Avec le démarrage du projet des potières à Mopti on espère d'introduire un modèle de foyer céramique au marché qui est moins cher et plus performant et d'ainsi rapprocher le foyers amélioré davantage au consommateur.

Notons enfin, qu'une concurrence d'un autre type a vivement bouleversé le marché de Bamako quand ATI, subventionné par le USAID, a décidé de mettre sur le marché le Kenya Jiko et de le produire à Bamako, et pour ce but a pris sous contrat le meilleur et le plus grand producteur de FA de Bamako, qui desormais ne produit que des quantités négligeables. Cette intervention d'ATI est entièrement contraire à la politique nationale qui a testé le Jiko, qui s'averait non seulement inadapté aux marmites utilisées localement et dont la performance dans les tests fut telle qu'il ne fut pas retenu parmi les modèles à vulgariser au Mali, mais qui est aussi plus cher. Le PFA et la SED ont conseillé ATI d'adapter le modèle au marché local et ont refusé d'accorder la subvention à ce modèle. Nous pouvons pas exclure que la stratégie d'ATI, de recruter le premier producteur de Bamako, était délibérée pour concurrencer les modèles courants et d'introduire leur modèle sur le marché.

TEST COMPARATIF DES FOURNEAUX CERAMIQUES AVEC FOURNEAUX METALLIQUES

Pour Marmite no.3 et un litre d'eau

TYPE	Temps d'eb	Pct.chal.util	Cons.spéc.1	Cons.spéc.2	Pct.chal.utit	Cons.totale
CNESOLER 2	28,6	15,9	46 g	208 g	23, 2	497 g
Sakkanal	17,4	21,8	34 g	165 g	30,8	390 g
Nafacaman 2-10	28,6	20,7	35 g	163 g	28,3	344 g
Céramique Djenné	22,6	20,6	34 g	189 g	28,4	407 g
Céramique B'ko 2	31,0	18,9	38 g	199 g	26,2	423 g
Fournau malgache	29,4	11,4	131 g	253 g	16,3	620 g

Temps d'ébullition en secondes
Pct.chal.util.: Pourcentage de chaleur utilisé dans la première phase (ébullition)
Cons.spéc.1 : Consommation spécifique dans la première phase en g de charbon
Cons.spéc.2 : Consommation spécifique dans la deuxième phase (évaporation)
Pct.chal.utit.: Pourcentage de chaleur utilisé sur la totalité de la phase
Cons.tot. : Consommation totale, en g de charbon

C'est surtout au niveau du rendement (le pourcentage de chaleur utilisé) que les foyers céramiques comparent favorablement avec les fourneaux métalliques. Il est surprenant que en temps d'ébullition le Céramique Djenné surpasse même les foyers Nafacaman et CNESOLER. L'emmagasinage de la chaleur , c'est à dire, le temps que le céramique garde la chaleur est clairement supérieur aux foyers métalliques, 3 heures et plus avant refroidissement. Ils sont excellents, selon les femmes temoins, pour l'utilisation de bois car ils produisent du charbon pour une 2è cuisson. Sur 4 cuissons, une est gratuite, c'est à dire les braises sont suffisantes pour faire un repas sans ajouter du combustible.

Ajoutons que les modèles testés furent les premiers prototypes et que depuis cette date des modèles ont été standardisés dont les tests restent à faire mais qui sont supérieurs aux premiers modèles.

2000	3000	3	1666
1500	3000	3	1500

1) c’est le prix conventionnellement calculé par les forgerons pour transformer un fût. Ceci a été gardé constant pour les calculs. Il est cependant concevable que des producteurs individuels prennent une marge inférieure, comme par exemple à Bankass ou Douentza, où les producteurs ne s’attribuent que 2250 F par travail de fût.

Le GIE devrait, selon les objectifs chiffrés de la SED, diffuser 7000 fourneaux à charbon en 1997 à Bamako et 1500 fourneaux à Sikasso et Ségou.

