be fed and make expenditures rise. Thus even household sizes are only relatively constant over time, with labor and educational migration making for fluctuations. Consumers in general, and those of energy in particular, can only be counted fully if adult, children take a smaller proportion of food or fuel consumption: therefore the urban averages may appear somewhat small, but in the towns large families are compensated by large

numbers of single-person households (widowers), single educating mothers, bachelors etc. Taking into account these variations, we do think our figures to be reasonally representative.

8.1.1. Bamako

1. Madou, a driver, lives on the western periphery in the hamlet of Sikoroni without access to electricity. His family of 4 uses kerosene for lighting, about 25 FCFA per day, and for cooking wood or charcoal bought in a neighboring retail store, valued at about 400 F per day. Whenever possible, he brings home firewood or charcoal from his trips where he buys the bundle at 300 and the bag at 1500 F, but this has become less frequent recently. In addition, he prepares tea in the evening with neighbors or household members for which he uses 25 F for charcoal. He uses a mobylette to drive to work, so every day costs him a litre of mix. His wife does not engage in petty trading for which other uses of energy is necessary. Thus total monthly energy expenditures add up to 30,000 F. With a monthly income of around 70,000, 35% of the household income are used for fuel.

Energy Expenditure per day	per month
300 F/j wood	9000
25 F/d lamp kerosene	750
25 F/d charcoal for tea, 125 F/d overall charcoal	3750
400 F/d1 litre melange + 2 l oil à 2 temps	12000 + 4500
TOTAL	30000
Revenue approx.	70000
Energy expenditure pct. 43 %	

2. Sidiki, is another driver, but lives in Kati, some 20 km to the west of Bamako with his wife and 3 children, and two brothers with their families. There is no electricity yet and the family statisfies its energy requirements from kerosene, wood and charcoal. However, he travels frequently and each time brings back from his trips a few bags of charcoal and firewood, which reduces expenditure considerably. Breakfast is prepared with gas in order to speed up the process of heating water, but for other meals gas is not used. In addition, lamp kerosene is used for night lighting at a rate of 50 F per day and, due to the distance of his home from the city,spends a considerable amount of fuel to run his mobylette, more than 25,000 FCFA. His wife is also earning money from marketing activities, even though she prepares no hot food which requires energy but sells sugar and rice in detail. With a total income of 100,000 F, and energy expenditures of about 35,000 F, his energy budget amounts to about 30% of the total household income (and expenditure), but savings are realized from buying cheaper wood in the rural markets.

Energy Expenditure per day	per month
1500 F 1 bag charcoal 1 month	1500
2250 F 1 bottle de gaz 6 kg pour 1,5 month	1750
150 F 1 bundle of wood per day	4500
50 F/d lamp kerosene	1500
3500 F 2 L oil 2 temps 1 month	3500

740 F/d 2 l petrol for moto	22200
TOTAL	34950
Revenue appr.	100000
Energy Expenditure pct. 30 %	

3. Another urban family is that of a blacksmith in Sikasso with one wife and 4 children but shares housing and cooking with his 2 brothers and their wives. His house has no electricity meter but he pays the neighbor a flat monthly rate of 2000 F for using his meter for a couple of lightbulbs and a fridge. But also kerosene lamps are used for lighting at night. Except for breakfast which is prepared with gas, cooking is done with wood acquired at 200 F per bundle (3 times cheaper than in Bamako). Charcoal is primarily used for preparing malian tea, after meals. We have not included here costs for flash light batteries which need to be bought regularly. The total monthly energy expenditures amount to 10,600 F. Since his revenue is relatively high, the energy budget amounts to only 20% of the total income.

Energy Expenditures per day	per month
200 F/d wood	6000 F
50 F/d charcoal	1500 F
500/m gas	500 F
600 F/m kerosene	600 F
2000 F/m electricity shared -meter	2000 F
TOTAL	10,600 F
Revenue appr.	60,000 F

Energy Expenditure pct. 20%

8.1.2. Mopti

4. Bella family

The poorer families in Mopti are immigrants who live in bottomland at the outskirts of town in unsurveyed plots. The Bella are former Tuareg slaves. This particular family has moved to Mopti - I suspect as a result of the Malian Tuareg conflict - from the Douentza cercle some 150 km north. The family lives in nomad huts woven from palm leaves The women are household heads and their main income comes from basket making. The surveyed family consists of 3 women and about 7 men and young boys who work as carriers and day laborers in the port of Mopti. Fuelwood for cooking is bought in the local retail market around the port, and daily expenditures are relatively high with 300 F, charcoal is used maily for tea preparation. For illumination of the huts kerosene lamps are used with a daily consumption of 100 F.