Diffusion	Année 1997	Année 1998	Année 1999	Année 2000	TOTAL
Foyers à bois	23.000	34.700	46.500	58.250	162.500
Bois économisé t	9.700	24.300	43.800	69.000	146.800
Fourneaux à charbon	9.500	15.750	21.000	27.600	73.850
Charbon économisé	1.500	3.900	8.100	14.300	27.900

Le Programme SED compte donc diffuser, sur les 4 prochaines années, 236.350 foyers et fourneaux pour réaliser une substitution de 146.800 tonnes de bois et de 28.000 tonnes de charbon. Force est de constater que le programme SED vise un véritable impact sur la consommation de bois (bienque selon nos estimations, une reduction de 300,000 tonnes de bois consommé nécessiterait une introduction d’environ 500,000 foyers dans les environ 500,000 menages urbains Maliens).

Force est aussi de constater qu’à la cadence actuelle de production globale de tous les forgerons formés par le Projet Foyers Améliorés, de 20.000 foyers par an, ces objectifs ne pourront pas être atteints. Les principaux goulots d’étranglement sont la quantité insuffisante et donc les prix relativement élevés de la matière première, les fûts de récupération. Nous estimons la quantité annuelle de fûts sur le marché à 10,000, alors que pour une production de 60,000 foyers/fourneaux (de taille 2à10) il faudrait 20,000 fûts. Malgré les efforts du projet en négociation de sources, on pourra à peine obtenir 5000 fûts pour nos associations-forgerons quoique à des prix intéressants de 500 à 1700 F. Cependant la concurrence des commerçants offre des prix autour de 2500 F aux cedants.

Le Programme SED a limité les paramètres et donc le rayon d’activité du GIE en n’acceptant que des prix égaux ou inférieurs à 2500 F par fourneau pouvant bénéficier de la subvention. Celle-ci est fixée à 1000 F et à faire flamber les commandes à 3000 fourneaux en 3 semaines, quantité qui ne pourra pas être saitsfaite dans un temps raisonable ni par le GIE ni par les associations-forgerons.

Cet accroissement de la demande nous fait croire que le prix de vente pratiqué par les forgerons (2750 à 3000 F pour un grand Nafaçaman) a été et est toujours trop élévé pour le consommateur, mais que le prix subventionné de 1500 F est trop bas, et que le consommateur s’adapterait bien à un prix autour de 2000 F. L’argument des forgerons est qu’une baisse de prix ne pourra pas être compensée plus tard, quand la matière première monte en prix encore, par une augmentation, mais ils sont relativement insensibles à l’argument de rabais de quantité pour des grosses commandes. En tout cas, l’expérience montre que pour le moment les forgerons ne sont pas de bons commerçants dans le sens qu’ils ne font pas une commercialisation active vers le consommateur mais attendent des commandes, et qu’il faut des organismes intermédiaires comme des GIE ou des ONG.

En deuxième conséquence, la productivité des artisans, qui produisent beaucoup d’autres articles en dehors des foyers/fourneaux améliorés, est trop faible et trop irrégulière. Des ateliers spécialisés, plus productifs se basant sur la matière première régulière (importation et achat de la tôle neuve) sont une alternative à considérer. Dans ce sens on étudie à présent l’installation des unités pilotes semi-mécanisées dans les régions sur la base des ateliers de menuiserie-métallique déjà existants. Une autre voie serait la modernisation progressive de certaines associations-forgerons des plus dynamiques.

En tous cas, le GIE a lors et déjà embarqué le chemin de la production sous contrat en engageant des jeunes forgerons pour la seule production de foyers améliorés sur la base d’un salaire et des primes de rendement, car la solution de passer des commandes avec les associations-forgerons n’a pas donné satisfaction, ni du point de vue prix ni du point de vue régularité et qualité de production. L’espoir est cependant que les deux s’entendront un jour autour des prix de 2250 à 2400 F et que les associations en proximité des grands marchés (Bamako, Sikasso, Ségou, Mopti) pourront approvisionner ces marchés, quoique en dessous des quantités requises.

© monetary institutions: savings associations, savings banks, banks
© non©governmental organizations
© regional development organizations
© projects
© national policies and programs: e.g. household energy programs

7. Summary and Resumé

The establishment and maintenance of networks as support systems is an important condition for establishing more efficient household (and commercial) energy markets and making a long-term impact on the energy situation. The need for networks is also evident when one considers not only energy sources but also the energy applicances as subject to demand and supply and fluctuating market prices.