With a total expenditure of 12,000 F and total income of about 30,000 F, the energy budget amounts to 40% of income.

Energy Expenditure per day	per month
300 F/d wood	9000
50 F/d charcoal	1500
100 F/d kerosene for 2 days	1500
no gas	
no electricity	
collection of cow dung in the hot season (free)	
sometimes sale of yam, rice and sauce for the market	
income from vannerie (basket making)	
TOTAL	12000
Revenue appr.	30000
Energy Expenditure pct. 40%	

5. Bozo fisherman family 14 pers.

The Bozo are the riverain population of the Niger and 'own the river': all products of the river and the inundation areas are theirs: fish, driftwood, floating rice, 'bourgou'[12].Besides fishing and trapping their main activity is river transport, and all the pirogues, pinasses and boats operated on the river are worked and mostly owned by them. They are therefore relatively rich, but our family does not come from Mopti but from the north and only lives here during the rainy season when high water level makes fishing difficult (because the deep holes where the fish can hide cannot be reached by nets) and all areas are flooded. The rainy season is a season of relative inactivity for the men who rest at home. Cooking fuel is bought daily by the women from boats which pass daily and bring wood from stocks which have been piled up during the dry season, and which are now being depleted. Daily expenditures are 400 F for cooking, tea is prepared from the charcoal a residue from firewood. The only other expenditure for lamp kerosene amounts to 100 F a day. Income and expenditure patterns vary from month to month: whereas expenditures for cooking and lighting remain relatively constant during the months, expenditures for fuel rise rapidly in the dry season for transport and smoking. Beginning december, with water levels receding, the family moves to Lake Debo to begin fishing and smoking of fish. Incomes from smoked fish are realized every two months or so, when about 10 tons of fish are ready to be transported to the port of Mopti for sale. One pinasse which can carry 10 tons of fish may realize 15 million F, the fuel needed for the journey amounts to 800 l (going and return), or 320,000 F: for smoking about 150,000 F worth of dry wood are used. We have estimated for the 6 months of the dry season about 3 trips @ 10 tons are made; this would give a total income of about 45 million minus 1.5 million F for fuel = 43.5 million. Over the 12 months this makes a family income of about: 3.6 million per month. Given the high income from fish sales (the kg at 1500 F) Energy expenditure amounts to 3% only.

Energy Expenditure per day	per month
400 F/d wood	
12000 F	
charcoal from residue wood	

[12] 'Bourgou' Echinochloa var., a widely harvested pasture grass in the inundation areas of the Niger

100 F/d lampe kerosene (1 l/j)
3000 F
TOTAL
15000 F

for fish smoking (en saison sèche à partir de décembre au lac Débo)
5000 F/d wood , stocked by Songhray behind Youvarou in large quantity
est. 2 month
150,000 F
wood
5,000 F
lamp kerosene
3,000 F
petrol for 10 t boat: 400 l petrol per voyage = 400*400 F= 320,000 F
TOTAL
478,000 F
the pinasse carries 10 t of smoked fish, which sells at 1500 F/ kg, thus 1,5 million per ton or 15 million F for 10 tons
hypothèse 5 t per month or
7,500,000 F

Note: it seems that the large stocks of dead wood which are supposed to exist around Youvarou and whose better exploitation is one of the goals of the Domestic Energy Strategy is already being exploited in grand style by the Bozo fishermen for the smoking of fish, and the quantities available for the urban markets will therefore be less than planned. In my view the SED cannot count on them for relieving the wood shortage.

6. Watchman Family at Sévaré

2 adults 2 babies,
income 20,000 F,
firewood 200 F/day, 6000 F
electricity, flashligh free
charcoal for tea, none
energy budget 6:20 = 33%

Like in Bamako, Mopti households use large amounts of charcoal for tea ceremonies and food processing (cakes from beans, millet flour and deep fried in oil). More specific uses include the use of incense burners for the perfuming of houses and clothes (Mopti being a fishing port and a water side town, smells and fumes are particularly strong), and for the smoking of fish. The estimated tonnage of smoked fish exported from the town is 60,000. As the entire area around Mopti is particularly devoid of fuel wood, supplies have to come from the Dogon plateau, which is already severely denuded.