Individual project situations may be artificial and subsidies which permit consumer-access to low-cost energy may end as soon as the project is over . If it is desired that energy and energy appliances are supplied by the market, subsidies - if it is necessary to initially inroduce them - should be removed as soon as possible to let prices take care of numerous market imperfections and high transport costs in developing countries.

Decentralized production systems where supply sources are close to demand seem to permit a better satisfaction of consumer demand. Producers themselves, who are usually less organized in enterprises, are subject to demand and price fluctuations of raw materials and therefore some of them are able to produce at lower costs than others.

The question thus arises which legitimate support for household energy systems is necessary and whether market forces should not be let to prevail. Some critics of improved stove distribution systems argue that " consumers are slow in adopting the stoves, and therefore do not have much demand for reducing their energy consumption and costs".

Total expenditure is part of the problem: Each of us has made the experience that he wanted to buy a household appliance but did not have the funds to pay at one time and made a credit arrangement to pay in instalments but paid a higher price than if he paid in a lump sum. If no credit ^possibilities exist, customers are obliged to buy energy and energy appliances in small quantities at retail prices.

8. La Nouvelle Dynamique dans la Vulgarisation de Foyers Améliorés

L' introduction de la Stratégie d'Energie Domestique en 1996 a eu comme effet, en premier lieu, de stimuler la demande pour les fourneaux à charbon, grâce à la subvention promise aux consommateurs. Et ceci à un moment où les producteurs - les quelques 25 associations de forgerons n'étaient pas encore prêts à réagir.

Les forgerons, à travers leur union UNICAF, n'ont pas voulu suivre la politique du projet voir la baisse des prix de vente grace à une matière bon marché, mais ont tenté a) vers la monopolisation de la production et b) la fixation de prix avec des marges bénéficiaires élevées. (Voir exemple en bas). Pire encore, ils ont vendu les fûts obtenus à bas prix où ont fabriqué d'autres produits que des foyers améliorés.

Le projet a repondu avec l'introduction de la concurrence, à travers le projet Banque Mondiale et le GIE, afin de baisser les prix et augmenter la demande, et a remis l'achat des fûts entre les mains du GIE.
Malgré des commandes eventuelles de plusieurs milliers de foyers/fourneaux, par un GIE (Groupement d'Intérêt Economique) fondé par les ex-employés du projet, qui a obtenu le marché de la vulgarisation et l'administration des subventions à Bamako, et ensuite à Ségou et à Sikasso, les associations-forgerons appartenant à l'UNICAF n'ont pas voulu baisser leur prix de vente bienqu'elles peuvent obtenir le fût à 2500 F est le prix de revient s'est reduit considérablement, grâce aux efforts de négociation du projet.

Prix de Fût	Prix de main d'oeuvre 1)	Nombre de fourneaux/fût	Prix de Revient	Prix UNICAF détail	Prix UNICAF en gros	Prix Production GIE ex Koulikro
6000	3000	3 grands Nafçm.	3150	3000	2750	
5000	3000	3	2666	3000	2750	
4000	3000	3	2333	3000	2750	
3000	3000	3	2000			1850
2500	3000	3	1833			1850

This program, designed for 1997-2001, is based on earlier provides for legislation to regulate forest production and an increase of supply to the cities, while simultaneously promoting measures to reduce effective demand . It is co-founded by the World Bank, GOM, the netherlands government, the French Assistance Fund (FAC) and the German Household Energy Program.

Measures on the demand side include the reduction of wood/charcoal consumption by 330,000 tons by 2000 via the - partially subsidized - distribution of 264,000 improved wood/charcoal stoves, and 25,000 kerosene or gas stoves. The program is managed in coordination between the Department of Energy (DNHE) and the Department of Forest Resources (DREFFH). On the supply side, the increase of 200,000 tons of wood by recovery from dead forests and supply to the cities is intended. In addition, better management of forest reserves by village associations, more efficient marketing and better control of entry points, are to result in a guarantees of steady supply at higher prices.

An interesting question is that of the effect of these measures: will there be an increased supply of fuelwood, and if so will that have an effect on the price of wood/charcoal energy at the end-consumer level. A reduction of price may result in the opposite of what is intended, namely the tendency of the households to economize on firewood. It is not clear whether the idea of the household energy program is to increase price levels in order to achieve a more efficient use, and if so to what level prices have to be increased.

---

5. Supply and Demand of Energy-Saving Equipment

Let us look at the magnitudes involved: to reduce annual urban energy consumption by 10% or 110,000 tons, about 100,000 improved stoves need to be introduced (assuming a fuel efficiency per stove of about 50% of the traditional one, or 3 kg of daily consumption instead of 6 kg). The introduction of 100,000 stoves would thus save theoretically 300 tons of wood per day (or 109,500 tons a year). After 3 to 4 years, stoves need to be replaced.

Now, 110,000 tons represent the increase in consumption in 5 years. In order to achieve a net impact, a much larger number of improved stoves need to be distributed.

At the present moment, there are about 300 people with the capacity to produce about 20,000 stoves per year. This capacity is mainly constrained by the availability of raw material for the production of improved metal stoves. The production of 100,000 stoves requires about 25,000 to 20,000 empty metal drums and 25000 man days (about 68 smiths have to produce day in day out). At present, about 200 trained blacksmiths produce and sell about 20- to 25,000 improved stoves a year. The market price of a drum - determined by wholesale traders who buy and sell for profit - is about 5500 F. It is very difficult to even obtain 5000 drums per year at lower prices than the going market price.

The purchasing power of the average Malian urban household is so low that he will prefer to make day to day purchases of firewood, rather than make an investment of 3000 F into a stove which will save him wood on the long run. Large-scale diffusion is difficult when raw material has to be purchased at the market price. Pricing policy of the producers also has set levels high so that consumers are reluctant to buy.

6. Micro- Economics

At about 6000 F per drum, the blacksmith can make 3 to 4 stoves , which he can sell at 2500 to 3000 F apiece leaving him with 1000 to 1200 F as reward to his labor, and a monthly income of 80,000 or $ 170 (production of 20 days and 4 stoves/day assumed). If he increases the price per stove, his sales which even presently do not amout to much will decline further, as consumers will hardly spend 3000 F on a stove.

Creation of Producer and Consumer Associations

the major axes of the network are:

© consumer (womens' and youth) associations
© producer associations
© professional support organizations : artisans federations,
chambers of crafts and industry,

Theoretically the northern regions - Tombouctou, Gao and Kidal have no productive forests and must be supplied from other regions. On the long run it is feared that population increases will outstrip the available supply,(through clearing for farm areas and consumption for firewood and constrution) because regrowth is minimal especially in dry years. In a wet year, 30 cubic meter per hectare can be produced in Sikasso, as compared to 15 cbm in Kayes, and only 8 cbm in Mopti.

Table 2 Forest Area by Region and Potential Production

Région	Surface Area ‘000 ha	Volume 000 m3/ha	Production m3/an
Kayes.........	10644	159087	8621640
Koulikoro.....	7565	104341	7111100
Sikasso.......	5516	165722	8163680
Segou.........	4727	51905	2836200
Mopti..........	4342	34138	1563120
TOTAL.......		515193	28295740

Theoretically, wood production from the forested regions is sufficiently large to cover the urban needs, but the rural population of these regions retains much of the production for its own purposes and Transportation costs and facilities - especially after the 1994 devaluation - limit the areas of exploitation.

Scarcity of forests and soil degradation exists around the major urban areas, but it is difficult to ascertain on the whole whether supply falls short of demand because price increases are less noticeable as suppliers reduce quantity at constant prices. The ton of firewood costs about 12.500 F in the rural areas and double that amount in Bamako; charcoal costs about 30,000 F per ton. These are wholesale prices while retail prices are considerably higher: one bag of charcoal of about 40 kg costs 1500 F (37,500 F/ton).

3. Strategic Issues

The basic issue is to bring supply in line with demand on the medium term, until other energy sources - especially the much hoped for hydro-electric power from the Manantali Dam - will become available (expected for the year 2005) and that a low cost. Recently, EDM raised the electricity by 12,5 %. But even the electricity in the future will be mainly for offices and industry, the problem of energy cost and expensive equipment will remain for the average households and wood and charcoal are likely to be consumed in large quantities until 2010.