Additional budgets in appendix I.

8.2. Household Strategies

One of the strategies, in particularly of housewives, to get low-cost fuel is to give money to travelling friends or drivers to buy charcoal or wood en route and thereby obtain cheaper fuel free of transport cost; another strategy employed in Mopti and Sévaré and most other semi-urban settlements is to collect free available fuels e.g. cowdung, rice straw, driftwood, from the fields or forests. In the Mopti region, use of cowdung, grain stalks and rice straw has become more and more frequent with growing shortage of wood fuels. Of course, polygamous households takes turns in cooking each wife having to provide fuel. In the south, however, the husbands have to provide fuel and therefore wives often do not have an incentive to economize. It seems therefore necessary in the awareness campaigns for stoves to specifically target men in the meetings. In cities, electricity is shared among several households in a compound by sub-renting/sub-letting of electric meters with users paying a flat fee to the meter subscriber.

With regard to reduction of consumption and fuel economy the use of the foyer amélioré has become more and more frequent. Yet the interviews among the poorer households highlighted the still widespread use of the iron coalpot which consumes almost twice the quantity of charcoal as the improved charcoal stove. The reasons cited were only in few cases unfamiliarity with the improved stoves but in most cases lack of money (whereby most of the household managers did not know the present subsidized price).

9. Health and Environment

As in most households cooking is done outdoors because of the extreme heat - except in the rainy season - and given the low population density, smoke pollution from open cooking fires does not appear to be a major factor affecting health outside Bamako. The capital, however, is an exception: cooking fires combined with the effects of other pollutants, e.g. exhaust fumes from vehicles, industrial smoke, burning of refuse, and not to forget the frequent dust storms (harmattan) create tremendous smog especially mornings and evenings when conditions prevail which would trigger a smog alarm in any European city. The decomposition of refuse deposited in the open air and open drains is accelerated by high temperatures and leads to noxious fumes.The Directorate of Health reports a high incidence of asthma and other respiratory diseases, but so far no measures have been taken to combat air pollution. The Bamako municipality and the communes have so far not put aside sites for dumping, and in the sector of waste management everything has yet to be started. There is no sewage treatment plant. In addition, water pollution is also a serious problem resulting in part from the indiscriminate discharge of ashes from cooking fires and household refuse into the streams and the Niger river. The Projet de Foyers Améliorés has developed a household incinerator but was not successful in its wide-spread diffusion: just the clean burning of dried household refuse would be an improvement over the haphazard lightning of refuse heaps.

In our view the urban hygiene services are rather ineffective and a hygiene education and sanitation project would have at least as high a priority as the many health programs.

10. Outlook and Recommendations

10.1. Development of the energy sector: description of trends (e.g. electrification).

The energy sector will be dominated by a growth in demand, and a rather stable supply until the year 2005, when the great hydro-electric dam of Manantali goes into production. The government hopes that an increased supply will lead to lower electric rates.

But it is estimated that the additional supply will be absorbed by the increase in demand, from industry and new housing. At the present time nothing can be said about future electricity prices but the woodfuel sector will remain of crucial importance for at least twenty years. The fossil fuel sector has an important role to play as it is the only actor in the market which can flexibly increase supply over the next years. The problem is, however, cheap and efficient small-scale equipment (e.g. diesel generators, stoves or gas lamps) to compensate for the shortage in electricity. Studies on the relative costs of particular forms of energy are lacking and should be produced and updated. (To cite an example, the introduction of gas lamps or kerosene equipment is hampered by the difficulties in handling; consumers often prefer to return to stoves and lamps which are easier to operate and maintain).

10.2. General Recommendations

Energy supply plans (Schemas Directeurs) for Bamako, the major cities of the south, and the North with emphasis on households and small-scale enterprises should be traced out taking into consideration major supply options (charcoal, electricity, gas, kerosene). For example, the towns of the North, Mopti, Timbuktou and Gao could be solely supplied by boats from dead wood around Lake Debo, without touching on the few remaining forest reserves. On the other hand, for the south, where higher rainfall prevails, fuelwood plantations and efficient protection of forest reserves seem to be the preferrable options. Sikasso, on the other hand, opting for electrification from the grid of the Ivory Coast.