Like with foodstuffs, the market has to supply adequate amounts of fuelwood energy at affordable prices, and this is where the problem seems to lie. Before the devaluation, the average household spent about 60,000 F/ year for fuel wood (in Bamako 84,000 F); after the devaluation this amounted to 87,000 F (Bamako 125,000 F). This appears to represent ten percent of annual household income. With transportation costs, there is no decline in sight over the next ten years and prices of fuelwood energy will likely continue to rise. Other regulatory measures, like control of illegal cutting and transport taxes, contribute to this - intended - policy of greater fuelwood scarcity, higher prices and incentives to use woodfuel economically. Households must conserve fuelwood energy in order to meet their budget constraints.

4. Past and Current Household Energy Programs

For a number of years there have been market and policy studies of the traditional energy sector (World Bank funded programs such as ESMAP and currently RPTES),which was little known. They have finally resulted in a National Household Energy Strategy whose goal is to conserve some 300,000 tons of fuelwood by the year 2000 (i.e. consume 300,000 t less than in 1995).

The Household Energy Market in Mali
Andreas MASSING, Ph.D., dec.1997

1. Demand for Household Energy

With about 10 million inhabitants Mali counts about 1.5 million households, 500.000 of whom live in urban areas and therefore buy their energy requirements. Only 10 per cent of the households' and small enterprises' energy requirements are presently covered by electricity, gas, or fuel (kerosene, diesel). 90 per cent of energy use comes from wood (and increasingly agricultural residues, e.g; millet stalks, rice straw and animal dung).

The average Malian household has about 6 members and consumes about 6 kg of wood (or roughly one kilogram/person) daily. Thus urban households alone burn about 1,1 million tons of wood a year (rural households may consume somehat less than twice that amount). The use of charcoal has increased rapidly in the towns over the last decade, and total annual consumption is now at about 60,000 tons per year. The transformation of wood into 1 ton of charcoal requires about 6 tons of wood; therefore, the charcoal consumption represents abut additional 360,000 tons of wood. The rate of increase of consumption of wood and charcoal can be assumed to be equal the rate of population increase, i.e. 2,5 per cent p.a.

Table 1 Consumption of Wood and Charcoal in Mali's Cities

Town	Fuelwood	Charcoal	Total tons of Wood Equiv.
Bamako	328.000	38.000	442.000
Ségou	101.000	4.600	128.600
Koutiala	58.000	3.200	67.600
Kayes	36.200	2.800	44.600
Mopti	82.400	5.400	98.600
TOTAL	705.000	54.000	867.000

The remainder is consumed in other major towns like Sikasso, Koulikoro, Gao and other district capitals. Note also that the inundation area (flood plain) of the Niger river produces very little fuel wood and that rural households there need to import all their wood fuel requirements from the upland areas.

Mentioned here are only the household requirements for cooking without mentioning the near-commercial uses such as for fish-smoking, meat- roasting, large institutional kitchens and restaurants, hospitals and health centers, beer-brewing, dying of cloth (bogolan) , pottery firing, charcoal use by smiths and roasting, frying and grilling of food in markets . The quantities in these uses may amount to an equal amount of that consumed by households alone, and for strategic reasons should be studied and included in energy programs.

2. The Supply of Energy

In most rural areas, household members gather their fuelwood with their own means of transport, i.e. animal drawn carts, donkey or boats. But to the urban areas fuelwood is marketed and transported by professional traders. The consumption figures for major cities shown above represent the supply, drawn as they were from spot-checks and counts at the entrance points to the towns.

But supply is highly unequally distributed within the the country: in the south, incremental annual production - the regrowth of trees - exceeds demand, but in the north, with sparse forests demand exceeds supply. The first region with large forest reserves but a poor transport system supplies very little fuelwood to the major consumption area of Bamako, which is mainly supplied from an over-exploited second region. The populations of the north are generally poorer, and there is almost no redistribution of firewood and charcoal between the surplus areas in the south and the deficit areas in the north, due to high transport costs. Therefore much of the fuelwood energy around the urban centers must be and is supplied from their own surroundings: in Mopti, for example, fuelwood is transported from as far as 150 km away, in part from the last forest reserves of the area.

In contrast to other West African countries, Mali has made minimal reafforestation efforts for firewood.