More important, in my view, are the preventive aspects and there is large room for improving energy efficiency at all levels and types of consumption, especially plan energy effiicency measures in construction and prior to building: consumption can be significantly lowered if houses are built in ways to avoid heating up of roofs and walls, and using insulation. Present housing styles - cubic concrete walls - make for a high need for cooling and air conditioning, including the large sector of international agencies (diplomatic missions, aid organizations) and public buildings. Better architecture iss the key to energy economy. But on the other hand, regular servicing of equipment (air conditioners, carburators, compressors) and use of newer more efficient equipment badly necessary but omitted, often due to ‘poverty’. An entire ‘Schema Directeur’ for improving energy efficiency should be elaborated.

Government and the general public are well sensitized about the advantages of improved stoves and awareness seems to be on the rise. Several ministries are willing to give full support to any future program e.g. Energy, Family and Social Affairs,

Youth, Agriculture and Forestry, Health. Regulations should be passed by urban councils to make it mandatory for commercial users such as restaurants to use fuel-efficient equipment or substitute wood and charcoal by gas or solar equipment (for example for drying). To pass such legislation, town councils and enterprises need to be sensitized and counseled.

Therefore, Consumer awareness (or enlightenment) campaigns for improved wood and charcoal equipment should be continued, however with specific messages to women and men and with concrete figures on monetary savings, subsidies and budget economies. Publicity campaigns, to be conducted via local FM stations and national TV, should focus their messages more on monetary rather than ecological advantages. In addition special subsidies for improved charcoal stoves should assist the real poor - single educating mothers, old couples or widowers - to replace inefficient equipment e.g. coalpots. A savings scheme to the urban poor through the more than 20 credit and savings banks, and the many women's associations (via the Social Service)could be launched. These strategies should be discussed with the World Bank/UNDP Poverty Alleviation Program and the National Coordination Agency (and potential other donors) to be integrated into a nationwide action plan.

A payment-in-instalment scheme could be introduced for the acquisition of gas stoves and bottles. Fuel companies such as TOTAL have already developed efficient gas burners. In Ghana, for example, the national petroleum company has built tanks in the major towns where each owner takes her/his bottle for refill. This reduces the need for handling and transport from bottling plants to intermediaries and end consumers. Once acquired the bottle is always available and the customer does not need to cope with a shortage of bottles and waiting times Such tanks should be available at the major filling stations, and agreement has to be made with the petroleum companies (Total, Mobil and eventually the smaller national companies (BenCo, Yattasaye, SDF).

Government should insist, via the Domestic Energy Strategy and publicity campaigns, on energy efficiency, for example the use and introduction of more efficient electrical equipment (refrigerators, air conditioners) and the energy-efficient construction of houses. The design of such campaigns should be awarded to architectureal and consultant bureaux in the same way as the SED awards the diffusion of stoves to independent NGO's.

The impact of the regenerative energy measures, especially the effects of the duty free importation of solar equipement and of the rural solar electrification program and the effects of tax subsidies need to be studied and evaluated. All developments to render solar, wind or biomass energy cheaper and competitive with other energies in terms of price should be provided to the consumer via an internet data base and radio/and tv spots.

10.3. Specific recommendations: improving access to energy or, energy-saving devices and equipement respectively (e.g. advisory services, credit).

- Focus on credit support for local production of fuel-saving equipment: e.g. adapted improved stoves from fired clay, ceramics, insulation material and panels;

- concentration on introducing fuel saving equipment to the semi-commercial food processors
  via publicity campaigns and credit components;
- promotion a charcoal efficient tea stove for adoption by consumers;
- introduction of efficient incinerators, especially for medical wastes at health centers;
- sensitization of government, EDM and savings banks to give support and credit for higher energy efficiency and thereby reduce building construction cost

Further support, not in the form of subsidies but in terms of acquisition guarantees, should be given to the decentralized producers of improved stoves, for example the 25 blacksmith associations. For this it is important to design a marketing strategy and sales targets for each of the major towns and poorer areas (certain quarters, the Dogon plateau, the interior delta, the area around Timbuktu). The marketing aspects i.e. the adequate intermediaries between producers and consumers should be studied, and a particular set of proposals for the most efficient marketing be made. The sellers of energy should at the same time be induced to sell energy-saving equipment e.g. at markets for wood and charcoal, the charcoal retailers in the markets, at fuel stations, even at EDM area offices.

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Appendices. Map of Bamako
Photo